“THE FIRE UPON US WAS TERRIFIC:” BATTLEFIELD ARCHEOLOGY OF WILSON’S CREEK NATIONAL BATTLEFIELD, MISSOURI

By

Douglas D. Scott,
Harold Roeker, and Carl G. Carlson-Drexler

Midwest Archeological Center
Technical Report No. 109

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Available

Making the report available meets the criteria of 43CFR Part 7, Subpart A, Section 7.18 (a) (1).

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1. INTRODUCTION

The rolling hills of the Ozark uplands along Wilsons Creek was the scene of one of the earliest armed clashes of the American Civil War. On August 10, 1861, Union troops under the command of General Nathaniel Lyon were defeated in a hard-fought battle with southern forces led by Major General Sterling Price and General Ben McCulloch (Bearss 1960; Piston and Hatcher 2000).

By 1860, the population of southwest Missouri was a mixture of immigrants from both the south and the north. The bitter sectional divisions and political strife that brought about Civil War pitted neighbor against neighbor throughout the state and region. On August 10, 1861, the most significant battle of the war in western Missouri took place, the Battle at Wilson's Creek. Its significance lies in the fact that it was the second major battle of the Civil War that it was second largest assembly of Union soldiers to ever fight a pitched battle up to that date, and that, largely as a result of the battle, Missourians had to make a decision whether they would stay in the Union or secede. Missouri did not secede, although the state was torn apart in bitter fighting for the remainder of the war (Bearss1960; Brookshear 1995; Piston and Hatcher 2000).

Human occupation of what is now Wilson's Creek National Battlefield has a long history, stretching back at least 5000 years. The human use of the land presents itself as a rich and varied archeological record that abounds throughout the park. Among the physical evidence of past occupation is an exceptionally vivid record of the events of August 10, 1861. The soldiers who fought that battle and the residents occupying the farms and woodlands where the battle was fought left us that legacy, in the form of archeological sites, features, and artifacts that aid us in recreating the story of the battle that builds upon and enlightens the rich historical record we have of that past conflict. In this report we describe the findings of a multi-year endeavor to locate the physical evidence of the Battle of Wilson's Creek.

Briefly, the battle (Figure 1) pitted a Union army commanded by Brigadier General Nathaniel Lyon against a Southern army commanded by Confederate General Benjamin McCulloch and Missouri Major General Sterling Price. The Union troops were composed of men from Missouri, Iowa, Illinois, and Kansas, and several regular army units and three batteries of artillery. The Southern forces, for they were not all formally Confederates at this time, were composed of the Missouri State Guard under command of Sterling Price, and a large contingent of Arkansas troops, a Louisiana unit, and a Texas unit under the command of Generals Ben McCulloch and N. Bart Pearce.

The southerners were camped southwest of Springfield on Wilson's Creek. Price and McCulloch were planning to attack Lyon's who was encamped at Springfield, defeat him, and gain Missouri for the Confederacy. Lyon and his Union command had a different idea, and he led a surprise attack on the enemy camp. Despite inferior numbers, Lyon divided his command, sending Colonel Franz Sigel on a swing to the south, to attack the

Southerners from the rear with Lyon attacking the north end of the southern camp with the main body of his troops.

Lyon's early morning attack surprised the encamped Southerners. His attack from the north drove off the southern guard, and Lyon was able to occupy the crest of a ridge that later became known as Bloody Hill. Lyon's advance was checked by the Pulaski Arkansas artillery battery, which gave the southerners critical time to reform and organize a battle line. The battle raged for over five hours. One of the more significant elements in the fight was a Federal attack through John Ray's cornfield, near the Ray House. Southern fire from the edge of the field halted and turned the Union advance in that area.

The attack from the south by Sigel was initially successful, but lost momentum in the fields of Sharp's farm as it came under artillery fire. Sigel's attack collapsed and his men were routed. On Bloody Hill, Lyon was wounded twice and then killed leading a countercharge. Major Samuel Sturgis assumed command of the Union troops, but with ammunition running low, ordered a withdrawal to Springfield. The Union lost the battle and suffered over 1,300 casualties. The southern victors also saw significant losses of over 1,200 men. The battle was a Union loss, but it galvanized support in the state and at higher levels in the U.S. government for keeping Missouri in the Union. The Battle of Wilson's Creek was the beginning of a protracted, bitter, and bloody four years of civil war in Missouri.

The Wilson's Creek National Battlefield Archeological Inventory

The National Park Service (NPS) has had an important role in preserving and protecting the nation's cultural heritage since its inception. Archeological resources, which are an important part of this cultural heritage, are present in most units of the National Park System, and many units have been created specifically to interpret and preserve archeological resources. Like all federal agencies, the NPS is obligated by the National Historic Preservation Act [section 110 (a)(2)], Executive Order 11593, and section 14 of the Archeological Resources Protection Act to identify, evaluate, preserve, and protect historic properties, of which one type is archeological sites. A 1991 Management Control Review of the Service's archeological program identified a critical high-risk material weakness in the basic inventory accountability of archeological resources on park lands. In short, the review indicated that the NPS simply does not know what its archeological resources consist of—their numbers, their locations, their significance—and consequently, NPS personnel cannot make informed judgments about their proper management.

Under the National Archeological Survey Initiative, an NPS task force created SAIP, the Systemwide Archeological Inventory Program (Aubry et al. 1992), a long-term approach to the objective of inventorying archeological resources on park lands. The program is intended to provide a framework for systematic, scientific research that locates, evaluates, and documents archeological resources. The importance of the SAIP is that it emphasizes research within a cultural resources management framework.

INTRODUCTION

In Fiscal Year 2000 a park-wide archeological inventory was initiated at Wilson's Creek National Battlefield. The program was funded for a five-year cycle that ended in Fiscal Year 2004. The first year of the project was dedicated to developing a park-wide inventory research design in concert with park management needs. The research design (Scott 2000a), developed for both Wilson's Creek and Pea Ridge National Military Park, called for an archeological inventory in each park, to identify, record, and evaluate for the National Register of Historic Places each site found. Prehistoric archeological inventory and non-Civil War related site inventory was conducted as a separate element under a separate research framework. In order to accomplish the non-Civil War archeological site inventory a cooperative agreement for the study of both parks was developed with the Department of Anthropology, University of Arkansas and directed by Dr. Marvin Kay. His inventory results are reported in a separate document. The Civil War battlefield was inventoried by the Midwest Archeolgical Center under the direction of the senior author.

The Midwest Archeological Center's element of the project plan and research design had as its goals the study of each parks' historic resources, particularly those dating to the Civil War. The project goals were to use the historical record and existing archeological collections (Bray 1967a; 1967b; 1975; Hayes 1999; Monk 1983; 1985a; 1985b; 1990; Sudderth 1992; Willey et al. 1999) as baseline information, then conduct park-wide archeological inventory with a view to identifying and recording the historic archeological sites with a focus on those dating to the Civil War in order to build a comprehensive understanding of the battles' events and movements.

During Fiscal Years 2001 through 2003 MWAC conducted metal detecting and visual inventories of the accessible areas of Wilson's Creek. Today much of the park is covered with trees and dense underbrush. This vegetative regime has developed since 1960 when the area became a park. Today park managers are actively reducing the underbrush and tree density through the use of prescribed fire and mechanical means in an attempt to restore the landscape and associated vistas to an 1861 appearance, at least in terms of the view shed. The battlefield inventory was limited to those areas open enough to allow metal detectors to efficiently sweep the landscape for battle evidence. Some large block areas were inventoried, such as the southern third of the park, while the northern quarter was too densely packed with trees and underbrush to be able to use metal detectors effectively. The middle section of the park was a patchwork of open areas and heavy vegetation. The inventory efforts focused on those areas open enough to use metal detectors effectively, thus a substantial area of the core battlefield was successfully inventoried, but some areas were only covered at a reconnaissance level and others not at all, resulting in a bit of a patch work of inventoried zones. The inventoried areas are depicted on Figure 2.

The use of prescribed fire to reduce unwanted vegetation types and encourage a more natural plant succession is well known in the natural resource arena. The effects of natural or wild fire and prescribed burning on archeological resources is well known, (Sayler et al. 1989) and has been shown to of little consequence in many cases where the fuel load is limited. Recent experimentally based research on the effect of fire on

archeological resources by Buenger (2003) has confirmed and enhanced the earlier studies. Cool season prescribed fires in grassland and riparian habitats will not normally affect buried archeological sites, features, or artifacts. The work at Wilson's Creek confirms the validity of these studies and provided an additional case for the use of prescribed fire as a means to conduct more efficient archeological inventories.

Wilson's Creek National Battlefield is located in southwest Missouri about 180 miles southeast of Kansas City. The battlefield, located in Greene and Christian counties, includes the 1,752-acre site of the battle. The battle was commemorated when Congress passed a joint resolution on December 24, 1861; and Wilson's Creek was only one of six battles to receive this distinction during the war. The park was created by Public Law 86-434 on April 22, 1960, and renamed a National Battlefield on December 16, 1970 (Hazelwood 1999). The Civil War battle is the primary interpretative emphasis of the park. However, Wilson's Creek National Battlefield also contains a wealth of prehistoric information.

Within Greene and Christian Counties, Missouri, there are aobut 1600 recorded archeological sites and 50 of those sites are found on Wilson's Creek National Battlefield. Wilson's Creek National Battlefield is listed on the National Register of Historic Places. Specific sites and features related to the 1861 battle are also listed and include: Ray House, Ray Spring House, Ray Cornfield, Gibson's Mill, Edwards Cabin, Sharp House, Sharp's Cornfield, Short Farmstead, T.B. Manley House, C.B. Manley House, Gwinn House, Manley Cemetery, Edgar Cemetery, Lyon Marker, Bloody Hill, the Sinkhole, Wire Road, and Sigel's artillery position. Objects included on the National Register listing include artifacts related to the battle that reside in the park collection.

There are 50 archeological sites recorded in the park (Table 1). Just over one-half have a component that is prehistoric in age. Twenty-five sites derive from the historic occupation of the land, and most of those were occupied at the time of the Civil War Battle of Wilson's Creek.

2. NATURAL AND CULTURAL SETTING FOR THE BATTLE OF WILSON'S CREEK

Wilson's Creek National Battlefield lies on either side of the Wilsons Creek valley [nota bene: When referring to the park or battlefield, the preferred form is the possessive—Wilson's; when referring to the creek, the officially recognized form is Wilsons]. This region is characterized by a generally rolling topography with steep slopes associated with waterways. Physiographically, Wilsons Creek is on the Springfield Plateau, an undulating to rolling plain of the western Ozarks. The Springfield Plateau is bounded on the north and east by the Missouri and Mississippi River valleys and on the south by the edge of the Arkansas River valley. The Plateau extends west into northeast Oklahoma. This region has less relief and stream dissection than most other regions of the Ozarks (Sauer 1920:66). The western Ozarks are considered (McMillan 1976:21) to be on the Prairie Peninsula border, an area of ecological importance in prehistoric settlement and subsistence patterns.

Bedrock of the Springfield Plateau is composed of sedimentary rock, mainly limestone, dolomite, sandstone, and shale. Very cherty limestone is abundant in the Wilsons Creek drainage (Hughes 1980:2). The most important mineral resource in the area (Hughes 1980:3) is the Burlington–Keokuk formation. It is a part of the Mississippian strata of predominately cherty limestone and is between the Pennsylvanian and Ordovician strata. Sinkholes and caves are common in this formation.

The main drainage system in the park is Wilsons Creek and its tributary, Skeggs Branch. At normal flow, Wilsons Creek is approximately 30 to 35 feet wide and five to six feet deep. A mile south of the park, the creek flows into the James River. Ground water consists of primary aquifers in limestone, dolomite, and sandstone formations (National Park Service 1976:11-10 – 11-12).

Annual precipitation in the Springfield area averages over 42 inches, with 41 inches occurring as rain and over one inch as snow. Usually 60 percent of the precipitation falls between the beginning of April and the end of September (Hughes 1980). The climate of Missouri is mid-continental, with temperature fluctuations of 40 degrees in winter and 54 degrees in summer (Chapman 1975:12). The average annual temperature is 56 degrees.

This region of the Ozarks is at the western limits of the eastern hardwood forest and is transitional into the westward savanna and prairie lands. The predominate forest taxon in the park is oak, occurring in several species including black, hickory, black jack, post, white, scarlet, and northern red oak. The forest is classified as part of the oak–hickory climax vegetation (National Park Service 1976:11-1).

The Springfield Plateau consists of at least three primary environmental zones including floodplain, open woodlands, and tall grass prairies (Steyermark 1959). Vegetation is variable in this area, depending to a great extent on slope and soil type (U.S. Department of Agriculture 1979). Springfield, on the average, has a growing season of 199 days, providing

adequate time for most regional agricultural crops (National Park Service 1976:11-9). Most areas that are not wooded or in crops have a cover of grasses and legumes and are used as grazing land (Hughes 1980:3).

Bearss (1978) and Gremaud (1986) have both studied the historic records relating to the past vegetation of the battlefield. Using firsthand accounts of battle participants, residents, and early General Land Office survey records, they reconstructed the vegetative pattern of the park at the time of the battle. In 1861 the park was a mix of prairie grasses in savannah-like situations, woodland areas, and farm fields. With the exception of farm fields, the park has probably had a similar environment for at least 5,000 years, with minor changes in density of vegetation regimes that co-varied with climatic shifts.

In the past, the prairie and open woodlands were the home of large animals including bison, elk, wolf, and black bear. The wooded areas contained white-tailed deer, fox, squirrel, cottontail rabbit, skunk, opossum, and woodchuck (Schwartz and Schwartz 1981:8). White-tailed deer was the staple meat item for many prehistoric inhabitants in this region (Parmalee 1965:24). The flood plains supported beaver, mink, muskrat, and otter (Sauer 1920:59). This area is not on any major flyway; so there is a limited abundance of waterfowl such as ducks and geese. Various songbirds and large hawks inhabit the park. Local fish include catfish, carp, buffalo, bass, sunfish, and sucker (Pflieger 1975). However, present-day pollution has greatly altered the natural habitats and densities of fish, reptile, and amphibian populations.

Culture History

A detailed culture history of the park will be presented in the University of Arkansas inventory report. For full descriptions of the prehistory of the area see Chapman (1975, 1980), Douthit (1981), and O'Brien and Wood (1998). Essentially, the prehistoric human occupation of the lands in and around Wilson's Creek National Battlefield begins around 8,000 to 9,000 years ago (Flanders et al. 1981; Ray et al. 1984). Native Americans continued to use the lands until the beginning of the nineteenth century, when Euro American settlers became the predominant land users.

The transition from prehistoric to historic is generally considered to occur at the time of the earliest contact by Europeans. In western Missouri, the early historic period is considered as the early 1700s. In this early historic period, the Osage and Missouri were the primary occupants of western Missouri, and the Osage resisted the pressure caused by the westward-expanding Europeans. To protect European endeavors, in 1789 the Spanish moved the Delaware and Shawnee into Missouri to confront the Osage. The Osage eventually moved west onto the Plains. The Delaware and Shawnee were given reservations in southwest Missouri. However, in the early 1800s they too were moved further west (Chapman 1959).

The earliest white settlers to the southwest area of Missouri are believed to have come from Kentucky, Tennessee, and North and South Carolina during the early to mid-1800s (St. Louis: Western Historical Company 1883:125–130). Greene County was organized in 1833, with the town of Springfield incorporated in 1838 (Ray 1999). By 1860, the population of southwest Missouri was a mixture of immigrants from both the south and the north that is typical of the general pioneer migration pattern where culturally like groups cluster in similar areas (Combs 2004).

Following the Civil War, southwest Missouri settled into a rural agrarian mode consisting of small farmsteads with homes scattered predominately along the drainage systems. Structures were usually log or plank and built by the owners or local craftsmen. By 1870, with the growth of railroads and sawmills, milled lumber became readily available and frame houses with clapboard siding became the norm for the region (Raferty 1970:223–300). About the beginning of the twentieth century and co-occurring with the development of a better road network, the rural settlement system shifted to homes situated along the roadways. Within the park there are about 25 recorded historic sites, mostly small farmsteads that correspond to the rural agrarian theme. Within the park is also the townsite of Wilson's Creek that began in the late nineteenth century and became defunct shortly after World War I.

A Brief Overview of Previous Archeological Investigations

Archeological investigations at Wilson's Creek began in the 1960s and have continued sporadically since. All of the investigations were conducted in response to specific management issues or in support of achieving compliance with Section 106 of the National Historic Preservation Act, as amended. Only those projects specifically related to recovery of information about the battle and related sites are discussed here. See Scott (2000b) for a more complete discussion of the previous archeological investigations at Wilson's Creek.

Historic Landuse and Farmstead Archeology at Wilson's Creek

By 1861 the entire area of what became Wilson's Creek battlefield had been purchased from the Federal government's General Land Office (Figure 3). Hundreds of acres were in agricultural production, and there were eight occupied farmsteads on the lands where the battle played out (Figure 4) and the area was crisscrossed by roads and traces (Figure 5). The early Euro-American settlement of the Wilson's Creek area is described in Bearss (1960) and in the Wilson's Creek Cultural Landscape report (Oculus 2000) and summarized here from those sources. Although earlier exploration and settlement did occur, it was not until the late 1830s that serious Euro-American settlement began to occur in southwest Missouri. The first person to settle and claim land within the battlefield was John Dixon. Dixon (Oculus 2000:2-30-31) purchased 40 acres in the southwest corner of Section 25 along Wilsons Creek. Dixon was followed in 1843 by Joseph Sharp who acquired 80 acres in the northeast quarter of Section 36. About that same time John Burden purchased 40 acres in the southwest quarter of the same section (Oculus 2000:2-30).

The northern portion of the park began to be settled and land purchased by the late 1840s. Those who purchased land from the Federal government were William Kerr, 40 acres in 1846; William Steele, 120 acres in three separate acquisitions in 1847; and Elbert Rose, 40 acres in 1848 (Oculus 2000:2-31).

Additional land purchases continued to occur after 1850 with John Ray purchasing three separate 40 acre tracts in 1851. Joseph Sharp expanded his holdings by purchasing 120 additional acres between 1850 and 1857. Two other early landholders were Elias B. Short who acquired 200 acres in separate parcels in 1854 and Hesekiah Blankenship who bought 200 acres in two separate parcels in 1855 (Oculus 2000:2-31). Land continued to be purchased from the Federal government and sales among various land holders continued throughout the 1850s. The Alexandria and Pacific Railroad Company was granted all of Section 26 and parts of Sections 24 and 36 in 1854 as part of a railroad right-of-way grant. They soon decided not to build west of Springfield and began selling their parcels off in a piecemeal manner (Oculus 2000:2-31).

By August 1861 the principal landholders on the battlefield were John Ray with 440 acres (150 in cultivation), John Gibson with 380 acres (115 in cultivation), John Dixon with 500 acres (200 in cultivation), William Edwards with 320 acres (only 32 in cultivation), Elias Short with 250 acres (50 in cultivation), and Joseph Sharp with the largest landholdings of 1250 acres (250 in cultivation) (Oculus 2000:2-33). Figure 3 depicts the landholdings at Wilson's Creek at approximately August 1861.

The pattern of land purchase and settlement approximates the general Ozark highland and eastern prairie settlement pattern as documented by Early (2000) and Wettstaed (2003). Generally the earliest settlers acquired the most fertile lands, those along well-watered steams and rivers or with convenient access to springs with good water. Succeeding waves of settlers took up less desirable lands on the terraces and later the upland areas. Wettstaed's (2003) analysis of archeological collections from several early farmstead testing and excavations suggest that these mid-nineteenth century setters had good access to the market economy with many types of material culture goods available to them. He notes that artifact classes that are often associated with socio-economic status and display of that status through material culture, like high quality ceramics, are virtually absent in the sites he studied from the central Ozark highlands. He attributes this to the Scottish-Irish cultural traditions that many of the earliest settlers carried with them as they migrated from Virginia, Kentucky, and Tennessee into the new state of Missouri.

Archeological investigations of several of the farmsteads and sites occupied at the time of the battle were undertaken as part of some of the earliest work in the park and have continued on a sporadic basis through the 1980s. Of the sites that figured prominently in the battle, Price's headquarters – the Edwards Cabin, the John Ray House, Gibson's Mill, the Elias Short house, and the Joseph Sharp farm were the subject of archeological investigations.

The John Ray House (23GR233)

The only extant structure present during the battle today is the Ray house (Figure 6). The house is believed to have been constructed sometime between 1851 and 1856. Ray was a substantial landholder in the Wilson Creek area, holding title to 240 acres of land by 1861 (Figure 3). The Ray house stands alone today, but during the battle there was at least a chicken house, struck by an artillery round during the battle, and probably a slave cabin about 75 feet southeast of the house (Occulus 2000:2-39). The Ray house is a well studied entity in the park (Bearss 1968) and a prominent feature since it was used as a southern hospital and General Lyons' body was brought to the house after the battle and laid out on the bed.

Robert Bray conducted a visual and metal detecting inventory of the site in the mid-1970s (Bray 1975:7-16). He attempted to locate Civil War era and other historic building sites associated with the Ray house, including a chicken house, smoke house, privy, cistern, and a barn. He located the site of a coal shed or pile, visible in the yard, but was unsuccessful in locating any definitive archeological evidence of any other structure. He did locate a disturbed area in the vicinity of where he thought the barn may have stood, but could find no clear archeological evidence to support the conclusion.

In 1982 and 1983, two additional periods of investigations took place at the Ray house. Construction-related activities necessitated archeological work, both inside and outside the house, and Mark Lynott excavated test units at the Ray House prior to preservation and stabilization construction (Hensley 1982). Evidence was found on the building's walls that a fireplace could have been located on the west wall. Further construction mitigation archeological work began in March 1983, under the direction of Susan Monk of the Midwest Archeological Center. Work focused on testing along the outer foundation of the house, which was the initial management concern (Monk 1983, 1985b).

A second project, in November 1983 under the direction of Jack Ray of the Midwest Archeological Center, focused on testing inside the house, under floorboards, and in the fireplace between Rooms 3 and 4. The MWAC team also conducted a walk-over survey of the plowed fields along the side and in back of the house and found historic artifact concentrations in the south field area that may correspond with possible locations of outbuildings. The historic artifacts that were recovered span a time period from the mid-nineteenth century until the present day. Prehistoric lithic materials were found scattered in the field to the south and east of the house.

Jack H. Ray's and Christopher H. Schoen's work inside the Ray House (Sudderth 1992) mapped and excavated areas in Rooms 3 and 4 that were to be disturbed by the restoration construction. Jack Ray also excavated along the west and north walls of the cellar located beneath Rooms 1 and 2 and discovered the original "south entrance" to the cellar discussed in oral histories. Historic household artifacts were recovered.

One archeological investigation was conducted by David Hayes, from Buffalo National River, in the yard of the Ray House (Hayes 1999) to assist in an Archeological Resources Protection Act vandalism investigation. During the spring of 1999, a relic collector was caught metal detecting at the Ray House. Hayes assisted the ensuing law enforcement investigation by documenting the damage to the site. He conducted limited test excavations to determine the manner and extent of damage to the subsurface resources. He recovered a variety of historic metal, glass, and ceramic materials, and also located an archeological feature of undetermined origin.

In an attempt to locate the site of any external features William Volf (see Appendix I) conducted electrical resistivity investigations in thirteen complete and one partial 20 by 20 meter grid units located on the side and in the rear of the Ray House. The coal shed or pile site located by Bray is clearly evident as well as two two-track road or trail alignments. A series of connected linear alignments were noted extending from the rear of the house into the back and side yards. Their origin is unknown, although they appear consistent with anomalies determined to be utility lines. There are no known utiity lines in this area of the Ray House, thus the function of the anomalies cannot be explained without archeological test excavations being undertaken.

John Dixon House

Private lands adjacent to the southern boundary of the park include the ground traversed by Sigel's command in trying to outflank Price and McCulloch and the site of the John Dixon house (Figure 3). In 2001 Neal Lopinot of Southern Missouri State University conducted a reconnaissance level inventory of the John Dixon farm at the request of then park Superintendent Richard Lusardi. Lopinot (email November 26, 2001 to Richard Lusardi) found some domestic trash that could date to the nineteenth century below where he believed the house may have set at one time. He opinioned that the house site may well have been compromised by later activities on the land, but a more complete inventory would be required to determine what archeological features remain intact and what has been affected by later occupation.

The Sharp Farmstead (23CN76)

One of the earliest and largest landholders and residents on Wilson's Creek was Joseph Sharp (Figures 3; 4). His cornfields played an important role in the battle, first as camping sites for the mounted troops and then as the scene of action between Sigel and McCulloch. There have been several attempts to locate the Sharp house archeologically, a prominent feature at the time of the battle, but with little success.

Historically the site of Sharp's house and outbuildings are described as located west of Wilsons Creek, south of Skegg's Branch, and adjacent to and east of the Wire Road (Occulus 2000:2-41). Battle era maps show two buildings, one probably the house, one unidentified outbuilding, often labeled Rebel Hospital, and fenced cornfields to the south.

There are few contemporary descriptions of the site, but none very specific as to the house or its location. A soldier of the Third Louisiana Infantry (Watson 1888) recalled

> *"immediately in the rear of the battery [the captured Backof Battery] was a pretty substantial farmhouse with extensive barns and outhouses. All the buildings were completely riddled by the shot. I was sent with a small part to search all the houses, in case some of the enemy had taken refuge or hidden themselves there. We found several of the enemy in a hayloft who surrendered as prisoners. I forced the backdoor of the dwelling house which was locked and entered the kitchen. Several cannon shots had passed through it, and the floor was strewn with dust and broken crockery. I examined the other rooms but found nobody. I was about to retire when one of the boys called to me that here was a stair down to a cellar and we might catch some one down thee. I went down, and caught a Tartar. A woman jumped up and confronted me. 'What do you want here? Get out…' she cried, as she launched into a tirade of abuses about how their house and property had been destroyed and themselves almost killed. I desired her to compose herself, as I was only looking to see of any of the enemy had taken refuge there. Looking around the place, I saw a younger woman, a man, and some children who were crouched in a corner behind some barrels and a large pile of apples. 'Is that your husband?' said I. 'Yes, he is my husband and them is my children.' 'Oh, very well, we will not molest you further,' said I, calling out to the boys, who were helping themselves to the apples, to desist, and we turned to go upstairs. 'Oh, take the apples,' said she, 'take a plenty of them; take all if you like. Are you Lincoln's folks or Jeff Davis' folks?' 'Jeff Davis' folks,' said I. She then asked if the fuss was over. I said I did not know, but that I thought it would be over at this part of the field, as we had taken the enemy's guns that had been in the front of her house. 'Then burn the pesky things,' said she. 'My head is split to pieces, and the children has got fits, and my old man has got quite deaf with the big noise of them.' I felt like saying that, considering her gift of speech, a worse thing might of happened to the old man. But the old man, having regained his hearing and a little assurance, asked me as we were ascending the stair if it would be safe for them to come up, as they had been down there ever since the fuss began. I said it would, but if they heard firing to go down again. They were quite safe in the cellar from any kind of shot, but that a shell, if exploding in it, might set the house on fire. The old woman was up first, but on seeing the wreck, and looking out and seeing the dead men and horses lying in front of the house, she broke out in a greater fury than ever. Who was going to pay for all this? Who was going to take away them dead folks and dead horses? Was she to have them lying stinking round her house? So that I was glad to get away and join the regiment, which was now forming to proceed to another part of the field."*

After the battle Sharp, a southern sympathizer, and his family left the area, resettling in Howell County, Missouri. The house was purportedly burned by Unionists in 1862 after he left the area. Sharp sold the property by 1867 (Occulus 2000:2-42-43), although Bray's (1975:17) research suggests Sharp sold the last of his property on Wilsons Creek in 1872.

In the ensuing decades the property remained in agricultural use. Houses, barns, and other outbuildings were built immediately south of the northern boundary of the Christian county line, purportedly on the site of the Sharp house, by the Steele family. A grandson of Joseph Sharp, D. S. Frazier, thought the Sharp house sat between the later Steele house and the barn, although he admitted that he did not know the exact location (Bray 1975:17).

There are no known contemporary images of the house or area, unfortunately. There is one stylized engraving based on a circa 1883 panoramic photograph that illustrates a structure in the area of the later Steele house (Wherry 1956:294) that is labeled 'Sharp's house (Sigel's position).' Since the Sharp house was likely burned in 1862, but certainly prior to 1872, it is unlikely the image, based on a circa 1883 photograph, portrays the Sharp house, rather more likely it is an early view of the Steele house site.

Bray's (1975:17-20) documentation notes that the Sharp farm had standing structures on it until 1968 when the house burned. After the fire the buildings were dismantled and removed from the site. In an interview with the last property owner and by analysis of a 1936 aerial photograph, Bray (1975:17) was able identify the Steele era garden area, a chicken house, the main house, a well, a garage, a milk house, and a barn, as well as the approximate site of a school house and an associated outhouse on the Greene county side of the county line.

Bray (1975:16-26) conducted the first archeological investigations at the Sharp site in an attempt to find physical manifestations of the Sharp occupation and locate the house site precisely. Bray conducted a close-order metal detecting inventory at the site. He laid out a 20 foot square grid system that covered the area around the known Steele house and barnyard, and metal detected it a 2 foot intervals. He located no Civil War era artifacts, but did find twentieth century agricultural implement fragments. Bray also excavated four test units, but recovered little that dated to the nineteenth century, and only one piece of ceramic that could have dated as early as the Civil War.

During archeological inventory and mitigation efforts in the early 1980s associated with the construction of the park tour road, another attempt was made to locate the Sharp house site. Lynott et al. (1982:28-35) relocated 23CN76 and a prehistoric site, 23CN81, earlier recorded by Bray. The tour road inventory crew conducted shovel testing and limited test excavations at the site. Lynott's crew dug forty shovel tests in a grid alignment that crossed the site of Steele's garden, house site and barn. Twenty-four shovel tests yielded artifactual material, mostly twentieth century farm debris, although a few prehistoric flakes were also recovered. Four test units were dug in CN76 and two in CN81 with only a few ceramics recovered that potentially dated to the Civil War era. All other historic evidence related to a very late nineteenth and early twentieth century agricultural occupation of the site.

The third archeological project to touch the Sharp site involved an inventory associated with a tree removal project. Jack Ray walked two transects across a portion of the Sharp site in late 1983 (Ray and Monk 1984:7). A few pieces of white ware ceramics

were noted as were some glass fragments. Nothing was recovered that provided a definitive Civil War era date, again.

A fourth archeological project was conducted at 23CN76/81 in the spring of 1984 as part of the mitigation measures undertaken in support of the construction of the new tour road. Susan Monk (1990:17-60) excavated sixty units at CN76 finding nine features and over 7,000 artifacts. The architectural features discovered in the excavations related to the twentieth century occupation of the site as did the vast majority of the artifacts recovered. Monk (1990:42) noted in her report that the last occupants of the site was Willie Fugitt and that park files contained information that the house was abandoned and in poor condition when it burned on October 3, 1968. The park then let bids for dismantling and removal of the remaining eight buildings, including the house, a root cellar, a pump house, two chicken houses, three barns, and a stock feeder. Monk (1990:42) associated the features she discovered with the house, root cellar and ancillary features associated with a milk house and barn as well as a water system.

No further work was conducted at the Sharp/Steele site until 2001 and the beginning of the park-wide archeological inventory effort. Metal detecting across the previously studied area which was approximately 200 meters long east to west and 100 meters wide north to south yielded many additional twentieth century farm and household debris (Figure 7). The material was not collected but reburied where it was found. No Civil War era items were found in the previously studied zone.

Given the assumption that the twentieth century farm debris and building dismantling and destruction efforts may have obscured the site of the 1860s Sharp house cellar, building foundations, and the barn site it was decided to employ geophysical remote sensing techniques to determine if Civil War era had been buried or obscured by later occupations. It seemed logical that the Sharp house cellar would have a definitive geophysical signature and could be seen as an anomaly by remote sensing instruments. Volf (appendix I) conducted an electrical resistivity survey of ten 20 meter by 20 grid units at the Sharp/Steele site (CN76). Volf identified a number of linear anomalies that most likely represent buried utility lines associated with the later Steele occupation.

No evidence of a cellar or other anomalies was discovered that might be associated with the Joseph Sharp occupation during the geophysical work. This suggests that the Sharp farm house and barn are likely located elsewhere on the site.

Metal detecting efforts in the vicinity of the Steele/Sharp site recovered many twentieth century metal items as noted earlier. As the transects moved south of the known farmyard area the density of twentieth century items decreased dramatically and there was concomitant rise in the frequency of Civil War era materials, especially small arms and artillery ordnance artifacts. The battle-related artifacts appear as a more or less linear arrangement roughly perpendicular to the Wire or Telegraph Road alignment and about 150 to 200 yards south of the juncture of the Wire Road with the modern tour road as it passes

the Steele/Sharp site. An analysis of the 1936 and 1940 aerial photographs of Wilson's Creek battlefield shows a patch of darker vegetation or soil disturbance in this same area. The Steele era farmstead buildings are clearly visible situated parallel to the old Greene and Christian county road running east to west on the county line.

The dark anomaly noted on the aerial photographs is south of the area of geophysical work, and thus remains an unverified anomaly (Figure 8). However, the anomaly's location south of the Steele complex, just east and adjacent to the Wire Road, as well as associated with the northwest to southeast tending line of Civil War era artifacts suggests that this site has real potential for future investigation. Further geophysical investigations in this area followed by exploratory test excavations has the potential to determine if this may be the site of the Sharp house that play such a prominent role in the battle.

Larkin Winn House (23GR236)

Research in conjunction with preparation of the park's cultural landscape report identifies the so-called Guinn or Gwinn house as seen on early battlefield maps as the house occupied by Larkin Winn about the time of the battle. The property was owned by Elbert Rose who may have leased the house and land to Winn. The house was occupied as a headquarters by General McCulloch and the Pulaski Artillery battery was sited nearby.

Robert Bray (1967a:29-40) conducted metal detecting inventory and test excavations in 1966 in an attempt to find the house site. His test excavations were extensive. He used the available battle and historic maps that showed the house in several locations, albeit in a relatively small area, to guide placement of the test units. He succeeded in locating the probable house site, represented by some limestone foundation blocks and a scattering of artifacts on an eroded terrace east of Wilsons Creek and northwest of the Telegraph road. Bray (1967a:39) noted that none of the foundation material formed any obvious alignment and he concluded that the site had been dismantled at some point in the past leaving a disrupted archeological record. However, Bray (1967b:200) revised his conclusions after additional historical research and fieldwork. Bray located a house foundation and a chimney base about one-quarter mile to the southeast of the site he had earlier tested. Based on oral interviews with Mr. and Mrs. Glen McIlhany who once lived there and had built a house occupied by them in 1967 about 300 feet to the northeast, as well as a study of the Greene County land records Bray concluded that the Winn house was located on the McIlhany property. Subsequent research by park staff and cited by Occulus (2000:2-45-46) clearly points to the first location as the Winn site. The second site identified by Bray was owned, in 1876, by several individuals, including some by the name of Wines, who conveyed it to a William Hackney. The similarity in the Winn/Wines name probably led Bray to an erroneous conclusion, given that it is now known that Larkin Winn had abandoned the property by 1861.

William Edwards Cabin (23GR237)

Little is known of William Edwards or his cabin, although it is an important site, as the cabin served as Sterling Price's headquarters and the surrounding land was the site of Missouri State Guard camps prior to and during the Battle of Wilson's Creek. Edwards settled on Wilson's Creek about 1842, although he did not purchase the 80 acres where the cabin was located until 1858 (Occulus 2000:2-40).

Bray (1967b:191-194) conducted limited test excavations at the site. He dug three 50 foot long trenches at the site. Two forming a T were excavated in the area Bray thought most likely to be a cabin site. Although he did not find foundation stones or fireplace stones he did locate a variety of domestic items and construction debris in the two trenches forming the T. He then excavated another trench about 250 feet south of the two trenches. He found only a piece of modern iron in this trench. He concluded that the first two trenches had likely located the Edward's cabin site.

Metal detecting transects across the site (Figure 9) in 2001 and 2002 yielded an area of high metal density that upon excavation proved to be cut nails, fragments of cast iron cookware, and a variety of other domestic and construction debris. Since this was the same area tested by Bray, the discovered artifacts were reburied in place under the assumption that future traditional archeological excavations will yield more information that metal detecting or limited trenching efforts.

In an attempt to define the extent of the cabin site more precisely geophysical remote sensing investigations employing electrical resistivity were employed with good results (see Appendix I). William Volf surveyed four 20 by 20 meter grid units in the area defined by the metal detector work. He located a rectilinear high resistance anomaly that is about 7 meters (22 feet) and 12 meters (38 feet) long. This could be a building site. A second oval shaped anomaly was found north of the rectilinear anomaly that is of unknown origin. It is in an area of dense metal debris and may be tentatively interpreted as a trash midden. Volf's geophysical investigations discovered anomalies consistent with their identification as cultural features. The site should be explored with test excavations to confirm the identification as well as ascertain the size and type of structural foundations they may represent, if indeed they are the remains of the Edwards cabin.

Caleb Manley House (23GR238) and Cemetery (23GR239)

Caleb Manley is a rather ephemeral figure in the history of Wilson's Creek. Bearss (1968:68) believed Manley built a cabin and resided in the area for sometime prior to the battle. However, there is little in the historical record to indicate that Manley actually owned property there. Perhaps he occupied land with the intention of purchasing it from the government, but failed to do so. County tax records indicate he owned nine head of cattle, but little else was noted in the records (Occulus 2000:2-41).

Robert Bray (1975:39-40) recorded the Manley house as Missouri archeological site 23GR238. The house played no direct role in the battle, but it and the surrounding yard may have been used as a hospital in the battle's aftermath. The log cabin owned by the Manley's stood for some years after the battle and is documented in at least one photograph showing a small rectangular hewn log building with a fieldstone chimney at one end. A smaller log structure stands nearby that was in near ruins at the time the photograph was taken. Judging from the clothing style of the person pictured standing in the cabin doorway the photograph was taken in the 1940s or early 1950s (Occulus 2000:fig. 32). Bray located and recorded a few artifacts and several limestone slabs that may have served as piers for raising the cabin sill off the ground. No other archeological work has been done at the site.

The Manley cemetery is not believed to have existed at the time of the battle, although there are conflicting accounts regarding its establishment. Caleb Manley died in 1872 and is generally believed the have been the first person buried in the Manley Cemetery, however, there are persistent stories suggesting some soldier dead were buried at the site in 1861 (Occulus 2000:2-64; footnote 94). Bray (1975:40) recorded the cemetery as 23GR239. In 1983 (Ray and Monk 1984:15-16) visited the cemetery, finding it overgrown and surrounded by a wire fence. They mapped the site, recording 30 grave markers, mostly unmarked field stone. In the summer of 2003 a tornado passed across the southern portion of Wilson's Creek with the cemetery directly in its path. Most of the trees in and around the cemetery were blown down with huge tree throws and deep holes resulting. Park maintenance personnel removed the downed timber from the cemetery leaving the area nearly clear of vegetation. The cemetery was remapped and re-recorded in the fall (Scott 2003). The Edgar Cemetery that was in existence at the time of the battle and associated with the Josiah Edgar property, another early settler to the area, was also mapped at the same time (Scott 2003).

John Gibson House (23GR230) and Mill Site (23GR227, 231, 232)

John Gibson and his family are believed to have moved to Missouri about 1854, settling, originally, about four miles north of the battle site. On October 20, 1859 Gibson purchased a house, mill, and other improvements on Wilsons Creek owned by W. A. Robertson. By 1860 Gibson employed a carder and a farmer resided on his property. Gibson apparently also carded wool as well as milling grain. The Gibson property is believed to have consisted of three major structures, a house, carding factory, and the mill, as well as mill dam and race, and agricultural fields (Occulus 2000 2-36-38).

The Gibson mill and house complex are designated as 23GR227 (mill dam 1), 230 (house), 231 (mill dam 2), and 232 (mill). The site is important to the battle story as it is one of the five major building complexes on Wilsons Creek that played a significant role in the battle. Plummer's battalion of regulars forded Wilsons Creek near the mill complex as they attempted to flank the southern forces on their right. They were initially stymied by the depth of the creek and the density of undergrowth along its banks. In all probability the battalion ran into the millpond and had to find a shallow ford to cross the creek, thus loosing

valuable time and tactical advantage to take the Pulaski Battery as a result. The movement resulted in the fight in Ray's cornfield, and in Capt. Joseph Plummer's subsequent retrograde movement his troops again forded the creek in the vicinity of the mill and house.

Bray conducted extensive study and excavation of the complex (Bray 1967a:43-135; 1967b:173-184) during his archeological investigations in the park. His work at the mill (Bray 1967a:62-90; 1967b:196-197) uncovered a rectangular stone founded building, the water powered turbine housing, and a number of other architectural features. He recorded several mill related features in Wilsons Creek itself, mostly timbers that had fallen or been thrown into the creek at the time of the mills' destruction by fire. Most were well preserved at the time. Bray (1967:91-112) also located and recorded remains of two milldams and the headrace during his field investigations. Finally, he conducted extensive excavations at the Gibson house site (Bray 1967a:113-135; 1967b:173-194). The house site excavation determined that the building site had been extensively disturbed by cultivation. Bray found an L-shaped structure with a cellar in the ell, and he located and excavated a detached root cellar. The site yielded evidence of it destruction by fire, known from the historic record to have occurred in the late nineteenth century, as well as a variety of domestic and architectural artifacts.

Elias B. Short House Site (23GR228)

Elias Short's house was not on the main battlefield, but Lyon's route from Springfield caused his army to pass by the house and initially engage the southern forces from practically Short's front yard. The battle passed quickly to the south and to the vicinity of Bloody Hill, thus leaving Short out of the main fighting, at least until the Federals retreated back to Springfield.

Short and his family were living in the area of Wilsons Creek as early as 1848, but did not purchase the land until 1852, on which his white house with green shutters that played a role in the battle sat. Short was apparently a successful livestock man, owning some 320 acres, raising cattle and mules (Occulus 2000:2-44-45) by 1860.

The Short house and farm yard figured prominently in Bray's (1967a:136-158) archeological investigations due its importance to the historic scene. Bray successfully located the house site and found the hearthstones and scattered remains of the stone chimney, as well as a reasonably well-preserved foundation. He was able to determine the approximate dimensions of the house, and he located a root cellar nearby. He unsuccessfully trenched the area for the barn location, but did document several metal concentrations with his metal detector transects of the site. Artifact recovery was good, with most items relating to domestic activities and agricultural pursuits. He did find a few Civil War artifacts including a brass U.S. belt plate (1855 pattern) and nearly half of a spherical 6-pounder case shot, which he called a cannon shell. The fuse hole is unthreaded indicating that the fusing system was a paper time fuse set in a wood fuse holder. This case shot fragment is likely to have been fired by the Southern forces, perhaps the Fort Smith Battery, at the

retreating Union troops as this was the only time the area came under artillery fire (Piston and Hatcher 2000:275-286).

Wilson's Creek Townsite (23GR243)

The town of Wilson's Creek, while not a Civil War era resource, is important to the development of the area, and for the effect it had on the prehistoric and Civil War era archeological record. The town was developed in 1907 as one of a series of small communities that sprang up along the Springfield Southern Railroad line, a branch of the Missouri Pacific Railroad, constructed around 1905. The town was platted into 63 lots with four main streets. The first buisness to locate at the north edge of the town was the Roger's White Lime Company. They developed a limestone quarry and built a limekiln. The company only operated five or six years (Barnett 1980; Barnett nd). According to Barnett's (1980; nd) research the town never really developed although several stores and a post office operated for a number of years. In late 1917 a tomato canning factory was built in the north end of town. It operated for about five years then closed. The town essentially ceased to exist by 1929 when the last residents moved away.

Composite maps of the town show that it occupied a terrace on the east side of Wilsons Creek and was west of the railroad right-of-way. The tomato cannery and the earlier lime kiln operation occupied the north end of the town site. There were at least eight small kiln worker houses constructed south of the kiln operation. There were at least thirteen other buildings, homes, stores, and barns constructed in the town durings its existance, as well as other undocumented privies, and outbuildings.

Bray (1975:42) designated the townsite as 23GR243. He thought it had little archeological significance at the time of his work in the park. He also noted during a walkover of the site in 1974 he found the area very disturbed by the town buildings and roads. He noted that there was very little likelihood that prehistoric or Civil War era material were intact on the site.

Bray's opinions were confirmed during the 2003 field season when the town site area was covered by a series of metal detector transects. Four Civil War bullets (two .69-caliber unfired balls, one .58-caliber Minié ball, and one .69-caliber Minié ball) were recovered as was one artillery shell fragment. The metal detector transects found large quantities of modern metal debris, and visual inventory discovered scattered prehistoric lithic debris on the town site. There is little doubt that Wilson's Creek town site development very nearly eradicated any evidence of the Civil War or earlier occupation on the site.

Civil War and Battlefield Archeology in Southwest Missouri

The prehistoric and historic archeological record of southwest Missouri is rich, but little attention has been paid to the Civil War archeological record by professional archeologists, at least until recently. Aside from the Bray's work at Wilson's Creek in the

1960s and 1970s little other professional work was done on local battle sites until a brief study of the Newtonia Battlefields of 1862 and 1864 was conducted in 1995 (Fryman 1995). The study was funded by a grant to the Newtonia Battlefields Protection Association from the National Park Service American Battlefields Protection Program. The work included historical research and limited metal detector survey. The metal detector work included survey of six different land parcels believed to have played a significant role in the 1862 or 1864 battles. Some Civil War material was found in three locations suggesting the battlefields still retain a good degree of integrity and warrant preservation.

A second metal detector study of the Newtonia battlefield by Cubbison et al. (1998) resulted in the identification and recovery of over 400 Civil War era artifacts. Their work was preceded by intensive archival research on both the 1862 and 1864 engagements that allowed field work to be focused on specific areas that were likely to yield archeological artifacts from reasonably well preserved contexts. The Whitestar team located the core of the 1862 battlefield including the probable battle position of the 9th Wisconsin Infantry. They were also able to locate artifacts associated with the Federal camps used during the occupation of Newtonia.

A Civil War campsite near Van Buren, associated with the 1863 Army of Southeastern Missouri's movements was intensively investigated as part of a mitigation effort associated with the construction of a new visitors center at Ozark National Scenic Riverway. Garrow et al. (2000) conducted visual and metal detecting inventories, as well as test and block excavations at the site of Camp Lincoln. Garrow's team recovered ample evidence of the camp site, located an artillery position, and during analysis was able to identify specific regiments' campsites based on the carefully plotted bullet types that associated with the historically recorded armament of the various units stationed there.

A professional archeological study of the Big Blue Battlefield, near Kansas City, associated with Price's raid into Missouri in 1864, was attempted by Marmor (1997). The investigation included survey and data recovery, although little in the way of Civil War era or battle-related materials was located. Unfortunately, the area of investigation was substantially disturbed by a variety of urban development.

The Mine Creek, Kansas battlefield, near Fort Scott, the last fight relating to Price's 1864 raid into Missouri, was successfully located and investigated by William Lees (1998). Lees and his team located the battlefield and a road trace feature after diligent research and extensive metal detecting efforts. The historically identified site was not accurately located, but archeological investigations were able to correctly identify the old Fort Scott road and then accurately locate firing lines and artillery positions related to the Battle of Mine Creek.

Each of these studies aids in establishing a baseline from which to evaluate the finds of the current Wilson's Creek battlefield study. But, there were also earlier relic collecting

activities and professional archeological investigations at Wilson's Creek that broaden and refine that baseline and on which the current study is built.

Relic Collecting at Wilson's Creek

Relic collectors were active on the Wilson's Creek battlefield for many years prior to its entering the National Park System. Casual collectors are known to have walked the fields after plowing picking up bullets and battle debris for many years following the battle. Although the number of collectors and the extent of their collections are unknown, there are two Wilson's Creek battlefield collections preserved in the General Sweeney Civil War Museum. The collections were made by the late Fleet Kerr and the late Darrell Trogdon, both local collectors and residents.

Both collections are largely unprovenienced, but consist of hundreds of items. Among the relics observed in the collections at the General Sweeney Museum are various calibers of lead balls and bullets (.30, .54, .58, and .69 calibers), fragments of 6-pounder and 12-pounder cannon shell and case shot, canister balls, solid shot, and blacksmith-made expedient cannister or so-called "bar" shot. Also present are musket take-down tools, some type of check chain, a pot hanger for a campfire, a Model 1816 bayonet, and a musket lockplate. The other park collections contain many of the same type bullets, cannonball fragments, bar shot, personal items, and accoutrement fragments. The majority of the park's battle-related collections came as donations from local residents who claimed the artifacts were found on the battlefield. A 10-pounder Parrot shell in the collections (ANCS 663) is unlikely to be a Wilson's Creek piece as no rifled cannon were used at Wilson's Creek by either side. Several other donated artifacts are misidentified. A "bar" shot (ANCS 18) is actually a six-sided 10 pound scale weight, and four 4-pounder spherical shot or 32-pounder canister balls (ANCS 238, 555, 1001, 5512, and 10553) are not artillery projectiles but iron balls used in a grinding mill for crushing rock. They do resemble spherical shot, but there are tell-tale wear marks around objects that indicate their true function. If they were indeed found on the battlefield they most likely originated from the limestone quarry and lime kiln works associated with the late nineteenth and early twentieth century town of Wilson's Creek.

The two relic collections and the park collection have little provenience information associated with them. However, Darrell Trogdon did make a rough sketch map of some of his finds (Figure 10). The map, drawn in ballpoint pen on a large scrap of Naugahyde, is part of the General Sweeney Museum collection and was made available for study through the kindness of Dr. Thomas Sweeney. The artifact find locations sketched by Trodgon include bullets, cannon shell fragments, and canister balls, as well as a few equipment items. The map is not precise but does give a general idea of the artifact types and distribution of finds Trogdon made along Wilsons Creek and north of Skeggs Branch to about the Gibson's Mill site.

Immediately north of Skeggs Branch and north of the Sharp farm house, Trogdon recorded on his map that he found thirty-four canister balls and eight bullets north of Skeggs Branch and one canister ball south of the creek during his relic collecting activities.

Trogdon found most of his battle-related artifacts on the western slopes of Bloody Hill between the site of tour road stop at Guibor's battery and to the north of the current tour road stop at the crest of Bloody Hill. He also collected from the tour road stop to Wilsons Creek. In this area he located a complete 12-pounder cannon shell, 72 artillery shell and case shot fragments, 39 canister balls, 17 bullets, and three gun tools. East of Wilsons Creek and along the fields bordering its banks west of the southern portion of Ray's cornfield Trogdon collected 28 canister balls, nine artillery shell or case shot fragments, and two unidentified objects.

Robert Bray, of the University of Missouri, was the first archeologist to attempt to conduct a systematic metal detecting inventory of Bloody Hill. Bray was one of the few archeologists of his era to advocate the use of metal detectors in studying historic sites. He was exposed to the value of metal detecting in archeology in 1958 during his work with historian Don Rickey at the Little Bighorn battlefield (Bray 1958; Connor and Scott 1997). During his Wilson's Creek field investigations in 1966 Bray employed a metal detector and spent four workdays sweeping the grids he laid out on Bloody Hill (Bray 1967a:10-11). He recovered only twelve metal objects, and only three of those related to the Civil War battle, a lead ball that may be Civil War in origin and three canister shot body/container fragments. Bray was frustrated by his lack of recovery, attributing it to relic collectors picking the area clean, heavy vegetation undergrowth hampering his survey technique and access to the ground, and the presence of large quantities of modern trash that obscured the Civil War era resources (Bray 1967:11). His conclusions were in a sense, only partially correct. There is little doubt that relic collecting has removed a portion of the battle-related resource, but as the modern inventory has shown there is still substantial integrity to the resource. Bray was correct that the vegetation undergrowth and modern trash did obscure the earlier materials, but he was hampered less by relic collecting than he was by the metal detecting technology of his day. Metal detectors simply did not have the electronic components that make modern metal detectors capable of finding very small metal objects buried as deep as 14 to 18 inches (Connor and Scott 1997). Metal detectors of the 1950s and 1960s were in an early stage of development. Developed in World War II as a device for find buried land mines and booby traps by the 1960s they were not much more than sophisticated electronic tools meant to be used to find large buried iron or utility and sewer lines. Their application to relic collecting was just beginning and manufactures were only beginning to recognize the need to refine their sensitivity to find smaller and more discrete targets. Bray's advocacy of the use of metal detectors makes him a leader in the area of their archeological use, but he was ahead of his time given the limitations of the technology.

The Union burial site, the sinkhole (23GR234) on the west side of Bloody Hill (where 34 Union soldiers had been buried and later, in 1867, exhumed for reburial in the Springfield National Cemetery), was excavated and restored by Bray (1967a). A few human

skeletal elements, bullets, and a few buttons were recovered during the restoration of the sinkhole. During 1999, human skeletal elements located in the park's collections, and presumably found in or around the burial sinkhole on Bloody Hill, were analyzed (Willey et al. 1999) and documented (See Appendix II for a discussion of human remains recovered during Bray's work and other collection efforts). The analysis determined that the skeletal elements overlooked by the early reburial parties represent a minimum of six individuals. The individuals represented appear, for the most part to be young males, and there is some evidence of trauma on the bones that is consistent with Civil War or nineteenth-century type wound trauma. One piece of expedient canister or "bar shot" was found in the sinkhole suggesting that at least one of these missiles found its mark during the battle.

Park Historian Richard Hatcher with the aid of several volunteers including Dr. Thomas Sweeney metal detected the backdirt removed from the tour road construction and the Bloody Hill pedestrian path construction in 1985 and 1986. Their efforts resulted in the recovery of 130 artifacts, the majority of which were bullets although a few personal items, horse tack, and some cut nails were also recovered. Unfortunately the majority of the items were recovered out of context in the construction backdirt, their work, nevertheless, demonstrated that there was extensive battle related evidence still present on the field despite all the years of relic collecting and in contrast to Bray's nearly fruitless attempt at systematic metal detecting twenty years earlier.

In addition to the current inventory efforts a contracted cultural resource inventory (Archeological Resources Protection Act permit 2000-4) was conducted along the existing transmission line corridor that passes through the park using visual observation, shovel testing, and metal detecting to locate evidence of past occupation and use. (Environmental Research Center 2004a). The crew also inventoried an alternative alignment that runs along the parks west and north boundaries. The inventory effort located one previously recorded prehistoric site (23GR245), located and recorded a previously unknown site (temporary number 23GR-ERC-7) and a historic tiff mine pit (temporary number 23GR –ERC-8). The report offers up the possibility that the tiff mine pit could be the second sinkhole burial site. Although located too far north of the presumed historically described site, the idea bears further examination as the tiff mine pit is located in the vicinity of the presumed site of the Union field hospital and ambulance park.

Documented Collecting Activities Adjacent to the Park

William Eastlake (personal communication April 14, 2001) told the senior author he and others had metal detected the Blount property, located at the southwest corner of the park along the alignment of the old wire road, for several years. He had personally collected about 150 pieces including .58-caliber and .69-caliber bullets, a Burnside cartridge case, knapsack hooks and triangles, a harmonica plate, and other Civil War era artifacts that he believed were lost during a firefight between Sigel's retreating forces and pursuing southern forces. Park employee Jeffrey Patrick and others (email to Scott from Jeffery Patrick October 30, 2002) obtained the land-owners permission to metal detect the property

as well. They found over 100 artifacts, mostly dropped .58-caliber bullets, and collected GPS locations on the area detected. Patrick believes the debris they found is likely related to a campsite of General Herron's division from an 1862 movement through the Wilson's Creek area. Subsequent to the informal inventory of this area an archeological inventory associated with a potential power line construction project covered a 100 foot wide transect through this area. The inventory effort identified a multi-component site near Skeggs Springs, temporary number 23GR-ERC-4 that includes a prehistoric component, possible sites of historic farmsteads, and the Union Civil War camp (Environment Research Center 2004b).

3. A BRIEF BATTLE HISTORY

McCulloch's and Price's army was in the better position to attack Lyon's army, outnumbering the Federals by more than two to one. Lyon was defending Springfield, but was concerned that the Southern cavalry could be used to hinder or prevent a withdrawal to his base of supply at Rolla. Lyon could not remain on the defensive at Springfield, nor could he withdraw without a fight for any number of strategic, tactical, and political reasons. Thus, when McCulloch and Price moved their army to Wilson's Creek, less than fifteen miles from Springfield, Lyon was forced to act, and decisively.

Lyon apparently used General Winfield Scott's Mexican War attack at the Battle of Cerro Gordo as a model for his strike on the Southern camps at Wilson's Creek. Lyon divided his outnumbered army into two parts, sending Colonel Franz Sigel's brigade of Volunteers on a night march to flank the south end of the Southern camps, while Lyon himself led the main force on a night march to attack the northern end of the camps. Initially, Lyon had the element of surprise and tactical initiative that temporarily made up for their lack in numbers. Lyon very well came close to winning the battle.

Unit Organization

Knapp's (1993:15-16) concise summary of both armies' organization is quoted to provide a synopsis of fighting forces.

> *"General Lyon's army consisted of small Regular Army infantry, artillery, and cavalry units, as well as larger Volunteer infantry formations organized much like the U.S. Army units in the Mexican-American War. Notable among the Regular units were Plummer's battalion of four companies from the 1st U.S. Infantry; Totten's Battery F, 2d U.S. Artillery; and Captain Eugene A. Carr's and Lieutenant Charles E. Farrand's companies of the 1st U.S. Cavalry and 2d U.S. Dragoons. Commanders on both sides felt that these Regular troops brought an additional measure of discipline and reliability to the battle. Confederates who engaged the Regulars in battle were quick to note that fact in their after-action reports, as if fighting against the U.S. Regulars was a significant point in proving the southern soldiers' ability to wage war.*
>
> *Most of Lyon's army, however, consisted of ninety-day volunteer regiments from Missouri, Kansas, and Iowa. In fact, soldiers in at least one regiment, Colonel John F. Bates' 1st Iowa, volunteered to remain beyond their three-month enlistment date to participate in the fight. Because these regiments were recently raised, most numbered from 600 to 800 men, nearly as large as some brigades in 1864 and 1865. The men of these regiments were generally well-armed with percussion fired rifled muskets and rifled and smoothbore muskets converted from flintlock to percussion. Volunteers made up two of the artillery batteries, Du Bois' and Major Frank Backoff's. Most of the cavalry was from the Regular Army.*

Lyon organized his army into four brigades, but with the exception of Colonel Sigel's brigade, he employed his formations without regard to organizations higher than the regiment. During the battle, Lyon placed units into position as he saw fit, and it was a measure of the relatively small scale of this fight that he could do so. In July, commanders at Bull Run had acted similarly. This practice was a direct result of lessons learned in the small battles in Mexico. For the most part, regiments at Wilson's Creek, and even companies, acted at the direction of higher-level commanders. Lyon's staff consisted of only a few aides and some civilian guides. Lyon himself led several attacks comprised of only two or three companies, and he died doing so. The Confederates, on their part, did not field regular troops at Wilson's Creek-at least not in the same sense as Federal Regulars-but General McCulloch considered that the formations he had brought with him from Arkansas, Louisiana, and Texas were more reliable and steadfast in battle than General Price's Missouri State Guard formations. Among McCulloch's formations were many former officers from the United States Army, such as Captain Woodruff, who commanded the Pulaski Arkansas Artillery Battery. It is worth noting that most of the formations in both McCulloch's and Price's commands went on to have worthy combat records fighting for the Southern cause during the war.

Perhaps the most unusual formation at Wilson's Creek was the Missouri State Guard (MSG) commanded by Major General Sterling Price. This militia organization formed more than one-half of the Confederate host and consisted of infantry, artillery, and cavalry. Although well-organized and adequately drilled, Price's command was armed with a mixture of poor weapons ranging from shotguns and pistols to swords and knives. Many of the men had no weapons at all. In their organization, each of the MSG "divisions" contained both infantry and cavalry. This caused some difficulty in the way the combined campsite at Wilson's Creek was laid out. Most of the infantry camped near the Edwards' cabin, while most of the cavalry camped in Sharp's cornfield. Thus, when the battle started, the mounted men were out of touch with their division commanders, and this led to much of the confusion that plagued the Confederate camps in the opening phase of the battle.

McCulloch organized his army into two major formations. He retained personal control of his and Pearce's Confederate brigades and allowed Price control of the MSG. Essentially, then, the Confederates had two division-size formations, but during the battle, McCulloch and Price (like Lyon) employed units without regard to organization above the regimental level. In fact, both Confederate commanders moved from unit to unit attempting to personally influence the action. In this regard, they had good success."

Once the guns opened the battle, the battle plans disintegrated into piecemeal maneuverings at the regimental and company level. Sigel's initial attack of the Southern cavalry camps in Sharp's cornfield was a model of combined arms maneuver (Knapp 1993; Mills 1979). From a hill east of the southern camps Sigel had four of his guns bombard

the camps. Sigel also sent his infantry to the south to cross Wilsons Creek and attack the camps, and he had his cavalry secure his flanks. Moreover, once in possession of the field, Sigel moved to a position from which he could block an expected southern retreat from Lyon's onslaught to the north.

The southerners were initially surprised with several units, especially the cavalry, loosing their effectiveness for the remainder of the battle (Mills 1979). McCulloch and Price quickly evaluated the situation and began to regain control of their surprised and disorganized units. The Missouri State Guard quickly responded to Lyon's presence on Bloody Hill. McCulloch personally led a counterattack that routed Sigel's brigade. McCulloch then moved to reinforce Price in the battle against Lyon on Bloody Hill that culminated in the Federal defeat and Lyon's death.

4. WILSON'S CREEK BATTLEFIELD ARCHEOLOGICAL INVENTORY PROJECT METHODS

In archeology it is not enough to know where artifacts are found, but also where artifacts are not found. A primary research goal of the Wilson's Creek Battlefield Archeological Project was to define the limits of the battlefield. The first requirement, then, was to develop field procedures that are capable of examining the entire extent of the battlefield. Faced with examining a large area, and assuming that most surviving artifacts of war are either metallic or associated with metal, metal detectors were employed as an inventory tool based on the success of the technique at Little Bighorn Battlefield National Monument (Scott and Fox 1987; Scott et al. 1989). The use of metal detectors operated by knowledgeable people has overwhelmingly proven its value (Connor and Scott 1998; Espenshade et al. 2002) and is now a common tool employed in archeological investigations of battlefields and campsites.

Locational control was accomplished through the use of a Global Positioning System handheld unit and electronic data collector. Each item or location recorded on the data recorder was identified by unique UTM coordinates and a previously established identification code. At the completion of a given day's work the recorded data was down-loaded onto a laptop computer containing the software program. The raw file was processed by the computer and a map of that day's finds was then generated.

Field Methods

Inventory Phase

The inventory phase included three sequential operations: survey, recovery, and recording. During survey artifact finds were located and marked. The recovery crew followed and carefully uncovered subsurface finds, leaving them in place. The recording team then plotted individual artifact locations, assigned field specimen numbers, and collected the specimens.

Inventory operations were designed primarily to locate subsurface metallic items with the use of electronic metal detectors. Visual inspection of the surface was also carried out concurrently with the metal detector survey. Volunteer operators furnished their own machines. Metal-detector operators were aligned at approximately 5 meter intervals. The operators walked transacts oriented to cardinal directions or, as necessary, oriented by topographic feature orientation. The daily composition of the detector crew ranged from six to twelve operators. Detector operators proceeded in line, using a sweeping motion to examine the ground.

Recovery The recovery crew excavated artifact locations marked by pin flags and left the artifacts in place for recording. This team consisted of excavators and metal-detector

operators. The number of operators and excavators varied from day to day depending on the workload.

Hand tools, such as spades and trowels were used to expose subsurface artifacts. Excavators were assisted by metal detector operators to ensure in-place exposure. Detector operators provided pinpointing and depth information to the excavator, thereby allowing a careful and accurate approach to the artifact. After exposure the pin flag was left upright at the location to signal the recording crew.

Recording The recording crew assigned field-specimen numbers, recorded artifact proveniences, and collected the specimens. Recorders backfilled artifact-location holes upon completion of recording duties. Artifacts were assigned sequential field-specimen numbers beginning at 1000. The collections are assigned park accession number 390, and MWAC accession numbers 924 (2001 season), 969 (2002 season), and 1010 (2003 season).

5. METAL DETECTED ARTIFACTS - DESCRIPTION

The metal detector investigations at Wilson's Creek yielded a wide variety of artifacts. The majority of collected specimens can definitely be attributed to the battle, although some items of unknown function or date were also collected in the field, and through subsequent laboratory analyses were determined to date to the post-battle occupation. These latter artifacts represent items lost or discarded by occupants of the area and visitors to the field. Post-battle artifacts that could be definitively identified as such in the field were not collected during metal detecting efforts.

