Cutting It Back and Burning It Black: Archaeological Investigations of Charcoal Production in the Missouri Ozarks

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Investigations by the Mark Twain National Forest have documented two extensive charcoal-production complexes affiliated with iron furnaces dating to the late-19th century. These complexes include numerous charcoal pits and temporary workers' houses. Investigations at several habitation sites recovered relatively small but clearly domestic assemblages and demonstrated variability among these sites. These results represent the first archaeological investigations of charcoal production in Missouri and provide a rare opportunity to examine the entire suite of sites related to charcoal production. They contribute to a fuller picture of the 19th-century Missouri iron industry.

Introduction

In the 19th century iron played an important role in the early development of Missouri. Until recently, the archaeological remains of the Missouri iron industry have been largely ignored, although this is beginning to change with the investigations at the Nova Scotia Ironworks.[1] Despite the importance of charcoal production to the Missouri iron industry, no previous attempt has been made to systematically investigate this aspect of iron production. Recent investigations by the Mark Twain National Forest in southeastern Missouri have discovered numerous archaeological remains associated with charcoal production.[2] Two kinds of charcoal-related sites have been documented. Most common are the collier's pits left behind by the actual production of charcoal. In addition to the charcoal pits, several small, ephemeral habitation sites were also recorded, and limited excavations were carried out at several of them. Such intact charcoal production complexes are rare in the eastern United States, and it is important to document those that remain.

The Missouri Iron Industry

Almost all of the iron furnaces constructed in Missouri were charcoal fueled, which was typical of frontier iron production.[3] However, Missouri iron producers were unusual in their continued reliance on charcoal as a fuel in the mid- to late-19th century. Nationally, by 1854 coal had become the main fuel, and by 1865 only 25 percent of the iron produced nationally was made using charcoal fuel.[4] For a brief period, Missouri showed signs of becoming an important iron producing state. In 1870, Missouri ranked as high as sixth in annual iron production, but it dropped to tenth in 1880 and continued to decline thereafter. The two main reasons for this decline were the exhaustion of many productive ore bodies and the inability of charcoal-fueled iron production to compete economically with coke fuel.[5] Those sites covered in this report come from two distinct mining districts, each of which is discussed below.

Iron production in Missouri began in 1815 or 1816 in what became known as the Iron Mountain District in St. Francis and Iron counties (figure 1), with consistent production beginning in the late 1840s. Production in this area focused on high quality specular hematite. A series of furnaces were constructed at Iron Mountain and Pilot Knob that produced 90 percent of Missouri iron output by 1870, but problems appeared in the late-1870s.[6] According to Arthur Cozzens, there was a shortage of charcoal fuel, and a new coke-fueled furnace was constructed in 1879.[7] Similar problems were reported for the Irondale Furnace, located north of the Iron Mountain District, where charcoal production was done under contract.[8] However, according to Carl Sauer, production in this district rapidly declined after 1887 because of cheap ore from the Lake Superior region and the exhaustion of local deposits.[9] Robert Gordon and Patrick Malone noted that claims of exhausted wood supplies typically meant that the furnace owners did not own enough timberland and/or were not willing or able to pay the going price for charcoal, which was always available for a price.[10] The Iron Mountain District was cited by Richard Schallenberg and David Ault as an example of how access to rich ore supplies was the critical factor in the survival of a mining district.[11]

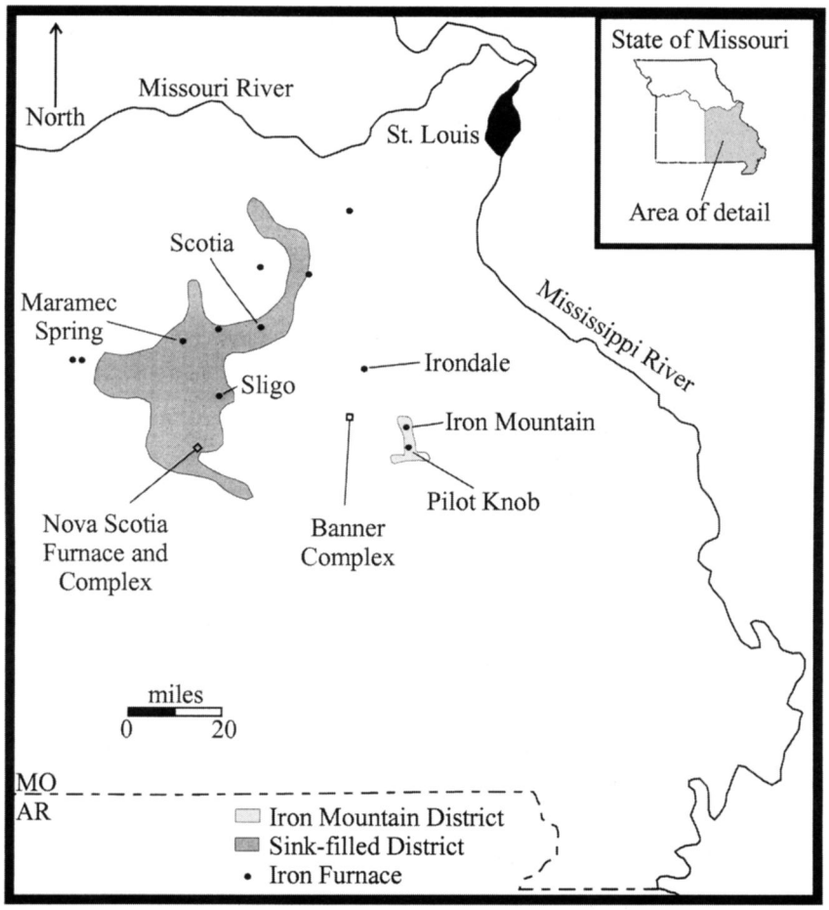

Figure 1. *Location of charcoal complexes as well as the main iron districts and furnaces within the state of Missouri. Locations of iron furnaces are indicated.* Map by author based on Arthur Cozzens, "The Iron Industry of Missouri," *The Missouri Historical Review* 35 (1941): figure 1.

Some of the charcoal features discussed in this report (those sites numbered "05-" in tables 1 and 2) are associated with the Banner Charcoal Complex, located in central Iron County, Missouri (figure 1), near the Iron Mountain District. It cannot be established to which iron furnace the Banner Complex provided charcoal, but it is likely that it was either Irondale or Pilot Knob. Both of these furnaces were located approximately 18 km from the Banner Complex.

A second major iron-producing district in Missouri was the Sink-Filled District in Phelps, Dent, and Crawford counties (figure 1). The focus of mining in this district was bowl-shaped pockets of hematite concentrated in old sinkholes. In some cases the whole deposit was of good quality ore, while in others the ore at the top was nearly pure but rapidly decreased in quality with depth. The best-known operation in this district was the Maramec Ironworks, which operated from 1829 to 1878.[12] A series of hot-blast furnaces was established in this district between 1870 and 1880, next to last of which was Nova Scotia (see below). Of these, only Sligo operated into the 20th century. According to Sauer, iron production ceased in this district after 1880 as the ore bodies were exhausted or competition from cheaper iron produced elsewhere made business unprofitable.[13]

Nova Scotia Ironworks Historic Mining District

A majority of the charcoal features described here are associated with the Nova Scotia Ironworks. The remains of the iron furnace, mine, and company town of Nova Scotia lie in southeast Dent County, Missouri (figure 1). Nova Scotia was a charcoal-fueled, hot-blast furnace that operated from 1881 to 1884. It was the largest iron furnace in Missouri, capable of producing 150–175 tons of pig iron per day, although it only averaged 51 tons. A substantial company town was established around the furnace, with a population estimated to range from a low of 100 families to a high of 2,000 residents.[14]

Machinery for the Nova Scotia Furnace was moved from the location of the former Scotia Furnace, located in Crawford County to the north, which ceased operations in 1880. The stack was 58 feet high and constructed with an iron shell that was lined with firebrick. Data on what may have been a typical production run for a day indicate that the furnace consumed 117 charges per day, with each charge consisting of 2,456 pounds of ore, 40 bushels of charcoal, and 200 pounds of limestone.[15] The primary reasons why the Nova Scotia Furnace failed were the depletion of nearby ore bodies and high transportation costs without access to a railroad.[16] All that indicates the location of the furnace stack today are the remains of the last charge and scattered firebrick, while the rest of the industrial complex is evident only as an archaeological site (figure 2). The legacy of the scale of industrial operations at Nova Scotia can be seen in the changed composition of the forest in the area. When General Land Office surveys were conducted in 1820, the area was characterized by large (50–75 cm diameter) mature pine trees with an open understory. In contrast, today the area is dominated by black oak with a dense, brushy understory and only small amounts of pine.[17] The replacement of pine by oak is largely due to the removal of fire from the ecosystem that accompanied historic settlement in the area.

