ARCHAEOLOGICAL INVESTIGATIONS AT THE REED GOLD MINE ENGINE MILL HOUSE (31CA18**1)

CHICORA FOUNDATION RESEARCH SERIES 6

ARCHAEOLOGICAL INVESTIGATIONS AT THE REED GOLD MINE ENGINE MILL HOUSE (31CA18**1), REED GOLD MINE STATE HISTORIC SITE, CABARRUS COUNTY, NORTH CAROLINA

RESEARCH SERIES 6

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P.O. Box 8664
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March 1986

ISSN 0882-2042

Gold is the worst of ills that ever plagued mankind; this wastes our cities, drives forth their natives to foreign soils, taints the pure heart, and turns the virtuous mind to basest deeds; artificer of fraud supreme, the source of every wickedness.

Creon, Antigone, Sophocles

ABSTRACT

Archaeological investigations of the Reed Gold Mine Upper Hill engine mill house (31CA18**1) were conducted in November and December 1985. This site was used intermittently from the mid-nineteenth through early twentieth centuries to process gold ore taken from the underground workings of the Reed Mine. The study was designed to provide a thorough understanding of the architectural components at the site, including the number, size, and locations of the various engine mill houses. In addition, it was to provide more detail than is available from the historical record concerning the processing of gold ore in the nineteenth century structures. Finally, the work was also designed to investigate the range of non-processing activities which might be represented in the archaeological record. The study reveals three structures, built in 1854, 1886, and 1895, on Upper Hill, with only the first two actually used to mill gold ore. Artifacts recovered from this study provide information not only on the structures, but also on the activities which took place in them and on the lifestyle of nineteenth century North Carolina miners. Recommendations for future work at 31CA18**1 are discussed.

TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

ACKNOWLEDGEMENTS

This work was funded by a $25,000 appropriation from the North Carolina General Assembly, sponsored by Representative Dwight Quinn as House Bill 922, Section 237. The money was administered by the Historic Sites Section, Division of Archives and History, Department of Cultural Resources. Project coordination and contract supervision was handled by Ms. Terry Maureen Harper and Dr. Jack H. Wilson Jr. of Historic Sites. I wish to express my considerable appreciation to these individuals for their support and assistance. I also wish to acknowledge the support of Mr. Larry G. Misenheimer and Dr. Richard Knapp, also of the Historic Sites Section.

Mr. John Dysart, Site Manager of the Reed Gold Mine State Historic Site extended us every possible courtesy during this study. The site's staff, particularly Messrs. Jeff Howell, Bob Remsburg, Norman Long, Tim Hagler, and Ms. Penny Whitley, provided considerable assistance, both in and out of the field. The work would have been much less enjoyable without the cooperation of the Reed Gold Mine staff. In addition, I wish to thank the members of the Gold History Corporation for their continued support of the Reed and their particular interest in the archaeology of the engine mill house. Mr. Harold Nash, First Vice-President of the Gold History Corporation, visited us on several occasions and worked hard to ensure funding of the archaeological project was maintained.

The fieldwork was conducted by Mr. Craig Birrell, Mr. Bill Jurgelski, Ms. Ann Long, Ms. Becky Roman, and Ms. Jean Wilson. I appreciate their work and interest in the project. Preliminary sorting of artifacts was conducted by Ms. Jean Wilson, while the artifact analysis was largely conducted by Ms. Linda Carnes with assistance from Ms. Harper. Computer data entry was done by Dr. Wilson and Ms. Homes H. Wilson, largely on their own time. I greatly appreciate this assistance, which allowed me to produce this report on schedule.

I am particularly appreciative of my colleagues and friends who took time from their own schedules to review this manuscript, including Ms. Debi Hacker, Mr. Stanley South, Ms. Jane Trinkley, Ms. Martha Zierden, Ms. Terry Harper, Dr. Jack Wilson, and Dr. Richard Knapp. This report has greatly benefited from these reviews, but of course I assume full responsibility for any inaccuracies or misinterpretations of data which might be found in the study.

INTRODUCTION

Background and Research Goals

This study reports on excavations conducted at the Reed Gold Mine's engine mill house (31CA18**1) in November and December 1985. This work was funded by the Historic Sites Section, Division of Archives and History, Department of Cultural Resources for the State of North Carolina. As is discussed in greater detail elsewhere in this report, the Reed Gold Mine, as one of the few remaining opportunities to study mid-nineteenth century mining technology and lifestyle in the Southeastern gold belt, assumes particular historical and archaeological significance.

The Reed Gold Mine, transferred to the State of North Carolina in 1971, was opened to the public in 1977. Since the mine's acquisition it has been the subject of numerous, small archaeological surveys. Five separate archaeological studies, prior to the one described in this report, are worthy of special mention. The first work at the Reed Mine's Upper Hill engine mill house, for which no detailed accounts have been found, involved a "four-day 'investigation'" in October 1973 by a team from the Archaeology Branch of the Archaeology and Historic Preservation Section of the Division of Archives and History (A&HP Archaeology Branch) (Babits 1974:n.p.). The work during this initial reconnaissance was limited to establishment of a grid and "some [unrecorded] exploratory excavation" in the engine mill house vicinity (Babits 1974: n.p.).

The next work involved additional study at the engine mill house, conducted by Larry Babits with the A&HP Archaeology Branch and excavations at the 1895 Stamp Mill, conducted by James Woody Nesmith, also with the A&HP Archaeology Branch. The engine Mill house work was conducted by a crew of 11 individuals from June 18 through July 19, 1974. Approximately 1584 person hours were devoted to this work, which opened 925 square feet of area and moved 700 cubic feet of soil. Unfortunately, the artifacts, photographs, and color slides from this work can no longer be found. Some field notes have been identified, but the only report prepared on the work was a 22 page memorandum (Babits 1974). The archaeological study of the 1895 Stamp Mill, located about 800 feet to the southwest of the engine mill house adjacent to Little Meadow Creek, was not completed until 1975 and only a preliminary report is available for this study (Robertson and Robertson 1975).

Further work on Upper Hill consisted of the boiler pit excavations in December 1979 which are discussed in Sacchi's 1980 report. The additional work in 1981 by Sacchi to complete the excavation has never been reported. No artifacts from either of these excavations have been studied or described. It is apparent, then, that while considerable archaeological effort has been directed toward the study of gold ore processing at the industrial sites found on the Reed Gold Mine property, few reports useful to either the archaeological community or the general public have been produced. As a result we know little about the archaeology of North Carolina's gold mine industrial sites and the Reed Gold Mine archaeological sites are not open for interpretation to the public in any meaningful way.

In a broad sense the purpose of this work was to correct these deficiencies by providing a body of sound archaeological research at the engine mill house site (31CA18**1). Of primary concern was a more complete understanding of the architectural components at the site, including the number, size, and locations of the various engine mill houses. Since Babits' study in 1974 there has been controversy over the number of structures actually built on the site. Babits noted that,

> no one is certain which of the lines of foundation can be said to date to which time period. Nor can anyone state definitely how many buildings once occupied the site (Babits 1974:n.p.).

Apparently parallel alignments of stone have been variously referred to by Babits as "interior walls" or "equipment supports" with little firm reasoning for either supposition. Corners have been difficult to ascertain. The correlation of period maps with the limited archaeology has proved complex. The first goal, that of obtaining a better, more thorough understanding of the engine mill house architectural components, was obtained by larger scale excavations using contiguous 10-foot squares. Emphasis was placed on identifying the alignment of walls, identifying corners, studying the building techniques of the walls, identifying wooden wall members, and studying the spatial distributions of certain artifact classes such as nails and window glass. Additional work was devoted to obtaining a better correlation of the historical documents (primarily maps and photographs) with the extant archaeological evidence.

A second goal of the work was to learn more about the processing of gold ore in the engine mill house. While historical accounts (discussed in a following section) offered a general description of the structures, little is known about the movement of ore through the structures, and hence, how the structures related to the total site complex. Babits (1974:n.p.) suggested that a particle size analysis of the tailings might be useful to determine the location of machinery and other researchers have indicated that the presence of mercury in the soil might indicate specific processing areas. For the most part this study used visual soil differences and archaeological features to indicate the presence of different processing activities. Comparison of the historical and archaeological records assisted in delimiting work areas and identifying the function of various features. The presence and distribution of various artifacts also offered clues to the activities which took place in the various engine mill houses.

The final goal of this project was to investigate more fully the range of non-processing activities which took place in the engine mill house. Since the structure was industrial in nature considerable diveragence from the Carolina Artifact Pattern (South 1977) was expected, with most artifacts expected to fall into either South's (1977:95-96) architectural group (i.e., window glass, nails, spikes, or building hardware) or activities group (i.e., tools, stable and barn items, or gold mining and processing hardware). As previously discussed, these artifact groups were expected to provide valuable information on the structures and the processing activities.

Although the Reed site complex offers the potential to study a number of domestic sites (including both miners' cabins and the Reed home site), none have been excavated. Consequently, the few kitchen, clothing, or personal group artifacts which might be found on the site offer our only archaeological glimpse of a mid to late nineteenth century miner's lifestyle. Little is known about the miners who worked the Reed Mine or who operated the ore extraction machinery in the engine mill house. A study of the recovered artifacts may provide information not only on their lifestyle, but also on their economic status. Regretably, the previous archaeological studies have not produced artifact analyses useful for comparative purposes.

Although the historic preservation movement of the 1960's recognized the importance of both public and private structures to an understanding of America's "social history," it was not until more recently that structures related to the history of technology and industry were recognized as important to an understanding of America's material culture and development. The archaeological study of the physical remains of industry, engineering, and technology have come to be known as "industrial archaeology." Brent Glass notes that the industrial archaeology of North Carolina "reflects its growth from a primarily agricultural society to the leading industrial state in the South" (Glass 1975:vii), with extractive industries, such as iron, gold, and coal mining, dominating economic life in the early and mid-nineteenth century. Knapp notes that "North Carolina produced more gold than any other state prior to 1849" and that "gold mining at one point reputedly was second only to agriculture as an occupation in the state" (Knapp 1975:1).

Because the sites studied by industrial archaeologists date from the period of the American Industrial Revolution and hence are relatively recent in age, there is a tendency either to emphasize recordation of standing structures or to rely on the historical, documentary, or engineering record. Three gold mine sites in North Carolina (Reed Gold Mine, North State Mining Company, and Coggins Gold Mine) have been recorded in the Historic American Engineering Record (HAER) (Glass 1975) and these inventories are significant as they preserve the physical layout of the sites. Yet, as Council and Honerkamp note,

> [i]ndustrial sites reflect patterned human behavior, and it is this behavior that is becoming the object of study. The industrial site is not a static relic, but a mirror of dynamic industrial and technological processes and their relationship with society and cultural processes (Council and Honerkamp 1984:6).

Simple plan drawings and photographs, while recording the physical remains, fail to recognize or reflect any anthropological concern with the activities which took place at these sites. The historical record of these sites, as will be observed in a following section, consists of archival records, newspaper accounts, engineering and technical manuals, and abundant speculation. Council and Honerkamp observe that this historical record "is not a ready-made source of interpretations for the industrial archaeologists [but rather] it is a data source that must be controlled" (Council and Honerkamp 1984:7). There are a variety of reasons why the historical record may be intentionally or unintentionally misleading. Even reliance on technical manuals must be questioned, as Penn (1978) argues that the diffusion of technical knowledge in the nineteenth century was frequently slow, informal, and based on personal experience.

Council and Honerkamp (1984), following the work of Brown (1978), discuss the use of "real-versus-ideal" comparisons to understand industrial development in the nineteenth century. In essence, this would involve comparing the archaeological remains of an industrial activity, such as site layout (the real, based on empirical observations) to the historical documents, such as technical literature which indicates how the site should be laid out (the ideal). Council and Honerkamp (1984), in their study of the Union Railyards site in Chattanooga, Tennessee, were largely unsuccessful in operationalizing this "real-versus-ideal" methodology for a variety of reasons. The "ideal" tends to vary both through time and by author. Further, the "ideal" may be difficult (or even impossible in some cases) to abstract from the historical literature. Frequently, the "ideal" is stated only in the most general terms. The "real," while empirically observable in the archaeological record, must still be recognized by the archaeologist and correctly interpreted.

Thus, while the "real-versus-ideal" comparisons may be "tenuous and heir to the same subjective, qualitative, inductive reasoning entrenched in contemporary archaeology" (Council and Honerkamp 1984:177) the methodology is significant if for no other reason than because it forces the archaeologist to recognize, and deal with, the emic-etic distinctions inherent in the data base.

This work, as previously indicated, is at least partially related to the sponsor-oriented goals of preservation, stabilization, restoration, and reconstruction with the concomitant problems outlined by South (1977:23-24). For example, while six weeks were allotted to the fieldwork, only eight weeks were allowed for processing the artifacts, analysis, historical research, and report preparation. Yet gold mining was an important extractive industry in North Carolina which has received considerable historic interest (Knapp 1975:1; see also Glass 1985, Green 1937, Knapp 1973) and some archaeological interest (but with virtually no results, as evidenced by my previous discussions). As a consequence, these excavations at the Reed provide an initial study of this significant site. Lacking any other substantive study of Southeastern mining, this archaeology provides basic descriptive and classificatory data, the "basic foundation of historical archaeology" (South 1977:21). It is hoped, as a result of this work, that not only will the Historic Sites Section have the necessary data to ensure a realistic, accurate site interpretation, but that future archaeological research will benefit from this initial comparative data base.

Natural Setting

The Reed tract, which contains about 822 acres, is situated in Cabarrus County, about 25 miles east of Charlotte, 13 miles southeast of Concord, off SR 1102 in the Georgeville vicinity. The UTM central coordinates are 548650 East and 3904450 North (Figure 1). The tract, bisected by Little Meadow Creek, is characterized by a series of four "hills" or ridge promontories known in the historical literature as Upper, Middle, and Lower Hills east of the creek and Lake Hill on the west bank (Figure 2).

Cabarrus County is within the Carolina Piedmont physiographic province. The topography is rolling, although there are steep areas parallel to the major streams. Cabarrus is dominated by two generalized soil complexes. Most of the county consists of residual soils, such as Cecil, Helena, Madison, and Appling, formed on acid igneous rocks. In the vicinity of the Reed tract, however, are soils produced from "Carolina slates," such as the Georgeville and Alamance series (Gregg 1972:19-24; Trimble 1974:9-10). The United States Department of Agriculture (1939:1064) notes that the Georgeville-Alamance Area embraces the "well-known Slate Belt of the southern Piedmont" and that the soils are primarily silt loams, low in organic material and strongly acid in reaction. Subsoil consists of light red to yellow silt clay loams to plastic red clay. The nearby Cecil-Appling Area typically evidences a red, stiff but brittle clay subsoil (United States Department of Agriculture 1939:1060). Mica is common to these soils, while fragments of slate and quartz are typical of the Georgeville-Alamance Area soils. Trimble (1974:3, 15) found erosion of up to 0.6 foot of soil in Cabarrus County, which was just on the northern edge of the Cotton Plantation Area. It is likely that erosion dramatically increased on John Reed's tract as mining's demand for timber increased and denuded the area. The United States Department of Agriculture (1980:25) notes that logging alone results in an erosion rate of 0.36 tons of soil per acre per year, an increase of 1200% over that associated with "undisturbed land."