This section consists of a description of the artifacts recovered during the metal detector inventory. The emphasis of these descriptions focuses on the battle-related artifacts. Interpretation of the relationship of these artifacts will be found in the section following the descriptions. The majority of artifacts recovered are bullets, and the majority of these are battle-related artifacts. Because of the large quantity of firearms related artifacts recovered the description and analysis emphasizes that artifact type. The Wilson's Creek collection is part of park accession number 370 and is also listed as Midwest Archeological Center accession numbers 924 (for the 2001 work), 969 (for the 2002 work), and 1010 (for the 2003 work).

Analytical Procedures

The methods employed in cleaning and analyzing the artifacts are the standard laboratory procedures of the Midwest Archeological Center. Essentially they consist of dry brushing or washing the accumulated dirt and mud from each artifact and then determining the condition of the artifact to see whether it requires further cleaning or conservation. For analysis and identification purposes some metallic items required a treatment by electrolysis or with Gemplers rust remover to remove oxides that had built up on them during the years in which they were in the ground. After it was cleaned each artifact was rebagged in a self-sealing clear plastic bag with its appropriate Field Specimen (FS) number and other relevant information on the bag. The artifacts were then identified, sorted, and analyzed.

The identification, sorting, and analysis consisted of dividing the artifacts into classes of like objects and then subsorting the artifacts into further identifiable discrete types. Sorting and identification of the artifacts were undertaken by personnel experienced with artifacts of this period, who compared the artifacts with type collections and with standard reference materials.

Presently the artifacts and original supporting notes, records, and other documentation are held at the National Park Service's Midwest Archeological Center.

Firearms Identification Procedures

A primary analytical tool of the project is Firearms Identification cases (Harris 1980; Hatcher, Jury, and Weller 1977). The comparative study of ammunition components is known as firearms identification analysis. Firearms, in their discharge, leave behind distinctive metallic fingerprints or signatures on the ammunition components. These signatures, called class characteristics, allow the determination of the type of firearm (i.e., model or brand) in which a given cartridge case or bullet was fired. This then allows determination of the number of different types of guns used in a given situation. This capability is very important because coupled with the precise artifact locations, the class characteristics can be used to identify specific combat areas and the weapon types used in that location. With this information, patterns of movement can be established and sequences of activity can be more precisely interpreted.

All cartridges, cartridge cases, bullets, and other ammunition components were analyzed utilizing these firearms identification procedures. The specific results of the analyses are discussed in the artifact analysis and interpretation chapters.

Artifact Descriptions

Percussion Caps

A single percussion cap (FS2710) was recovered at the south edge of Ray's cornfield. A second cap (FS3419) was found on the eastern flanks of Bloody Hill. The first is unfired and the second is fired, both are the top hat or military musket style percussion cap (Hunt 1989:334-349).

.36-Caliber Bullet

FS 1236 is a fired .36 caliber pistol bullet. It has evidence of rifling marks on it but suffers from distortion because of impact damage. The rifling pattern is not distinct enough to identify the pistol type with certainty, but may be a Colt Navy pistol.

St. Louis Arsenal produced a unique bullet type for the Colt revolver (Thomas 2003:15) Two of these St. Louis bullets in .36-caliber (FS2393 - fired, 2522 - dropped) were recovered (Figure 11a, b). The fired bullet exhibits seven lands and grooves impressions with a right-hand twist indicating it was fired from a Colt revolver. FS3459 is an unfired .36-caliber solid base bullet that has rouletting around the base. It is unfired but is similar in construction to identified Watervliet Arsenal produced bullets (Thomas 2003:18)

.38-Caliber Bullet

A single (FS3485) .38-caliber "Picket-style" smooth bodied, pointed nosed, solid base bullet was recovered. It is unfired. McKee and Mason (1980:22-23) identify this bullet style as one used in "country rifles" that were personally owned firearms.

.40-Caliber Bullet

Another "country rife" type bullet (Figure 11c) may be represented by FS3015. It is a fired badly impact damaged solid base bullet. It exhibits remains of a casting sprue as well as rifling marks and impressions of cloth patching. The rifling marks are too obscured to determine gun type.

.44-Caliber Bullets

Colt revolvers were the most widely known and used revolvers during the Civil War. Colt held a well recognized prominence prior to the war that carried through well past the end of the war (Coates and Thomas 1990:54). A Colt fired bullet (FS3108) that was recovered (Figure 11d). FS3108 is the standard U.S. arsenal produced pressed bullet with recessed base/raised ring style (Thomas 2003:10).

FS3354 is also a .44-caliber lead bullet (Figure 11e) fired in a Colt revolver, but it is unusual in that it has a tie-ring base and resembles a Sharps .44-caliber bullet. The specimen has strong right hand twist land and groove marks and a clear ramrod or loading lever impression on the nose, each of which are consistent with being loaded and fired in a Colt revolver. It is likely this was not fired in a Colt pistol, but a .44-caliber Colt Revolving rifle.

.45-Caliber Bullet

A .45-caliber cast bullet (FS3303) is a round-nosed hollow base three groove bullet (Figure 11f). It has three wide lands and three narrow grooves right hand twist rifling impressions. The weapon type is unknown, but may represent one of the so-called "country rifles" or privately owned hunting rifles that may have been a personal weapon.

.50-Caliber Bullets

A Maynard .50-caliber bullet (FS1011) was recovered in Sharp's field. This bullet (Figure 11h) was a component of a self-contained cartridge that was used in the Maynard breach loading type carbine. This weapon has been described as, "The Maynard carbine, a rugged and well made light weight breach loading firearm of .50 caliber that was manufactured from before the Civil War and continued through the war"(Coates and Thomas 1990:43). This bullet does not exhibit attributes of being fired. It has been flattened

around the body of the bullet and has what appear to be marks cut into the bullet with a knife that was used as a tool to better grip the projectile to pull it from the case.

Sharps .52-Caliber Bullets

The Sharps firearm was patented in 1852 and was a very popular military and commercial firearm for the next 50 years. It was produced in percussion and after the Civil War in cartridge styles. Its popularity was due to its accuracy and its reputation for having effective stopping power. Particularly in the larger calibers it was the favored gun of big game hunters on the plains and in the west in the years after the Civil War (Gluckman 1965:230,268; Barnes 1989:139). The Sharps was favored by both Union and Confederate cavalry. The weapon utilized a paper or linen cartridge firing a .52-caliber bullet (Coates and Thomas 1990:45-46). FS2661, 2709, 3602, 3646, and 3645 are .52 caliber Sharps tie-ring base bullets (Figure 11i) that have been fired.

Single groove solid base Sharps bullets that are considered to be the early style bullet originally intended for the slant breech style carbine (McKee and Mason 1980:26-27) are represented by FS2595, 2698, 3019, 3515, and 3565. All are fired and exhibit impact damage.

A third type Sharps bullet is a two groove, raised ring, solid base bullet. There were six recovered at Wilson's Creek (FS1238, 3041, 3214, 3367, 3642, 3368).

.54-Caliber Bullets

Another caliber of Minié ball recovered on the Wilson's Creek battlefield is the .54-caliber. Eight .54 caliber Minié balls (FS1243, 2587, 2610, 2611, 3305, 3634, 3503, 3539) are unfired (Figure 11j) but some have damage from agricultural activity.

There are 20 three groove standard U.S. type .54-caliber fired Minié balls (FS1041, 2315, 2338 [basal damage indicating it was in yaw], 2352, 2381, 2383, 2395 [body flattened indicating it was in yaw], 2561, 2466, 2496, 2760, 3021, 3039, 3091, 3095, 3171, 3208, 3382, 3393, 3653). All have remains of 6 land and groove rifling impressions (Figure 11k) with a right hand twist indicating they were fired in the Model 1841 "Mississippi" rifle.

FS1234 is a smooth sided conical bullet like the English style Enfield .54 caliber bullet. The lands and groove marks on the bullet are right-hand twist three wide land and groove rifling that is consistent with the Gallager carbine. The bullet retains fabric impressions on the body from impact. The source of the fabric is undetermined It is a round-nosed solid base smooth bodied bullet (Figure 11g).

Two .54-caliber Minié balls (FS2736, 2737) are unfired and have two lubricating grooves. The bullets are identical to bullet types identified by McKee and Mason (1980:35) as used in the so-called Garabaldi rifle, one of the many models imported from Austria,

Germany, France, or Belgium to equip militia companies prior to the outbreak of hostilities and after the war began (Noe et al. 1997).

A badly impact damaged two groove solid base bullet that measures a nominal .54-caliber (FS2713) is unidentified as to weapon, but is consistent in style with the Colt .56-caliber revolving rifle bullet (McKee and Mason 1980:26-27).

.58-Caliber Bullets

The standard military .58-caliber Minié ball was recovered from most areas of the battlefield. According to Coates and Thomas (1990:14) the Model 1855 rifled musket was the first gun produced by the United States to fire the famed .58-caliber Minié ball. Two hundred eighty-four .58-caliber bullets or Minié balls found at Wilson's Creek, of these, 199 appear to have been fired and 196 have residual rifling marks (Figures 12, 13). The other three fired bullets were identified as being fired by the distortion or the flattening of the bullet by impact. have obliterated the rifling marks, or the bullets may represent guns that were excessively fouled with black powder residue causing the bullet to become spin destabilized as well as fail to imprint the rifling's land and groove marks. One .58-caliber Minié bullet (FS2469) was loaded in a musket, but pulled from the barrel prior to firing as is evident from the bullet screw/puller thread marks in the bullet nose (Figure 14). Whether done prior to, in the heat of battle, or afterward is unknown. Two of the bullets (FS34417, 3498) are actually .577-caliber and represent two types of British Enfield pattern bullets. This bullet type could be fired in either the Model 1855 .58-caliber U.S. made rifled musket or the Pattern 1853 British made Enfield rifled musket.

One Minié ball (FS1116) appears to have been hand cast from some kind of harder lead/tin alloy. The alloy could be some kind of metal like the common tire weight. It is nose cast with residual cap point and a truncated cone base. This specimen has rifling grooves, an indication that it was fired, and is believed to be a modern cast bullet that is intrusive. There are 30 unfired or dropped .58-caliber Minié balls that retain evidence of being cast and seven fired bullets were cast. Twenty-eight bullets were manufactured by pressing while the majority does not retain clear evidence of how they were manufactured.

Fired: FS1225, 1229, 1241, 1249 [M1855 ramrod mark], 1259, 2276, 2279, 2283, 2287, 2290, 2291 [M1855 ramrod mark], 2292, 2293, 2294, 2299, 2310, 2316, 2321, 2323, 2328, 2340 [M1855 ramrod mark], 2353, 2355, 2357, 2359, 2360, 2361, 2363, 2364 [M1855 ramrod mark], 2369, 2371, 2372 [M1855 ramrod mark], 2379, 2380, 2382, 2384 [M1855 ramrod mark], 2388, 2394, 2399, 2404, 2413, 2420, 2426, 2428, 2430, 2432, 2434, 2442, 2444, 2447, 2453, 2455, 2462, 2470, 2471, 2475, 2477, 2480, 2485, 2486, 2490 [M1855 ramrod mark], 2491, 2494, 2495 [M1855 ramrod mark], 2497, 2499, 2500, 2502, 2503, 2507, 2512, 2513, 2524 [M1855 ramrod mark], 2534, 2557, 2563, 2564, 2750, 2573, 2574, 2576, 2579, 2584, 2585, 2596, 2606, 2608, 2609, 2624, 2627, 2652, 2654, 2659, 2702, 2708, 2716, 2725, 2726, 2730, 2731, 2732, 2734, 2735, 2745, 2746, 2747, 2750, 2762, 2766 [M1855 ramrod mark], 2768, 2770, 2774, 2775, 2777, 2779, 2780, 2782, 2783, 2785, 2786, 2787,

2789 [M1855 ramrod mark], 2795, 2797, 2799, 2801, 2803 [M1855 ramrod mark], 2804, 2805, 2808, 2812 [M1855 ramrod mark], 2813, 3012, 3022 [cast], 3029, 3030, 3032, 3033, 3034, 3042, 3043, 3046 [cast], 3049 [cast], 3057 [cast], 3059 [M1855 ramrod mark], 3061, 3062, 3063, 3069, 3073, 3077, 3080 [M1855 ramrod mark], 3081, 3082, 3083, 3084, 3085, 3087, 3089, 3100 [M1855 ramrod mark], 3104, 3105, 3106, 3107, 3109, 3142, 3147, 3154, 3157, 3166, 3195, 3203, 3209, 3213, 3219, 3238, 3240 [cast], 3244, 3252, 3256 [cast], 3263, 3278, 3302, 3312, 3323, 3333, 3334, 3340, 3344, 3349, 3359, 3360, 3381 [cast, M1855 ramrod mark], 3384, 3394, 3417 [Enfield pattern], 3425, 3426 [M1855 ramrod mark], 3434, 3436, 3444 [M1855 ramrod mark], 3448, 3461, 3468, 3476, 3481, 3483, 3486, 3487, 3488 [M1855 ramrod mark], 3489 [Enfield-Prichett pattern], 3490, 3494, 3518, 3528, 3529 [cast], 3530, 3531, 3532, 3534, 3541, 3556 [M1855 ramrod mark], 3578, 3585, 3604, 3632 [cast], 3634, 3649, 3650, 3660, 3661 [M1855 ramrod mark], 3663, 3667.

Dropped: FS2322, 2437, 2445, 2463, 2464, 2469 [pulled, M1855 ramrod mark], 2501, 2505, 2509, 2515, 2516, 2519, 2533, 2539, 2541, 2581 [cast], 2583, 2622, 2629, 2637, 2639, 2648, 2670, 2674, 2691, 2692, 2694, 2728, 2738, 2793, 2798, 3146, 3187, 3192 [cast], 3206, 3210 [cast], 3217 [cast], 3234 [cast], 3242, 3245 [cast], 3247, 3248, 3250, 3258 [cast], 3260 [cast], 3261 [cast], 3264, 3269, [cast], 3282 [cast], 3294 [cast], 3308, 3317 [cast], 3324, 3326, 3337, 3362 [cast], 3374 [cast], 3375 [cast], 3385, 3390, 3397, 3398 [cast], 3399 [cast], 3401 [cast], 3413, 3437, 3446, 3453 [cast], 3471, 3484 [cast], 3496 [cast], 3498 [cast], 3558 [cast], 3563 [cast], 3568, 3630, 3640 [cast], 3641, 3643 [cast], 3652, 3656, 3657, 3668 [cast], 3670 [cast], 3683 [cast], 3689 [cast].

.69-Caliber Bullets

According to Coates and Thomas (1990:8) the first U.S. 69-caliber rifled musket was the Model 1842 that was designed to fire the hollow based conical Minié ball. The Model 1842 rifled musket replaced the Model 1816 series and it variations and the Model 1842 smoothbore musket. The smoothbore muskets were retained in federal arsenals as second class arms and were regularly distributed to state militia and guard units in the years preceding the Civil War.

There are 66 fired and 50 dropped or unfired .69-caliber Minié balls (Figure 15a, c, d, e) recovered from a variety of locations across the battlefield. Of these five are cast bullets and 43 are pressed bullets. The remainder do not retain evidence of their manufacturing technique. The recovered .69-caliber Minié balls are listed below:

Fired FS1001, 1094 (ramrod mark), 1244, 2277 [rodent chewed], 2280, 2324, 2397, 2408, 2419, 2452, 2472, 2488 [M1842 ramrod mark], 2527, 2531, 2550, 2559, 2592, 2646, 2647, 2664, 2669, 2672, 2677, 2721 [cloth impression], 2751, 2752, 2758, 2771, 2772, 2781, 3007 (M1842 ramrod mark], 3016 [M1842 ramrod mark], 3051, 3053 [M1842 ramrod mark], 3078, 3093, 3121 [cast], 3122, 3130, 3189 [cast], 3211, 3268, 3289 [cast], 3329, 3368, 3370 [ramrod mark], 3402, 3409, 3415, 3443, 3454, 3455, 3457, 3470, 3479, 3501, 3506, 3513, 3521, 3522, 3525 [ramrod mark], 3527, 3538, 3591, 3620, 3679

Dropped FS1010, 1253, 2327, 2337, 2425, 2460, 2667, 3045, 3126, 3140, 3141, 3150, 3167, 3168, 3172, 3176, 3178, 3181, 3183, 3200, 3202, 3204, 3205, 3216, 3226, 3227, 3229, 3230, 3235, 3241, 3243, 3279, 3313, 3356, 3380, 3407, 3408, 3421, 3438, 3473, 3474, 3477, 3478, 3480, 3495, 3519, 3564, 3569, 3570, 3572.

.71-Caliber Bullets

One fired (FS2441) and three unfired or dropped (FS2307, 2309, 2676) .70-.71-caliber Minié balls (Figure 15b) were recovered during the investigations. No U.S. made firearm was made in this caliber, but several European countries manufactured weapons in this large caliber. Austria produced the Model 1842 long rifle and the Model 1849 long rifle, also known as the "Garibaldi" (Noe et al. 1999:81). Germany or its individual states produced the Model 1809 "Postdam" musket and several other models, including the Prussian Model 1839/55 rifled musket, the Hanseatic League Model 1840 rifled musket, and the Saxon Model 1844 rifled musket (Noe et al. 1999: 93-96). Belgium and France also produced guns in this caliber in at least five different models (Noe et al. 1999: a106-110). Many of these guns were imported by both sides during the war, especially during the first year when firearms were in short supply. Most of these guns were not imported by either government until late 1861 and early 1862. Thomas (1997:253-254) indicates that cartridges and bullets for these guns were not imported by the U.S. government until December 1861, and that order was by the State of Ohio. The presence of this caliber at Wilson's Creek suggests that some units were armed with these import guns early in the war, or that later military visitors to the battlefield may have lost the bullets. The context of recovery mitigates against the visitor interpretation, rather supporting that one or more companies fighting there in 1861 were armed with these large caliber muskets. Given the large number of German immigrants in the St. Louis area prior to the war as well as the prevalence of German-American militia companies there and elsewhere (Rentshcler 2003) at the time it should not be a surprise that some individuals or companies may have been armed with European, particularly German made arms at the time of Wilson's Creek.

Undetermined Caliber Bullets

There are a 52 impacted bullets that are too deformed to identify as to caliber, but through remaining lubricating grooves or a visible hollow base they can be identified as a fragment of a Minié' ball. The FS numbers are: 1221,2282, 2285, 2297, 2345, 2347, 2368, 2418, 2427, 2431, 2537, 2613, 2663, 2727, 2744, 3011, 3054, 3113, 3125, 3160, 3161, 3185, 3186, 3212, 3266, 3237, 3319, 3347, 3350, 3379, 3383, 3387, 3403, 3405, 3435, 3464, 3475, 3497, 3523, 3526, 3557, 3588, 3589, 3596, 3625, 3626, 3627, 3635, 3638, 3648, 3659, and 3669.

.36-Caliber Spherical Balls

Six .36-caliber spherical balls (FS2302, 2317, 2468, 2548, 3152, 3553) represent small caliber revolvers used in the battle. All exhibit either impact scars or rifling marks (Figure 16a, b). Those with clear marks indicate they were fired in Colt revolvers.

.42-Caliber Spherical Balls

Two .42-caliber spherical balls may represent one of the so-called "country rifles" or privately owned hunting rifles that may have been a personal weapon. FS3232 is a cast ball that was fired in a rifle with 6 land and grooves and a right hand twist. The other ball (FS3684) is unfired. It is a ball with casting marks that suggest the mold was too cold to properly cast the ball and may have been discarded for that reason.

.44-Caliber Spherical Balls

There are eighteen .44-caliber spherical balls in the collection. Some are cast. FS 1228 is an impact damaged fired ball. Ten have land and groove marks indicating they were fired in Colt M1860 Army revolvers (Figure 16c, d). (FS2325, 2535, 2615, 2704, 2729, 2748, 3034, 3198, 3255, 3559). Three are unfired, dropped cast balls (FS2459, 2473, 2802), four are too badly deformed by impact to determine weapon type (FS2476, 2707, 3190, 3283)

.50-Caliber Spherical Balls

Nine .50-caliber spherical balls were found during the investigations. All are fired and exhibit impact damage (FS2722, 2811, 3050, 3129 [cloth impressions], 3131, 3151, 3155, 3335, 3647). All appear to be cast balls that were fired in rifled guns (Figure 16e, f). The rifling marks are six land and groove right hand twist indicating they were fired in either the Model 1833 or Model 1840 Hall carbine which was nominally .52-caliber (Gluckman 1965:336; Frasca and Hill 1995).

.54-Caliber Spherical Balls

Of the 17 .54-caliber spherical balls in the collection one (FS1213) is a cast dropped ball. Thirteen are fired and impact damaged (FS2396, 2549, 2551, 2554, 2561, 2589, 2655, 2788, 3004, 3036, 3094 [chewed by pig], 3222, 3432 [chewed by pig], 3631). Some exhibit 6 right hand twist land and groove rifling marks indicating they were fired in the Model 1841 "Mississippi" rifle (Figure 16g, h). Others have no visible rifling marks and may have been fired in a .54-caliber horse pistol. Two (FS 3225, 3388) are flattened by impact but have clear 16 land and groove rifling impressions (Figure 16i) indicating they were fired in M1819 Hall rifles.

.69-Caliber Spherical Balls

The oldest, most fundamental, projectile used in the Civil War by both sides was the spherical ball (Thomas 1997:98). It was fired in various small arms, the .69-caliber smoothbore musket being the classic and probably the most common caliber (Figure 17a, b) represented at Wilson's Creek. There are a number of models of smoothbore muskets that could have fired these balls; the most common would be the Model 1816 or one of many variations including those converted from flintlock to percussion ignition system. As a mater of reference for size the .69-caliber round ball can be fired in a 12-gauge shotgun.

Soft lead was desired in the manufacture of ammunition fired in small arms like spherical balls. To a certain extent, the spherical ball became compressed and distorted making the ball look more cylindrical thereby sealing the barrel even in the smooth bore musket. Some of the lead spherical balls have very definite attributes indicating that they were a fired as a buck and ball load (Thomas 1997:10). These balls have three distinct dimples or what actually looks like a smiley face on one surface of the ball where three buckshot (.35-caliber) balls resided (Thomas 1997:112). The reason for the addition of three buck shot (Figure 17c, d, e) to the standard musket ball load was to multiply the effectiveness of this weapon by increasing the number of projectiles fired per given round expended. The .69-caliber smoothbore muskets are notorious for their poor accuracy beyond 100 yards (Coggins 1990:38), but at close range the smooth bore musket could be a deadly and efficient weapon because they were fast to reload and the lead ball was heavy enough to carry quite a punch (Thomas 1997:104).

There were 154 fired spherical balls, 49 balls with buckshot impressions, and 99 unfired or dropped spherical balls recovered. Thirty-nine .69-caliber balls were manufactured by being cast in molds, and 29 bullets were manufactured by pressing. The remainder does not retain clear evidence of how they were manufactured. The recovered .69-caliber balls are listed below:

Fired: FS1057, 1185, 1247, 1254, 2278, 2281, 2288, 2289, 2295, 2296, 2298, 2300, 2301, 2303, 2304, 2318 [cast], 2319, 2326, 2341, 2343, 2344, 2346, 2348, 2349, 2350, 2351, 2354, 2356, 2365, 2374, 2377, 2378, 2390, 2402, 2407 [M1816 ramrod mark], 2415, 2423, 2424, 2435, 2456 [cast], 2465, 2479, 2498, 2506, 2518, 2521, 2578, 2582, 2590, 2591, 2593, 2594, 2599, 2601, 2612 [faceted], 2623, 2630, 2638, 2642, 2649, 2651, 2653, 2658, 2682 [M1842 ramrod mark], 2711, 2718, 2720 [cast], 2723, 2756, 2759, 2764, 2767 [M1842 ramrod mark], 2791, 2792, 2794, 3006, 3052 [cast], 3060 [M1842 ramrod mark], 3101, 3112, 3116, 3120, 3127 [faceted], 3133, 3134, 3136, 3138, 3143, 3165, 3201, 3224 [M1842 ramrod mark], 3228 [faceted], 3233, 3239, 3254 [faceted], 3262 [cast], 3272 [cast], 3273 [cast], 3274, 3275, 3276, 3277, 3291, 3300, 3301, 3304, 3314, 3320, 3322 [cast], 3328, 3330, 3336, 3338, 3341, 3342, 3355, 3358, 3363, 3365 [faceted], 3371, 3373, 3376, 3377, 3378 [faceted], 3391, 3392, 3395, 3411, 3420 [cast], 3431, 3449, 3463, 3467, 3509, 3517, 3535, 3536, 3545 [cast], 3548, 3571, 3573, 3575, 3577, 3581, 3584, 3586, 3587 [faceted], 3590, 3592, 3593 [faceted], 3594 [cast], 3600, 3614, 3633, 3651,

Buck and Ball: FS1067, 1196, 2306, 2314, 2334, 2362, 2392, 2417, 2422, 2429, 2481, 2532, 2634, 2660, 2671, 2681, 2693, 2715, 3111, 3115, 3117, 3132, 3137, 3139, 3152, 3162, 3164, 3188, 3193, 3194, 3231, 3236, 3251, 3253, 3285, 3293, 3296, 3307, 3310, 3332, 3343, 3369, 3472, 3553, 3554, 3566, 3576, 3601,

Dropped: FS1120, 1135, 1146, 1147, 1150, 1155 [cast], 1157 [cast], 1174, 1178, 1180 [cast], 1190, 1192, 1209 [cast], 1246, 2387 [cast], 2504 [cast], 2514, 2520, 2597 [cast], 2626 [cast], 2665, 2668, 2687 [cast], 2719, 2724 [cast], 2733 [cast], 2743, 2749 [cast], 2753 [possibly chewed], 3018 [cast], 3020, 3044 [cast], 3047, 3056 [cast], 3058, 3110 [cast], 3114, 3119 [cast], 3123, 3148, 3149 [cast], 3169, 3173, 3180, 3182, 3184 [cast], 3191, 3196 [cast], 3197, 3207, 3246, 3267, 3270 [cast], 3280, 3281, 3284, 3286 [cast], 3288 [cast], 3290, 3292, 3306 [cast], 3311, 3316 [cast], 3331 [cast], 3345, 3346, 3351, 3400 [cast], 3406, 3414 [cast], 3416, 3428 [cast], 3429, 3430 [cast], 3433, 3441, 3447 [cast], 3450, 3451 [cast], 3452 [cast], 3456, 3458, 3465 [cast], 3507 [cast], 3508, 3511 [cast], 3512 [cast], 3516 [cast], 3520 [cast], 3524 [cast], 3533, 3537, 3542 [cast], 3546 [rodent chewed], 3655 [cast – pig chewed], 3677 [cast], 3678 [cast], 3680 [cast – pulled], 3687.

Five of the fired balls retain ramrod marks indicating they were fired in Model 1816 .69-caliber smoothbore muskets using the button type ramrod or the M1842 smoothbore musket (Figure 18) using a cone type ramrod. The remainder of the fired balls are either too distorted by impact or do not have clear ramrod marks to ascertain the type of weapon from which they were fired. One impacted ball (FS386) retains an interesting impact scar that of a tiny fossil shell (Figure 19), where it struck a piece of limestone.

Eleven fired and 45 dropped or unfired balls were cast in moulds. The remainder were pressed balls or by being fired the attributes of casting, the mould seam and sprue stem, were obliterated. One .69-caliber spherical ball was loaded in a weapon but not fired. It has a ball puller or extractor screw hole on one side. Whether this represents a ball pulled during the battle or after the fighting ceased is unknown.

Seven of the .69-caliber balls are modified by hand hammering five or more facets on the bullet (Figure 20). This faceting had the effect of diminishing the diameter of the ball. The purpose of the facets is not entirely clear, but it may be possible that this was done in order to resize standard issue ammunition for firing in a smaller caliber bore, such as a 16 gauge shotgun. Thus the hand modified balls may represent expedient field manufactured projectiles for use in one or more personal shotguns brought to the battle. One cannot exclude the possibility these faceted balls were fired as part of an artillery canister round. However, the facets are not consistent with other spherical balls known to have been fired as canister.

Buckshot and Shotgun Shot Pellets

Thirteen (FS1191, 2305, 2489, 2618, 3159, 3218, 3410, 3424, 3439, 3514, 3540, 3636, 3681) buck shot sized pellets were recovered in a number of locations at Wilson's Creek.

These buckshot are consistent size, near 00 (approximately .33 to .35-caliber) (Anon. 2001:7-13) that are associated with .69-caliber buck and ball rounds (Figure 17c, d, e). However, post-battle hunting as source cannot be ruled out. One buckshot is particularly interesting (FS3159) as it has a groove cut in the ball that encircles its circumference. Whether this is an intentional effort or a by-product of manufacturing cannot be determined.

Unidentified Lead

There are 33 pieces of solidified lead drops and splashes that are probably lead waste product from the field casting of bullets by the Southern forces and some are likely fragments of fired and impacted or ricochet bullets associated with the battle. They are: FS 1167, 1182, 1184, 1211, 1219, 1240, 1245, 1248, 2342, 2385, 2412, 2586, 2603, 2607, 2625, 3001, 3002, 3008, 3009, 3075, 3076, 3088, 3177, 3259, 3412, 3445, 3616, 3092, 3102, 3118, 3327, 3372, and 3423. Two of those lead pieces (FS 1184, 1245) are clearly spherical lead balls that were malformed in the molding process, most likely the mold was too cold and the misshapen balls were discarded. Both were recovered, as were a number of other lead drips and splashes from the field around the Edwards' cabin, the site of Gen. Price's headquarters and one of the Missouri State Guard camping grounds. Field Specimens 1014, 1218, and 2545 are fragments of lead pieces or strips that are unidentified to source, but may be lead that was being cut up for melting and casting into balls for ammunition in the Southern camps.

Cartridge

A single copper (Bloomfield Gilding Metal) Civil War era cartridge case (FS1153) was found in the Southern cavalry camp in Sharp's field. The case is a separate primed variety for the .54-caliber Gallager carbine (Thomas 2002:54-55). Mahlon Gallager patented his breechloading firearm in 1860, but no orders were made for the gun by the Union army until September 1861 and delivery did not occur until 1862, and then for only .50-caliber guns. The Gallager .54-caliber cartridge case likely represents a private purchase firearm brought to Wilson's Creek by one of the Southern cavalrymen.

Artillery-Related Artifacts

Artillery Shell and Case Shot Fragments

All of the cannon at Wilson's Creek were smoothbore guns firing spherical shot of one form or another. The artillery at Wilson's Creek fired one of four types of rounds, solid shot, shell, case shot, or canister, all constructed of gray cast iron. Solid shot, as the name implies was a solid iron ball of a prescribed weight and diameter that corresponded to the gun caliber, e.g. 6-pounder, 3.58 inches in diameter; 12-pounder, 4.52 inches in diameter (Melton and Pawl 1994:50-51). Spherical shell are hollow cannon balls of the same diameter as the solid shot. Shell had an opening into which the powder was placed as a bursting charge in the hollow interior, and the opening was fitted with a time delay fuse that allowed

the shell a certain number of seconds of flight before bursting and spreading shrapnel at its target. Case shot was also a hollow ball with slightly thinner walls than shell. Case shot were filled with .69-caliber lead balls, then the interstices filled with either pine resin or a sulphur matrix to hold the balls in place, and finally a hole was drilled into the matrix from the fuse hole and filled with a charge of gunpowder. The fuse hole was fitted with a time delay fuse like that of the shell. Case shot was the invention of a British Lieutenant, Henry Shrapnel, in 1787 and was also called the "Shrapnel Shell" (Dickey and George 1993:16). Canister rounds are described below.

Gibbon (1860: appendix:27) states that 12-pounder shell walls ranged from 0.66 inch to 0.74 inch thick with 0.70 inch as the average. Case shot wall thickness is listed from 0.4250 inch to 0.475 inch with the mean dimension as 0.45 inches. The majority of the specimens recovered did not fit the identified ranges, the shell fragments being somewhat thinner and the case shot slightly thicker than the historic documents noted. During the analysis it was decided to use 0.6 inch wall thickness or thicker to identify 12-pounder shell as opposed to thinner case shot. The 6-pounder case shot was separated from shell also by wall thickness. Gibbon (1860: appendix 27) identified 6-pounder case thickness as between 0.335 and 0.385 inch, with the average thickness of 0.36 inch. Shell walls were correspondingly thicker.

Eighty-three shell and case shot fragments (Figure 21f, g) were recovered during the field work. There were thirteen 12-pounder shell fragments (FS1029, 1033, 1044, 1072, 1264, 2536, 2547, 2680, 3023, 3066, 3271, 3598, 3612) and thirty-four 12-pounder case shot fragments (FS1052, 1058, 1068, 1069, 1072, 1074,1082, 1083, 1087 [threaded fuse ring], 1093, 1095, 1098, 1109, 1113, 1127, 1151, 1220, 1260, 2373, 2391, 2467, 2621, 2633, 3010, 3072, 3135, 3175, 3297, 3325, 3339, 3352, 3353, 3613, 3617). Two of those fragments represent portions of fuse rings (Figure 21e). FS1087 exhibits a flat undersurface consistent with the Hubble Patent of 1858 (Dickey and George 1993) and is threaded for the Bormann fuse. One fragment, FS3072, exhibits a smoothly curved interior surface and a smooth portion of a fuse ring. This is an example of an older type case shot designed for a paper time fuse set in a wood adapter that was pounded into to fuse hole or ring. This fuse style was commonly used throughout the Civil War, but was generally considered obsolete and superceded by the Bormann fuse, although the south continued to use the paper time fuse throughout the war years due to problems producing the Bormann fuse in southern arsenals or procuring reliable fuses from other sources (Jones 2003).

Only one piece of 6-pounder shell fragment was recovered (FS2666), but eight fragments of 6-pounder case shot were found (1189, 2333, 2358, 2643, 2755, 3580, 3597, 3610).

There are eight fragments of case shot (FS1036, 1045, 2657, 2706, 3163, 3174, 3357, 3579 [threaded fuse ring]), and fifteen undifferentiated fragments (FS 1018, 1028, 1084, 1121, 1126 [threaded fuse ring], 1140 [threaded fuse ring], 2644, 2645, 3144, 3221, 3582 [threaded fuse ring], 3583, 3603, 3615, 3685) that could not be otherwise subsorted to caliber

or artillery round type. They are generally too small to sort beyond the obvious designation of artillery projectile fragment.

Case Shot Balls

The hollow interior of case shot was filled with .69-caliber lead balls. Since the case shot ball and the .69-caliber musket ball are one and the same they are difficult to differentiate. The criteria used in this investigation was either evidence of the ball being drilled as part of placing the bursting charge process, or having multiple randomly situated dimples on the surface of the ball formed by being in contact with other balls in the case shot or having occurred during the dispersal of the balls at the time the bursting charge scattered the pieces. Fourteen case shot balls (Figure 17f, g) were identified having one or more of the required characteristics (FS 1007, 1012, 1024, 1138, 1164, 1183, 2697, 2705, 2757, 2761, 2763, 3215, 3223, 3674).

Artillery Fuses and Underplugs

Two fragments of Bormann fuses were recovered during the archeological investigations. The Bormann fuse is a lead and zinc alloy biscuit shaped device with Roman numeral marked divisions on the upper surface. A cannoneer cut a number exposing a powder train that would burn that number of seconds in flight when it would ignite the bursting charge in the shell or case causing shrapnel or case shot balls to scatter among the enemy. The most complete specimen is FS3658, with only the time delay marks lost from the central portion of the fuse (Figure 22). The other piece (FS3599) is a small fragment of fuse body.

In order to keep the Bormann fuse from becoming deformed by the shock of firing an iron or brass underplug was screwed into the lower section of the round's fuse ring. The plug had one or two holes drilled through it to facilitate the transfer of the lighted powder train from the fuse to the bursting charge. Three iron underplugs with single transfer holes were recovered (FS1142, 2450, 3574).

A single friction primer (FS1031) was also collected, but it is a modern example that was used during demonstration cannon firings by the park staff.

Canister

Canister rounds are usually lead or iron balls placed in a tin container that were fired from cannon at a short range (less than 500 yards for field guns) as an antipersonnel device. Canister rounds performed as a large shotgun blast, sending large numbers of balls toward an on-coming enemy. The normal round was filled by the process of placing a layer of shot in the can and then packing the voids with dry sawdust and packing the components firmly. The sawdust had a two-fold purpose-to give more solidity to the mass,

and to prevent the balls from crowding upon each other when the gun was fired (Dickey and George1993:17).

The inventory work recovered 86 canister balls (Figure 21a, b) representing two gun calibers, 6 and 12-pounder cannon, 2 tin canister body fragments (FS 3499, 3500), 3 cast iron canister base plates (Figure 23a) (6-pounder gun – FS 1071, 3547 and 12 pounder gun – FS3654), two sheet iron 12-pounder gun canister top plates (Figure 23b) (FS3493, 3662), and 34 expedient canister projectiles made from iron bar (Figure 21c, d) and rod stock (Figure 24a, b, c).

The 1862 Army Ordnance Manual noted that 6-pounder gun canister balls were to be between 1.14 and 1.17 inches in diameter, 12-pounder gun canister balls to be between 1.46 and 1.49 inches in diameter, and 12-pounder howitzer canister balls to be between 1.05 and 1.08 inches in diameter. The recovered iron canister balls range in diameter between 1.07 and 1.23 inches in diameter and are consistent with being fired in either 6-pounder guns or 12-pounder howitzers. The few oversized canister balls may represent some that were simply outside the range of variation for 6-pound guns or the diameter measurement was inaccurate due to vagaries of the thickness of oxidation on the balls.

The following FS numbers fall within the diameter range of the 6-pounder gun size: (n=61) 1022, 1053, 1103, 1106, 1119, 1222, 1226, 1231, 2311, 2312, 2320, 2331, 2386, 2398, 2400, 2414, 2416, 2436, 2438, 2443, 2448, 2523, 2525, 2529, 2556, 2562, 2571, 2572, 2600, 2602, 2604, 2605, 2614, 2616, 2619, 2631, 2635, 2650, 2807, 2836, 3013, 3017, 3064, 3065, 3068, 3070, 3071, 3086, 3145, 3156, 3220, 3287, 3295, 3299, 3315, 3543, 3550, 3607, 3609, 3611, 3664.

Those FS numbers falling within the diameter of the 12-pounder howitzer size are: (n=23) 1054, 1105, 1227, 1230, 1257, 1258, 2446, 2457, 2478, 2508, 2517, 2540, 2542, 2543, 2568, 2662, 2784, 3035, 3037, 3103, 3124, 3595, 3619.

Two canister ball fragments (FS2366, 3666) were also recovered. The fragments are too small to measure for diameter.

Another artifact related to canister is a canister base plate, FS1071. This circular piece of rolled flat iron measures about 3.5 inches in diameter indicating that it is a 6-pounder canister base plate. It retains indentations from the canister balls on one surface. A 6-pounder sheet iron top plate (FS3547) was also recovered. A 12-pounder canister base plate was also recovered, FS3654, as well as two sheet iron top plates, FS3493, 3662, which are crumpled and distorted from firing and impact (Figure 23b).

Among the more interesting canister artifacts are the 34 expedient canister projectiles. It is well documented that Guibor's battery of the Missouri State Guard manufactured canister projectiles and tins after the Battle of Carthage (Patrick 1997:32). These canister projectiles are well-known in southwestern Missouri and northwestern Arkansas and

are locally referred to as barshot, but are more properly termed expedient canister. The projectiles were made from bar stock found in Carthage's local blacksmith shops. Four of the projectiles (FS1015, 1025, 1056, 1104) are cut from square bar stock that measure approximately 5/8 inch by ¾ inch on a side. The individual pieces range from 1.45 to 1.79 inches long. The ends exhibit evidence of being hot cut, probably using a blacksmith's cutting chisel and hardy. The square iron bar stock canister was all recovered at the south end of Sharp's field in the area where Col. Sigel's men were routed by the southern forces.

The remaining 30 expedient canister specimens are all constructed of round iron stock. They range in diameter from approximately 7/8 inch to 1 inch and in length from 1inch to 2 ¼ inches, with the majority being 1 ¼ to 1 ½ inches long. The cut ends indicate the round stock was cold cut using heavy blacksmithing shears (Bealer 1969: 89). The rods were probably handheld as some exhibit angled cuts and twisting to snap the rod from the cut piece as would likely occur without the stock being jigged in place. All were found in and around the Federal positions on Bloody Hill.

The FS number for the expedient rod canister pieces are: (n=31) 2332, 2335, 2336, 2401, 2406, 2409, 2410, 2454, 2458, 2483, 2487, 2492, 2493, 2580, 2588, 2628, 2632, 2640, 2641, 2741, 2742, 2776, 2778, 3005, 3469, 3482, 3491, 3492, 3628, 3644, 3665.

Artillery Tool

FS 3567 is an unidentified spanner shaped iron object that has a U or Y shape. It is about 3 inches long with the arms about 3/4 inch apart. The function is unknown, but similar pieces are occasionally recovered by relic collectors at Civil War artillery emplacement sites (personal communication to Scott from Sam White, June 22, 2003).

Firearms Parts and Gun Tools

Several firearms parts and gun tools were recovered from the Wilson's Creek Battlefield. The gun tools include a J-shaped tool (FS1129) that is a combination screwdriver and musket flint resharpening tool (Figure 25b) for the Model 1816 musket (Shaffer et al. 1992:150). Three Model 1855 main spring vices (Figure 26c) (FS1252, 2684, 3170) (Shaffer et al. 1992:246) were found as were four Model 1841/1842 combination nipple wrench and 2-bladed screw drivers (Figure 25a) (FS2699, 2769, 3179, 3637) and one Model 1855 (FS2617) open ended nipple wrench and screw driver. Shaffer et al. (1992:155-156) identifies these tools as musket takedown or disassembly and maintenance tools issued to soldiers to carry in their cartridge boxes. The mainspring vice was carried only by corporals or sergeants, since private soldiers were not allowed to disassemble a lock without supervision (Shaffer et al. 1992:243). Three Model 1816 Type III .69-caliber cleaning worms (FS1131, 2675, 3309) or gun wipers (Figure 25e) (Shaffer et al. 1992:102), carried by each solider issued a musket, were also recovered. The final gun maintenance devise is an expedient percussion nipple or cone protector made from a musket ball (Figure 27a, b). The lead .69-caliber ball (FS2790) was modified by being hammered down over the percussion nipple to form

a seal that was held in place by the gun's hammer. A groove has been cut in the exterior of the ball probably to hold a string, twine, or leather thong that could be tied to the gun's trigger guard or sling swivel to keep from losing the protector when it was not in place. The expedient protector was intended to keep dirt and moisture from entering the nipple.

The gun parts recovered include a lower barrel band (FS1149) (Figure 25d), an upper barrel band with a broken sling swivel attachment (FS1215), a lock retaining screw (FS1021), and a broken barrel band retaining spring (FS1208). The parts are likely associated with one or more Model 1816 muskets or possibly Model 1842 muskets. The parts are similar between models. A percussion musket hammer (FS3551) is typical of the type used on M1816 muskets converted to the percussion system. The blade of a Model 1816 bayonet (FS1144) (Figure 26d) was found in the same general area as the barrel bands, band spring, and lock screw.

At least two additional firearm types are represented by parts. One (FS1043) is a tang and patent breech for a double barrel percussion shotgun, and an unassociated iron shotgun trigger guard (FS1154) (Figure 25c). These guns were common throughout the mid and latter part of the nineteenth century. The context of recovery suggests they probably represent two different shotguns and may have a battle association, but they may have been discarded by one of the many resident farmers also. The second firearm is a common or hunting percussion rifle represented by a brass trigger guard fragment (FS1201) and a fragment of a brass butt plate (FS1210). Again the context of recovery, in the southern cavalry camp in Sharp's field, suggests its association with the battle. A curved iron fragment (FS1020) may be a fragment of a trigger guard from yet another civilian gun, but is more likely just an unidentified piece of iron. An approximately .30-caliber iron bullet mold (FS2538) (Figure 26b) may also represent another civilian gun used in the battle as it was recovered in the vicinity of the Missouri State Guard camping area.

A rear sight from a military issue Spencer rifle or carbine (FS1084) is undoubtedly a post-battle item. This type of rear sight was not employed before 1863 (Marcot 1983) and could not have deposited before that date. The sight was found in the vicinity of the Sharp/Steele farmyard and most likely associates with that occupation.

One of the more unique firearms associated items, also found in the Sharp's field cavalry camp, is a fragment of embossed brass or copper powder flask (Figure 26a). The embossing is of a large federal eagle with rays and stars. The fragment (FS1128) is consistent with a 2-oz. Fine Colt-style powder flask. (Riling 1953:202).

Battle-Related Personal and Equipment Items

The investigations yielded relatively few definitively battle-related non-firearms related artifacts. The few items that can be clearly associated with the battle are pieces of equipment, buttons, camp gear, utensils, and a few miscellaneous items.

The one military equipment item recovered is a bayonet scabbard tip (FS2329) (Figure 28f). The brass tip was fitted to a leather scabbard for a musket bayonet and is a typical U.S. type used from well before the Civil War until 1872 (Reilly 1990).

Three brass grommets (FS1076 – 1 inch, 1080 – 1 inch, 2510 – ¾ inch) are of undetermined origin, but may associate with tenting or tarpaulins used during the battle. The grommet style is ubiquitous enough that dating them is difficult.

Uniform and trouser buttons are the only remains of uniforms recovered. A 13/16 inch diameter brass Federal eagle coat button (FS1233) was found in the Sharp's field. It has a "C" for cavalry in the shield on the eagle's breast (Figure 28b) and has a partially readable backmark that includes the word "Waterbury", a famed center of button production for over 150 years (Tice 1997:53). The area around the "C" has traces of gilding present suggesting this was a high quality gilt button when new. Two other Federal eagle coat buttons were recovered in different parts of the field. One (FS3048) (Figure 28c) has an "A" for artillery in the shield and is backmarked "Horstmann & Sons" who used that backmark for their buttons from 1848 to 1893 (Tice 1997:40-41). The other Federal eagle coat button (FS3249) has the infantry "I" in the shield and still retains gilding over much of the surface (Figure 28a). The button is backmarked "Schulyer H. & G Co/ New York" for the well-know military suppliers Schulyer, Hartley, and Graham who had their buttons custom marked by the Scovill Company of Waterbury, Connecticut (Tice 1997:25-30). Two brass buttons are non-military in origin, but given the context of their recovery, they may be buttons from coats of the Southern soldiers. Both are plain fronted brass buttons. FS2739 is a convex stamped brass button that is 5/8 inch in diameter (Figure 28d). The attaching loop is missing from the back. FS3003 is a flat cast brass button (Figure 28e), 13/16 inch in diameter, with an omega style attaching loop. Neither button is backmarked.

Several other buttons were also recovered, but they are either modern replica military buttons or from working garb such as modern overalls. FS1005 is a scene of the USS *Constitution* surmounted by a ribbon. It is backmarked "Waterbury Cos. Inc./Conn." This mark is a twentieth century mark for the Waterbury Button Company (Tice 1997:50-51). FS1016 has a star on the front surmounted by the word "Texas." It is also backmarked with the Waterbury twentieth century mark. FS1017a, 1017b, and 2714 are modern replicas of four-hole sew-through trouser or suspender buttons. They are cast of modern alloyed white metal that resemble but do not duplicate the nineteenth century style. FS2528 is the front of an overall or workingman clothing button, and FS 3404 is an iron 2 hole sew-through pressed button from a modern working shirt or pants.

Two other clothing items may associate with the soldiers' clothing. Both are suspender adjustment devices. FS1112 is a 1 ½ inch wide stamped brass slide and FS3128 is a 1 ¼ inch wide iron adjustment buckle. The latter has two prongs for holding a strap in place and is a common style found on trousers, suspenders, or vests.

A single footwear toe or heal clip (FS3561) is a well worn brass artifact with multiple nail holes covering the wear surface. Some holes were punched in during the manufacturing process, but most are expedient holes indicating that the clip loosened during wear and was repeatedly renailed to hold it in place. At least 18 nail holes are present in this 2 ¼ inch long by 5/8 inch wide stamped brass footwear clip.

Personal items are represented by musical instruments and scissors. Musical instruments are represented by four (FS1250, 3621, 3622, 3673) brass harmonica tone plates. Two, FS3621 and 3622, are from the same instrument and conjoin, thus there are three separate harmonicas represented. A second musical instrument is a white metal whistle (FS3466). It is a common nineteenth and early twentieth century style, often designated as a dog call. Two scissors fragments (FS2673, 2695) are the other personal items. FS2695 is the finger bow fragment of a pair of sewing type scissors. Its association with the battle is undetermined. FS2673 was found near the Lyon marker on the slopes of Bloody Hill. The fragment consists of a complete and a broken finger bow as well as the hinge and upper section of the blades. The scissors style is consistent with mid-nineteenth century medical shears often found in surgeon's capital operating kits (Dammann 1983).

The Sharp's field southern cavalry camps yielded several utensils. FS 1048, 1130, are fragments of handles and bolsters from table knives. FS 1059, 1102, and 1255 (found in Ray's cornfield) are stamped iron spoon bowls. FS1202 is an iron knife or fork handle fragments with iron rivets for attaching wooden or bone slabs. FS 3074 is also an iron knife or fork handle fragment, but was recovered in the vicinity of the Edward's cabin. FS 1203 is a handle and stem fragment from of a fork or spoon.

Several cast iron pieces are fragments of cooking pots and were recovered in the context of the Southern cavalry camps in Sharp's fields. A fragment of a coffee grinder hopper is represented by FS1122. The fragmented base and one leg of a dutch oven are represented by FS1199. Cast iron pot or dutch oven body fragments are represented by FS1204 and 1207.

FS 1143 is a fragment from an otherwise unidentified food tin can.

Other artifacts recovered that probably date to the battle, but have long manufacturing dates are locks and keys. A brass lever padlock front plate (FS1060) and a shackle (FS1081) may be from the same lock. They are certainly nineteenth century in origin (Arnall 1988:9-13). Three lock keys (FS2544, 2678, 2701) were recovered around Bloody Hill. Their association with the battle is undetermined.

Miscellaneous Post-Battle Artifacts

A few horse and wagon items were recovered during the investigations. They are ubiquitous enough that they cannot be directly associated with the battle. They were found in a variety of places around the battlefield; however, the context is unclear enough to

state they are from the battle era given the long usage of horses and wagons as a means of conveyance. A wide variety of other materials were recovered during the field investigations. Most items were reburied if they could be positively identified in the field as post-battle in age, but some were collected if identification or affiliation was uncertain. Subsequent analysis determined them to be post-battle in origin. These items include bits of farm machinery, internal combustion engine parts, nails, fence staples, modern coins, overall buttons, horseshoes, horse tack and harness, shed door hooks, nuts, bolts, and a variety of personal items like buttons and pocket knives. Some bullets that could not be clearly identified during field investigations were also collected for later analysis that proved to be modern in origin. These materials were fully described and cataloged as part of the project collection, but are not listed here for the sake of brevity.

6. INTERPRETING THE ARCHEOLOGICAL EVIDENCE

For convenience interpretations of the evidence and how it relates to the battle are divided into a number of segments for interpretation of the archeological finds. The initial discussion focuses on the historical record of firearms used in the battle and then the archeological evidence is presented showing where the historical documents and participant recollections meld or are at odds. The physical evidence of firearms use, studied using firearms identification procedures provides new insight into the range of guns used by the battle participants. Then this evidence is used to interpret the three elements or segments of the battle. Although the segments occurred nearly simultaneously the information is divided for clarity of presentation into the fight in Sharp's field, the fight in Ray's cornfield, and the fight around Bloody Hill.

Firearms Types at Wilson's Creek – The Historical Accounts

The rich historical records and accounts of the Battle of Wilson's Creek are replete with references to cannon and small arms use. As rich as those records may be they are also relatively obtuse regarding the identification of weapon types used by specific units. There are many references to the use of muskets, shotguns, rifled muskets, and country rifles, but frustratingly little on specific types or models in the hands of the soldiers. Most references to small arms use are non-specific and anecdotal in nature as exemplified in the following quotations:

Capt. Eugene Carr, 1st Cavalry, recalled the early stages of the fight in Sharps fields as "*opening up with my carbines, for the purpose of distracting the attention of the enemy, being at too great a distance to do much execution*." (Report of Captain Eugene A. Carr, First U. S. Cavalry. Official Records of the War of the Rebellion, Series 1, Vol. 3, Part 1, pp 89 [hereinafter cited as OR, series, volume, part, and page number).

Two accounts of the fight in Ray's cornfield have equally generic comments on firearms types used by the soldiers. John Dailey (Vickers 1896: 574-591) stated "*Both sides were armed with muzzle-loading smooth-bores, which carried three buckshot and ball. They were formidable weapons at close range when well aimed*." While another Union soldier commented *"…you have shotguns and squirrel rifles and we have buck and ball with high grade powder behind them…..Howard came back to show me he had been hit in the shin by a small bullet*." (Gilbert 1895).

Yet another account mentions the use of military muskets, but only in a general sense: "*I saw Tom Bacon, of Hannibal, MO, slowly sinking to the ground. Mechanically I raised my old smoothbore musket and fired*." (Weed 1918:392).

Although many of the comments about firearms are of a general nature the documentary record contains some references to specific arms carried by elements of both combatant groups. The greatest specificity resides in the Union records. Careful reading

and gleaning of the official reports, participant recollections, and a study of Union ordnance records reveals some information on unit armament.

Ordnance reports are a valuable tool to ascertain the types of arms in use by a unit, but the records for the early months of the Civil War are woefully lacking. The few that survive for the immediate pre-war and first year of the war are helpful, but very fragmentary. Nevertheless there is some information to be found on unit armament.

Most of the information on unit armament that is to be had comes from a series of documents called *Summary Statements of Quarterly Returns of Ordnance and Ordnance Stores in the Hands of Regular and Volunteer Army Organizations, 1862-1871* (RG 159, National Archives and Records Administration, M1281) The ordnance records for the units that fought at Wilson's Creek exist only for the fourth quarter of 1862, that is firearms and equipment issued to units as of December 1862, over a year after the battle (Table 2). Thus these returns may be misleading as to the firearms used by the unit during the battle. Many units may have been rearmed and reequipped after Wilson's Creek as the supply and logistic system was reorganized for a protracted conflict, so the statements undoubtedly reflect the 1862 issues of weapons, although some units may have retained their originally issued arms. With this caveat in mind, that the list reflects the arms on hand in late 1862, it is still instructional to look at the arms in the hands of troops from the earliest surviving quarterly statements.

As the data in the table suggest soldiers of the regular army units that fought at Wilson's Creek were well armed with U.S. regulation firearms. In addition Greene (1894.574) recalled the unit of regular recruits attached to the 1st Brigade was armed with smoothbore muskets, and Piston and Hatcher (2000:74) report the Pioneers carried Sharps rifles.

Although the 1862 quarterly ordnance statements contain no information on the U.S. regular cavalry armament, there are surviving1861 reports for the 1st Cavalry and 2nd Dragoons. McAulay (1996:11) reports that the April (first quarter) 1861 firearms inventory show the 1st Cavalry armed with New Model 1859 Sharps and 1st Model Maynard carbines and the 2nd Dragoons armed with Model 1853 and 1859 Sharps carbines.

Other sources help round out and in part confirm the armament picture for the Union troops. Piston and Hatcher (2000:63) note that the some companies of the 1st and 2nd Kansas Infantry were armed with rifled muskets with the remainder of the companies of each regiment armed with smoothbore muskets, but no specific models are mentioned. This statement suggests that the 1862 returns noting the 1st Kansas armed with either Model 1842 rifled muskets or Model 1841 "Mississippi" rifles rebored to .58-caliber indicates a rearmament of the unit sometime after Wilson's Creek as none of the 1862 listing shows a smoothbore musket in the hands of the Kansas troops. Rankin (nd) recalled "*The 2nd Kansas was armed with an old flintlock musket, changed to a percussion-cap gun, using a one ounce ball with three buckshot.*" Another 2nd Kansas soldier, a member of Company G, complained that his unit was issued old common muskets that should have been condemned

(Hatcher and Piston 1993:40). These are likely some variation of the Model 1816 smoothbore musket converted from flintlock ignition to the percussion system.

Unfortunately there is no equivalent ordnance return for the southern troops known. In order to ascertain what arms were used by southern troops at Wilson's Creek one must rely on participant accounts and available after action reports. It is in this series of documents and participant accounts that the impression arises that many of the men were armed with shotguns and country rifles brought from home and that the average southern soldier who fought at Wilson's Creek persevered without adequate arms in the face of an attack by better armed Union troops.

The official after action reports are replete with references to the inadequacy of southern armament. Captain George Fairchild in a letter to the editor of the *St. Louis Republican*, August 14, 1861 stated "*…they came so near that the old shot guns and other indifferent weapons of the latter could be used with the same deadly effect as Minnie* [sic] *muskets. Our men were at great disadvantage, on account of the inferior weapons, but they fought generally with great bravery.*"

Brigadier General Ben McCulloch's August 12, 1861 official report of the battle at Wilson's Creek stated that *"My effective force was 5,300 infantry, 15 pieces of artillery, and 6,000 horsemen, armed with flint-lock muskets, rifles, and shot-guns. There were other horsemen with the army who were entirely unarmed, and instead of being a help, were continually in the way…. Many of my men had but twenty rounds of ammunition, and there was no more to be had*." (OR, Series 1, Vol. 3, Part 1, pg. 104).

Many of the southern force accounts, in particular those of the Missouri participants, reflect the official line on the lack of adequate arms and munitions. Lt. William Barlow (Patrick 1997:39) of Capt. Henry Guibor's battery recalled that "*old hunters loaded their heavy hunting rifles when dead and wounded were lying thick around them; they would place a piece of cotton or buckskin over the muzzle, press down the ball a little, pull an old knife from the pocket, cut off the patching, return the knife and ram the ball gently down, put on a cap, then gaze under the smoke and look for a shot.*"

Col. Thomas Snead (1956:268; 1886) mentions many men as being unarmed and those that were had mostly shotguns and rifles. "*Several thousand of them had not arms of any kind. The rest were for the most part armed with shotguns and rifles which they had brought from their homes. Of powder and lead they had an abundance, but no fixed ammunition for either their seven pieces of artillery or for their small arms. ….There were enough good officers to organize and command the men; but it would have puzzled almost any one to drill a company of raw recruits, armed, some with shotguns, some with rifles, a few with old fashioned flintlock muskets, and here and there a man with a percussion musket*."(Snead 1956:269). Snead (1956:270-271) counters the good officer comment by saying that very few men had any military background or skills; "*Colonels could not drill their regiments, nor captains their companies; …companies were paraded by the*

sergeant's calling out 'Oh, yes! Oh, yes, all you who belong to Captain Brown's company fall in here.'…, but repeats the statement that "*There only arms were the rifles with which they hunted squirrels and other small game….a powder horn, a cap pouch, 'a string of patchin,' and a hunter's knife completed their equipment.*"

General N. Bart Pearce (1956:299), from Arkansas, recalled "*here, a group would be moulding* [sic] *bullets – there, another crowd dividing percussion caps, and, again, another group fitting new flints to their old muskets …it was, perhaps, the old-accustomed method of using rifle, musket, or shotgun as gamesters or marksmen that won them the battle when pressed into close quarters…*"

A Missouri State Guardsman also recalled that "*….our men were armed with shotguns and squirrel rifles….when they got within fifty or seventy-five feet of us, I gave the command, 'To the top of the ridge and fire!'…This volley of slugs, chunks of lead, buckshot, and balls completely upset the line; and just as we fired Major Woodruff, of the Little Rock Battery…turned loose on them.*" (Coleman 1911:284-285). John Webb recalled (*Steelville Democrat,* October 3, 1901) "*while at breakfast, the first we knew of the approach of the enemy, a six pound ball from Gen. Lyon's battery, lit in the midst of our camp,… we dropped the roasting ears, gathering up our shotguns and we went away in a trot…*" Yet another Missourian, J. F. Edwards in an article in the *Jefferson City Tribune* (August 13, 1897) states that at least 2000 men had no weapons and the balance had any kind of gun they could find at home, specifically mentioning yagers or Mississippi rifles from the Mexican War and squirrel guns. Guardsman J. N. Boyd (1911:9-10) commented that several of their men had Mississippi rifles that were captured at Neosho. One more Missouri State Guardsman recalled that (James 1916:972) "*Many of our men had double-barreled shotguns, and ten men in the company to which I belonged went into battle without guns, but it was not very long before they got them.*"

Even Union soldier recollections reflect the prevalence of shotguns in the southern ranks. A 1st Kansas infantryman recalled that Lt. James Ketner (Co. G) secured a double barrel shotgun dropped by a southern soldier and used it to good effect in the battle (Hatcher and Piston 1993:82).

The problem of ammunition supply for the southern, and in particular the Missouri, troops is also reflected in a variety of comments from participants. John Bell's recollections (1914:271-272, 318-319) mentions that Price's Missourians had no cartridge boxes, but the men carried their ammunition in their pockets, and those with shotguns had powder horns and shot pouches. He also mentioned that prior to Wilson's Creek he was busy rolling cartridges, filling them with powder, and nine buckshot rather than the traditional buck and ball load used in smoothbore .69-caliber muskets. In regard to ammunition supply problems Missouri State Guard Quartermaster General James Harding recalled that providing an array of ammunition to the units for such disparate arms was difficult. He mentioned that he had bullets cast in molds purchased before the war as well as having crude buckshot cast in molds made from green oak logs (Lindberg 1995:310).

Guardsman Joseph Mudd, later a Confederate army doctor, recalled (1992:125) that "[Isaac] *Terrill and I made all the cartridges used by our regiment that day. Each contained nine bullets. There were issued to each man a hundred cartridges and gallon of bullets, with orders to pour down a handful after ramming the cartridge home*." He also noted in book he wrote on his experiences as a Confederate in Missouri (Mudd 1992:369) that the men were eager to get into the fight and said they could soon get guns. In a footnote Mudd (1992:371) quotes Lucien Carr as saying the men were armed with nothing but hunting rifles and shotguns. Later Mudd (1992:392-393) also noted that they did have around 150 regulation weapons available, those that Colonel John Burbridge "had taken by guile" from a state militia company made up of loyal Germans probably from the Pike county area. In another recollection Mudd (1914:93-94) states that Co. B, Jackson's Guards, had muskets while Co. A, Calloway Guards, had Mississippi Rifles, and the others companies were armed with double barrel shotguns, muskets and shotguns of the same bore, as well as a few hunting rifles. Each man had 100 rounds of ammunition. The mention of muskets and shotguns of the same bore suggests that these may be .69-caliber muskets as a .69-caliber musket ball would fit a 12 gauge shotgun. Mudd's recollections foster the view that most of the southern combatants at Wilson's Creek were armed with shotguns and country rifles, yet in the same recollections Mudd also admits that muskets and rifled muskets were not uncommon. These conflicting accounts of armament are of more than casual interest, and the question arises as to whether shotguns and country rifles were really the predominate arm or were disproportionately remembered.

One of the more colorful accounts of ammunition shortages and expedient solutions is recounted by Thomas Knox (1865): *"A lieutenant of the First Missouri Infantry reported that he saw one of the men of his regiment sitting under a tree during the battle, busily engaged in whittling a bullet. 'What are you doing there?' said the officer. 'My ammunition is gone, and I'm cutting down this bullet to fit my gun.' (The soldier's musket was 54 caliber and the bullet was 59* [sic] *caliber) 'Look around among the wounded men' was the order, 'and get some 54 cartridges. Don't stop to cut down that bullet. I would look around, Lieutenant,' the soldier responded, 'but I can't move. My leg is shot through. I won't be long cutting this down, and then I want a chance to hit some of them*."

Mudd and others mention the presence of military muskets and rifles in the hands of the Missouri troops on an individual and unit basis, but rarely do they speak to actual quantity. Henzie and Farnham (1997:14-16) mention the Missouri State Guard had a shortage of weapons prior to the war, but they obtained some guns by purchase, others from the St. Louis Arsenal before the war, and yet others from the seizure of the Liberty, Missouri Arsenal.

A few personal accounts like that of Pvt. Richard Hubbell of Alexander Steen's Cavalry Regiment, Missouri State Guard recalled specific military weapons. In his case he brought a silver mounted Mississippi Rifle that had been presented to his uncle for bravery during the Mexican-American War to do battle with at Wilson's Creek. He and a companion also each carried a flintlock horse pistol that had also seen service in the

Mexican-American War (Lindberg nd). Henry Cheavens of Clark's Division also had a Mississippi rifle (Piston and Hatcher 2000:86) at the battle.