The Nova Scotia Ironworks Historic District was listed on the National Register of Historic Places in August 2003. Unfortunately, little documentary record of this furnace has been found.[18] Almost everything that is known about Nova Scotia has been learned from the archaeological record. Research at this district was carried out over a number of years under the sponsorship of the Mark Twain National Forest. This research included completing a company history and conducting four test excavations throughout the town of Nova Scotia. Investigations at the industrial complex around the furnace were limited to mapping. The identification of intact charcoal production facilities in close proximity to Nova Scotia (figure 3) was one of the important factors in establishing the historic district, which encompasses 3,500 acres.[19]

Charcoal Production

Although charcoal was not produced in pits, the term "charcoal pit" is the common term used in Missouri and elsewhere.[20] The term "pit" as used in this study denotes the remains of a temporary charcoal production facility and is sometimes interchanged with the term "kiln," which usually indicates more substantial installation. Charcoal production was one of the most important

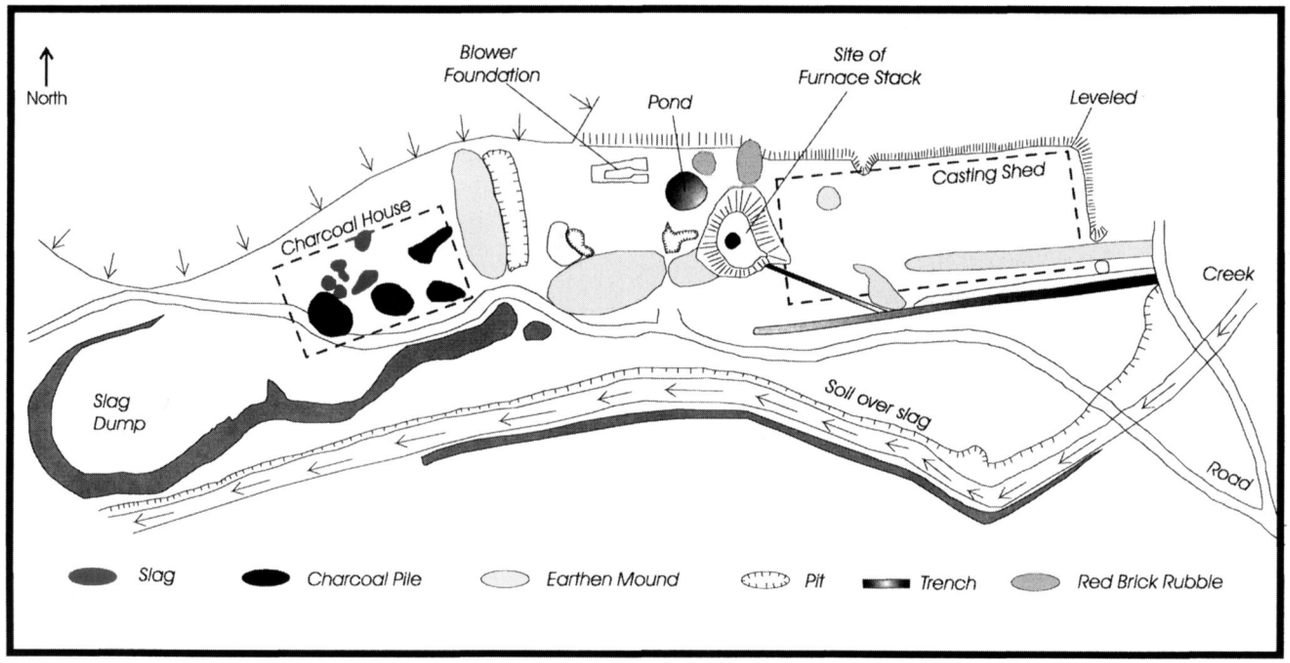

Figure 2. *Nova Scotia industrial complex*. Map by author based on fieldwork by Robert Elgin and James Price.

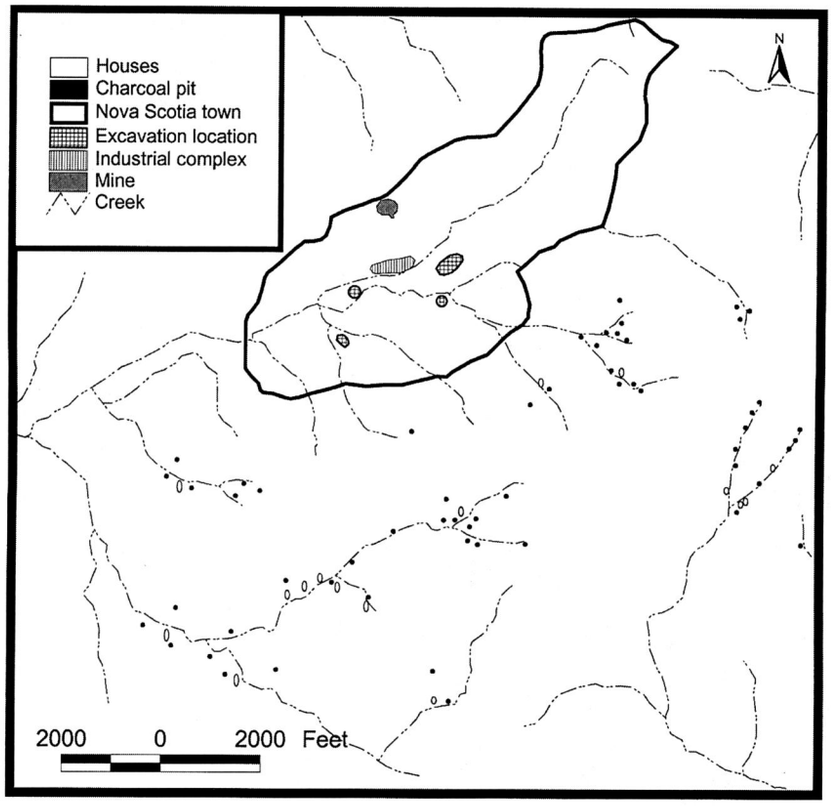

Figure 3. *Distribution of recorded charcoal pits and residential sites around Nova Scotia. Because only scattered surveys have been conducted in the area, the overall distribution of the sites shown in this figure is indicative of the location of the surveys rather than the actual site density.* Map by the author.

parts of iron production at Missouri iron furnaces. Early furnaces using charcoal as a fuel were often established in remote, isolated locations because they required extensive woodlands from which to produce charcoal, as was the case with the Missouri iron industry.[21] The various aspects of charcoal production employed by far the largest number of workers at an ironworks, usually more than 50 percent of the workforce. It was also one of the most difficult and dangerous jobs in the industry. For many furnaces, charcoal production was the single greatest expense of the entire iron production operation.[22]

The following general discussion of charcoal production addresses those methods believed to have been used in Missouri in the 19th century. Several other studies provide detailed descriptions of the process as well as variations used elsewhere.[23] The actual production of charcoal involved three basic steps: cutting and preparing the wood and kiln site, producing the charcoal, and transporting the final product to the furnace. To provide wood for charcoaling, woodcutters usually worked from late October through early spring because wood was lighter when sap was in the roots, the wood dried quicker, and transport was easier over ice-covered roads in cold areas. Often, the woodcutters were seasonal employees. The woodcutters were responsible for felling the trees, trimming and cutting the logs to the correct length, and hauling the logs to a storage area. The wood was then stacked and left to dry.[24]

The charcoaling process ran from March through December. Wood was piled in heaps and covered in earth, and a fire was set to char the wood. The demanding process had to be carried out in a careful and controlled manner.[25] Charcoal pits were set on a clean, level ground surface, sheltered from the wind. If the surface was not level, a flat terrace was produced by excavating into the hillside and dumping the spoil on the slope to create a level platform. An area measuring 12–15 meters in diameter was generally cleared. The logs were stacked, end on end, typically 3.6–4.5 meters high. A central chimney opening would be left in place. The pile was covered with a layer of dirt, clean charcoal dust, and wet vegetation several centimeters thick. The pit was then fired through the chimney. The burning rate was controlled using the chimney and vent holes at various locations. In favorable conditions (such as dry, calm weather), a pile could be reduced to charcoal in 7–10 days, though it could take up to 21 days in poor conditions.[26]