Partz describes the Reed Mine as being "on the western slope of that ridge of the chloritic talcose slate formation, which is specially called the slate belt" and the hills as "containing one or more metalliferous veins" (Partz 1854:161). More recently, the area has been referred to as the Gold Hill-Silver Hill Fault zone with the earliest rocks formed from alternating cycles of volcanism and sedimentation. Two major types dominate the area -- argillite and greenstone. Argillite

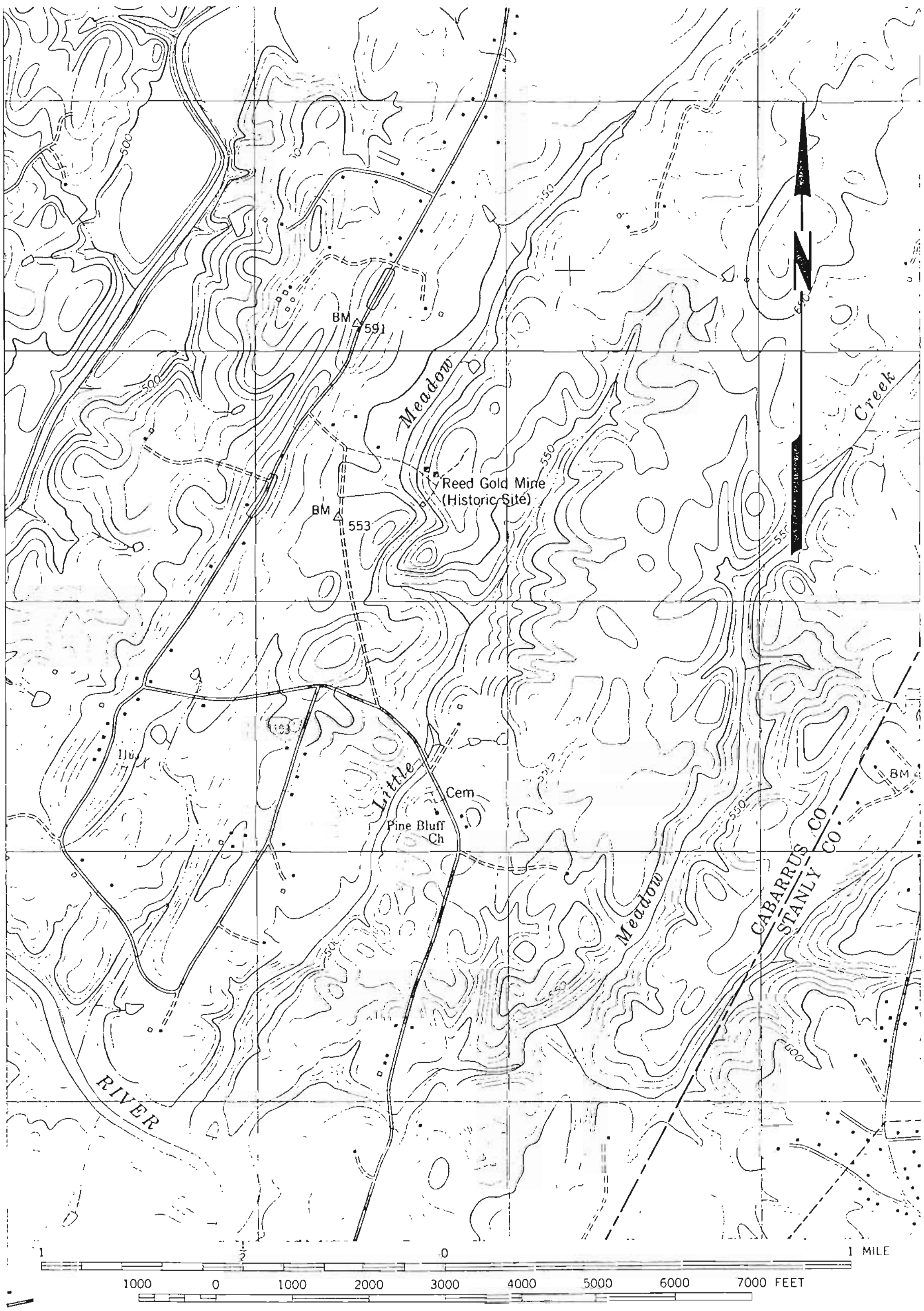

Figure 1. A portion of the Locust 7.5' U.S.G.S. topographic map, showing the location of the Reed Gold Mine in Cabarrus County, North Carolina.

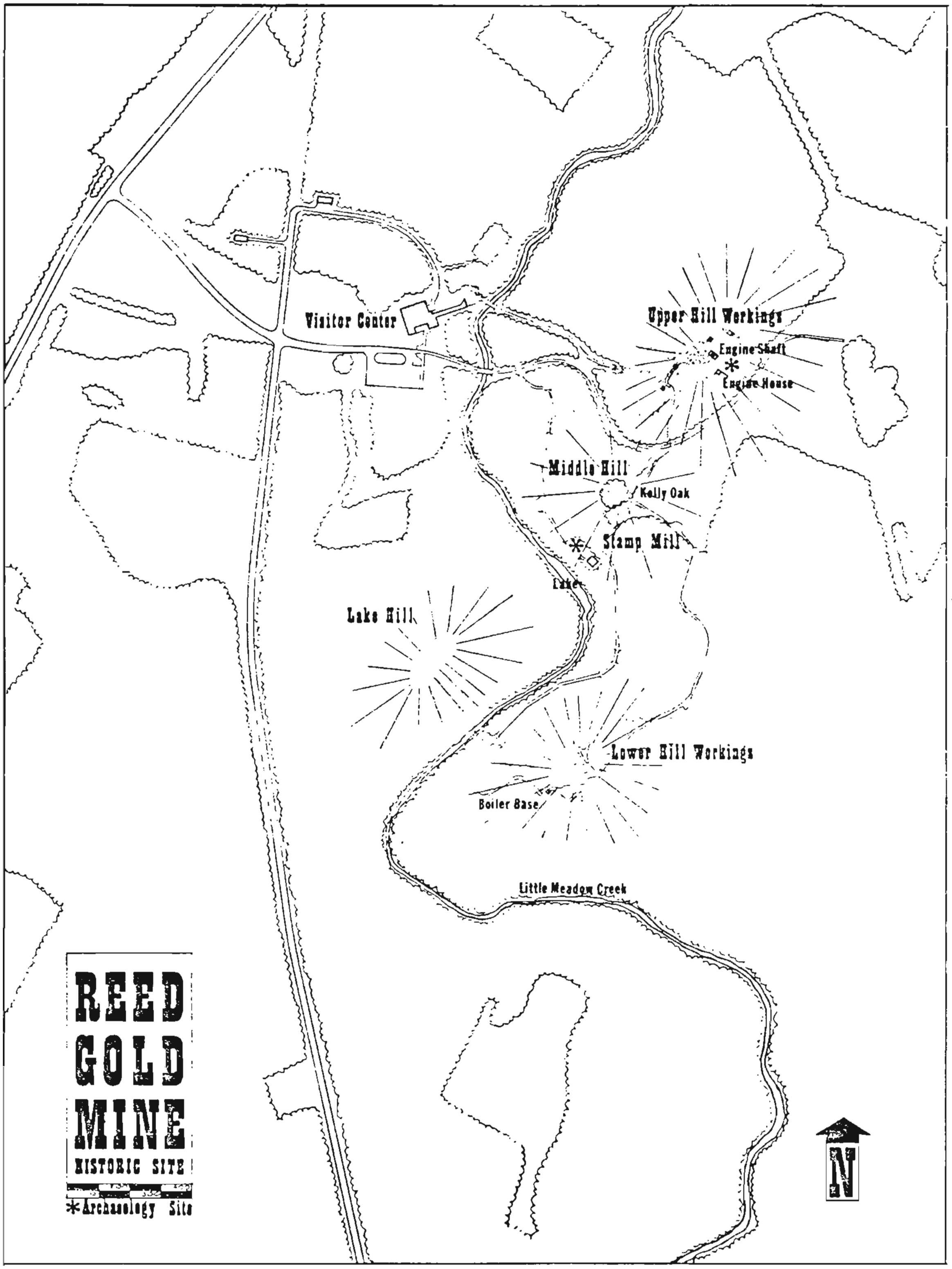

Figure 2. The Reed Gold Mine State Historic Site, Cabarrus County, North Carolina.

is derived from siltstone, claystone, or shale. It has a higher degree of induration than its parent rocks and is intermediate between these materials and slate. Argillite is typically gray to light gray-green, is rather soft, and has a poor conchoidal fracture. Greenstone is a generic name for any number of dark green, usually altered, compact rocks such as diorite. It is within the matrix of the greenstone that gold-bearing quartz veins are found. Osman (1978:26) reports that in the Reed vicinity these veins may be less than an inch to more than 6 feet in thickness. Some gold-bearing quartz appears as outcrops and abundant gold had been eroded from its surrounding rock matrix to result in the rich alluvial or placer gold deposits in the Little Meadow Creek floodplain. West of Meadow Creek is a ridge which contains chalcopyrite, a mineral similar to pyrite that includes a large percentage of copper. Another ridge, also on the western border of the property, contains galena, the principal ore of lead, which reportedly is associated with significant silver deposits on the site (Partz 1854). The property, therefore, contains at least three metal ores, all of which have been mined during the history of the property (Gregg 1972:15).

The region around the Reed tract falls within the Atlantic Slope Section of the Oak-Pine Forest Region (Braun 1950:261-267). This upland deciduous forest is composed of primarily white oak, hickories, and other oaks. Braun notes that the region is "transitional between the central deciduous forest and the prevailingly evergreen forests of the Southeast" (Braun 1950:259). Consequently, pine is found in varying amounts, depending on the stage of transition (pine being a common pre-climax species) and the quality of the soil (being more numerous in those areas less suitable to deciduous species). The shrub and herbaceous undergrowth of the oak forests is sparse and bottomland forests are usually of limited extent (Braun 1950:262, 265).

These observations are significant from a technological standpoint since mining required a large number of timbers for the shafts (Knapp 1973:87). While oak was the preferred wood for timbering (Knapp 1973:87) because of its excellent decay resistance (Scheffer and Cowling 1966:151) and toughness (Panshin and de Zeeuw 1970:572), a 1854 map of the area indicated the presence of "Field Pines of Mine Timber size" (Knapp 1973:87, n.17). The use of inferior pine may have been caused by the rapid deforestation of the tract through a combination of farming and harvesting wood for use as fuel and timbers. An observer of the Reed tract in 1853 noted that the land "affords many advantages for agricultural purposes, and is adapted to the production of wheat, oats, rye, etc., and other products peculiar to the region of country in which it lies" (Tenney 1853:372).

The climate of Cabarrus County is mild and temperate, with rainfall normally well distributed throughout the year. Summers are usually long with warm weather lasting from May to September. The average number of days without a killing frost is 239 and the average warm season (April to September, inclusive) precipitation is about 26 inches. Winters are mild and relatively short, although freezing temperatures occur during about half of the winter days. The more western mountain ranges form a partial barrier to the cold waves that move southeastward from the interior of the continent and as a result they are usually modified prior to reaching the central Piedmont (Gregg 1972:2-5; Kichline 1941:1042-1044; Lemert and Harrelson 1954:13-19).

Historical Overview

The history of gold mining at the Reed has been detailed by Knapp (1973, 1975) and these sources should be consulted for a more thorough perspective. This discussion will only briefly review the chronology of mining activities at the Reed, with particular emphasis directed toward the historical accounts surrounding the Upper Hill works. It was the Reed farm that produced the first authenticated discovery of gold within the borders of the United States, and it is at Upper Hill that the first mechanized and systematic attempt to extract gold from hard rock was made at the Reed. As previously mentioned, gold mining was a significant, albeit underreported, part of North Carolina history (Knapp 1973:xiii) and mining was ranked second only to agriculture as an occupation in antebellum North Carolina (Green 1937; Knapp 1973:xiii). In spite of the historical importance of gold mining in North Carolina, archaeological studies have only been conducted at the Reed and few of these have been desseminated to the professional community.

Although the first gold nugget was found in Little Meadow Creek in 1799, it was not recognized until 1802 and mining did not begin until 1803. This first mining, undertaken by a partnership of Reed and three other local men, was limited to seasonal placer mining of the Little Meadow Creek gravels using a variety of screening devices (Knapp 1973:1-3). Although these techniques were primitive and time consuming, Knapp (1973:5) reports that in 1804 alone $11,000 in gold was sent from Cabarrus County to the Philadelphia mint, most, if not all, probably coming from the Reed operations.

Placer mining at the Reed continued for 27 years in spite of technological advances and the knowledge that the hills "abound in gold" (Thornton 1807:6). Knapp suggests that by 1826 the creek had yielded $200,000 in gold nuggets and that Reed,

> chose to continue the pattern of close-knit family operation at his mine rather than disrupt an acceptable life-style by an expansionary effort and the importation of outside workers, values, technology, and perhaps capital. After all, he had attained a satisfactory, perchance even a comfortable, existence and likely saw no point in risking his situation by changing an apparently successful policy (Knapp 1975: 8).

However, by 1831 Reed's mining activities had progressed, for whatever reasons, to hard-rock underground mining (Knapp 1973:31). This underground mining took place primarily on Upper Hill (Knapp 1973:31), where a horse drawn whim may have been used by 1834 to raise rock from the underground workings (Knapp 1973:46). Once on the surface this quartz ore was crushed and the gold amalgamated through the use of a "drag mill" or arrastra probably located south of Lower Hill near the ford in Little Meadow Creek (Knapp 1973:52).

The mine was closed from 1834 through 1845 as a result of a legal entanglement over the ownership of a 9.5 pound nugget. John Reed died in 1845, near the end of the court action, and his will provided that the mine be sold. The property was sold, in 1846, into the family and work continued on Upper Hill (Knapp 1973:53-54). According to the 1850 census, the Reed Mine produced 5000 pounds of ore containing gold valued at $7500 during the year. The average monthly labor costs for the 20 male workers were $400, and the census indicates that only hand and horse power were being used (Knapp 1973:59). The mine, however, left the family in 1852 when it was sold for debts.

Another period of inactivity was to last about a year until the property was purchased in 1853 by the newly formed Reed Gold and Copper Mining Company. Although this company would last for only a year before going bankrupt itself, the year 1854 was to mark the "high tide" of operations at the Reed. The New York based corporation hired professional miners including Dr. Louis Posselt, formerly a professor of chemistry in the German University of Heidelburg and superintendent of a Mexican silver mine, to operate the Reed Mine. The only good account of this activity comes from an article in The Mining Magazine by August Partz, who visited the Reed in July 1854. Partz's account indicates,

> improvement of the underground works at the Upper Hill [by] . . . the enlarging and retimbering of the Engine shaft . . . One of Worthington's pumps was placed in it . . . . There are now a number of hands engaged in sinking this shaft further down . . . in order to obtain more water for the mill . . . . Near the shaft a large and substantial whim has been erected . . . . A steam engine of fifty horse power is employed to work four sets of stamps, three large circular mills, one drag mill, and a set of shaking tables. The number of stamps will soon be increased, and in the mill-house, which has lately been erected there is sufficient room for other additional machinery. A new office and store building, and a number of miners' cabins, have also been erected . . . (Partz 1854:167).