Other personal recollections mention pistols like that of Lt. William Barlow's (Patrick 1997:31) who recalled that Col. Tom Monroe had a Navy six.shot revolver, probably a .36-caliber Colt revolver. Barlow (Patrick 1997:37) also told a tale of Jack Murphy, a deserter from the 2nd Dragoons who joined the Missourians, and acted as a scout for Price at Wilson's Creek. Barlow notes that at one point in the fighting Murphy mounted his horse and drew an old single-barreled horse-pistol, perhaps referring to one of the older model single-shot pistols issued to cavalrymen and dragoons up to the late 1850s.

Other Missouri State Guard units are known to have been armed with current regulation guns. Joseph Kelly's Regiment, 6th Division, or at least some members, were issued the M1855 Maynard tape primed rifled muskets (Lindberg nd). And Piston and Hatcher (2000:87) note the predominately Irish unit, the Saint Louis Blues, was also armed with the Model 1855 .58 caliber Springfield percussion musket.

The documentary record and participant accounts of the Arkansas and Texas units also focus on the poor quality of arms available to those troops. The 1st Arkansas Mounted Rifles, the Pulaski Rangers, was armed with flintlock muskets (Piston and Hatcher 2000:94; Lindberg nd). And Henry Flanigan's company of the 2nd Arkansas Mounted Rifles was armed with shotguns and homemade knives (Piston and Hatcher 2000:97), while some of the 3rd Arkansas Infantry was armed with rifled muskets (Piston and Hatcher 2000:208; Lindberg nd).

Douglas Cater (1990) typifies the view that the Texans who participated in the Wilson's Creek battle were "*armed with shotguns and squirrel rifles, with their powder horns and shotbags, they must dispute the invasion of their country by well armed, equipped, and disciplined federal soldiers…*"

However Samuel Barron (1908:27, 35, 65) and Rose (1960:17) note that the Third Texas Cavalry, known as the Texas Hunters of the South Kansas Texas Cavalry during the battle of Wilson's Creek (Piston and Hatcher 2000:21), were armed with a variety of weapons including a pair of holster pistols (possibly singles shot horse pistols), shotguns, rifles of any kind, double barrel shotguns, squirrel rifles, and some men had Colt revolvers with Company A having Colt revolving rifles.

Piston and Hatcher (2000:123) also note that Col. Elkanah Greer's cavalry had three companies armed with Colt revolving rifles and Sharp's carbines with the remainder armed with shotguns and hunting rifles. When ordnance supplies from the captured San Antonio Arsenal were distributed, Greer's men received horse pistols, some two and some only one.

Firearms used by the Louisiana troops are equally obtuse despite some specific recollections.

Louisiana soldier William Watson (1888) recalled the fight in Ray's cornfield with "'*Charge them with bayonets!' cried a voice near me. 'Give them cold steel, boys!'*" giving the impression that some of the soldiers were armed with muskets capable of taking a bayonet. Yet W. H. Tunnard (1866:53) recalled that in the Sharp's field fight that it began for the 3rd Louisiana Infantry with the sharp crack of a Mississippi Rifle. Capt. John Vigilini also reported on the attack on Sigel's line by saying in his official report of the fight that) *"At the same time raising his rifle to shoot, but ere he had time to execute his design the sharp crack of a Mississippi Rifle carried a messenger of death to him*." (Report of Captain John P. Vigilini, Third Louisiana Infantry. OR, Series 1, Vol. 3, Part 1, pp 117). The Model 1841 "Mississippi" rifle was not designed to accept a bayonet, indicating the Pelican Rifles likely were armed with the Model 1841 rifle, while other companies of the regiment were armed with other types of muskets or rifled muskets capable of accepting a bayonet.

These colorful and compelling participant accounts and official reports belie a major part of the armament story for both combatant groups. Prior to the Civil War state militia companies received arms from the federal government on a routine basis. Missouri troops are known to have received 400 Hall rifles (Schmidt 1996:120) prior to the war. Some of those may have been confiscated by Lyon during the Camp Jackson affair, but others remained in the hands of the Missouri troops. As of October 1860 the Little Rock Arsenal and the Baton Rouge Arsenal, both seized by southern forces, are reported to have had 2,684 and 2,287 Hall rifles on-hand respectively (Schmidt 1996:121).

The U.S. Army kept most of its old model muskets, particularly the Model 1816 .69-caliber musket, in the various arsenals and designated them as second or third class arms to be issued in case of an emergency They became, in essence, back-ups in case war broke out and local and state militia units needed to raised and armed in the event of a national emergency. Beginning in 1855 at least 20,000 Model 1816 muskets were converted from flint ignition system to the percussion ignition system at various federal arsenals and armories. At least 2,000 Model 1816 smoothbore muskets were rifled with a standard U.S. Army 3 land and groove rifling at Harpers Ferry Armory between 1856 and 1857. Others were rifled at other arsenals and by contract in the years before the Civil War (Schmidt 1996:139).

General James Harding, quartermaster of the Missouri State Guard, even had a few hundred flintlock muskets converted to the percussion system and issued to his troops. He also tried, with limited success, to recall other old muskets that had been issued to former members of militia units long since disbanded who had taken the guns home (Lindberg nd). Harding noted that in arming the troops there was little trouble when he attempted to keep uniformity in style and caliber as much as possible to reduce the problems of logistics. He states that as long as he had the converted muskets, and the 600 flintlocks receipted from

General N. Bart Pearce he had no significant problems. His tribulations came when trying to supply ammunition to those armed with hunting or squirrel rifles (Lindberg nd).

Piston and Sweeney (1999:19) record that the Missouri Sate Guard quartermaster issued just under 1000 outdated muskets and two six-pounder artillery pieces prior to Wilson's Creek. They also note that General Price was able to borrow another 600 muskets from Confederate sources, as well as, another four pieces of artillery, and 400 rifles and muskets captured during the seizure of the Liberty, Missouri arsenal on April 20, 1861.

Arkansas troops seized 40,000 .58-caliber rifled musket cartridges, 10,000 .58-caliber blank cartridges, 20,000 .52-caliber Sharps carbine cartridges, 50,000 Colt round ball cartridges, and 10,000 Colt blank cartridges from a shipment of government stores on the steamboat *Southwester* on January 21, 1861 that was enroute to posts on the Arkansas River. (J. McKinstray, acting Quartermaster, to Capt. S. Williams, Assistant Adjutant General, Department of the West, February 12, 1861, OR Series I, Volume I, pp. 646-647).

The seizure of the Little Rock Arsenal in February 1861 by Arkansas troops also netted the southerners over 10,000 stands of arms. The list of captured ordnance stores noted include 250,000 musket cartridges, 520,000 percussion caps, four bronze cannon supposedly from Capt. Braxton Bragg's Mexican War battery, 5,625 M1822 flintlock .69-caliber muskets, 53 M1822 muskets converted to the percussion system, 357 M1842 .69-caliber percussion muskets, 900 M1855 .58-caliber percussion rifled muskets, 54 M1841 "Mississippi" percussion rifles, 125 M1817 common rifles, 2 M1847 musketoons, 267 Hall carbines, and 2, 864 Hall flintlock rifles (OR Series I, Volume III, pg 579-580).

By April some of those seized weapons had been distributed to Arkansas troops protecting the frontier. T. B. Flournoy wrote L. P. Walker, in the new Confederate capital, on April 25, 1861 requesting arms for Arkansas as Governor Henry M. Rector had used the available percussion guns to arm troops to secure the frontier to protect the state from invasion leaving only the flintlock small arms in Little Rock (OR Series I, Volume I, pp. 688-689). Oates (1961:63) states that the Little Rock Arsenal supplied 10,000 Hall rifles in percussion and .50-caliber Model 1854 [Maynard] cavalry carbines with most going to Gen. N. Bart Pearce's infantry and Col. DeRosey Carroll's Arkansas Cavalry. However, these figures are in dispute with those given in the Official Record of the War of the Rebellion noted earlier. No doubt the Little Rock Arsenal did have 10,000 stands of arms, but not all were Halls or cavalry carbines.

In Texas, Oates (1961:63) records that the seizure of the San Antonio Arsenal supplied Texas units with .69- or .54-caliber flintlock rifled muskets, provided with percussion locks. Part of the 3rd Texas Cavalry acquired .52 [sic]-caliber Mississippi rifles. McCulloch apparently purchased or tried to purchase about 1000 Colt revolvers. Oates (1961:64-65) quotes McCulloch stating that some of his men were armed with old US

Model 1852 [Sharps] carbines and squirrel rifles sent from San Antonio, some men had their own Colt revolvers, and many had Bowie knives.

Some of those weapons were captured by Sigel's men in the southern camps in Sharps field: "*It was but a moment before the camp was entirely cleared, and as we passed through it I saw many dead bodies and quantities of arms of all description lying on the ground, many of the latter I caused my men to destroy. There were in their camp a wagon load of Maynard rifles, one of regular rifled muskets, and several boxes of United States regulation sabers, all new.*" (Report of Second Lieutenant Charles E. Farrand, First U. S. Infantry. OR, Series 1, Vol. 3, Part 1, pp 91)

It seems clear from the historic documents and recollections of participants that the Union troops at Wilson's Creek were armed with the Model 1855 rifled musket, Sharps rifles and carbines, Maynard carbines, as well as a mixture of second-class arms such as Model 1842 muskets, Model 1842 rifled muskets, and older smoothbore muskets of various types.

The southern troops' armament appears more eclectic. The records show that the Missouri, Arkansas, Texas, and Louisiana troops had a wider variety of arms than the Union troops. The southerners reported Model 1855 rifled muskets, Model 1841 "Mississippi" rifles, a variety of the second class arms, some converted to percussion and others sporting their original flintlock ignition system, as well as a myriad of personal weapons like single and double barrel shotguns and country or hunting rifles, often referred to as squirrel rifles. The southern accounts emphasize that many Missouri volunteers, perhaps as many as 2,000 did not possess any firearms, and many others had only shotguns and squirrel rifles. The overall impression that arises from analysis of the southern accounts of their arms is that they were inadequately armed, having only a few old second-class military issue weapons with many men having brought personal weapons from home to defend their southern rights. Yet other recollections and information about the arms issued after the seizure of the Baton Rouge, Little Rock, and San Antonio arsenals and depots creates a somewhat different impression of availability of first and second-class military firearms. Obviously, the truth of the matter lies somewhere in between. That is where the physical evidence recovered during the archeological project can aid in elucidating the story.

Firearm Types at Wilson's Creek Derived from the Archeological Record

Analysis of the recovered archeological firearms related artifacts provides a wealth of evidence regarding the weapons actually used during the battle. Using firearms identification techniques, as described elsewhere, weapon calibers and types can be identified and placed on the battlefield. Firearms identification procedures provides a powerful tool to enable us to state what types of weapons were used during the fierce fighting on the field. More important is knowing where the firearms related components were found on the battlefield, because knowing what was used where allows, in combination with analysis of

the documentary evidence of the battle, the development of a greater precession in placing units accurately on the landscape.

Small arms - Pistols, Muskets, Rifled Muskets, Rifles, and Shotguns

Small arms are those firearms carried by individual soldiers and as an artifact class constitute the largest number of recovered artifacts, reflected primarily by lead bullets.

Pistols

The archeological record of hand guns includes three types of pistols. The.36-caliber Colt revolver is represented by both conical bullets and spherical balls. Two conical bullet types, one manufactured at St. Louis Arsenal and one probably at Watervliet Arsenal indicate the diversity of sources for ammunition supply even this early in the war. Spherical balls, some cast and some pressed also confirm the use of the Colt .36-caliber revolver at the battle.

The use of the .44-caliber Colt Model 1860 Army revolver is confirmed in the archeological record by the presence of both fired spherical ball and conical bullets.

A few fired spherical balls in .54-caliber were recovered that had no rifling marks indicating they were fired in smoothbore guns. There are several possibilities for this caliber, but in all likelihood these rounds were fired in one of the many models of singles hot pistol also called a horse pistol that is often associated with mounted troops and officers. These single shot pistols were obsolete by the mid 1850s but were still carried on arsenals and depots inventories as second-class arms.

Shoulder fired arms

Shoulder fired muskets and rifles are well represented in the artifacts recovered during the archeological investigations, indicating at least nineteen types of guns were used in the battle. A single .44-caliber bullet is impressed with the land and groove marks that indicate it was fired in a Colt Revolving rifle, and a single Maynard style .50-caliber bullet indicates the presence of that early breechloading carbine at the battle.

Three varieties of Sharps.52-caliber bullets were recovered. The varieties include three ring or cannelures and so-called tie base varieties, all indicating the use of the Sharps carbine or possibly the rifled musket during the battle. Another .52-caliber gun is represented by fired spherical balls with that are consistent with being fired in the Model 1833 or Model 1840 Hall carbine, and two spherical balls have the 16 land and groove rifling impressions indicating they were fired in M1819 Hall rifles.

Fired and land and grooved impressed .54-caliber spherical balls and conical bullets indicate the presence of the Model 1841 "Mississippi" rifle. A single .54-caliber cartridge

case indicates the presence a Gallager carbine in the southern cavalry camps located in Sharps field. A single fired bullet of the Gallager type was also recovered, but it was found in the Ray cornfield area. The presence of at least one Gallager probably represents a privately owned gun brought to the battle, perhaps by a Texas or Arkansas cavalryman, as the gun was not used by either side in this caliber officially.

Several .54-caliber bullets designed for the so-called Garabaldi rifle were also found on the field, These bullets probably represent one of the many models of shoulder arms imported from Austria, Germany, France, or Belgium to equip militia companies prior to the outbreak of hostilities and after the war began (Noe et al. 1997).

A single .56-caliber two groove solid base bullet that measures a nominal .54-caliber (FS2713) is consistent in style with the Colt .56-caliber revolving rifle bullet (McKee and Mason 1980:26-27). Although consistent in type and style with the Colt revolving rifle, it assignment to that firearm type is only probable.

The Model 1855 Springfield rifled musket is well represented in the archeological collection. Nearly 300 Minie balls, conical hollow base bullets, were found in .58-caliber. Most were of pressed manufacture although a fair number were made by casting. The land and groove rifling impressions as well as distinctive ramrod marks on a number of the bullets confirm the presence of this rifled musket during the battle. Two .58-caliber conical bullets are smooth sided and consistent in style with the British Enfield pattern rounds. The land and groove impressions on these fired bullets indicate they were fired from Springfield Model1855 rifled muskets.

The .69-caliber Model 1842 rifled musket is clearly represented by fired three land and groove impressed Minie balls. A number of these bullets also retain ramrod or loading rod impressions that further reinforce the identification of the Model 1842 rifled musket. The smoothbore .69-caliber musket is also well represented by .69-caliber spherical balls. Both single ball and buck and ball loads are represented among the spherical balls recovered in this caliber. There are a variety of U.S. musket models and European import muskets that could have fired these rounds. A recovered segment of a Model 1816 bayonet, barrel band, barrel band spring as well as a percussion hammer used on converted flintlock muskets attests to the presence of the Model 1816 or one of its many variations. Further confirmation of the use of the Model 1816 is seen in the fact that some of the .69-caliber balls have ramrod impressions evident that is consistent with the convex head of the Model 1816 button or mushroom shaped tipped ramrod.

One fired and three unfired or dropped .70-.71-caliber Minié balls were recovered during the investigations. No U.S. manufactured firearm was made in this caliber, but several European countries manufactured weapons in this large caliber. Austria produced the Model 1842 long rifle and the Model 1849 long rifle, also known as the “Garibaldi” (Noe et al. 1999:81). Germany or its individual states produced the Model 1809 “Postdam” musket and several other models, including the Prussian Model 1839/55 rifled musket, the

Hanseatic League Model 1840 rifled musket, and the Saxon Model 1844 rifled musket (Noe et al. 1999: 93-96). Belgium and France also produced guns in this caliber in at least five different models (Noe et al. 1999:106-110). Many of these guns were imported by both sides during the war, especially during the first year when firearms were in short supply. Most of these guns were not imported by either government until late 1861 and early 1862. Thomas (1997:253-254) states that cartridges and bullets for these guns were not imported by the U.S. government until December 1861, and that first order was by the State of Ohio. The presence of this caliber at Wilson's Creek suggests that some units were armed with these import guns early in the war. Given the large number of German immigrants in the St. Louis area prior to the war as well as the prevalence of German-American militia companies there and elsewhere (Rentshcler 2003) at the time it should not be a surprise that some individuals or companies were armed with European, particularly German, made arms at the time of Wilson's Creek.

The country rifle or personally owned rifle was certainly present at Wilson's Creek as a plains style brass trigger guard and butt plate fragments attest. A few bullets in non-military calibers also demonstrate the presence of personally owned rifles, although in very small numbers compared to the military caliber bullets recovered. A single .38-caliber "picket-style" bullet, a .40-caliber bullet, and two 42-caliber round balls may represent three of the so-called "country rifles" with two more represented by a single .45-caliber cast bullet and a .50-caliber bullet.

The presence of at least a few shotguns is attested to by several lines of archeological evidence. A shotgun trigger guard was found among the artifacts recovered in the southern camps in Sharp's field. The patent breech of a double barrel shotgun indicates that one was used on the site, but its context near the Sharp's farm area leaves the question of its war use or civilian association open to interpretation However, seven of the .69-caliber balls are modified by hand hammering five or more facets on the bullet are less equivocal in their association with the battle. This faceting had the effect of diminishing the diameter of the ball. The purpose of the facets is not entirely clear, but it may be possible that this was done in order to resize standard issue ammunition for firing in a smaller caliber bore, such as a 16 gauge shotgun. Thus the hand modified balls may represent expedient field manufactured projectiles for use in one or more personal shotguns brought to the battle.

In summary there are twenty-two types of small arms represented in the archeological artifacts recovered from Wilson's Creek battlefield. Three pistol types include the .54-caliber singles hot horse pistol and the .36-caliber and .44-caliber Colt revolver. Shoulder fired guns include the .44-caliber Colt revolving rifle, .50-caliber Maynard carbine, .52-caliber Sharps carbine, .52-caliber Model 1819 Hall rifle, and the Model 1833 or Model 1840 Hall carbine, .54-caliber Model 1841 "Mississippi" rifle, .54-caliber Gallagher carbine, .54-caliber imported rifled musket, .56-caliber Colt revolving rifle, .58-caliber Model 1855 rifled musket, .69-caliber Model 1816 and its variations smoothbore musket, .69-caliber Model 1842 rifled musket, .70-.71-caliber imported rifled musket, .38, .40,

.42, .45, and .50-caliber "country rifles" or personal rifles, as well as probable 12 and 16 gauge shotguns.

The presence of five different calibers of country rifles supports the historical documentation that these privately owned firearms were present and used in the battle. The question of numbers present is another matter. Were they as prevalent as the historic record suggests? The answer is the archeological sample does support their presence, but not in large numbers. The archeological investigations recovered 635 conical bullets and spherical balls that can be associated with the battle, but only six bullets represent non-military type weapons, seven if the Gallagher carbine that was likely a personal weapon is also included. On a raw percentage basis these seven bullets represent slightly less than 1% of the total number of recovered Civil War bullets found during the archeological investigations. On the other hand 75% of all bullets recovered (excluding .69-caliber spherical balls for the sake of argument as they could have been fired in 12 gauge shotguns) represent military type firearms. With the .69-caliber spherical balls factored in the percentage of military firearms rises to 99%.

A review of the park's small arms bullet collection as well as the Wilson's Creek battle related artifacts in the General Sweeney museum show that similar proportions of military to non-military bullets are present in those collections as well, so the archeological sample appears to be representative of what was fired by the participants during the battle. The historic record is correct that shotguns and country rifles were present and used during the battle, but the archeological record clearly demonstrates they were present in very small numbers. The archeological record also clearly shows that both sides relied on military issue firearms as the main troop armament. While many of these guns were older models such as the smoothbore variations of the Model 1816 and the Model 1842 smoothbore musket, as well as the Model 1819 Hall rifle, and variations of the Hall carbine, the largest quantity of a bullet type recovered was the .58-caliber Minie ball, the one used in the Model 1855 rifled musket, the most recent issue infantry weapon developed for the Army. The historic record and participant accounts are correct that shotguns and personally owned rifles were used in the battle, but the historic record is entirely incorrect and gives a biased picture and places a disproportionate emphasis on the numbers of those weapons used during the battle.

If there is one myth the archeological record can aid in dispelling it is that these western troops, whether northern or southern, were poorly armed with the dregs of the U.S. arsenal system. The archeological evidence is compelling and clearly shows that both sides had Model 1855 rifled muskets, Model 1842 rifled muskets, Sharps and Maynard carbines and rifles, as well as the older second class arms like the Hall rifle and carbine, flintlock percussion conversion Model 1816 muskets, and the Model 1842 smoothbore musket. These weapons were present in quantity at the battle. There is no doubt that as many as 2000 of the southern troops at Wilson's Creek hand no arms of any kind, but for the most part they did not participate in the battle. Another myth that the archeological record dispels is that the southern troops were heavily armed with shotguns and rifles taken from the mantle of

the home fireplaces and brought to defend states rights and their southern heritage. Indeed they were present, but in very small numbers, accounting for no more that 1% of small arms used in the battle.

The righteousness of the southern cause and the reputation of the southern commanders were enhanced by the defeat of Lyons at the hands of a poorly armed, but brilliantly led, group of men who had flocked to the cause. The official accounts and later participant recollections all seem to fall into this genre to rationalize Lyons' defeat, even some of the northern participant accounts take up this view from time to time. Yet the archeological record dispels the myth of the poorly armed southerner defeating a better armed foe. Aside from self-aggrandizement the source of the shotgun and country rifle myth probably has a real basis in the historic record.

It seems plausible that many of the accounts that mention the presence of shotguns may simply be an issue of nomenclature. It is just possible that comments like Lt. Barlow's (Patrick 1997:34) "*Our ordnance stores consisted principally of powder in one-pound canisters, G. D. caps and bar lead. Most men carried hunting rifles and each of the men had his own bullet mould. Each company carried enough hand-melting ladles to mould their bullets. We had a few buck and ball cartridges for shot guns and minnies* [sic] *for Kelly's men, who alone carried rifled muskets*" are not referring to country rifles or actual shotguns, but to the older style rifled guns like the Model 1819 Hall rifle that was furnished with a bullet mold that was issued to each soldier or smoothbore muskets like the Model 1816 or its variations. While a 12 gauge shotgun could fire a .69-caliber round, buck and ball rounds were intended for smoothbore muskets, not shotguns.

It is important to remember that in the pre-war militia system that military weapons were issued to enrollees and were intended to be kept in the home of the rural militiamen. Militiamen, in the true spirit of the old minuteman concept, did not always keep their firearms in a centralize place, rather they took them home to be kept available for training or emergencies. Another factor in this argument is that in many of the statements about the presence of shotguns among the men is that the terms shotguns and double barrel shotguns occur together frequently. Making a distinction between shotgun types suggests they are very different guns rather than representing single and double barrel variations of the shotgun genre. Following the logic that shotguns in the generic sense are smoothbore muskets then the mention of double barrel shotguns as representative of the true shotgun class makes sense. Thus Barlow's statement may simply mean that he and others referred to any smoothbore gun as a shotgun and any rifled musket as squirrel rifle rather than reflect a very specific firearm type. This reinterpretation of the accounts reduces the number of true shotguns in the soldiers' hands by a substantial number, but places emphasis on the reference to double barrel shotguns as representing the fact that some true shotguns were present at the battle. The number of references to double barrel shotguns is far fewer in the literature than the term shotgun, and this interpretation seems to be more in concert with the archeological evidence for the presence of the older smoothbore musket in quantity with a few shotguns present during the battle.

Another question that the bullets, specifically the conical rifled musket bullets, can aid in answering is the effect of sustained firing on the ability of a rifled musket to deliver accurate fire. Black powder, as a propellant, is notorious for fouling the bores of guns after a few shots, thus reducing the accuracy of the weapon as well as even the ability to load the gun in extremely fouled situations. Fouling does not build up in an entirely predictable manner, but is subject to the effects of temperature and humidity. Recent experiments of live firing Civil War muskets and monitoring the effect of repeated firings on the ballistic stability of the bullet using Dopler Radar, observed by the senior author, demonstrate that between five and eight shots are all that can be expected from a musket before spin destabilization occurs to the bullet. When a bullet becomes spin destabilized, commonly called tumbling, its trajectory is affected and the manner in which it impacts leaves evidence on the bullet to indicate the lack of spin stability. The Wilson's Creek .69-caliber and .58-caliber conical bullets were reviewed for evidence of impact scars resulting in 46 and 201 bullets respectively that could be evaluated. Of those only 39% of the .69-caliber and 42% of the .58-caliber Minie balls had impact evidence indicating they were spin stabilized and had normal trajectory at the time of impact. In other words 61% of the .69-caliber and 58% of the .58-caliber Minie balls suffered from some form of impact damage indicating they became spin destabilized due to a fouled bore or as a result of reaching their terminal velocity before impacting. In essence this means that six of every ten Minie balls fired during the battle were unlikely to hit the target at which they were aimed. Dirty bores or just plain poor shooting are both the likely culprits in this situation.

The number of rounds fired in the battle is unknown, but it must have been in the thousands for both sides. Mudd (1914:93-94) says that each man had 100 rounds of ammunition, but most claim the southern forces and the Missouri State Guard had only about 25 rounds per man as an average. Piston and Hatcher's (2000:234-235) analysis of the historic documents suggest that most firing by the southern forces began at 100 yards or less or within shotgun range, which is entirely consistent with the distribution of the archeological evidence of the fighting lines as described later. Private John Bell (Piston and Hatcher 2000:235) recalled that he fired only five rounds during the battle, although Private Henry Cheavens fired eight in one encounter alone. Piston and Hatcher's analysis (2000:235) suggests that generally the southerners fired in massed volleys that were of short duration, using the Mexican War era tactics of two or three ranks firing sequentially on command as did some of the Union troops. The archeological sampling, hindered as it was by dense vegetation in many places, recovered hundreds of bullets in many different calibers. These bullets give us insight in the small arms actually used by the men in the battle, but they represent only a systematically gathered sample of all of the bullets fired on August 10, 1861.

Artillery at Wilson's Creek – The Archeological Evidence

Cannon played a significant role at Wilson's Creek. The armies that fought there deployed thirty-one smoothbore guns in two calibers, 6-pounder and 12-pounder howitzer. Both gun types fired solid shot, shell, case shot, and canister. Fragments of 6-pounder shell

and case shot as well as 12-pounder shell and case shot confirm the presence of these artillery gun types. A metallurgical analysis of the microstructure of a small sample of the Wilson's Creek shell and case shot fragments was undertaken by Coles et al. (2004; Appendix III) to determine if differences in manufacturing techniques could be seen between the Union and southern artillery ordnance. Her study demonstrates the potential for microstructure analyses on artillery fragments. It also shows that among the samples tested from Wilson's Creek that there is a great deal of uniformity in the manufacturing process as seen in the metallurgical examination. This is taken to mean that the majority of shells and case shot fired at Wilson's Creek by both sides were from one source – that is the majority of rounds were probably Federal stock either issued to units prior to the start of the Civil War or in the southern units' case, taken during the seizure of the various federal arsenals and depots, as well as other sources. It is possible that some of the artillery rounds fired at Wilson's Creek were quite old, perhaps dating back to or just after the Mexican War era.

The available records provide an indication of the approximate munitions output of the St. Louis and Baton Rouge Arsenals in seven of the eight years prior to the Civil War (Secretary of War 1853; 1855; 1856; 1857; 1859; 1860; 1861). St. Louis Arsenal production is available for the fiscal years (ending in June) 1856, 1857, 1859, and 1860 is quite remarkable. For small arms St. Louis produced at least 6,097,665 rounds of miscellaneous small arms cartridges, 3,817,074 rounds of .58 and .69 caliber conical ball ammunition, approximately 837,000 rounds of .54 caliber balls, 211,000 rounds of Sharps ammunition, 2,745,405 rounds of pistol and carbine ammunition, 146,400 rounds of musketoon and .69 caliber buck and ball rounds, 40,000 buckshot rounds, approximately 524,670 rounds of Colt revolver ammunition, and they cleaned 2953 metallic cartridge cases (probably either Gallager or Maynard cases), as well as broke up another 129,835 rounds of old ammunition.

Artillery ammunition for St. Louis is equally impressive. It includes producing or overhauling 10661 rounds of different calibers of shot, shell, and case shot, 1593 rounds of miscellaneous calibers of canister, 83 rounds of expanding shells for rifled guns, 4019 metallic (Borman?) fuses, 4100 fuse plugs, and 17632 paper fuses. The arsenal also reported breaking up 717 rounds of canister.

Reports are available for only the last three years for the Baton Rouge Arsenal where they produced or altered 1,623,740 small arms cartridges, and cast 105,500 .58-caliber conical balls. Baton Rouge also produced or overhauled 21,130 spherical shot, shell and case, made 38 canister rounds, and broke up 1431 old canister rounds.

Some of this ammunition was supplied to the western forts and military establishments as part of their normal year to year supply, as well as supplying the Utah expedition in 1857-1858, and some was issued to the various authorized state militias from year to year. Nevertheless, the combined production of the two arsenals in the five years prior to the outbreak of the Civil War was at least 15,166,104 rounds of small arms ammunition and 33,505 rounds of artillery ammunition.

Given this output it seems clear that at least for this first major western battle that the majority of small arms and artillery ammunition was the product of federal sources, regardless of who was firing it. While the artillery shell and case shot may have been produced by the federal arsenals, this is clearly not the situation with all of the canister fired at Wilson's Creek. The archeological finds of canister rounds fired during the battle help to round out the picture of the gun types and with some unique types aid in placing individual batteries at specific locations on the battlefield.

Canister

Canister rounds are lead or iron balls placed in a tin container that were fired from cannon at a short range (less than 500 yards for field guns) as an antipersonnel device. Canister rounds performed as a large shotgun blast, sending large numbers of balls toward an on-coming enemy that could be devastating to an infantry charge. Like a shotgun the range of canister is limited and was not intended for use beyond 400 to 500 yards, and never beyond 600 yards according to nineteenth century artillery manuals (Scott 1864; Benton 1867).

The 1862 Army Ordnance Manual recorded that 6-pounder gun canister balls were to be between 1.14 and 1.17 inches in diameter, 12-pounder gun canister balls to be between 1.46 and 1.49 inches in diameter, and 12-pounder howitzer canister balls to be between 1.05 and 1.08 inches in diameter. The inventory work recovered 85 canister balls representing two gun calibers, 6-pounder gun and 12-pounder howitzer, 2 tin canister body fragments, 3 cast iron canister bases, two sheet iron 12-pounder howitzer canister top plates, and 34 expedient canister projectiles made from iron bar and rod stock.

The recovered iron canister balls range in diameter between 1.07 and 1.23 inches in diameter and are consistent with being fired in either 6-pounder guns or 12-pounder howitzers. The few oversized canister balls may represent some that were simply outside the range of variation for 6-pounder guns or the diameter measurement was inaccurate due to vagaries of the thickness of oxidation on the balls.

Among the more interesting canister artifacts are the 34 expedient canister projectiles. It is well documented that Guibor's battery of the Missouri State Guard manufactured canister projectiles and tins after the Battle of Carthage (Patrick 1997:32). These canister projectiles are well-known in southwestern Missouri and northwestern Arkansas and are locally referred to as barshot, but are more properly termed expedient canister. The projectiles were made from iron bar stock found in Carthage's local blacksmith shops. Four of the projectiles are cut from rectangular bar stock measuring approximately 5/8 inch by ¾ inch on a side. The individual pieces range from 1.45 to 1.79 inches long. The ends exhibit evidence of being hot cut, probably using a blacksmith's cutting chisel and hardy. The iron bar stock canister was all recovered at the south end of Sharp's field in the area where Col. Sigel's men were routed by the southern forces.

The remaining 30 expedient canister specimens are all constructed of round iron stock. They range in diameter from approximately 7/8 inch to 1 inch and in length from 1inch to 2 ¼ inches, with the majority being 1 ¼ to 1 ½ inches long. The cut ends indicate the round stock was cold cut using heavy blacksmithing shears. The rods were probably handheld as some exhibit angled cuts and twisting to snap the rod from the cut piece as would likely occur without the stock being clamped in place. All were found in and around the Federal positions on Bloody Hill.

The historical records provide some background and evidence of the use of these expedient canister. Barlow (Patrick 1997:32) one of Guibor's lieutenants states that the Battle of Carthage, "*furnished a few loose, round shot. With these for a beginning, Guibor established and 'arsenal of construction.' A turning-lathe in Carthage supplied sabots; the owner of a tin-shop contributed straps and canister; iron rods which a blacksmith gave and cut into small pieces made good slugs for the canisters; and a bolt of flannel, with needles and thread, freely donated by a dry goods man, provided us with material for our cartridge bags. A bayonet made a good candlestick; and at night… the men went to work making cartridges; strapping shot to the sabots, and filling the bags from a barrel of powder placed some distance from the candle… my first cartridge resembled a turnip, rather than the trim cylinders from the Federal Arsenals, and would not take a gun on any terms, but we soon learned the trick and, at the close range at which our next battle was fought, our homemade ammunition proved as effective as the best.*"

Guibor's gunners are likely the source of the round stock expedient canister found on and around Bloody Hill. Barlow's account (Patrick 1997:32) identifies blacksmith donated round rod or stock as the source of their expedient canister, and its archeological distribution is consistent with the effective range and known positions of Guibor's guns. Bell recalled (1914:271-272, 318-319) that "*….beyond the dead line formed by the crossfire of Guibor's Battery (the guns loaded with buckshot, scrap iron, slugs, and gravel) and McBride's Rifles*" were used to effect in the battle. While Bell's recollection that the cannon were loaded with buckshot, scrap iron, and gravel is incorrect in the detail, he is correct that the expedient canister was used with good effect. Bell's recollection typifies the type of memory of events that takes a grain of truth and magnifies it into the myth of the south using any available source of material in a cannon to repel the enemy. Guibor, as a trained artillerist, would have known not only the danger of loading loose gravel, scrap iron, or buckshot in a cannon to his own gunners and troops, but would have also been aware of the potential for damaging his guns' bore by using inappropriate ammunition. The archeological evidence is abundant that Guibor did make use of expedient canister, but he also manufactured it according to a prescribed standard that would be safe for use in his guns.

Guibor was short of ammunition after Wilson's Creek and he made use of his time in Springfield and after the Battle of Lexington to again use local resources to manufacture supplies of ammunition. Barlow (Patrick 1997:44) mentions that they took possession of a foundry in Springfield after the battle where they cast six-pounder spherical shot, "*cast*

iron rods cut into slugs for canister and in two or three weeks, well rested and equipped, we started north for the Missouri River," and after Lexington Gubior's battery camped at the fair grounds and spent a week manufacturing ammunition, including solid shot and grape [sic canister] cast in a local foundry (Patrick 1997:45).

The Physical Evidence of the Fight in Sharp's Cornfield

The archeological inventory recovered a seemingly meager 268 artifacts within the 300 acre inventoried area of Sharp's cornfield and house site. The small number belies the patterns that are evident in the artifact distribution maps and the interpretive potential of those artifact distribution patterns. One of the most striking elements of the plotted artifact distribution is the clustering of all types of artifacts in essentially two specific areas of Sharp's cornfield.

The first area discussed is the cluster located in the southern area of the field and situated on the second terrace above Wilson's Creek. This artifact cluster was the most diverse of any area searched. It yielded thirteen 12-pounder case shot and shell fragments, six-pounder case shot fragments, along with case shot balls (Figure 29). Other artifacts recovered include dropped .69-caliber Minie balls (Figure 30), spherical balls, and buck and ball rounds (Figure 31), as well as personal items, gun maintenance tools, equipment fragments, and gun parts. The interpretation of the data is that this area represents the site of one or more of the southern cavalry camps that were bombarded by Sigel during the early morning hours of August 10. From the recovered evidence it appears Sigel's gunners opened fire with case shot and shell that burst scattering fragments and balls across the campsites. The archeological data is entirely consistent with the historical records noting the camps were bombarded while the southerners were asleep or at breakfast as reported by Sigel (OR, Series 1, Vol. 3, Part 1, pp 86-87): *In sight of the enemy's tents, which spread out in our front and right, I planted four pieces of artillery on a little hill, whilst the infantry advanced towards the point where the Fayetteville road crosses Wilson's Creek, and the two cavalry companies extended to the right and left, to guard our flanks, It was 5.30 o'clock a. m. when some musket firing was heard from the northwest. I therefore ordered the artillery to begin their fire against the camp of the enemy (Missourians), which was of so much effect, that the enemy's troops were seen leaving their tents and retiring in haste towards the northeast of the valley.*"

An effort was made to metal detect Sigel's first position on the high bluffs east of Wilsons Creek. The inventory area was constrained by the park boundary and hampered dense vegetation. The area inventoried yielded no Civil War era artifacts. If the vegetation is ever reduced in along the bluffs they should be inventoried to determine if evidence exists of the first battery position as well as that of Carr's 1st Cavalry, where he had his men fire a few rounds from their carbines toward the camps.

Archeological evidence for Sigel's march across Wilson's Creek to the north and through the camp area is nearly non-existent. In particular there is no direct evidence of

Sigel's second gun position site, where he deployed his guns to fire on the southerners as they began to regroup around Sharp's house at the northern edge of the field and on a high terrace above Skegg's Branch and Wilsons Creek. Indirect evidence exists in the form of shell and case shot fragments found impacted just north of the later Steele house site. However, there are alternative explanations of this data distribution.

The historical documents show that Sigel then moved his troops to a location perpendicular to the Wire or Telegraph Road somewhere near Sharp's house. There he deployed in a line with his cannon, infantry, and cavalry ready to halt the Southerners retreat from their defeat by Lyon's attack from the north. The precise location of Sigel's third or final position has been in some dispute among historians. The archeological artifact distribution helps clear up this historical question.

The documentary record is clear that after Sigel (1956) deployed his troops that McCulloch reorganized his scattered southerners. McCulloch placed two artillery batteries to fire on Sigel's line and reformed his infantry for an attack. One of the more colorful moments recorded in the documentary record is the story of the gray-clad Louisiana Infantry moving south to attack Sigel, whose troops mistook them for gray uniformed Iowans. Sigel's men, believing the Iowans were the advance troops from Lyon's successful northern attack held their fire until the Louisiana infantry were within 40 yards of the Union line. As the southerners opened fire with the fabled Mississippi rifles and artillery it was too late for Sigel's men to respond effectively and they were forced to retreat.

Civil War era artifacts were found in a linear alignment, but not in the immediate vicinity of the Steele house site. The linear artifact distribution is south of the Steele house site and runs northwest to southeast from the north slopes of Skeggs Branch until in intersects the modern tour road as it makes a south to north sweep after crossing Wilsons Creek. The alignment of artifacts is perpendicular to the Wire or Telegraph Road, crossing it about 150 to 200 yards south of where the current tour road intersects with the old Wire Road alignment. This is in the area of a vegetation pattern change adjacent to the Wire Road and seen on the 1936 (Figure 8) and 1941 aerial photographs as noted earlier. We suspect that this anomaly could be the site of the original Sharp house.

Today the slopes of Skegg's Branch are densely vegetated and difficult to traverse, and historical accounts suggest the same was true in 1861 (Piston and Hatcher 2000:247). The metal detecting team's work south of Skegg's Branch and west of the Wire Road was at best a reconnaissance level due to the dense vegetation cover and understory growth. However, the area yielded three fired .58-caliber Minie balls (Figure 32), a .44-caliber bullet fired in a Colt revolver (Figure 33), one deformed lead bullet, six pieces of 12-pounder howitzer canister (Figure 34), and one fragment of 12-pounder case shot (Figure 29). The impacted artillery and small arms ordnance indicate the left of Sigel's line came under fire in this area with both small arms and artillery. The case shot fragment and the canister balls indicate at least two different artillery rounds were fired at this area. The presence of canister indicates that the gun position would not have been more than 400 to 500 yards

away, and probably represents firing by Bledsoe's battery that was likely positioned above and west of the Edward's cabin site. The presence of a .44-caliber pistol bullet indicates that at least some of the firing was done at short range, as these pistols had an effective range of only about 25 yards, although the bullet could travel farther if it missed its intended target. The .58-caliber Minie balls could have been fired in either the Model 1855 Springfield rifled musket or in the rebored and enlarged caliber Model 1841 "Mississippi" rifle.

The left of Sigel's line was held by Capt. Eugene Carr's dismounted company of 1st Cavalry. Historical accounts, summarized by Piston and Hatcher (2000:247) indicate Carr and his men became disoriented in the woods causing them to increase their separation from Sigel's main line. The cavalry also came under a rather ineffective fire from small arms and artillery. Knapp's (1993) and Piston and Hatcher's (2000:247-252) reconstruction of Carr's movements place him further south toward the top of a low hill than the pattern of artifacts found during the investigations indicates. However, the knoll is so densely vegetated today that little effective metal detecting work could be undertaken there. The area deserves additional investigation to clarify the full movements of Carr's company, although the archeological data suggest he was at least initially lower on the south slope of Skegg's Branch at one point in the battle.

Backoff's artillery battery was positioned adjacent to the Wire Road and near the Sharp house with a battalion of about 250 men of the 3rd Missouri Infantry to the right of the artillery (Piston and Hatcher 2000:251). Farrand's 2nd Dragoons anchored the far right of Sigel's line and were positioned at the east side of Sharp's field near Wilsons Creek. Archeological evidence of Farrand's deployment is non-existent due to flooding and alluviation of Wilsons Creek, and destruction of some of the area by construction of the current tour road.

The area near the presumed Sharp's house site provides clear physical evidence of the final elements of the fight. The artifact distribution reveals a mixture of dropped and fired .69-caliber, Minie balls and spherical balls, as well as a fired .54-caliber "Mississippi" rifle bullet and a Maynard bullet, 12-pounder artillery shell and case shot fragments, 12-pounder canister shot, 6-pounder canister shot, and several pieces of expedient "bar-shot" canister scattered throughout the area to the east of Sharp's house site. There is a noticeable gap in the recovered artifacts west between the Wire Road and the dense woods on the slope of Skegg's Branch. This area of low density artifact recovery is about 100 yards wide. This artifact distribution attests to the fight that occurred in the area and confirms the historical accounts of artillery counter-battery fire and infantry musketry fire, and probably reflects both Sigel's second position artillery shelling of groups of southerners attempting to reorganize, and the southern small arms and artillery fire on Sigel's final position.

The concentration of small arms, both dropped and fired rounds, as well as burst artillery shell and case shot fragments is to the east of the Wire Road, which would have been the position held by the battalion of the 3rd Missouri Infantry. What is singularly absent is a significant number of artillery shell and case shot fragments, canister shot,

rifle bullets or musket balls in the archeological record of this phase of the fight. They are present, but only in small quantities. Several factors were considered to account for the small quantity of artifacts representing the fire fight, and indeed the entire action in Sharp's cornfield. One factor considered is relic collecting that occurred at Wilson's Creek prior to the site becoming a National Park. Two large relic collections are still extant and in a private museum. One of those collections was documented by general mapping of relic types. This is the Darrel Trogden collection. The mapped relic distribution does not include materials from Sharp's cornfield. The sources of the other two collections are not definitively known. Certainly these early collectors may have biased the archeological record to some extent.

Another factor that was taken into account is past agricultural activities. Sharp's cornfield was plowed and cultivated for nearly 100 years after the battle. That too may have affected the archeological record. However, the systematic metal detecting inventory of 2001 did recover a significant pattern to the small quantity of artifacts recovered in the area. Agricultural activities could have moved things around to some degree, but as has been shown in studies of the effect of plowing on artifact patterns, that effect is expected to be minimal. Relic collecting activities are harder to quantify, but non-systematic relic collecting activities tend to find only larger items, and most of the collecting at Wilson's Creek was done before 1960 and before sophisticated modern metal detecting equipment became available. Thus, while we cannot discount the effect of either early relic collecting or agricultural activities, it appears that they cannot completely account for the small quantity of artifacts actually recovered in patterned distribution in Sharp's cornfield.

We are then left with reassessing the historic record to seek a rational explanation. Both commanders and several subordinate commanders reported, in their after action reports, and in later recollections, that the fighting around the Sharp house was intense, but short-lived (Piston and Hatcher 2000:240-255). The Southern infantry attack appears to have come up from Skegg's Branch breaking into the open in the gap between Carr's troops in the woods to west and Backhof's Battery positioned on the Wire Road near Sharp's house. The Louisianans fired into Sigel's ranks just as two batteries of Southern artillery opened fired on his line. Sigel's men quickly broke ranks and command and control devolved into a relatively disorganized flight by the rank and file.

The report of Major John M. Schofield, First Missouri Infantry, and Acting Adjutant-General Army of the West, of operations August 1-14, August 20, 1861. (OR, Series 1, Vol. 3, Part 1, pp 61) makes specific mention of the brevity of the fire fight at Sigel's final position: *"At this moment an artillery fire was opened from a high point about 2 miles nearly in our front, from which Colonel Sigel was to have commenced his attack. This fire was answered from the opposite side of the valley, and at a little greater distance from us, the line of fire of the two batteries being nearly perpendicular to our own. After about ten or twelve shots on either side the firing ceased, and we neither heard nor saw anything more of Colonel Sigel's brigade till about 8.30 o'clock, when a brisk cannonading*

was heard for a few minutes about a mile to our right of that heard before, and from 2 to 3 miles distant. This was the last during the battle."

William Wherry's (1956:293) comments reinforce the perception of the brevity of the Sharp field fight by those engaged with Lyon on Bloody Hill: "*About this time great anxiety began to be felt for the fate of Sigel's command. Shortly after Lyon's attack the sound of battle had been heard in the rear of the enemy's line. It continued but a short time, and was renewed shortly afterward for a very brief period only, when it ceased altogether.*"

Those perceptions are further reinforced by the southern reports of the fight in Sharp's field. The reports of Brigadier General Ben McCulloch (OR, Series 1, Vol. 3, Part 1, pp 104) acknowledges the role of the Fort Smith Battery in the action: "*When we arrived near the enemy's battery we found that Reid's battery had opened upon it, and it was already in confusion. Advantage was taken of it, and soon the Louisianans were gallantly charging among the guns, and swept the cannoneers away.*" Captain J. G. Reid, commanding Reid's battery (OR, Series 1, Vol. 3, Part 1, pp 120) supports McCulloch's statements in his report: "*At the commencement of the battle on yesterday morning we were ordered by Captain McIntosh to take a position on the hill southeast of the camping grounds, supported by General Pearce's Fourth and Fifth Regiments of Infantry. We immediately got into position, and remained so for one hour, at the end of which time our first fire opened on the enemy's battery on the hill to our left. We disabled the enemy's battery after a fire of about three minutes. The Louisiana regiment then carried it.*"

The official report of Colonel John R. Graves, commanding First Brigade, Second Division, Missouri State Guard (OR, Series 1, Vol. 3, Part 1, pp 128) gives a slightly more Missouri based view of the final engagement with Sigel: "*Colonel Rosser, commanding the First Regiment and Fourth Battalion, with Captain Bledsoe's artillery, being stationed on the extreme left, was attacked by Colonel Sigel's battery, and his men exposed to a deadly fire for thirty minutes, when Captain Bledsoe, with a well-directed fire, succeeded in disabling a portion of the enemy's guns, and almost at the same instant a portion of the infantry, commanded by Colonel Rosser, together with the Louisiana regiment, led by General McCulloch in person, drove the enemy from their guns, capturing five pieces of artillery, three of which have been attached to Captain Bledsoe's battery.*"

There is little doubt that the expedient canister found near the Sharp farmstead were fired by Bledsoe's Battery of the Missouri State Guard as is clear in Graves report. It is unlikely Guibor's battery fired on Sigel's position for several reasons. First is that it was heavily engaged against Lyon on Bloody Hill and there are no historic accounts of Guibor's guns reversing position to fire on Sigel's command. The second reason is simply that Guibor's position on the lower and southwestern slope of Bloody Hill put him below the line of sight required to see and fire upon Sigel's lines at Sharp's farm.

In order to determine the approximate position of Bledsoe's and Reid's batteries we employed a reverse view shed analysis concept using the power of the computerized Geographic Information System in which the archeological field provenience information is stored. Taking the distribution of the expedient canister we used it to establish a line of sight for Bledsoe's gun position and constrained it first by a distance of no greater than 600 yards, the maximum effective range of canister before it reaches terminal ballistic velocity, and second by a height above the ground surface equivalent to cannon in battery. The analysis identified only one small area where the guns could have been situated. This location is about 150 yards west and 125 yards south of the Edwards cabin site, at a distance of about 480 yards from the Sharp house site. This site is slightly north of that suggested by Piston and Hatcher (2000:246-250) based on their analysis of the historic records. The guns likely went into battery on the terrace above and west of Edwards cabin which is located adjacent to the Wire or Telegraph road, and in a position generally consistent with the historic accounts of Bledsoe's position. A review of the known locations of historic road traces shows that three old traces or trails cross this area and would have provided convenient access from the camping grounds on or near Wilsons Creek and the Wire Road near the Edward's cabin to the terrace where we postulate Bledsoe's guns were placed in battery to fire on Sigel's position. It is our opinion that Bledsoe's guns account for all of the canister found by Trogdon along Skegg's Branch as well as near the Sharp house site. Certainly the expedient "bar shot" canister originated from Bledsoe per our following analysis.

Several fragments of 12-pounder case shot and shell, as well as canister balls were also found in this area indicating some artillery bombardment of Bledsoe's position (Figures 29, 34), which is consistent with the reports of Union counter battery fire. While the shell and case shot fragments might have been fired by one of the guns deployed with Lyon, for they are within that range, the canister balls are unlikely to have been fired from the north, as they are several hundred yards out of range for the guns on Bloody Hill. The canister rounds found in the posited Bledsoe battery position are, however, within range of Backoff's guns that went into battery near the Sharp house.

Applying the same reverse view shed analysis to 12-pounder shell and case shot fragments as well as the iron canister balls gives the same result as the earlier analysis, but also suggests where Reid's Fort Smith battery was most likely sited. Most interpretations of Reid's battery location are based on the official records (cited above); place his guns about ½ mile east of Sharp's house on the east side of Wilsons Creek on a low terrace (Knapp 1993:42; Brooksher 1995:192). The reverse views shed analysis shows that neither Sigel's line nor Backoff's guns could be seen nor see this position. It is too low in the valley, and with out line of site the artillerymen could not aim or fire their guns. There are several possible areas that meet the criteria for line of site and are within canister firing range. One is a site on the east side of Wilsons Creek at the south end of the old town site of Wilson's Creek which is at 600 yards from the Sharp's house site. This is approximately 200 yards east of the Edwards cabin site and about 225 yards south. Another site, and the one favored by Piston and Hatcher's (2000:246-250) interpretation is about 250 yards west

of the Manley Cemetery and east of the old railroad cut. While this fits the historic record best the location is at least 700 yards from the Sharp house site, and thus outside canister range, but still within shell and case shot range. If this site is the one occupied by the Fort Smith battery, then it is unlikely that Reid fired any canister from this position.

The fact that no other iron bar stock expedient canister was recovered from any battle position north of Bledsoe's or Guibor's position strongly suggests that Bledsoe's battery was the only one to make use of that particular type of expedient canister. After Bledsoe fired on Sigel he either reversed position or moved his guns somewhat north to fire on Lyon's troops on Bloody Hill. If he simply reversed position then he was out of range to fire canister on the Federals on Bloody Hill and that may explain why no square bar stock expedient canister was found in the Bloody Hill fighting area.

The final element of the fight in Sharp's field was Sigel's disorganized retreat. Apparently his command scattered and fell back in a piecemeal manner, with command and control completely lost (Piston and Hatcher 2000:254-261). There is little direct evidence of the chaotic retreat, although a button, a Gallagher bullet, a country rifle bullet, and two Sharps carbine bullets found in a roughly north to south pattern along the side slopes of a deeply dissected ravine near the southwest boundary of the park may well be the remains of one line of that retreat. If so, the few artifacts represent lost items of the running fight between the fleeing Union troops and the pursuing Southerners.

The archeological record appears to confirm the short-lived intense firefight. Expedient canister made from wrought iron bar, so-called "bar shot", was found in the area likely occupied by Sigel's line. The expedient canister is, we believe, a signature of the Missouri State Guard artillery batteries, indicating the direction of fire from the southern batteries was from north to south. Artillery case shot and shell fragments correlate with fire from another southern battery, the Fort Smith Battery, raking the Union line from the northeast. Small arms bullets also confirm that the southern infantryman played a role in the fight. Yet the number of individual artifacts is small relative to the impression given in the historical record. Allowing for relic collection and agricultural activity effects on post-depositional sequences, one still cannot reconcile the historic accounts with the low artifact density. An alternative explanation is that the first two or three artillery rounds from the Missouri State Guard and Fort Smith Battery cannon along with a volley of musketry fire so rattled the inexperienced Union line that they broke and ran after a very few minutes.

The same can be said of the earlier phase of the fight in which Sigel's artillery fired only a few rounds into the southern cavalry camps that, in turn, inspired their hasty departure. The archeological record can be reasonably interpreted to suggest that the southern camp inhabitants fled in panic at the first bursts of artillery rounds fired from Sigel's guns. Likewise, the sudden artillery bursts and infantry musket fire that hit the final Union position caused a general panic among Sigel's troops allowing the line to collapse.

Confirmation of the use of famed "Mississippi" rifle by the 3rd Louisiana Infantry in their attack on Sigel's line is less than overwhelming. A single .54-caliber bullet fired from a Model 1841 "Mississippi" rifle was found in the area we believe represents the 3rd Missouri's line confirming the rifle was present and used, but the majority of fired rounds found in this area were from .69-caliber muskets and rifled muskets. The presence of these older model and larger caliber firearms is consistent with the historical accounts of some of the Louisianans being armed with guns capable of accepting a bayonet (Watson 1888). The crack of a Mississippi rifle being fired may have opened the infantry assault on the 3rd Missouri line, but it was concentrated artillery fire of shell, case shot, and canister, as well as a charge by Louisianans armed with .69-caliber muskets and rifled muskets that carried the guns of Backoff's battery and compelled Sigel's line to collapse.

The Physical Evidence of the Fight in Ray's Cornfield

The story of the fight in Ray's cornfield is told in detail by Bearss (1960), Piston and Hatcher (2000:202-208), and Knapp (1993:40-45). Essentially, Lyon ordered Capt. Joseph Plummer and his regulars to protect the left flank of the Union attack. Plummer sent a subordinate, Lt. Charles Gilbert, forward with one company to feel to the left, while Plummer moved along Lyon's left with the other three companies of the 1st U.S. Infantry. Lyon then ordered Plummer to press the attack on the left by crossing Wilsons Creek and striking for the Wire Road.

Plummer marched his men east and down the rocky slopes of Bloody Hill in an effort to join with Gilbert's company. Plummer found Gilbert in a densely vegetated area where his command was held up in crossing the creek. Gilbert probably encountered the mill ponds of Gibson's mill and the 1st Infantry took time finding a suitable crossing, and when they did they were further delayed by running into more swampy ground with dense stands of willows and reeds on the east side. Once across this impediment Plummer reformed his four companies, crossed Gibson's recently harvested oat field and then moving southeasterly crossed a fence into Ray's cornfield, described as Indian corn of moderate height. Plummer's command moved in a southerly direction across the field and nearing its center saw the position of Capt. W. E. Woodruff's Pulaski artillery battery hammering away at Lyon's left flank. He moved his troops toward the battery determined to rush the guns and silence them if the opportunity afforded itself. About the time he reached the cornfield's southern boundary, a rail fence, he was met by elements of the 3rd Louisiana Infantry and the 2nd Arkansas Mounted Rifles just emerging from a heavily vegetated ravine.

Woodruff had notified Gen. McCulloch of the threat posed by Plummer's advance across the cornfield and McCulloch ordered Col. Louis Hebert and Col. James McIntosh to deploy their respective units to meet the threat. Hebert's and McIntosh's units moved along a trail or road trace that passed the Ray springhouse and traversed a thickly vegetated ravine that rose on its northern flank to become the southern boundary of the cornfield. Two companies had time to deploy on the ravine flanks as Plummer's Union troops opened

fire. Using the brush choked ravine as cover the southerners returned fire. As the firefight ensued other companies of the 3rd Louisiana and the 2nd Arkansas began deploying on the initial two companies right flank. This caused the southern line to form an L-shape that allowed them to fire into the flanks of the regulars. Plummer, outnumbered and outgunned, was forced to fall back with losses to his command of nineteen killed and 52 wounded including himself.

Apparently, Plummer formed his roughly 300 men into company ranks in depth, as Piston and Hatcher (2000:216) quote that some men complained that their cheeks were singed by the muzzle blast of the rank behind them firing indiscriminately. There was a halt in the fire fight at one point and verbal insults were exchanged, but McIntosh took advantage of the situation to order his men to charge. This broke the Union line of battle and forced Plummer to retire across the cornfield and Wilsons Creek. He was hotly pursued by part of the 3rd Louisiana and 2nd Arkansas.

Plummer's men crossed Wilsons Creek, but the McIntosh's, now disorganized, command was halted north of Gibson's Mill to regroup. As the men were being sorted out, Lt. John Du Bois' Federal battery, which had just been ordered to limber his guns and move to the right, had his orders countermanded and he swung his guns toward the assembling southerners. Unleashing several rounds into their midst caused the Louisiana and Arkansas troops to retreat. One group of Hebert's Louisianans fell back to the rear of the Ray house. This group was spotted by Du Bois and he fired two rounds toward them. One hit Ray's chicken coop. The house was being used as a hospital by the southerners and when the artillery rounds exploded in the yard, they hastily unfurled their yellow hospital flag which Du Bois saw and promptly ceased fire on the house as called for in the conventions of warfare of the day.

The artifactual evidence of the fight in Ray's cornfield is even more meager than that found in Sharp's field. Less than fifty artifacts were recovered in over 200 acres of inventory in the cornfield and surrounding open areas. The combat evidence is limited to one percussion cap, three dropped .58-caliber Minie balls (Figure 32), three fired .58-caliber Minie balls, two fired .52-caliber Sharps bullets (Figure 33), one unfired .69-caliber spherical ball, one fired .69-caliber spherical ball, two fired .69-caliber spherical balls that retain evidence they were buck and ball rounds (Figure 31), one .69-caliber case shot ball, two .44-caliber spherical balls fired in one or more Colt revolvers (Figure 33, one fragment of a 12-pounder case shot, two fragments of 12-pounder shell fragments, and one fragment of a 6-pounder case shot (Figure 29). Three gun maintenance tools, two main spring vises and a screwdriver/nipple wrench of the Model 1841/1842 pattern were also recovered. Several possible personal items were found, including a harmonica tone plate, the bowl of a pressed iron spoon, and the finger bow of a pair of scissors. Although the spoon, harmonica, and scissors could be items lost by soldiers, they could also be items lost at a later date. Other items were found in the field, but they relate to subsequent agricultural activities and post-date the Civil War.

The artifact distribution does not appear to be particularly meaningful, except that the majority of the Civil War small arms items found did concentrate on the north of the edge of a heavily vegetated ravine located at the southern end of the reconstructed cornfield. The evidence is entirely consistent with the historical descriptions of the fight location and the rout of the Federal troops. The few bullets recovered indicate the forces were armed with Model 1855 rifled muskets or possibly rebored Model 1841 "Mississippi" rifles, Model 1842 rifled muskets, Model 1842 smoothbore or Model 1816 variation smoothbore muskets, Sharps rifles or carbines, and Colt revolvers. One participant account of the fight indicated both sides had .69-caliber muskets: Vickers (1896: 574-591) quotes a participant account believed to have been written by John Dailey about the fight in Ray's cornfield "*Both sides were armed with muzzle-loading smooth-bores, which carried three buckshot and ball. They were formidable weapons at close range when well aimed*." A second participant, a member of the 3rd Louisiana Infantry, William Watson (1888) recalled the order to attack Plummer: "*''Charge them with bayonets!' cried a voice near me. 'Give them cold steel, boys!'*" Both accounts refer to muskets, the first referring to .69-caliber smoothbore muskets, and the second weapons capable of accepting a bayonet. Both are consistent with the archeological evidence of .69-caliber buck and ball rounds as well as .69-caliber rifled muskets being present. The physical evidence is also consistent with the historical records indicating Plummer's regulars were armed with the Model 1855 rifled musket, while the recruit company was armed with smoothbore muskets (Greene 1894:574).

Henry Flanigan reported that his company of the 2nd Arkansas Mounted Rifles was armed with shotguns and homemade knives (Piston and Hatcher 2000:97). There is no archeological evidence found during the current investigations to support this statement, although this could be a function of the inventory methods employed in the investigations.

The absence of any .54-caliber Mississippi rifle balls or conical bullets belies the fact that at least one company of the 3rd Louisiana Infantry, the Pelican Rifles, was purportedly armed with the Model 1841 rifle. It may be a factor of artifact recovery that no bullets in this caliber were recovered, but it is just as likely that the unit was armed with Model 1841 rifles that were rebored to .58-caliber. Part of the 3rd Louisiana was involved in the fight in Sharp's field were they are attributed with using their Model 1841 "Mississippi" rifles to start the infantry assault on Sigel's line. The near absence of .54-caliber bullets in that area, coupled with the fact that .58-caliber Minie balls were found in Ray's cornfield may add strength to the argument that the Pelican rifles were using the enlarged bore Model 1841 rifle.

The gun maintenance tools are another interesting bit of archeological evidence of the fight. Mainspring vices were carried by non-commissioned officers in their haversack, while the other gun tool would be found in the haversack or cartridge box of a soldier. Their distribution provides some suggestion of the route of advance and/or retreat of the units involved in the fight. They form a roughly linear pattern running north to south along the east side of the field.

The metal detecting inventory work associated with Ray's cornfield covered the vast majority of the open fields and accessible woodlands east of Wilsons Creek, bounded by the current tour road on the east, such that this encompasses over 200 acres of land. The absence of any other concentrations of Civil War era artifacts is important. The inventory of the area surrounding the traditional site of the cornfield fight is essentially devoid of Civil War era materials. The few Civil War era artifacts found were in the Ray cornfield of tradition. One factor that hampered full investigation of the south end of the cornfield and the all-important ravine located there, is the very dense vegetation that frustrated the metal detectors and precluded them from working in that area. Several artifacts, including a percussion musket cap, were found on the lip of the ravine in an area consistent with the historical accounts of where the 3rd Louisiana Infantry began the fight with Plummer's regulars. The entire southern end of the cornfield as well as a large area on the eastern side of field is covered with underbrush. When this vegetation tangle can be reduced this area should be targeted for detailed metal detection inventory, as it is very likely that more patterned information relating to the fight in the cornfield will be found there.

Dense vegetation along Wilsons Creek also precluded metal detector work that could have recovered evidence of the retreat route and the site of Du Bois' shelling of the pursuing southern troops. However, thanks to Darrell Trogdon's mapping of his pre-1960 finds, that location can be posited. Trogden recorded, on his all-important Naugehyde map, the approximate find spots of 28 canister balls and nine fragments of shell or case shot on the east side of Wilsons Creek, but well south of Gibson's Mill. Some of the shell fragments may represent Du Bois' battery fire against the Pulaski Battery which was positioned near the Wire road somewhat further east. However, the canister would not have likely been fired at the Pulaski position as it is well out of canister range, about 935 yards from battery to battery. The distribution of the canister found by Trogdon is within the currently densely vegetated areas that were inaccessible to the inventory team. It is about 385 yards from the posited Du Bois battery site and well within the 400 to 500 yard maximum range of canister. Whether Trogdon was able to look north of this shell and canister concentration area is not known, but Gibson's Mill and the area north are well out of canister range (ranging from 675 yards to over 935 yards) for any of the Federal guns, or at least their postulated positions. Also the areas north of Gibson's Mill today have large areas of open fields that were examined with the metal detector team. No Civil War era artifacts were found in those areas. Thus it appears most likely that the Louisiana and Arkansas troops were not concentrated north of the mill, but south as they halted their pursuit of Plummer's retreating regulars.

As noted earlier 12-pounder and 6-pounder shell and case shot fragments, as well as a case shot lead ball, were recovered (two west of the cornfield, one east of the cornfield and one in the cornfield) east of Wilsons Creek (Figure 29). Although too few in number to make a definitive statement regarding their meaning, these artillery shell and case shot could be either rounds fired at the pursing southern troops or may represent fragments of the shot fired at the Ray house (a range of some 1250 yards) after elements of the 3rd Louisiana Infantry retreated to that location. In either case these artifacts likely represent

the shell and case shot fired by Du Bois at the southern forces as they fell back from Wilsons Creek after their pursuit of Plummer was halted.

The Physical Evidence for the Main Battle On and Around Bloody Hill

The complete story of Lyon's attack on Price's command is well told in various sources (Piston and Hatcher 2000; Knapp 1996; Bearss 1960; Brooksher 1995) and the basic history is abstracted from those sources here. In the early morning hours of August 10, Gen. Lyon's command moved from their late night resting place south along a road that passed the Short farmyard and home. The Short's were startled from their breakfast as thousands of soldiers passed through their property. It was on the Short farm that Lyon began to deploy his troops.