As soon as the charcoal was cool enough to work with, the last step of charcoal production was begun, which involved drawing the charcoal from the heap and hauling it to storage at the furnace. A typical pit of 1,500 bushels would be completely drawn in a week. Rakes were used to remove the charcoal from the heap. If the workers were not careful, the entire pile of charcoal could catch fire while drawing the charcoal. The cooled charcoal was loaded into large, high-sided wagons, each of which carried 100–250 bushels of charcoal, and hauled to the storage sheds adjacent to the furnace.[28]

Summary of Investigations

The investigations of the charcoal sites documented in this study involved three different cultural resource management (CRM) projects carried out over several years. Because this work was completed as part of CRM investigations, it was limited in extent, with only enough data being gathered so as to avoid and protect the sites. Two survey projects inventoried several thousand acres prior to timber sales in Dent, Iron, and Reynolds counties in the north-central Ozarks, documenting most of the sites included in this study.[28] No test excavations were conducted at a majority of these sites, and fieldwork involved mapping and limited shovel testing and/or the use of a metal detector. Limited exploratory test excavations were carried out at one charcoal pit and a residential site to investigate the nature and function of features present at the sites.[29] Two additional residential sites were investigated to assess the extent of damage inadvertently caused by recent timber harvest activities.[30] The results of these investigations are briefly summarized in the following two sections.

Charcoal Pits

Sixty-eight charcoal pits have been documented in these studies (Table 1), and all are essentially the same. The pits average 12.3 m in diameter and 17 cm deep. These

Table 1. Data on Charcoal Pits

Site No.	Pit Size	Pit Depth	Platform Size	Artifacts	Location
23DE142a	9.2 × 10.0 m	17 cm	15.4 × 18.5 m	Muleshoe	Terrace
23DE142b	5.4 × 5.4 m	19 cm	NA	No	Terrace
23DE142c	10.8 × 10.0 m	18 cm	NA	No	Terrace
23DE142d	18.5 × 6.9 m	18 cm	18.5 × 13.1 m	Wire	Terrace
23DE142e	6.9 × 9.2 m	14 cm	NA	Metal strapping	Terrace
23DE142f	5.4 × 10.8 m	16 cm	NA	No	Terrace
23DE143a	10.1 × 16.2 m	21 cm	13.1 × 17.7 m	No	Toeslope
23DE143b	14.6 × 17.7 m	14 cm	14.6 × 16.9 m	Piece of collier's rake, tin can	Terrace
23DE143c	12.3 × 15.4 m	22 cm	13.1 × 13.9 m	No	Terrace
23DE143d	16.2 × 15.4 m	15 cm	17.7 × 15.4 m	Condensed milk can	Terrace
23DE143f	9.2 × 6.4 m	12 cm	10.8 × 11.1 m	Iron strapping, 2 pieces wire, 2 piece sheet metal	Terrace
23DE144a	18.5 × 19.3 m	14 cm	15.4 × 19.3 m	No	Ridge
23DE144b	16.9 × 15.4 m	18 cm	NA	No	Terrace
23DE145a	16.2 × 10.0 m	19 cm	12.3 × 10.0 m	No	Terrace
23DE145b	5.4 × 5.4 m	22 cm	10.8 × 7.7 m	No	Terrace
23DE145c	6.9 × 6.2 m	36 cm	14.6 × 17.9 m	No	Terrace
23DE145d	13.1 × 15.4 m	13 cm	13.1 × 13.4 m	No	Terrace
23DE145e	13.9 × 10.0 m	13 cm	15.4 × 10.8 m	No	Terrace
23DE145f	10.8 × 10.8 m	19 cm	11.6 × 14.6 m	Wagon tongue clevis, wire	Terrace
23DE146a	9.2 × 8.5 m	15 cm	12.3 × 10.0 m	Nail	Terrace
23DE146b	26.2 × 17.5 m	23 cm	27.0 × 23.1 m	No	Terrace
23DE147a	14.7 × 13.9 m	18 cm	NA	Wire	Terrace

Continued on page 34

Table 1. Data on Charcoal Pits (Con't.)

Site No.	Pit Size	Pit Depth	Platform Size	Artifacts	Location
23DE147b	16.9 × 13.9 m	13 cm	13.9 × 14.6 m	Harness part	Terrace
23DE147c	15.4 × 11.6 m	20 cm	NA	No	Terrace
23DE147d	8.5 × 9.2 m	12 cm	NA	No	Terrace
23DE148a	12.3 × 13.1 m	21 cm	NA	No	Terrace
23DE148b	13.1 × 10.8 m	10 cm	NA	Tin can	Terrace
23DE148c	13.9 × 11.6 m	13 cm	NA	Prince Albert tobacco can	Terrace
23DE148d	15.4 × 13.9 m	13 cm	15.4 × 13.9 m	No	Terrace
23DE148e	13.9 × 13.1 m	12 cm	18.5 × 13.1 m	Wire, large spike, 3 nails	Terrace
23DE148f	13.1 × 14.6 m	12 cm	13.1 × 13.9 m	Chain link	Ridge
23DE149a	21.5 × 11.5 m	20 cm	17 × 20 m	No	Terrace
23DE149b	14.5 × 6.0 m	20 cm	16 × 9 m	Horseshoe, muleshoe	Toeslope
23DE149c	17.7 × 17.0 m	23 cm	20.8 × 20.0 m	Tin can	Toeslope
23DE149d	15.4 × 7.7 m	14 cm	18.5 × 12.3 m	No	Terrace
23DE151	9.2 × 16.9 m	18 cm	NA	No	Terrace
23DE153	15.4 × 10.8 m	13 cm	13.9 × 13.1 m	Chain link	Terrace
23DE155	7.7 × 6.9 m	21 cm	10.8 × 16.9 m	No	Terrace
23DE156	4.6 × 10.0 m	13 cm	11.6 × 11.6 m	No	Ridge
23DE157	14.6 × 13 m	23 cm	NA	Chain link, 3 pieces sheet metal	Toeslope
23DE158	13.1 × 20.0 m	20 cm	NA	Cast iron vessel	Terrace
23DE159	10.8 × 10.8 m	18 cm	13.9 × 12.3 m	No	Ridge
23RE115b	15.4 × 10.0 m	12 cm	NA	Nail	Terrace
23RE115c	11.6 × 12.3 m	22 cm	14.6 × 16.9 m	No	Terrace
05-697	8.2 m	15 cm	11 m	Wire	Slope
05-698	8.4 × 10.6 m	13 cm	10 × 12.6 m	No	Slope
05-699	15.2 ×10.8 m	18 cm	15.2 ×10.8 m	Metal hook	Ridge
05-700	9.2 × 8.5 m	18 cm	9.2 × 8.5 m	No	Slope
05-701	10.5 × 11.5 m	14 cm	10.5 × 11.5 m	Numerous—see text	Slope
05-702	10 × 10.8 m	18 cm	10 × 10.8 m	No	Slope
05-703	10 × 8.5 m	13 cm	10 × 8.5 m	No	Ridge
05-704	10 × 7.8 m	13 cm	10 × 10 m	No	Toeslope
05-705	10.8 × 8.5 m	15 cm	10.8 × 8.5 m	Bolt, bracket, washer, chain link	Toeslope
05-707	12 × 12 m	15 cm	12 × 12 m	Nail, metal plate	Ridge
05-708	10.8 ×10.8 m	15 cm	10.8 ×10.8 m	Wire	Slope
05-710	9.2 × 13.1 m	15 cm	9.2 × 13.1 m	Horseshoe	Ridge
05-725	6 m	15 cm	6 m	No	Ridge
07-381	13.1 × 11.6 m	18 cm	NA	Horseshoe, sheet metal	Terrace
07-382	12.3 × 15.4 m	18 cm	NA	Horseshoe	Terrace
07-383	13.7 m	15 cm	NA	No	Terrace
07-384	13.1 × 11.6 m	15 cm	NA	Horseshoe	Terrace
07-385	12.3 m	19 cm	12.3 m	Bolt	Terrace
07-386	?	20 cm	NA	No	Terrace
07-387	8.5 m	18 cm	8.5 m	No	Terrace
07-388	5.4 × 8.5 m	14 cm	5.4 × 8.5 m	No	Terrace
07-389	10 × 11.6 m	21 cm	10 × 11.6 m	Sheet metal	Terrace
07-390	13.1 × 15.4 m	19 cm	NA	2 nails, bracket	Terrace
07-393	9.2 m	15 cm	NA	No	Terrace

dimensions reflect diameter at the ground surface, while the depth reflects the charcoal fines left behind after the process was completed. Almost all pits are located on creek terraces adjacent to the base of the slope (figure 3). The original ground surface was artificially leveled by excavating into the base of the slope, and the spoil from this excavation was used to build up the lower side of the platform thus created (figure 4). These excavated areas averaged 14.95 meters in diameter. On a basic level, the charcoal pits recorded by these projects resemble those documented by previous studies. Detailed excavations, such as those discussed by Ronald Reno were not performed, so only basic comparisons can be made.[31] In contrast to the findings of Charles Zeier and Reno, a layer of burned earth was not obvious beneath the charcoal pits.[32] The reason for this is not clear, although it is possible that the pits examined were only used once, while those examined by Zeier and Reno were used multiple times, or perhaps the characteristics of the underlying soils were sufficiently different as to obscure evidence of burning. The frequency of charcoal pits, 1 every 13 acres, is the same as seen in the Blue Ridge Mountains of Virginia.[33]