Included with this essay were detailed maps of the Reed Mine, including the Upper Hill works (Figure 3). This map clearly indicates a single structure, measuring approximately 55 feet in length and 45 feet in width, which Partz labeled Mill and Engine House. Adjacent, and connected to, the engine mill house was a Boiler House (boiler pit), which measured about 15 feet in width and the same 45 feet in length, for a total structure size of about 70 by 45 feet. Northwest of the engine mill house and on the other side of Engine Shaft, was a whim house which measured about 40 feet square. Over the shaft itself was a headframe. About 10 feet northwest of the engine mill house's western wall was a 10 by 24 foot tank, built by Posselt to store water, probably for the milling process. An engraving which accompanied the Partz article indicates that the whim house was an open sided, peaked roof structure supported by large corner timbers. The headframe, while consisting of an "A-shaped" frame, apparently incorporated a similar open sided, roofed structure set on corner posts to cover the shaft (Knapp 1973:Figure 51). Southwest of the engine millhouse about 60 feet was a dogtrot structure with two end chimneys labeled "Cabins." Additional structures were scattered over the entire tract (see Knapp 1973:Maps

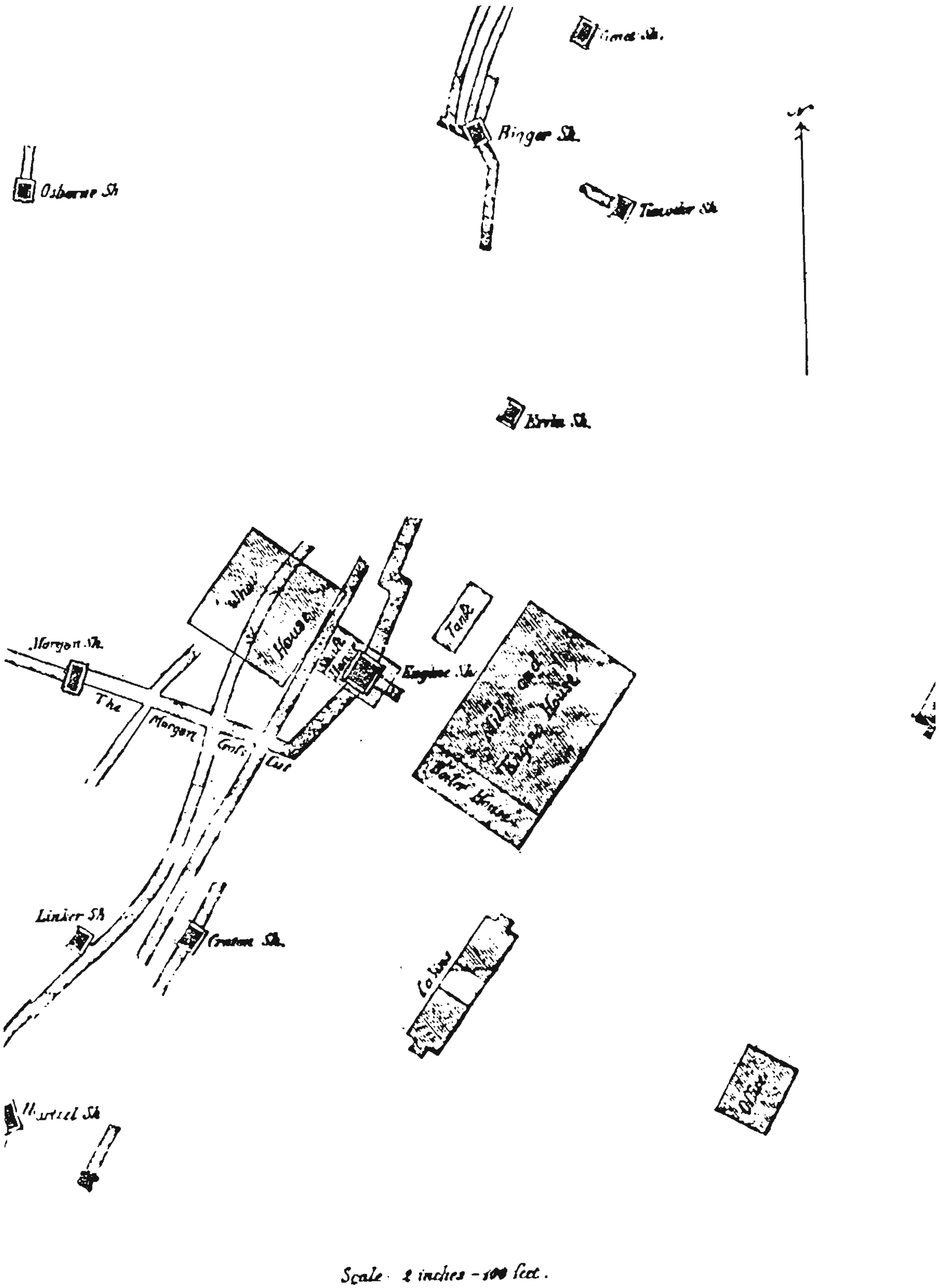

Figure 3. The Upper Hill workings as drawn by Partz in 1854.

1 and 3). Although Partz provides no indication of the construction techniques used on the engine mill house, a map and engraving (known as the Kelly Map) pre-dating a boundary change in 1891, show the structures in considerable detail (Figures 4 and 5). Although the Kelly Map lacks the accuracy of the earlier Partz map, the two closely resemble one another. Many of the major buildings are shown in the same locations, although the miners' cabins have changed positions. The engine mill house is shown as a wooden building. The whim house, headframe, and connecting structure are essentially identical to those shown by Partz.

Knapp (1973:123-131) provides considerable detail concerning the boiler, steam engine, and pumps used at the Reed during 1854 and speculates, based on the relative absence of height of the mill house that a horizontal cylinder rather than a vertical beam engine was used. Unfortunately, the earlier archaeology conducted at the site failed to provide any evidence for the type of engine used. A study of the boiler pit construction, however, suggests that Knapp is correct. From the chimney to the west about 20 feet the northern boiler pit wall (between the sunken boiler pit and the engine mill house) is heavily constructed and 7 feet in thickness. Beyond this point the wall narrows to a mere 2 feet, the same thickness observed uniformly along its southern extent. Set into the expanded boiler pit wall are three sets of 1 inch anchor bolts, spaced about 6 feet apart along the east-west axis and separated by about 2 feet north-south. At the eastern end of the expanded boiler pit wall there is a 2.5 by 1.5 feet "step" or insert. This expanded wall, with vertical projecting anchor bolts, probably served as support for the horizontal steam engine. Such engines usually have a single frame or bedplate which carries all the parts, including the main bearings in which the crankshaft with its flywheel turns (Stowers 1958:131). The "step" or insert observed in the boiler pit wall may have provided access to engine parts. Abernathy (1880) provides detailed instructions for setting up a steam engine, which are quoted at length,

> first plant a firm foundation . . . better a little waste of material in the construction of the foundation than a constant wear and tear of the machine after it is started, on account of having a shaky foundation . . . . The material used for the foundation of a steam engine should be rock . . . of something else not subject to decay . . . . To the foundation the bed of the engine should be firmly bolted by long bolts running

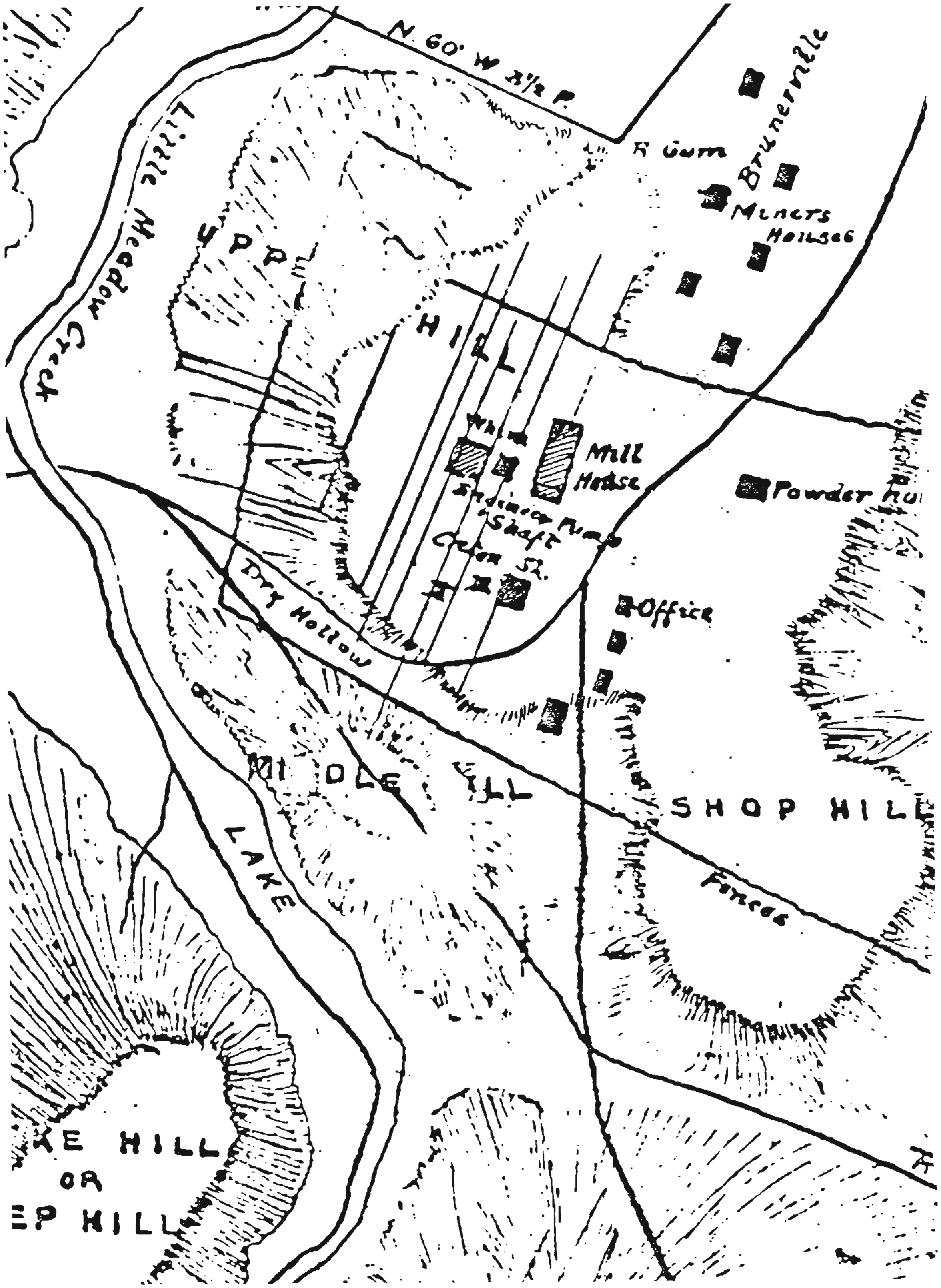

Figure 4. The "Kelly Map" of the Reed Gold Mine, ca. 1880.

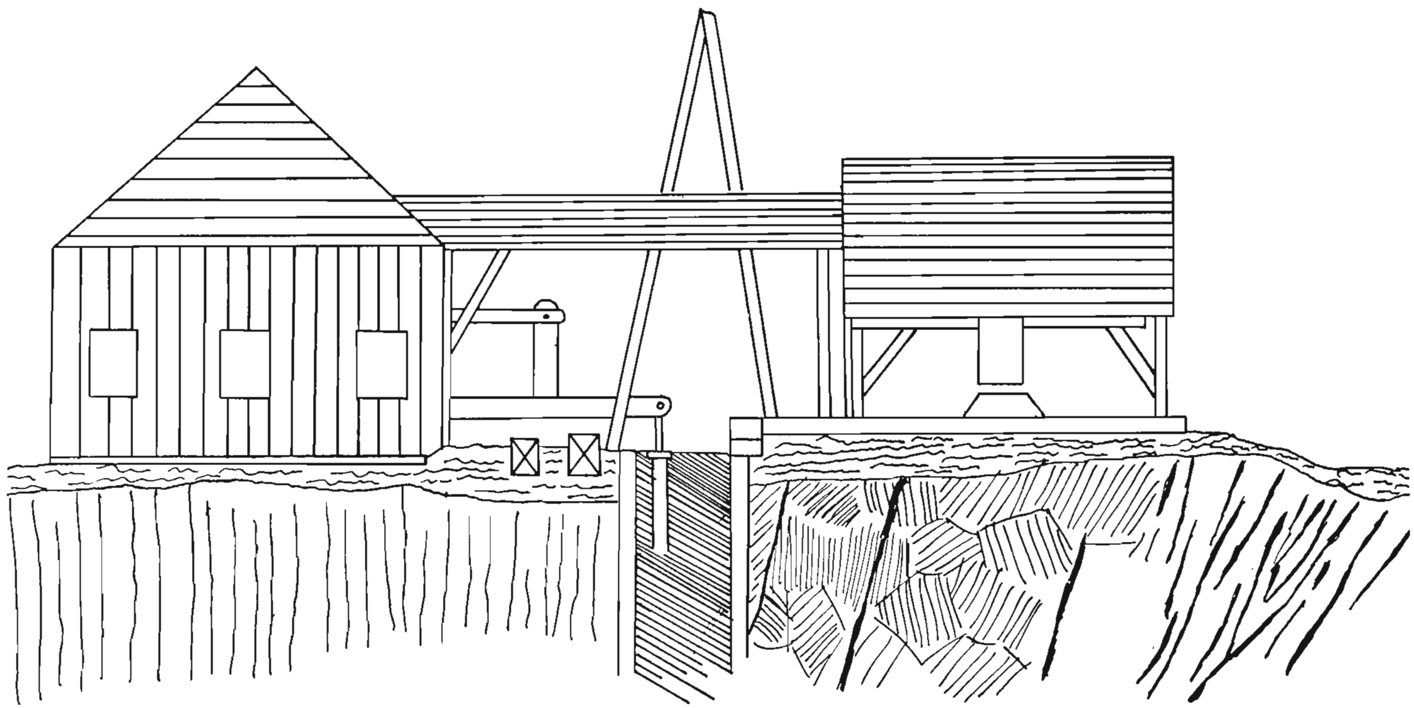

Figure 5. Buildings shown on the "Kelly Map," ca. 1880 (redrawn because of poor map condition).

> up through the foundation, and around which the foundation has been built. Thus the entire mass of the foundation and the engine bed-plate will be clamped together (Abernathy 1880:283).

Knapp supports this reconstruction by noting that "[t]he steam engine and flywheel probably were located at the chimney end of the building near the boiler pit in a position which would have been convenient for driving pumps in the Engine shaft" (Knapp 1973:151). In addition, Posselt would have located the engine in close proximity to the boiler to avoid loss of steam temperature as it passed through uninsulated pipes.

The 1854 50-horsepower steam engine also was to power "four sets of stamps, three large circular mills [Chilean mills or edge mills], one drag mill [arrastra], and a set of shaking tables" (Partz 1854:167) within the 2400 square foot structure. It is appropriate at this point to briefly review the technology of these various devises, recognizing as Knapp (1973:161) notes that Posselt intended these items to be integrated in their operation.

Leeds, in 1854, noted that,

> [t]hus far the process of separating the gold from the the accompanying rock has been exceedingly primative and simple; the . . . stamps, the Chilean mill . . . ., and the araster [arrastra] mill, though far from meeting all the requisites on the score of economy and time, have proven of more practical utility than any of the more costly and complicated machines (Leeds 1854:361).

Nitze and Wilkins (1897:34), describing operations at a Virginia mine in 1847, remarked that the ores, upon arriving at the surface, were divided into two classes. The hard ores were processed by stamps, while the soft ores ("slate and fine ore") were processed by the Chilean mills (cf. Leeds 1856:31). It is probable, given the hardness of the gold bearing quartz rock, that the Reed ore was first processed by the stamps. Ure describes a stamp mill as consisting of,

> several movable pillars of wood . . . placed vertically, and supported in this position between frames of carpentry . . . . These pieces are each armed

> at their under end with a mass of iron . . . . An arbor or axle . . . turning horizontally, tosses up these wooden pestles, by means of . . . cams . . . . These are raised in succession, and fall into an oblong trough below . . ., having its bottom covered either by plates of iron or hard stones. In this trough, beneath these pestles, the ore to be stamped [is placed] (Ure 1840:813).

Leeds indicates a few changes by 1854, noting that,

> a set of stamps are used to reduce the veinstone to a powder. These are formed of iron weights, varying from fifty to one hundred pounds each, attached to the lower end of an upright shaft of wood, which by a simple framework is retained in a vertical position; some six or eight of these weights thus attached are ranged side by side to constitute a set . . . The ore to be stamped is placed in an iron trough with a grated bottom, through which the fragments fall when broken sufficiently small by the stamps (Leads 1854: 362).