Col. James Cawthorn was one of the first southerners to recognize the Federal threat. He ordered Col. DeWitt Hunter and his cavalry to sortie to the north to ascertain the nature of a reported federal movement on the camps. Lyon responded by ordering Totten's artillery battery into position on a knoll, probably the area where the park visitor center sits today, and Lt. George Sokalski's battery to unlimber in the Short farmyard. With his artillery in place he then ordered the 1st Missouri Infantry to move south to meet Hunter's cavalry sortie. The Missourians were supported on the right by the 2nd Missouri Infantry and on the left by Plummer's 1st Infantry regulars.

Light skirmishing occurred between the troops as the Federal forces moved from the high ground at Short's farm south down a long sloping hill in to the shallow drainage on the north flank of what was to become Bloody Hill. Hunter was reinforced by James McCowan's and Robert Peyton's cavalry units about the crest of the hill.

In the meantime the 1st Kansas Infantry deployed on the left of the 1st Missouri while Plummer moved further east. The 1st Missouri and 1st Kansas in light skirmishing forced the southern cavalry units off the crest and the Union troops occupied the crest of Bloody Hill. There the Union forces were met by artillery from Capt. William Woodruff's Pulaski Battery stationed on a knoll along the Telegraph Road and south of Ray's cornfield. Guibor's Missouri State Guard Artillery went into battery on the west side of the southern line on the lower flanks of Bloody Hill above Skegg's Branch.

As the southern forces deployed to the east of Guibor's battery, from left to right, Kelly, Burbridge, Hughes, and Cawthorn with men of Wingo's, Foster's, and Weightman's units filling in behind the line or moving up to fill in gaps, a southern cavalry unit lead by John Rives moved north to face the Union troops.

Rives was quickly driven back by elements of the 1st Missouri Infantry. As Totten deployed his artillery on the crest of Bloody Hill, Lt. John Du Bois' guns went into battery down slope and to the east in an attempt to silence the Pulaski Battery. Lyon held the 2nd Kansas in reserve on the north slope of Bloody Hill and sent the 1st Missouri forward with

six companies of the 1st Kansas on their left to tackle the southern forces arrayed to their south or front.

The Union advance was checked by southern musket fire supported by Guibor's battery throwing shell, case shot, and canister at the Union troops. The Kansans and Missourians retired back to the hill crest where Lyon redeployed his troops in long front. He sent Sokalski's battery to a knoll at the right end of his line with the 2nd Kansas on their left, followed by the 1st Missouri, 1st Kansas, Totten's Battery supported by Capt. Frederick Steele, then Du Bois' battery with the 1st Iowa anchoring the left end of the line. Lyon's battle line probably extended from just above Wilsons Creek on his left to a knoll that is now outside the park boundary and west of ZZ Highway.

The southern forces also redeployed with Guibor moving his battery to the west and above Skegg's Branch. To the right of the artillery was Wingo's command, then Foster, Burbridge slightly overlapping with the 1st Arkansas Mounted Rifles, then Hughes command. The 3rd Louisiana Infantry was behind and between Hughs and the 1st Arkansas Mounted Rifles. Weightman's command moved up slope behind Hughes with Cawthorn's men and the 2nd Arkansas Mounted Rifles completed the southern right flank. This became the second southern assault on the Union troops holding the crest of Bloody Hill and is probably about the time Lyon was killed, not where his marker stands today, but likely on the right of the 2nd Kansas line where the pull out for the Bloody Hill parking lot is today.

Part of the legend and myth of Wilson's Creek is that Lyon was killed by a southern rifleman. Alonzo Shelton (1974) a member of a Missouri State Guard unit commented on the probable death of Lyons. "*…when within about 75 yards of our line, riding a small grey horse, waving his sword urging his on his men, some ragged Missourian* [sic] *with his squirrel rifle drew a shooting match bead on him…*" And another guardsman recalled (Weed 1918:392) "*his time had come, and a ball form one of the old-fashioned squirrel rifles in the hands of a lanky back-woodsman pierced the breast of the truly brave general…*" Piston and Hatcher (2000:268; Wherry 1956:289-297) state that it was a large caliber ball that struck Lyon's in the chest that caused his death. The definition of a large caliber ball is open to question, but it more consistent with a musket ball than a hunting rifle ball, although the question cannot be addressed with the available archeological data, except to note, once again, there is very little evidence of the use of non-military rifles in the archeological record of the battle.

The battle did not end with Lyon's death; in fact, his officers went to lengths to disguise the fact he was dead. The battle continued to rage when Maj. Samuel Sturgis was informed that he was now in command by reason seniority of rank in the regular army. The Union lines were under fire from the southerners posted to the west and south of Bloody Hill's crest.

Piston's and Hatcher's (2000) analysis of the terrain and the primary documents indicates that the right end of the Union line was most likely positioned on high ground that

is now outside the park boundaries. They also place the left half of the southern line west of the boundary just south of a modern east west running farm road.

From these positions the fighting continued between the opposing forces with shifts in both lines that became the third southern attack on the Union lines. The 1st Iowa moved from the Federal left to behind and between the 2nd Kansas and 1st Kansas positions. The southerners redeployed by moving the 3rd Missouri, 3rd Arkansas, 5th Arkansas, Wingo, Kelly, the 1st Arkansas Mounted Rifles, and Burbridge's units to the west and north in an attempt to flank the Union right near Soklaksi's battery. Price also brought up Reid's Fort Smith Battery placing it northwest of Guibor's Battery. The South Kansas-Texas Cavalry attempted swing around the end of the Union line, but was forced back.

By this time, Major Samuel Sturgis realized his troops were exhausted and he was running out of ammunition. He staged a strategic withdrawal of the Union army back to Springfield. He formed a column with the 2nd Kansas leading the way. He deployed detachments of the 1st Missouri, 1st Iowa, and 1st Kansas on the southern slopes of Bloody Hill, backed by Totten's Battery, to hold the southerners at bay while the main body of troops with drew. These rear guard detachments then withdrew as well. Unbeknownst to Sturgis, Price and McCulloch's men were equally exhausted and low on ammunition. Thus the Union withdrawal was not under any extreme pressure.

The systematic metal detecting inventory of Bloody Hill was extremely productive yielding hundreds of fired and dropped bullets as well as a limited amount of canister and spherical case and shell fragments (Figures 29, 30, 31, 32, 33, 34). This is not surprising given the intensity of the fighting on Bloody Hill for nearly six hours on August 10, but given previous relic collecting efforts prior to 1960 and one earlier archeological investigation's limited recovery, the extent of in situ battle remains is an important discovery.

As noted earlier Darrell Trogden and Fleet Kerr, among many other casual collectors, are known to have relic collected on and around Bloody Hill. Trogden did record the distribution of his finds for posterity (Figure 10). Trogdon found most of his battle-related artifacts on the southern and eastern slopes of Bloody Hill between the site of tour road stop at Guibor's battery and to the north of the current tour road stop at the crest of Bloody Hill. He also collected from the tour road stop to Wilsons Creek. In this area he recorded on his map finds of a complete 12-pounder cannon shell, 72 artillery shell and case shot fragments, 39 canister balls, 17 bullets, and three gun tools.

Park Historian Richard Hatcher with the aid of several volunteers including Dr. Thomas Sweeney metal detected the backdirt removed from the tour road construction and the Bloody Hill pedestrian path construction in 1985 and 1986. Their efforts resulted in the recovery of 130 artifacts, the majority of which were bullets although a few personal items, horse tack, and some cut nails were also recovered. Unfortunately the majority of the items were recovered out of context in the construction backdirt, their work nevertheless demonstrated that there was extensive battle related evidence still present on the field

despite all the years of relic collecting and in contrast to Bray's nearly fruitless attempt at systematic metal detecting twenty years earlier.

The Bloody Hill metal detecting inventory was carried out with great success over much of the crest and the slope, encompassing some 160 acres. However, the inventory effort was hampered by such dense vegetation in places that either precluded metal detecting work altogether or allowed the team only a limited sampling of some areas. The north slopes of Blood Hill are a tangle of brush, portions of which were cut with a bush hog after prescribed burning failed to reduce the density of the brush and saplings. The mowing allowed for detailed metal detecting on portions of the north slope. However, dense woody vegetation east and south of the Lyon marker limited the effectiveness of the inventory in those areas. At best the metal detectors achieved a good sample, but not a complete inventory of those areas. Dense vegetation north of a shallow drainage that demarcates the north side of Blood Hill separating it from the next rise to the north precluded any work in this area. This area includes Lyons initial attack route, the site of the at least one field hospital, and the federal retreat route which could not be examined. The same is true of the heavily wooded area on the eastern flanks of Bloody Hill, east of the Lyon marker to Wilson's Creek. Some less densely vegetated areas or at least more open areas exist in this zone, and they were sampled where possible. Likewise, the entire area west of the tour road on the west side of Bloody Hill, a low lying drainage, and along the park's western boundary, was so densely wooded as to preclude any metal detecting work in this area. Figure 2 depicts the metal detected areas.

The distribution of bullets and artillery shell and canister on Bloody Hill reflects, in part, the areas the team was able to metal detect. It also shows definitive clusters of the material of war. Given the back and forth nature of the fight on and around Bloody Hill the artifact distribution is more difficult to interpret than the less complicated actions at Sharp's field and Ray's cornfield. Nevertheless, there are some clear patterns in the artifact distributions.

On the lower and southern flank of Bloody Hill, aligning with the current Guibor battery tour stop and running from the northwest and angling east to the terrace above the Edward's cabin site there is a well defined line of artifacts that is composed mainly of fired and impacted .58-caliber and .69-caliber Minie balls, forty and nine respectively. Also recovered were one unfired or dropped .69-caliber Minie ball and six unfired or dropped .69-caliber spherical balls. Four fired. 69-caliber spherical balls were found on this line as well (Figures30, 31, 32).

About 150 yards north of this linear array of artifacts is a less clearly defined alignment, but nonetheless, a line of artifacts running east to west that angles to the north on the western side. Within this angled line are a mixture of fired and impacted .58-caliber and .69-caliber Minie balls as well as a few unfired or dropped .58-caliber Mine balls. This area also yielded twelve fired .69-caliber spherical balls. Between the two linear arrays

of bullets there are widely scattered fired and impacted bullets, mainly .58-caliber and .69-caliber Minie balls.

The two east to west trending alignments of artifacts likely represent the battle lines of Price and Lyon during the early stages of the battle. As Lyon's Missouri and Kansas troops pushed down slope from the crest of Bloody Hill they were met by Price's hastily assembled men. Acknowledging that discipline in the Missouri State Guard was far from perfect and that many units were indifferently armed, Piston and Hatcher (2000:234) state that Lyon's assault on the south face of Bloody Hill was met by military musket and hunting rifle fire at long range from the southern troops as the Union Missouri and Kansas regiments made their way through the trees and brush on the lower flanks of the hill.

The impacted bullets on the lower or southern forces line indicate that the 1st Missouri and 1st Kansas were armed with Model 1855 or rebored Model 1841 rifled muskets, Model 1842 rifled muskets, as well as smoothbore muskets in .69-caliber. The northern group of impacted bullets is more difficult to interpret as the ground was occupied by not only the northern troops, but later in the battle by southern forces as well, thus the impacted and dropped rounds can be reflection of either the northern or southern line, or both. It is likely they represent both, thus the bullets found in this area are of mixed origin. What can be reasonably drawn from the bullet evidence along the northern line is that the southern forces were firing Model 1842 rifled muskets and various models of smoothbore muskets at the northern forces. The near absence of civilian rifle balls or shotgun pellets argues that the fabled country rifles were not nearly as ubiquitous as the historic literature would have us suppose. Likewise there is little evidence of the widespread use of shotguns, although the 10 or 12 gauge shotgun would accept a .69-caliber round ball or buck and ball load without modification and some may have been fired as ersatz muskets rather than traditional shotguns.

The western side of the line that angles north was occupied by 1st Missouri Infantry under Lyon. During the initial fighting they faced a flank attack on their right from General James McBride's command of the Missouri State Guard (Piston and Hatcher 2000:239-243). If the northwestern angle of the line reflects the Missourians attempt to halt McBride's attack then the archeological evidence indicates that McBride's men were not overwhelmingly armed with "deer rifles" brought from home (Piston and Hatcher 2000:239) as one of Clark's men reported. Rather the bullet evidence indicates that the southern forces firing into the Missouri lines were armed with Model 1842 rifled muskets and various smoothbore .69-caliber muskets. Likewise the McBride's flanking attack was met by fire from Model 1855 or rebored Model 1841 and Model 1842 rifled muskets and some smoothbore muskets.

Immediately to the north of the second line, and in the vicinity of the Lyon's marker, there is a significant cluster of over twenty unfired or dropped .69-caliber spherical balls, as well as six fired balls of the same caliber. In this same area the team recovered a dozen unfired or dropped .58-caliber Minie balls and about six fired bullets.

A second large cluster of unfired or dropped bullets was found on the northwest slope of Bloody Hill. This is a significant concentration of over thirty .58-caliber Minie balls, twelve .69-caliber Minie balls, and over twenty .69-caliber spherical balls. Interspersed among these bullets were fired rounds of all three types, but the vast majority were fired .69-caliber spherical balls.

The clear clusters of dropped or discarded bullets, that is unfired bullets (Figures 30, 32), argues that soldiers bunched up or crowded together at some points in the battle as opposed to maintaining their spacing on skirmish and battle lines.. This bunching behavior is well documented in military literature. For the nineteenth century du Picq (1946:144) and in the twentieth century Marshall (1978:160-161) have addressed this question of crowding or bunching behavior. They consider crowding behavior to mean that men have lost the will to fight, that fear has set in, and that the first instinct before flight or surrender is to cluster together in disorganized elements – for some form of psychological comfort and support. Fox (1993:47-49) develops an archeological based model of what he calls tactical stability and tactical disintegration based on these and other concepts. The bullet clusters seen on Bloody Hill fit his model well as evidence of tactical disintegration and can be reasonably interpreted as evidence of loss of command and control exhibited in men who have lost unit cohesion and the ability to fight effectively. Good leadership can mitigate such behavior by getting the men under control and back into fighting lines.

One such example was the bunching of men, in this case southern troops of the Calloway Guards after a Union assault. As Lt. John Haskins attempted to restore order among the men he was cut in two and two men nearby beheaded by a Union artillery burst (Piston and Hatcher 2000:236).

Which units were involved in the bunching behavior is not entirely clear. The lower group, clustered around the Lyon marker site, may represent elements of the 1st Iowa falling back during the second southern assault or perhaps elements of the 1st and/or 2nd Missouri falling backing during the third southern attack on the left flank of the Federal line. The dense cluster of unfired or dropped bullets located on the northwest flank of Bloody Hill is also difficult to interpret as to those responsible for their deposition.

During a lull in the battle after the initial Federal attack, both lines redeployed with the Federal units running from east to west across the crest of Bloody Hill then angling to the northwest roughly along today's ZZ Highway which forms the park's western boundary. Likewise the southern forces redeployed in an east to west manner, eventually angling to the northwest. One attempt by Col. Elkanah Greer's cavalry to flank the Union lines on the right was defeated, but not before some troops, perhaps a detachment of 2nd Kansas Infantry were routed. At least two members of the 2nd Kansas reported that some companies were armed with old smoothbore muskets (Rankin nd; Hatcher and Piston 1993:40), those being .69-caliber taking either buck and ball or spherical ball rounds, thus the finding of large numbers of .69-caliber unfired spherical balls is consistent with this interpretation.

A second and equally plausible interpretation is the northern cluster of unfired or dropped spherical balls (Figure 31) may relate to a detachment of Regular recruits that were routed during the third southern assault. They were routed from the line and fell back to the area where reserves were stationed, on the northwest side of Bloody Hill in a low area. Like the 2nd Kansas the Regular recruits were reportedly armed with smoothbore muskets (Greene 1894.574). It is possible the northern cluster of unfired or dropped rounds may represent both events melded together, one superimposed over the other, so as to be otherwise indistinguishable in the archeological record. Regardless of the source, these two clusters fit the model of tactical disintegration just as the linear arrays of bullets clearly fit the models of tactical stability. The archeological record may be muddled by multiple troop movements over the same ground, but there are localities that show clear evidence of where troops were deployed on line, and where panic caused some elements to bunch together before stability was restored.

Over 80 canister balls (Figure 34) were found on Bloody Hill. Their find locales, at a minimum, reflect where the team was able to work and the lack of hindering vegetation in those areas. The canister distribution probably reflects all elements of the battle, but using known artillery tactics and landscape features some interpretation of the meaning of that distribution can be set forth.

The expedient, rod or "bar shot" canister is considerable in quantity amounting to 27 pieces found on the southern flanks of Bloody Hill and up to its crest just east of the current tour stop. Using the maximum range of 600 yards, once again, as a limiting factor from the guns firing this type of canister allows a reasonable reconstruction of the battery location. Guibor's Missouri State Guard Battery was the only unit likely to have fired these rounds. Since the majority of the expedient rod canister is on the southeastern facing slopes of Bloody Hill, it could not have been fired from Guibor's second or third positions, west of current ZZ Highway, as these locations are out of line of sight. The location that best fits the distribution of canister is at or near the current tour stop for the Guibor Battery, on the southwestern flank of Bloody Hill and well above Skegg's Branch.

Six pieces of 6-pounder and 12-pounder howitzer canister were recovered on the north slope of Bloody Hill. This area was heavily vegetated and could not be metal detected in detail. The Trogdon map shows that he recovered a few canister balls and at least 25 shell fragments on these northern slopes as well. Some of these may be overshot rounds fired at the Du Bois battery located further to the east. There are two other interpretations of the distribution as well. One is that some of the shell fragments and the canister represent Union artillery fire during the opening rounds of the battle as Lyon had his guns go into battery in the Short farmyard to fire on Hunter's cavalry. The shell and canister distribution can also be interpreted as southern artillery firing on the Union troops as they withdrew from the field. Depending on the final positions of Guibor's and Reid's batteries this may or may not be the case. If the final southern artillery positions are west of ZZ Highway and south of Farm road 188 then they were too low to be able see and to fire at retreating Union troops, although some of shell fragments and canister balls might represent overshots. If

the guns were further forward and up hill they could have fired on the final Union lines and retreating troops.

A group of five 6-pounder canister balls and thirteen 12-pounder howitzer canister balls were recovered in two general areas on the lower and southern flanks of Bloody Hill. These clusters likely represent Union artillery fire. The western area could represent counter battery fire directed at Guibor, or both areas could represent cannon fire directed at the first southern line of defense and attack. The eastern group is out of range of any of the artillery batteries on Bloody Hill, but in range of Backoff's battery firing from Sigel's line near the Sharp house, as discussed previously.

Aside from the east to west trending linear array of bullets that are interpreted as the initial stage of the fighting on Bloody Hill the majority of the fired and unfired bullets as well as the canister and artillery shell fragments group in a north to south alignment on the western side of the hill, along the tour road's current alignment. This alignment is consistent with the Union troop deployment that faced the second and third southern attacks. However, Piston's and Hatcher's (2000:250-290) insightful and well reasoned analysis of the historic documents places the Union troop center and right flank deployment west of ZZ Highway and outside the park boundary to face the left of the southern line.

Unfortunately the archeological team was unable to work west of the current tour road due to very dense vegetation between the road and the park boundary. Likewise, we were constrained by being able to work only within the park boundary. Until such time as the area between the road and the western park boundary and private lands can be inventoried we can only offer a working hypothesis to account for the dense distribution of bullets and artillery fragments west of the road. This working hypothesis is simple and straight forward, and that is the Union lines were not west of ZZ Highway angling to the northwest from the crest of Bloody Hill. Rather we suggest that the positions occupied by the 2nd Kansas, 1st Missouri, 2nd Missouri and possibly by Sokalski's battery were on the west side of the road and slightly down slope from the higher points. Perhaps they occupied the higher ground during the second and third southern attacks, but were pushed back, or perhaps they initially occupied these positions using the intervening higher ground as expedient protection from the incoming southern small arms and artillery fire. There are many reports of the men being ordered to lie down in the grass, firing from that position or from kneeling positions during the southern onslaught (Piston and Hatcher 2000:263-270). Pvt. Eugene Ware (1907:317) gives one of the more graphic accounts: "*We all lay down on the ground, and for some time the shells, round shot, and canister were playing closely over our heads…, we simply laid down on the ridge and watched the battery in front of us, or sat up or kneeled down. When we saw a puff of artillery we dodged and went down flat…*"

7. CONCLUSIONS

It might be said the historical record is accurate in recording the events, but perhaps not precise in its description or detail of where actions occurred on the ground. Taking into account the fact that this was a first battle for most participants it is not unreasonable to expect some distorted views of the fight to occur. Both commanders and their men were surprised and routed, particularly the Southerners at the beginning and the Union at the end of the fight in Sharp's field. Neither likely wanted to place too harsh a critical light on those episodes of the engagement. Rather it seems likely that both commanders and their subordinates focused on the positive aspects as well as, perhaps, exaggerated the intensity of the fire fight to justify their actions and reactions at different points in the battle.

Regardless of the frailties of the depositional context in Sharp's field and Ray's cornfield, the archeological data recovered there is the physical evidence of those events on that hot August morning of 1861. The archeological record of the fight in Sharp's fields provides a new and independent means of assessing and evaluating the disparate historical record of those events. It certainly does not alter the outcome, but it does provide a physical link, and an interpretable body of data, to a significant episode in the history of the American Civil War. Franz Sigel never became a highly regarded battlefield commander; rather he had a clouded career as an army officer for the remainder of the Civil War, although he rose to the ranks of general officer. Ben McCulloch was killed in action in March 1862 while scouting well forward of his troops during the Battle of Pea Ridge, Arkansas. Ironically he was once again facing troops under the command of Sigel. While the archeological record may not give us direct insight into the personalities of McCulloch or Sigel, the patterned artifact distributions found in Sharp's field do provide us a glimpse in to how effectively or ineffectively two military commanders fought their men on August 10, 1861.

The archeological record indicates the position of some of the southern cavalry camps by the discovery of camp debris and gun parts, as well as the direct evidence of Sigel's shelling of the camps in the form of shell and case shot fragments recovered in the same context. Although the Sharp house site still eludes us, Sigel's final line of battle can be placed with reasonable accuracy on the ground. That linear array of artifacts along with identifying a nearby anomaly from a study of early aerial photographs may be the best lead we have to narrowing the search for the actual site of the Sharp house.

Analysis of the archeological collection and artifact distribution through computerized modeling of the landscape and terrain provides us with a relatively specific location where Bledsoe's battery was positioned while firing on Sigel's last line. That same analysis also gives two alternative locations for the location of Reid's Fort Smith battery. One is near the traditionally interpreted site, the other somewhat further west. Either is plausible, unfortunately both areas have suffered from significant ground disturbance in the past; probably resulting in the near total destruction of the archeological record that might aid in clarifying which location is the correct one.

WILSON'S CREEK NATIONAL BATTLEFIELD

Archeological discoveries of small arms and artillery fire on the south side of Skegg's Branch suggests that Carr's cavalry, anchoring Sigel's left flank, were initially further down slope than previously thought. Dense vegetation there and on the knoll above the branch hindered full archeological investigation of that area. When the woods can be thinned through mechanical means or through prescribed burning we recommend that additional archeological inventory be undertaken in those areas to clarify Carr's positions and movements during the final stages of the fight in Sharp's field.

Likewise, the same recommendation holds for further investigation in Ray's cornfield. Archeological evidence was recovered showing the fight occurred in the southern portion of the field. However, the ravine that played such a prominent role for the southerners in the fight is still choked with brush and could not be inventoried using metal detectors. The material evidence of the fight in Ray's cornfield suggests the fight was far less intense than the historical record portends. The archeological record indicates that some of the pursuing southerners, and perhaps the retreating Federals moved west across the cornfield to Wilsons Creek and not north as reported in the historic documents. Darrell Trogdon's map of his finds certainly suggests this by the number of canister rounds he found in that area, and by the fact that the area north of the Gibson Mill was out of canister range for Du Bois' battery that supported Plummer's withdrawal. But we clearly recognize that the full extent of the fighting and retreat line was not inventoried due, again, to the dense vegetation in some areas. When the thick vegetation can be reduced along Wilsons Creek and in the ravine south of Ray's cornfield perhaps the issue can be resolved with more clarity.

Metal detecting work around Du Bois's battery was also hampered by dense vegetation and only a small sample was recovered. The limited metal detecting that we were able to accomplish around the presumed site of Du Bois' battery indicates there was significant fighting in this area. A probable artillery tool suggests that the site of the Du Bois battery is now located and that it faced considerable counter battery fire from the Pulaski battery as well as small arms fire from infantry troops. The investigations were entirely thwarted by dense foliage in the Pulaski battery area and by the disturbance of the area just to the south by the development of the town of Wilson's Creek in the early twentieth century. When the density of vegetation can be reduced in the from the Lyon marker east to the Creek and in the vicinity of the Pulaski battery site, a detailed metal detection inventory is recommended to confirm both battery positions as well as clarify the role of small arms firing on both.

The archeological investigations were more successful in the area of Price's headquarters at Edwards' cabin and on southern slopes of Bloody Hill. The prescribed fire efforts and more open terrain aided the metal detecting field work. Lyon's initial attack lines of the 1st Missouri and 1st Kansas as well as the southern battle line are clearly delineated by the archeological record. The archeological evidence is even clear on where the lines angled to the northwest in this early stage of the battle.

CONCLUSIONS

There is considerable archeological evidence of artillery and small arms fire for the second and third southern assaults on the Union lines. What are unclear are the exact positions of the Union and southern lines during those episodes of the fighting. Piston's and Hatcher's (2000:238-260) analysis of these events place the Union battle line just beyond the park boundary, roughly aligning with today's ZZ Highway. The southern lines are interpreted to be further south, extending west of the highway. The archeological inventory discovered a north to south trending band of dense artifacts of war running from the southern side of the crest of Bloody Hill to the higher ground north of the ridge top. This dense zone of artifacts can be interpreted to be the Union battle line related to the second and third southern assaults. We can only offer this idea as a working hypothesis to be tested in future investigations. The area west of the current tour road and those areas outside the park boundary were not available to us for study. It is clear from the area inventoried and the questions that arise from the archeological discoveries on the higher areas of Bloody Hill that much more archeological investigation should be done on the northern slopes of Bloody Hill and on the western boundary of the park. The area outside the park should be systematically investigated if land owners permission can be secured as well as project funding.

Lyon's initial movement from the Short house to the crest of Bloody Hill and Sturgis' retreat route still needs to be sorted out. The north side of Bloody Hill was only sampled and none of the area between the visitors center and the ravine north of Bloody Hill could be investigation due to the dense brushy understory.

Finding and verifying the location of at least two camping areas with clear archeological evidence aids in the interpretation of the battle. At least portions of the cavalry camps in Sharp's field were identified, and various debris found in the vicinity of the Edwards' cabin is the direct physical evidence of some of the camps of the Missouri State Guard. Temporary camps often leave little in the way of definitive patterns that can be retrieved archeologically. Yet men do leave bits of trash and lost items that can be recovered under ideal conditions. Thanks to Lyon's surprise attack, some traces of those camps were left to become part of the archeological record in this case.

Encampments, whether temporary or long-term, had to be situated based on the conditions imposed by the terrain occupied and the tactical situation of the moment. Regardless of the type of encampment or issues of terrain well-trained armies followed a set of regulations on how to camp and how to organize a camp for rapid deployment if the need arose (Whitehorne in press). The southern forces at Wilson's Creek are often depicted as a poorly organized army, with only a few units showing any semblance of order or discipline. Overall that may be true, but the role of command and control exercised by the generals in charge are reflected in the camp organization and structure seen at Wilson's Creek. Price and McCulloch had their troop camp by division and unit. More importantly the historic record (Dorsch 1966; Piston and Hatcher 2000) as well as the archeological evidence shows the general camp organization followed the model of regulations dating to the Mexican War era, reflecting the commanders' previous military experiences. Infantry camped by

units and divisions with artillery nearby to support or be supported by the infantry. The cavalry camped farther away reflecting the need for picketing horses and finding forage for the horses. The capability for rapid movement and response by the cavalry, at least in theory, meant they did not have to camp close to the other units.

The southerners do not appear to have camped, at least by units, in a haphazard or disorganized manner. Rather the order of the camps reflects general military training of the day as well as typical response to the terrain that constrained the camp layouts.

It is fairly obvious that the artillery units with Price and McCulloch were not randomly situated for camping purposes either. A review of Capt. William Hoeckle's 1865 map of the battlefield shows a series of roads, traces, and trails crisscrossing the landscape that became Wilson's Creek National Battlefield. The archeological and historical evidence of the battery locations during the battle shows that they were all located on or very near one of these roads or traces. Much of the hilly and rocky terrain than defines Wilson's Creek would have made the deployment of artillery into battery difficult without the use of these roads. The archeological analysis of the evidence of the location of Bledsoe's battery and either alternative for the site of Reid's battery was derived independently of any terrain constraints except line of sight and distance. Placing the cannon on the landscape based on the archeological evidence puts both on or immediately adjacent to roads or traces shown on Holecke's map.

During the battle hundreds of rounds of artillery shell, case shot and canister were fired. Lt. George Sokalski of Totten's Battery reported that his two gun section fired 240 rounds during the battle. This averages about one shot every three minutes (Piston and Hatcher 2000:235). No other reports are available on the expenditure of artillery rounds from other gun sections, although given the reports of continual artillery fire most of the units engaged at Bloody Hill must have fired hundreds of rounds. On the other hand Backof's battery attached to Sigel's command may well have only fired 10 or 12 rounds, at least in the late stages of his fight. The archeological investigations recovered 83 shell or case shot fragments, 86 canister balls, and 34 expedient canister shot. The Trogdon and Kerr relic collections held by the General Sweeney museum contain hundreds more shell fragments and canister balls. Trogdon's plots of his finds show he noted just under one hundred canister ball finds and over seventy shell fragments and one complete shell. Trogdon and Kerr ranged over most of the battlefield at one time or another in their collecting efforts. The systematic archeological investigations were constrained by vegetation mosaic on the battlefield today. Nevertheless, the archeological team recovered a significant sample of artillery shell, case shot, and canister pieces. Analysis of the pieces confirms the presence of 6-pounder and 12-pounder howitzer cannon on both sides. Metallurgical analysis of a sample of the shell and case shot indicates a strong uniformity in the manufacturing process suggesting that much of the artillery ammunition fired at Wilson's Creek was old U.S. arsenal production.

CONCLUSIONS

The expedient canister found confirms the historical record that the Missouri State Guard batteries under Guibor manufactured expedient canister and used it with good effect during the battle. The archeological evidence shows that Guibor's battery fired expedient canister made from round stock or rods, while Bledsoe's battery fired expedient cansiter made from square or bar stock. The presence of these canister types aided the project in reconstructing the probable locations of those two batteries during the fighting.

The hundreds of small arms bullets recovered allowed us to identify, using firearms identification procedures, at least 23 types of shoulder arms and pistols used by both sides during the battle. The archeological evidence confirms the presence of shotguns and country rifles in the hands of the southern forces, but it disspells the myth that many of the southerners were armed with those guns almost to exclusion. The archeological recovered bullets are overwhelmingly, 99%, associated with military firearms. Bullets fired from the Model 1855 rifled musket or rebored Model 1841 rifle predominate the military shoulder fired arms. Most of the other muskets used in the battle were either Model 1842 smoothbores, Model 1842 rifled muskets, or Model 1816 smoothbore muskets or one of its many variations. There clear physical evidence of the use of Model 1819 Hall rifles, various Hall carbines, a smattering of Sharps rifles and carbines, Maynard carbines, at least one Gallager carbine, and Colt revolving rifles. The southern army was undoubtedly armed with a more diverse group of muskets, rifled muskets, and rifles than Lyon's army, but for the most part those participating in the figthing on the southern side, employed military weapons, albeit many older models, to good effect on August 10, 1861.

In conlusion we can readily state that the battlefield archeology component of the park-wide inventory was very successful. Robert Bray was frustrated in his attempts to metal detect portions of the battlefield in the mid-1960s due not to relic collectors having taken everything, but by the limitiations of the technology he employed at the time. His other great frustration was the density of the vegetation cover that precluded good metal detector sweeps of the ground surface. The current investigation used the latest metal detector technology and electronic mapping capability. It is abundantly clear that relic collectors have not taken everything. There is a true plethora of buried evidence of the Battle of Wilson's Creek remaining on the field today and in patterns of depostion that can be interpreted in light of the historic records. Relic collecting has taken some toll on the archeological resource, but not destroyed the over all patterned distribution of the artifacts. Wilson's Creek National Battlefield retains a rich and significant amount of physical evidence of the battle that raged across those rolling hills for over six hours on August 10, 1861.

At the same time, there are large areas of the park that could not be metal detected, and have direct bearing on the battle story, due to thick vegetation cover. It is recommended that additional metal detecting inventories be planned and conducted in the following areas when the understory can be reduced by mechanical thinning or the use of prescribed fire. In Sharp's field the area south of Skegg's Branch and along the western park boundary should be investigated in detail to determine Carr's location and movements during this

phase of the battle. The entire northern third of the park, north of Bloody Hill as well as the strip of land between the tour road on the west side of the park and the park boundary should be inventoried to determine if Lyon and Price deployed men in this area during the later phases of the battle. The northern third of the park should have evidence of the initial advance and retreat of Lyon's army, as well as the location of the field hospital and possibly the baggage train. This area contains the newly recorded site of a tiff mine that the discoverers (Environmental Research Center 2004a) suggest could be the site of the lost second sink hole used for burial of some of the Union troops killed in action. The site should be tested to determine if there are any indications of its use as a burial site. The heavily forested areas on the north slope of Bloody Hill need further investigation to locate archeological evidence of Lyon's final troop deployment and to accept or reject the hypothesis that this final line is within the park boundary along the high points of the ridge line. The forested areas along Wilson's Creek and the areas east of Blood Hill also need further investigation to ascertain the role this ground played in the battle.

Likewise the thick brushy ravine at Ray's cornfield and the surrounding area bear further investigation to locate and define the extent of the archeological patterns of the figth in the cornfield, the role the ravine played in the fight, and the exact route of the Plummer's retreat and pursuit by the Louisiana and Arkansas troops. Archeological data from this area and east of Wilsons Creek will likely aid in refining the location of Du Bois battery. Another area needing investigation after vegetation reduction is locating the site of the Pulaski battery.

The location of the Sharp house is still in question, but an alternative site has been suggested. Additional multi-instrument geophyiscal investigations may help define the potential site, such at it has aided in the identification of the Edwards cabin site. The geophysical grid done around the Ray house should be expanded and additonal areas investigated to determine if any features remain that could be outbuildings of the Civil War era. The geophysical investigations should be followed up with tradational archeological testing at the Edwards cabin site, as well as the Ray house, and Sharps house site if features are discovered during additional geophysical work. The traditonal archeological testing will be needed to identify and confirm the nature of the anomalies identified by the geophysical investgations.

The protracted nature of the American Civil War left behind a wealth of historic documents, maps, sketches and photographs for modern day reserarchers to peruse and ponder. That bitter war also left behind a rich material culture legacy, much of it in the form of the archeological record. The battlefield archeology of Wilson's Creek National Battlefield has yielded up a rich and diverse array of physical evidence of that event. The physical evidence, the artifacts, were recovered from the ground at Wilson's Creek in discernable patterns and have yielded and will continue to yield a new depth and richness to the story. The acrid white haze of gun smoke may long be gone from the rolling hills of southwest Missouri, but the material culture legacy of that bitter fight still remain for the visitor to see, have interpreted, and gain a greater apprecation of our history.

REFERENCES CITED

Anonymous
2001 Shot Sizes – What Do They Mean? *Museum of the Fur Trade Quarterly* 37(1):7-13.

Arnall, Franklin M.
1988 *The Padlock Collector*. The Collector, Claremont, CA.

Aubry, Michele C., Dana C. Link, Mark J. Lynott, Robert R. Mierendorf, and Kenneth M. Schoenberg
1992 Systemwide Archeological Inventory Program. Anthropology Division, National Park Service, Washington, DC.

Barnett, Howard
1980 The Town of Wilson's Creek. Manuscript on file, John K. and Ruth Hulston Library, Wilson's Creek National Battlefield, Republic, MO.

Nd Wilson's Creek Was Once a Town, Too. Clipping on file, John K. and Ruth Hulston Library, Wilson's Creek National Battlefield, Republic, MO.

Barnes, Frank C.
1989 *Cartridges of the World 6th Edition*. DBI Books, Northbrook, IL.

Barron, S. B.
1908 *The Lone Star Defenders: A Chronicle of the Third Texas Cavalry Ross' Brigade*. Neale Publishers, New York.

Bealer, Alex W.
1969 *The Art of Blacksmithing*. Funk and Wagnels, New York.

Bearss, Edwin C.
1960 *The Battle of Wilson's Creek*. United States Department of Interior, National Park Service, Washington, D.C.

1968 The Ray House, Wilson's Creek Battlefield National Park. Office of Archeology and Historic Preservation, Washington, DC.

1978 Historical Base and Ground Cover Map Wilson's Creek National Battlefield, Greene and Christian Counties, Missouri. Denver Service Center, National Park Service, Denver, CO.

WILSON'S CREEK NATIONAL BATTLEFIELD

Bell, John P.
1914 Price's Missouri Campaign. *Confederate Veteran* 22(6):271-272.
1914 Price's Missouri Campaign. *Confederate Veteran* 22(7):318-319.

Benton, J. G.
1867 *Course of Instruction in Ordnance and Gunnery; Prepared for the Use of Cadets of the United States Military Academy*. D. Van Nostrand, New York.

Boyd, J. N.
1911 The Battle of Oak Hills or Wilson's Creek. *Confederate Veteran* 19(1):9-10.

Bray, Robert T.
1958 A report of archeological investigations at the Reno Benteen site Custer Battlefield National Monument June 2 July 1, 1958. Ms on file Midwest Archeological Center, Lincoln.

1967a An Archeological Survey and Excavations at Wilson's Creek Battlefield National Park, Missouri. Manuscript on file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

1967b Wilson's Creek Revisited: An Account of the 1967 Excavations. Manuscript on file at the National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

1975 Inventory and Evaluation of the Archeological Resources. Wilson's Creek National Battlefield, Missouri. Manuscript on file at the National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Britton, Wiley
1899 *The Civil War on the Border, Volume 1*. G. P. Putnam's Sons, New York, NY.

Brooksher, William Riley
1995 *Bloody Hill: The Civil War Battle of Wilson's Creek*. Brassey's, Washington, DC.

Buenger, Brent A.
2003 The Impact of Wildland and Prescribed Fire on Archaeological Resources. PhD dissertation, Department of Anthropology, University of Kansas, Lawrence.

Cater, Douglas John
1990 *As It Was: Reminiscences of a Soldier of the Third Texas Cavalry and the Nineteenth Louisiana Infantry*. State House Press, Jefferson City, MO.

Chapman, Carl H.
1959 *The Origin of the Osage Indian Tribe: An Ethnographical, Historical and Archaeological Study.* Ph.D. dissertation, University of Michigan, Ann Arbor.

1975 *The Archeology of Missouri, I.* University of Missouri Press, Columbia.

1980 *The Archeology of Missouri, II*. University of Missouri Press, Columbia.

Coates, Earl J. and Dean S. Thomas
1990 *An Introduction to Civil War Small Arms*. Thomas Publications, Gettysburg.

Coggins
1990 *Arms and Equipment of the Civil War*. Barnes and Noble Books, New York.

Combs, H. Jason
2004 Pioneer Migration to the Western Fringe of Settlement: 1837-1850. *The Geographical Bulletin* 46(1):4-14.

Coleman, W. O.
1911 Service of Col. W. O. Coleman. *Confederate Veteran* 19(6):284-285.

Connor, Melissa and Douglas D. Scott
1998 Metal Detector Use in Archaeology: An Introduction. *Historical Archaeology* 32

Cubbison, Douglas R., Laurence S. Alexander, James Moore, and Charles R. Brown
1998 Newtonia Battlefields Archaeological Survey. White Star Consulting, Mount Pleasant, Tennessee. Report on file Newtonia Battlefields Protection Association, Newtonia, MO.

Dammann, Gordon
1983 *Pictorial Encyclopedia of Civil War Medical Instruments and Equipment*. Pictorial Histories Publishing, Missoula, MT.

Dickey, Thomas S. and Peter C. George
1993 *Field Artillery Projectiles of the American Civil War*. Arsenal Publications II, Mechanicsville, Virginia.

Dosch, Donald P.
1966 A Study of Battery and Camp Positions at Wilson's Creek Battlefield with Addendum. Ms on file John K. and Ruth Hulston Library, Wilson's Creek National Battlefield, Republic, MO.

Douthit, Mary Lee
1981 Final Report on Archaeological Investigations of Sites along the James River Interceptor Sewer, City of Springfield, Greene County, Missouri: 1979. Center for Archaeological Research, Southwest Missouri State University, Springfield, Missouri.

du Picq, A.
1946 Battle Studies. Military Service Publishing, Harrisburg, PA.

Early, Ann M. (editor)
2000 Forest Farmsteads: A Millennium of Human Occupation at Winding Stair in the Ouachita Mountains. Arkansas Archeological Survey Research Series 57, Fayetteville, AR.

Environmental Research Center
2004a Cultural Resource Investigations, Phase I Survey, Wilson's Creek National Battlefield, 161kV Project, Greene County, Missouri. Environmental Research Group, Jefferson City, MO

2004b Cultural Resource Investigations, Phase I Survey, Battlefield Substation to Clever Substation, 161kV Project, Christian and Greene Counties, Missouri. Environmental Research Group, Jefferson City, MO.

Epenshade, Christopher, Robert L. Jolley, and James B. Legg
2002 The Value and Treatment of Civil War Sites. *North American Archaeologist* 23(1):39-67.

Flanders, Robert, Suzanne Harris, and David Quick
1981 A Cultural Resources Survey of the Proposed University Plaza Project City of Springfield, Greene County, Missouri: 1981, Project CAR-441, 2 volumes. Center of Archaeological Research, Southwest Missouri State University, Springfield.

Fox, Richard Allan, Jr.
1993 *Archaeology, History, and Custer's Last Battle*. University of Oklahoma Press, Norman.

Fox, Richard A. Jr. and Douglas D. Scott
1991 The Post-Civil War Battlefield Pattern: An Example from the Custer Battlefield. *Historical Archaeology* 95(2):92-103.

Frasca, Albert J. and Robert H. Hill
1995 *1909 Catalog: Springfield Armory Museum Arms and Accourterments, July 1, 1909, Including Supplemental Information from the 1925 & 1939 Catalogs and the National Park Service*. Whitlock Publishing, Springfield, OH.

Fryman, Robert J.
1995 "Engaged the Enemy Again": An Assessment of the 1862 and 1864 Civil War Battlefields at Newtonia, Missouri. Garrow and Associates, Atlanta, GA.

Garrow, Patrick H., Jeffery L. Holland, and Larissa A. Thomas
2000 Camp Lincoln of the Army of Southeastern Missouri: Historical and Archaeological Studies of 23CT355, Van Buren, Missouri. Garrow and Associates, Atlanta, GA.

Gibbon, John
1970 *The Artillerist Manual, Compiled from Various Sources and Adapted to the Service of the United States*. Benchmark Publishing, Glendale, NY, reprint of 1860 edition.

Gilbert, C. C.
1895 Copy of personal letter on file John K. and Ruth Hulston Library, Wilson's Creek National Battlefield, Republic, MO.

Gluckman, Arcadi
1965 *Identifying Old U.S. Muskets, Rifles, and Carbines*. New York: Bonanza Books.

Greene, Albert R.
1894 In the Ranks Under General Lyon in Missouri – 1861: The Observations of Private Soldier. *Blue and Gray* 4:142-147 and 574-591.

Gremaud, Greg
1986 Wilson's Creek National Battlefield, A Plan for the Restoration of the Historic Vegetation. Missouri Department of Conservation, Jefferson City, MO.

Harris, C. E.
1980 Sherlock Holmes Would Be Impressed. *American Rifleman* 128(5):36-39,82.

Hatcher, Julian, Frank J. Jury, and Jac Weller
1977 *Firearms Investigation, Identification and Evidence*. Stackpole Books, Harrisburg, PA.

Hatcher, Richard W. and William Garrett Piston
1993 Kansans at Wilson's Creek. Studies of the Civil War in the Trans-Mississippi West No. 3. Wilson's Creek National Battlefield Foundation, Springfield, MO.

Hayes, David Dixon
1999 Assessment of Damage to the Archeological Resources at the Ray House, Wilson's Creek National Battlefield, Republic, Missouri. Buffalo National River, Harrison, AR.

Hazelwood, Laura
1999 Legislative History of the 1960 Enabling Act of Wilson's Creek National Battlefield and the Amending Act of 1970. Wilson's Creek National Battlefield, Republic, Missouri.

Hensley, Tom
1982 Trip Report, Wilson's Creek November 8-9. On file Midwest Archeological Center, Lincoln, Nebraska.

Henzie, David C. and Karen Farnham
1997 *The Battle of Carthage, Border War in Southwest Missouri, July 5, 1861*. Savas Publishing, Campbell, CA.

Hughes, Harold
1980 *Soil Survey of Greene and Lawrence Counties, Missouri.* U.S. Department of Agriculture, Soil Conservation Service, Jefferson City, Missouri.

Hunt, William J., Jr.
1989 Firearms and the Upper Missouri Fur Trade Frontier: Weapons and Related Materials from Fort Union Trading Post National Historic Site (23WI17), North Dakota. Ph.D. dissertation, Department of American Civilization, University of Pennsylvania.

James. J. W.
1916 Battle of Oak Hills. *Confederate Veteran* 24(2):972.

Jones, Charles H.
2001 *Artillery Fuses of the Civil War*. O'Donnell Publications, Alexandria, VA.

Knapp, George E.
1993 *The Wilson's Creek Staff Ride and Battlefield Tour*. Combat Studies Institute, U.S. Army Command and General Staff College, Fort Leavenworth, KS.

Knox, Thomas W.
1865 *Camp-Fire and Cotton-Field: Southern Adventure in Time of War. Life with the Union Armies and Residence on a Louisiana Plantation*. Berlock, New York, NY.

Lees, William B.
1998 Archaeology of the Mine Creek Civil War Battlefield, Linn County, Kansas. Ms on file, Office of the State Archeologist, Kansas State Historical Society, Topeka, KS.

Lindberg, Kip A.
1995 "The Semblance of a Weapon": Arms and Equipment of the Missouri State Guard. Appendix C in Sterling Price's Lieutenants: A Guide to the Officers and Organization of the Missouri State Guard, 1861-1865 by Richard C. Peterson, James E. McGhee, Kip A. Lindberg, and Keith I. Daleen, pp. 308-312. Privately published by the authors, Jefferson City, MO.

nd Uniform and Equipment Descriptions of Units at Wilson's Creek. Manuscript on file, John K. and Ruth Hulston Library, Wilson's Creek National Battlefield, Republic, MO.

Lynott, Mark J.
1982 23GR250: An Early-Middle Archaic Site at Wilson's Creek National Battlefield. *Missouri Archaeological Society Newsletter,* Number 357 and 358.

Lynott, Mark, S.M. Monk, J.J. Richner, and T.R. Chevance
1980 Archeological Survey and Testing at Wilson's Creek National Battlefield Tour Road Alter-natives A, B, and C. Report on file, National Park Service, Midwest Archeological Center, Lincoln.

Marcot, Roy M.
1983 *Spencer Repeating Firearms*. Northwood Heritage Press, Irvine, CA.

Marmor, Jason
1997 Prelude to Westport: Phase I Archaeological Survey of a Portion of the Big Blue Battlefield in Kansas City, Jackson County, Missouri and Addendum, Archaeological Data Recovery Investigations of a Portion of the Big Blue Battlefield in Kansas City, Jackson County, Missouri. TRC Mariah Associates, Laramie, WY.

Marshall, S. L. A.
1978 *Men Against Fire*. Peter Smith, Gloucester, MA.

McAulay, John D.
1996 *Carbines of the U.S. Cavalry, 1861-1905*. Andrew Mowbray Publishers, Lincoln, RI.

McKee, W. Reid and M. E. Mason Jr.
1980 *Civil War Projectiles II Small Arms and Field Artillery*. Moss Publications, Orange, VA.

Melcher, Samuel
1985 *An Account of the Battle of Wilson's Creek*. Reprint, Greene County Historical Society, Springfield, MO.

McMillan, R. Bruce
1976 The Dynamics of Cultural and Environmental Change at Rodgers Shelter, Missouri. In *Prehistoric Man and His Environments*, edited by W.R. Wood and R.B. McMillan, pp. 211-234. Academic Press, New York.

Melton, Jack W., Jr. and Lawrence E. Pawl
1994 *Introduction to Field Artillery Ordnance, 1861-1865*. Kennesaw Mountain Press, Kennesaw, Georgia.

Midwest Archeological Center
1999 Midwest Region, Systemwide Archeological Inventory Program Plan. Midwest Archeological Center, Lincoln.

Mills, Roger
1979 The Fight at Wilson's Creek. *Civil War Times Illustrated* 17(9):46-47.

Monk, Susan M.
1983 A Preliminary Report on Survey Reconnaissance and Evaluation of the Phase II Section of the Proposed Tour Road Right-of-Way at Wilson's Creek National Battlefield. MS on file.

1985a Archeological Survey and Testing of the Proposed Tour Road, Wilson's Creek National Monument, Missouri. USDI, NPS, MWAC, *Occasional Studies in Anthropology*. 11.

1985b Archeological Testing at the Ray House: Wilson's Creek National Monument, Missouri. USDI, NPS, MWAC, *Occasional Studies in Anthropology.* 10.

1990 Archeological Excavations at Eight Sites in Wilson's Creek National Battlefield USDI, NPS, MWAC. microfiche; Government Document on file.

Mudd, Joseph A.
1914 What I Saw at Wilson's Creek. Missouri Historical Review 8:89-105.

1992 *With Porter in North Missouri*. Camp Pope Bookshop, Iowa City, IA (reprint of 1909 edition).

National Park Service
1976 Draft Environmental Statement, Master Plan Wilson's Creek National Battlefield, Missouri. United States Department of the Interior, National Park Service, Midwest Region, Lincoln, Nebraska.

Noe, David, Larry W. Yantz, and James B. Whisker
1999 *Firearms from Europe*. Rowe Publications, Rochester, NY.

Oates, Stephen B.
1961 *Confederate Cavalry West of the River*. University of Texas Press, Austin.

Obrien, Michael J. and W. Raymond Wood
1998 The Prehistory of Missouri. University of Missouri Press, Columbia.

Oculus
2000 Draft Cultural Landscape Report, Wilson's Creek National Battlefield, Republic Missouri. Charlottesville, VA.

Parmalee, Paul W.
1965 The Food Economy of Archaic and Woodland Peoples at Tick Creek Cave site, Missouri. *The Missouri Archeologist* 27:1-34.

Patrick, Jeffery L.
1997 Remembering the Missouri Campaign of 1861: The Memoirs of Lieutenant William P. Barlow, Guibor's Battery, Missouri State Guard. *Civil War Regiments* 5(4):20-60.

Pearce, N. B.
1956 Arkansas Troops in the Battle of Wilson's Creek. *Battles and Leaders of the Civil War, Volume 1* pp. 298-303. Thomas Yoseloff, New York, NY (reprint edition).

Pflieger, William L.
1975 *The Fishes of Missouri*. Department of Conservation, Jefferson city, Missouri.

Piston, William Garrett and Richard W. Hatcher III
2000 *Wilson's Creek: The Second Battle of the Civil War and the Men Who Fought It*. University of North Carolina Press, Chapell Hill, NC.

Piston, William Garrett and Thomas P. Sweeney
1999 "Don't Yield An Inch!" The Story of the Missouri State Guard. *North & South* 2(5):10-25.

Rafferty, Milton Dale
1970 Persistence Versus Change in Land Use and Landscape in the Springfield, Missouri Vicinity of the Ozarks. Unpublished Ph.D. dissertation, Department of Geography, University of Nebraska-Lincoln.

Rankin, John
Nd Copy of letter to A. R. Greene on file John K. and Ruth Hulston Library, Wilson's Creek National Battlefield, Republic, MO.

Ray, Jack H.
1999 An Intensive Cultural Resources Survey for Proposed Improvements of Republic Wastewater Facilities, Greene County, Missouri, Project CAR-1087. Center of Archaeological Research, Southwest Missouri State University, Springfield.

Ray, Jack H. and Susan M. Monk
1984 Archeological Survey of Tree Removal Zones, Wilson's Creek National Battlefield. Occasional Studies in Anthropology Number 15, Midwest Archeological Center, National Park Service, Lincoln, NE.

Ray, Jack H., Betty Jane Turner, and David W. Benn
1984 An Intensive Cultural Resources Survey of the Battlefield Suburban Development Zone, Greene County, Missouri: 1984, Project CAR-582. Center for Archaeological Research, Southwest Missouri State University, Springfield.

Reilly, Robert M.
1990 *American Socket Bayonets and Scabbards*. Andrew Mowbray, Lincoln, RI.

Rentschler, Thomas B.
2003 *Rifles and Blades of the German-American Militia and the Civil War*. Blue Hills Press, Hamilton, OH.

Riling, Ray
1953 *The Powder Flask Book*. Bonanza Books, New York.

Rose, Victor A.
1960 *Ross' Texas Brigade*. Centennial Book, Kennesaw, GA.

Sauer, Carl O.
1920 *Geography of the Ozark Highland of Missouri*. University of Chicago Press, Chicago.

Sayler, Rodney D., Robert W. Seabloom, and Stanley A. Ahler
1989 Impacts of Prescribed Burning on Archeological and Biological Resources of the Knife River Indian Villages NHS. University of North Dakota, Grand Forks.

Schaffer, James B., Lee A. Rutledge, and R. Stephen Dorsey
1992 *Gun Tools Their History and Identification*. Collector's Library, Eugene, OR.

Schmidt, Peter A.
1996 *Hall's Military Breechloaders*. Andrew Mobray Publisher, Lincoln, RI.

Schwartz, C.W., and E.R. Schwartz
1981 *The Wild Mammals of Missouri. Revised Edition*. University of Missouri Press and Missouri Department of Conservation, Columbia, Missouri.

Scott, Douglas D.
2000a Pea Ridge National Military Park and Wilson's Creek National Battlefield Historic Battlefield Archeological Research Design and Project Goals. On file, Midwest Archeological Center, National Park Service, Lincoln, NE.

2000b Archeological Overview and Assessment for Wilson's Creek National Battlefield, Greene and Christian Counties, Missouri. Midwest Archeological Center Technical Report No. 66, Midwest Archeological Center, National Park Service, Lincoln, NE.

2003 Archeological Mapping of the Manley and Edgar Cemeteries, Wilson's Creek National Battlefield, Missouri. MS on file Midwest Archeological Center, National Park Service, Lincoln, NE.

Scott, Douglas D. and Richard A. Fox Jr.
1987 *Archaeological Insights into the Custer Battle*. University of Oklahoma Press, Norman.

Scott, Douglas D., Richard A. Fox Jr., Melissa A. Connor, and Dick Harmon
1989 *Archaeological Perspectives on the Battle of the Little Bighorn*. University of Oklahoma Press, Norman.

Scott, H. L.
1864 *Military Dictionary*. D. Van Nostrand, New York.

Secretary of War
1853 Chief of Ordnance Report, Executive Document, Messages from the President of the United States to the Two Houses of Congress, 1st Session, 33rd Congress, 1853-1854, Vol. 1, Part III. Government Printing Office, Washington, DC.

1855 Chief of Ordnance Report, House of Representatives Executive Documents, 2nd Session, 33rd Congress 1854-1855, Vol. 1 Part 2 Government Printing Office, Washington, DC.

1856 Chief of Ordnance Report, Senate Executive Documents, 1st Session, 34th Congress 1855-1856, No. 841 Government Printing Office, Washington, DC.

1857 Chief of Ordnance Report, Senate Executive Documents, 3rd Session, 34th Congress 1856-1857, No. 894, Vol. 2, Government Printing Office, Washington, DC.

1859 Chief of Ordnance Report, Senate Executive Documents, 2nd Session, 35th Congress 1858-1859, No. 976 Government Printing Office, Washington, DC.

1860 Chief of Ordnance Report, Senate Executive Documents, 1st Session, 36th Congress 1859-1860, Vol. 3 Government Printing Office, Washington, DC.

1861 Chief of Ordnance Report, Senate Executive Documents, 2nd Session, 36th Congress 1860-1861, No. 1079, Vol. 2 Government Printing Office, Washington, DC.

Shelton, Alonzo
1974 *Memoir of a Confederate Veteran*. Clay Platte Chapter, United Daughters of the Confederacy, Kansas City, MO.

Sigel, Franz
1956 The Flanking Column at Wilson's Creek. *Battles and Leaders of the Civil War, Volume 1* pp. 304-306. Thomas Yoseloff, New York, NY (reprint edition).

Snead, Thomas L.
1886 *The Fight for Missouri*. Charles Scribner's Sons, New York.

1956 The First Year of the War in Missouri. *Battles and Leaders of the Civil War, Volume 1* pp. 262-277. Thomas Yoseloff, New York, NY (reprint edition).

Steyermark, J.A.
1959 *Vegetational History of the Ozark Forest.* University of Missouri Studies No. 31.

St. Louis: Western Historical Company
1883 *History of Greene County*. Nixon-Jones Printing Company, St. Louis.

Sudderth, W. E.
1992 The 1983 Archeological Excavations at the Ray House, Wilson's Creek National Battlefield, Missouri. USDI, NPS, *Midwest Archeological Center Technical Report*. 15.

Thomas, Dean S.
1997 Round *Ball to Rimfire: A History of Civil War Small Arms Ammunition, Part One*. Thomas Publications, Gettysburg, PA.

2002 *Round Ball to Rimfire: A History of Civil War Small Arms Ammunition, Part Two, Federal Breechloading Carbines and Rifles*. Thomas Publications, Gettysburg, PA.

2003 *Round Ball to Rimfire: A History of Civil War Small Arms Ammunition, Part Three, Federal Pistols, Revolvers, and Miscellaneous Essays*. Thomas Publications, Gettysburg, PA.

Tice, Warren K.
1997 Uniform Buttons of the United States, 1776-1865. Thomas Publications, Gettysburg, PA.

Tunnard, W. H.
1866 *A Southern Record of the History of the Third Regiment of Louisiana Infantry*. Baton Rouge, reprint 1970, Morningside Bookshop, Dayton, OH.

U.S. Department of Agriculture
1979 Soil Survey of Greene and Lawrence Counties, Missouri. Jefferson City, Missouri.

Vickers, George M. (editor)
1896 In the Ranks Under General Lyon in Missouri, 1861: The Observations of a Private Soldier, In *Under Both Flags, A Panorama of the Great Civil War*, pp 574-591. W. S. Reeve Publishing, Chicago, IL.

Ware, Eugene F.
1907 *The Lyon Campaign, History of the First Iowa Infantry*. Crane and Company, Topeka, KS.

Watson, William
1888 *Life in the Confederate Army: Being the Observations and Experiences of an Alien in the South during the American Civil War*. Scribner and Welford, .

Webb, John
1901 A Participant of the Battle of Wilson's Creek. *Steelville Democrat*, October 3.

Weed, F. F.
1918 In the Battle of Carthage, MO. *Confederate Veteran* 26(9):392.

Wettstaed, James R.
2003 Perspectives on the Early-Nineteenth Century Frontier Occupations of the Missouri Ozarks. *Historical Archaeology* 37(4):97-114.

Wherry, William M.
1956 Wilson's Creek, and the Death of Lyon. *Battles and Leaders of the Civil War, Volume 1* pp. 289-297. Thomas Yoseloff, New York, NY (reprint edition).

Whitehorne, Joseph W.
In press Blueprint for 19th Century Camps: Castramentation, 1778-1865. In Huts and History: The Historical Archaeology of Military Encampment During the American Civil War, edited by Clarence Geier, David Orr, and Matthew Reeves. University Press of Florida, Gainesville.

Willey, P., Paulette Leach, and Deanna Grimstead
1999 Analysis of Human Bones Attributed to the Civil War Battle of Wilson's Creek: The Kerr-Glidwell and Manion's Auction Collections. Report on file Midwest Archeological Center, Lincoln, NE.

TABLES

Table 1. List of archeological sites recorded or known at Wilson's Creek National Battlefield.

Site No.	Site Name	Time Period	Site Type
23CN76	Sharp House	Historic	Farm house/complex
23CN77		Prehistoric	Lithic scatter
23CN78		Prehistoric	Lithic scatter
23CN79		Prehistoric	Lithic scatter
23CN80		Prehistoric	Rockshelter/lithic scatter
23CN81		Prehistoric	Lithic scatter
23CN700		Prehistoric	Lithic scatter
23CN702		Prehistoric	Lithic scatter
23GR227	Gibson Mill Dam 1	Historic	Dam
23GR228	Short House	Historic	Farm house/complex
23GR230	Gibson House	Historic	Farm house/complex
23GR231	Gibson Mill Dam 2	Historic	Dam
23GR232	Gibson Mill	Historic	Mill
23GR233	Ray House	Historic	Farm house/complex
23GR234	Sinkhole	Historic	Civil War burial locale
23GR235	Gwinn House	Historic	Farm house/complex
23GR236	Winn House	Historic	Farm house/complex
23GR237	Edwards Cabin	Historic	Farm house/complex
23GR238	Manley Cabin	Historic	Farm house/complex
23GR239	Manley Cemetery	Historic	Cemetery
23GR240	Burial Well	Historic	Civil War burial locale
23GR241		Historic	Rock art locale
23GR242	Lyon Memorial	Historic	General Lyon memorial marker
23GR243	Wilson's Creek Town	Historic	Town site
23GR244		Prehistoric	Lithic scatter
23GR245		Prehistoric	Lithic scatter

Table 1. Concluded.

Site No.	Site Name	Time Period	Site Type
23GR246		Prehistoric	Lithic scatter
23GR247		Prehistoric	Lithic scatter
23GR248		Prehistoric	Rockshelter/lithic scatter
23GR249	Short Site	Prehistoric	Lithic scatter
23GR250	Short Spring Site	Prehistoric	Lithic scatter and midden
23GR251	Gibson House Site	Prehistoric	Lithic scatter
23GR252	Gibson Mill Site	Prehistoric	Lithic scatter
23GR253	Guinn House Site	Prehistoric	Lithic scatter
23GR254		Prehistoric	Lithic scatter
23GR255	Manley House	Historic	Farm house/complex
23GR256	Gibson Mill Headrace	Historic	Mill complex
23GR431		Prehistoric	Lithic scatter/Mid-Late Archaic
23GR629		Prehistoric	Lithic scatter
23GR630		Prehistoric	Lithic scatter/Late Archaic
23GR631		Prehistoric	Lithic scatter
23GR632		Prehistoric	Lithic scatter
23GR636		Prehistoric	Lithic scatter
23GR637	Manley Mill Dam	Historic	Dam circa 1938
23GR638		Prehistoric	Lithic scatter
23GR639	Manley Quarry	Historic	Rock quarry
23GR640	Sinkhole/Natural Trap	Prehistoric	Natural sinkhole with fauna
23GR680	Short/McKeel Site	Historic	Farm house/complex
Not assigned	Wire Road	Historic	Historic road and telegraph line
Not assigned	Wilson's Creek Battlefield	Historic	Civil War battle site

Table 2. Order of Battle for Wilson's Creek (after Piston and Hatcher 2000334-338)

THE WESTERN ARMY – Southern Forces
Brigadier General Ben McCulloch, commanding
Reiff's Arkansas Cavalry Company [McCulloch's bodyguard] (Captain V. A. Reiff)

McCulloch's Confederate Brigade
Brigadier General Ben McCulloch, commanding
Colonel lames M. McIntosh, de facto commander
McRae's Arkansas Infantry (Colonel Dandridge McRae)
Third Louisiana Infantry (Colonel Louis Hebert)
South Kansas-Texas Cavalry (Colonel Elkanah Greer)
First Arkansas Mounted Riflemen (Colonel Thomas J. Churchill)
Second Arkansas Mounted Riflemen (Colonel James M. McIntosh)

Brigade Total: Strength = 2,720; Killed = 68; Wounded = 276; Total = 344

Arkansas State Troops
Brigadier General Nicholas Bartlett Pearce, commanding
Third Infantry (Colonel John R. Gratiot)
Fourth Infantry (Colonel Jonathan D. Walker)
Fifth Infantry (Colonel Tom P. Dockery)
Carroll's Cavalry (Captain Charles A. Carroll)
First Cavalry (Colonel DeRosey Carroll)
Fort Smith Light Battery, 4 guns (Captain John G. Reid)
Pulaski Light Battery, 4 guns (Captain William E. Woodruff Jr.)