All charcoal pits were investigated using a metal detector. Once a metal object was detected, a trowel was used to scrape the soil until the object was located. Thirty-four charcoal pits had associated artifacts, ranging in frequency from one to five artifacts per pit, with one exception to be discussed below. Artifacts recovered from charcoal pits in this project include mule shoes, shoe nails, wagon parts, horseshoes, harness parts, a fragment of a wagon tongue clevis, chain links, a stove door hinge, pieces from a cast-iron vessel, a collier's rake (metal piece in which wooden tines were set), square-cut nails, tobacco cans, condensed-milk cans, metal strapping, bolts, brackets, and wire. These artifacts are generally associated with animals or wagons, food storage and preparation, charcoal production, and clothing. Most are probably derived from the animals or wagons used to haul the charcoal to

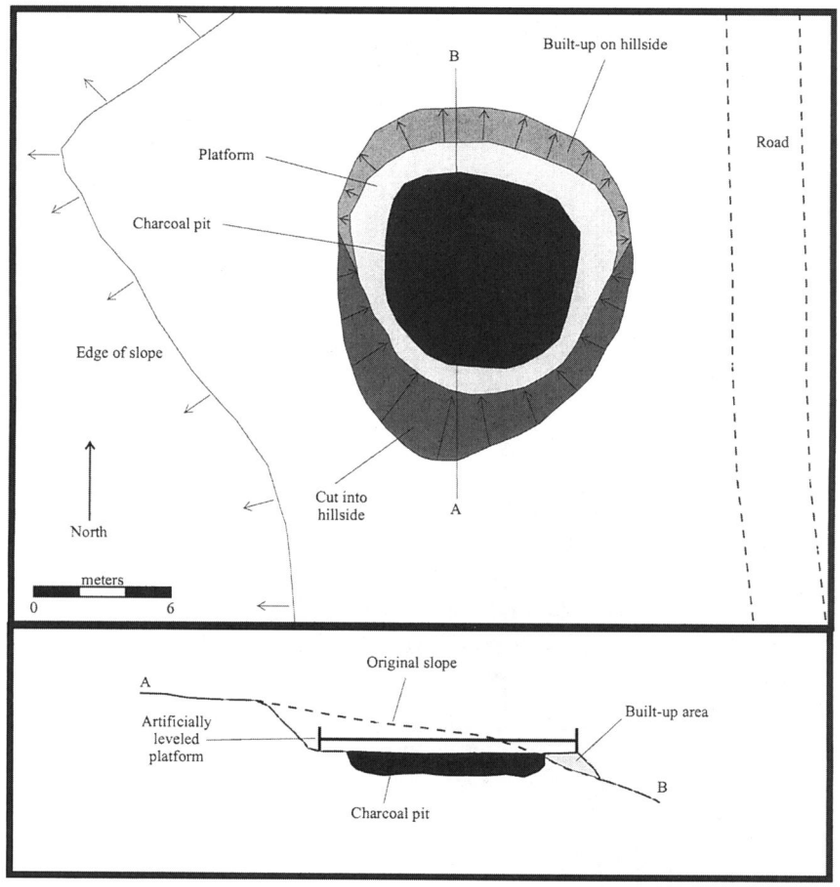

Figure 4. *Sketch of a typical charcoal pit recorded by this project.* Map by author.

the furnace. The rest are probably associated with the personal possessions of the workmen, such as food or drink containers and clothing. Some, such as the stove door hinge and cast-iron vessel, suggest occupations near the charcoal pits. These may have been in the form of tents or lean-tos, possibly used by the colliers.

Initial investigations at one of the charcoal pits in the Banner Charcoal Complex, Banner No. 5 (site no. 05-701), revealed a more substantial concentration of artifacts than was found at any other charcoal pit.[34] Use of a metal detector around the pit revealed a concentration of metal artifacts, including square-cut nails (n=35), cast-iron vessel fragments (n=4), and a chain. Pottery was recovered while troweling for positive metal detector responses. In order to investigate the artifact concentration, limited testing covering 2.75 m^2 was carried out in the area where the chain and pottery were found (figure 5).

A majority of the nearly 100 artifacts recovered from the site were pottery sherds (n=54), and most pottery (n=26) is engine-turned whiteware, almost certainly from the same vessel.[35] These sherds are blue with black bands. Additional sherds representing other vessels include 5 plain sherds, 19 pottery fragments too small to identify, 2 pieces of stick-stamped whiteware (black with a red band), 1 piece of hand-painted whiteware (green with a red band), and 1 piece of plain ironstone. Based on the pottery recovered, it is likely that this site was occupied between 1860 and 1880.[36] The only other artifacts beyond those already mentioned are two buttons. This concentration of artifacts likely represents the remains of a short-term occupation, possibly by the colliers burning the charcoal. Alternatively, it could represent woodcutters working earlier in the process. No evidence for a structure has been found, and the dwelling may well have been a tent.

According to Reno, watch stations were established near the charcoal pits.[37] Burning pits had to be monitored constantly, and one person or several working in shifts might do this. At those watch stations investigated by Reno, the material culture left behind by this activity was described as "sparse in the extreme."[38] It is likely that many of the artifacts recorded around the charcoal pits by the investigations reported here are related to the use of such watch locations.

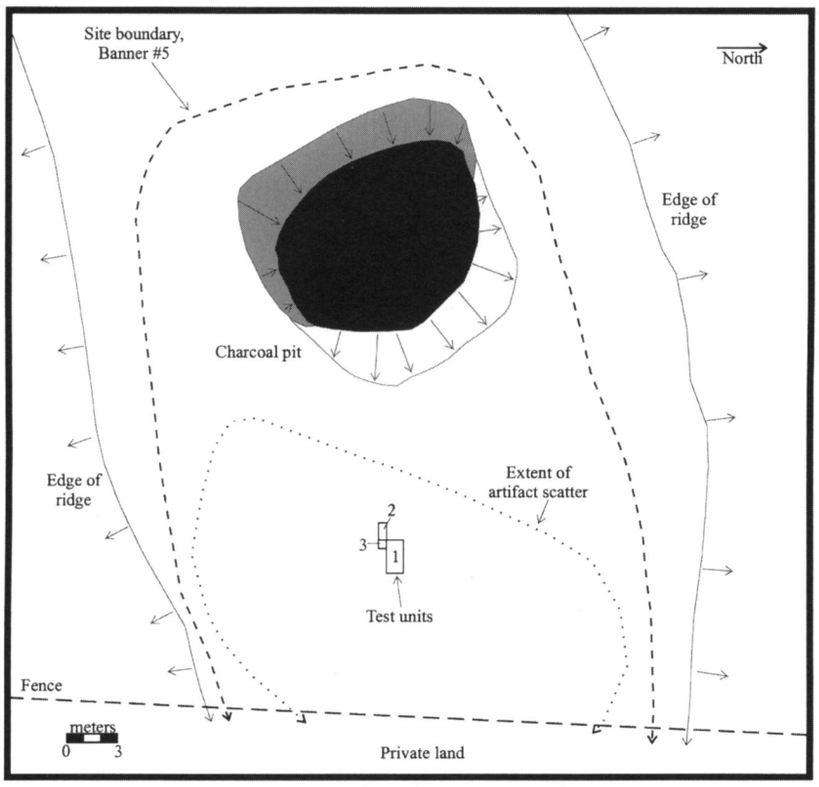

Figure 5. *Sketch of Banner No. 5 showing location of artifact scatter and test pits in relation to the charcoal pit. No investigations occurred on private land.* Map by author.