Andre (1877:I:189) notes that a battery may contain three to six stamps, although five stamps was the most common. Egleston (1887-1890:I:154) noted that the typical California stamp mill, such as was used later at the Reed, differed from European stamp mills in that its parts were interchangeable and were made entirely of iron or steel. The California stamp also differed from the Cornish stamp in that its stems, shoes, and dies are made round.

It has been supposed that the stamp mills used by Posselt in 1854 were not of a California design. Such an assumption cannot be supported either from the archaeological evidence, or from the historical documents. An article in the 1898 Mining and Scientific Press indicates that the major design changes characterizing the California stamp mill had been made by February 1852, providing ample time for these changes to be incorporated by Posselt. The article states that, "we found we had made a great improvement and our mill was soon attracting much attention. Revolving iron stamps were soon in use in various directions" (Stanford 1898:107).

Leeds notes that "the stamps will prove a valuable method of reducing the rock to sand" and that "[s]tamps are used with water or without it, as suits the views or fancy of those using them" (Leeds 1856:31). Egleston, in contrast, noted that,

> [w]hen stamps are used in connection with the arrastra, as they frequently are, . . . the motars [sic] are set without screens and the ore crushed dry. The [reduced ore] . . . varies in size from dust to the size of a pigeon's egg. It is charged into the arrastra just as it comes from the stamp. A battery of five stamps will crush, in two hours, all the ore that a single arrastra can treat in twenty-four hours (Egleston 1887-1890:II:396-397).

The shaker or percussion tables, suspended from the ceiling by rods and chains, are vibrated by a cam mechanism. The ore sand obtained from the stamps is deposited on the table,

> the successive percusions that it receives, determine the weightier matters, and consequently those richest in metal, to accumulate toward its upper end . . . . Each of these bands [of ore] is removed separately and thrown into the particular heap assigned to it. Every one of the heaps thus formed becomes afterwards the object of a separate manipulation on a percussion table, but always according to the same procedure (Ure 1840:816-817).

The two shaker tables, therefore, would have been used by Posselt to enrich the ore sands and reduce the quantity of material necessary to be treated by amalgamation.

The Chilean and arrastra mills both serve to grind the ore, reducing it in size and also allow amalgamation with mercury. Leeds described the Chilean mill as,

> constructed by having two large and heavy stone wheels made to revolve upon a solid stone bed. Around this bed a wood work of about twelve inches in height is placed, forming a large tub, of which the stone bed constitutes the

> bottom . . . . A stream of water enters over the rim upon one side of the tub, and is discharged over the rim on the opposite side. This stream should be sufficient in quantity to hold the comminuted sands in suspension, and allow them to be floated off in a thin slime (Leeds 1856:29-30).

In contrast, the arrastra was,

> a stone bed, surrounded with a circular frame-work of stones, forming a large and shallow tub with a stone bottom. A revolving upright shaft with horizontal arms, drags forward constantly a large piece of flat stone, attached to each arm by chains, over the stone bed (Leeds 1854:363).

Although the arrastra is an extremely old and simple devise, it was highly regarded by mining experts. Leeds states that, "I consider the arrastre [sic] as the best and most efficient amalgamator at present in use" (Leeds 1856:267), while Egleston remarks that the Chilean mill is more expensive to use than the arrastra and "does not do its work any better" (Egleston 1887-1890:I:24).

The construction of the arrastra is detailed by Egleston (1887-1890:I:270-275; II:388-402) who notes that if the construction is poor, the mill must be torn up every 15 to 20 days to recover gold particles which have escaped into cracks. It is more likely that Posselt would have constructed his arrastra carefully, in which case it could,

> be cleaned up every few days without disturbing the pavement . . . . In the best works, the edges of these stones are carefully dressed and they are put together with cement . . . . when put in with care, the bottom will last for twelve months. It will then be necessary to clean out all the cracks and repair it, taking up the stones (Egleston 1887-1890:I:271).

Both the Chilean mill and the arrastra were used with mercury to collect the fine particles of gold (Janin 1895; Leeds 1854:363). This amalgamation process involved the addition of mercury to the ore during the grinding process, the collection of the amalgum after an appropriate length of time, and finally the separation of the gold and mercury. Janin (1895) notes that the process may cause considerable loss of gold (and mercury) because first, the gold may be so fine that it will float away in suspension and will fail to come in contact with the heavy mercury. Second, gold in a clayey pulp "is difficult to amalgamate . . . . [because] the pulp coats the quicksilver . . . not giving them an opportunity to catch the gold" (Janin 1895:311). Third, the ore may be crushed too fine or too coarse to allow amalgamation, or the water being used may be inappropriate.

It appears unlikely that either the stamps or the shaker tables would have left any obvious archaeological indicates of their locations. The stamps may have left a number of archaeologically identifiable fragments, but they were set on heavy timber foundations which would not survive in the archaeological record. The shaker tables were suspended from the ceiling and are not expected to have left archaeologically distinquishable slurry deposits. The Chilean mills and arrastra, of course, would have produced vast quantities of slurry, identifiable not only by its texture, but also by a presumed high concentration of both gold and mercury. The technical literature fails to describe the construction details of Chilean mills, so their impact on the archaeological record is not known. The arrastra, however, is expected to leave distinct archaeological evidence.

In spite of the construction and mining activities, the Reed Gold and Copper Mining Company failed by the end of 1854 and the property was sold in 1855. Little or no activity took place at the mine for a decade. By 1865, however, Stevens (1866) reported in the American Journal of Mining that the Reed was in successful subsurface operation at Upper Hill (Knapp 1973: 166). Yet, the mine was again inactive by 1868 and was not restarted until 1881, when a Mr. Nesbit repaired the steam engine and began operating the mine. An absence of water prevented milling and it is possible that the 1854 structure was not standing at this time (Knapp 1973:166-167). How long this activity continued is not known, but by early 1886 a Dr. J.P. McCombs and a Captain Gad were working on an underground vein of quartz and a newspaper account stated, "[a] Chilean mill is being made ready so as to get at results as soon as possible" (North Carolina Herald, January 7, 1886, p. 3). Work continued through 1887 (North Carolina Herald, November 16, 1987, p. 3) and Kerr and Hanna (1888:264) reported that the Reed was being worked during the late 1880s. By 1894, however, Engine Shaft, deteriorating as early as 1882, was inaccesible.

In 1895 the Reed Gold Mine was again active, under the direction of Dr. Justin D. Lisle, an Ohio physician. A 10 stamp mill was erected at the foot of Middle Hill and the steam engine on Upper Hill may have been repaired (Knapp 1973:179). Knapp suggests that a new engine mill house was built at this time, primarily because of the "increased rate of activities in the summer of 1895" (Knapp 1973:180, n.30). Several photographs from the 1919-1920 period show a much smaller (ca. 12 by 27 foot, with an attached but offset 10 foot square whim house) and poorly constructed structure with a tin roof, which has been assumed to represent the 1895 structure (Figures 6 and 7) (Knapp 1973:180).

By the time of Lisle's operation it has been argued that no milling took place in the structure, which served primarily as a covered shed for the hoist (Knapp 1973:180). Several individuals interviewed by Knapp reported that the hoist was powered by a steam tractor engine during the mine's final days (ca. 1900, and possibly during Lisle's tenure). The use of a portable engine would explain why the 1895 structure was not built to take advantage of the boiler and why the ca. 1920 photograph (Figure 7) fails to show the steam engine. Knapp (1972:180), again based on interviews, suggests that the ore recovered from Engine Shaft was moved to the stamp mill on Middle Hill by a tram. That the structure housed some blacksmithing operations (Knapp 1973:180) is suggested by a hole in the north face of the chimney, which would have provided a flue for the forge. Mining operations under Lisle's direction at the Reed lasted for only a few years, probably ceasing by 1898.

Mining operations were relatively insignificant in the twentieth century, although some hardrock mining may have taken place on Upper Hill through the first decade of the century (Knapp 1973:197). The photograph taken ca. 1920 (Figure 7) shows an abandoned, deteriorating building. Photographs of the area immediately north of the structure (North Carolina Department of Cultural Resources, Division of Archives and History Negative Number N73.5.394; Bryson 1936:87), taken at or about the same time, show two Chilean mill bases, several mill stones, and a number of flywheel and gear parts, apparently from the 1854 structure. A ca. 1940 photograph (North Carolina Department of Cultural Resources, Division of Archives and History Negative Number N73.7.26) shows the flywheel and one Chilean mill visible in the earlier photographs, as well as the collapsed structure in the background. Thus, by the 1940s the last engine mill house was in ruins, although much debris from the earliest structure was still present.

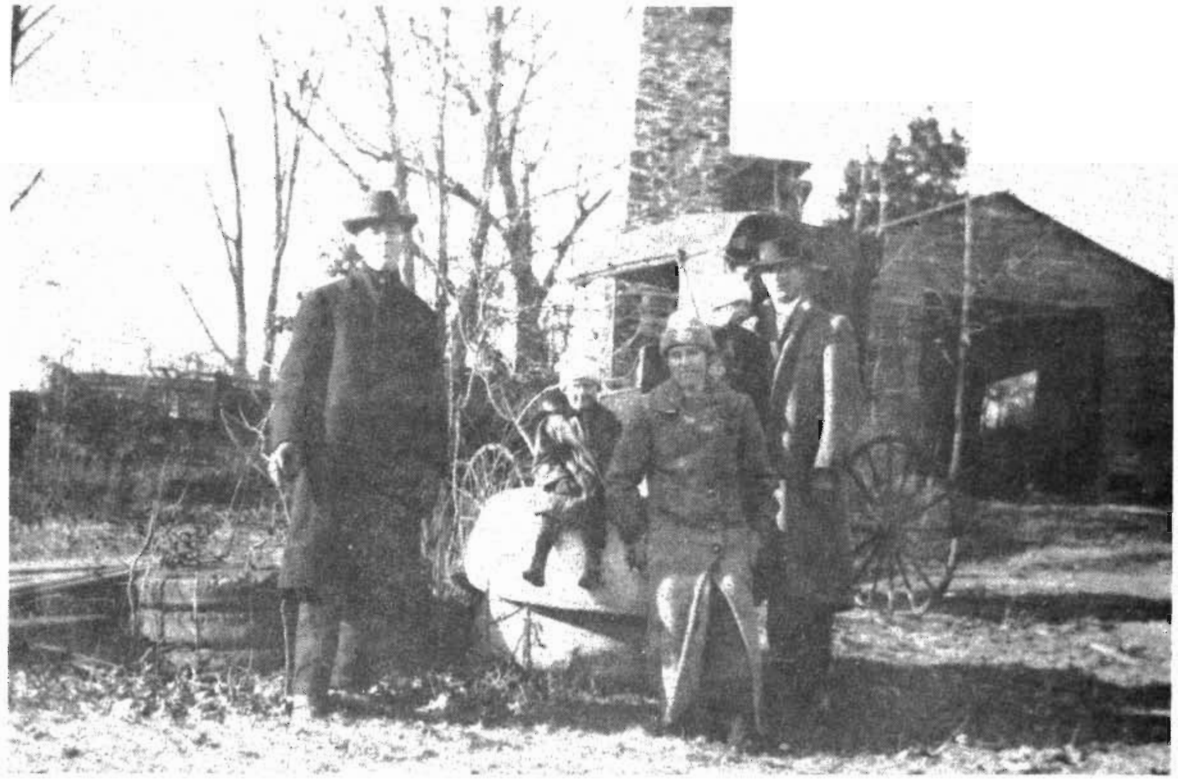

Figure 6. The Upper Hill engine mill house, ca. 1919 (N.C. Department of Cultural Resources Negative N72.8.303).

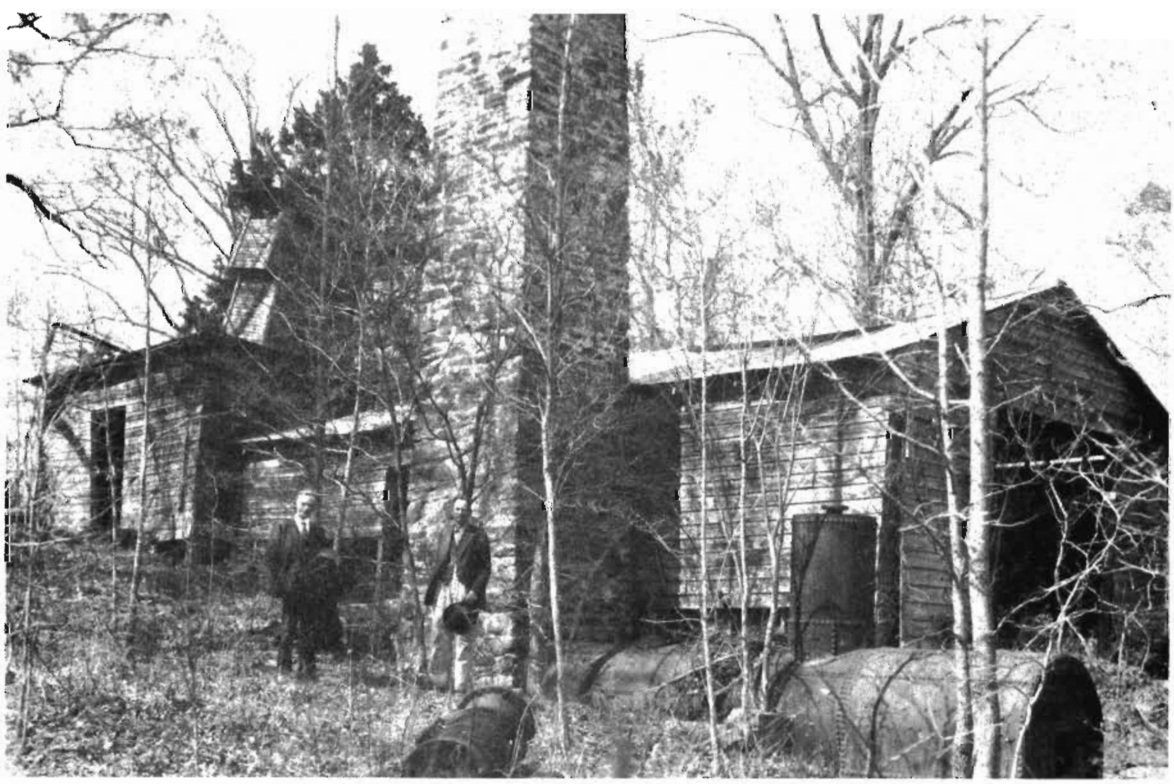

Figure 7. The Upper Hill engine mill house, ca. 1920 (N.C. Department of Cultural Resources Negative N72.9.79).

EXCAVATIONS

Strategy

The previous archaeological studies at the Upper Hill engine mill house by Babits had demonstrated the futility of opening small, relatively isolated units. Such an approach made an already confusing picture hopelessly muddled. Probing for wall foundations, as observed by Sacchi, is useless because of the "heavy concentration of natural rock" (Sacchi 1980:18). It was therefore decided that future work would employ contiguous 10 foot excavation units. Such an approach ensures that walls can be clearly distinquished from rock rubble and that alignments can be precisely identified.