Brigade Total: Strength = 2,234; Killed = 36; Wounded = 118; T = 154

Missouri State Guard
Major General Sterling Price, commanding
THIRD DIVISION (Brigadier General John B. Clark Sr.)
Burbridge's Infantry (Colonel John Q. Burbridge)
Major's Cavalry (Lieutenant Colonel James P. Major)

FOURTH DIVISION (Brigadier General William Y. Slack)
Hughes's Infantry (Colonel John T. Hughes)
Rives's Cavalry (Colonel Benjamin A. Rives)

SIXTH DIVISION (Brigadier General Mosby Monroe Parsons)
Kelly's Infantry (Colonel Joseph M. Kelly)
Brown's Cavalry (Colonel William B. Brown)
Missouri Light Artillery, 4 guns (Captain Henry Guibor)

SEVENTH DIVISION (Brigadier General James H. McBride)
Wingo's Infantry (Colonel Edmond T. Wingo)
Foster's Infantry (Colonel John A. Foster)
Campbell's Cavalry (Captain [Leonidas S.:'] Campbell)

EIGHTH DIVISION (Brigadier General James S. Rains)
Weightman's Infantry (Colonel Richard H. Weightman)
Cawthorn's Cavalry (Colonel James Cawthorn)
Missouri Light Artillery, 3 guns (Captain Hiram Bledsoe)

Table 2. Continued.

Missouri State Guard Totals:
Strength = 7,171 (includes an estimated 2,000 unarmed); Killed = 175; Wounded = 551; Total = 724

Western Army Totals:
Strength = 12,125 (including an estimated 2000 unarmed MSG); Killed = 277; Wounded 945; Total = 1222

ARMY OF THE WEST, Union Forces
Brigadier General Nathaniel Lyon, commanding
Lyon's Bodyguard (commander unknown)
Voerster's Pioneer Company (Captain John D. Voester)

FIRST BRIGADE (Major Samuel D. Sturgis)
Battalion of Regulars (Captain Joseph B. Plummmer)
Companies B, C. and D. First U.S. Infantry,
Lt. H. C. Wood's company of recruits
Second Missouri Infantry (Major Peter J. Osterhaus)
Kansas Rangers, mounted Company I, Second 1 Wood)
Company D, First U.S. Cavalry (Lt. Charles W. Canfield)
Company F, Second U.S. Artillery, 6 guns (Capt James Totten)

Brigade Totals:
Strength = 884; Killed = 34; Wounded = 107; Missing = 12; Total = 153

SECOND BRIGADE (Colonel Franz Sigel)
Third Missouri Infantry (Lt Col. Anslem Albert)
Fifth Missouri (Col. Charles E. Salomon)
Company I, First U.S. Cavalry (Capt Eugene Carr)
Company C, Second U.S. Dragoons (Lt. Charles E. Farrand)
Backof's Missouri Light Battery, 6 guns (Lt. Franz Backof)

Brigade Totals:
Strength = 1,200; Killed = 35; Wounded = 132; Missing = 130; Total = 297

THIRD BRIGADE (Lieutenant Colonel George L. Andrews)
Battalion of Regulars (Captain Frederick Steele)
Companies B and E, Second U.S. Infantry, Lieutenant Warren Lothrop's company of recruits;
Sergeant John Morine's company of recruits
First Missouri Infantry (Lieutenant Colonel George L. Andrews)
Du Bois's Battery, 4 guns (Lieutenant John V. Du Bois)

Brigade Totals:
Strength = 1,116; Killed = 91; Wounded = 254; Missing = 14; Total = 359

FOURTH BRIGADE (Colonel George W. Deitzler)
First Iowa Infantry (Lieutenant Colonel William H. Merritt)
First Kansas Infantry (Colonel George W. Deitzler)
Second Kansas Infantry (Colonel Robert B. Mitchell)
[minus Captain Wood's Kansas Rangers]
Thirteenth Illinois battalion (Lieutenant James Beardsley)

Table 2. Concluded.

Brigade Totals:
Strength = 2,221; Killed = 94; Wounded = 384; Missing = 30; Total = 508

Army of the West Totals:
Strength =5,431; Killed = 2580; Wounded = 873; Missing = 186; Total = 1,317

Table 3. U.S. Firearms types reported by unit from Ordnance Returns as of 4th Quarter 1862.

Unit and Company	Firearm Type
1st Infantry	
Co. I	M1855 Rifled Muskets
1st Cavalry	
Co. D	no data
Co. I	no data
2nd Infantry	
Co. B	M1855 Rifled Muskets
Co. F	M1855 Rifled Muskets
Co. M	M1855 Rifled Muskets
2nd Dragoons	
Co. C	no data
2nd Artillery	
Co. F	no data
1st Iowa Infantry	
	no data
1st Kansas Infantry	
Co. A	M1841 rebored Rifled Musket
Co. B	M1841 rebored Rifled Musket
Co. C	M1841 rebored Rifled Musket
Co. D	M1841 rebored Rifled Musket
Co. E	M1841 rebored Rifled Musket
Co. F	M1841 rebored Rifled Musket
Co. G	Model 1842 Rifled Musket
Co. H	M1841 rebored Rifled Musket
Co. I	M1841 rebored Rifled Musket
2nd Kansas Infantry	
	no data
2nd Kansas Mounted Infantry	
Co. I	no data
1st Missouri Infantry	
Co. A	M1841 rebored Rifled Musket
Co. B	no data
Co. C	no data
Co. D	no data
Co. E	no data
Co. F	M1841 rebored Rifled Musket
Co. G	M1841 rebored Rifled Musket
Co. H	M1841 rebored Rifled Musket
Co. I	M1841 rebored Rifled Musket
Co. K	M1841 rebored Rifled Musket

Table 3. Concluded.

Unit and Company	Firearm Type
2nd Missouri Infantry	
Co. A	Enfield Rifled Musket
Co. B	no data
Co. C	no data
Co. D	no data
Co. E	no data
Co. F	Enfield Rifled Musket
Co. G	no data
Co. H	no data
Co. I	no data
Co. K	no data
3rd Missouri Infantry	
Co. A	no data
Co. B	M1842 Rifled Musket
Co. C	M1842 and 1855 Rifled Musket
Co. D	no data
Co. E	M1842 Rifled Musket
Co. F	no data
Co. G	M1842 Rifled Musket
Co. H	M1842 Rifled Musket
Co. I	no data
Co. K	no data
5th Missouri Infantry	
Co. A	no data
Co. B	no data
Co. C	no data
Co. D	no data
Co. E	no data
Co. F	M1855 Rifled Musket
Co. G	no data
Co. H	no data
Home Guards	no data
Backoff's Battery Artillery	no data
Du Bois Battery Artillery	no data

FIGURES

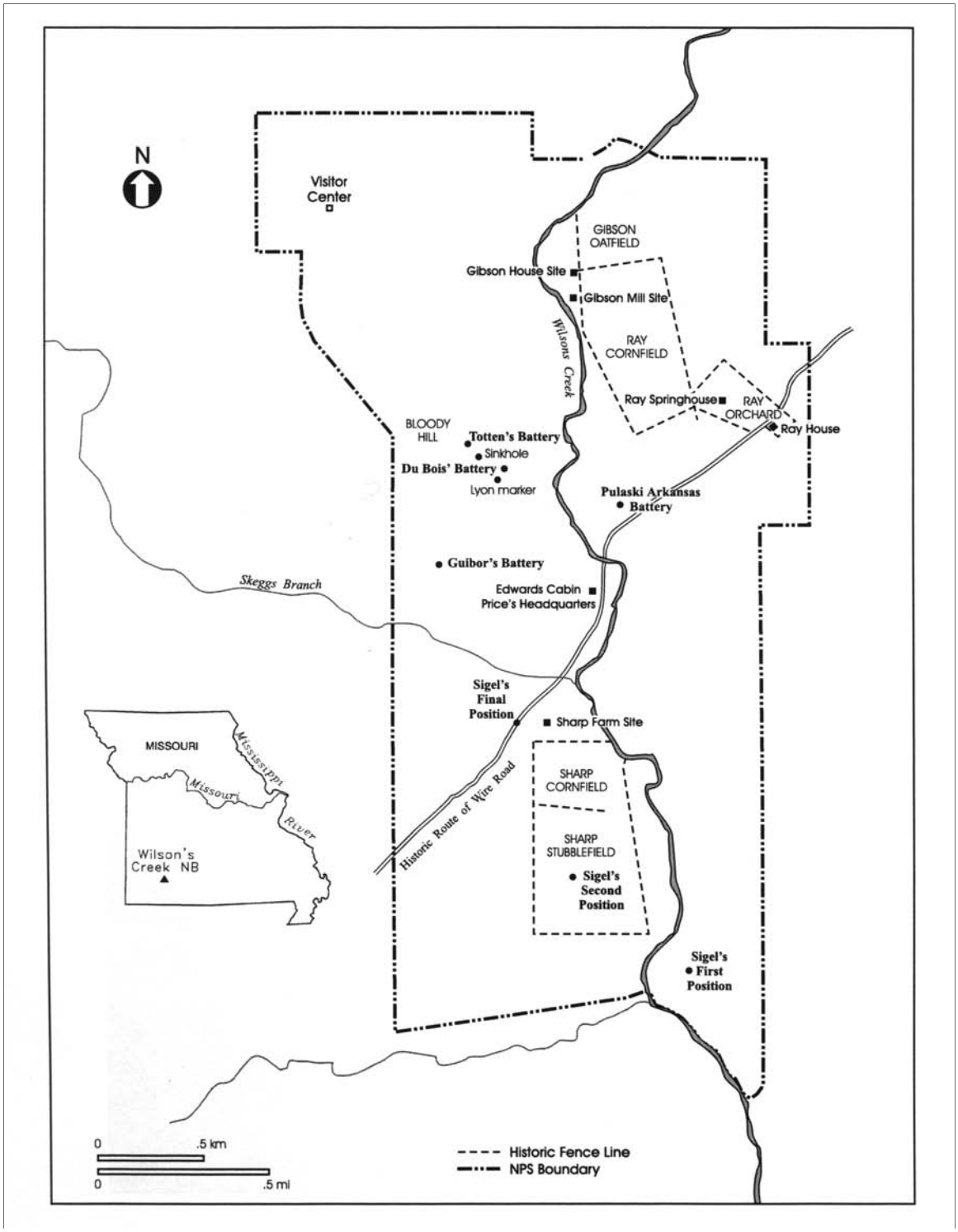

Figure 1. Location of Wilson's Creek National Battlefield and battlefield features within the park.

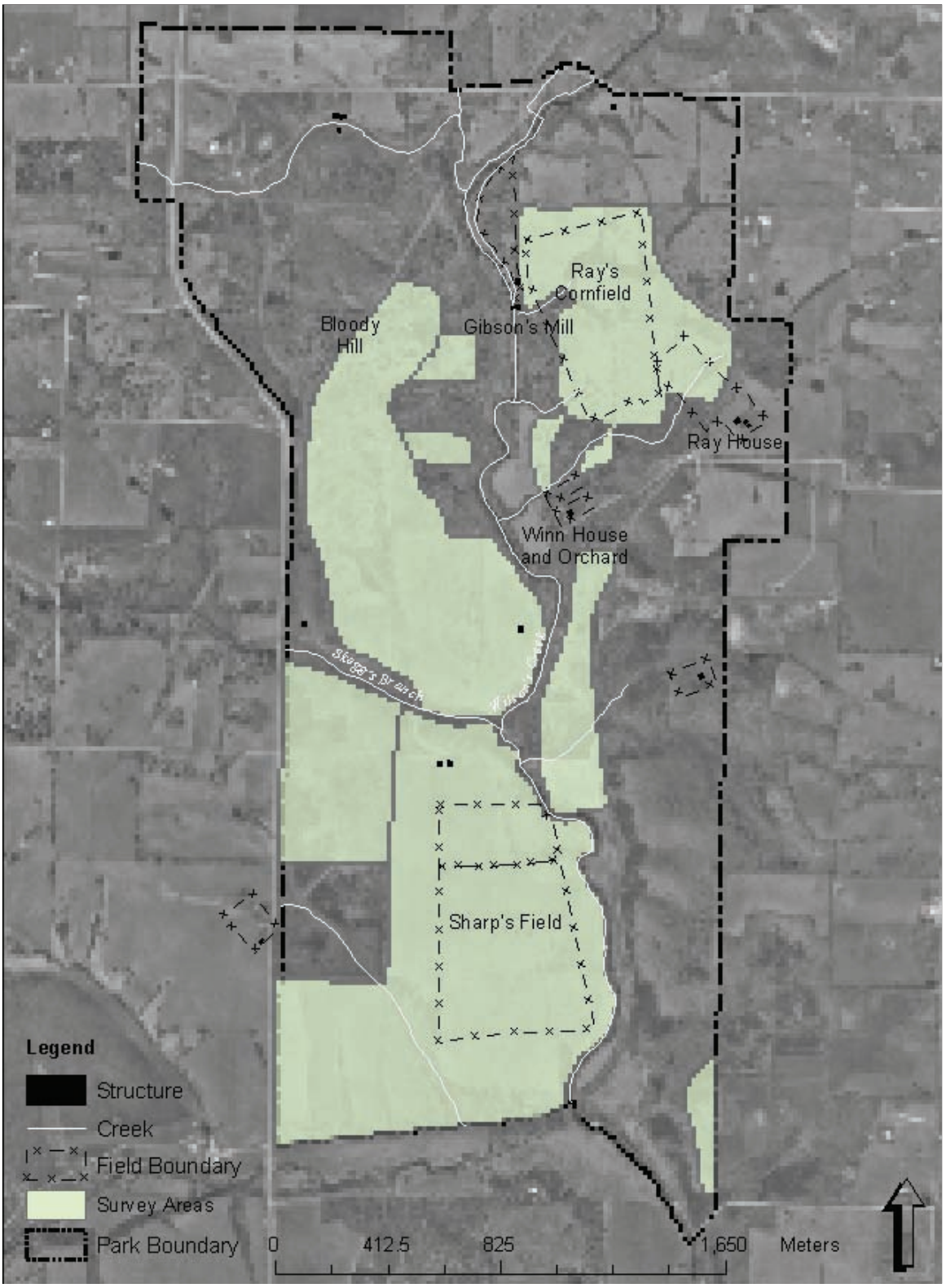

Figure 2. Areas metal detected during the 2000-2004 project shown as shaded zones.

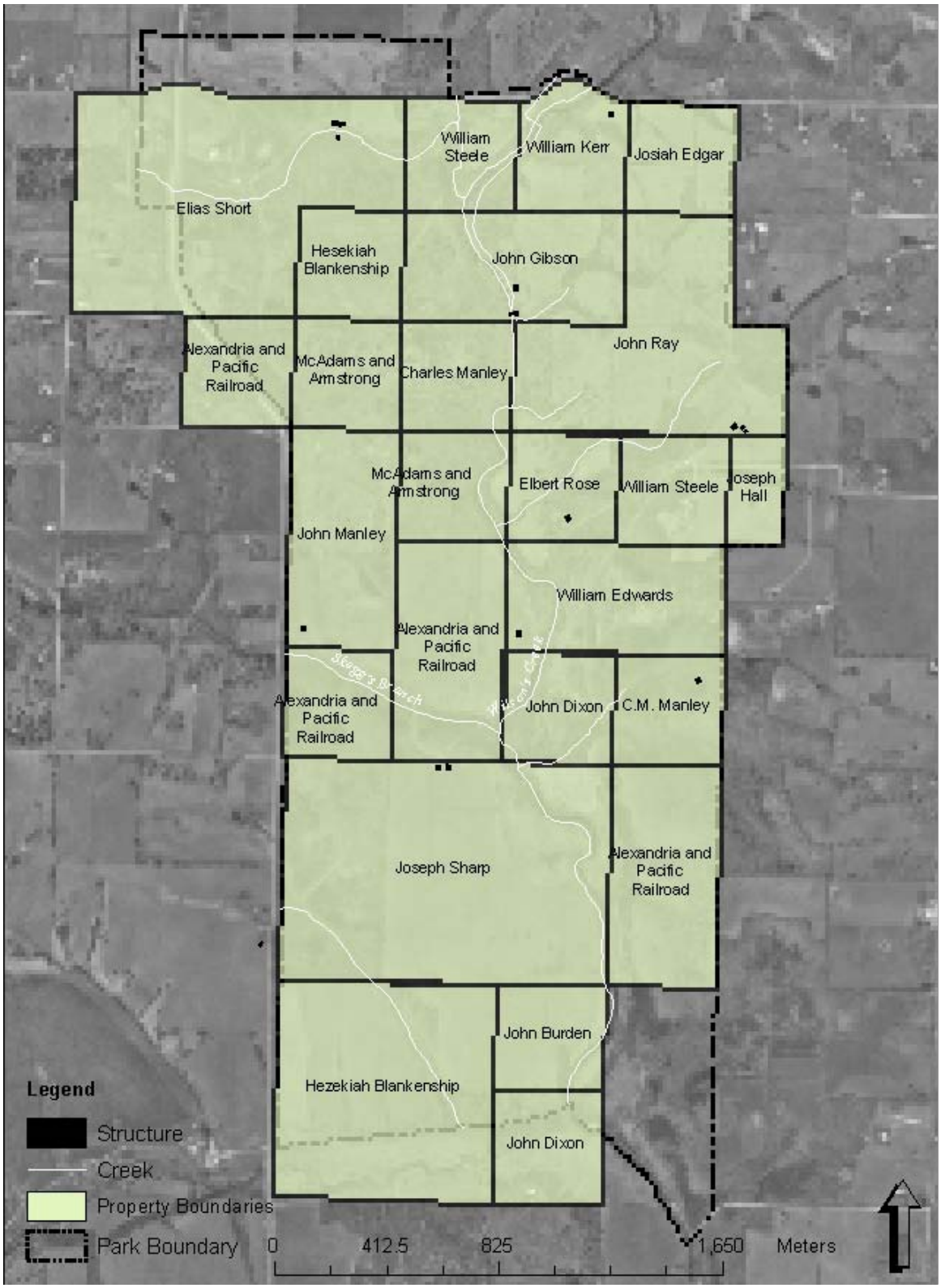

Figure 3. Land ownership status as of August 1861.

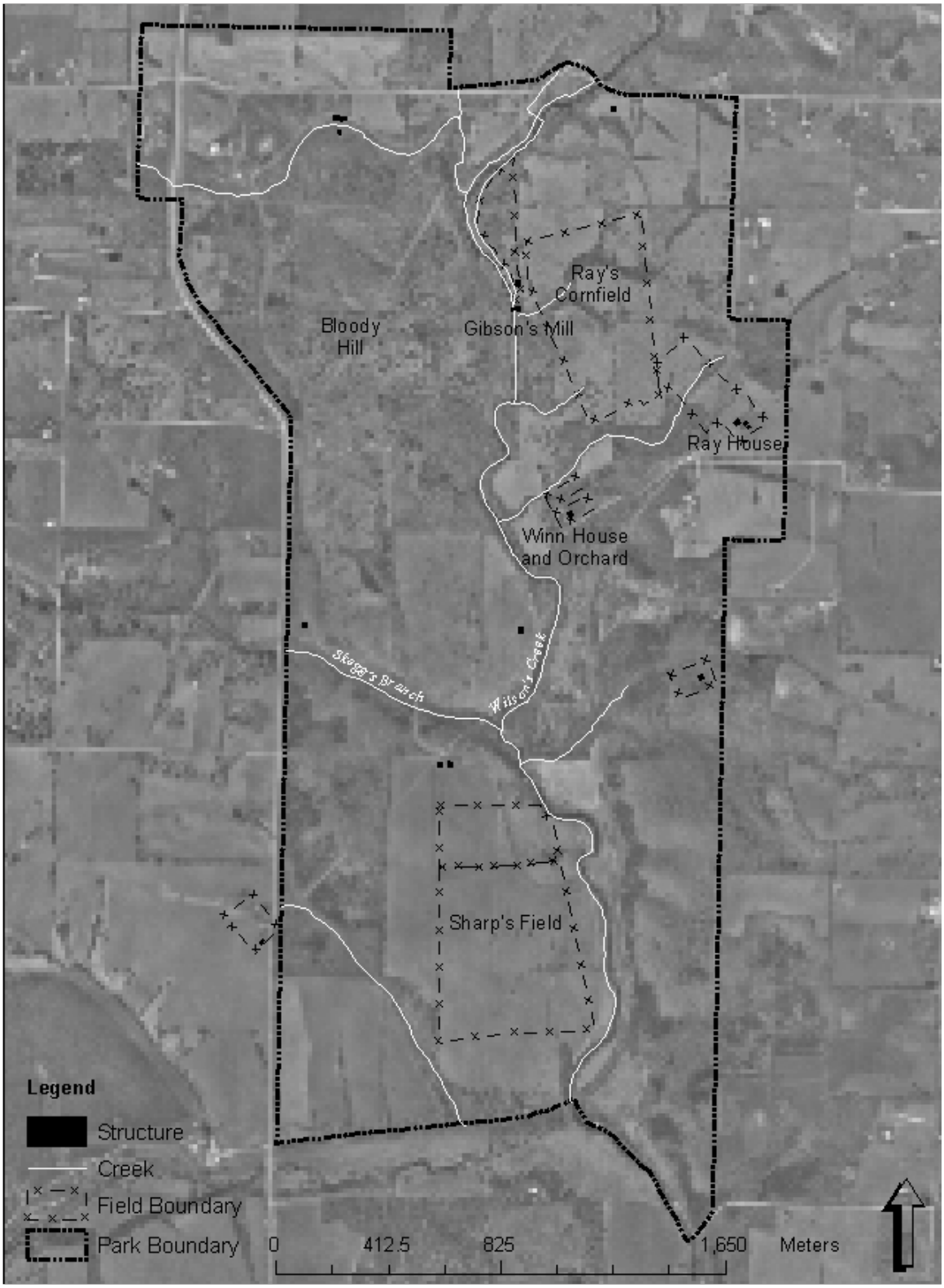

Figure 4. Known farmsteads and cultivated fields as of August 1861.

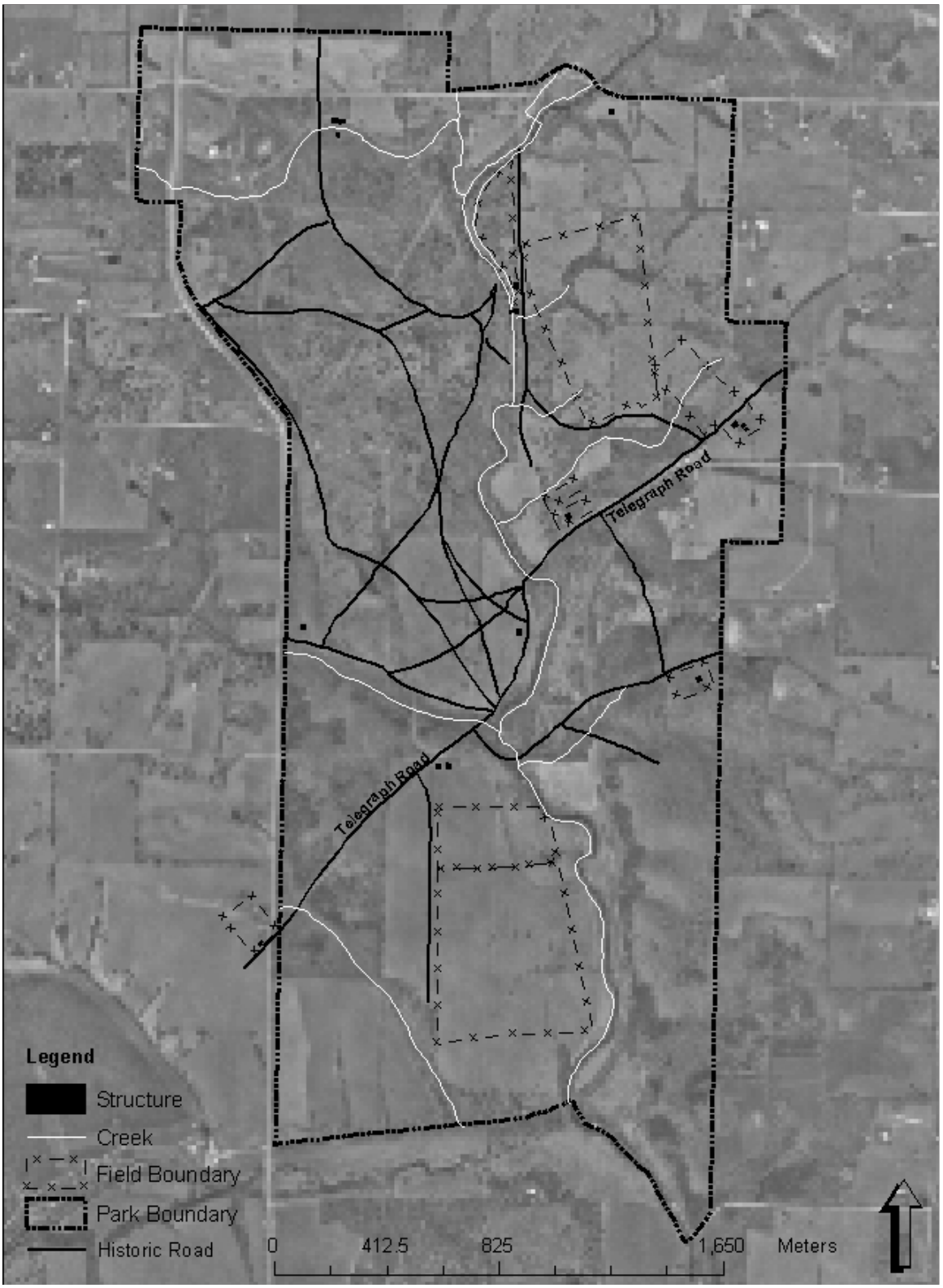

Figure 5. Roads and traces that crisscrossed Wilson's Creek at the time of the battle.

Figure 6. The Ray house is the only structure still standing from the Civil War era.

Figure 7. The metal detector team at work in the area of the Sharp farmstead.

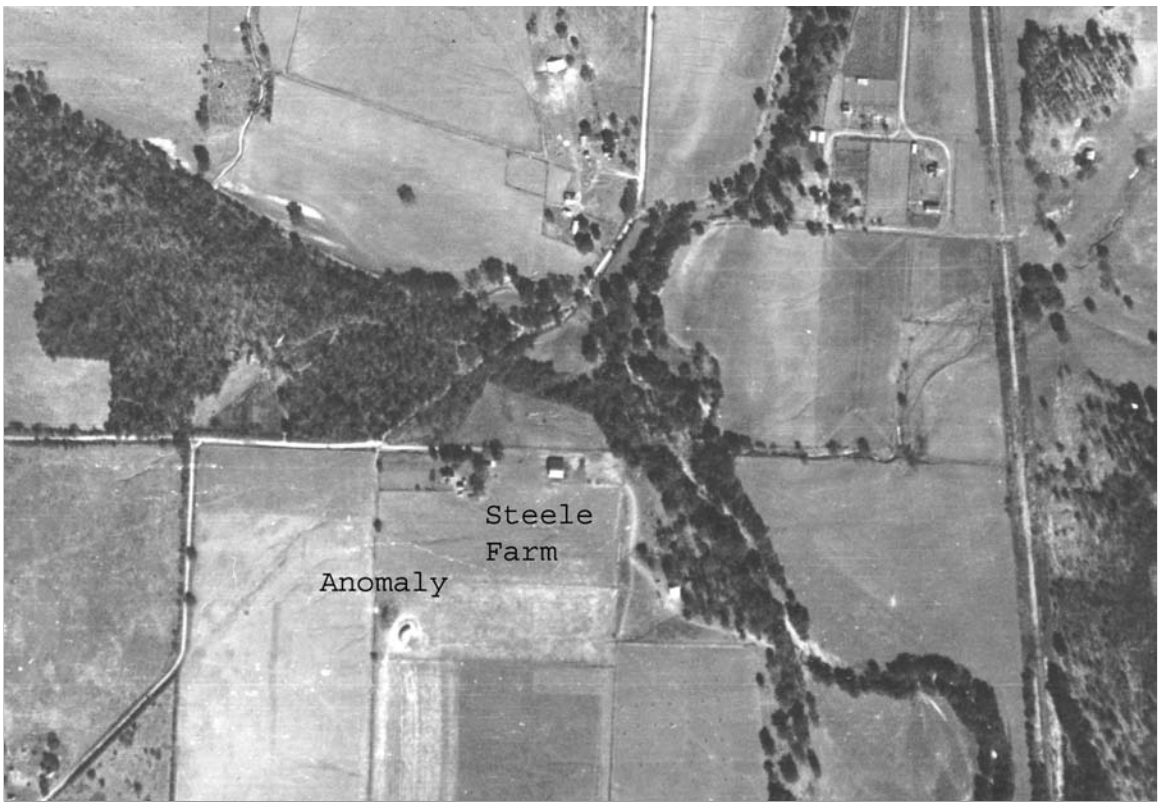

Figure 8. A 1936 aerial view of the Sharp/Steele farmstead area with the Steele farmyard and house and an anomaly that could be the site of the Sharp house noted.

Figure 9. The Edwards cabin site, the location of Gen. Price's headquarters, with a later cabin in the background.

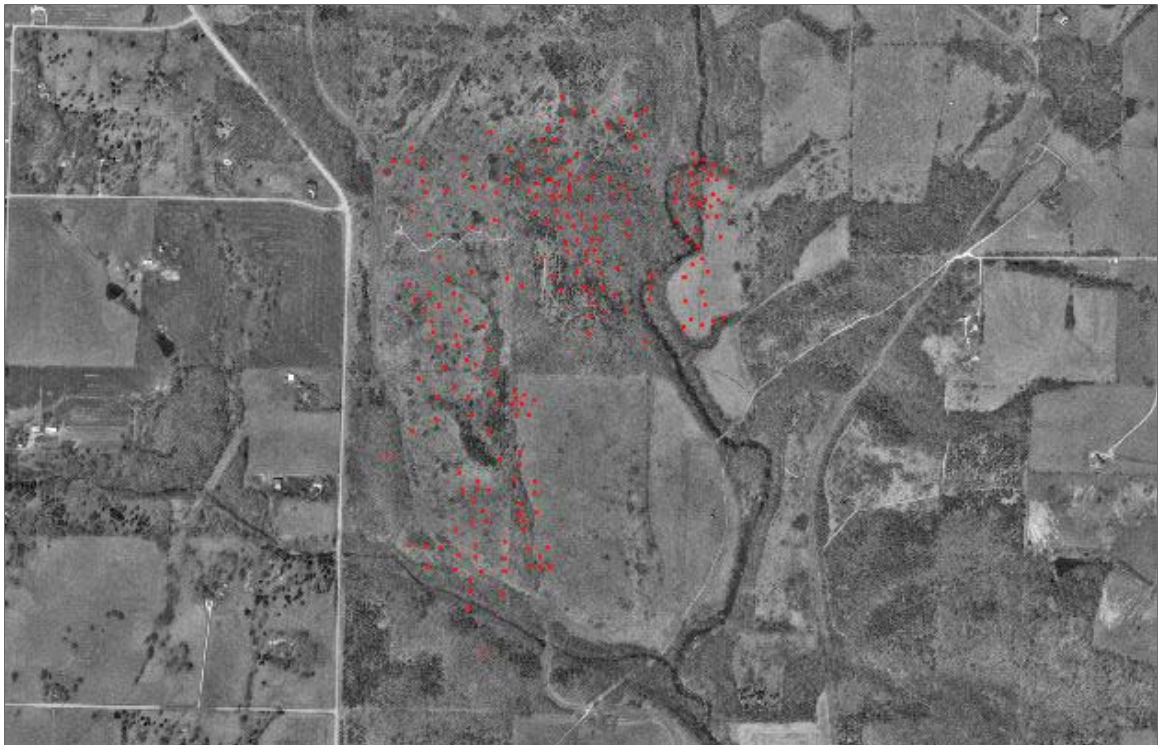

Figure 10. Darrell Trogdon's battlefield find locations relative Wilson's Creek landscape features.

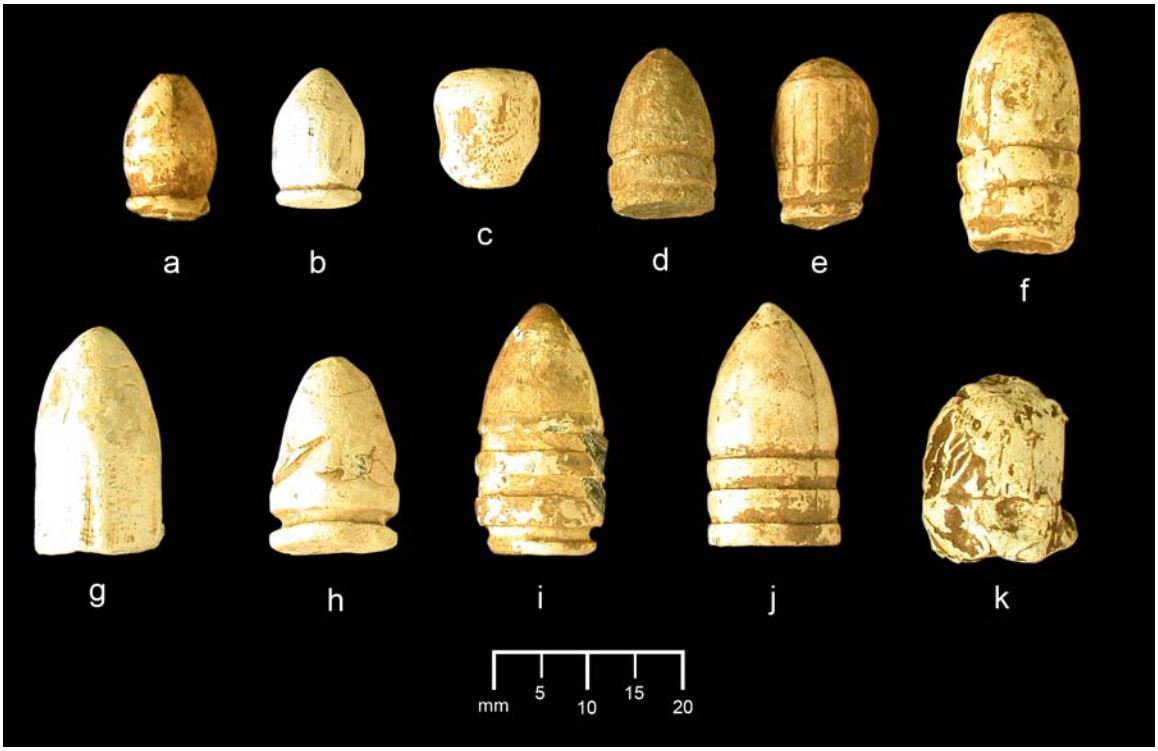

Figure 11. Various caliber bullets found during the archeological inventory. a., b. .36-caliber St. Louis Arsenal pistol bullets (FS2392, 2522), c. .40-caliber country rifle bullet (FS3015), d., e. .44-caliber bullets fired in Colt revolvers (FS3108, 3354), f. .50-caliber country rifle bullet (FS3303), g. .50-caliber Gallager carbine bullet (FS1234), h. .50-caliber Maynard carbine bullet (FS1011), i. .52-caliber Sharps bullet (FS3645), j., k. .54-caliber M1841 rifle bullets (FS3503, 2383).

Figure 12. .58-caliber Minie balls. a. unfired round (FS3490), b. fired round (FS3417), c. fired and impact damaged (FS3434), d. modified bullet with ramrod mark (FS3426), e., f. fired bullets with ramrod impressions from being loaded in a M1855 rifled musket (FS2789,2830).

Figure 13. A .58-caliber Minie ball with extreme ramrod marks and heavily engraved rifling marks from a M1855 rifled musket (FS2789).

Figure14. Close-up of a gun screw hole in a .58-caliber Minie ball. The bullet was pulled from the gun before firing (FS2469).

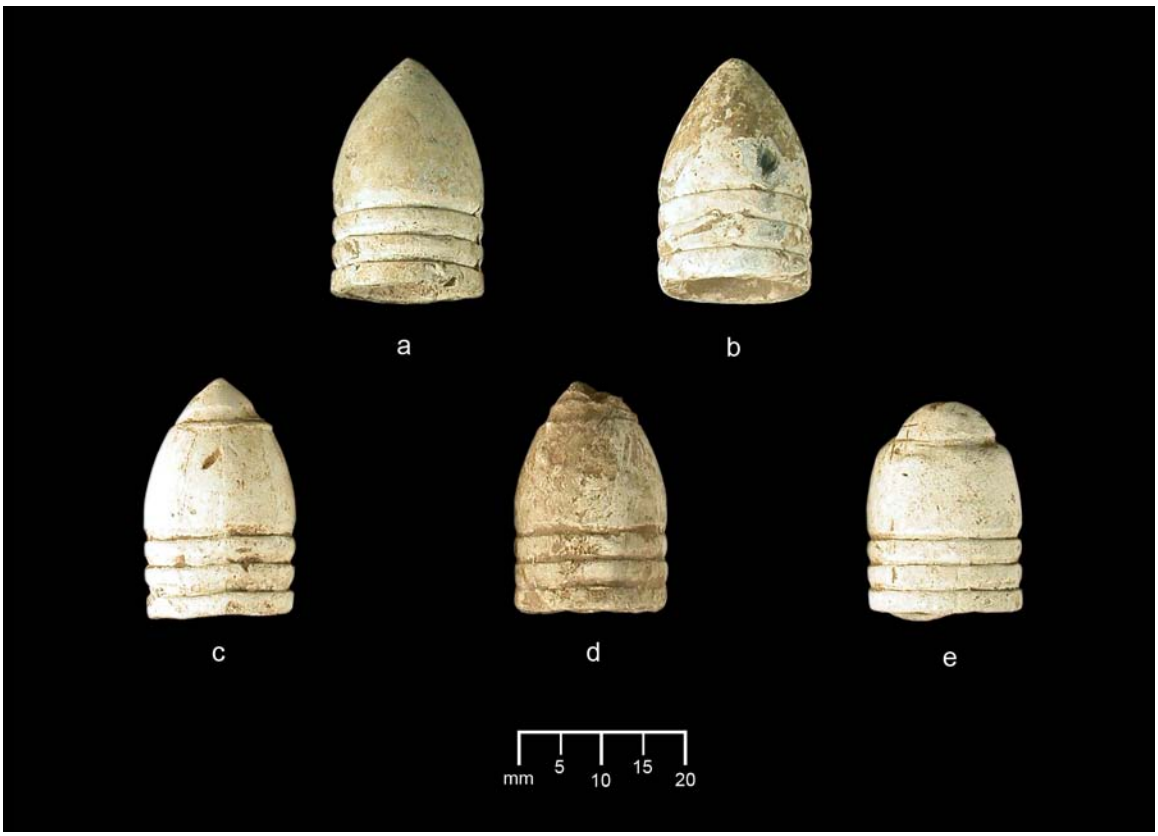

Figure 15. .69- and .71-caliber Minie balls. a. unfired (FS3126), b. .71-caliber Minie ball for a foreign import gun (FS2309), c., d., e. ramrod marks on .69-caliber balls indicating loading in M1842 rifled muskets (FS3007, 3051, 3016).

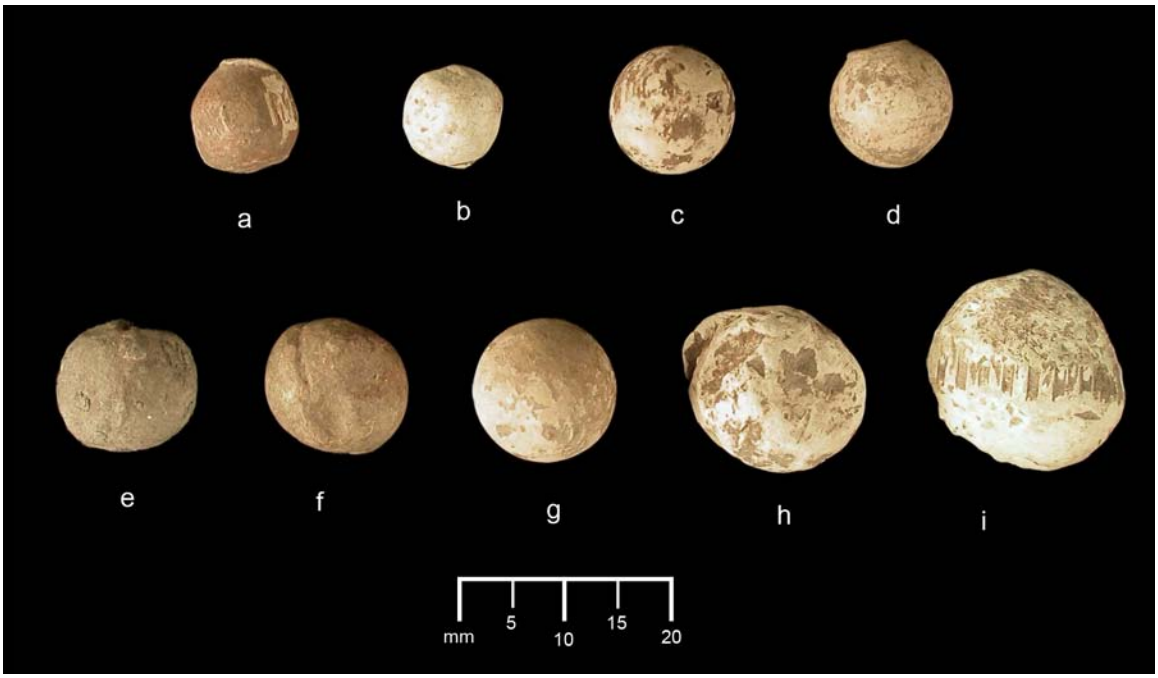

Figure 16. Miscellaneous spherical balls. a.,b. .36-caliber spherical balls for pistols (FS2468, 2548), c., d. .44-caliber pistol balls (FS2535, 2549), e., f. .50-caliber country rifle balls (FS3155, 3050), g., h. .54-caliber M1841 spherical ball (FS2549), i. .52-caliber spherical ball flattened by impact showing land and groove impressions of being fired in a M1819 Hall rifle (FS3225).

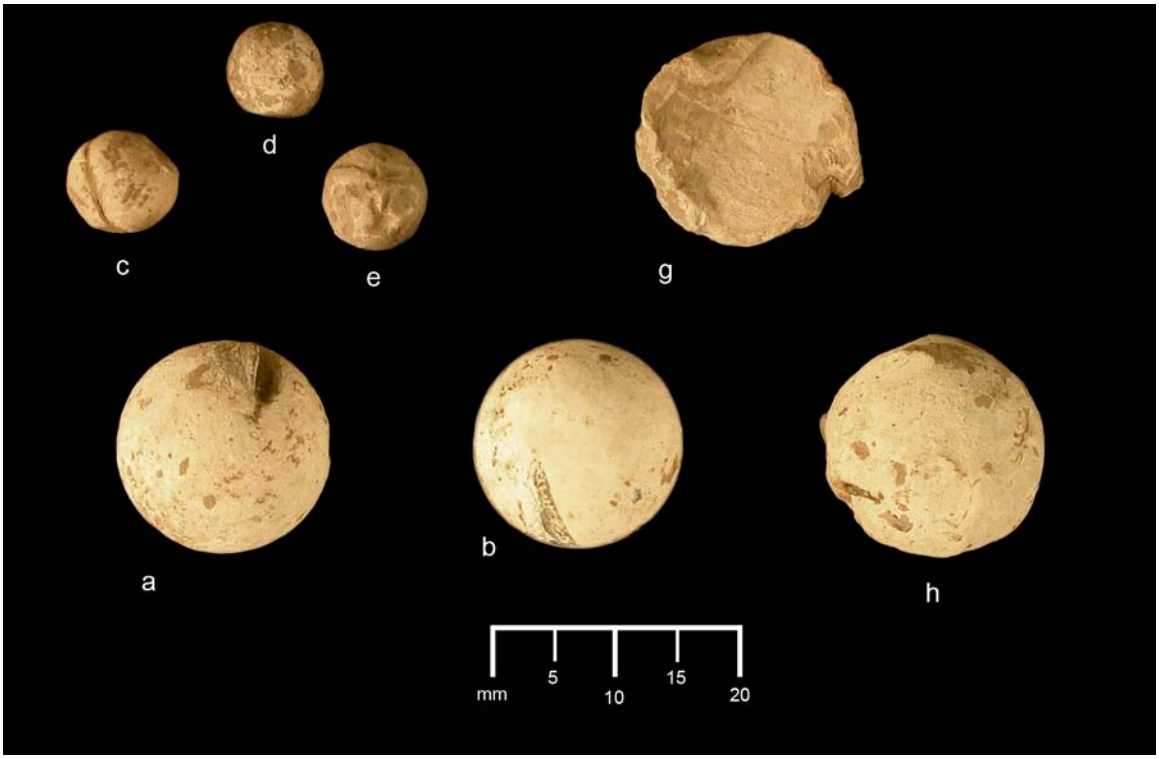

Figure17. .69-caliber spherical balls and buckshot. a., b. .69-caliber musket balls (FS1135, 1146), c., d., e. .30-caliber buckshot shown in configuration of a buck and ball round (FS3439, 3159, 3154), g . caseshot ball with drill marks (FS3223), h . caseshot ball, note battering and flattening in multiple areas (FS3674).

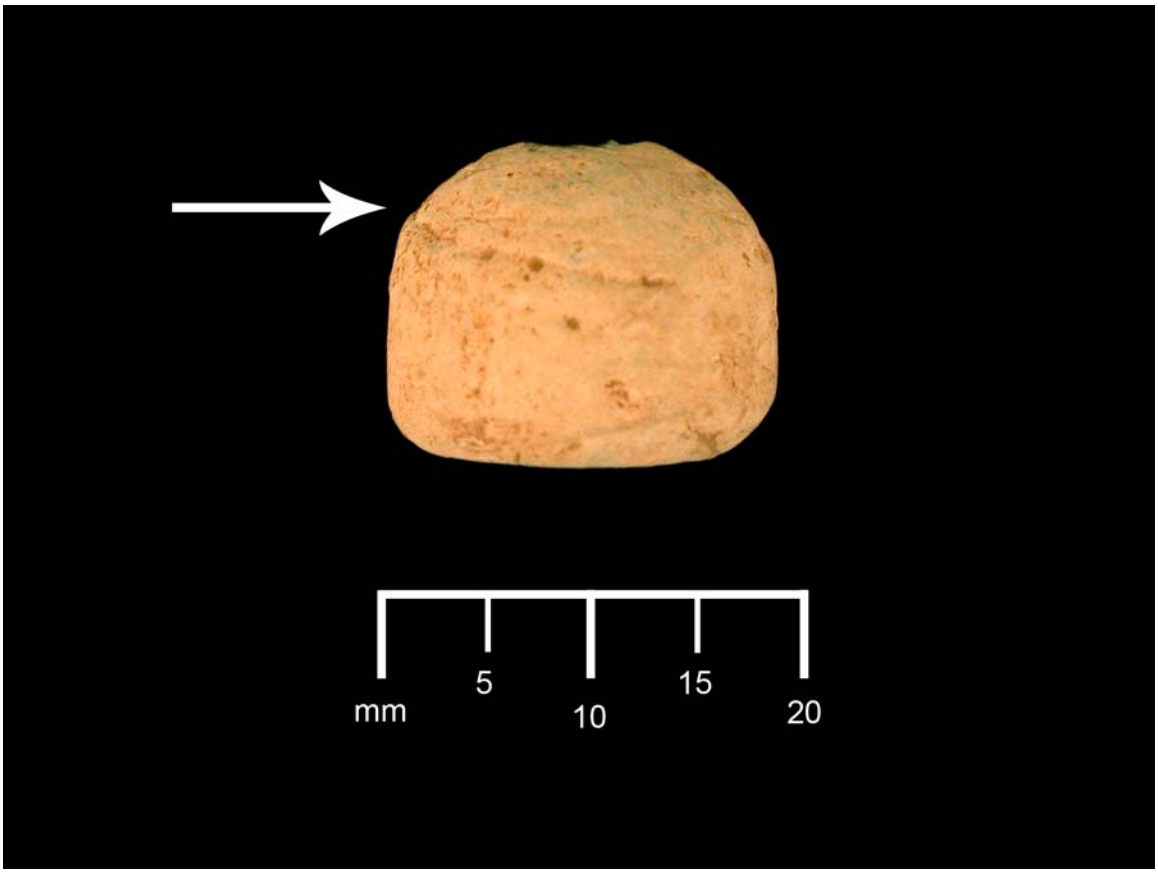

Figure18. Ramrod marks and shallow land and groove marks on .69-caliber spherical ball indicating it was fired in a M1842 rifled musket (FS2767).

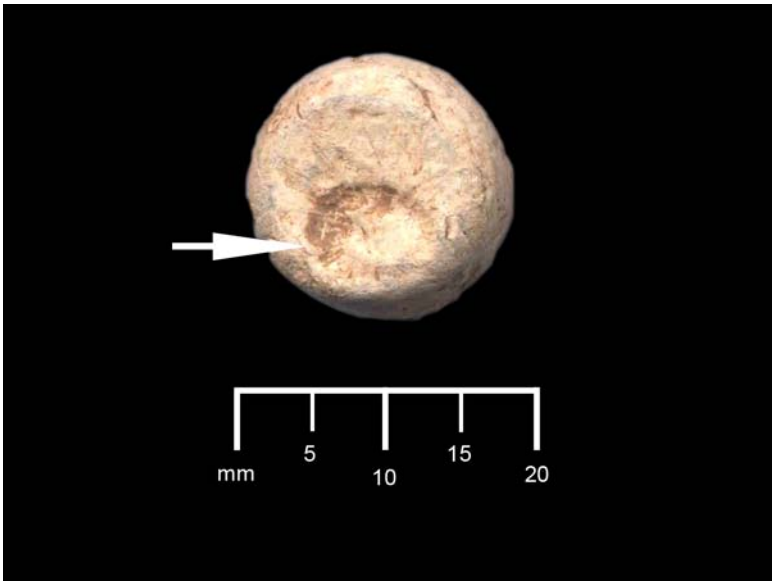

Figure19. Impact scarring on FS2767 showing an impression of a fossil shell from striking limestone.

Figure 20. A hammered and faceted .69-caliber spherical ball that was reduced in size to fit another caliber weapon (FS3127) or used as canister.

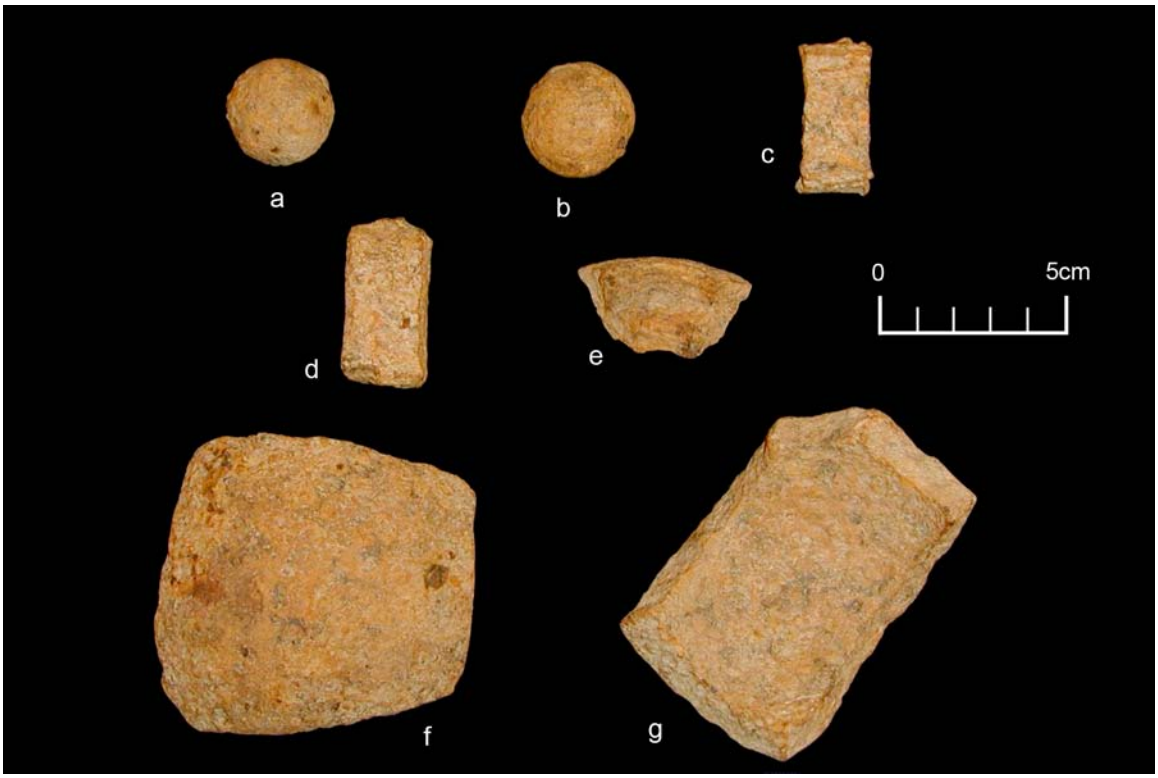

Figure 21. Artillery shell fragments and canister balls. a., b. canister balls, c., d. southern made expedient canister made from bar stock, e. portion of a fuse ring of an exploded shell, f., g. spherical shell fragments.

Figure 22. An exploded Bormann time fuse.

Figure 23. Canister base and top. a. 12 pounder canister cast iron base plate, b. 6-pounder sheet iron canister top plate crumpled from being fired.

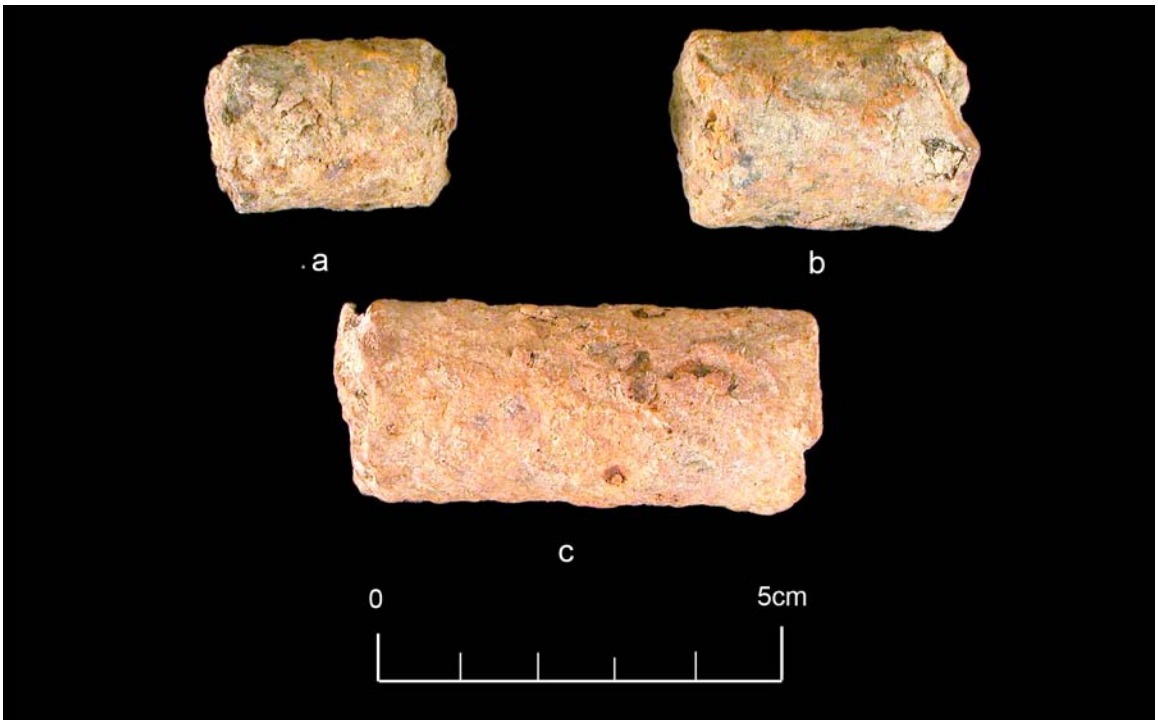

Figure 24. Southern made expedient canister constructed from round stock and probably fired by Guibor's battery at Lyon's troops on Bloody Hill.

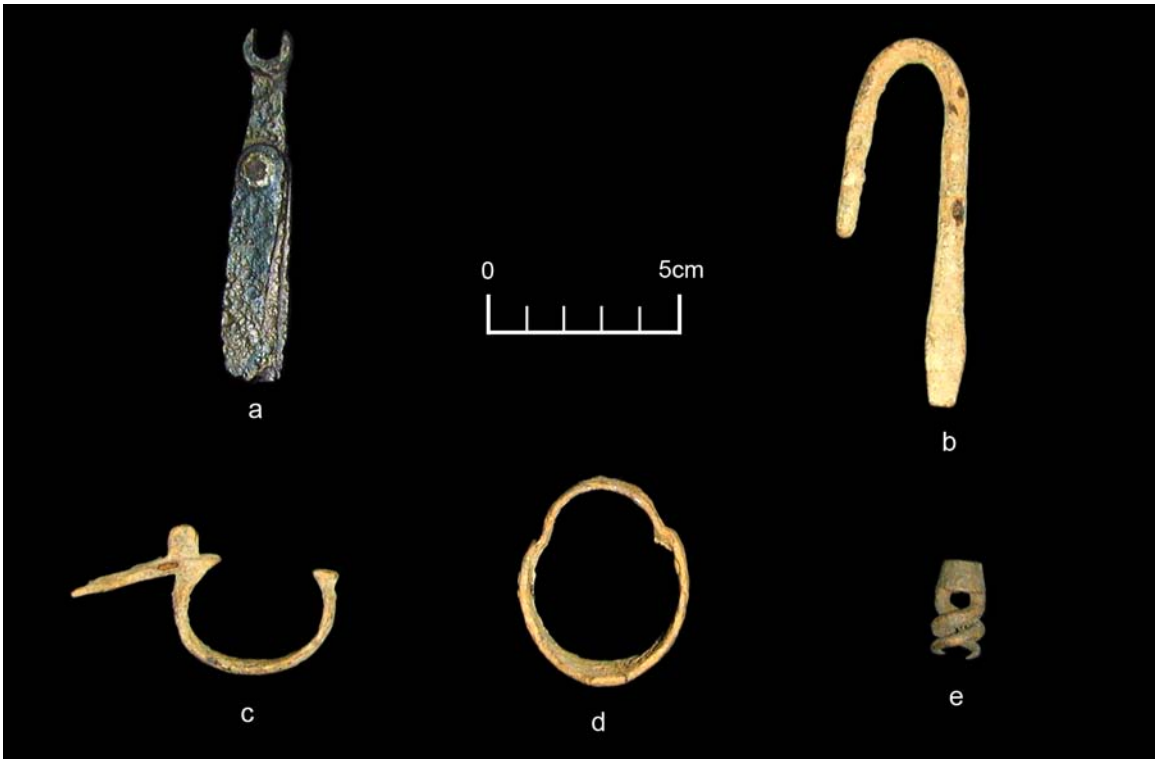

Figure 25. Firearms parts. a. M1842 maintenance tool and screwdriver, b. M1816 J-tool for maintaining flints, c. iron shotgun trigger guard, d. M1816 middle barrel band, e. .69-caliber Type III gun worm or cleaning device.

Figure 26. Firearms related artifacts. a. fragment of a Colt "Eagle" powder flask, b. .30-caliber bullet mold, c. M1855 mainspring vice for weapon maintenance, d. triangular-shaped blade fragment of an M1816 bayonet.

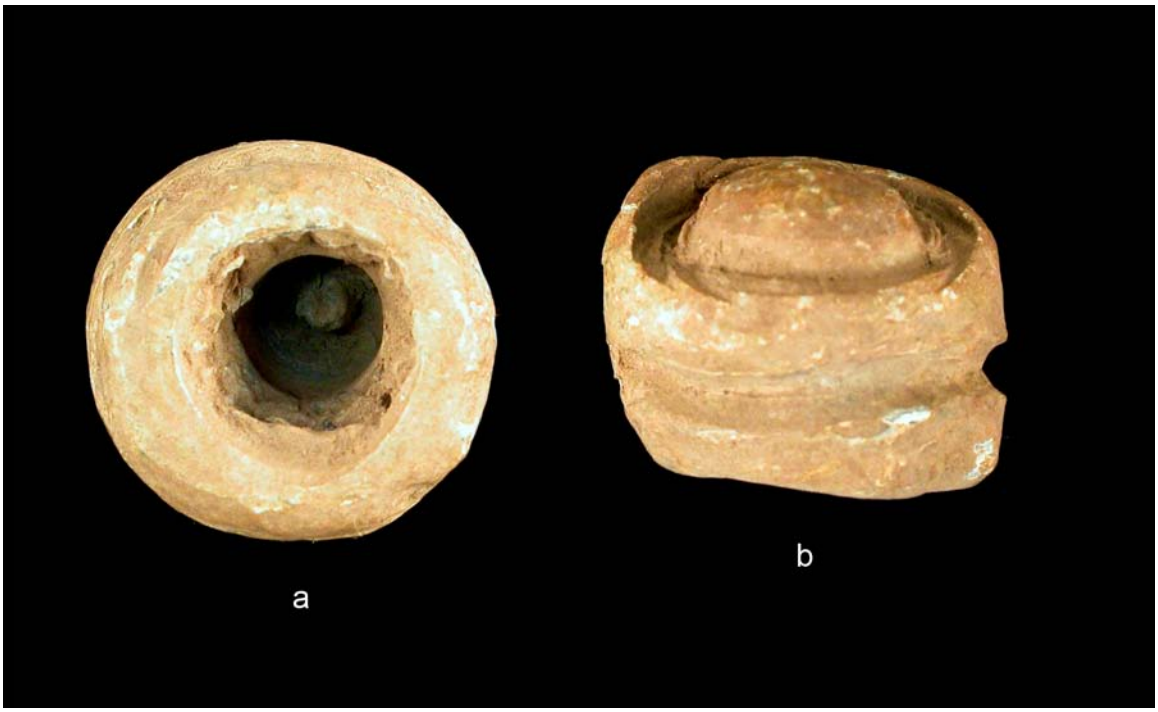

Figure 27. Bottom and side view of an expedient nipple or percussion cone protector made from a spherical lead ball.

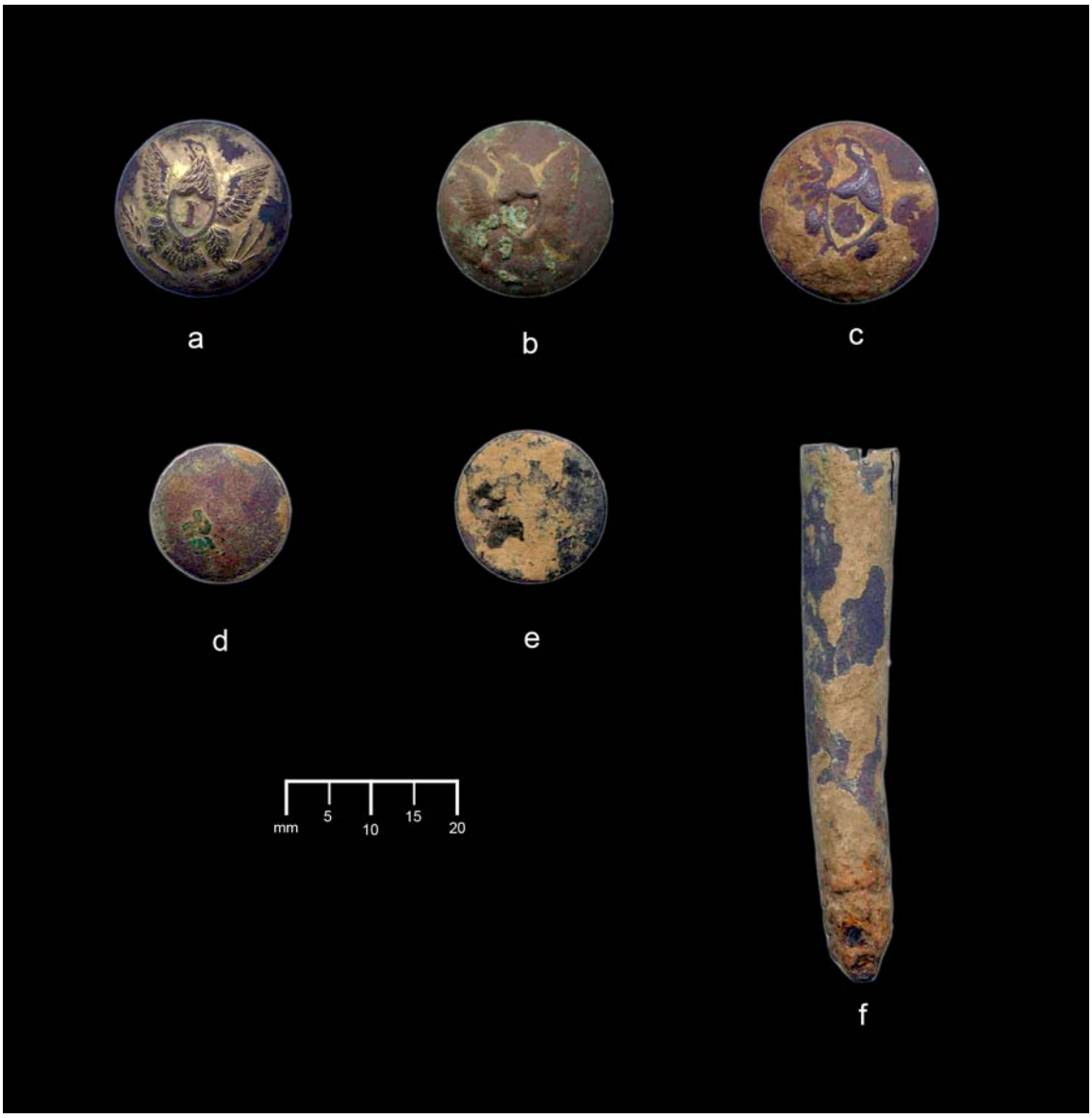

Figure 28. Military and civilian buttons recovered from the field. a. Infantry with strong traces of gilting, b. Cavalry, c . Artillery with some remaining gilting present, d. civilian convex faced button, e. civilian flat faced button, f. brass bayonet scabbard tip.