Structures

Twenty-one features are believed to represent the remains of short-term occupations associated with charcoal production. The structures themselves consist of small rock piles and associated light scatters of historical period artifacts (Table 2). These rock piles come in a range of sizes, varying from 2.0 to 15.75 m^2. Based on data obtained from excavations, the rock piles probably represent the hearths at the base of mud and stick chimneys. Such "mudcat" chimneys are common in Arkansas but have not been recorded in this area before.[39] A majority (n=16) have a rock pile that measures 5 m^2 or less.

The heaviest concentration of artifacts is located immediately around each of the rock piles. These consist primarily of square-cut nails and stove parts, but several other types of metal artifacts were observed, along with small quantities of whiteware and bottle glass. The overall size of the associated artifact scatters ranges from 180 m^2 to 4,550 m^2. Of the 14 structures for which the dimensions of the artifact scatter were determined, a majority (n=8) have an area of less than 400 m^2, two sites measure between 900 m^2 and 1,280 m^2, and four measure greater than 2,000 m^2. These features have a distinctly domestic feel to them, despite the small quantity of artifacts recovered. They generally are located on creek terraces adjacent to the base of the ridge (figure 3). Five of the features require a more detailed discussion because they were the subject of more intensive investigations, and these sites collectively provide important information relating to the nature and function of this type of site.

One structure locality (23DE142 S2) was recorded that appeared different from the others. It consisted of the usual rock pile and artifact scatter, but it was adjacent to an artificial pond. The creek has been channelized and excavated deeper in order to form a hole that holds water year-round. There are a larger number of mule shoes at this structure than at any of the others, and the only ox shoe from the entire Nova Scotia complex was found at this structure. A number of tack and wagon

Table 2. Data on Structures

Site ID	Site Size	Site Area	Rock Pile Size	Rock Pile Area
23DE142 S1	31 × 41 m	1271 m^2	2.5 × 3.0 m	7.5 m^2
23DE142 S2	81 × 35 m	2835 m^2	2.7 × 2.2 m	5.94 m^2
23DE142 S3	9 × 20 m	180 m^2	2.1 × 2.1 m	4.62 m^2
23DE142 S4	15 × 15 m	225 m^2	2.0 × 1.0 m	2.0 m^2
23DE142 S5	13 × 18 m	234 m^2	2.3 × 3.0 m	6.9 m^2
23DE143	NR	NR	2.3 × 2.6 m	5.98 m^2
23DE144	NR	NR	3.0 × 3.0 m	9.0 m^2
23DE145 S1	NR	NR	3.3 × 2.4 m	7.92 m^2
23DE145 S2	NR	NR	2.4 × 2.7 m	6.48 m^2
23DE146	NR	NR	2.0 × 2.0 m	4.0 m^2
23DE147	NR	NR	1.4 × 1.6 m	2.24 m^2
23DE150	NR	NR	3.0 × 3.0 m	9.0 m^2
23DE162	50 × 40 m	2,000 m^2	3.0 × 2.0 m	6.0 m^2
23DE163	50 × 45 m	2,250 m^2	2.3 × 2.3 m	5.29 m^2
07-392a	16 × 17 m	272 m^2	1.7 × 2.0 m	3.4 m^2
07-392b	16 × 23 m	368 m^2	3.0 × 2.0 m	6.0 m^2
23DE161	22 × 18 m	396 m^2	3.0 × 3.6 m	10.8 m^2
23DE160	16 × 18 m	288 m^2	1.25 × 2.0 m	2.5 m^2
07-368	45 × 20 m	900 m^2	4.5 × 3.5 m	15.75 m^2
07-391	16 × 16 m	256 m^2	2.5 × 2.0 m	5.0 m^2
05-696	70 × 65 m	4,550 m^2	3.0 × 3.0 m	9.0 m^2

NR = site size could not be determined because of disturbance.

parts were also recorded at this locality. The assemblage from the site, combined with the large developed water source, suggests the presence of larger numbers of draft animals, at least in comparison to the other areas at Nova Scotia.

Site 23DE161 is located on a low terrace at the end of a point ridge between two intermittent creeks (figure 6). It consists of a rock pile (3.0 × 3.6 m) two stones thick and an associated scatter of artifacts (22 × 18 m). The rock pile is interpreted as originally consisting of a rectangular platform of stones with a chimney. Excavations at the site consisted of nine test pits (2 × 2 m), laid out along an area disturbed by use as a skid trail in recent logging activity.[40] Ninety-seven artifacts, most of which were sherds (n=38) and nails (n=30), were recovered. Pottery from the site includes 5 hand-painted whiteware sherds (3 blue, 2 green), 2 earthenware sherds, and 31 plain whiteware sherds. Other artifacts include bottle/container glass, a piece of slate, flat glass, lamp glass, and sheet metal. This site appears to represent a domestic assemblage, probably a short-term occupation, based on the scant remains.

Site 23DE160 is located on a high terrace of an intermittent creek, adjacent to the base of the slope (figure 7). It consists of a low rock pile (1.25 × 1.8–2.2 m) two courses thick (figure 8) and a scatter of artifacts that

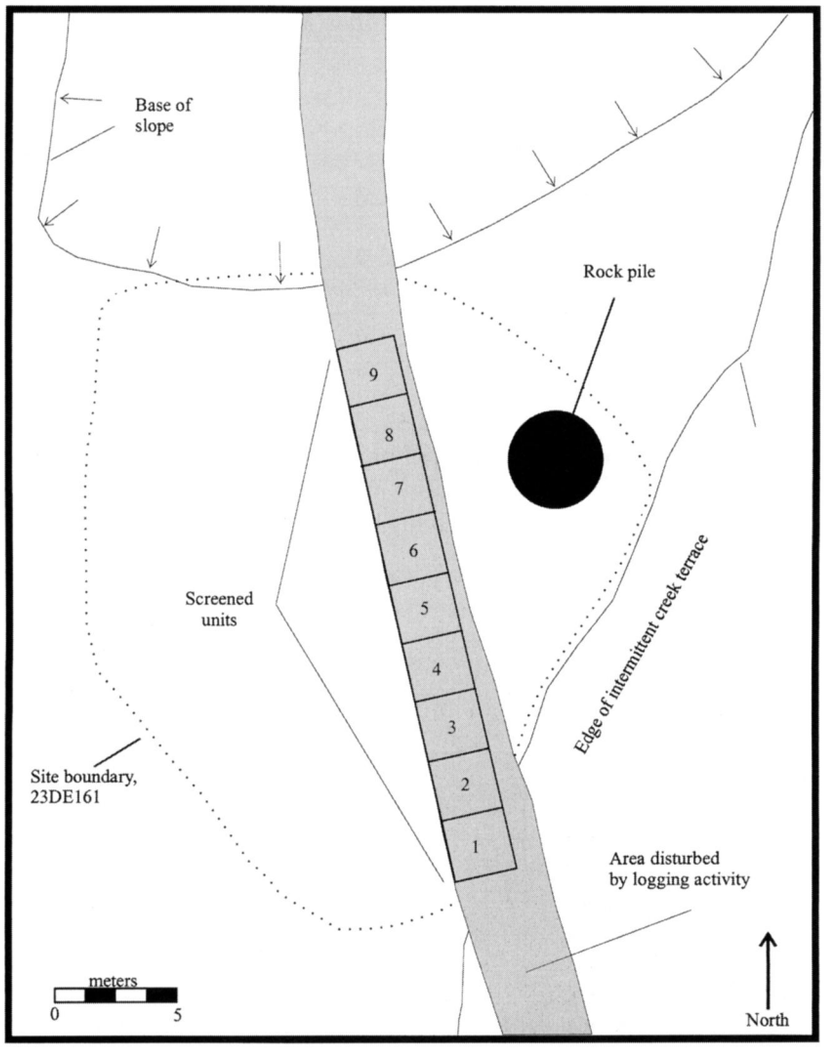

Figure 6. *Sketch of site 23DE161 showing location of features, artifact scatter, and test pits.* Map by author.