After 11½ years the excavation units which Babits (1974: n.p.) had covered with plastic and a layer of straw were found to be in poor condition. The hay had provided an ideal environment for vegetation such as honeysuckle and poison ivy, while roots proliferated under the plastic. The site had grown up in small hardwoods and abundant herbaceous vines. The Reed Gold Mine crew removed a number of the larger trees prior to our arrival at the site in early November, but the site was decidedly overgrown when the work began (Figures 8 and 9). The original grid had been established by Babits using primarily wooden stakes, most of which had rotted away and unit profiles had slumped considerably. A series of four wooden stakes were eventually found standing, as well as an iron pipe used as a corner point in 1974. It was possible, using these few remaining points, to re-establish the 1974 grid. The present grid, which has 0.5 inch rebar at its northwest and southeast corners and 1 inch pipe at its northeast and southwest corners, is within 0.5 inch of its 1974 counterpart. In keeping with the 1974 work the grid is aligned such that grid north is N43°E of magnetic north. All directional references in this report refer to the grid directions. The original units were designated by their northwest corners and were tied into a pipe at the northwest corner of the boiler pit chimney. Unfortunately, this pipe, which also served as the site's vertical control, had been shifted prior to our work. The 1974 units were designated as feet N (north) and feet E (east) of this pipe. The 1985 work did not use this system; the squares are designated by their southeast corner and are tied into a modified Chicago grid system (Figure 10). The first number indicates feet north of an off-site datum (ORO) while the second number indicates feet right (or east) of this datum. Consequently, the 1985 grid point 10R20 is identical to the 1974 grid point 15N05E. Vertical control at the site was re-established by replacing the shifted pipe at the northwest chimney corner with a 3-foot

Figure 8. General view of the site area in November 1985, view to the west.

Figure 9. Excavation in square 60R20, view to the northwest.

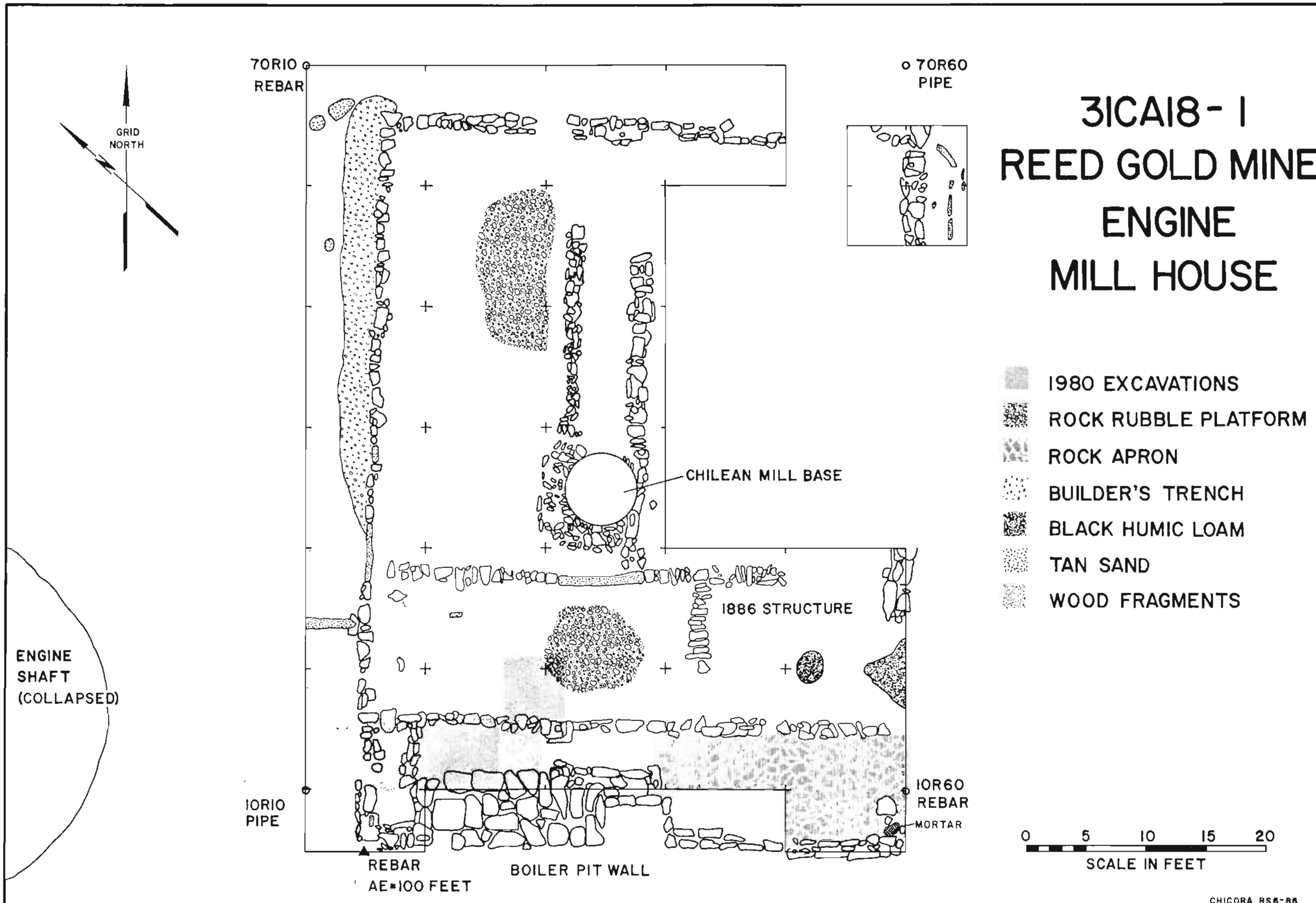

Figure 10. Plan view of the engine mill house excavations.

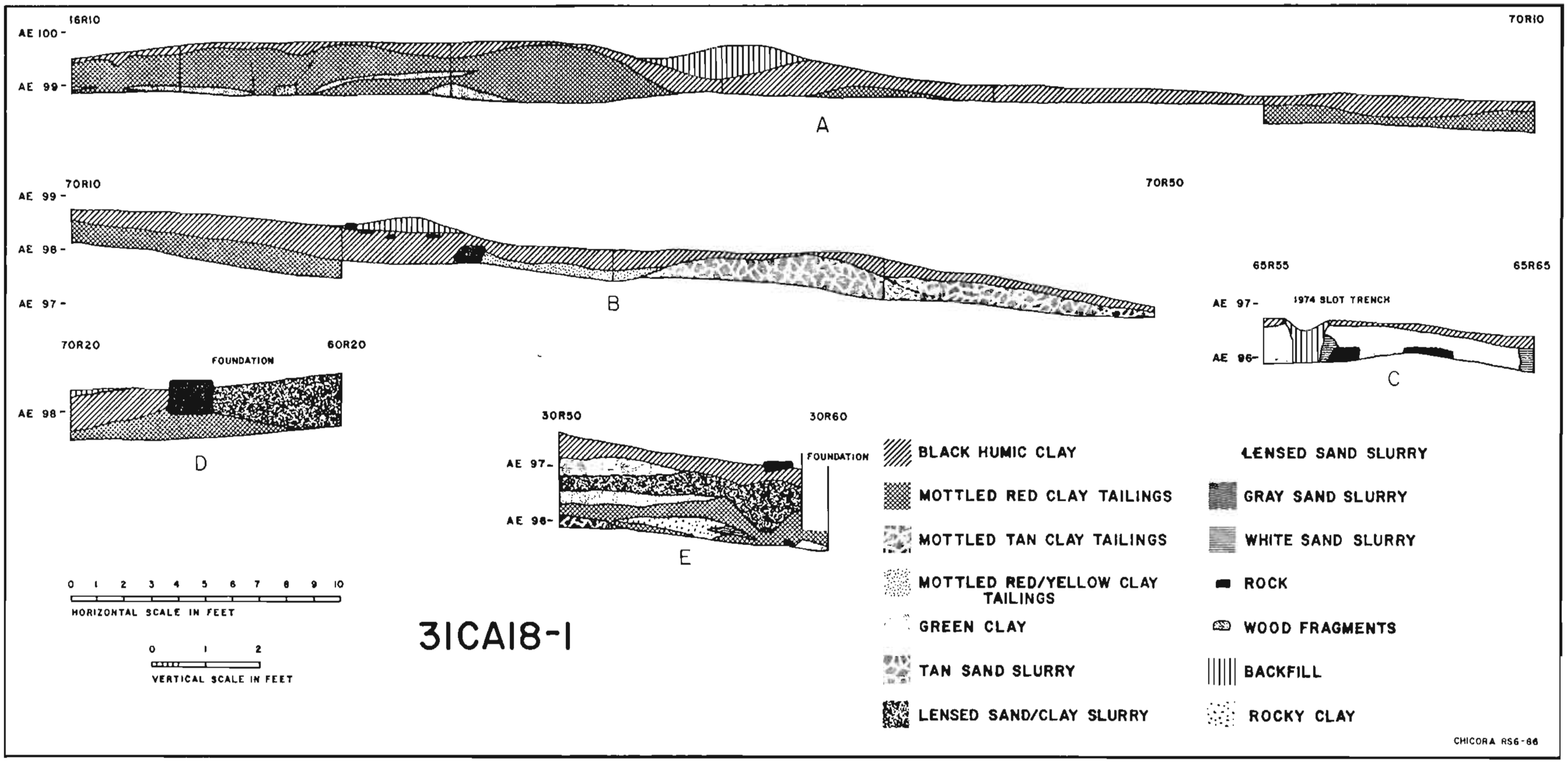

Figure 11. Profile drawings of the engine mill house excavation. A, 16-70R10, looking west; B, 70R10-50, looking north; C, 65R55-65, looking north; D, 70-60R20, looking east; E, 30R50-60, looking north.

piece of rebar. This rebar, reset to approximate the 1974 datum elevation, was assigned the arbitrary or assumed elevation of 100 feet.

Excavations at 31CA18**1 (Upper Hill Engine Mill House) were conducted on 34 days from November 12 through December 30, 1985 by a crew which ranged in size from three to seven individuals. A total of 1608 person hours were spent excavating 2450 square feet (22 10-foot squares, two 5 by 10 squares, and six 5 foot squares) of the site. Over 1268 cubic feet of soil was excavated and screened through ¼-inch mesh for the recovery of over 5000 specimens. Backdirt from these excavations was stockpiled outside the excavation area either at the northeast site periphery or on the northern site edge.

The excavations conducted during the 1974 work were by arbitrary 0.5 levels, although few of the units were deeper than the first level and some had depths of less than 0.2 foot. This arbitrary excavation strategy possibly resulted in the mixing of temporally discrete zones, as well as the mixing of remains from within and outside the structure (the seriousness of these effects, however, is unknown since the artifacts were never analyzed and cannot now be located). To correct these possible shortcomings, natural zones were used during these excavations, although all units were not excavated to sterile subsoil (Figure 11 illustrates typical stratigraphy at the site).

Zone 1 represents a dark black to brown humic clay which overlies virtually all areas of the site. The zone represents the site's A horizon and frequently contains abundant recent debris, such as mid-twentieth century glass and metal, aluminum foil, and plastic. It, of course, also contains earlier remains brought to the surface through the agencies of animals or plants. Zone 1 varies from a thin veneer to 0.7 foot in thickness. In general, the zone is thickest along the northern edge of the site where there has been the least amount of distrubance in recent years. There were several areas which evidenced 1974 backdirt overlying the Zone 1 humic clay. Although artifacts were collected during its removel, this backdirt was not screened nor was the backdirt designated as a zone.

Underlying the humic clay is a fairly thick zone of tailings or slurry representing a mixture of waste rock and soil, crushed quartz, and other debris. Outside the 1854 structure these tailings are designated Zone 2. No attempt was made to isolate microstrata or lenses of clay and sand, nor was an effort made to distinquish between tailings (primarily red clay) and slurry (primarily lensed reddish-yellow sand). Zone 2 is recognized as the waste by-products of the milling activity deposited

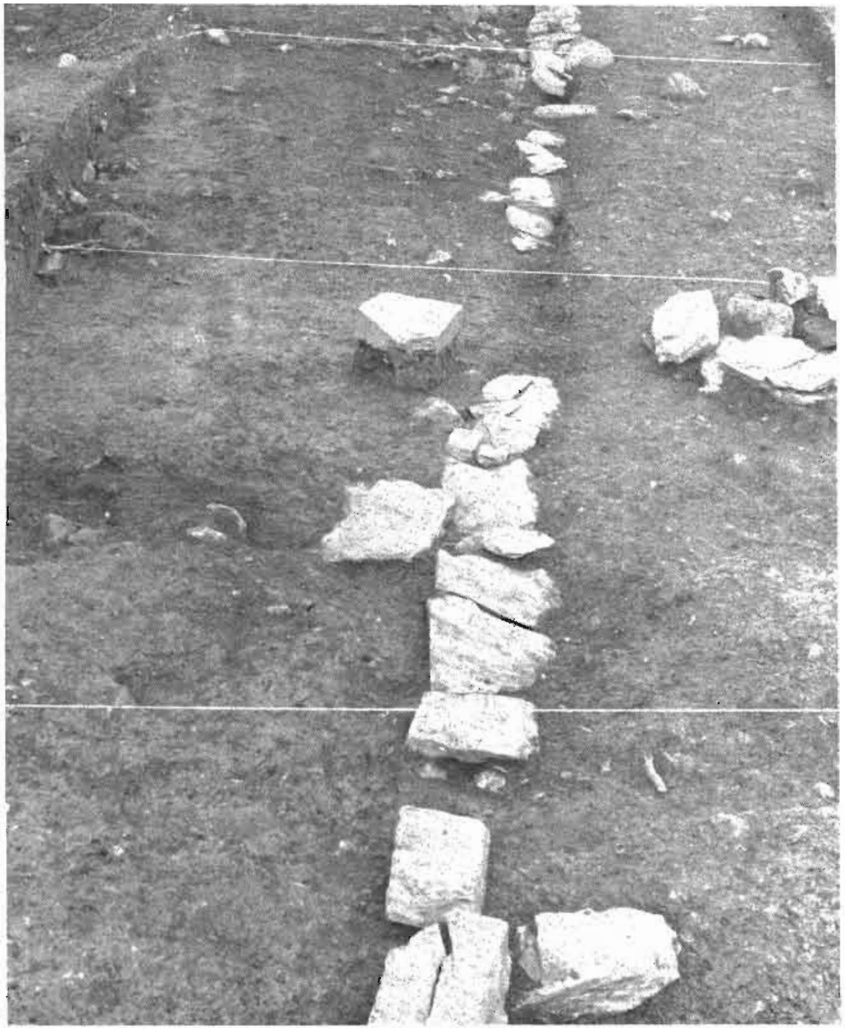

Figure 12. North-south wall in the R20 line from N16 to N70, looking north. This is the west wall of the 1854 engine mill house.

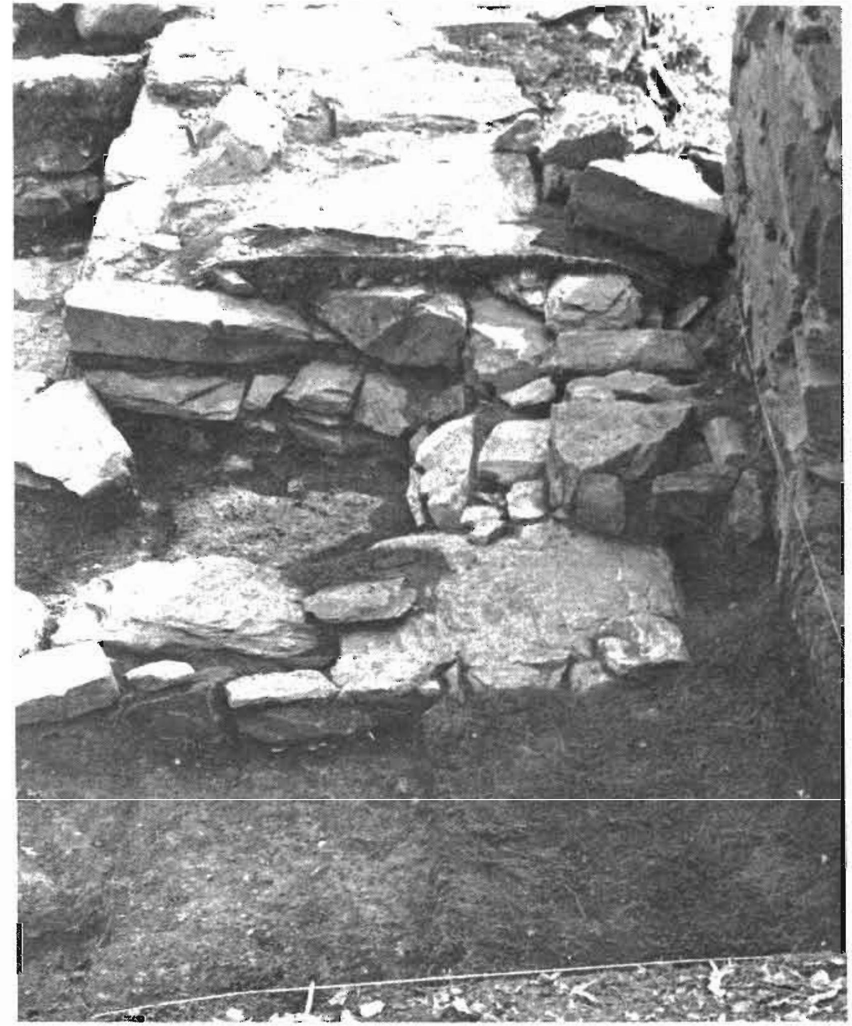

Figure 13. Square 5R20, looking east.