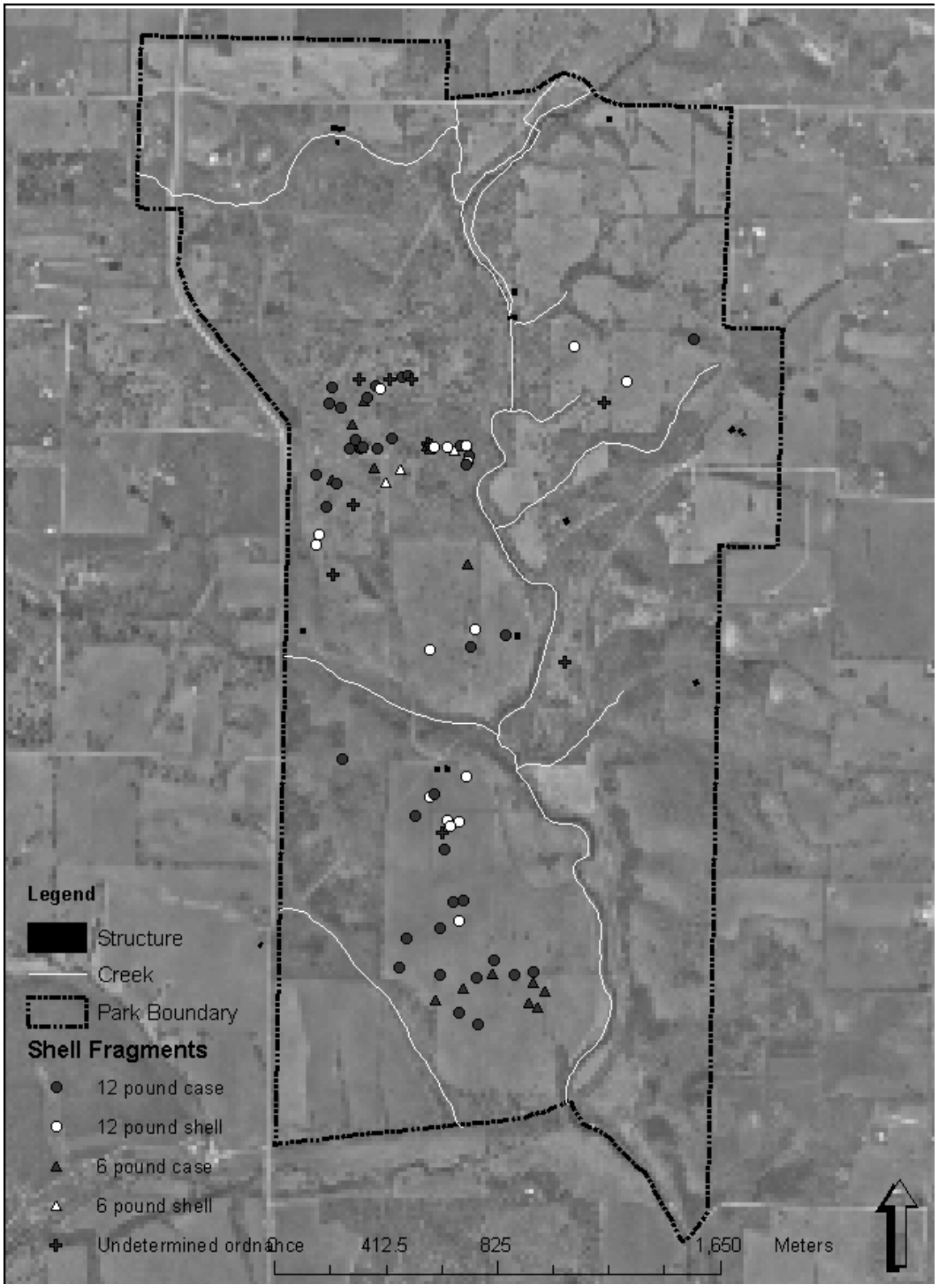

Figure 29. Distribution of 12-pounder and 6-pounder shell and caseshot fragments.

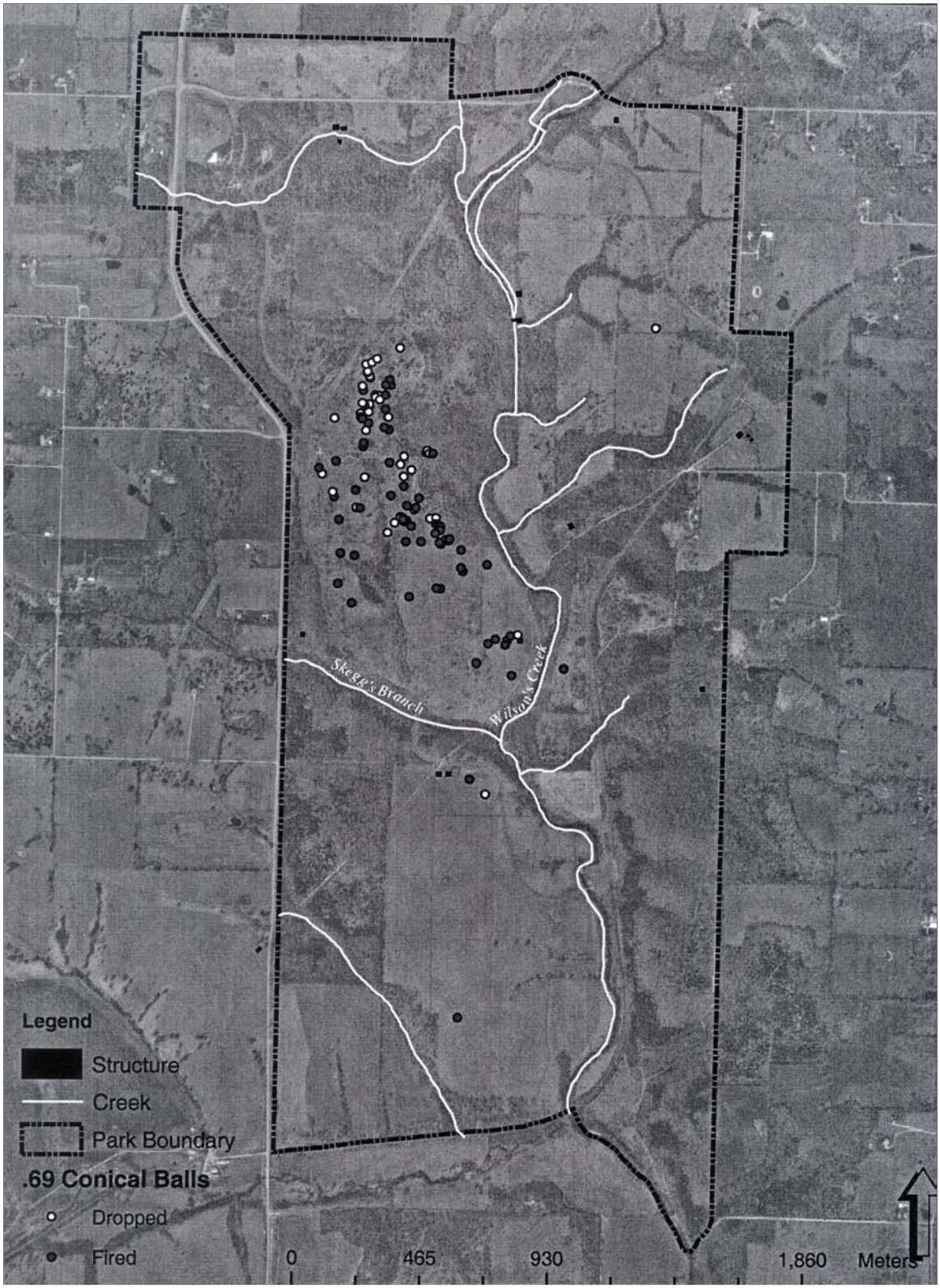

Figure 30. Distribution of .69-caliber conical bullets, Minie balls.

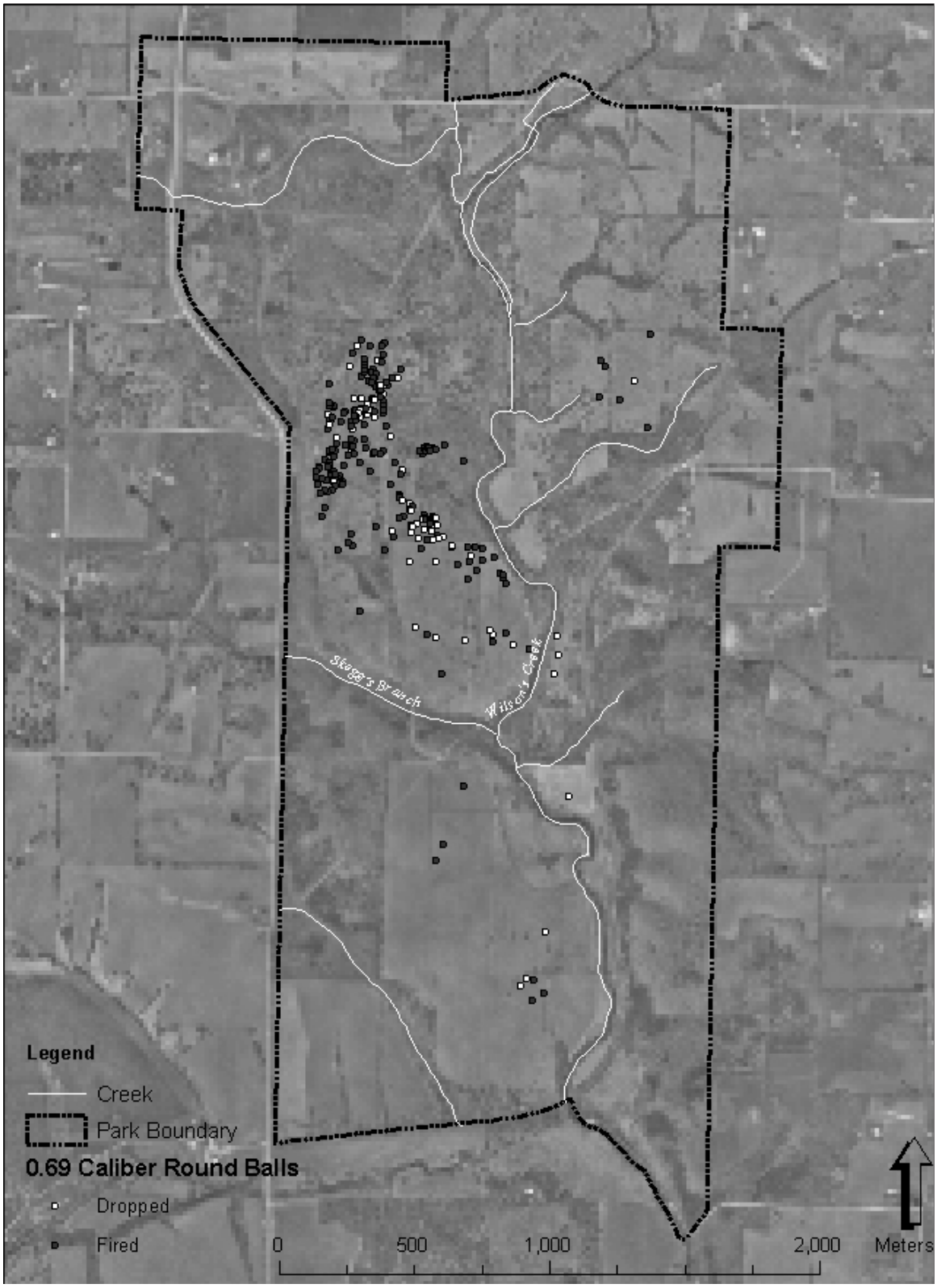

Figure 31. Distribution of 69-caliber spherical balls.

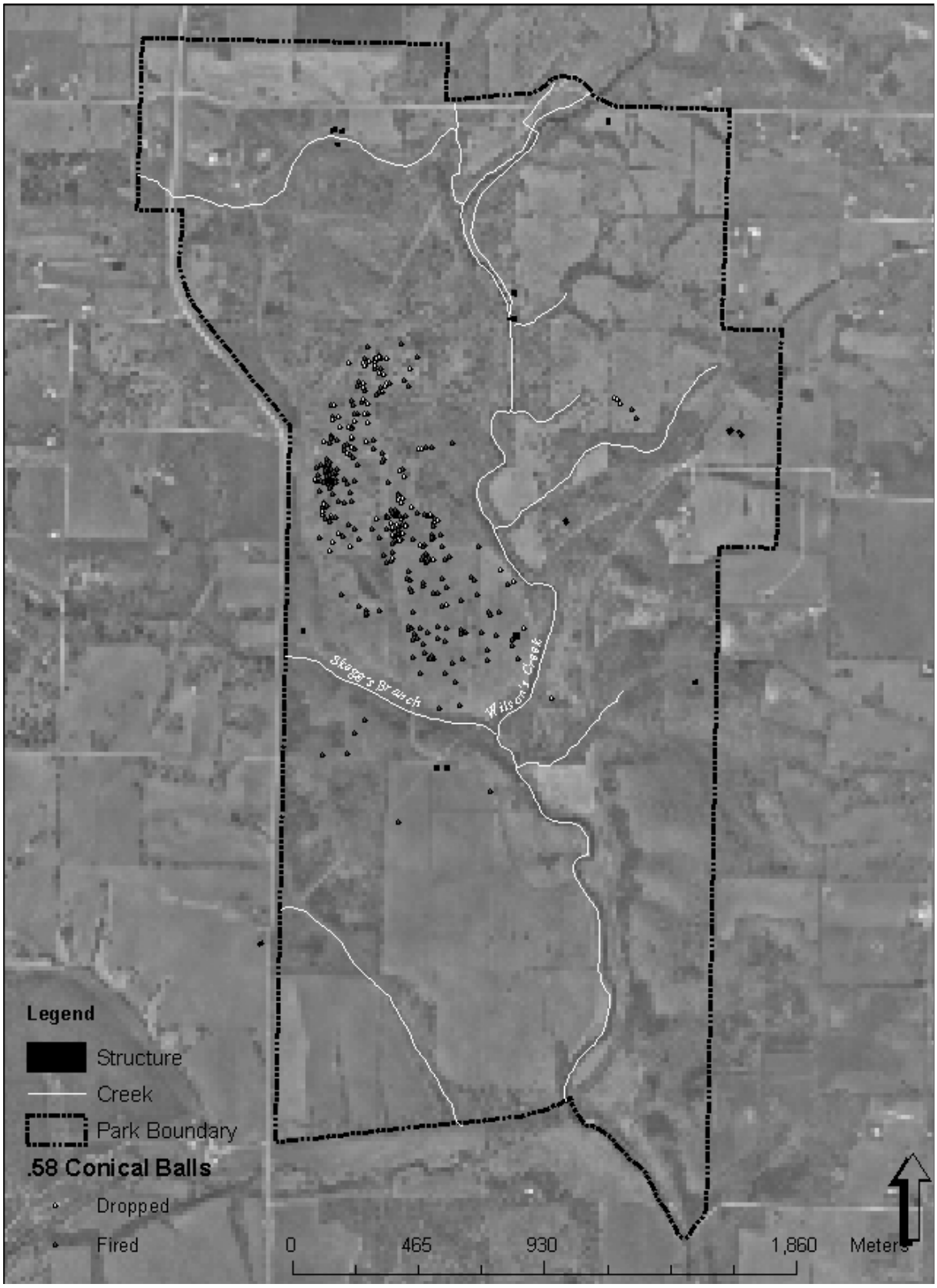

Figure 32. Distribution of .58-caliber conical or Minie balls.

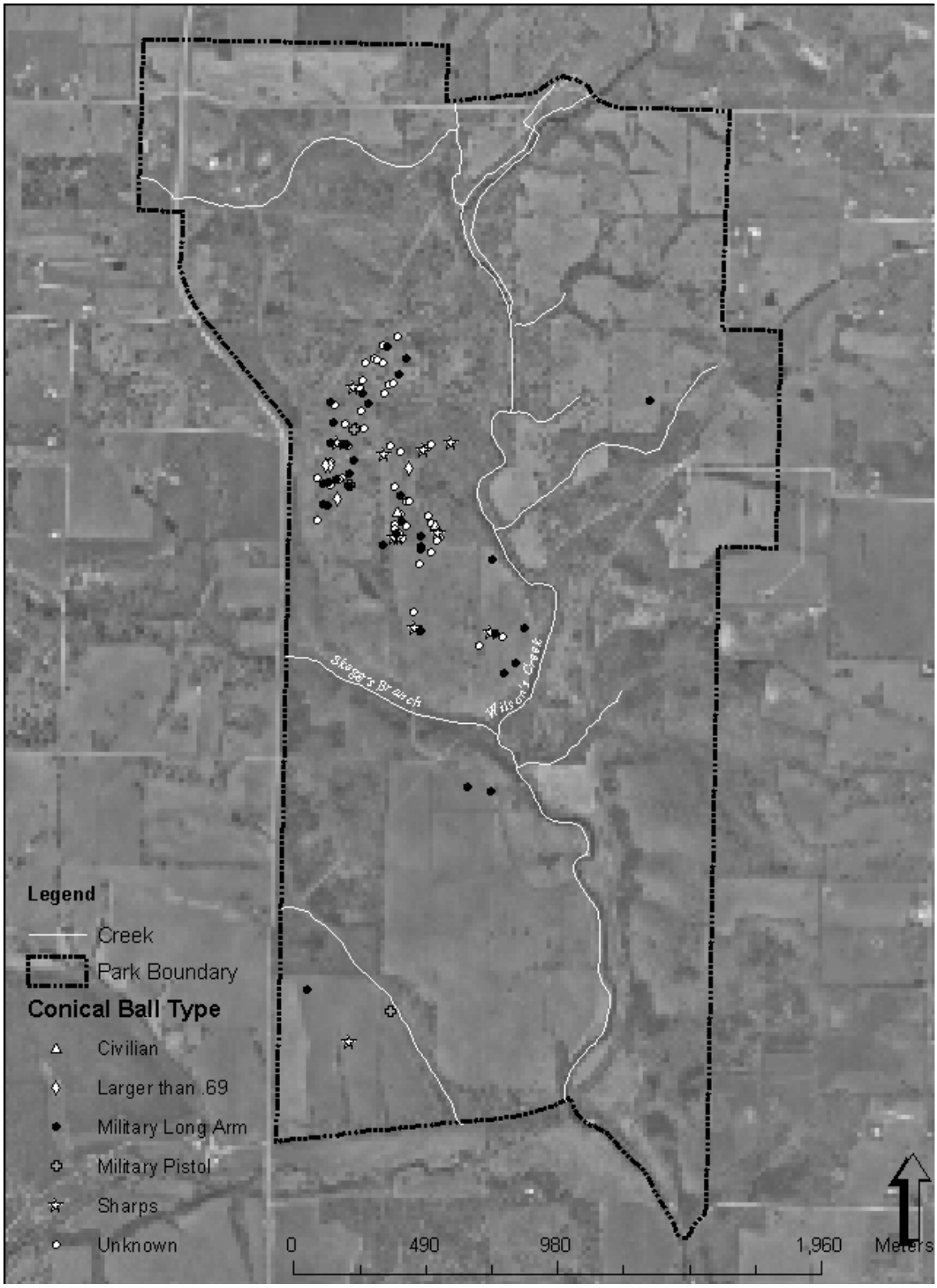

Figure 33. Distribution of miscellaneous caliber bullets.

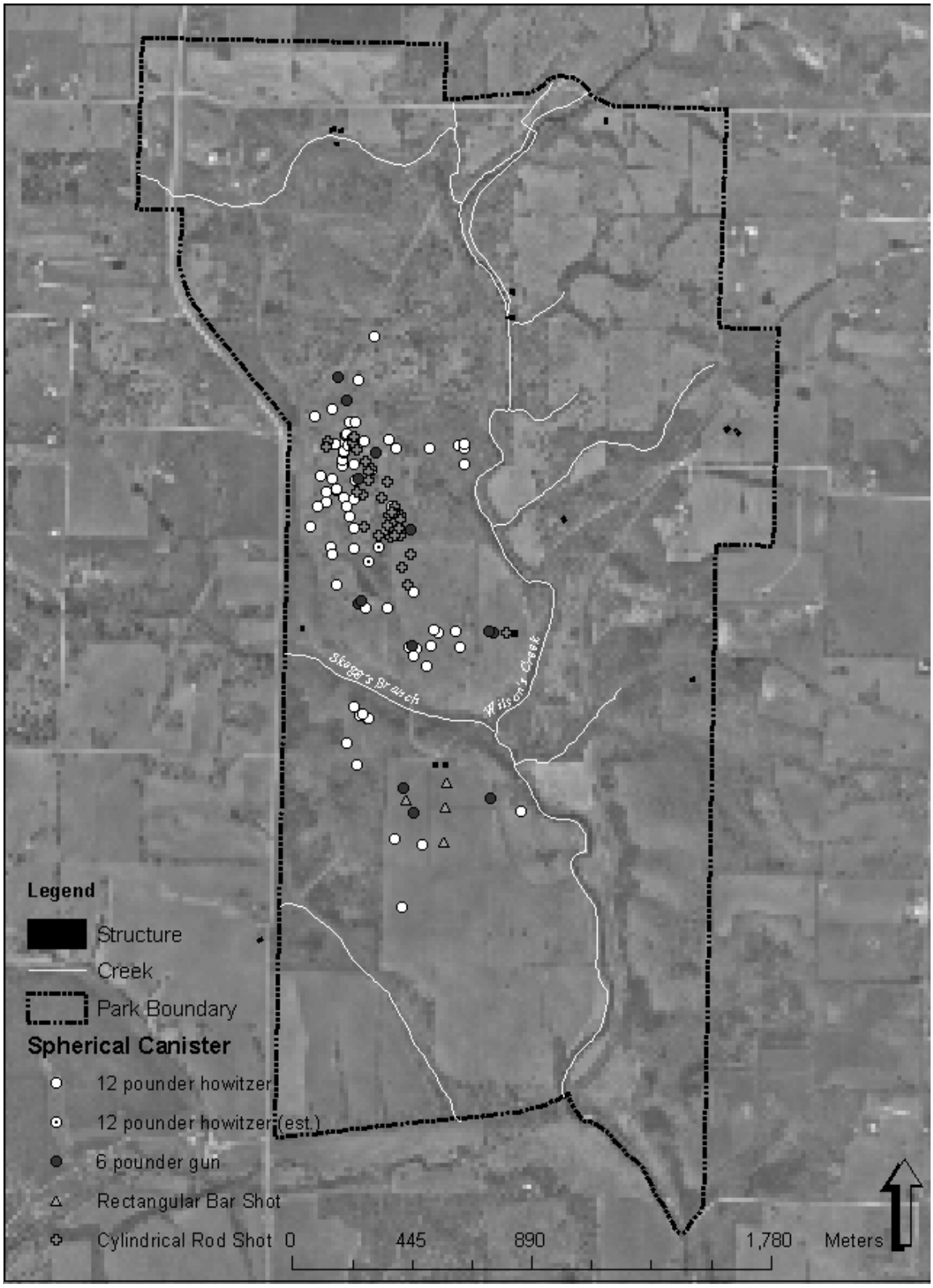

Figure 34. Distribution of 12-pounder and 6-pounder canister balls and expedient canister.

APPENDIX I

GEOPHYSICAL INVESTIGATIONS AT WILSON'S CREEK NATIONAL BATTLEFIELD

By William Volf

Abstract

During 2002-2003, Midwest Archeological Center (MWAC) staff conducted resistance geophysical surveys utilizing a Geoscan Research RM-15 resistance meter at the Ray house, Edwards Cabin area, and Sharp farmstead area within Wilson's Creek National Battlefield, Springfield, Missouri (WICR). The research was performed as part of a broader inventory of the cultural resources of WICR. The goal of the resistance surveys at WICR was to attempt to locate various structural elements and features of the properties that relate to the Civil War era in a non-destructive manner.

At each surveyed area, soil resistance anomalies possibly the result of cultural activity are identified. Whether the anomalies are absolutely the result of cultural activity or of Civil War vintage can only be determined through future archeological testing of the anomalies.

Project Description

During April 1-5, 2002 and March 30-April 2, 2003 a soil resistance geophysical investigation was performed at three locations within Wilson's Creek National Battlefield (WICR). In 2002, work was performed on grounds surrounding the Ray House (23GR233) and in an area where the Edwards Cabin is suspected of having stood. Work in 2003 at WICR was conducted at the suspected location of the Sharp farmstead.

Wilson's Creek National Battlefield is located just outside Springfield, Missouri in Greene and Christian counties. The 1,752 acre battlefield commemorates the site of the 1861 Civil War Battle of Wilson's Creek. Accordingly, the main interpretive emphasis of the park is the Civil War battle.

The geophysical investigations described in this report were performed to non-destructively inventory the project area grounds for possible subsurface structures and features relating to the Civil War era. A Geoscan Research RM-15 soil resistance meter was used to conduct the surveys.

WILSON'S CREEK NATIONAL BATTLEFIELD

Background

Ray House

The John A. Ray House, 23GR233, sits atop one of the many rolling hills associated with the western Ozarks. The extant house was present when the Civil War battle took place at Wilson's Creek. It is reported that John Ray sat on his front porch at watched as the battle took place on the opposite ridge known as Bloody Hill. Following the battle, the house served as a field hospital with the Ray family tending to wounded and dying soldiers (Monk 1985).

Several archeological investigations have taken place at the Ray house. However, the extent of the excavations has been limited to areas adjacent to the structure. Pertinent to this research, in 1975, Robert Bray conducted a surface inspection and metal detector survey of the Ray house area. Most importantly, Bray developed a sketch map using documentary and oral history sources of suggested locations of structures once associated with the Ray house (Figure 1). The usefulness of the map is in providing information about the number of outbuildings as well as providing spatial relationships between the structures.

Edwards Cabin

Maps depicting the area during the time of the Civil War battle show a house located on the right bank of Wilson's Creek and west of Telegraph Road. Archeological investigations to locate the depicted structure were undertaken by Robert Bray in 1967 (Bray 1967). The investigations consisted of a series of exploratory trenches three feet wide of varying length. The trenches yielded a small amount of domestic artifacts on the highest part of the terrace bordering the west bank of Wilson's Creek. Bray interpreted the presence of domestic artifacts as an indication of former structure location. However, no structural elements such as foundation stones were discovered during the excavations.

Sharp

Several historical sources indicate a structure located near the bluff at Sigel's final position as that of Joseph Sharp. Immediately following the battle the Sharp family left the house and moved to nearby Boaz. Anti-slavery factions reportedly burned the house in 1862.

Archeological investigations to locate the Joseph Sharp house have proven fruitless. Bray used metal detectors and several exploratory trenches to conduct his search for the Sharp house in 1975. Of the artifacts recovered, only one artifact is likely from the Civil War era. The remaining artifacts all relate to a post-Civil War habitation of the area by the Steele family (Bray 1975).

Methods

The following presents a brief background of the resistance geophysical technique. The reader is referred to Anthony Clark (1996) and Bruce Bevan (1999) for detailed description of the application of resistance surveys to the archeological record.

A resistance survey introduces an electrical charge into the earth and measures in ohms, a unit of electrical resistance, the ease or difficulty that the current encounters passing through the soil. The result is that changes in soil resistance across a site are recorded. Geological and cultural processes can alter the soil resistance across a site. Combinations and levels of soil moisture, soluble ion concentration, and soil type all affect soil resistance. Clay and other fines soils will have a lower resistance than sands and moist soils. For cultural activities to be observed in the recorded data, the contrast between the archeological record and the surrounding soil must be great enough to be detected. Depending upon the soil characteristics, cultural features such as stone foundations and footings are likely to display higher resistance while backfilled trenches and pits tend to be lower in resistance.

A Geoscan Research RM15 Resistance Meter mounted on a PA-5 probe array was used for the resistance surveys. Operated in the twin-electrode mode, the instrument electrode spacing was set at 0.5 m. This setting provides an effective response depth between 10 and 80 cm. The instrument was configured to operate at 40 v output and 1 ma current. Data was collected every 0.5 m along each traverse. Traverse separation was 1 m. This sampling combination produced 800 data readings per 20-x-x-m grid.

The recorded values were downloaded to a laptop computer and viewed at the end of each day using Geoscan Research GEOPLOT version 3 software. Subsequent laboratory processing typically consisted of removal of data spikes and applying a high pass filter. These processing techniques can enhance the visibility of small, low contrast features, as well as setting the mean of the data set to zero. In doing so, the resulting data image presents areas of greater than or less than the local average resistance of the area.

At each project area, a grid was arbitrarily established to maximize survey coverage while minimizing obstacles. After a baseline was established the area was gridded into contiguous 20-x-20-m blocks. The location of the corners of the geophysical grid was recorded with a Global Positioning System unit to allow future relocation of the surveyed areas (Tables 1, 2, and 3).

Results

Ray House

Thirteen complete and one partial 20-x-20-m grids (5400 m^2) were surveyed with an RM-15 resistance meter around the extant Ray House (Figure 2). Numerous anomalies are present in the resistance data (Figures 3 and 4) and are indicated in figure 5. Cultural and

geological anomalies are present in the collected data. Some of the anomalies are the result of known cultural activities. A high resistance area at 42N/48E is the result of a coal pile that is visible on the present surface. Bray also noted a coal pile in his generalized sketch map of the Ray farmstead at approximately the same location. Two two-track roads also are readily apparent in the data as parallel anomalies of lower resistance. A broad linear high region adjacent to linear low region corresponds with a terrace on the grounds. However, some anomalies are certainly cultural in origin but the exact cause for the anomaly is unknown. There is a peculiar series of interconnected, very narrow, low resistance values extending off the back and to the side of the Ray house. Clearly this set of anomalies is due to cultural activity although the nature is not known. Conversations with various park staff indicated that there is no awareness of any utility lines in this area. Without test excavations to determine the cause of the anomaly, what the anomaly represents will remain undetermined.

Broader large-scale anomalies are also apparent in the data. The area closest to the Ray house bears less variability in resistance values. In contrast, the further one gets from the house, a higher variability and greater contrast occurs. This is likely the result of greater disturbance occurring further away from the house, probably related to farming.

Unfortunately, no discernible evidence of structures can be seen in the data.

Edwards Cabin

Four 20-x-20-m grids (1600 m^2)were surveyed in 2002 at the suspected location of the Edwards Cabin (Figure 6). The resultant resistance data is presented in raw, processed, and processed with interpretive features, respectively in Figures 7, 8, and 9. A rectangular shaped high resistance anomaly occurs in the southeastern portion of the surveyed area. The anomaly measures 7 m in width and 12 m in length. While only speculative, the anomaly may represent the location of the Edwards Cabin or a trash dump. An oval shaped area of higher resistance occurs near the middle of the small survey area and is of unknown origin. The small survey area combined with the "noise" generated from the local geology make broad interpretation of the resistance data difficult. Archeological investigations at the site will be needed to confirm the interpretation of the anomalies.

Joseph Sharp House

In 2003, ten 20-x-20-m grids (4000 m^2) were surveyed in the suspected location of the Joseph Sharp house (Figure 10). The resultant resistance data is presented in figures 10, 11, and 12. Numerous linear anomalies are readily apparent in the data (see Figure 12). The linear anomalies are suggestive of subsurface utility lines likely associated with the later Steele farmstead. The data also depicts numerous broad high and low resistance areas. Given the size and irregularity in form, it is likely that these anomalies are the result natural in origin and may reflect variation in soil depth. No definitive identification of any structures can be identified in the data.

Conclusions and Recommendations

During 2002-2003, soil resistance geophysical surveys were carried out at three locations within WICR. The surveys were conducted at the Ray house, Edwards Cabin, and Sharp house. The goal of the project was to non-destructively locate various Civil War related structures believed to occur at the project areas. No definitive structures were identified in that data collected at the Ray house and Sharp house project areas. However, the resistance data from the Edwards Cabin area does indicate a possible structure. Structures constructed without substantial foundations would leave subtle, if any, trace in the resistance data. This notion combined with the high variance caused by the local geology at these locations likely masks any indication of potential structures. Further, "noise" created by various ground surface disturbances (e.g. plowing) would mask subtle resistance anomalies as well.

Despite the lack of obvious potential structures in the data at two of the three locations investigated, the data can be useful in managing the parks cultural resources. Traditional archeological investigations will need to take place before any definitive interpretation of the resistance data can take place. It is hoped that the collected data in this project will be used to guide future archeological investigations at these locations.

REFERENCES CITED

Bevan, Bruce W.
1999 *Geophysical Exploration for Archaeology: An Introduction to Geophysical Exploration*. Special Report No. 1. National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Bray, Robert T.
1967 Wilson's Creek Revisited: An Account of the 1967 Excavations. Manuscript on File, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Bray, Robert T.
1975 Inventory and Evaluation of the Archaeological Resources. Wilson's Creek National Battlefield, Springfield, Missouri. Manuscript on file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Clark, Anthony
1996 *Seeing Beneath the Soil: Prospecting Methods in Archaeology*. Revised Edition. B.T. Batsford Ltd., London.

Monk, Susan M.
1985 *Archeological Testing at the Ray House: Wilson's Creek National Battlefield, Missouri*. Occasional Studies in Anthropology No. 10. National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

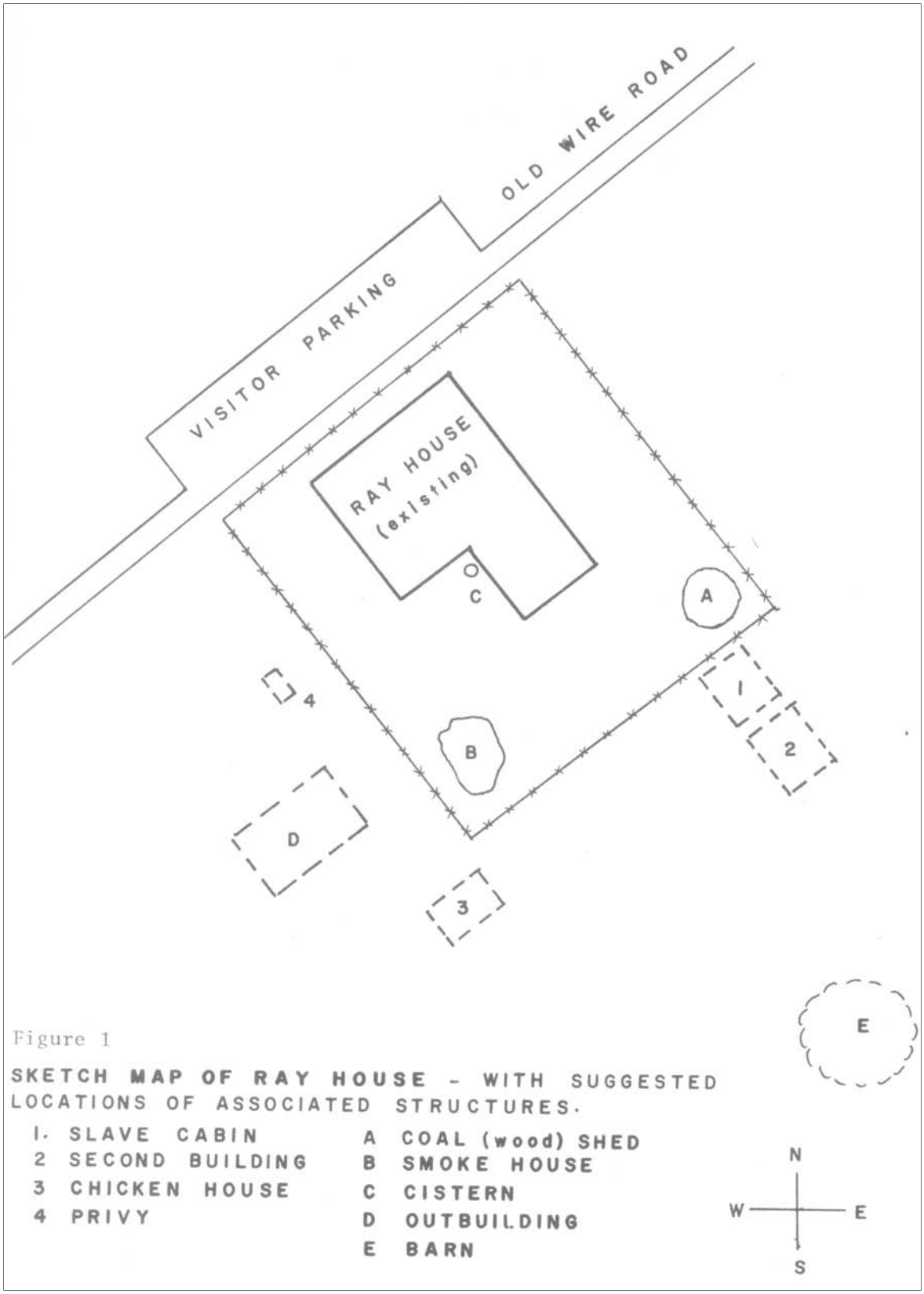

Figure 1. Possible Ray house features at the time of the battle (after Bray 1967:9).

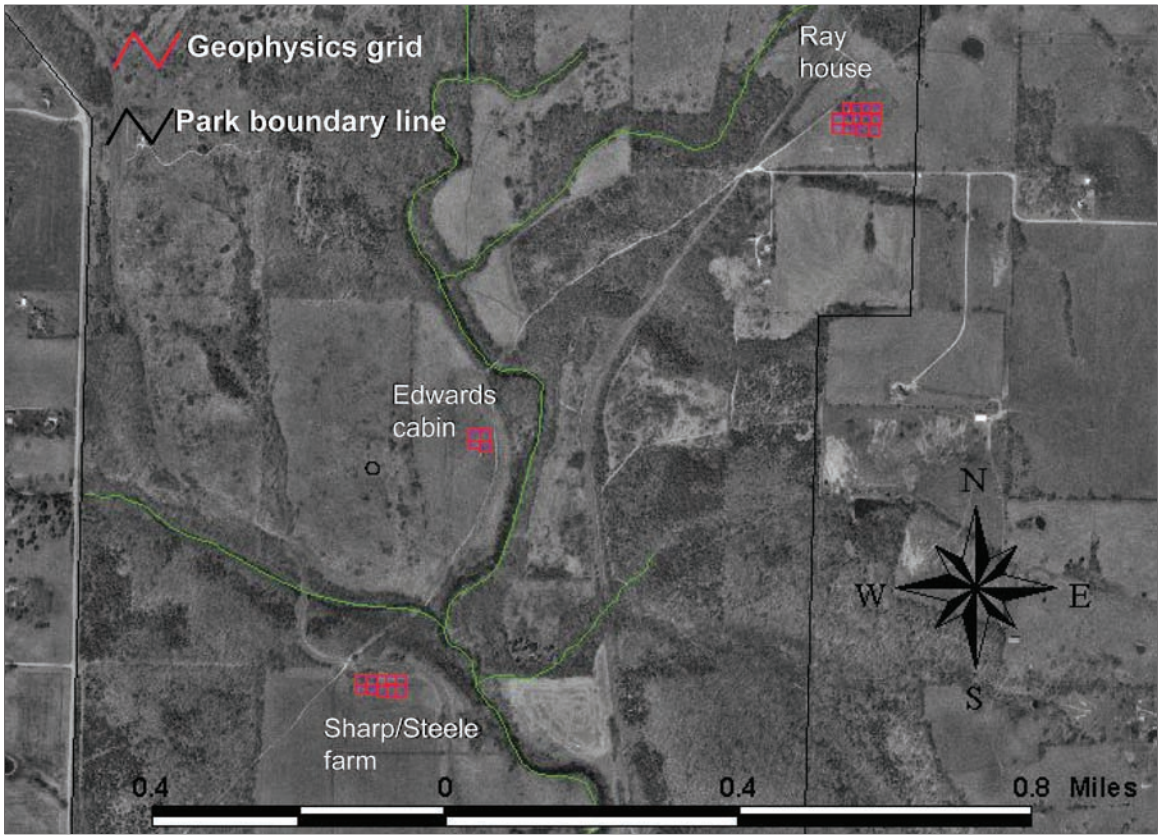

Figure 2. Locations of the three geophysical grids at Wilson's Creek.

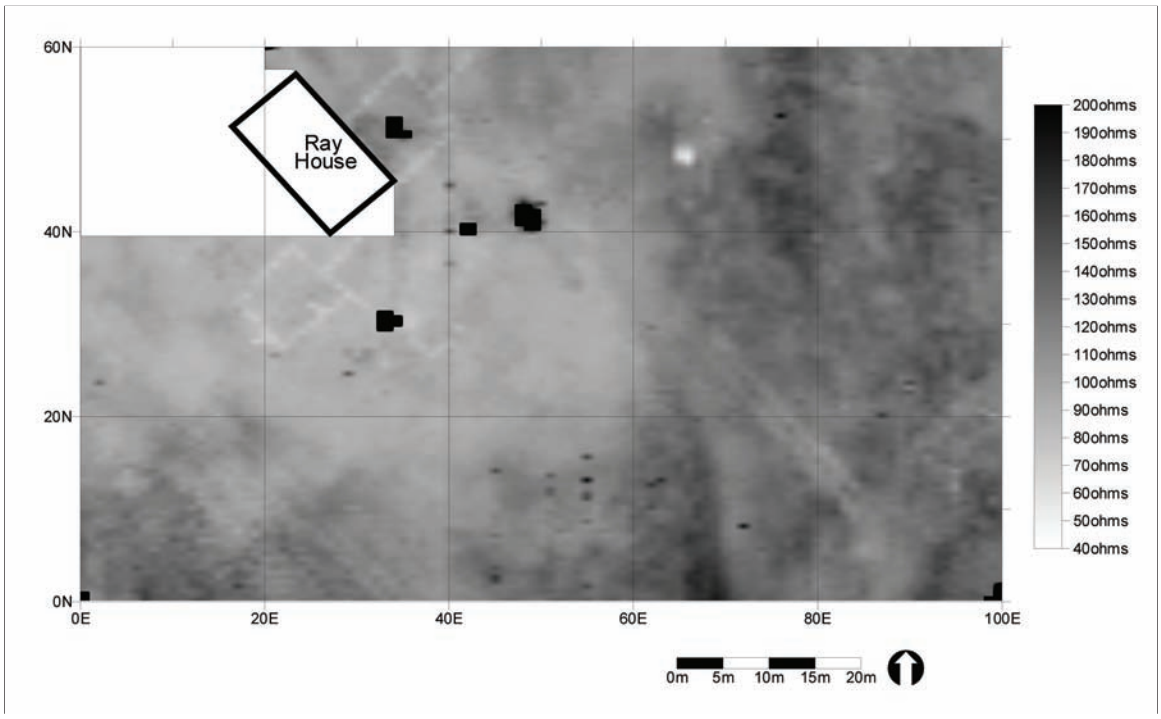

Figure 3. Raw resistance data from Ray House.

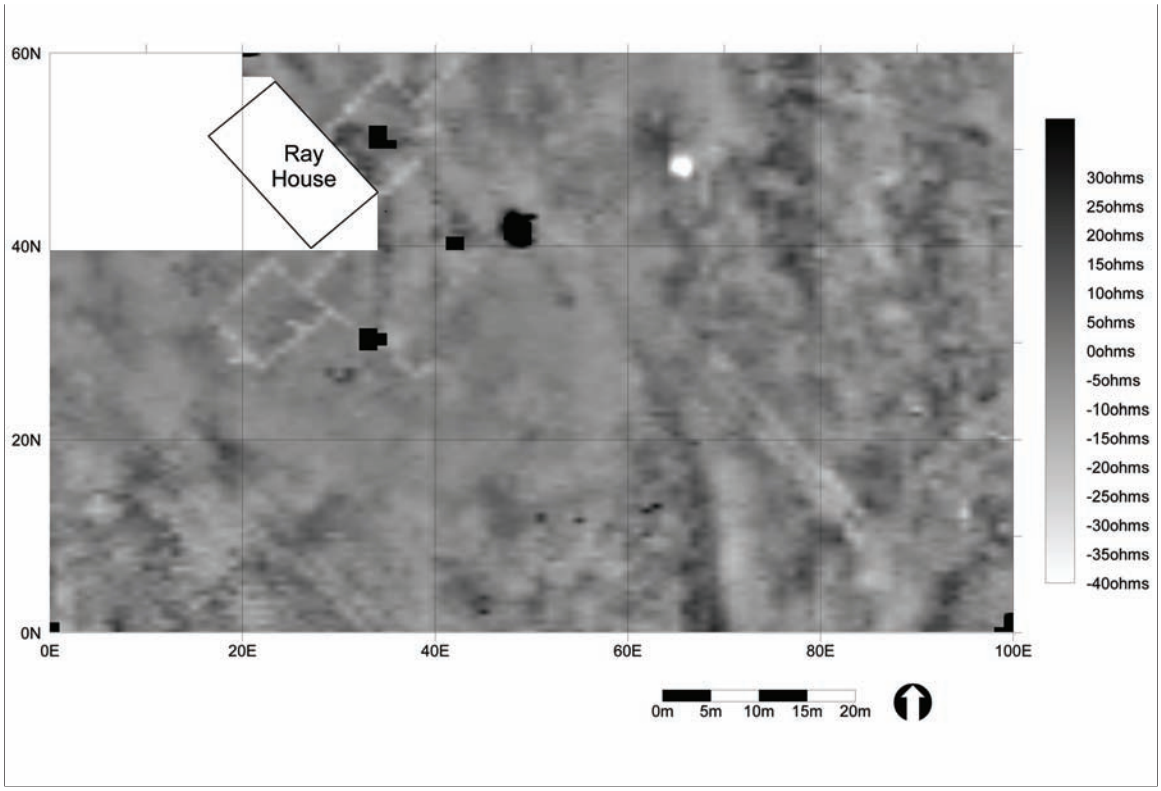

Figure 4. Processed resistance data from Ray House.

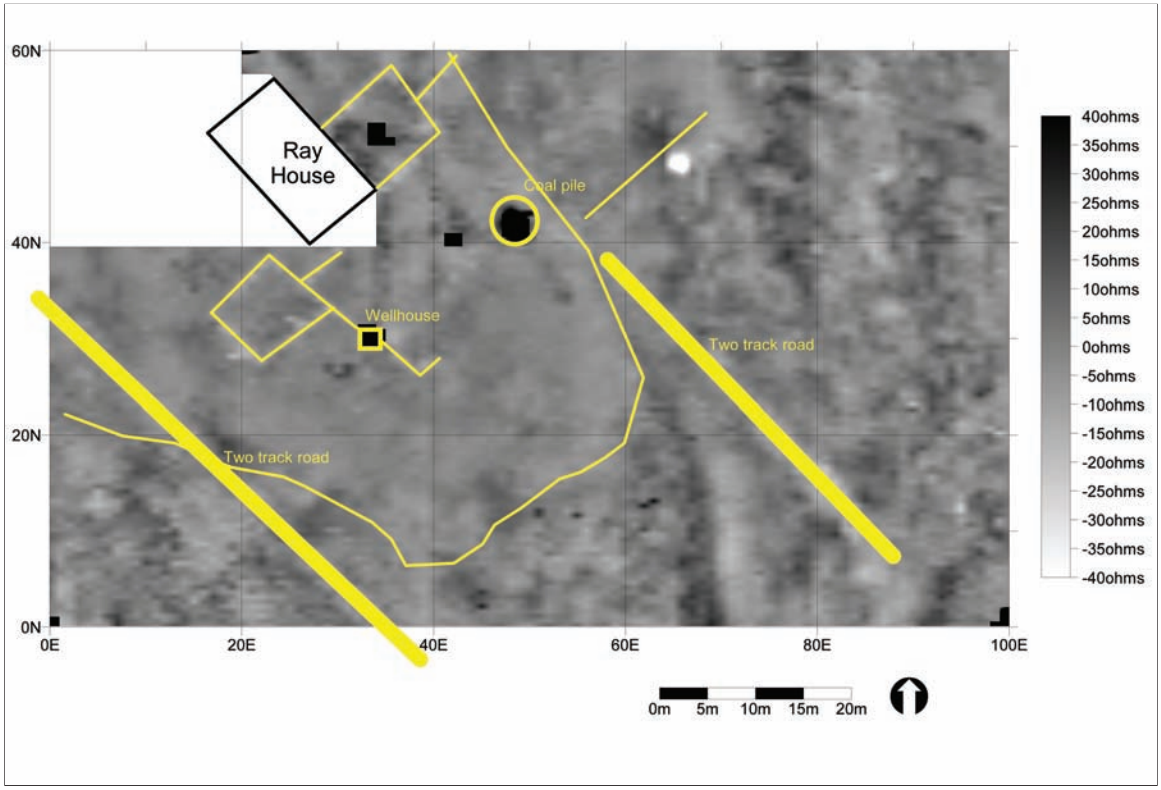

Figure 5. Interpretation of processed resistance data from Ray House.

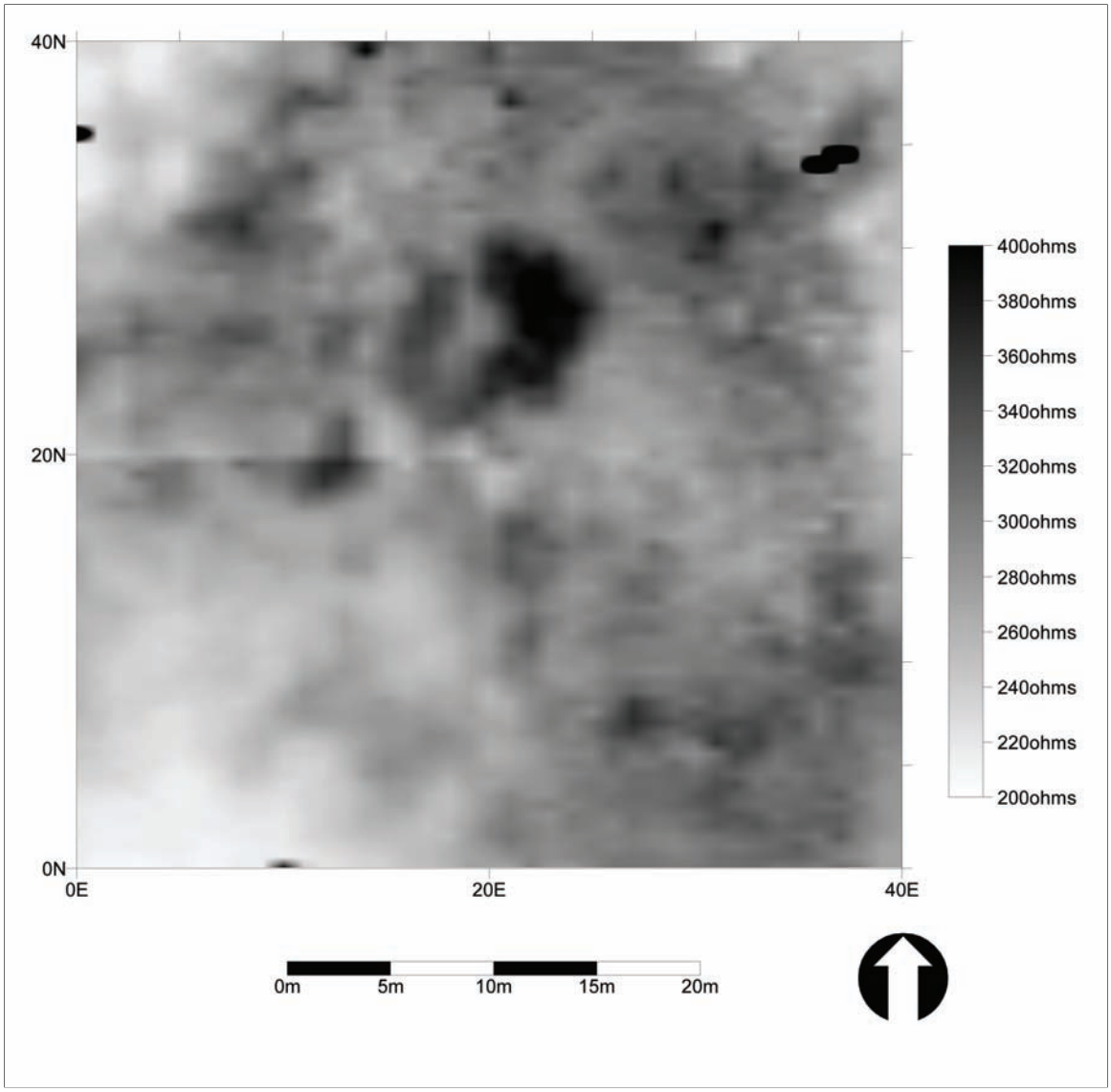

Figure 6. Raw resistance data from the suspected location of the Edwards Cabin.

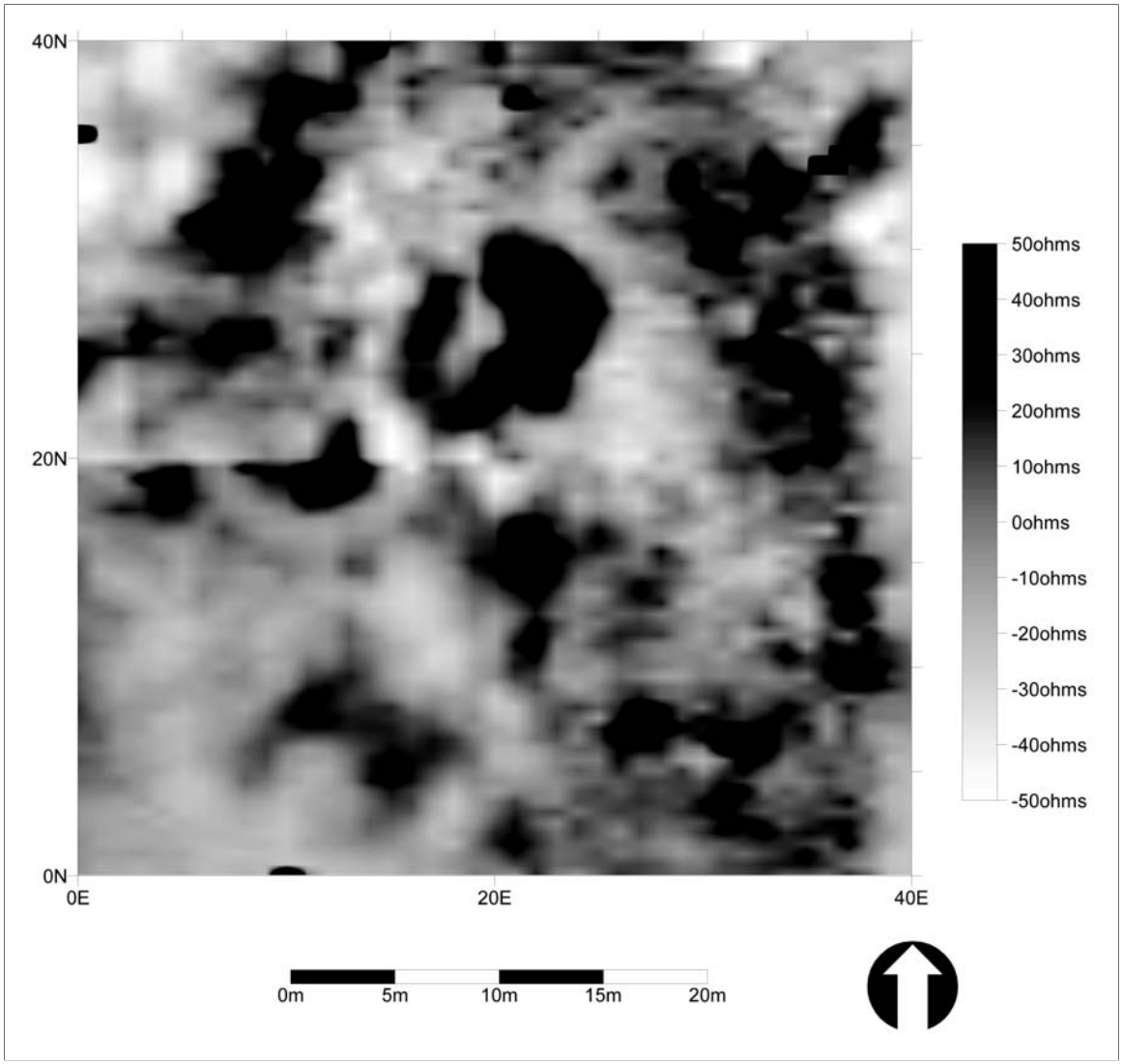

Figure 7. Processed resistance data from the suspected location of the Edwards Cabin.

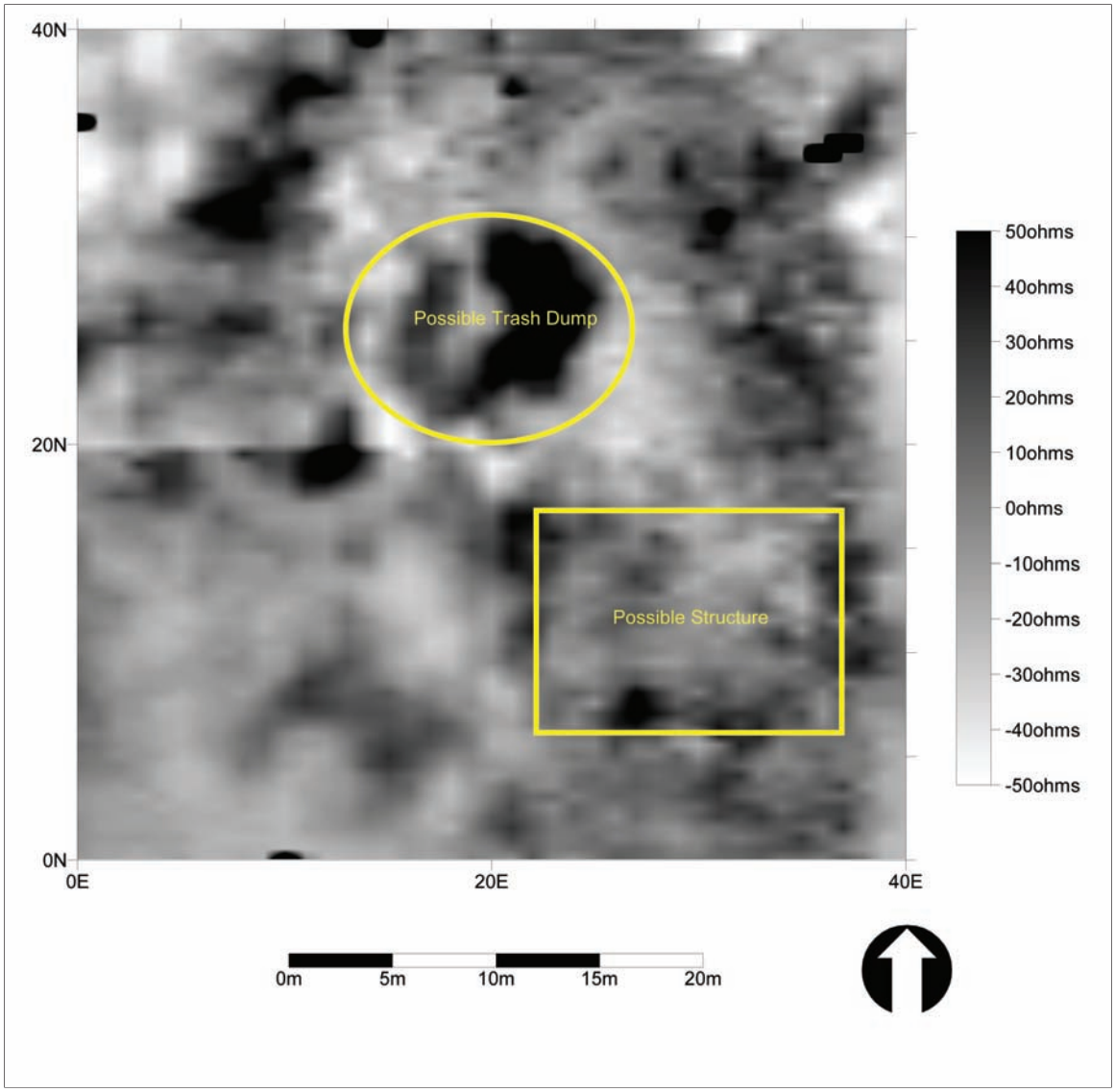

Figure 8. Interpretation of processed resistance data from the suspected location of the Edwards Cabin.

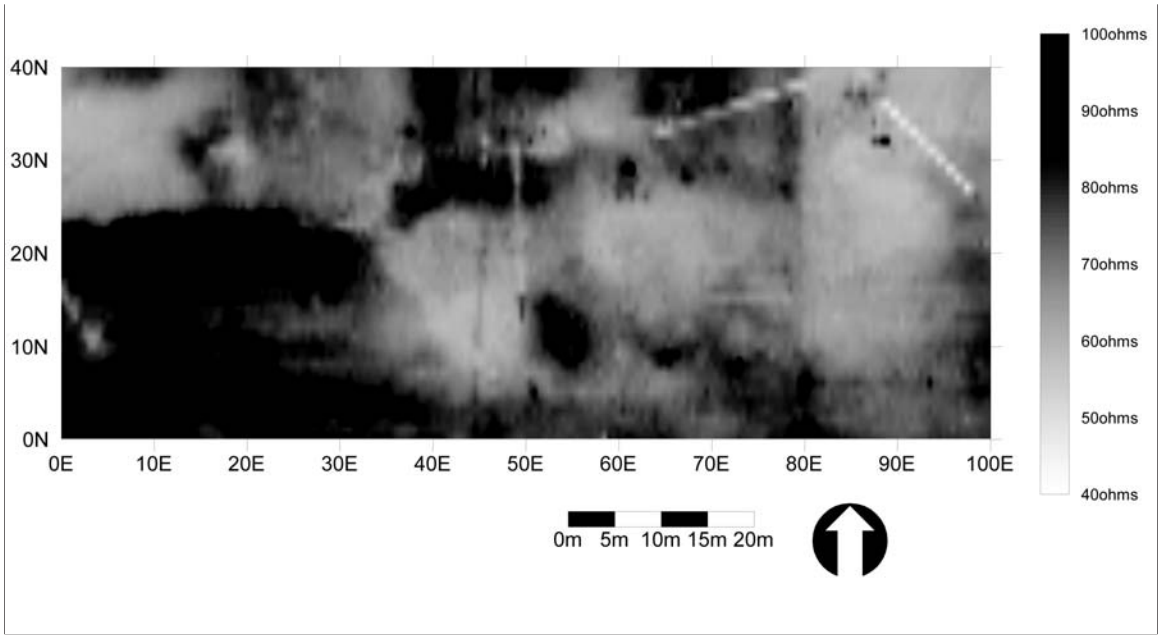

Figure 9. Raw resistance data from the suspected location of Joseph Sharp's house.