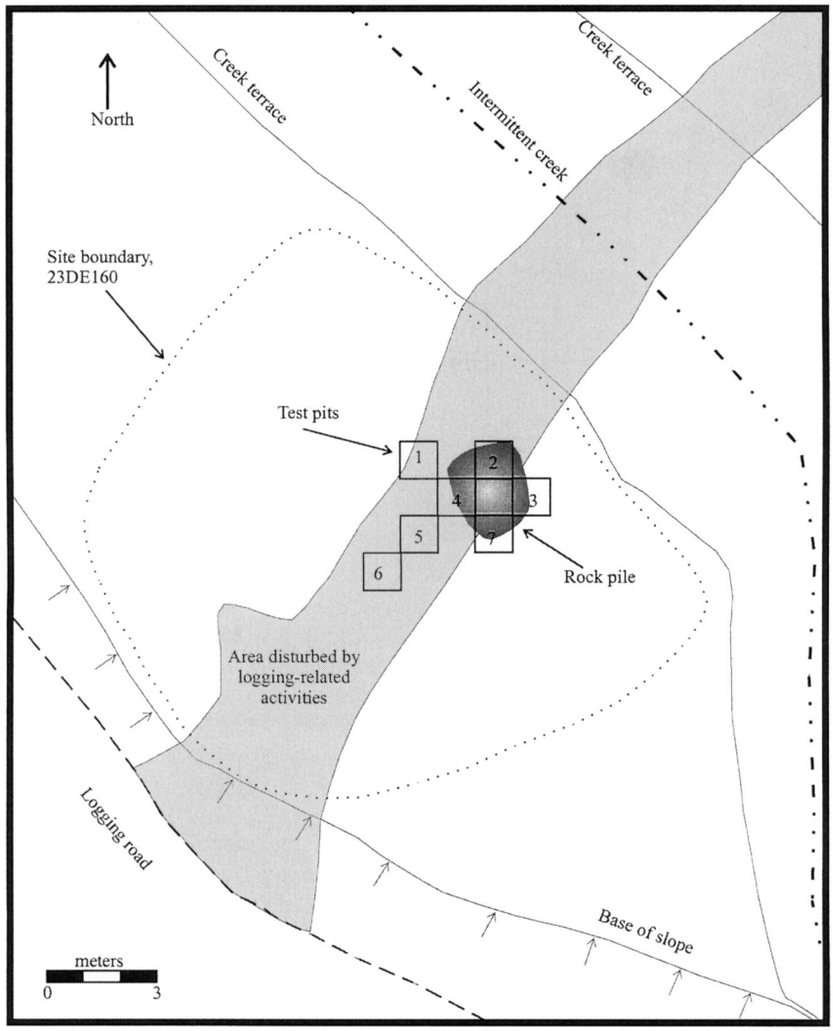

Figure 7. *Sketch of site 23DE160 showing location features, artifact scatter, and test pits.* Map by author.

covers an area measuring 16 by 18 meters. All of the rocks in the feature show signs of extensive exposure to heat, and charcoal and burned earth was also observed immediately adjacent to the platform. A skidder, which drove over the central rock pile, damaged the site, and a series of seven test pits (1 × 1 m) were excavated in the disturbed areas.[41] Nearly 200 artifacts were recovered, and not surprisingly the largest single category consists of square-cut nails (n=60), followed closely by pottery (n=45). The pottery from the site includes 2 pieces of green hand-painted whiteware and 43 pieces of plain whiteware. Next in order of frequency are lamp chimney glass fragments, sheet-metal fragments, and clear bottle/vessel glass, while other artifacts recovered include clothing items, a medicine bottle, a clay tobacco pipe, a harmonica, and a cobalt blue glass tumbler. This assemblage appears to be domestic in origin and is roughly similar in makeup to the sites excavated within the town of Nova Scotia.[42]

Excavations at site 07-368 (figure 9) focused on the rock feature at this site, which measured 4.5 by 3.5 meters (figure 10). Investigations at this site involved the excavation of 13 contiguous test pits (1 × 1 m) over one end of the rock feature.[43] Many of the loose rocks had been burned and were jumbled and disorganized, clearly having fallen into their locations, and numerous artifacts were found beneath these rocks once they were

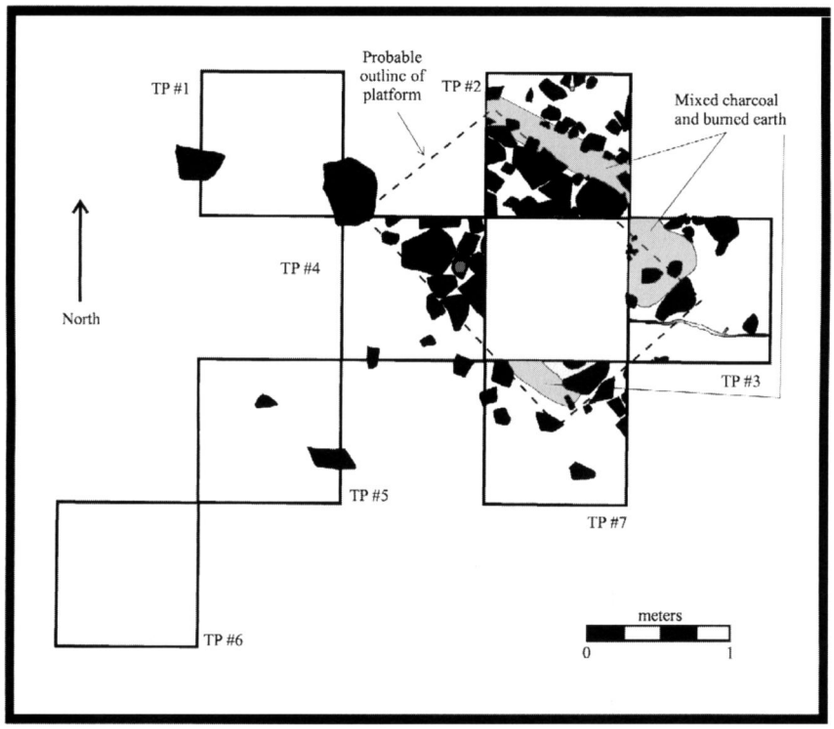

Figure 8. *Detail of rock pile at site 23DE160 and the location of test pits.* Map by author.

removed. Underneath the disturbed rocks were the base of a chimney constructed with large, thick stones set in a stack, and a hearth platform consisting of large, but relatively thin, flat rocks set into the original ground surface (figure 11).

Square-cut nails and fragments were the most common type of artifact at the site, accounting for 65 percent of the total. Plain whiteware pottery was the next most common at 9 percent, with flat glass (5%), sheet metal fragments (3%), buttons (3%), and clear glass fragments (2%) following. In addition to the plain whiteware, two red transfer-print whiteware sherds were recovered. The flat glass fragments may well represent the remains of a single windowpane, as they were found in a very limited area immediately adjacent to the platform. Some artifacts suggest that, although this may have been a temporary occupation site, the residents tried to bring some finer items with them, and the furnishings may not have been as primitive as some accounts suggest. Two upholstery tacks were found along with a small key of the type that would go with a clock case or small chest. Also of interest were the three ceramic doll parts (one foot, two pieces of a head) found in front of the cabin. These almost certainly came from a child's toy. The assemblage from site 07-368 likely represents that of a largely self-sufficient family.

Our interpretation is that these rock features are the remains of structures that represent short-term habitation sites, probably occupied by the woodcutters. Overall, the assemblage from these sites clearly appears to be domestic in origin. All three tested cabins have a roughly similar artifact assemblage. The artifact collection as a whole from these sites is quite similar in content and appearance to those recovered from excavations within residential areas of Nova Scotia, especially the workers' houses.[44] The artifacts are also roughly similar to early-19th-century domestic sites excavated in the Ozarks.[45] The main differences are in the pottery, with the earlier sites containing more decorated whitewares, while the later sites are dominated by undecorated whitewares. Although it is possible that these structures represent outlying houses from the town of Nova Scotia itself, they are more than a mile from the main part of town. No cisterns or wells are present, and the only developed water source is a waterhole or pond that was constructed at one site, which would probably

not have been used for domestic purposes. This lack of a good water source, along with the absence of additional features such as cellars, also suggests that these structures do not represent farmsteads. None of the area has been cleared for agriculture, and long-term habitation sites in the area all have a developed water source and additional outbuildings. The apparently sparse midden also supports the hypothesis that these represent short-term occupations. A longer, more established occupation would likely generate much more refuse.

Discussion

Charcoal production has been the subject of a number of previous studies.[46] The present study has documented the presence of an extensive charcoal-production complex associated with the Nova Scotia Ironworks, as well as a second complex that could not be associated with a specific furnace. Overall, the complexes documented by this study resemble in a general way charcoal-production facilities described elsewhere that are roughly contemporaneous with the present study.[47]

This similarity may well be related to the fact that in all three areas charcoal production was carried out as part of an industrial operation. Some studies have not discovered evidence for the presence of features other than the charcoal pits.[48] It is possible that this difference is temporal, as the sites Susan Frye was studying were used in the early-19th century. The furnace that used the pits documented by Frye was also smaller than the operations at Nova Scotia or the other studies. Zeier suggested that charcoal production organized on a pattern different than the centralized, industrial organization he found in Nevada may have a different appearance. Those operations investigated by Frye may have been organized differently than the industrial operations described by Zeier, Reno, and Edward Heite in their studies.