Figure 14. Northeast corner (foreground) of the 1854 structure, squares 55-60R60-65. Note the slurry deposits on the interior and the rotted wood on the exterior. View is to the southwest.

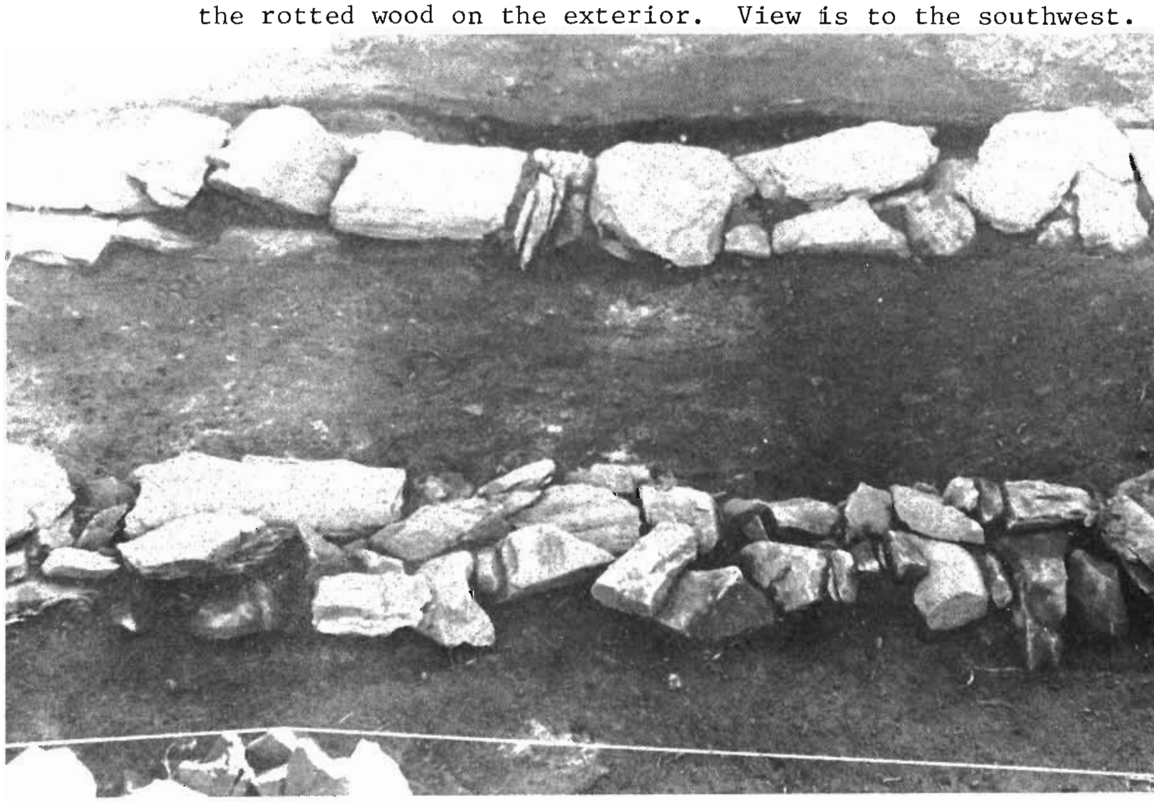

Figure 15. Parallel stone walls on the interior of the 1854 structure. View is to the east.

outside the 1854 structure. It varies in excavated depth from about 0.2 to 0.5 foot, although there is evidence that these tailings may be about 0.8 foot in depth outside the structure. Where, beneath the humic clay of Zone 1, the foundations were not visible, Zone 2 was subdivided into Zone 2a and Zone 2b. Zone 2a represents the tailings deposited over the 1854 foundations, while Zone 2b represents the tailings underlying 2a, but outside the 1854 foundation. Consequently, Zones 2 and 2b may represent any period up to the very late nineteenth century when mining largely ceased at the site and Zone 2a represents tailings deposited on the site after the abandonment of the 1854 structure, probably by the 1880s.

Zone 2a was also used to designate the tailings found within the posited late nineteenth century structure(s). Because of the super-imposition of the various structures, the tailings tend to reflect considerable mixing. Yet it is apparent that the tailings are deepest in the southern third of the site area, presumably because of the sequential construction and use episodes. As a consequence, the use of the Zone 2a designation continues to distinguish the tailings deposited during mining activities after the abandonment of the 1854 structure.

A Zone 3 designation was given to a darker soil adjacent to the 1854 wall exterior in square 60R20. This "zone" was initially thought to be debris piled against the foundation wall. Further, investigations, however, suggest it to be a builder's or robber's trench. In any event it represents a feature activity rather than a deposited zone and will be further discussed below. Rather than redesignate portions of the site, the "zone" designation was allowed to remain.

Zone 4 represents tailings found within the 1854 structure. They consist of fill quite similar to that labeled Zone 2, and include both red clay tailings, rock rubble (primarily greenstone, although quartz was occasionally found), and lensed sand and clay slurry. This zone is estimated to be about 0.8 to 1.0 foot in depth throughout most of the structure. Material from this zone should date from the period during which the structure was standing, roughly 1854 through the early 1880s.

Excavation was primarily by shovel and all soil was hand screened through ¼-inch mesh. Artifacts were bagged by unit and level, with washing and preliminary sorting conducted in the field laboratory. Ferrous metal artifacts were stabilized in a basic solution of sodium bicarbonate in the field to prevent further deterioration. Electrolysis of the ferrous metal was begun in the field laboratory and was continued at the Historic Sites Section in Raleigh and at the Chicora labs in Columbia.

Cataloging and analysis was conducted in Raleigh, where the artifacts were cataloged as Accession Number 100. The materials from this study, including artifacts, fieldnotes, color slides, and black and white photography are curated by the Historic Sites Section.

Excavation units were usually toweled for photographs at the base of Zone 2a or 4. Photographs were taken in both black and white negative and color slide film. Plan drawings of each unit were made at a scale of 1 inch to 2 feet. Profile drawings used the same horizontal scale coupled with an exaggerated vertical scale of 1 inch to 1 foot.

Architectural and Archaeological Remains

The 1854 Structure

The 1974 study had partially exposed a plethora of stone concentrations, stains, and posited walls. To better understand these architectural details a series of squares were first opened along the R20 line, beginning at 10R20 and continuing northward to 60R20 (Figure 10). These squares succeeded in fully exposing a north-south foundation line and corner where the wall turned to the east. This wall, interpreted as the west wall of the 1854 structure, is only one or two stone courses deep and varies in elevation from 98.78 feet at its southern end to 98.88 feet at its northern end, indicative of a well laid, level wall (Figure 12). The stones evidence some minimal preparation, but the walls may be described as coursed random rubble masonry, where uncut or roughly squared blocks are selected to bed horizontally (McKee 1973:32). The blocks average about 1 to 1.5 feet in length, 0.6 to 0.8 foot in width, and 0.3 foot in thickness. This western wall was laid at or just below the original site grade and was probably of dry wall construction, although the use of clay mortar cannot be ruled out. Such a foundation could have supported a safe working load of 2.5 tons per square foot (Nolan 1921:266). The southern half of the wall had been overlaid by Zone 2a tailings, while its northern half was found directly under the Zone 1 humic clay. This suggests that after abandonment of the building mining activity continued to deposit tailings over the southern portion of the structure.

As squares were excavated in the R20 line, a shallow trench filled with Zone 1 humic clay was noted uniformly overlying the foundation. This "trench" feature was removed as Zone 1 and was found to contain occasional mid-twentieth century items in addition to numerous nineteenth century artifacts. This "trench," about 1.5 feet in width, appears to be a slot trench excavated in 1974 to trace the foundation wall, although no such trench is reported by Babits (1974). Parallel to the wall's exterior and running from its northwest corner southward to square 30R20 is a 2.5 to 3 foot wide trench (Figures 10 and 12). The trench fill was removed as Zone 3 in square 60R20 and contains a black humic clay fill, abundant small rock, and nineteenth century artifacts. Originally interpreted as debris piled against the foundation, it now appears this may represent a builder's trench. Builder's trenches for this wall observed elsewhere are usually under a foot in width and contain a tan sandy clay fill.

Two gaps in the stone wall were noted and upon further excavation these gaps revealed abundant decayed wood, probably representing sill plates for doorways (Figure 10). In each case the wood fragments were found in a straight line, approximately 0.6 to 0.8 foot in width. The first opening, from 27R15.3 to 32R15.3, is the largest (Figure 12). The second opening, centered at 37.8R15.6, is only 2 feet in length.

Another decayed wood sill was found associated with the west wall in square 20R20. A wood beam at least 0.8 foot in width was placed on a stone support tied into the wall at 24R14. The beam was laid perpendicular to the wall and disappears into the west profile of this unit at 24R10. To the south of the beam there is an apparent builder's trench about 0.8 foot in width. The function of this sill plate could not be determined during this study.

A 5 by 10 square, 5R20, was excavated to determine how the west wall tied into the boiler pit or its chimney. Work in this unit revealed that the expanded boiler pit wall construction ends at the R19 line and the wall tapers to that observed at the eastern end of the boiler pit, about 2 feet in thickness. The stone filled builder's trench for the chimney, also observed by Sacchi (1980) in his square 3, was found along the southeastern edge of the unit. The north-south wall observed in the other squares along the R20 line continued into 5R20 and tied into the boiler pit wall at 6.5R16 (Figures 10 and 13).

At the base of Zone 2a (red clay tailings) in square 5R20 a zone of light brown loamy clay with abundant small gravel was discovered. This corresponds to Sacchi's level 4 from units 1 North and 3, described as "a highly compacted dark gravel loam" which was probably compacted by "continuous work related activities" (Sacchi 1980:22). Although this zone is tentatively attributed by Sacchi (1980:12) to blacksmithing activities, he also notes that it lies outside the various structures in his unit 3 (Sacchi 1980:22). A more reasonable interpretation is that this light brown loamy clay represents the site's old (pre-1854) humus zone. Its compaction is related to the activities associated with the 1854 structure and the absence of artifacts is related to the general absence of both structures and domestic activity on Upper Hill prior to 1854. The humus is sparsely preserved within the structure because of the processing activities that occurred there and periodic removal of tailings from most areas within the structure. It is found within the structure at 5R20 because this narrow area between two walls probably saw little activity. Below this humus zone there is a zone of pre-1854 tailings about 0.5 in thickness. These tailings, coupled with the evidence to be presented from 20R60, clearly demonstrate the presence of mining at Upper Hill prior to the 1854 construction activity by the Reed Gold and Copper Mining Company.

This north-south wall, which has a length of approximately 59 feet, is interpreted to be the western wall of the 1854 engine mill house. It continued eastward from its corner in 60R20 uninterrupted through squares 60R20-50. Although the wall is badly disturbed by trees in several squares, it remains distinct and constructed in a manner similar to that observed in the west wall. This northern wall ranges in elevation from 98.64 feet at its western end to 96.27 feet at its eastern end. This drop of 2.4 feet is the result of the wall being extensively robbed at its eastern end, where only the bottom course of rocks remains. No robbers trench is observed in this area, but one would most likely not have been needed since the site topography slopes down to the east. The foundation is expected to have been primarily above ground and, as a consequence, easy to remove. Evidence of the builder's trench, on both the interior and exterior of the wall, was found in squares 60R40-50. The trench fill is a tan to tan-gray sandy clay with few rocks.

Four 5 foot squares (55-60R60-65) were excavated around point 60R60 to identify the wall's northeastern corner. The corner was identified at 64R61 and additional evidence of stone removal was provided by the very sparse north wall remains (Figures 10 and 14). The northern wall of the 1854 structure is estimated to have been 44 feet in length.

From 64R61 the wall turns southward to form the eastern wall of the 1854 engine mill house. Time constraints regretably cause this to be the least well investigated part of the site. The eastern wall is exposed for about 10 feet by the excavations in 55-60R60-65 and is visible just below the leaf litter beginning at 50R60. The wall continues southward into square 20R60 where it was more fully exposed by excavation. At 24R60 however, the wall stops and does not reappear until 7R59, where a yellow sandy soft mortar suggests it was tied into the boiler pit foundation.

This 17 foot gap appears to represent complete wall removal, perhaps as the result of a later construction episode. It is unlikely, given the jaggedness of the break at 24R60, that the gap was intentional. The wall is nominally four courses at its highest in 20R60 and the elevations range from 96.38 feet at the north end of the wall to 97.03 feet for the uppermost course at the south end. If the next course down at the southern end is used (AE=96.42 feet), the north-south difference in elevation is reduced from 0.65 to 0.04 foot.

This eastern foundation is slightly over 2 feet in width, compared to the western wall which is no more than a foot in width. The downslope (east) wall was necessarily thicker than the upslope (west) wall because of its increased height. Somewhat suprisingly, neither wall was placed substantially below grade (see Nicholson 1852:49). Although clay soils at the turn of the century were thought to be capable of carrying a load up to 2 tons per square foot (Morgan 1921:141), certainly sufficient to support the engine mill house, common practice in clay soils was to use footings below grade to further spread the load and to drain the soil through trenching, particularly on slopes (Dempsey 1851:5). Concerning clays it was noted, "they may be considered as always holding a certain amount of water or moisture, while an excess of it renders them slippy and liable to unexpected subsidence" (Dempsey 1851:5).

Today this eastern foundation is over 2 feet lower than the western foundation; this closely approximates the slope of the extant ground surface, suggesting that the walls were uniformly robbed to, or just below, the late nineteenth century ground level. As previously mentioned, the eastern wall found in 20R60 provides evidence that the site was mined and that tailings were spread over Upper Hill prior to construction of the 1854 structure. A layer of tailins was found to go under the wall in square 20R60 and sterile soil was not encountered until a depth of about 95.2 feet.

1854 Structure Features

Features outside this 1854 foundation are limited to the previously discussed wood beam in square 20R20, the builder's trench along the west wall, the builder's trench found adjacent to the north wall, three possible post holes in squares 50-60R20, and wood beams lying east of the structure in 55-60R60-65. These features were recorded but not removed during this study. The post hole in square 50R20 is circular, about 1 foot in diameter, and the fill is dark brown loamy clay. The southern post hole in square 60R20 is also about 1 foot in diameter and has a light brown clay fill. Slightly to the northeast of this post hole is a distinct light brown clay and charcoal stain which measures about 3 feet southwest-northeast and about 1.2

feet southeast-northwest. Figure 14 illustrates the wood plank remains lying scattered outside the east wall of the 1854 structure. A series of at least three planks, probably 1x6s from the structure's frame construction, were identified and two of these planks had cut nails in place. These remains are similar to planks identified by Sacchi (1980:12,17) within his unit 1. These planks, found in a haphazard arrangement with nails still in place, suggest that the 1854 structure was either torn down for partial salvage, or that it simply fell into decay.