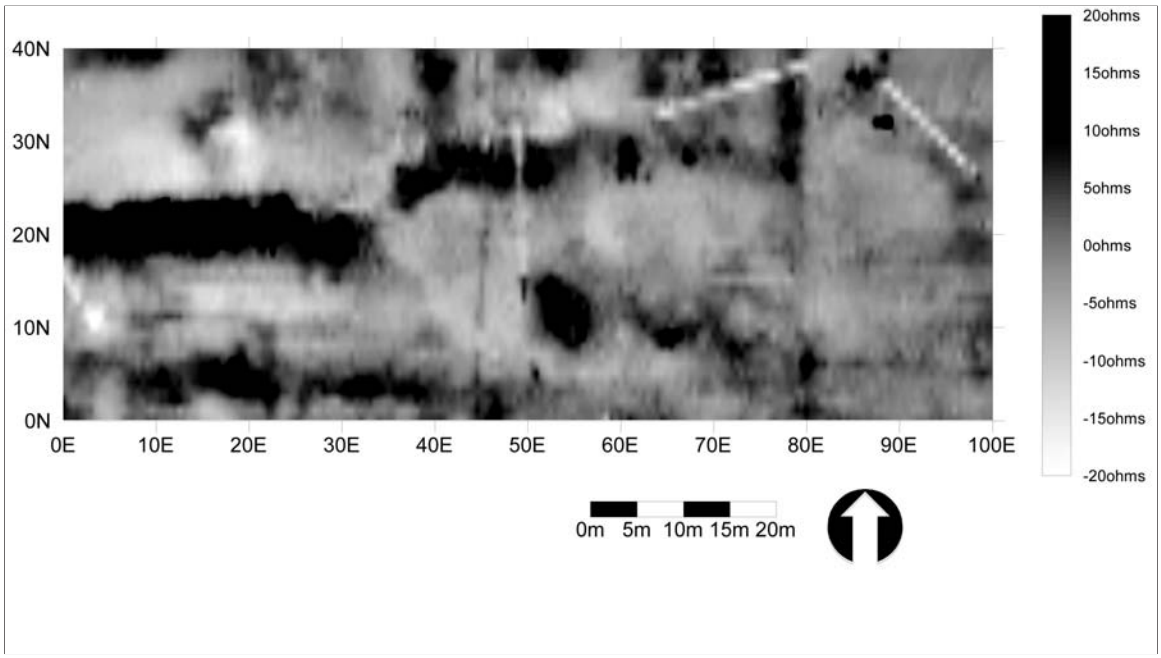

Figure 10. Processed resistance data from the suspected location of Joseph Sharp's house.

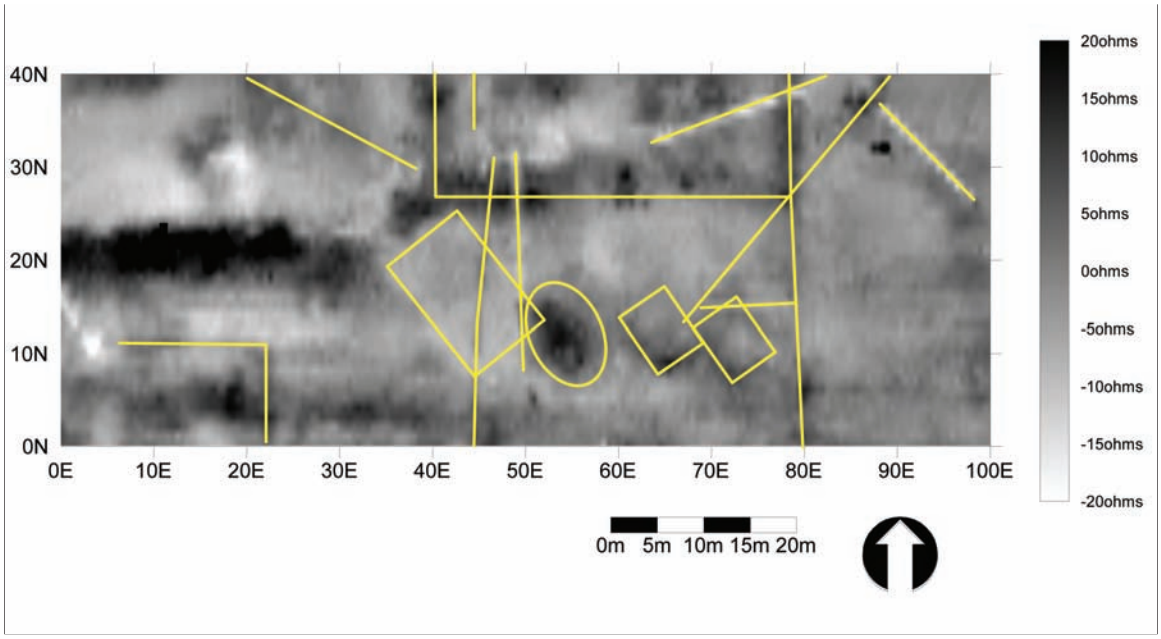

Figure 11. Interpretive map of anomalies at the suspected location of Joseph Sharp's house.

APPENDIX II

ANALYSIS OF HUMAN BONES FROM THE CIVIL WAR BATTLE OF WILSON'S CREEK: BRAY'S COLLECTION FROM THE SINKHOLE

By P. Willey, Daniel Tyree, Nicole Cavales and Douglas D. Scott

Introduction

After the Battle of Wilson's Creek, which occurred in southwest Missouri on August 10, 1861, the battlefield was left strewn with the debris of war. One of the most immediate concerns was to cover the dead, perhaps as much to reduce the stench and avoid contagion as to respect and honor the fallen soldiers. The victorious Southerners reported 265 dead and 80 missing, while the defeated Union had 235 dead and 102 missing (DeArmond 1985: iii). Another source (Bearss 1975:161-165) indicates somewhat higher casualties—277 Southern dead, 258 Union dead, and 186 Union missing.

The Southern corpses received some ceremony during their interment, but the vanquished Union dead were not afforded such rituals. Some of the Union dead were buried in heaps, and some left exposed above ground (Holcombe and Adams 1985:66); others were dumped into a sinkhole and a well (Holcombe and Adams 1985:66).

Six years later, in 1867, a contractor exhumed the Union remains. The contractor claimed he removed 183 Union soldiers from the battlefield, including 30 from the Sinkhole (Anon. 1869, Holcombe and Adams 1985:66). The bones were moved to the national cemetery in Springfield, Missouri. There they lay at rest—at least most parts of them.

Other parts, however, remained behind on the battlefield. Archeologist Robert T. Bray (1967:14) noted that according to local reports after the 1867 exhumation, the Sinkhole had been churned by relic hunters hunting bones and stirred by survivors savoring memories. The Sinkhole, as others have noted, has a prominent spot in the history of the battle aftermath, and thus is part of the Civil War legend (Bray 1967:14).

During a 1966 archeological project, the Sinkhole was excavated and restored to its 1860's contours (Bray 1967). As a parenthetical note, there seems to be confusion concerning the year that Bray excavated the Sinkhole. Bray excavated the Sinkhole in August 1966 (Bray 1967; Slaughter 1999), not in 1967, although the completion of his written report concerning that fieldwork was dated 1967.

A few artifacts and many bones—especially the smaller, most distal elements—were recovered during Bray's Sinkhole excavation. Bray noted that fewer bones were found in the archeological excavation than he expected. His table (Bray 1967:24-25, table 2) indicated that 222 human elements and fragments were gathered; that section of Bray's table is reproduced here (Table 1). Although not a large number (the average adult human skeleton

has 206 elements—almost as great as the number that Bray recovered), the 222 recovered elements were nonetheless impressive. The irony of Bray's statement was that some of the elements that Bray did not find were being clandestinely gathered by Kerr (Willey et al. 1999), a matter presented in more detail later.

Table 1. Human elements recovered during the 1966 archeological excavations of the Sinkhole at Wilson's Creek Battlefield. (Modified from Bray 1967:24-25, table 2.)

Elements from Bray's Sinkhole	Number	Percentage
Skull (fragment)	1	0.5
Vertebrae	19	8.6
Costals (fragments)	20	9
Pevis (fragment)	1	0.5
Long bones (fragments)	19	8.6
Carpals and tarsals	33	14.9
Metacarpals, metatarsals and phalanges	128	57.6
Patella	1	0.5
Total	**222**	100.2

In addition to the fieldwork that did locate and recover human bones, other attempts were unsuccessful. During 1974 and 1975 additional archeological work was performed at WICR (Bray 1975). The purpose of this work included finding a second sinkhole and a well, both of which presumably acted as sepultures where corpses had been dropped following the battle. Hopes of locating a second sinkhole were foiled, although a well, presumed to contain human remains, was located and probed. No human remains, however, were found in that operation.

In addition to these formal collections of human bones, there were other, less official gatherings of fragments from the battlefield. At least two unofficial gatherings of human remains and artifacts were made and these two were later returned to the battlefield.

One set of clandestinely acquired remains was apparently gathered during the 1950s from a sinkhole or a well. The other remains were apparently gathered surreptitiously during or perhaps following Bray's 1966 Sinkhole archeological excavation (Willey et al. 1999).

The first unofficial source was a collection of bones apparently gathered during the 1950s from a sinkhole and/or a well. Documentation concerning this set of remains came from a letter dated October 9, 1995, written by Jim Thrasher of Manion's International Auction House, Kansas City, Kansas, and addressed to the Wilson (sic.) Creek Battlefield (Thrasher 1995). While dealing with a family "in the North West part of the country," Thrasher was told that the family's father hailed from Springfield, Missouri. While living in the Springfield area, the father "had picked up some things from the battlefield during the 1950s in the well or sink area" (Thrasher 1995).

The second unofficial source of remains was from Fleet Kerr of Springfield, Missouri, who apparently returned the remains to WICR in the early 1990s. According to

an inter-office memo dated September 8, 1992 and written by John M. Sutton (WICR Chief Ranger), Kerr said that during the 1967 (sic.) archeological excavations at the Sinkhole, Kerr visited the area after hours and gathered remains and artifacts from that location (Sutton 1992). Kerr kept the bones in a cheese box for "a couple of years" (Sutton 1992). Then he attempted to have the remains interred in the Springfield National Cemetery, but authorities there declined his offer. Later he gave the bones to WICR Historian Rick Hatcher. Sutton, citing statements of WICR Interpreter Gus Klapp, said that the archeological crew sifted the fill through screen which had a large mesh and allowed many of the smaller bone fragments to pass through (Sutton 1992). Presumably some of the elements Kerr collected were these elements that had passed through the screen. In addition, Kerr apparently removed bones from the Sinkhole itself, digging where the archaeologists had not dug (Sutton 1992).

Both the Kerr collection and those bones returned by Manion's Auction have been analyzed and reported (Willey et al. 1999). The conclusions of that report can be summarized by quoting its abstract (Willey et al 1999:2).

> *In many ways the two collections are typical of remains left behind following a nineteenth century battlefield exhumation. Together the collections had 237 bones or bone fragments, representing a minimum number of six individuals. The collections consisted mostly of smaller elements and small fragments. The elements displayed postmortem exposure, erosion of the bone surface, and fragmentation. What little could be determined concerning the biological parameters of the individuals indicated ages representing at least an older adolescent, a young adult and a middle-aged adult. The race of at least one individual was probably White. Indications of diseases were most frequent in the teeth, especially as indicated by carious lesions. Possible perimortem injuries included a split molar and a probable metal fragment, most likely from a gunshot wound. Cultural modifications indicated use of tobacco and consumption of somewhat gritty foods. These conclusions are all in keeping with what would be expected of a Civil War military sample. Further, the elements are consistent with those portions which were most likely to have been omitted and left behind during the exhumation attempts of the late 1860s and the archeological excavations of the 1960s.*
>
> *On the other hand, there were some unexpected results. It is possible that one of the individuals was a female—or perhaps a small male or subadult. The skeletal stature estimations were shorter than the Union enlistment average, and there was also the possibility that one non-White casualty was represented.*

In addition to the human bones, this collection also contained several artifacts, including two buttons and a lead shot. The two metal buttons (a General Service button and a composition brass button) appeared identical to buttons described and illustrated by Robert Bray in his 1967 report of archeological investigations at Wilson's Creek. A piece of lead shot also appeared to be the same as that illustrated by Bray. Scott (1999) described these artifacts.

WILSON'S CREEK NATIONAL BATTLEFIELD

During preparation of the Wilson's Creek National Battlefield Archeological Overview and Assessment (Scott 2000), an objective of that research was devoted to finding the location of artifact collections. A portion of that research entailed determining the disposition of the human remains collected by Bray in 1966 from the Sinkhole (23GR234). All other archeological material collected by Bray reside at the Midwest Archeological Center (MWAC).

The MWAC holdings were reviewed and no collections from 23GR234 were held at MWAC. The University of Missouri Museum and Center for Archeological Research collections manager (Luella Speakman Parks) was contacted to determine if the collections were in Columbia. Their records indicated that all Wilson's Creek collections were forwarded to MWAC, and no material from site 23GR234 remained in their hands. On February 28, 2002, however, University Museum personnel contacted Midwest Region Ethnographer Michelle Watson to inform her that human remains from the Sinkhole had recently been located in the museum's collections. Those remains were forwarded to Wilson's Creek for final disposition in the Springfield National Cemetery. Before reburial, the remains were sent to Willey, Tyree and Cavales of Chico State to determine age, race, sex and stature, and to document the extent and nature of any pathologies, anomalies and trauma. While sorting the remains, they found a few artifacts. These artifacts appeared to be the same group of those materials as found in the Sinkhole by Robert Bray in 1966 and briefly described by him in his report (Bray 1967).

Materials and Administrative Procedures

As mentioned above, for many years it was uncertain where the artifacts and bones from Bray's 1966 excavation of the Sinkhole were located. It was thought that the remains had been buried in the Springfield National Cemetery, although a search of the cemetery records failed to find any records of that event (Slaughter 1999). As an alternative, it was thought that the materials had been moved to and were being curated at the University of Missouri, Columbia, where Bray was a faculty member. Following Bray's death, an inquiry to the Anthropology Museum, University of Missouri, Columbia, stimulated a search and discovery of the Wilson's Creek materials. They were being curated there and were transferred to WICR.

A purchase order was negotiated between the National Park Service and Willey (Willey et al. 2003). The human bones were sent from WICR and arrived in Chico, California, on July 31, 2002, accompanied by related written documentation. Willey inspected the package that day and acknowledged its receipt via an electronic message to Connie Slaughter Langum with a copy sent to Scott.

In the package, there were ten Ziplock bags containing both bone elements and vials, and there were three loose vials. Five of the bags contained bones and bone fragments and a few artifacts. One of those five bags had a label indicating a questionable association with the Sinkhole or even WICR, for that matter. The bags were numbered 1 through

5. The other five bags and the three loose vials contained artifacts. The artifacts were submitted to Scott, who analyzed and described them. During August 2002, Willey, Tyree and Cavales identified, examined, photographed and x-rayed the bones. Analysis and write up continued through November 2002.

One major separation of the bones occurred during analysis. As mentioned earlier, one of the five bags containing human remains (WICR Bag 2) might not have been from the Wilson's Creek Sinkhole. The WICR Bag 2 label read "WICR-2 23GR234 Wilson Creek WICR Sinkhole Fragments found in box with 23HI208 but they don't belong. Also… metal pcs. found are historic." It was difficult to judge the probability that the materials in this bag were affiliated with the Wilson's Creek Sinkhole, so the WICR Bag 2 materials were analyzed and are presented separately from WICR Bags 1, 3-5 until their association could be assessed.

Methods

The methods employed in analyzing the human bones were standard, macroscopic ones. They followed those of earlier analyses of another battle-related skeletal series (Willey 1997), supplemented with additional observations recommended by a committee concerned with making skeletal analyses uniform following the federal reburial mandate (Buikstra and Ubelaker 1994). Considering that the present collection tended to have the smaller elements, however, additional alternate techniques were employed. More exactly, the methods followed those employed in studying the Kerr-Glidwell and Manion's Auction collections also attributed to the Wilson's Creek Battlefield (Willey et al. 1999). As in that examination, no destructive techniques—such as trace element or osteon analyses--were employed on the elements.

The human remains required some modifications by the researchers before the analysis could proceed. All bones were free of soft tissue and a few were relatively free of dirt. Most elements, however, were covered with some dirt and required a little cleaning before examination. To minimize modifications to the bones themselves, the dirt was brushed away with a toothbrush, but even after cleaning, some small details may have still been obscured by remaining dirt, making observations difficult. Critical elements and anatomical locations were washed with water, as well as brushed.

The initial examination identified the elements present in each Ziplock bag. They were also separated by element sides and completeness. Contiguous fragments of the same element were glued together and counted as a single element. However, those fragments which could not be matched were counted as separate elements for the purposes of this inventory. Thus, the element count may reflect a "maximum" number of elements, because two fragments which could not be matched could possibly be from the same bone with a intervening missing section. We believe, although admittedly subjectively, that counting fragments of the same element twice in such a fashion was uncommon and that the element counts are relatively accurate.

There was an additional issue mentioned above that requires elaboration. One of the five ziplock bags, WICR Bag 2, may or may not have belonged with the other WICR materials. On the one hand, the total number of elements from all five Ziplock bags (total n = 216) was close to the number reported by Bray (1967:24-25, table 2; n = 222); the number of elements excluding the second Ziplock bag (n = 198) was different from that reported by Bray. On the other hand, the kinds of elements in Bag 2 were not in keeping with those reported by Bray, as will be demonstrated below. Based on these differences in types of elements and the uncertainty of the second bag's provenience, the materials in the second Ziplock bag were presented separately from those of WICR Bags 1, 3-5.

The skeletal inventory was organized by anatomical regions (axial skeleton, pectoral limb and pectoral girdle, and pelvic girdle and pelvic limb), and further subdivided by element and side of element (left and right). The identifications were tabularized and summarized (see Appendix A). Elements that were too fragmentary to determine side were placed in the columns marked "Side?" Elements that were on the midsagittal plane and lacked sides (such as the vertebrae), or elements that were too fragmentary for an exact identification (such as a specific metatarsal), or had sides which were difficult to determine (such as the hand and foot phalanges) were excluded from the side columns; they were included in the column totals only.

The minimum number of individuals was the fewest number of individuals possible based on the elements present. Because there were few and scanty remains and based on the presumed homogenous nature of the individuals (young adult White males), no attempt was made to sub-divide the sample by sex, age, race or size, at least at this preliminary stage of the analysis. The element inventory and the minimum number of individual determinations were done to assess how many individuals were represented by the bones and to establish the foundation for the rest of the analyses.

Alterations and modifications to the elements caused by postmortem (taphonomic) processes were identified. The remains were examined for indications of burial, exposure, weathering, animal and plant modifications, handling, cutting, burning, and perimortem alterations.

Age at death was estimated with a variety of methods. The maxillary sutures were examined for closure (Mann et al. 1991). Epiphyseal union of the vertebral rings (Albert and Maples 1995) and short and long bone epiphyses (Flecker 1932-33) were examined for fusion. Degenerative joint disease, especially osteophytosis (Stewart 1958), was assessed. Other standard age estimation techniques--such as cranial vault suture closure, dental attrition or development, and pubic symphysis or auricular surface morphologies—were not applied because those elements or element portions were absent from this collection.

Sex was determined using cranial observations and discriminant functions. Mastoid size was macroscopically assessed (Bass 1987), and mastoid length was metrically appraised in FORDISC (Ousley and Jantz 1996). Metacarpal measurements were employed

in discriminant functions to determine sex (Falsetti 1995, Scheuer and Elkington 1993), as were tarsal (Steele 1976) and metatarsal measurements (Robbling and Ubelaker 1997). Other standard and more accurate methods of estimating sex, such as pelvic morphology and articular surface size, were not applied because the required elements were not present in these WICR materials.

Stature was estimated. Lacking complete long limb bones in the collections, metacarpal and metatarsal lengths were employed. The metacarpal formulae of Meadows and Jantz (1992:151, table 4) from the Terry Collection's White males and the metatarsal formulae of Byers et al. (1989:277, table 1) for Euro-American males were used.

The bones were examined for indications of diseases and injuries. The examination was visual, supplemented by x-rays. In particular, the bones and the x-rays were examined for old, healed fractures, metal fragments suggesting gunshot wounds, the presence of infectious lesions, and other indications of antemortem disease.

Also, the bones were examined for evidence of cultural modifications. The metatarsals and tali were examined for evidence of kneeling and squatting.

In addition to the basic descriptions of elements and biological parameters, comparisons of the present inventory with other inventories and other series were also made. The present study's element counts were compared with the counts derived by Bray for the same Sinkhole series (Bray 1967: 24-25, table 2). To compare the types of elements in the present study with those previously reported by Bray, some analytical combinations of elements were required. In Bray's categories, metacarpals, metatarsals and phalanges were grouped together, and a total for all of those elements combined was presented. Bray's categories also combined all carpals and tarsals. Humeri, radii, ulnae, femora, tibiae and fibulae were grouped together in this report, and they are presented here as "long bones." Pelves and crania also have been grouped together to achieve adequate sample sizes for these categories for statistical analysis. A chi-square test was used to compare Bray's inventory and the present one.

Besides comparisons with Bray's counts, there were other elements that have been attributed to Wilson's Creek and have been reported. Those were the previously mentioned Kerr-Glidwell and Manion's Auction collections. The analysis of those materials included element count summaries (Willey et al. 1999:21, table 5). A chi-square test was used to compare the element inventory of the Kerr-Glidwell and Manion's Auction collections with the present one.

In addition to these two intra-site comparisons, the element counts in the present study were compared with those from the Battle of the Little Bighorn. The Little Bighorn specimens employed in this comparison are those from the marker locations that were excavated by Scott et al. in the 1980s. For comparison, the present elements were combined according to the categories used by Scott et al. (1998:232-233, table 29) in their presentation

of Little Bighorn elements. In their tabular summary, any number of skull fragments were counted as one if they were from same geographical location, however many there might be; and wrist-hand and ankle-foot elements were combined and presented as a total. After making similar adjustments to the present WICR count for comparisons, a chi-square test was used to compare the present collection with the Little Bighorn remains.

Comparisons of stature estimations employed a t-test.

Results and Interpretations

Artifacts

The artifacts described below were the items recovered by Bray and mentioned in his report (Bray 1967). Some of the items were illustrated by Bray and there is no question that these artifacts were one and the same as described by Bray.

Metal Cable Clamps

Two pressed iron cable clamps were in a plastic tube labeled "WICR Sinkhole, 66-4." They were found in a bag labeled 23HI208. The clamps were 1 ¾ inches long and ½ inch high with a cutout in the center of each clamp. There were traces of red paint adhering to both clamps. These items were undoubtedly 20th century in origin.

Bucket Fragments

Two stamped iron bucket bail ears were in a plastic bag labeled "Wilson's Creek, WICR Sinkhole, Inv. 17610, 23GR234." The bail ears were 2 inches long and were once riveted to the bucket. Remnants of tinning were evident on both ears.

A 4 ¼ inch long piece of folded iron with a length of iron wire inside was also in the bag and likely was a fragment of a rolled bucket rim reinforce.

Animal Trap Pan or Bait Platform

Another item in the plastic bag labeled "Wilson's Creek, WICR Sinkhole, Inv. 17610, 23GR234" is a 1 ½ inch diameter iron circle with a cutout letter **V** in the center. This piece is technically called a pan, but is also referred to as a bait platform/trigger for a steel animal trap. It was manufactured by the Victor Trap Company in the early 20th century.

Miscellaneous Iron

Included in the plastic bag labeled "Wilson's Creek, WICR Sinkhole, Inv. 17610, 23GR234" were four pieces of iron of undetermined origin. Three pieces were thin tinned iron, consistent in thickness with the body of a tin can. The other piece was a heavier gauge

iron that was also tinned and had one edge folded over. It was 2 inches long and 1 ½ inches wide. Its origin was undetermined.

One other piece of iron was in a plastic tube labeled "WICR Sinkhole 66-4, WICR 11." It was a folded iron piece about 5 inches long, similar, although heavier in construction, to a bucket rim reinforce. It may be a cable protector from some type of farm machinery.

Expedient Canister Shot

One piece of a ¾ inch diameter iron rod was in a plastic tube labeled "WICR Sinkhole, 66-4, 23GR234." The rod was about 1-inch long and exhibited hot cutting marks on both ends. This piece was an expedient canister shot probably fired into a Federal soldier by the Missouri State Guard's gun batteries during the Battle of Wilson's Creek. Bray (1967) also identified the piece in his report.

Cloth Fragment

A single piece of cloth was in a plastic tube labeled "WICR Sinkhole, 66-5, 23GR234, WICR 12." The fragment was about ¾ inch long and 3/8 inch wide. It was a moderately fine woven cloth, probably cotton, and possibly of shirt weight.

Glass Bottle Fragments

Three glass bottlenecks and finishes were in the Sinkhole collection. Each had a paper tag wired to the neck. An amber/brown oil or ring finish and neck section was labeled "WICR Sinkhole 66-1." The finish was molded and hand finished. A clear glass brandy finish, neck, and shoulder fragment was labeled "WICR Sinkhole 66-1." It too was molded with a hand-finished lip. The final finish was a clear prescription finish with neck and a fragment of shoulder. The bottle was molded but the finish appears to be hand applied. This piece was also labeled "WICR Sinkhole 66-1." The oil and brandy finished pieces likely date to the late 19th century, although the prescription finish could date to the mid-19th century.

There are nine other glass fragments that were in a plastic bag labeled "WICR-6, 23GR234, Inv. 17619, WICR Sinkhole, 66-1." Two fragments were dark green wine bottle fragments from the shoulder and body of a bottle. There was one pressed glass bowl fragment, which was clear with a tendril and grape motif in relief on the exterior. A prescription-type bottle base and body fragment was also present. It had opalized and was a lavender color, but was probably originally clear. The remaining body fragment has the letters **SOURI** in relief. This is probably part of the word Missouri. A clear glass fragment also had partial letters in relief. The letters were **OM** and parts of two others that probably were a P and an A, thus the word may have been COMPANY. It was possible that this fragment was from the same bottle as the opalized piece. It may have been a patent medicine bottle from a Missouri-based company. The diagnostic features on these

glass fragments do not avail themselves for dating beyond noting that they could be late nineteenth century to early twentieth century in date.

The other five fragments were part of a single piece of clear glass from a bottle panel and was embossed with the word **Kirby's**. This may have been part of a Kirby's Magic Cholera Drops bottle. Kirby was making patent medicine in Birmingham, Connecticut, as early as 1853 (Baldwin 1973:294). This may have been a Civil War period bottle fragment(s).

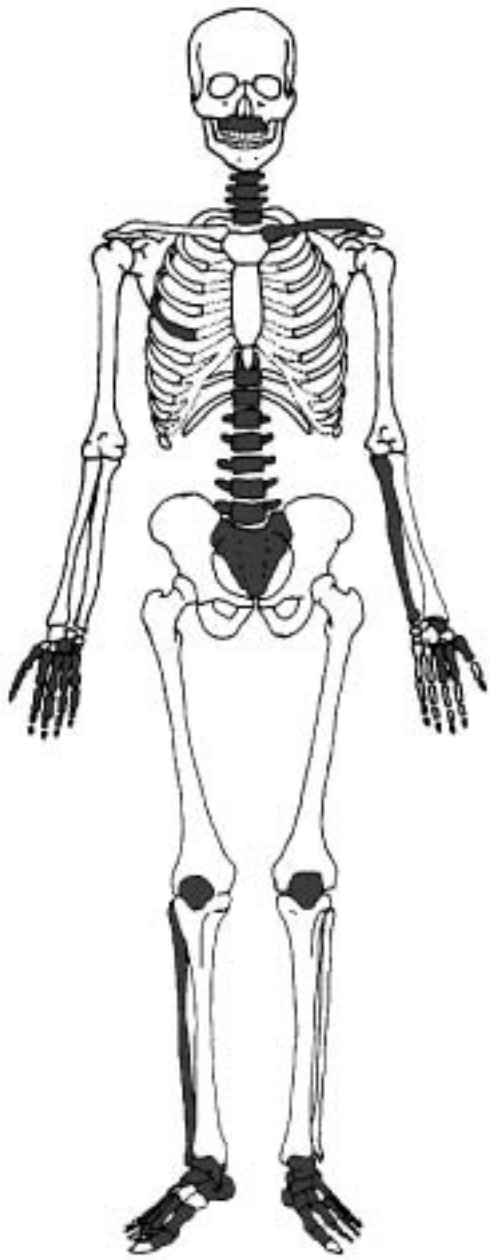

Figure 1. Schematic illustration of elements in WICR Bags 1, 3-5. Shaded elements indicate at least a portion of that element was present. Ribs and some vertebrae are representatively depicted.

Skeletal Inventory

WICR 1, 3-5

The present collection consisted of 198 human elements and element fragments (Fig. 1; Appendix A, Willey et al. 2003). In addition to the human bones, there were 14 non-human bones from a large mammal or mammals. These non-human bones were excluded from the count of 198 human elements and from further consideration in this report.

The human elements represented most of the major anatomical regions. They included elements and fragments from the cranium, postcranial axial skeleton (vertebrae, ribs, and sacrum), pectoral girdle (clavicle), pectoral limb (ulna, and some carpals, metacarpals and hand phalanges), and pelvic limb (patellae, fibula, and some tarsals, metatarsals and foot phalanges). Many major bones were absent, including the mandible, sternum, scapula, humerus, radius, femur and tibia, as well as many other smaller elements from the wrist-hand, the ankle-foot and the teeth.

The elements present were generally small. The largest one (a right fibula shaft fragment) was only 97 mm long. Most of the larger elements were between 30 mm and 70 mm in length.

There appeared to be no selection of the elements by side. There was nearly an even number of left elements (n = 44) and right elements (n = 43) present.

No set or combination of elements was distinguishable as being from a single individual. It is possible, then, that each fragment may have potentially represented different portions of a single individual, except those few elements that were duplicated.

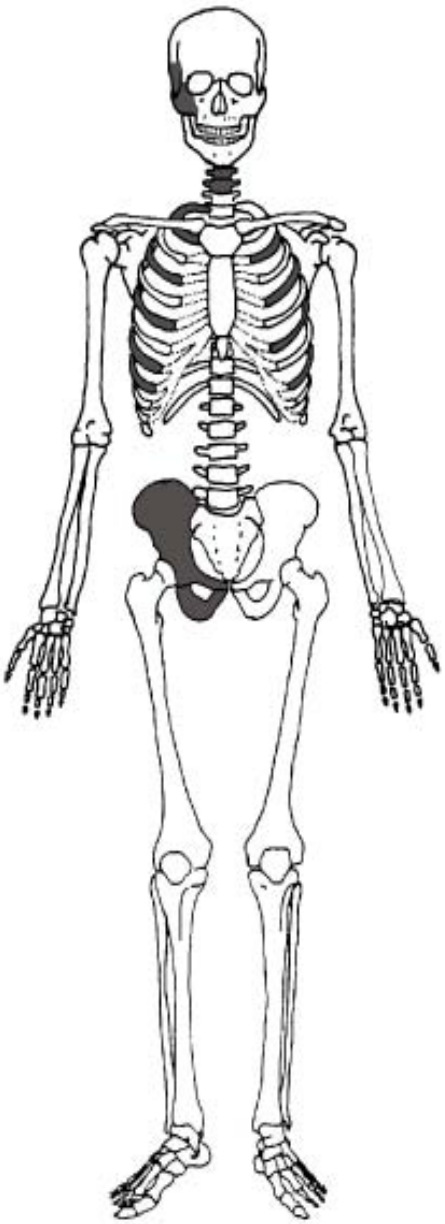

Figure 2. Schematic illustration of elements in WICR Bag 2. Shaded elements indicate at least a portion of that element was present. Ribs and some vertebrae are representatively depicted.

The greatest number of duplicated elements was seven right metacarpal IIIs and seven left calcanea, indicating at least seven individuals present in the collection. This number of duplicated elements was followed by six left metatarsal Is, six right metatarsal Vs, five right metatarsal IIs, and four left tali. There were many other duplicated elements represented by two or three of the same elements.

WICR 2

This collection consisted of 20 human elements and element fragments (Fig. 2; Appendix A, Willey et al. 2003). Two non-human elements were also included in this sample and were excluded from further consideration in this report.

The human elements represented only a few major anatomical regions. They included elements and fragments from the cranium, postcranial axial skeleton (vertebrae and ribs), pelvic girdle (innominate), and pelvic limb (fibula). Most of the major bones were absent, including major elements of the axial skeleton (teeth, mandible, sternum and sacrum), all elements of the pectoral girdle and limb and those of the ankle-foot, and nearly all of the other long bones.

The elements present were generally small with the largest one—a nearly complete

temporal—measuring 95 mm long. Most of the larger elements were between 40 mm and 70 mm in length.

Similar to the WICR 1, 3-5 materials, this sample did not contain any combination of elements that could be identified as being from a single individual. On the other hand, each fragment may actually represent different portions of a single individual.

No duplicated elements were observed in this sample. Therefore, the MNI for these materials is one.

Taphonomy

WICR 1, 3-5

The elements displayed many postmortem changes. Nearly all of the elements had dirt adhering to them and were a tan or brown color. These modifications suggested that the elements had been in contact with soil and had not been cleaned before our analysis. A few of the elements, on the other hand, had little dirt, suggesting that they were exposed on the ground surface of the Sinkhole or had been thoroughly cleaned following recovery.

A few elements (by count 2% or less) displayed bleaching. This bleaching was consistent with exposure to sunlight.

Many of the elements were fragmented, some from old pressures, as indicated by old breaks. Many of the breaks, however, were recent. Nearly all of the elements displayed at least some erosion and exfoliation of the cortical surfaces. No indications of root etching were observed, although bone surface alterations may have obscured this modification. Possible rodent chewing was observed on one human and one non-human element.

Several elements displayed recent small cuts or incisions on their surfaces. These modifications were probably caused by cutting, perhaps by a shovel or other digging tool.

If this interpretation is correct, then it indicates that at least some of the elements were excavated in a haphazard manner.

WICR 2

The material from this sample was largely dirt-covered with many old and new breaks. Most of the elements displayed some cortical erosion, exfoliation and fragment loss. No root etching was observed; one element showed evidence of possible rodent chewing.

One human fragment deserves further mention. A right temporal displayed a large deep linear mark on the superior portion of the mastoid process (Fig. 3A), a defect most likely caused by a shovel during excavation. There was also a large fracture that traveled

through the petrous portion to the external auditory meatus and ended near the superior-anterior portion of the mastoid process. This fracture may have resulted from the contact between the shovel and the bone. However, it is possible that the fracture was created from perimortem trauma to this area of the skull.

Figure 3. Right temporal with linear defect. A. Lateral view. Arrow indicates recent linear defect. B. Superior view. Arrow indicates recent damage. WICR Bag 2.

Age at Death

WICR 1, 3-5

Age at death, by necessity, was assessed on an element-by-element basis. Had multiple bones been attributable to the same individual, age estimation of that individual could have employed multiple approaches. The bones indicated that at least two young adults and a middle-aged adult were present.

Nearly all epiphyses present were completely united. All of the long and short bones had united epiphyses; none were un-united. An exception to complete union was a superior epiphyseal ring of a lumbar vertebra. Union was in the middle phase (early-mid Stage 2), indicating an age interval of 17 to 26 years (Albert and Maples 1995:632, table 5, male standard).

In addition, the fragmentary maxilla provided another opportunity for age estimation. The incisive suture was closed on the palatal (inferior) surface, but partially open on the nasal passage (superior) surface. The anterior median suture was open. These observations suggested a young or middle-aged adult.

The odontoid process of a second cervical vertebra had osteoarthritis (Fig. 4). Although this development may represent a pathological process, it was more likely that

Figure 4. Second cervical vertebra's odontoid process. Arrow indicates location of osteoarthritis. Anterior surface. WICR Bag 2.

the defect is at least partially age-related. It suggested a person who was a middle-aged or older adult.

WICR 2

All of the epiphyses were united, consistent with adult. No additional, more age-sensitive anatomical features were present.

Sex

WICR 1, 3-5

Sex was based on discriminant functions of eight metacarpals (metatarsals II-IV), one calcaneus, four tali, and two metatarsals (both metatarsal Is). Nearly all elements (13 of 15 identifications) were classified as male with the exception of one left talus and one left metatarsal I, which were identified as female (Table 2).

WICR 2

The mastoid process of the temporal bone was large, measuring 32.5 mm. Based on a FORDISC 2.0 discriminant function, the mastoid was classified as male. The posterior probability was 0.68 and the typicality probability was 0.993. This discriminant function correctly identified the sex of 72.1% of base samples used to establish the function.

Table 2. Sex determinations of WICR Bags 1, 3-5 elements.

Element	Discriminant function score	Sex
Left metacarpal II	59.65	Male
Right metacarpal II	51.77	Male
Right metacarpal II	54.02	Male
Left metacarpal III	1.26	Male
Right metacarpal III	1.71	Male
Right metacarpal III	1.26	Male
Right metacarpal III	0.95	Male
Right metacarpal IV	35.83	Male
Left calcaneus	33.65	Male
Left talus	53.44	Male

Table 2. Concluded.

Element	Discriminant function score	Sex
Left talus	51.29	Male
Left talus	46.62	Female
Left metatarsal I	170.56	Female
Left metatarsal I	226.06	Male

Ancestry

WICR 1, 3-5

None of the WICR Bags 1, 3-5 materials were suitable for assessing ancestry.

WICR 2

None of the WICR 2 material was suitable for determining ancestry.

Stature

WICR 1, 3-5

Stature was estimated from 13 metacarpals and 10 metatarsals—a total of 23 estimations (Table 3). The statures (Fig. 5) varied from the shortest of 158.12 cm (62.25 in) to the tallest of 177.27 cm (69.65 in). The mean of these 23 stature estimations was 169.08 cm (66.57 in).

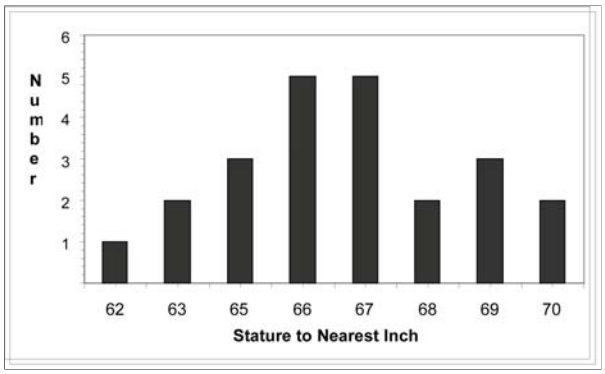

Figure 5. Distribution of stature estimations of WICR 1, 3-5 from metacarpal and metatarsal lengths. The stature estimations have been rounded to the nearest whole inch for display purposes.

WICR 2

None of the WICR 2 material was suitable for determining stature.

Diseases and Injuries

WICR 1, 3-5

The specimens were free of indications of major diseases, although there were indications of relatively minor ailments. There were a few laminal spurs on the superior and inferior articular facets, one vertebra displayed ossified ligamentum flava (Fig. 6), and the body of a thoracic vertebra had Schmorl's nodes on the superior and inferior (Fig. 7) surfaces. There was also an extension of the posterior lateral tubercle of a left talus, which was probably a

congenital variant. Another probable congenital alteration was a depression in the middle of the proximal articular surface of a proximal foot phalanx (Fig. 8).

Table 3. Stature estimations based on metacarpals and metatarsals from WICR Bags 1, 3-5.

Element	Stature in centimeters	Stature in inches
Left metacarpal I	176.39	69.44
Left metacarpal I	169.45	66.71
Right metacarpal I	168.73	66.43
Right metacarpal I	173.60	68.35
Left metacarpal II	164.90	64.92
Right metacarpal II	175.17	68.96
Right metacarpal II	177.27	69.79
Right metacarpal II	172.16	67.78
Left metacarpal III	171.04	67.34
Right metacarpal III	176.91	69.65
Right metacarpal III	170.15	66.99
Right metacarpal III	174.44	68.68
Right metacarpal IV	169.54	66.75
Left metatarsal I	166.94	65.72
Left metatarsal I	158.12	62.25
Left metatarsal I	165.42	65.13
Right metatarsal I	166.63	65.60
Right metatarsal II	168.61	66.38
Right metatarsal II	168.73	66.43
Right metatarsal II	170.76	67.23
Left metatarsal III	159.88	62.94
Left metatarsal IV	159.36	62.74
Left metatarsal V	164.58	64.80
Mean	169.08	66.57
Shortest	158.12	62.25
Tallest	177.27	69.65

Relatively few injuries were observed among these specimens. One element (a metatarsal V) had a small incision in the proximal end (Fig. 9); the linear defect was in the process of healing at the time of death. A right metatarsal II had a possible antemortem healed fracture; there was a small exostosis on the plantar midshaft of the bone. If this exostosis was not caused by an old, well-healed fracture, it may have resulted from degenerative joint disease. In addition a metatarsal I had an extension of the distal articular surface on the plantar side (Fig. 10), suggesting focal degenerative joint disease or perhaps an old injury at that location.

Figure 6. Thoracic vertebra with ossified ligamentum flava (arrows). Posterior view. WICR Bag 5.

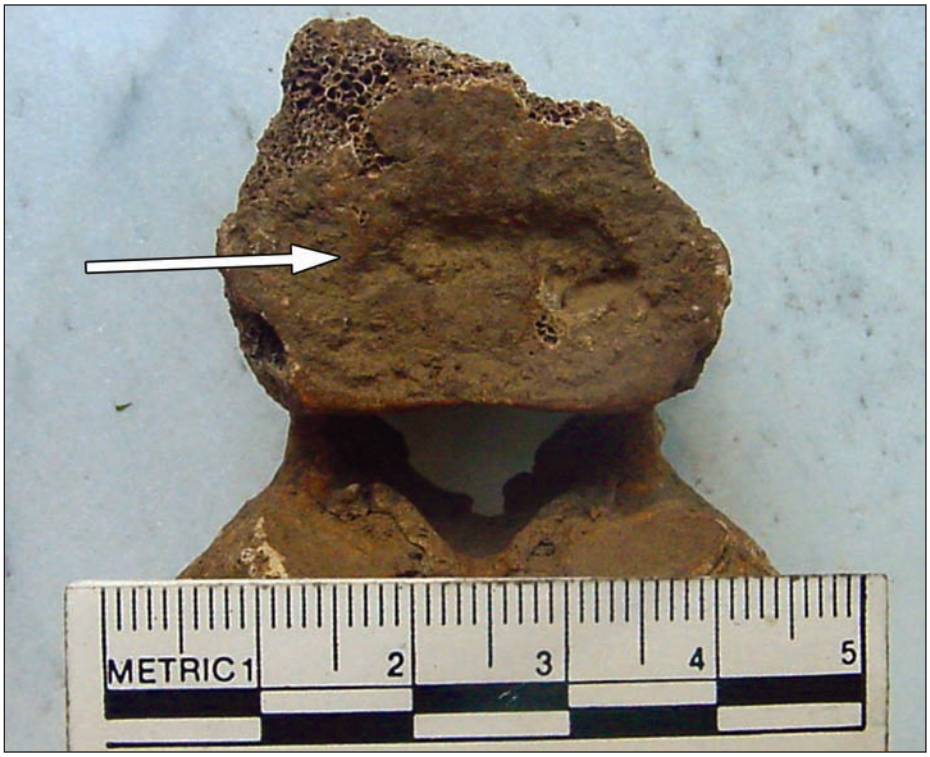

Figure 7. Thoracic vertebra body with depression indicating Schmorl nodes (arrow). Inferior view. WICR Bag 5.

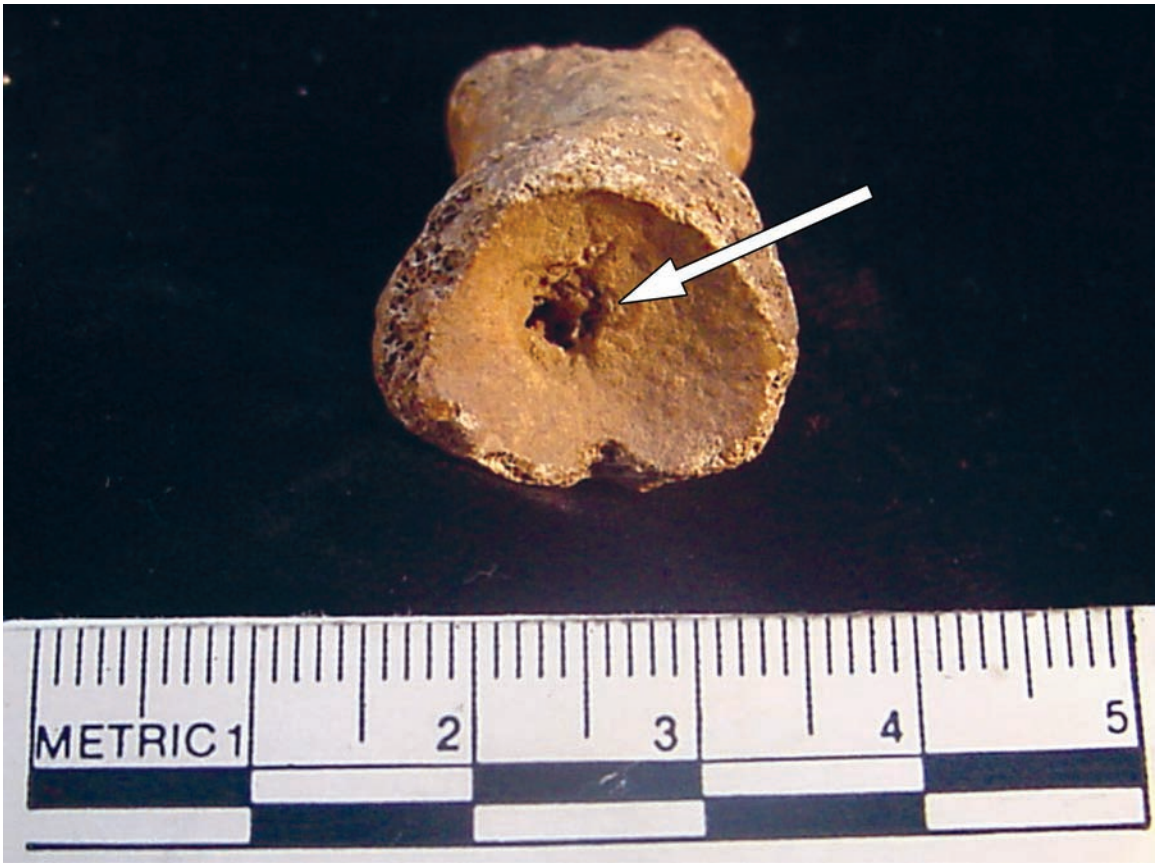

Figure 8. Proximal end of proximal foot phalanx with defect in articular surface (arrow). WICR Bag 4.

Figure 9. Metatarsal V with healing linear lesion near proximal end (arrow). WICR Bag 4.

Figure 10. Metatarsal I with bony exostosis on distal medial plantar surface (arrows). A. Medial view. B. Plantar view. WICR Bag 4.

There were radiopaque fragments in some of the bones, perhaps associated with the soldiers' violent deaths. Proceeding in a superior-to-inferior direction, there was a possible fragment in the distal shaft of a metacarpal II (WICR 4), a fragment in the shaft of a middle row hand phalanx (WICR 4), a possible fragment in a sacrum (WICR 1), a possible fragment in a left calcaneous (WICR 3), a fragment in a metatarsal I shaft (WICR 4), two fragments in a metatarsal V shaft (WICR 4), and two fragments in a different metatarsal V proximal shaft and midshaft (WICR 4). The radiopaque fragments were all small, the largest being less than 2 mm in maximum x-ray "shadow" length. These fragments were consistent with, although not exclusive to, small metal pieces embedded in the bones from gunshot wounds or artillery rounds.

WICR 2

A second cervical (axis) vertebra displayed osteoarthritis on the superior-anterior portion of the odontoid process (Fig. 4). Such changes may be normal, age-related changes or a form of degenerative joint disease.

There were no other indications of disease or injuries in the WICR Bag 2 sample. There were no radiopaque fragments in the bones.

Antemortem Cultural and Behavioral Alterations

WICR 1, 3-5

There was possible evidence of kneeling; a right metatarsal II had a possible kneeling facet on the superior distal surface. In addition to this metatarsal, a left metatarsal I and a left metatarsal V had articular facets near the heads on the lateral surfaces, possibly from contact with the head of the adjacent metatarsal or possibly a subluxed phalanx. There were no other indications of antemortem cultural or behavioral alterations.

WICR 2

There was no evidence of antemortem cultural and behavioral alterations.

Non-Human Elements

WICR 1, 3-5

Fourteen non-human elements were included with the human bones from this sample. They were from a large mammal and appear comparable in weathering to the human elements. None of the chicken or small mammal bones identified by Bray (1967:25, table 2) were present in the WICR 1, 3-5 bags or the WICR 2 bag.

WICR 2

Two non-human elements were included in this sample. They were both from a large mammal and were in similar condition as the human elements from this accession.

Discussion and Comparisons

This discussion follows the same sequence of the topics as presented in the previous section of this report. First, the element inventory is considered with comparisons of the present materials with those of other collections from Wilson's Creek and those from the Little Bighorn Battlefield. Then MNI, taphonomy, age, sex, ancestry, stature, diseases and injuries, and finally cultural modifications are discussed.

Elements

The element inventory is presented in order of anatomical location, and then compared with Bray's element counts for the Wilson's Creek Sinkhole materials, the combined Kerr-Gildwell and Manion's Auction collections from Wilson's Creek, and elements gathered from the Little Bighorn Battlefield.

The bones in the present collection were mostly the smaller, more distal elements and a few fragments of the larger, more proximal elements (Figs. 1 and 2). No large elements—or at least no large segment of large elements—were present. In addition, most elements were from the distal portions of the body and fewer elements were from the proximal portions. The smaller, more distal elements tended to be less frequently represented than the larger, more proximal ones. This observation suggested that the smallest, most distal bones were overlooked in the Sinkhole, both during the exhumation of 1867 as well as Bray's 1966 archaeological excavations. So the most distal, smallest elements—such as the phalanges—probably still remain in the Sinkhole or the area where the Sinkhole fill was moved.

The recovery of these smaller, <u>more</u> distal elements (in contrast with the missing <u>most</u> distal elements), suggested some of the "filters" that the skeletons experienced. Most of the larger, more readily found and identifiable elements were probably gathered during the major 1867 exhumation and/or during the activities of the curio and relic seekers. Those elements that were found and removed probably tended to be the skulls, limb bones, and most of the bones of the torso. The parts left behind apparently tended to be the smaller, more numerous, more distal elements. These left-behind elements were probably more difficult to locate, and if found, more difficult to identify as human and of less interest than the larger bones. The left-behind elements included the bones of the wrist-hand and ankle-foot, the vertebrae and ribs, as well as the fragments of larger elements.

The next section involves intra- and inter-site comparisons. Comparisons of element inventories begin with the remains in the collection, proceeds to other collections from

Wilson's Creek, and concludes with comparisons of materials from another 19th century battle site.

The first set of comparisons was within the present collection to test for intra-sample variability and collection integrity. This step was important because the provenience for WICR Bags 1, 3-5 may differ from that of WICR Bag 2; recall that the WICR Bag 2 remains were found in a different box, included with materials from another site. When the WICR Bags 1, 3-5 human elements were compared by category with those of WICR Bag 2, there was a statistically significant difference (Appendix B, Table B-1; $X^2 = 32.071$, df = 3, $P < 0.000$). WICR Bag 2 is under-represented in vertebrae and over-represented in ribs and pelvis-skulls. It is possible that the two groups of elements (WICR Bags 1, 3-5 vs. WICR Bag 2) may have been collected from the same locality, but once collected, the elements may have been separated by types and bagged separately from one another.

The next comparison was between the present inventory (WICR Bags 1-5) and Bray's inventory of the Sinkhole materials. The number and the kinds of elements were compared. The grand total of the human elements in WICR Bags 1-5 (n = 218) was close to the number reported by Bray (n = 222). However, when all of the non-human elements in WICR Bags 1-5 were included in the count (n = 234), the similarity in numbers decreased.

In addition to the total number of elements reported, the kinds of human elements and their frequencies were compared. There was a statistically significant difference between the kinds of presumably human elements reported by Bray and the present inventory of human elements (Willey et al. 2003 Appendix B, Table B-2; $X^2 = 20.806$, df = 6, $P < 0.002$). Contributing the most to this difference was the WICR Bag 1-5 over-representation of vertebrae and the under-representation of long bone fragments (Fig. 11).

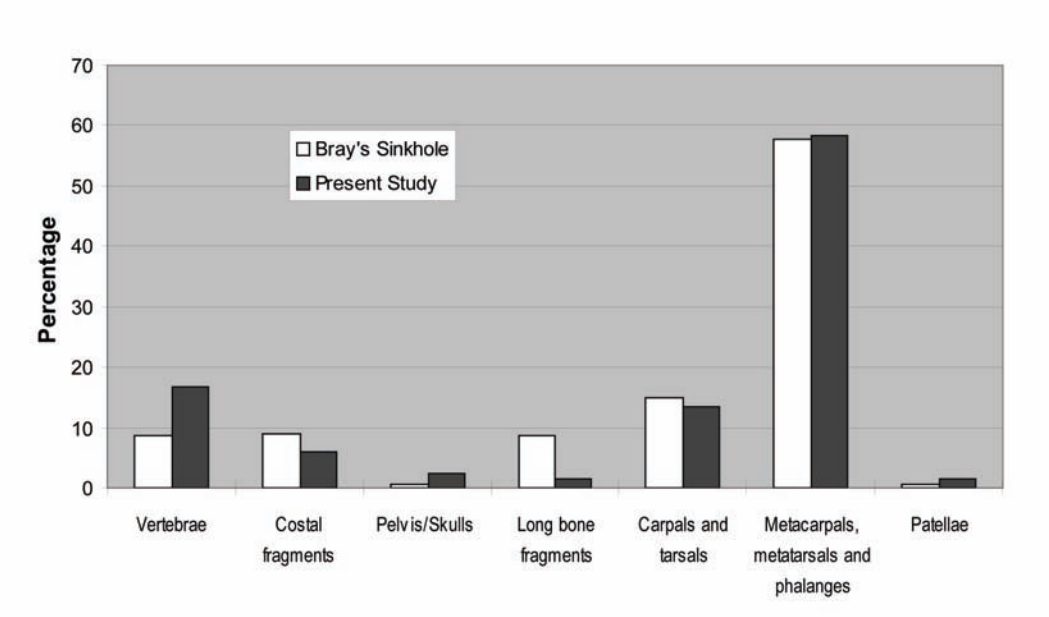

Figure 11. Comparison of the element percentages reported by Bray (1967) from the Wilson's Creek Sinkhole with those in the present study. Nonhuman elements were excluded from this comparison.

One possible explanation for this statistically significant difference is that Bray may have misidentified some of the nonhuman elements as human. To test this possibility, the nonhuman long bone fragments from WICR Bags 1-5 were added to the human element inventory; the nonhuman short and irregular bones from WICR Bags 1-5 were excluded. The total element count for WICR Bags 1-5 including the nonhuman limb bones and nonhuman rib (n = 223) was one element greater than the number Bray reported. This modified element inventory is not statistically different from Bray's inventory (Table 4; Willey et al. 2003, Appendix B, Table B-3; $X^2 = 10.499$, df = 6, $P < 0.105$).

Table 4. Comparison of element counts and percentages from Bray's (1967:24-25, table 2) Sinkhole inventory and those in the present study. This count excludes nonhuman elements from the present inventory.

Elements	**Bray's Sinkhole**		**Present Study**	
	Number	**Percentage**	**Number**	**Percentage**
Skull (fragment)	1	0.5	4	1.9
Vertebrae	19	8.6	36	16.9
Costals (fragments)	20	9	13	6.1
Pelvis (fragment)	1	0.5	1	0.5
Long bones (fragments)	19	8.6	3	1.4
Carpals and tarsals	33	14.9	29	13.6
Metacarpals, metatarsals and phalanges	128	57.6	124	58.2
Patellae	1	0.5	3	1.4
Total	**222**	**100.2**	**213**	**100.0**

To conclude this comparison between Bray's Sinkhole element inventory and the inventory of WICR Bags 1-5, comparing the total number and different kinds of elements statistically is a poor substitute for element-by-element identification comparisons. With the limited information available, however, it seems likely that Bray's Sinkhole inventory included all of the WICR Bags 1-5 and erroneously identified at least some of the nonhuman long bone fragments as human. This was a "best fit," but not an exact one. The subsequent comparisons employed element inventory of all of the WICR Bag inventories, excluding the nonhuman elements, of course.

The second skeletal series compared with the WICR Bags 1-5 inventory were those from the Kerr-Glidwell and Manion's series. As mentioned previously, those remains were claimed to have been surreptitiously removed from the Wilson's Creek Battlefield in the 1950s and 1960s, then returned to battlefield authorities years later. According to the accounts, at least some of the materials originated from the Sinkhole, the same as Bray's skeletal materials. The Kerr-Glidwell and Manion's series had previously been compared with Bray's inventory and demonstrated to have element distributions statistically different than his (Willey et al. 1999:20). When the Kerr-Glidwell and Manion's element inventory was compared with the WICR Bag 1-5 inventory, however, there was not a statistically

significant difference although it approached significance (see Willey et al. 2003, Appendix B, Table B- 4; $X^2 = 12.189$, df = 6, P > 0.058).

These results indicated that the Kerr-Glidwell and Manion's element distribution could not be statistically separated from the WICR Bags 1-5 distribution. However both the Kerr-Glidwell and Manion's, as well as the WICR Bags 1-5 series, differed at a statistically significant level from Bray's inventory (see Willey et al. 2003, Appendix B, Table B-5; $X^2 = 20.726$, df = 7, P > 0.004). This result indicated that element identification has a greater impact on interpretation than the manner that the elements were collected. This interpretation contrasts with the previous one promoted (Willey et al. 1999:21), which argued that differences in collection manner (Bray's official excavation vs. the Kerr-Glidwell and Manion's surreptitious gatherings) explained the differences in the element inventory of the two series. Element identification--the most basic step in every osteological analysis--is critically important to understanding the assemblages and the processes that affect them.

The final comparison was between the WICR Bag 1-5 inventory and another series from a 19th century battlefield. One of the best-known examples of burial, exhumation, and then excavation is the treatment of the human remains from the 1876 Battle of the Little Bighorn. In the years following the Battle of the Little Bighorn, there were several official attempts to exhume the trooper skeletons from the battlefield and rebury them in more desirable locations. Finally, the original battlefield burial locations were scoured in 1881 by a military fatigue party and the gathered remains were placed in a mass grave on Last Stand (Custer) Hill. Subsequently, the original grave locations were memorialized by markers placed at those scattered locations in 1890. Some of the areas surrounding those markers were excavated in the 1980s. In addition to those excavations, surface discoveries have been made near the markers in recent years. Those element recoveries have been summarized by Scott et al. (1998:232-233, table 29) and are presented in Fig. 12 and Table

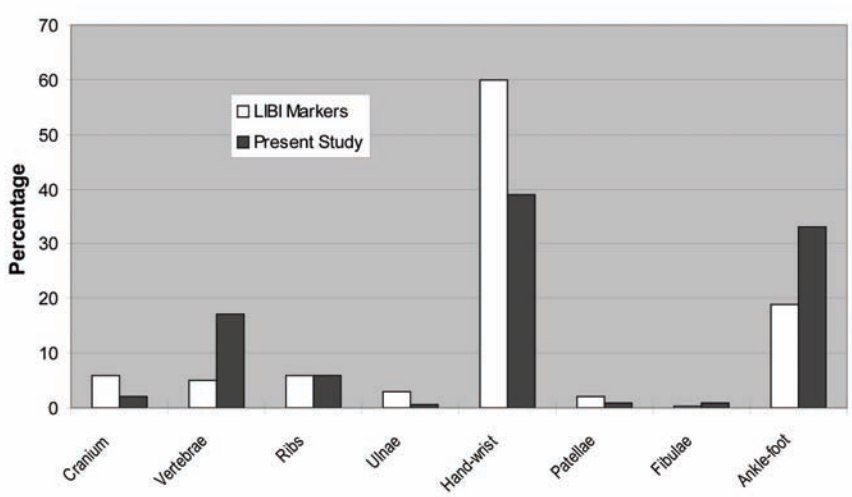

Figure 12. Comparison of selected element percentages reported from the Little Bighorn Battlefield markers (LIBI Markers; Scott et al. 1998) with those in the present study.

5. Note that for the purposes of this comparison, the mandibles, teeth, humeri, and radii inventories from the Little Bighorn Battlefield were omitted; these omissions made a more rigorous test of the differences between the inventories.

The Little Bighorn Battlefield element distribution was significantly different from the WICR Bag 1-5 materials (Willey et al. 2003, Appendix B, Table B-6; $X^2 = 49.0$, df = 7, $P < 0.000$). The greatest deviations from expected values were WICR Bag 1-5's over-representation of vertebrae and ankle-foot elements, and WICR Bag 1-5's under-representation of crania, ulnae and hand-wrist elements.

Table 5. Comparison of element counts from the Battle of the Little Bighorn markers (LIBI Markers) and those in the present study. The Little Bighorn count is the marker inventory modified from Scott et al. (1998).

Elements	**LIBI Markers**		**Present Study**	
	Number	**Percentage**	**Number**	**Percentage**
Cranium	17	5.7	4	1.9
Vertebrae	15	5.0	36	17.0
Ribs	17	5.7	13	6.1
Ulnae	10	3.3	1	0.5
Hand-wrist	180	59.6	83	39.2
Patellae	6	2.0	3	1.4
Fibulae	1	0.3	2	0.9
Ankle-foot	56	18.5	70	33.0
Total	**302**	**100.1**	**212**	**100.0**

There are two possible explanations for the differences between the elements from the Little Bighorn markers and the WICR Bags 1-5. The first explanation relates to the nature of the original burials and the people conducting the exhumations in the 19th century. The materials from Wilson's Creek all come from a single, small, delineated locality—a sinkhole. The graves at the Little Bighorn were mostly single and isolated, scattered across miles of prairie. Perhaps as importantly were the people doing the exhumations. The exhumers at Wilson's Creek were civilian contract workers who may have been paid by the "head." If this is true and they emphasized recovery of skulls and the other superior portions of the bodies, then the under-representation of superior elements among the WICR elements would be explained. The fatigue party performing the exhumations at the Little Bighorn Battlefield markers, on the other hand, presumably did not have such anatomical and monetary constraints on their work as the Wilson's Creek civilian contractors.

The second possible explanation for the element distribution is related to the archaeological recoveries of materials in the mid-late 1900s. The elements from the Little Bighorn were collected using the more contemporary, formal archeological methods of the 1980s, which probably resulted in the recovery of more of the smaller elements—including more of the wrist-hand bones that were under-represented in the WICR elements. Bray's Sinkhole excavation occurred in 1966, a time when even screening excavation fill was often not done.

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Leaving intersite comparisons and returning to the present elements from Wilson's Creek alone, there was the question of MNI. For the purposes of this assessment, it was assumed that Bags 1, 3-5 and Bag 2 were part of the same accession. Based on the seven right metacarpal IIIs as well as the seven left calcanea, the MNI was seven. This minimum number was small when contrasted to the number of Union dead—235 or 258 killed and more than 100 missing, with 30 of those individuals deposited in the Sinkhole (Anon. 1868, DeArmond 1985, Bearss 1975). In reality, of course, the actual number of soldiers represented by these present remains could have been much greater than this small MNI suggests.

Summing up our discussion in the previous report of the Kerr-Glidwell and Manion's remains, we wrote "A further complication is how or if Bray's material, had it been analyzed using the methods of the present study, would have altered this number [the MNI for the Kerr-Glidwell and Manion's element]. A systematic analysis of all of those materials from Wilson's Creek probably would have increased this MNI" (Willey et al. 1999:22). Instead of the Kerr-Glidwell and Manion's MNI of six, the WICR Bag 1-5 materials increased the MNI by one to seven—only a slight increase.

Taphonomy

Following the element inventory and MNI assessment, the elements were examined for evidence of postmortem processes. The soil coating the elements as well as the breaks and loss of cortical bone—the results of taphonomic processes themselves-- limited the assessment of other taphonomic processes.

Many of the elements displayed breaks. Some of the breaks were from old pressures, but many were from more recent forces. Some of the more recent forces were probably from damage that occurred during Bray's excavation. The right temporal with the linear defect near the mastoid that was mentioned previously is probably an example of excavation damage.

Although less frequent than bone breakage, there were two other forms of taphonomic alteration. Bleaching, consistent with exposure to sunlight, was present on a few elements, and possible rodent chewing was observed on several elements. No root etching or canid gnawing was observed. For the most part, these observations were consistent with similar observations for the Kerr-Glidwell and Manion's elements.

Age at Death

Considering the age at death of the WICR Bag 1-5 materials altogether, most of the major age indicators suggested young adults, although a middle or older adult may have been present. The presence of young adults was based on vertebral epiphyses and maxillary suture closure. These techniques should provide relatively reliable age estimations.

The evidence for the possible middle-aged or older adult (based on osteoarthritis of the odontoid process) was surprising. Some of the battle participants have been older than the average young-adult soldier. It is also possible that the remains were from a young adult who suffered from premature degenerative changes in the spine.