One of the biggest differences between this study and previous investigations of charcoal production in Missouri and the eastern United States is the identification of artifacts in frequent association with charcoal pits. However, similar patterns have been found in the western United States. A wide variety of artifacts were recovered, including mule shoes, wagon parts, tack, and tools, as well as stove parts and food/beverage containers. Most of these artifacts (shoes, tools, wagon parts) represent items broken while in use at the pits and dis-

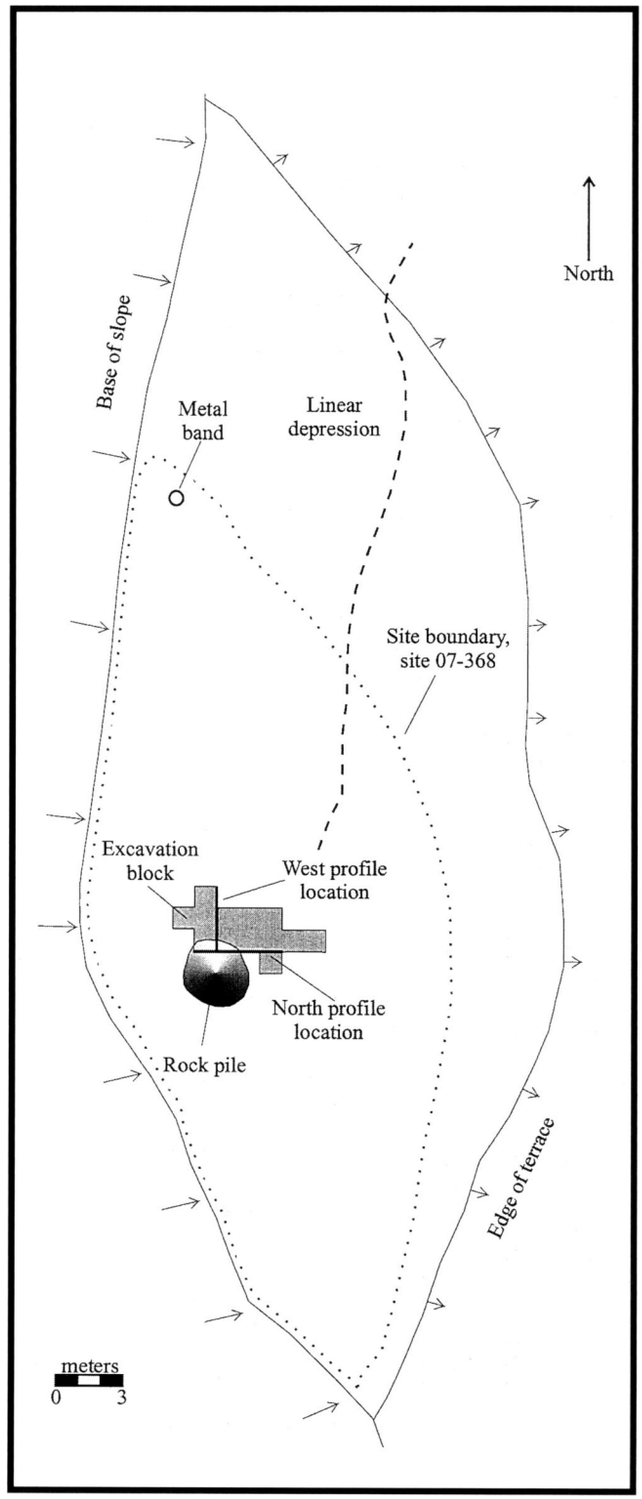

Figure 9. *Sketch of site 07-368 showing location of features, artifact scatter, and test pits.* Map by author.

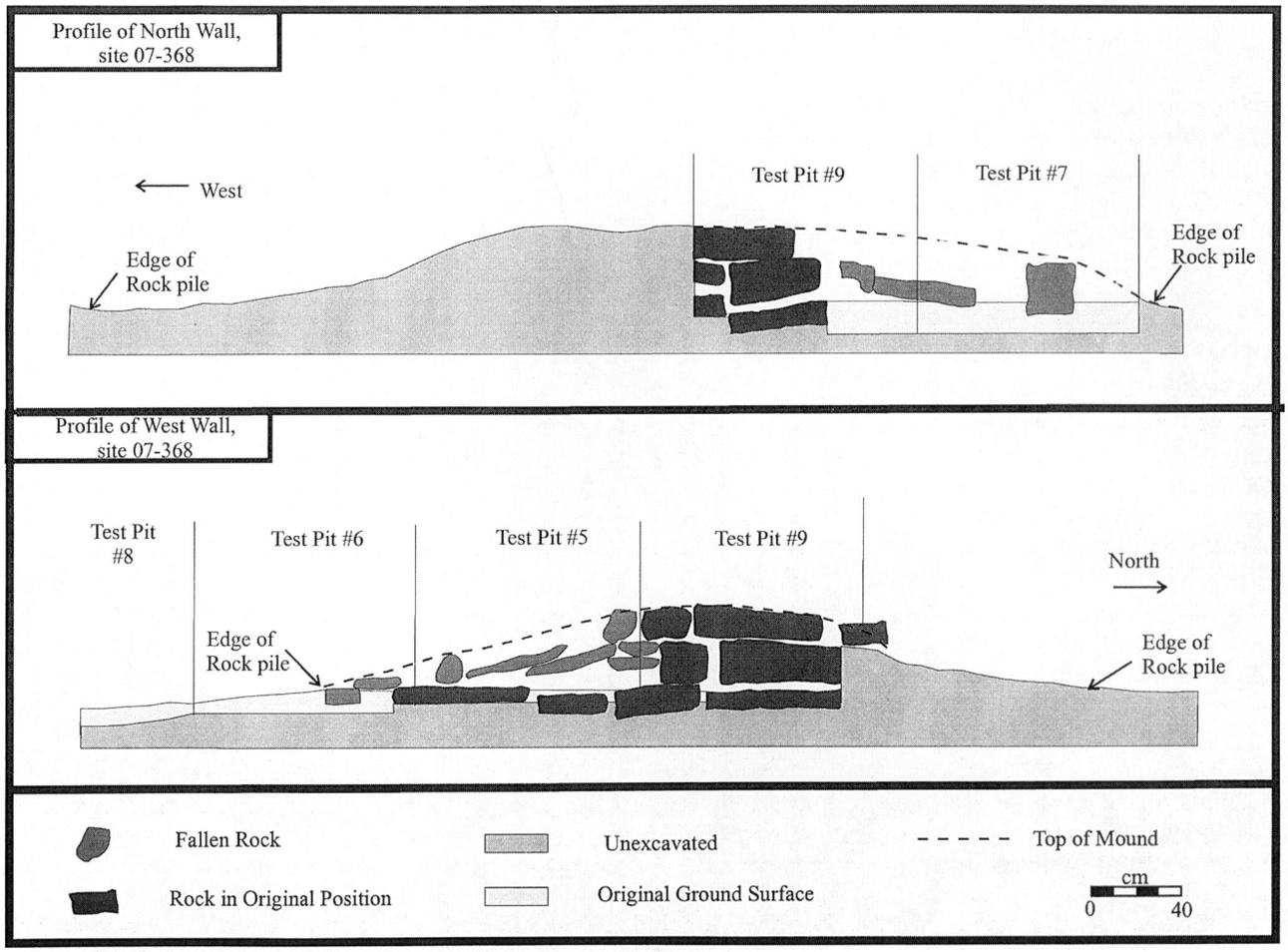

Figure 10. *Profiles of rock feature at site 07-368 showing location of test pits in relation to base of chimney and hearth.* **Map by author.**