Work within the posited 1854 structure revealed a number of architectural and archaeological details, including an intrusive structure (Figure 10). Those features which appear to be associated with the 1854 structure include a rock rubble platform, two parallel stone walls, and a flat rock platform. In addition, there are a number of stains and possible ditch features, which will not be further discussed.

The rock rubble platform is roughly rectangular in appearance, with its long axis parallel to the west structure wall. The feature, which measures about 14 by 6 feet and is situated in squares 40-50R30, appears to be constructed by loosely placing rock rubble in a 1 to 2 foot deep hole. The spaces around the rocks are partially filled with a sandy slurry. The soils to south, west, and east of this platform are primarily red clay tailings. To the north, however, there is abundant sandy slurry extending west to the northwest structure corner and eastward to squares 55-60R60-65.

The function of this platform has not been conclusively determined, although it is profitable to consider it in light of the equipment Partz discussed as being present in the engine mill house. The four sets of stamps are expected to have occupied as much as 450 square feet (based on a set measuring about 16 by 7 feet), an area far larger than represented by this feature. Regardless of size, this plartform is neither sufficiently level, nor strong enough to support a stamp mill. The stamps would not have processed or produced this rock as a by-product, as mingling the waste rock with the ore produced a material very difficult to amalgamate (Janin 1895:317). The shaker tables, as previously mentioned, also are not expected to produce any recognizable archaeological signature. The drag mill or arrastra would have been circular, not rectangular. It is therefore unlikely that the feature represents either a destroyed or rubble filled drag mill. It is equally obvious that the feature does not represent the remains of a Chilean mill, although little is known about their set-up. These mills, however, required a flow of water during the entire grinding process, which might last from under an hour to over two days (Knapp 1973:158). The shorter period of time was more common, but regardless a

Figure 16. Rock rubble platform within the second structure. The north doorway is in the foreground and both the southern wall and the boiler pit wall are in the background. View is to the south.

Figure 17. Rock apron between the second structure and the boiler pit. View is to the west.

quantity of water and tailings would flow off the mill during its operation. The rock platform may have functioned as a sump, permitting drainage of at least some of the waste water (co-mingled with slurry). The platform may have assisted the leveling of the Chilean mills.

Ure (1840), in his discussion of ore preparation in metallurgy, details the use of stamps, but does not mention Chilean mills. He does, however, describe the "edge mill" under the manufacture of fat oils (Ure 1840:899) and the gunpowder mill described and illustrated by Ure (1840:630) appears to be identical to the Chilean mills described by Young (1970:71-72) and Sloane (1970). Apleton (1953:368) does describe the CHilean mill in his discussion of metallurgy, using an engraving almost identical to Ure's gunpowder mill. Appleton's 1853 work may explain the failure of an earlier reference in Ure, as it states "similar mills are exclusively employed in North Carolina for crushing gold ores, also to some extent in Virginia" (D. Appleton and Company 1853:368).

It appears that the set-up and operation of these mills may have been site specific, with individual mine operators establishing mechanisms according to their individual ability and the resources of local stone cutters. It is likely that mines would vary and improve upon techniques observed elsewhere. As a consequence, it may not be possible to correlate the observed archaeological remains with any written account of mill set-ups.

Two parallel stone walls are found in squares 20-40R40 (Figures 10 and 15). The first to be considered is the eastern wall, which runs from 28R37.5 northward to 54.5R38. The coursed random rubble wall consists of large stones laid without mortar in a manner similar to that observed elsewhere in the 1854 structure. The foundation varies in height from 98.40 feet at its southern terminus to 98.54 feet at the north end, although the variation is primarily the result of the wall being somewhat more intact toward the north. The southern end has been removed by the intrusive structure, so that the actual length of the wall is unknown. Since the northern end comes to within about 10 feet of the north end of the structure, it is likely that the foundation continued southward another 8 feet. This foundation is almost exactly centered in the structure, being 22 feet from both east and west walls.

It seems unlikely that a single story frame structure only 44 feet in width would require any central supports. Hamilton (1958:471-472) and Dempsey (1851) both indicate that timber trusses typical of the mid-nineteenth century could easily span this distance. Nicholson (1852:56) indicates that a 50 foot tie beam of oak should measure 13 by 9½ inches and he provides information on spans of up to 70 feet. There is no evidence of heavy roofing, such as slate or tile, which would increase the load. It appears that this central "foundation" may have been a retaining wall which served to create two areas of level ground within the engine mill house. As previously mentioned, the ground today slopes about two feet from the west to the east, or about 5%, which would make it difficult to level and operate the various equipment in the engine mill house. Posselt had three options: to fill the entire structure to the western ground level which would result in the eastern foundation serving as a retaining wall for about 2 feet of soil, cutting the western area down by a foot and using it to fill the eastern section which would result in both eastern and western foundations serving as retaining walls, or constructing a central wall and leveling the soil in each half of the structure. This last option, chosen by Posselt, while requiring the construction of an additional wall, used no more stone than the other options, resulted in less earth movement, and did not create as great a stress against the wall foundations. Although there has been some site disturbance and earth movement in the site area since the mid-nineteenth century, the effects of this strategy are still observed today. The western half of the structure is nearly level at elevations from 98.80 to 98.50 feet, while the eastern half exhibits less care in leveling (or more recent disturbances) with the elevations ranging from 97.50 to 97.00 feet. The failure to extend the central retaining wall to the northern edge of the structure suggests this 10 foot corridor may have served as a "ramp," allowing access to the two different structural levels. A similar "ramp" may have existed at the southern end of the structure, adjacent to the boiler pit.

The second wall is parallel to the first, beginning at 39.5R32 and running to 56.5R32.5. Its elevation in square 40R40 is 97.96, slightly lower than the eastern wall, but the most noticeable difference is that the western wall is entirely made up of random rubble stone set without mortar. The construction appears more casual than the eastern wall (Figure 15). Its purpose has not been determined, although the wall does not appear capable of supporting much of a load or withstanding any significant stress.

The last feature which appears to be part of the 1854 structure construction is a flat rock platform found primarily in square 30R40 (Figure 10). The platform, composed of flat greenstone rocks which range in size from 0.5 by 1 foot to 1 by 1.5 feet, forms a rectangle about 8 feet north-south by 6 feet east-west laid immediately west of the eastern central foundation. Today a Chilean mill base is situated over this platform, but the mill is not in situ. Excavation around the base demonstrated that it rests on humic soil and wood debris and it was apparently dragged to this spot, probably from the west or northwest, based on the bulge in the foundation wall which runs through 30R40.

The function of this platform cannot be determined at the present time, although it may be associated with the western central foundation which is just north of the platform's north-western corner. As the platform abutts the eastern central foundation it appears that they are roughly contemporary. More concerning this platform might be learned if the mill base were to be moved. Unfortunately, moving the base was beyond the technological capability of the current project.

The only soil study conducted consists of an analysis of three samples for mercury levels. Mercury, used in the gold amalgamation process with the arrastra or Chilean mill, was expected to be present in the slurry deposits. The historic records suggest that the gold recovery techniques were relatively poor, with the result that much of the amalgum was lost with the waste sands. The red clays at the site were expected to exhibit a low concentration of mercury, since they represent unprocessed waste rock or tailings. The sandy slurries, however, represent the waste from processing and are expected to exhibit mercury levels above the clay tailing background levels. The level of mercury in the slurries, of course, would indicate the care with which the gold was being processed. The lower the concentration, the greater the care given the milling process.

The analysis was conducted by A&L Eastern Agricultural Laboratories in Richmond, Virginia. Sample 100ml80 was collected from square 20R20, Zone 2a and consisted of red clay tailings. This sample contained 0.36 ppm of mercury and represents a background level. Sample 100ml327 was collected from square 20R50, Zone 2a and consisted of a white silty sand. The sample contained 60 ppm of mercury. The final sample, 100ml395, was collected from square 60R50, Zone 4 and consisted of a tan course sand slurry. This sample contained 151 ppm of mercury.

The results from samples 100ml327 and 100ml395, particularly when compared to the background level of sample 100ml80, exhibit extremely high levels of mercury. Sample 100ml327 contains 1200 times the allowable level of mercury for drinking water (Robert Wilroy, personal communication 1986). It is apparent that mercury amalgamation was being used by Posselt in 1854, but that the technique was being poorly controlled, with the resultant loss of large quantities of amalgum.

The 1886 Structure and Features

During the excavation of the N10-20 lines a second, intrusive, structure was identified by two east-west foundation walls (Figure 10). The southern wall begins at 16R17 and continues to 15R58.5, for a length of about 42 feet. A short north-south wall connects this southern foundation to the boiler pit in square 10R10. The wall is of greenstone ramdon rubble construction with thick mortar joints still visible in some areas. Although little or no effort had been made to fit the rocks into orderly courses, the stones themselves are well prepared and appear to represent the robbed stone from the 1854 structure. The foundation varies in height from 98.89 at its western end to 95.75 at its eastern, for a drop of over 3 feet. This drop, of course, corresponds to the current site topography.

The northern wall of the second or intrusive structure, situated about 12 feet to the north, is of identical construction. The wall runs from 28R18 to 27.5R50 where it abruptly stops. Begining about 27.5R44 the wall is in very poor condition and it is likely that the eastern 9 feet were not recognized during the excavation of square 25N40E (25R55) in 1974. An examination of Babits' 25N40E plot sheets revealed that at the base of level 1 an "underlying rock base" was recognized and recorded. It is in alignment with the remainder of the foundation uncovered during this study, but was apparently not felt to be significant in 1974, for it was removed with level 2 (Historic Sites, 31CA 18**1, notes on file). It appears that this northern foundation also extended a total of 42 feet and ranged in elevation from 99.13 feet to 97.44 feet.

The northern foundation has a southern projection about 8 feet in length at the R43 line. A wooden sill in the north foundation from 27.5R31 to 27.5R38 provides evidence for a doorway west of this south projecting interior wall. There is no evidence of either an east or west end wall for this structure, although at the west end there were several rocks which may have served as supports for a wood sill. The east end was either open, or consisted of large doors.

Although quite smaller than the 1854 engine mill house, this second structure, which measured 42 by 12 feet, was carefully designed. The primary consideration appears not to have been attractiveness or even permanence, but rather ease of construction. To understand its design and construction it is necessary to remember that the 1854 builders had terraced the slope of the Upper Hill within the confines of the original structure, except for 10 foot ramps at the north and south ends of the building. As the original engine mill house decayed or was salvaged, this terrace with its ramps, or natural ground slope, remained. Consequently, the second builders had a partially terraced, partially sloping piece of ground on which to work. They naturally desired to stay close to the boiler pit and steam engine, but apparently chose not to use either of the boiler pit foundations as their southern wall. As a result both the boiler and the steam engine were excluded from this second structure, making it most properly only a mill house.

Portions of the 1854 foundation were salvaged and the second structure oriented so that its northern doorway would be at the terrace edge. The foundation, however, would drop in elevation from the west to the east. Positioning the doorway just west of the terrace, however, meant that the wall would take on no obvious slope and thus there would be no need for a builder's trench or other efforts to gradually terrace the wall. The southern foundation was constructed on the 1854 "ramp" or slope which had not been terraced. Along this line the use of random rubble masonary allowed the builders to simply follow the terrain, again without any need for trenches or gradual terracing of the foundation. Both the north and south walls are poorly constructed, but the load on the walls would have been considerably less than the load on the original 1854 structure foundations.

This construction would have left a retaining wall running north-south through the approximate center of the structure, to within about 5 feet of the southern wall. The arrangement was apparently unsatisfactory, so a new retaining wall was constructed about 5 feet to the east of the old one and the ground leveled to the west of the new wall. The same 5 foot wide natural "ramp" or slope was left.

One reason may be offered for the need to relocate the retaining wall. The only significant feature within this second structure is a large rock rubble platform, somewhat similar to the one discussed for the original 1854 engine mill house. The platform is square with rounded corners and is centered at approximately 21.5R34 (Figures 10 and 16). It measures about 9 feet east-west by 7 feet north-south and has an elevation of about 98.40 feet, the same as the wooden door still directly to the north. Based on reasoning previously offered, it is suggested that this platform represents the location of a Chilean mill in the second structure.

Outside the structure, between the southern wall and the boiler pit, there is a poorly paved rock floor or apron extending from the R40 line eastward to the R60 line (Figure 17). Rocks within this area are both angular and flat, but are arranged in no particular order. The elevation from about R45 to R60 is level, varying from 95.95 to 95.82 feet. Between R40 and R45 there is abundant rubble, some probably from the foundation and other possibly representing the floor, but it slopes upward as was suggested by the presence of the retaining wall within the structure at R43. It appears that these rocks were laid on the extant ground surface during the construction of the second structure. The same degree of care is found consistently through this building.

The 1895 Structure

It is immediately apparent that the structure shown in the ca. 1919 and 1920 photographs of the mill house on Upper Hill (Figures 6 and 7) is not the second structure identified archaeologically. Carefull scaling of Figure 7 reveals a structure that is about 11-12 feet in width and which extends 8 feet east of the chimney. The structure, which has doors on its east end and also on its north face, continues westward, toward the Engine Shaft. While the photographs do not provide detail on the foundation east of the chimney, Figure 7 suggests wood piles were used west toward the mine shaft. The structure is of simple drop horizontal board construction and roofed with either tin or galvanized iron.

Although the width of this photographed structure is correct for the archaeologically observed foundation, the length is by far too short. It appears that a third structure was built on Upper Hill, using the basic plan and foundation of the second mill house. Rather than rebuilding the foundations, those of the second structure were adopted, but the third building was oriented more westward toward the Engine Shaft. Where there were no stone foundations, wooden piers were used. This first time use of wood piers rather than stone, and the re-use of previous foundations, suggests that the third structure was more hurriedly and less carefully built than even the second structure.

The archaeological record reveals little about this third structure, except to support Knapp's (1973:180) assessment that little activity took place in the building. The structure's dimensions and placement suggest that the steam engine previously mounted on the boiler pit wall, was no longer being used. The southern foundation, however, clearly shows the eastern end of this third structure at R32 (Figure 16) where the foundation suddenly is reduced in height by about 0.7 foot.

Further research on this third structure, which dates to the 1895 mine activity, would require the excavation of units west of the R10 line. Based on the erosion and slumping of Engine Shaft, the wooden piers used by the 1895 structure, and the limited activities conducted in the building, it is unlikely that much evidence of the structure will remain. This additional work, however, might recover evidence of the tram supposedly used during this time period.

ARTIFACT ANALYSIS

Descriptions

The artifacts recovered from the engine mill house (N=4882) encompass three general classes: ceramics, glass, and metal (primarily iron). Analysis on such a level, however, fails to reveal adequately the complexity and variety in the archaeological record. As a consequence, the artifacts will be discussed by artifact groups, such as Kitchen, Architecture, Furniture, Arms, Clothing, Personal, Tobacco, and Activities (which are slight revisions of South 1977). Such an approach allows the quantification and discussion of artifacts in a broad functional framework. The initial analysis will not attempt to consider temporal episodes, but rather will consider all artifacts at a synchronic level. Although some information is offered on the temporal range of various artifacts, no diachronic study is attempted because of the sporadic episodes of activity at the engine mill house and the relatively small collection available for study. Artifact measurements are given in both metric and english units for the convenience of other researchers. Percentages of each group will be found in Table 6.

Kitchen Artifact Group

The Kitchen Artifact group at 31CA18**1 consists of 153 ceramics, 18 "wine bottle" fragments, seven canning or jar lid fragments, 95 patent or proprietary medicine bottle fragments, six pharmaceutical bottle fragments, 37 can fragments, and 213 indeterminate bottle or container glass fragments, for a total of 529 specimens.