Sex

Relative to sex, the only bones suitable for sex determination were eight metacarpals, five tarsals, two metatarsals, and a mastoid length. All but two of these assessments indicated males; only a talus and a metatarsal were classified as female. Because we expected only males in the Wilson's Creek series, the female identifications were unexpected, although our earlier work (Willey et al. 1999:14) also suggested the possibility of a female being present.

There were a number of explanations for the female identifications among the WICR Bag 1-5 materials. The female identifications were based on talus and metatarsal measurements in discriminant functions. Considering the inaccuracy of the functions (generally 10-20 percent incorrect classification based on the original samples) and the probability of small body size among the Wilson's Creek male combatants, the accuracy of the female identification is questionable. A further complication was that both the talus and the metatarsal identified as female were from the left side of the body, which among males—at least among metacarpals--were smaller and thus more likely to be misclassified as a female than those from the right side (Lazenby 1993). So, it was likely that the remains identified as females actually were from small adult males.

As a further consideration, historians (e.g. Blanton and Cook 2002:207) have noted that the sex identity of women combatants was likely to be noted and documented if they were killed. The WICR bones analyzed in this report were all presumed to be battle casualties and there were no recorded female soldiers' deaths. One female soldier, however, was documented as being in the battle and being wounded then (Blanton and Cook 2002:10, 99). So, the historic documents fail to support the female skeletal identification.

On the other hand, the possibility of female casualties in the battle should be considered. If the identifications were correct and the tarsal and metatarsal really were from a female or females, then perhaps there were female casualties in the battle. An estimated 400 females served for the Union during the Civil War (Burgess 1994), and perhaps—remote as this likelihood may be—the individual from WICR was one of their sisters-in-arms.

Ancestry

None of the WICR Bag 1-5 materials were suitable for determining ancestry.

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Stature

In the absence of limb bones, stature was estimated using metacarpals (n = 13) and metatarsals (n = 10). Extremes in stature varied from the shortest of 158.12 cm (62.25 in) to the tallest of 177.27 cm (69.65 in). Not surprisingly, considering this interval, the mean was a relatively short 169.08 cm (66.57 in). This mean was nearly an inch less than the 67.4-inch mean for a large sample of Union Civil War recruits, draftees, and volunteers measured during life (Baxter 1875).

On the other hand, the WICR Bag 1-5 stature estimations were greater than the Kerr-Glidwell and Manion's stature estimations. Those seven estimations averaged 166.64 cm (65.61 in), more than an inch less than the WICR 1-5 mean. The stature difference, however, was not statistically significant (Willey et al. 2003, Appendix B, Table B-7; $t = 0.980$, $df = 28$, $P > 0.335$).

Several explanations for the specimens' short stature are possible. The short skeletal statures could accurately reflect the stature of the soldier casualties. Most of the battle casualties were probably from the enlisted ranks; they tended to be shorter than the officers. So, the short estimated stature of the battle casualties from these bones may be an accurate reflection of the soldiers' height.

On the other hand, it is possible that the skeletal stature estimations, based on bones of the extremities, may be inaccurate. The stature estimation formulae for metacarpals and metatarsals may tend to under-estimate their actual statures. As a possible explanation for this under-estimation, there may have been a secular change in metacarpal and metatarsal lengths relative to overall body height. Such secular changes have been found with limb-length-to-body-size proportional changes (e.g. Meadows and Jantz 1995). Similar secular trends for metacarpal and metatarsal lengths-to-stature relationships may have changed and thus distorted the stature estimations calculated in the present report.

This suggestion can be assessed indirectly using the stature estimations from the WICR materials. If the stature estimation techniques are true and unbiased, then the same stature should be estimated whatever the element employed in the estimation. There were two different standards used in estimating stature: namely, one for metacarpals and another for metatarsals. The estimations from those two sources can be compared, and when they are, a statistically significant difference existed between the two sets of estimations (Willey et al. 2003, Appendix B, Table B-8; $t = 4.372$, $df = 21$, $P < 0.000$). The formulae for the metacarpals (mean = 67.83 in) estimated taller statures than those for the metatarsals (mean = 64.922 in), a difference of nearly three inches. Although it is impossible from these data to determine which set of formulae provide more accurate stature estimations for the Wilson's Creek materials, it is noteworthy that the mean stature estimations based on metacarpals (mean = 67.83 in) is similar to the mean of a large sample of Union soldiers measured during the war (mean = 67.4 in).

Finally, there was an additional assumption involved with the method used in these stature estimations. Our overall stature mean assumed there were 23 individuals present, but this assumption may be wrong. The 23 bones employed could represent as few as three individuals; there are three right metacarpal IIs, three right metacarpal IIIs, three left metatarsal Is, and three right metatarsal IIs. At the other extreme, the 23 elements could represent as many as 23 individuals. Or it is possible that the actual number was between that upper extreme and three. So the averaging of stature estimations of these 23 bones may have been more of a statistical exercise than a modal reality. Because the actual number of individuals represented was unknown (at least three, perhaps as many as 23), the average stature presented here may have little reliability.

Diseases and Injuries

Few indications of disease and injuries were found on the bones. Most of the antemortem diseases involved the spine, suggesting intervertebral disk degeneration and other forms of spinal degenerative joint disease (DJD). A metatarsal also may have had DJD.

Besides indications of DJD, there were several possible injuries, mostly affecting bones of the ankle and foot. The possible healed fracture of a metatarsal and the exostosis on another metatarsal, whatever the actual causes, were lesions that occurred long before death. The possible presence of small metal fragments in some of the bones may have been an indication of these individuals' battle-related deaths. Radiopaque fragments are usually associated with gunshot wounds in current clinical practice, but the possibility of other metal debris associated with the battle or the burial environment cannot be excluded.

Antemortem Cultural and Behavioral Alterations

There were indications of a few skeletal alterations that might be associated with behavioral practices. One metatarsal had possible indications of kneeling, and a couple of other metatarsals had accessory articular facets that may have been associated with habitual behavioral activities.

Conclusions

Few and mostly fragmentary elements attributed to the Civil War Battle of Wilson's Creek are described and analyzed in this report. They were excavated in 1966 by Bray from the Sinkhole.

One of the most troubling issues this analysis raised was the reliability of previous conclusions. If our conclusion that the WICR Bag 1-5 elements represented all of those that Bray recovered and reported (Bray 1967) and none others, then there were significant problems. There were apparently errors in element identification and these errors, rather than being minimal, were substantial and led to significant differences between the present

and Bray's element counts. These errors perhaps should have been expected considering the peculiar categories of elements reported by Bray (1967:24-25). Combining carpals and tarsals in a single category, or metacarpals, metatarsals and phalanges in another—as he did--was an odd analytical step. Contemporary osteological analyses would have identified and reported each of those kinds of elements individually.

Element identification is the most fundamental step in any osteological analysis. If this step is incorrectly executed, then all of the analyses that follow and build on it are affected. And the more subjective osteological analyses--such as age, sex, ancestry and pathology--are likely to be even more in error. The only way to assure that such errors are identified and corrected is by having collections available for reanalysis even decades after the original work.

Another issue is more directly connected with the identifications in this report. It is the reliability of the biological assessments based on the smaller elements that are present in WICR Bags 1-5. To most accurately assess the biological parameters, larger elements are typically required. To accurately assess sex, for instance, the skull, mandible, limb bones or innominates are usually emphasized; they manifest the greatest sexual dimorphism in the skeleton. When those bones are absent, attempts to determine sex is compromised and reliability is reduced. Similar compromises occur for estimations of age at death, sex, ancestry and stature.

None of the techniques for determining the major biological parameters from the bones of the hands and feet were available when Bray completed his report. All but a few of these techniques have been developed in the past 15 years. Considering what the next 15 years will bring, the WICR Bag 1-5 material should be available for further analysis in the future.

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REFERENCES CITED

Albert, Arlene Midori, and William R. Maples
1995 Stages of Epiphyseal Union for Thoracic and Lumbar Vertebral Centra as a Method of Age Determination for Teenage and Young Adult Skeletons. Journal of Forensic Sciences 40(4):623-633.

Anonymous
1868 Springfield National Cemetery Reinterment Record Book. Wilson's Creek National Battlefield Museum Catalog 669.

Baldwin, Joseph K.
1973 Patent and Proprietary Medicine Bottles. Thomas Nelson, Nashville, TN.

Baxter, J.H.
1875 Statistics—Medical and Anthropological of the Provost-Marshal-General's Bureau Derived from Records of the Examination for Military Service in the Armies of the United States during the Late War of Rebellion Over a Million Recruits, Drafted Men, Substitutes, and Enrolled Men. Government Printing Office, Washington, DC.

Bass, W.M.
1987 Human Osteology: A Laboratory and Field Manual. Third edition. Missouri Archaeological Society, Columbia.

Bearss, Edwin C.
1975 The Battle of Wilson's Creek. George Washington Carver Birthplace District Assoication, Artcraft Printers, Bozeman, Mont.

Blanton, DeAnne, and Lauren M. Cook
2002 The Fought Like Demons: Women Soldiers in the American Civil War. Louisiana State University, Baton Rouge.

Bray, Robert T.
1967 An Archaeological Survey and Excavations at Wilson's Creek Battlefield National Park, Missouri. National Park Service Contract 14-10-0232-1209.

Bray, Robert T.
1975 Inventory and Evaluation of the Archaeological Resources, Wilson's Creek National Battlefield, Missouri. National Park Service Grant 61154-0141.

Buikstra, J.E., and D.H. Ubelaker
1994 Standards for Data Collection from Human Skeletal Remains. Arkansas Archeological Survey Research Series 44.

Burgess, Lauren Cook
1994 An Uncommon Soldier. Oxford University Press, New York.

Byers, Steve, Kaoru Akoshima, and Bryan Curran
1989 Determination of Adult Stature from Metatarsal Length. American Journal of Physical Anthropology 79(3):275-279.

DeArmond, Fred
1985 Introduction to the Centennial Edition. IN Holcombe and Adams An Account of the Battle of Wilson's Creek, or Oak Hills, Greene County Historical Society. Pages iii-viii.

Falsetti, Anthony B.
1995 Sex Assessment from Metacarpals of the Human Hand. Journal of Forensic Sciences 40(5):774-776.

Flecker, H.
1932-33 Roentgenographic Observations of the Times of Appearance of the Epiphyses and Their Fusion with the Diaphyses. Journal of Anatomy 67:118-164.

Holcombe [, Return I.,] and [W.S.] Adams [First names omitted in original document]
1985 An Account of the Battle of Wilson's Creek or Oak Hills. Centennial edition reprinted by Greene County Historical Society, Springfield, Missouri.

Lazenby, Richard A.
1993 Identification of Sex from Metacarpals: Effect of Side Asymmetry. Journal of Forensic Sciences 39(5):1188-1194.

Mann, R.W., R.L. Jantz, W.M. Bass, and P.S. Willey
1991 Maxillary Suture Obliteration: A Visual Method for Estimating Skeletal Age. Journal of Forensic Sciences 36(3):781-791.

Meadows, Lee, and Richard L. Jantz
1992 Estimation of Stature from Metacarpal Lengths. Journal of Forensic Sciences 37(1):147-154.

Meadows, Lee, and Richard L. Jantz
1995 Allometric Secular Change in the Long Bones from the 1800s to the Present. Journal of Forensic Sciences 40:762-767.

Ousley, S., and R.L. Jantz
1996 FORDISC 2.0: Personal Computer Forensic Discriminant Functions. The University of Tennessee, Knoxvlle.

Robling, Alexander, and Douglas H. Ubelaker
1997 Sex Estimation from the Metatarsals. Journal of Forensic Sciences 42(6):1062-1069.

Scheuer, J. Louise, and Nicholas M. Elkington
1993 Sex Determination from Metacarpals and the First Proximal Phalanx. Journal of Forensic Sciences 38(4):769-778.

Scott, Douglas D.
1999 Buttons and Shot Associated with Skeletal Remains from Wilson's Creek National Battlefield, Missouri. Report on file, Midwest Archaeological Center, National Park Service, Lincoln, NE.

Scott, Douglas D.
2000 Archeological Overview and Assessment for Wilson's Creek National Battlefield, Greene and Christian Counties, Missouri. Midwest Archeological Center Technical Report 66, National Park Service, Lincoln, NE.

Scott, Douglas D., P. Willey, and Melissa A. Connor
1998 They Died with Custer: Soldiers' Bones from the Battle of the Little Bighorn. University of Oklahoma Press, Norman.

Slaughter, Connie
1999 Personal communication. Electronic message to P. Willey dated June 4, 1999.

Smith, Shelley L.
1996 Attribution of Hand Bones to Sex and Population Groups. Journal of Forensic Sciences 41(3):469-477.

Steele, D. Gentry
1976 The Estimation of Sex on the Basis of the Talus and Calcaneous. American Journal of Physical Anthropology 45:581-588.

Stewart, T. D.
1958 The Rate of Development of Vertebral Osteoarthritis in American Whites and Its Significance in Skeletal Age Identification. The Leech 20:144-151.

Sutton, John M.
1992 Inter-Office Memorandum from Sutton to files. Dated September 8, 1992. On file at WICR.

Thrasher, Jim
1995 Letter addressed to Wilson [sic.] Creek Battlefield Park [sic.] dated October 9, 1995. On file at WICR.

Willey, P., Paulette Leach, and Deanna Grimstead
1999 Analysis of Human Bones Attributed to the Civil War Battle of Wilson's Creek: The Kerr-Glidwell and Manion's Auction Collections. National Park Service Purchase Order 1443PX611599037. Report on file Midwest Archeolgical Center, National Park Service, Lincoln, NE.

Willey, P, Daniel Tyree, Nicole Cavales, and Douglas D. Scott
2003 Analysis of Human Bones from the Civil War Battle of Wilson's Creek: Bray's Collection from the Sinkhole. National Park Service Purchase Order P6115020041. Report on file Midwest Archeolgical Center, National Park Service, Lincoln, NE.

APPENDIX III

METALLURGICAL ANALYSIS OF SHELL AND CASE SHOT ARTILLERY FROM THE CIVIL WAR BATTLES OF PEA RIDGE AND WILSON'S CREEK (PERI AND WICR)

By Alicia Coles with Carl Drexler and Joel Masters

Introduction

As archaeological sites go, battlefields are relatively common, occurring across cultures and time. However, battlefield archaeology has been somewhat superficial, concentrating on the "present" actions that occurred on them, assuming that counts and locations of artifacts are the extent of information to be gained from their presence.

While sorting and cataloging ordnance and other artillery from the early Civil War battles of Wilson's Creek and Pea Ridge, Archeologist Douglas Scott of the National Park Service noticed that fragments of shell and case shot ordnance are relatively uniform in size and shape (Figures 1 and 2). We were approached and queried as to whether or not it was possible to determine what taphonomic processes created these artifacts. We propose that the following metallurgical tests may be useful in eliciting information to assist in answering these questions: finite element analysis, optical and scanning electron microscopy, chemical profiling, and hardness.

The results show that metallurgical analysis of military ordnance is indeed a useful and informative tool that provides data unavailable through conventional archaeological methods. It not only helps us understand their use and the results of their use on the battlefields but illuminates the processes of manufacture and procurement in the events leading up to the battles. This is especially important for understanding artillery foundry practices before and during the Civil War as arsenal records from this time are spotty at best.

Background

Wilson's Creek, Missouri

Wilson's Creek is often referred to as the "second great battle of the Civil War." It was fought a few weeks after First Bull Run, and was the first major battle fought west of the Mississippi River. After a summer of campaigning for control of Missouri, the Union and Confederate armies lay barely a dozen miles apart. After advancing from the rail terminus at Rolla, the Federals had occupied Springfield long enough to deplete the stores they had brought with them (Cutrer 1993: 231). They had to move back to Rolla to stay supplied, but could not do so with the enemy so near to the South. Their commander, General Nathaniel

Figure 1. Confederate shell fragments.

Figure 2. Federal shell fragments.

Lyon, had to launch a preemptive attack to stall the Confederates long enough to allow him to withdraw to Rolla (Cutrer 1993: 231).

The Federal Army left Springfield on the night of August 13, 1861 in two columns. The larger of the two, a force of 3,300 men under the command of Nathaniel Lyon, was to fall upon the Confederate camps from the north at dawn (Piston and Hatcher 2000: 185). Simultaneously, the smaller command, 1,100 men under Franz Sigel, after a march to the east of the Confederate camps, would attack from the south (Piston and Hatcher 2000: 190). This pincer move was meant to break up the Confederate force before they could mount an effective resistance, and would allow the Federals to break off and move back to Rolla unmolested.

Initially, the attack proceeded as planned. The Missouri State Guard, who had been joined by a brigade of Arkansas State Troops and a brigade of Confederate States Army soldiers and now numbered 12,000 men, was completely shocked by the appearance of the Federals, who opened fire on their camps with artillery as the men were cooking breakfast (Cutrer 1993: 231). Lyon and Sigel both capitalized on this confusion by pushing towards each other, squeezing the southerners between them.

After overcoming the initial shock, the southerners began to exert their better than two-to-one numerical superiority, halting Lyon on what is now known as Bloody Hill (Cutrer 1993: 236). To the south, Sigel had inexplicably halted his troops in column barely forty yards from the ravine cut by Wilson's Creek. Confederate soldiers filed into this cover and, at a rush, descended upon the Federals who were, due to their deployment, virtually unable to defend themselves, and therefore fled in confusion (Cutrer 1993: 234).

With the threat posed by Sigel's men neutralized, the Southerners were free to focus on Lyon's men atop Bloody Hill. Repeated attacks had failed to pry the Iowans, Missourians, and Kansans from this position, despite the loss of Lyon, who was struck in the chest by a musket ball (Piston and Hatcher 2000: 268). His successor, Major Samuel Sturgis, realized around noon that Sigel was not going to arrive, and that the army had achieved its goal of damaging the Rebels enough to keep them from pursuing, and therefore deemed it time to withdraw. By early afternoon, the battle was over. It had cost the Federals 1,300 men killed, wounded, and missing. 1,200 Southern soldiers were either killed or wounded in the engagement (Piston and Hatcher 2000: 337, 338).

Both sides justly claimed victory at Wilson's Creek (known as Oak Hills by some Confederates). The Confederate armies had managed to maintain the field, achieving a tactical victory. On the other hand, the Federals had achieved a strategic victory, as the Southern commanders chose to tend to their damaged army rather than pursue the Yankees back to Rolla. In the following months, the Arkansans and Confederates returned to Arkansas, and the Missouri State Guard did its best to bring Missouri under their control. The Federals remained at Rolla, reeling from the loss of one quarter of the army as well as their commanding officer (Piston and Hatcher 2000: 337, 338). After receiving reinforcements

and a new commander that fall, they launched a campaign in January, 1862 that culminated in the March battle of Pea Ridge, where they once again faced the combined forces of the Confederate Army and the Missouri State Guard.

Pea Ridge, Arkansas

In late February, 1862, the Confederate Army of the West, under whose command the pro-Confederate Missouri State Guard temporarily placed itself, marched north to meet the Union Army of the Southwest, entrenched on the bluffs overlooking Little Sugar Creek in Benton County, Arkansas (Shea and Hess 1992). Rather than try to force their way through those fortifications, the Southerners attempted a flanking march, beginning on the night of March 6, around the Union lines to the west and take their enemy from the rear.

Unfortunately, the march was ill planned. Southern soldiers had neither slept nor eaten for two days and had marched scores of miles over tough Ozark roads in frigid temperatures. Throughout the following battle, hundreds, maybe even thousands of men would drop from the ranks with fatigue, thereby diminishing the numerical superiority enjoyed by the Rebel troops. When dawn broke on March 7, 1862, half of the army, the Confederate forces under General Benjamin McCulloch, lagged several miles behind the Missouri State Guard (Shea and Hess 1992). In an attempt to shorten his route, McCulloch turned onto a side road that led his troops directly into an advancing Union force, sent to investigate rumors of enemy troops in the area of a small farming hamlet called Leetown. McCulloch sent one brigade under Colonel Louis Hebert to deploy in nearby Morgan's Woods with orders to advance when the firing began, then rode forward alone to reconnoiter for the main attack. In doing so, he stumbled across a party of Union skirmishers who promptly shot the exposed Confederate general. A second volley of musketry killed the second in command, James McIntosh, a few moments later (Shea and Hess 1992). The third in command, Hebert, began his attack when he heard the firing that killed McCulloch and McIntosh and was, consequently, too far forward and too far away to be contacted.

Hebert's assault made initial progress, but became confused in the tangled underbrush and was eventually shattered by Union reinforcements. Hebert and a large portion of his brigade were taken prisoner. The loss of McCulloch and McIntosh, coupled with the apparent disappearance of Hebert completely immobilized the Confederate forces at Leetown. Had another officer taken control of the situation, the rather small Union force in their front could probably have been brushed aside fairly easily, but such was not the case. Instead, fully half of the Southern army sat on its hands for the rest of the day.

Farther east, the Missouri State Guard made better progress. Although they did not realize their dream of finding the Federal rear completely unguarded, they were able to gain ground all day long against a stiffening Union defense (Shea and Hess 1992). By the evening of March 7, the Missourians had pushed south of Elkhorn Tavern onto the margins of some large cornfields.

During the night, the Missourians, bolstered by a portion of the Confederate forces from Leetown now under Colonel Elkanah Greer, huddled close to one another, trying to keep warm in the middle of a snowstorm that came blowing in just after dark (Monaghan 1855: 245). Their opponents faired little better, though they did have some food to choke down. Neither side built campfires for fear of drawing fire from enemy soldiers who shivered a mere two hundred yards away.

The morning of March 8th began with an impromptu artillery duel between two Union and two Southern batteries. Other federal batteries, posted on commanding ground to the west, now known as Welfley's Knoll, quickly joined in and drove the gray-coated gunners to the rear. It was at this point that the Rebel artillerymen realized their commander, Major General Earl van Dorn, a dashing, rash ex-cavalryman, had neglected to order the supply train forward when the army began its flanking march, putting additional ammunition, which all of the army needed desperately, well beyond the reach of the troops (Hartje 1967: 158). The result of this was that the Federals were able to mount an uncontested, two hour long artillery barrage against the Rebels hiding in the timber to their north. At least 1800 rounds were fired into the masses of closely packed Confederates huddled close to the ground some 500 yards to the north (Shea and Hess 1992). This proved to be more than most of the Rebels could handle, and they began to quit the field in groups of a half dozen or more. Van Dorn's army literally evaporated from the field, exhausted, unable to defend themselves, and without any semblance of order.

The Federal victory at Pea Ridge, named for the plateau on which it was fought, cemented Union control of northwest Arkansas, ensured the safety of Saint Louis, an important staging point for actions elsewhere, and gave morale throughout the Federal army a much needed boost. Attacks down the Mississippi River, based on St. Louis, were made possible by the crippling defeat handed to the Confederates and their Missouri comrades at Pea Ridge.

Thousands of artillery shells and case shot were fired during the battles. The shells burst into pieces and many fragments were dispersed in the fields of Pea Ridge and Wilson's Creek to be found over one hundred and forty years later during extensive archaeological investigations. Those shells and case shot indeed appear to be manufactured of cast iron.

Gray Cast Iron

To be better able to understand why the chemical composition and microstructures of the artillery fragments we see are important to this research, it is necessary to review a basic understanding of gray cast iron, its properties, and the effects alloying elements and external forces (i.e. cooling temperature and rate) have on said properties.

By the Civil War, metallurgists had a decent understanding of the properties of cast iron. Artillerists recommended gray cast iron for use in cannon balls (Gibbon 1860: 171). While the artillerist manual does not go on to state why gray cast iron was the preferred

material, it is safe to say that the deciding factors were that it is easy to cast and it is cheap; the least expensive of all cast metals (Callister 2001: 349).

> *"Little more than twenty years ago, cast iron was regarded as a low cost material suitable only for inferior utility. It was regarded as undependable except where strength went with weight, stress resistance meant bulk, and appearance was entirely irrelevant. Although the use of alloys and particularly nickel had been mentioned as early as the start of the nineteenth century, knowledge of definite and varied use of alloys was meager. Microscopy, refinement in melting control, determination of properties by regulation of inherent constituents such as silicon and carbon, and heat treating were practically unknown"* (Bolton 1937: 5)

What was known about the properties of gray cast iron by these metallurgists was that it has high castability or the measure of the metal which establishes the minimum thickness that can be flowed into a mold of a given volume/area to obtain consistent physical properties (Lyman 1961: 350), good fluidity and expansion upon cooling in the molds, the melting point is low (~1200°C), and the cast form has strength in compression and is weak in tension (Scott 1991). The question remains of how these metallurgists could produce a consistent product. Gray iron is not specific. All gray irons contain iron, carbon, and silicon as well as appreciable amounts of phosphorus, sulphur, and manganese. The free-graphite in the material matrix is formed "as cast" and can take on one of a number of different microstructures (Bolton 1937: 80-81). This is quite useful in that we can therefore assume that cannon balls produced in different foundries, and at different times will have varying microstructures.

The following will often refer to gray iron as eutectic. A eutectic reaction is a reaction wherein, upon cooling, a liquid phase transforms isothermally and reversibly into two mixed solid phases. The phases exist as lamellae that alternate with one another. In gray iron, the reaction is as follows:

$$Fe_3C \rightarrow 3Fe(\alpha)+C$$

Fe=iron
C=Carbon
α=ferrite

For gray cast iron, there are two important periods for cooling: 1135°C-1150°C in which graphite is formed, most importantly the ratio of combined to graphitic Carbon (Lyman 1961: 351) and 650°C-720°C in which the matrix is determined (Angus 1976: 36). Slow cooling favors graphite production while rapid cooling favors metastable ferrite and some free cementite (iron carbide, Fe_3C) or mottled iron (Davis 1996: 8; Lyman 1972: 81) which will exhibit properties not ideal for artillery.

Cooling rate and temperature not only determines the chemical composition of ferrite and graphite but also determines the shape of the graphite flakes within the matrix.

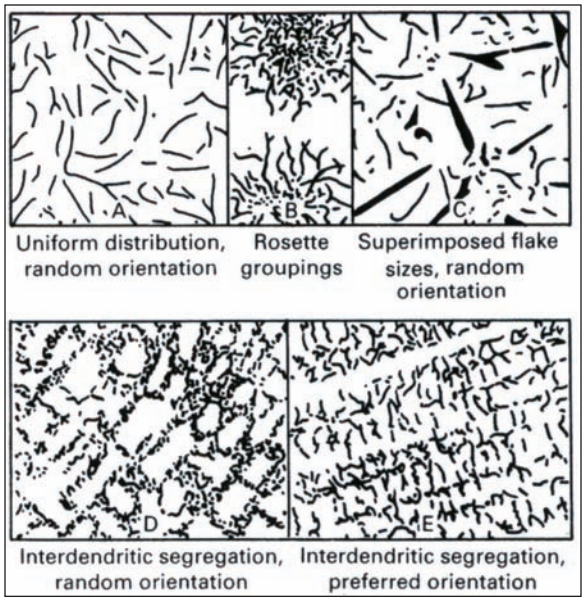

Figure 3. Typical Graphite Structures.

The typical microstructure is a matrix of pearlite (a layered mixture of ferrite and cementite) with sharply pointed (Callister 2001: 410) graphite flakes dispersed throughout. Very slow cooling is likely to produce considerable ferrite throughout the matrix (Lyman 1961: 351). Our samples exhibit two types of graphite structure: B and C (Figure 3) (Davis 1996: 35):

Type B is formed in near-eutectic iron compositions that solidify with moderately high undercooling (slow cooling). It generally appears as a rosette pattern. It is common in moderately thin sections and along surface of thick sections. We see it throughout the body of many of our fragments but it must be noted that the rosettes are smaller and more densely packed along the surface and in and amongst the threads of the fuse rings.

Type C occurs in hypereutectic irons with a relatively higher Carbon content than type B. The graphite precipitates during the initial freezing (solidification) of the iron. The graphite appears as superimposed flakes with random orientation.

All of our samples indicate very slow cooling. It can be inferred that this cooling rate was determined by the ambient temperature of the foundry. In addition, under-cooling also depends on the melting technique and melt treatment (van de Velde 1999), another characteristic specific to individual foundries.

Graphite shape is directly related to strength (Davis 1996: 7). Graphite in the undercooled form gives a lower strain to failure in the tensile test than random flake graphite and lowers impact resistance and increases damping capacity (Angus 1976). Where high impact resistance is needed, gray iron is not recommended. Of all the cast irons, gray iron has the lowest impact resistance (Lyman 1961: 357, Davis 1996: 45). Of course in cannon balls we would expect and want extremely low impact resistance so the maximum amount of energy will be transferred to the projectile fragments.

All gray irons fail in a brittle manner. Fracture occurs along the lamellar graphite plates, exhibiting a “gray” fracture surface (Davis 1996:4). The compressive strength of gray cast iron is roughly three to four times its tensile strength. Fracture occurs at the maximum compressive load (Angus 1976: 46). We can think of the cannon ball as a thick-walled spherical pressure vessel and the failure as an impact overload exceeding the compressive strength. It appears that the mode of failure can be attributed to thermal stress

overload wherein the stress from a thermal change (the charge) demands a specific change of dimension. As the gray cast iron cannot expand plastically, the yield strength is exceeded causing fracture (Davis 1996: 347). The resulting shape of the fragments will be further analyzed later in the report.

Variations in graphite size and distribution will cause wide variations in hardness readings across the sample, however; the hardness of the metallic matrix is constant (Lyman 1961: 356). Lyman (1961: 356) recommends using Brinell hardness over Rockwell though we feel that a more accurate and justifiable measure can be taken with Knoop Microhardness as will be seen in the experimental data. While Angus states that there is no relationship between hardness and tensile strength for cast iron (1976: 48), he does not give any information relating hardness and compressive strength.

It is shown in the experimental data that there is varying chemical compositions among the samples. While in some elements, the difference may be minimal, slight variations in the chemical make-up will alter the mechanical properties of the cast iron. Typical alloying elements in gray cast iron are as follows: Silicon and Aluminum increase graphitization, increase the ferrite-pearlite ratio, and lowers strength; Nickel, Copper, and Tin increase graphitization, increase pearlite, and raises strength and hardness; and Chromium, Molybdenum, Tungsten, and Vanadium decrease graphitization and increase strength as long as carbides do not form (Davis 1996:8). Silicon and Nickel tend to decrease hardness due their tendency to increase graphitization, while Phosphorus, Manganese, Sulphur, Chromium, Molybdenum, and Vanadium increase hardness values (Angus 1976: 51). In all gray cast iron, the Sulphur and Manganese content must be balanced according to the following (Davis 1996: 34):

$$\%Mn \geq 1.7\%S + 0.3\%$$

The total Carbon, Phosphorus, and Silicon content, as related in the following Carbon Equivalent Equation:

$$CE = \%C + (\%Si + \%P)/3$$

establishes the solidification temperature and is related to the foundry characteristics of the alloy and its properties (Davis 1996:6). In all impact tests, a high Phosphorus content decreases energy to rupture (Angus 1976: 82). Gray cast iron usually contains from 1.7%-4.5% C and 1.0%-3.0% Si (Lyman 1961: 349). The Carbon Equivalent value tells immediately the eutectic state of the iron (Angus 1976: 3). The following phase diagram (Figure 4) (Callister 2001) relates the percentage Carbon (or CE) to the temperature.

The addition of Silicon increases the stability of ferrite while decreasing the stability of carbides (i.e. cementite) and promotes graphitization, however; the strength is adversely affected. It lowers the percentage of Carbon required for the eutectic as well as raises

the eutectic temperature which in turn can modify the graphite distribution. Silicon also increases castability by lowering the casting's total contraction (Davis 1996:5-6; Bolton 1937: 135-136).

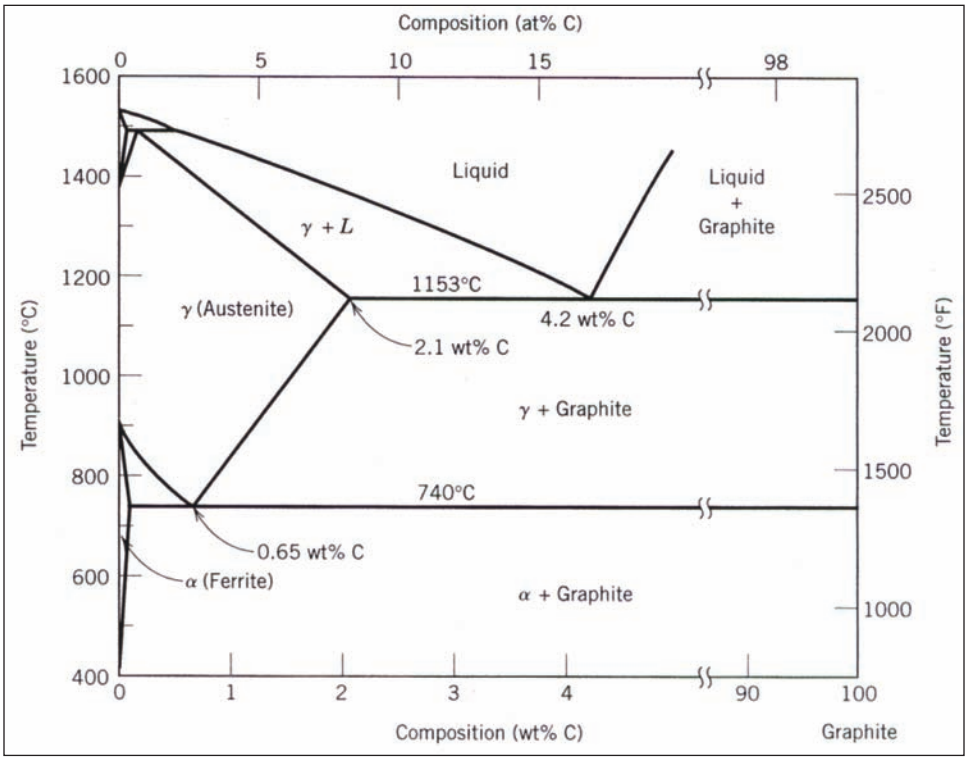

Figure 4. Carbon Equivalent Phase Diagram.

Manufacture

There are two types of artillery projectiles analyzed in this study: spherical shell and case shot. The sphere was a common shape of artillery as it presents the minimum surface for a given volume thus reducing the effect of wind resistance. Also, if it strikes an object in flight (perhaps another projectile fragment) it is less deflected from its course than any other form (Gibbon 1860: 155). Both the North and the South manufactured and imported both types of projectiles and could fire captured and/or confiscated artillery (McKee and Reid 1980: 92).

Both the shell and case shot were manufactured using similar methods. The projectile mold is made of sand mixed with clay and water as the binding. The projectile is allowed to cool while still in the mold. This allows for slow cooling of the metal in layers commencing on the outside of the casting and contracting as it cools. This method lends to slow cooling as the ambient temperature of the sand rises (Gibbon 1860: 73; 170-171). Each projectile had to pass a rigorous visual and dimensional inspection. Those that did not pass could be melted and go through the casting process again. Those that passed were polished in a rotating iron cylinder and were coated with a lacquer (Gibbon 1860: 170-171; 174).

Shells are hollow shot with equal thickness throughout the body of the projectile. There is a conical opening, or eye, used to load the shell with the fuse (Gibbon 1860: 163). Shells contain a bursting charge of black powder which can be designed to explode in the air or on contact depending on the fuse type. They are considered to be most effective against blockhouses or other wooden structures and for opening breaches in entrenchments. Against troops, especially those masked by the landscape features, the effect depended on the fragmentation of the pieces and often also affected the morale of cavalry (McKee and Mason 1980: 92-93) due to the increased noise and force of explosion over solid shot (Gibbon 1860: 250; McKee and Mason 19080: 92-93).

Case shot are similar in dimension to shell however they are usually thin-sided and are filled with small lead or iron balls and a mixture of sulphur pitch or asphalt (Thomas: 16). They are thin so as to be able to contain the maximum number of bullets. The bullets act as a support to the case and prevent its breakage by the force of the discharge from the gun (Gibbon 1860: 164-165). Case shot is considered to be effective up to eight hundred yards though, as destructiveness of the bullets is a function of the velocity at the time of bursting, shorter distances are preferred (McKee and Reid 1980: 93). McKee and Reid state that the case shot is not recommended against advancing troops though do not explain why (1980: 93).

Typical dimensions for both shell and case shot are listed below (Gibbon 1860: 27) (Figure 5):

The resistance offered by the shell (including case) to the force of the powder increases with side thickness. When a shell is burst while stationary, the pieces are dispersed in almost every direction with more or less force according to the resistance of the sides. The number of fragments is directly related to the brittleness of the material (Gibbon 1860: 163; 250). Theoretical and experimental evidence show that the least amount of resistance and crack initiation propagates through the fuse ring (this will be expounded upon later in the analysis). If the projectile is in motion, the fragments projected forward will continue with an increase in velocity and those in the rear with a decrease in velocity. If the shell is moving very slowly, the fragment velocity may be overcome for the rear parts of the explosion and the pieces may drop to the ground or be thrown backwards (Gibbon 1860: 250).

Bertrand

April 1, 1865, the steamboat Bertrand sank on the Missouri River in the De Soto Bend in Western Iowa. She was en route from St. Louis to the mining territories of Montana carrying a variety of supplies and sundries for men, women, and children. Among the cargo was included twelve pound mountain howitzer case artillery loaded in crates marked "CANNON SHELLS FOR MOUNTIAN HOWITZER, 1 doz. SHELLS FIXED FEBR. 1865, 18 FRICTION PRIMERS FROM ST. LOUIS ARSENAL" (Petsche n.d.: 98). Though these shells apparently were shipped to Montana for purposes unrelated to the Civil War,

Shells.

	For Columbiads and S. C. Howitzers.		For Mortars.			For Guns and Howitzers.				
	10-in.	8-in.	13-in.	10-in	8-in.	42	32	24	18	12
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Diameter	9.87	7.880	12.870	9.87	7.880	6.84	6.250	5.680	5.170	4.520
Thickness of sides and bottom, True	2.00	1.500	2.100	1.60	1.250	1.20	1.000	0.900	0.900	0.700
Thickness of sides and bottom, Greatest	2.10	1.580	2.250	1.70	1.330	1.25	1.050	0.950	0.940	0.740
Thickness of sides and bottom, Least	1.90	1.420	1.950	1.50	1.170	1.15	0.950	0.850	0.860	0.660
Thickness at fuze-hole	3.00	2.250	2.100	1.60	1.250	1.80	1.350	1.350	1.350	1.050
Diameter of fuze-hole, Exterior	1.45	1.338	1.800	1.75	1.300	1.00	0.900	0.900	0.900	0.900
Diameter of fuze-hole, Interior	1.00	1.000	1.483	1.51	1.113	0.73	0.698	0.698	0.698	0.743
Distance between ears	6.00	5.000	7.000	6.00	5.000					
Weight ....lbs.	101.00	50.500	197.000	87.50	44.500	31.00	22.500	17.000	13.400	8.400

The 8-inch mortar shell is used for the siege-howitzer.

Spherical Case Shot.

	8-in.	42	32	24	18	12	6
	In.	In.	In.	In.	In.	In.	In.
Diameter	7.880	6.840	6.250	5.680	5.170	4.520	3.580
Thickness of metal at the sides, True	0.700	0.650	0.600	0.550	0.500	0.450	0.360
Thickness of metal at the sides, Greatest	0.725	0.675	0.625	0.575	0.525	0.475	0.385
Thickness of metal at the sides, Least	0.675	0.625	0.575	0.525	0.475	0.425	0.335
Thickness of metal at the fuze-hole	1.600	1.500	1.500	1.100	1.100	0.750	0.750
Radius of reinforce at the fuze-hole	3.000	2.750	2.500	2.300	2.100	1.800	1.400
Diameter of fuze-hole, Exterior	1.200	1.200	1.200	0.900	0.900	0.900	0.900
Diameter of fuze-hole, Interior	0.960	9.075	0.975	0.735	0.735	0.788	0.788
Mean weight....lbs.	30.000	20.320	16.000	11.860	8.700	6.100	3.060

The thickness of metal at the fuze-hole is supposed to be measured in the axis of the fuze-hole, between the spherical surfaces of the shell and of the reinforce.

The fuze-holes of shells and spherical-case shot taper 0.15 inch to 1 inch.

Figure 5. Standard Ordnance thickness from Gibbon 1860.

and they were manufactured/shipped approximately four years after the battles with which this study is concerned, they are of the same morphology and manufacture as the shell fragments in question and can therefore be used as an exemplar concerning interior dimensions. It was not possible for us to take metallurgical samples from the case.

Figures 6 and 7 show an example of these howitzer cases loaded with lead shot and pitch and with an intact Bormann fuse.

Figure 6. Cut away of Bertrand 12-pounder case.

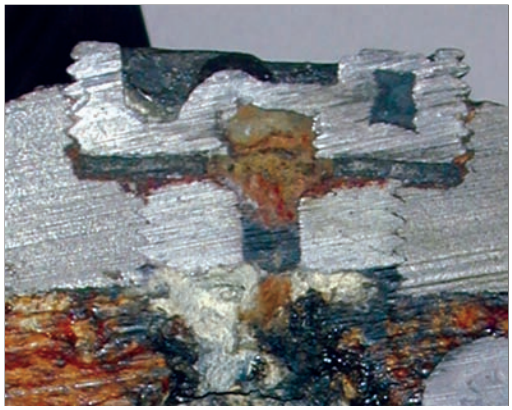

Figure 7. Detail of fuse and underplug.

Measurements taken of the wall thickness show that the inner molds for the cases were irregular (Figure 6). Figure 7 shows detail of the still intact Bormann fuse assemblage of which the importance shall be made clear later in the study. As none of the fragments chosen for this study mend, it is therefore not possible in the scope of this study to determine how this affects the fracture mechanics, though there is undoubtedly a correlation in wall thickness and fragment size among others. Samples of the binding material were also taken. Analysis of this material awaits future study.

Procedure and Analysis

Samples

The following cannonball fragments were deaccessioned from the collections of Wilson's Creek National Battlefield and Pea Ridge Military Park during archaeological studies by the Midwest Archeological Center, National Park Service for testing and analysis. They were chosen according to artillery type, location found, and whether they are assigned Union or Confederate status.

Pea Ridge National Historic Battlefield, Arkansas

#	Category	Location	Description
2309			James Type I Skirt Fragment
4133		Near Foster's Field	Hodgekiss Base Cup Fragment
4288			Conical Nose Fragment
4478	US Shell	Big Mountain	12-lb Shell Fragment
4534	US Shell	Big Mountain	12-lb Shell Fragment
3380	US Shell	Foster's Field	12-lb Shell Fragment
3418	US Case	Foster's Field	12-lb Case Fragment
3417	US Case Shot	Foster's Field	Lead Case Shot, Drilled and Faceted
3376	US Fuse Ring	Foster's Field	12-lb Shell Fragment
2527	CS Shell	Narrow Ridge	12-lb Shell Fragment
4045	CS Shell	Cox's Field	12-lb Shell Fragment
4055	CS Shell	Cox's Field	12-lb Shell Fragment
4144	CS Shell	Wefley's Knoll	12-lb Shell Fragment
2448	CS Case	Narrow Ridge	12-lb Case Fragment
2701	CS Case Shot	Narrow Ridge	Iron Case Shot
2419	CS Fuse Ring	Narrow Ridge	12-lb Shell Fragment

Wilson's Creek National Battlefield, Missouri

#	Category	Location	Description
1028	US Shell	Sharp's Field	12-lb Shell Fragment (Tentative ID)
1121	US Shell	Calvary Camp	12-lb Shell Fragment
3685	US Shell	Counter-Battery Fire	12-lb Shell Fragment
1175	US Case	Sharp's Field	12-lb Case Fragment
1089	US Fuse Ring	Sharp's Field	12-lb Shell Fragment
1018	CS Shell	Sigel's Route	12-lb Shell Fragment
2645	CS Shell	Bloody Hill	12-lb Shell Fragment
3221	CS Shell	Bloody Hill	12-lb Shell Fragment
2536	CS Case	Bloody Hill	12-lb Shell Fragment
2403	CS Case	Bloody Hill	12-lb Case Fragment

US-United States
CS-Confederate States

Removal of Iron Oxide

Roughly half of the samples were cleaned with the following method. Each piece is placed in a beaker and covered with a buffered solution of Hydrochloric acid (6 N Hydrochloric Solution; 2 Grams/Liter hexamethylene tetramine). The beaker is then placed into an ultrasonic cleaning bath. Every few minutes, the piece is removed and brushed with a soft toothbrush to remove rust particles. The remaining samples were left soaking under a vapor hood in the above solution for approximately four to five days then rinsed. Both methods proved to remove the same amount of oxidation. Once the piece is free of rust, it is removed from the buffered HCL and sprayed with methanol to prevent rusting. It is then rinsed with water and dried with a blow dryer and soaked in WD-40. The lead case shot was cleaned by soaking the artifact in a 10% Glycolic acid solution.

Visual Inspection

All of the samples that are part of the cannonball wall fractured into trapezoidal or square shapes. The samples that are part of the fuse ring fractured very similarly. With the expected impact of the explosion, the surfaces all have many visible large inclusions and have a non-uniform gray colored fracture plane. An interesting exemption to the above is P2309, the James Type I Skirt fragment. Rather than the typical red iron oxide coating the surface of the fragment, this specimen exhibited an abundance of black oxide in addition to the red that flaked easily from the surface.

CAD and Finite Element Analysis

To determine the forces that causes the ordnance to fracture in a regular pattern of roughly trapezoidal shapes, we built a three dimensional model in **Solidworks**, a three dimensional CAD program, of a shell based on the dimensions of the case shot from the

Bertrand. In **Solidworks**, we were only able to create a "perfect" model of a shell which has no variations in thickness or properties, as well as no imperfections, inclusions, or surface defects as are present in any actual cast shells. Since we know that these were present in our specimens, this is only meant to demonstrate how finite element analysis could be used to study archaeological artifacts. More detailed finite element analysis programs can be used to produce more accurate results.

A mesh (Figure 8a) of the shell was produced which determines the directions on which forces can be applied. With finite element analysis, a hypothetical stress (i.e. bursting charge) was placed in the center of the mesh. This stress was designed to be much greater than required to explode the shell so as to insure that the model experienced forces greater than those necessary for total failure.

Figures 8b and 8c represent the shell stressed to failure constrained at the top (Figure 8b) and around the sides (Figure 8c). The areas in red represent critical failure. In Figure 8c, we can see that in this computation, the area represented in red that a stress concentration is present around the fuse ring. This could account for the uniform shape of fragments that

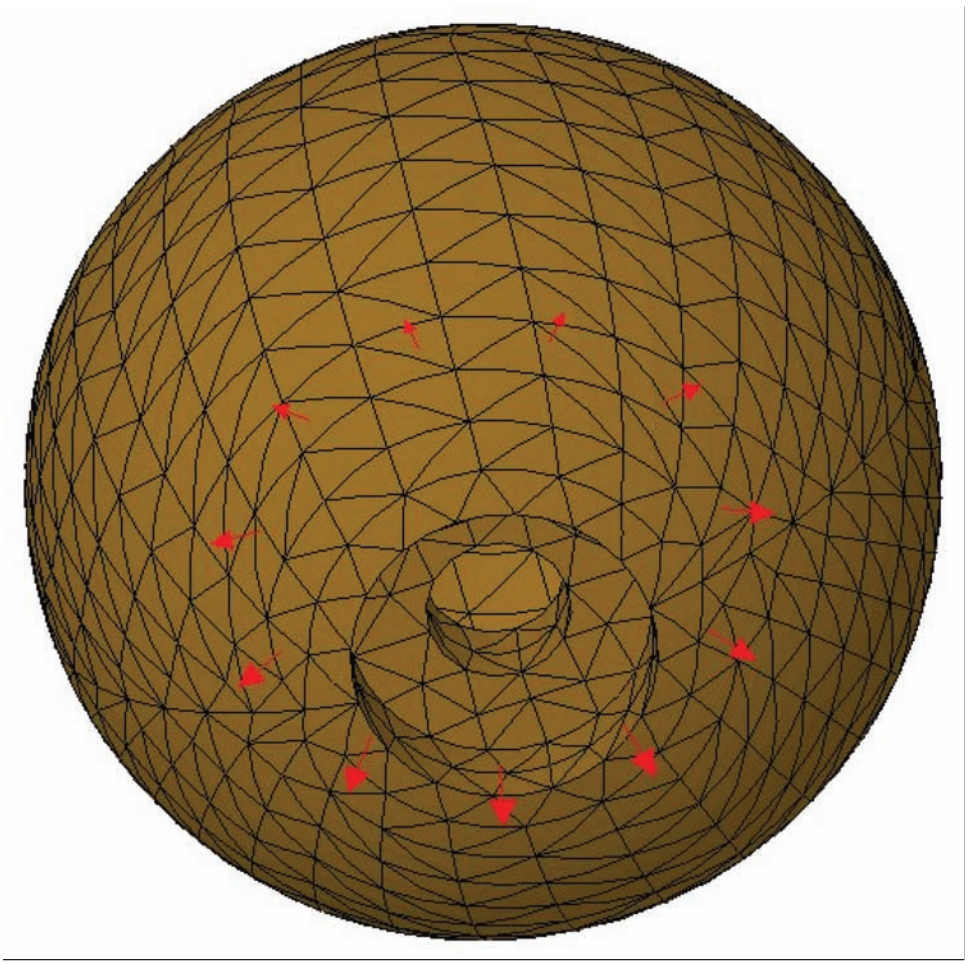

Figure 8a. Solid works model of spherical shell.

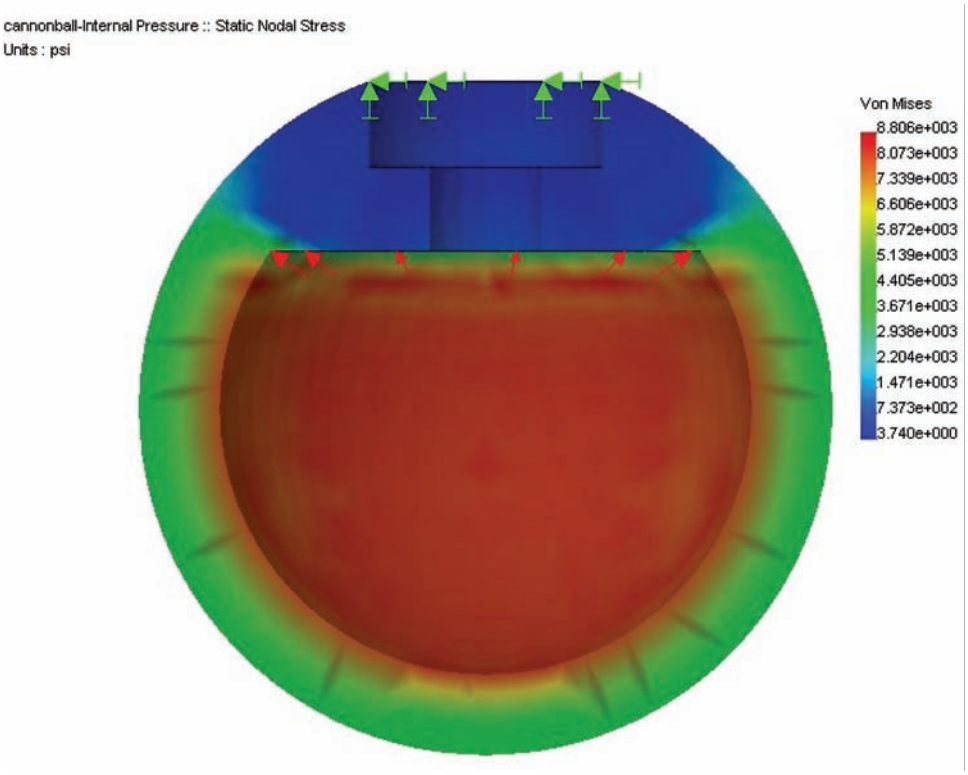

Figure 8b. Cross-section of spherical shell showing shaded areas and weakest points for fragmentation by lines and arrows.

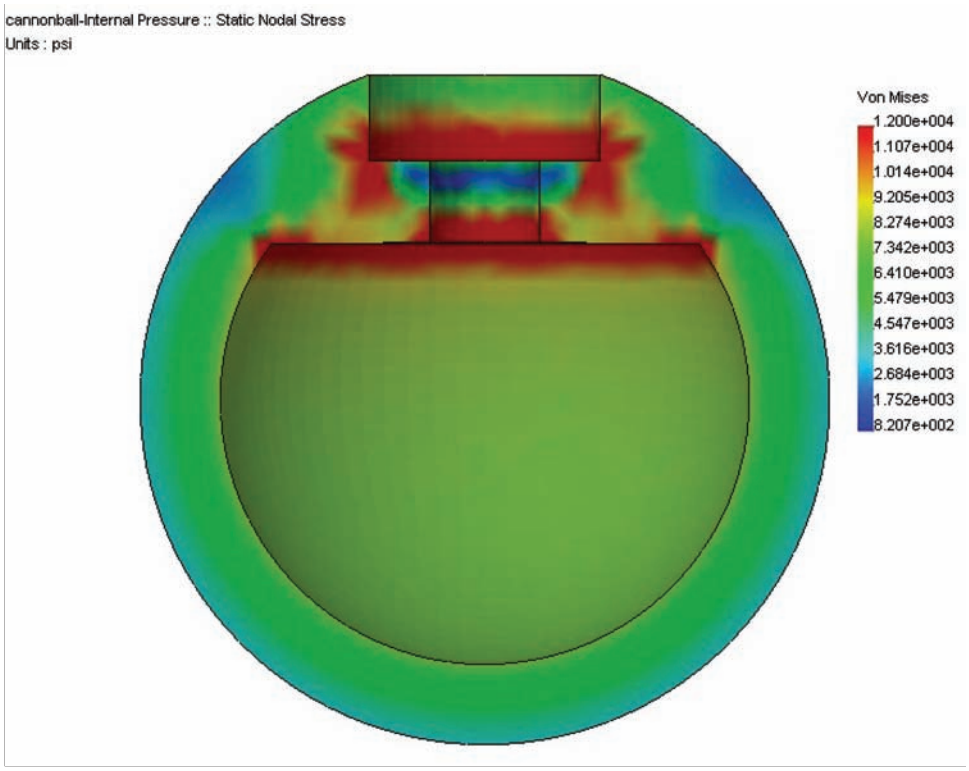

Figure 8c. Cross-section of spherical shell showing fuse ring area as a structurally weak point by shading.

contain portions of the fuse ring. In most cases, fracture occurs at a stress concentration such as a sharp corner, shoulder, edge, etc. The shapes of the body fragments could be explained by Figure 3b. We can see that failure occurs through the body at random locations, however; crack initiation and progression always occurs in a direction perpendicular to the surface of the shell creating the parallel fracture surfaces we see in the fragments.

Scanning Electron Microscopy

Samples for this analysis were selected by visually inspecting for significant crack initiation. In addition, the surfaces had to exhibit minimal surface corrosion damage. An overloading force was applied to develop the crack to a surface edge revealing a fresh fracture surface for examination. The two samples chosen were W2403, a Confederate Case and P4133, the Hodgekiss base cup fragment. Note that the latter fragment fractured easily in two stages. The first stage was similar to the gray colored fracture surface of all of the fragments. The second stage fractured by hand. The surface appears much darker and granular than the other fracture surfaces. The results are given in Appendix C.

For W2403 we can see that the initial failure occurred in brittle manner, which is expected of cast iron. The specimen had transgranular, brittle failures. One is a text-book example of a fracture through a dendritic graphite cluster. Transgranular, cleavage fracture are also present. In addition, one resembles intergranular fracture, it is actually graphite flakes lifting up off of the surface after brittle fracture. The bright white and cup like structures in two other samples are iron oxide corrosion which in all samples used throughout this study begins to grow when any clean surfaces are exposed to air.

We expected to observe a difference in the SEM results for P4133. This however proved not to be the case. While there is a slight difference in surface roughness, there is little difference between this fragment and W2403. We believe that the visible difference that is seen on the surface of the fracture can be attributed to a difference in the angle of fracture between to two fracture methods.

Chemical Analysis

A conclusive chemical analysis was needed to determine the exact composition of the samples, all of which were then sent to **Chicago Spectro Service Laboratory, Inc**. in Chicago, Illinois. The results, provided in Appendix D, are consistent with the properties of gray cast iron.

Sectioning and Mounting

Samples of the fragments were cut with a water flux circular saw. Each of the four samples was mounted in bakelite, a black powdered polymer that can be heated and compressed into a solid form. Each was then water flux sanded over four grades of sandpaper and micropolished with a water flux aluminum oxide over a felt wheel. This

process removes all cut marks and scratches from the sample surface allowing for proper material characterization.

Hardness

Rockwell Hardness B readings were taken on selected samples (those that easily fit into the testing machine) to determine if the readings are indeed variable as expected (see above characterization of gray cast iron). Five readings were taken on both the inside and the outside surface of each piece. The results do indeed show that surface hardness is not a reliable indication of actual material hardness as consistent readings were not found on any of the samples. The readings can be assumed to be neither precise nor accurate.

A more informative and accurate measurement of material hardness for gray cast iron is microhardness. Readings were taken on the inside, center, and outside of the mounted and polished cross-sections of each of the samples. Results show that hardness readings are dependent upon the microstructure that the indenter is resting on. High readings are obtained when the indenter is placed on the ferrite matrix and low readings are obtained on the graphite dendrites. The average of the readings gives a reliable value for the hardness of the sample (See above characterization of gray cast iron).

Etching

After Microhardness testing, each of the four mounted samples was etched with NITAL 2%, a nitric acid solution. The acid is left on the sample until it turns a dull gray in color then rinsed. It is checked with the optical microscope for the development of microstructures on the sample surface. The process is repeated until the microstructures can be clearly delineated.

Results

WILSON'S CREEK
Confederate

Number	Hardness	C%	Si%	P%	CE	Graphite Type	Graphite Density	Pearlite Density
1018		3.62	1.65	1.25	4.59	C; Some grouping	Medium/Low	Medium
2403		3.47	2.46	0.988	4.62	C; Some grouping	Low	Medium
2536		3.69	1.64	0.536	4.42	C	Low	Low
2645		3.44	2.38	1.10	4.60	Mostly B low packed; Some C	Medium	High
3221		3.37	2.86	1.03	4.67	B	Medium/High	Low

Union

Number	Hardness	C%	Si%	P%	CE	Graphite Type	Graphite Density	Pearlite Density
1028		3.54	2.20	0.901	4.57	C	Low	High
1089		3.60	1.34	0.582	4.24	C; Some grouping	Low	Low/Medium
1121		3.39	1.82	1.96	4.65	B	Medium/High	Medium
1175		3.57	2.12	0.761	4.53	B	Low/Medium	Medium
3685		3.05	2.43	1.59	4.39	B	Low/Medium	Low/Medium

PEA RIDGE
Confederate

Number	Hardness	C%	Si%	P%	CE	Graphite Type	Graphite Density	Pearlite Density
2448		3.40	2.70	0.916	4.61	B; Densely packed	Medium	High
2527		3.62	1.99	0.777	4.54	C; Some grouping	Low	High
4045		3.62	3.08	1.09	5.01	Equal B and C sections	Medium	Very Low
4055		3.54	3.23	1.01	4.95	B; Densely packed	High	Very Low
4144		3.37	2.16	1.41	4.56	B; Low packed	Low/Medium	High

Union

Number	Hardness	C%	Si%	P%	CE	Graphite Type	Graphite Density	Pearlite Density
3376		3.29	2.54	0.486	4.30	C	Low/Medium	High
3380		3.50	1.88	1.24	4.54	C	Very Low	Medium
3418		3.35	1.72	1.98	4.58	C	Very Low	High
4478		3.29	1.96	1.94	4.59	C	Low	High
4534		3.79	1.99	0.395	4.59	C	Low/Medium	High

Specialty Ordnance

Number	Hardness	C%	Si%	P%	CE	Graphite Type	Graphite Density	Pearlite Density
2309		3.50	1.99	0.229	4.24	B	High	Medium
4133		3.69	1.88	1.26	4.74	B and C	Medium/High	Medium/High
4288		3.40	2.14	1.18	4.51	B	Medium	Low

We can see that though the relative amounts of Carbon, Silicon, and Phosphorus vary, at times considerably, the Carbon equivalent value across the board is uniform. We infer that this indicates that metal mixing, melting, and casting occurred in small batches and that none of our samples are from the same piece of ordnance. One point to notice is that the Carbon equivalent is uniformly higher for the Confederate ordnance than for the Union. This could be used as a tool at these two battlefields to determine to which side the fragments belong if spatial analysis and other means of visual inspections prove insufficient. Overall, the results show that these are in fact made of undercooled gray cast iron that was manufactured under accurate, but not precise control.

Conclusion

By analyzing the microstructure of the samples, we see that there was much more uniformity in the Union artillery as opposed to the Confederate. Now, while uniformity was greater at Pea Ridge than at Wilson's Creek for both armies, the Union artillery was of nearly complete uniformity at this battle. This is most likely due to the fact that much of the ordnance fired at Wilson's Creek, the earlier and one of the first Western battles in the war, probably was obtained from many sources, possibly even from stocks as far back as the war with Mexico in 1848. By the time of the battle at Pea Ridge, enough ordnance would have been fired in the war that the ordnance found at Pea Ridge was likely manufactured just before the battle and would have been procured from fewer suppliers thus providing more uniformity.

The question remains then of the reason that the Union ordnance, though highly uniform, is so undercooled. We believe that this may be due to the assumed season of manufacture. The battle was fought in the spring and the ordnance was likely produced within a few months before the battle. Though they were, if we assume that all foundries followed the instructions provided in the Artillerist's Manual as described above, allowed to solidify in the sand mold, the ambient temperature of the foundry in the winter may have assisted in the retention of heat in the mold. Though this is conjecture at this time, we feel that it is worth exploring further. Another explanation may be that larger batches were being made at a time or production output at individual foundries was greater at Union foundries that at Confederate. This could mean that artillery and ordnance was being obtained from fewer Union suppliers than Confederate.

What does this mean for National Battlefield Management?

The quality of this type of artifact analysis only improves with an increase in sample size. While we feel that twenty fragments were sufficient for this pilot study to make reasonable inferences concerning ordnance manufacture and fracture, they do not insomuch form a reliable statistical sample. However the results are valid. These analyses undertaken on a much larger scale will do much to contribute to the knowledge, not only of artillery use and troop movement on the battlefield, but will help delineate artillery choice and management processes undertaken before the individual battles. In essence, the results show that every ordnance fragment is important; much more important than having a curated fraction as a representative example in museum collections. This also means that the loss of artillery ordnance fragments through unsanctioned collecting will further erode our ability to gain greater understanding of the role artillery played in the battles. This metallurgical study also provides park managers additional evidence as to the importance of protecting archaeological artifacts and their provenience in our National battlefield parks.

REFERENCES CITED

Angus, H.T.
1976 *Cast Iron: Physical and Engineering Properties*. Butterworths, London.

Bolton, John W.
1937 *Grey Cast Iron: General Manufacture, Structural Metallurgy, and Engineering and Physical Properties*. Penton Publishing Co., Cleveland.

Callister, William D., Jr.
2001 *Fundamentals of Materials Science and Engineering*. John Wiley and Sons, Inc., New York.

Cutrer, Thomas W.
1993 *Ben McCulloch and the Frontier Military Tradition*. University of North Carolina Press, Chappell Hill.

Davis, J. R., ed.
1996 *ASM Specialty Handbook: Cast Irons*. ASM International, Materials Park, Ohio.

Gibbon, John
1860 *The Artillerist's Manual*. Benchmark Publishing Company Inc., Glendale (reprint).

Hartje, Robert G.
1967 *Van Dorn: The Life and Times of a Confederate General*. Vanderbilt University Press, Nashville.

Lyman, Taylor, ed.
1961 *Metals Handbook: Properties and Selection of Metals*. American Society for Metals. Metals Park, Ohio.

1972 *Metals Handbook: Atlas of Microstructures of Industrial Alloys*. American Society for Metals. Metals Park, Ohio.

Monaghan, Jay
1967 *The Civil War on the Western Border: 1854-1865*. University of Nebraska Press, Lincoln.

Petsche, Jerome E.
n.d. The Steamboat Bertrand: History, Excavation, and Architecture. On file, Midwest Archeological Center, Lincoln.

Piston, William G. and Richard W. Hatcher III
2000 *Wilson's Creek: The Second Battle of the American Civil War and the Men Who Fought It*. University of North Carolina Press, Chappell Hill.

Scott, David A.
1991 *Metallography and Microstructure of Ancient and Historic Metals*. Getty Conservation Institute, Paul Getty Museum.

Shea, William and Earl Hess
1992 *Pea Ridge: Civil War Campaign in the West*. University of North Carolina Press, Chapel Hill.

van de Velde, Cees
1999 The Solidification of Gray Cast Iron. A New Approach to the Solidification of Cast Iron.