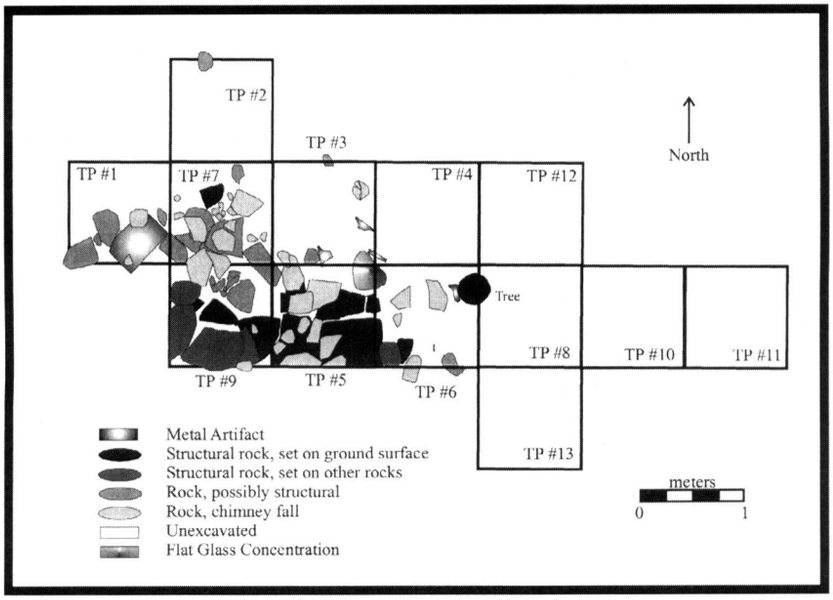

Figure 11. *Sketch of excavation block at site 07-368.* **Map by author.**

carded in place. A few are suggestive of other activities. Although the food and beverage containers could have been carried to the sites by the workmen, the stove parts and cooking vessels probably represent at least a temporary occupation of a location. The results of investigations at Banner No. 5 (site 05-701) confirm that occupations occurred in the vicinity of charcoal pits. These likely represent watch locations such as those described by Reno.[49]

The use of temporary structures appears to have been common in industrial charcoal production. As Gordon and Malone have noted, proper charcoal production required constant supervision by the collier, who had to live nearby.[50] Heite, Reno, and Zeier report the use of temporary structures by charcoal workers.[51] Victor Rolando reports that in Vermont "the collier spent the entire charcoal-making season on a mountainside, living in a small hut among his mounds."[52] Woodcutters from the Maramec Ironworks of central Missouri lived in primitive cabins while working over an area. According to James Norris, "the wood choppers built bleak and lonely huts."[53]

Woodcutters working for the large lumber companies in the southern Ozarks often lived in primitive cabins or large wall tents for several months at a time while working over an area. Several of these temporary cabins (sites 23RI512, 23RI515, 23RI565) have been recorded by Cynthia Price in Ripley County.[54] Although they do not contain the rock piles, these cabin sites consist of surface scatters of artifacts that are similar in content to those documented here. Land records on file with the Mark Twain National Forest indicate that loggers occupied these sites for a short period of time. Two are described as "small lumber cabins," while the third is reported to be a logging camp occupied by four families for three months. In addition to temporary cabins and tents, loggers in southern Missouri are also known to have lived in portable wooden cabins built on skids.[55]

The cabins investigated by Zeier and Reno were fairly basic with little elaboration in the material culture.[56] Both woodcutters and colliers used such cabins. Only males lived in the cabins (28 m^2) investigated by Zeier, constructed using vertical pinion posts.[57] None of the cabins recorded by Heite were tested, but they averaged 29.16 m^2 in area and consisted of small, circular mounds with a central depression.[58] These were also reported to have only been used by males and were used first by woodcutters and then by the colliers. Reno investigated cabins with an average size of 13.75 m^2, ranging from 8.4 to 19.2 square meters.[59] Primarily males lived at these sites, although a few families were present.[60] The pattern seen for the present study is similar to these studies. In most cases, the size of the cabins documented in the present study could not be established, but at site 07-391 the distribution of nails and possible foundation stones indicated that the structure could have measured 5.4 to 6.0 meters in diameter. This corresponds with the sizes of structures described by Zeier and Heite.[61]

It is proposed that the structure localities recorded by this project are temporary cabins occupied by woodcutters. Several pieces of evidence have been used to reach this conclusion. At site 23DE142 the structure was occupied prior to the use of a nearby charcoal pit. An ax found at another site (23DE145) is also suggestive of use by woodcutters as this was of a type that would have been used for felling and bucking trees.[62] Norris reported that woodcutters working for the Maramec Ironworks lived in primitive cabins.[63] Woodcutters typically worked from October through spring, a time when more substantial structures would have been required. At least one of the sites (23DE142) contained the remains of a heating stove. In contrast, charcoal was burned from March through December. Based on this information, it is our present interpretation that woodcutters used the structures recorded by these projects. Colliers, who worked during the warmer months, probably made use of more ephemeral structures, such as wall tents. The presence of this kind of shelter may be seen in the occasional recovery of artifacts such as the stove door hinge at one pit or the cast-iron vessel at another. The artifacts recovered from the area of Banner No. 5 definitely suggest some form of occupation in the vicinity of the charcoal pits.

The picture obtained as a result of these excavations differs from that presented by Norris for the woodcutters working for the Maramec Ironworks. According to Norris,

> the wood choppers built bleak and lonely huts . . . temporary shelters, lacking even the most rudimentary comforts. The small huts usually had no windows and only one door, hung on leather hinges to permit entrance and egress. Most had log and dirt roofs, log sides, no floors, and a primitive fireplace for both heating and cooking.[64]

Site 07-368 clearly does not fit this description. Although it appears to be a temporary shelter, rudimentary comforts are definitely present. The presence of women and children also differs from accounts of charcoal-production. According to Zeier and Norris, only men were present at the charcoal sites, while Heite refers only to men. Women and families were rare according to Reno.[65] However, woodcutters working for the large timber companies in southern Missouri in the late-19th, and early-20th centuries often lived in primitive cabins or large wall tents for several months at a time while working in an area.[66] In many cases, entire families were present. This appears to be the case at site 07-368.

The presence of families in the Ozarks, as opposed to primarily males in Nevada, may be related to the different labor pools.[67] In the Ozarks most of the workers, especially the woodcutters, were seasonal employees who farmed or performed other work the rest of the year. Even if they were recent immigrants to the area, they were almost all Americans who brought their families to settle in the area. In contrast, the charcoal workers in Nevada, to a large extent, were immigrants and often their families had not accompanied them to the United States.

Overall there is great similarity between the three excavated cabins, with one distinct difference. The artifact assemblages are roughly similar with no substantial differences, and all appear to result from a habitation site. The only real difference appears to be in the complexity of the rock feature. The rock feature at site 23DE160 was a simple, rectangular stone hearth that originally had a mud and stick chimney. In contrast, site 07-368 has a rock chimney with a stone hearth, and the rock feature is the largest such feature documented to date. Much more effort was put into constructing the rock feature at site 07-368. One possible reason could be that this house was to be the residence of a family, as opposed to that of a single adult male. The man who constructed the cabin at site 07-368 may have desired a more substantial and elaborate cabin to house his family. In contrast, the man who built the cabin at site 23DE160 may have simply desired a functional shelter. An alternative explanation could be status differences; someone of higher status may well have had the ability to build, or have built, a more elaborate structure containing better furnishings. There is a real variety in the shapes and sizes of the 18 rock piles recorded in the surveys that were not tested (Table 2). At the present time it is not possible to determine if these differences reflect differences in personal preference, the presence or absence of families, status differences, or some other explanation.

Conclusions

The present study has documented the presence of two extensive charcoal-production complexes, one of which has been listed on the National Register of Historic Places. These investigations reveal elements of a historic cultural landscape created by the production of iron in Missouri that can still be seen more than 100 years after production ceased. It may be typical of those associated with charcoal-fueled iron furnaces throughout the 19th century; differences in the details reflect possible regional, cultural, or functional differences in the industry.

While these charcoal-production complexes are typical, they are also unusual in another way. As Heite noted, "intact coaling complexes of pits, huts, and roads are fragile and extremely rare."[68] Such intact complexes are rare in the eastern United States for a variety of reasons. They consist of small, ephemeral features that are dispersed across a landscape covering hundreds or thousands of acres. Most investigations focus on the industrial heart of an iron operation, neglecting the thousands of acres of associated features. In order to document the full range of operations associated with the iron industry, it is necessary to conduct intensive surveys of large areas around the industrial plant. Because a majority of the workers associated with an iron furnace worked and lived away from the furnace for most of the year, we will not learn about their lives if we do not look for and investigate sites such as those discussed here. As with many aspects of archaeology, the small and ephemeral can be as important to understanding what occurred in the past as the big and highly visible.

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mistakes are those of the author and none of the conclusions or opinions reflect those of the reviewers or the author's employer.

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