The ceramics include a single fragment of a brown English stoneware used for ink, beer, and other liquids, often referred to as ginger beer bottle. Hume notes that, "cylindrical brown stoneware bottles were made in England in enormous quantities throughout the Victorian era, and many of them found their way to America" (Hume 1969:79). South (1977:210) provides a date range of 1820 to 1900+ and a median date of 1860 for this ceramic. Wilson (1981:7-11) discusses the use of similar bottles in the ale and stout industries. Two fragments of a gray saltglazes stoneware, speckled brown, were found in the vicinity of the cabins shown on the 1854 Partz map (Figure 3). One is a body sherd, while the other is a rim. These ceramics are examples of American traditional saltglazed stoneware typical of the nineteenth century (Ramsay 1947:138-139). The form is similar to preserve jars or churns. There are 14 sherds of stoneware from a minimum of two vessels which were distinctly cylindrical with a square, ridgelike shoulder, commonly refered to as "stacker" or "shoulder" jugs. This form dates to the late nineteenth century, was common by 1900 (Blair 1965; Ketchum 1983:14), and continued to be made through the 1920s (Terry Harper, personal comunication 1986). An albany slip stoneware jug with straight sides and a sloping shoulder was represented by eight sherds. This style typically dates to the mid-nineteenth century, although it had a long popularity (Ketchum 1983:14). The most common stoneware at the site, however, is an alkaline glazed variety (N=33), probably from local potters in the Lincoln and Catawba county area of North Carolina (Figure 18e-f). Burrison (1975:379) indicates that this pottery spans the period from 1830 to 1910. At least three vessels are present in the collection, one having the form of a small jug with a basal diameter of about 12 cm (4 1/2 in).

Red bodied coarse earthenwares with a clear lead glaze are fairly common at the engine mill house (N=22) and probably reflect the work of local potters. The ceramic is comparatively soft and porous, being commonly called redware. The pottery is glazed on both the interior and exterior, and a minimum of one vessel is present in the collection (Figure 18d). The sherds are too small to allow identification of vessel form, but redware was commonly made in utilitarian forms such as crocks, jugs, jars, and mugs (Ketchum 1983:10; Ramsay 1947:128-138), although the baking dish form was the most common style in North Carolina (Terry Harper, personal communication 1986).

The three final ceramic categories from the engine mill house are whiteware, ironstone, and semi-porcelain. The difficulty distinguishing between whiteware and ironstone has been previously discussed by South (1974:247-248), who uses an "ironstone-whiteware" category, and Price (1979:11), who uses a "whiteware" (including ironstone) category. Both researchers point out that differentiating between whiteware and ironstone using vessel hardness (or degree of vitrification) is an uncertain or even invalid approach (cf. Worthy 1982). South remarks that, "[t]he hardness, which is a major means of distinguishing these types, is so variable that often a vessel with a hardness of earthenware will have 'Ironstone China,' or some similar designation as part of its mark" (South 1974:248). Such a situation is present at 31CA18**1. Consequently, the collection is discussed under the term whiteware, although there are sherds which evidence greater vitrification and which some researchers might prefer to categorize as ironstone. These more vitrified ceramics are noted in the discussions, although they are designated as whiteware. A distinction is made between the whitewares and the semi-porcelains or "Hotel Ware," which is stonger, more vitrified, but still opaque and hence not a true porcelain. These semi-porcelains post-date the period from 1870 to 1885 (George Miller, personal communication 1985; Ramsay 1947:109), while the whitewares post-date 1820 (South 1977:211).

Whiteware at the engine mill house accounts for 69 sherds and nine vessels. Of these, 52 (seven vessels) compose the category of less thoroughly vitrified whiteware, while 17 fragments of two vessels are more completely vitrified and might be characterized by some researchers as ironstone or "white granite." The 52 whiteware fragments include six plates, one cup, one saucer, and one pitcher. Three plates evidence embossed or molded edge designs, one with four bands, another with two bands, and the third with an indeterminate design, but otherwise are undecorated (Figure 18B). Price (1979:22) suggests this variety post-dates 1850 in the Ozark region. Miller notes that unscalloped rim patterns have a date range of 1825 to 1891, with a mean date of 1849. They were apparently most popular between 1841 and 1857 (George Miller, personal communication 1985). A fourth plate is also undecorated, but has a scalloped rim. This style peaks in popularity between 1874 and 1884 (with a mean date of 1879), although it was produced as late as 1897 (George Miller, personal communication 1985). A fifth plate is sponge decorated in a light green color (Figure 18D). Price (1977:19-20) suggests a date range of about 1820 to 1860 for this type while Bartovics (1978:213) suggests a range of 1836 to 1870. The sixth plate has a blue transfer printed floral pattern. Bartovics (1978:213) suggests a date range of 1831 to 1865 for this pale blue transfer print style. The single cup is a basal fragment, which is undecorated, as are the fragments of the single saucer. The only marked pieces are the basal fragments of the pitcher, which are stamped "IRONSTONE DAVENPORT" under a lion/crown/unicorn/shield motif (Figure 18A). This mark is not easily dateable, although the Davenport firm operated from about 1793 to 1887 and Ironstone-type ware was produced by the firm up to the 1880s. Godden notes that, "[e]arly marks incorporate the names 'REAL STONE CHINA', ... 'REAL IRONSTONE CHINA', or 'IRONSTONE'" (Godden 1971:64-65) which suggests a mid-nineteenth century date for the pitcher.

The 17 more vitrified ceramics include a single plate and cup form. The plate has a molded or embossed rim with a faint band design and a scalloped edge. The cup is undecorated. Finally, the single fragment of semi-porcelain or "Hotel Ware" is a basal plate fragment with a faded decal print. This decal or decalcomania motif dates from about 1860 through the early twentieth century (Orser et al. 1982:642, 910).

The 18 "wine bottle" fragments are of a olive green color which appears black in reflected light. They are mold blown and probably represent a single bottle. The basal portion does not appear sufficiently large to represent either a champagne or wine bottle; it is likely that these specimens represent an ale bottle. The specimen probably dates from the nineteenth century, but a more specific date is not possible given the small fragments and absence of the neck and lip.

The seven canning jar or lid specimens include six milk glass lid liner fragments for zinc caps. These items post-date 1869 when Louis R. Boyd patented a glass liner for the zinc Mason cap (Toulouse 1977:135). The other specimen in this category is a complete glass canning jar lid of the lightening type, which post-dates 1882 (Lorrain 1968:42; Toulouse 1977:126) (Figure 18N).

The 93 examples of patent or proprietory medicine bottles are dominated by light green or clear panel bottles, of which 35 specimens are embossed. Lorrain (1968:40) notes that lettered panel bottles first appeared in the 1860s. Fifty-one examples of panel bottles were either not embossed or too small to allow detection of embossing. Seven fragments represent a single dark blue Bromo Seltzer bottle. Bromo Seltzer, produced by the Emerson Drug Company in Baltimore, Maryland was an early twentieth century headache cure (Cramps 1911:363).

Two of the panel bottles are sufficiently intact to reconstruct the bottle's panels. One, a light aqua color, is embossed "RAMON'S/NERVE & BONE OIL/BROWN MFG. CO. PROPRIETORS" (Figure 18k). This particular nostrum could not be immediately identified in the literature, although Cramps (1921:391) notes that the Brown Manufacturing Company, of Greenville, Tennesse, also produced "Ramon's Pepsin Headache Cure" during the early twentieth century. The other, clear in color, is embossed "GIBSON'S/DRUG STORE" (Figure 18J). Gibson Drug Store, Inc. is noted in the 1902 Concord City Directory as run by J.F. Gibson. Unfortunately, city directories for Concord, North Carolina prior to 1902 are not readily available. The store continues, under several proprietors, through the 1970s, although by 1949 it had become a Rexall Drug store.

The six pharmaceutical bottles are all clear glass and at least four specimens appear to be machine made. Three specimens are embossed with the Rexall symbol and "Charlotte Drug." Two other specimens are mold made, but are too small to permit a more detailed analysis. One of these two specimens is embossed with a line and "200 cc." The pharmaceutical bottle fragments recovered from the engine mill house appear to date from the early twentieth century.

The 37 can fragments are all small and heavily rusted. A few appear to be small, flat cans, such as sardines might be packed in, but most are too fragmentary to allow meaningful analysis. All of the fragments appear to have double side seams, which suggests a late 1890s date (Rock 1984:105). An attempt was made to separate those fragments which might reasonably have been food cans from those which may have contained non-food items; as a result, there are 42 additional can fragments discussed under the Activities Artifact Group.

The remainder of the artifacts in the Kitchen Artifact group includes 213 indeterminate bottle or container glass fragments, most under 2 cm in diameter. These fragments, while appearing to represent either a bottle or some other container, were too fragmentary to allow further identification.

Architectural Artifact Group

The Architectural Artifact group includes window glass, nails, spikes, staples, and screws. Surprisingly, no construction hardware was recovered, nor was there evidence of any door lock parts.

The category of window glass includes 179 fragments of light green (N=173) and clear (N=6) rolled glass. These specimens were classified as window lights based on thickness and lack of curviture.

Recently, the use of flat window glass as a dating tool has been advanced by Roenke (1978), Adams (1980), and Orser et al. (1982). Basically, window glass tends to increase in thickness throughout the nineteenth century. It has been further demonstrated that this thickness change is variable in different parts of the United States either because of difference between glass makers or because of recycling the glass panes. Orser et al. (1982:652) offer a regression formula for calculating the date of window lights based on thickness.

$$y = 41.46x + 1762.76,$$

where 41.46 is the slope of the line, 1762.76 is the y-intercept, x is the modal glass thickness and y is the mean date. They also suggest a correction factor of +53.75 years. The formula yields the results in Table 1 (Orser et al. 1982:661). It should be noted, however, that the formula for flat glass is probably curvilinear rather than linear, as there are practical limits of both thinness and thickness (Orser et al. 1982:665).

Table 2 shows the thickness of window glass at 31CA18**1, indicating a modal value of glass in the range of 1.7-1.8 mm. Using the transformed dates, this suggests a structure with mean dates of 1886.99 to 1891.14, although a construction phase as early as 1857.97 is indicated by the 0.9 mm glass. The earliest construction phase at Upper Hill appears to have been Posselt's 1854 Engine mill house, which may have had glass windows. Consequently, it appears that the transformed dates of Orser et al. (1982:Table 132) are approximately 3 years too recent. Such a downward adjustment, yielding dates of 1883.99-1888.14 for the 1.7-1.8 mm glass, provides dates much closer

Glass Thickness (mm)	Transformed Dates
1.0	1857.97
1.0 - 1.2	1857.97 - 1866.26
1.3 - 1.4	1870.41 - 1874.55
1.5 - 1.6	1878.70 - 1882.85
1.7 - 1.8	1886.99 - 1891.14
1.9 - 2.0	1895.28 - 1899.43
2.1 - 2.2	1903.58 - 1907.72
2.3 - 2.4	1911.87 - 1916.01
2.5 - 2.6	1920.16 - 1924.31
2.7 - 2.8	1928.45 - 1932.60
2.9 - 3.0	1936.74 - 1940.89
3.1	1945.04

Table 1. Regression dates for flat glass with transformations (after Orser, et al. 1982:Table 132).

Glass Thickness (mm)	Number	%	Revised Dates
1.0	1	0.6	
1.5 - 1.6	34	19.1	1875.70 - 1879.85
1.7 - 1.8	82	45.5	1883.99 - 1888.14
1.9 - 2.0	43	24.1	1892.28 - 1896.43
2.1 - 2.2	14	7.9	1900.58 - 1904.72
2.3 - 2.4	1	1.7	1908.87 - 1913.01
2.9 - 3.0	2	1.1	1933.74 - 1937.89

Table 2. Flat glass thickness at 31CA18**1.

to those proposed by Orser et al. (1982) than originally proposed by Rothman (1980).

Three types of nails were recovered from the engine mill house excavations: wrought, machine cut, and wire. Of the 3344 nails, only 8 or 0.2% were hand wrought and none were sufficiently intact to determine size. The hand wrought nails date from the seventeenth through nineteenth centuries and Nelson notes that "it is not uncommon to find a few hand-wrought nails used well into the nineteenth century" (Nelson 1968:3). It is also likely that cut nails replaced wrought nail technology less quickly in rural areas such as Carbarras County. The shanks are rectangular in cross-section and the heads are the round "rose head" form.

"Modern" machine cut nails account for 60% of the collection (N=2004), although only 715 (35.7%) are sufficiently intact to allow penny weight measures. These nails were first manufactured in the late 1830s and have uniform heads and shanks with burrs on the edges (Nelson 1968:7). Of the 1332 wire nails (39.8% of the total nail collection), 1043 or over 78% could be accurately sized during this study. It appears that the wire nails, being more recent, have been subjected to less deterioration and consequently are in generally better condition. The wire nails were first widely available in the 1850s, but were apparently not common until the 1870s (Nelson 1968:9-10). Wire nails have round heads and round, pointed shanks. The wire nails are further subdivided into common nails, finishing nails, and roofing nails.

Because different size nails served different functions, it is possible to use the relative frequencies of nail types to indicate building construction details. Nails were early designated by their penny weight, which compared the weight of a nail to that of a silver penny. Gradually the term came to designate length rather than weight, but the equivalence varied over time and it was not until the 1890s that pennywights were thoroughly standardized (Orser et al. 1892:675). To avoid confusion, Table 3 lists both the pennyweight size, Standard Average European (SAE) size, and metric range for the nails which were sufficiently complete for analysis. The table as organized, however, provides few clues to the construction of the various mill buildings. Cut nails are fairly evenly divided among all sizes, with noticeable peaks only at the 4d and 12d sizes. The wire nails, in contrast, cluster at sizes between 8d and 12d. One of the few commonly accepted rules in nail length is, "to have the nails full three times as long as the Sheating Board is thick" (Betteswork and Hitch 1981:2:n.p.). Within certain broad limits the size of nail used to perform a certain task was flexible, depending on the carpenter and the availability of nails. This variation is reflected in Orser et al. (1982:677). As a rough guide, however, 2d to 4d nails

Pennyweight	SAE	Metric Range (in mm)	Cut #	Cut %	Wire #	Wire %
2d	1"	23-28	3	.4	31	0.1
3d	1 1/4"	29-34	12	1.7	6	0.6
4d	1 1/2"	35-41	148	20.7	24	2.3
5d	1 3/4"	42-47	20	2.8	8	0.8
6d	2"	48-53	26	3.6	52	5.0
7d	2 1/4"	54-59	18	2.5	28	2.7
8d	2 1/2"	60-65	68	9.5	159	15.2
9d	2 3/4"	66-72	57	8.0	140	13.4
10d	3"	73-79	27	3.8	160	15.3
12d	3 1/4"	80-85	191	26.7	253	24.3
16d	3 1/2"	86-95	66	9.2	18	1.7
20d	4"	96-108	27	3.8	121	11.6
30d	4 1/2"	109-120	44	6.2	22	2.1
40d	5"	121-132	5	0.7	22	2.1
50d	5 1/2"	133-145	2	0.3	7	0.7
60d	6"	146-157	1	0.1	22	2.1
Total			715		1073	

Table 3. Whole machine cut and wire nails by size.

Function	Cut #	Cut %	Wire #	Wire %
Small timber, shingles (2d-5d)	183	25.6	39	3.8
Sheathing, siding (6d-8d)	112	15.6	239	22.9
Framing (9d-12d)	275	38.5	553	53.0
Heavy framing (16d-60d)	145	20.3	212	20.3

Table 4. Whole machine cut and wire nails by function.

nails were commonly used to fasten small timbers and shingles; 6d to 8d nails were used for sheathing or siding; 9d to 12d nails were used for heavy framing. Table 4 illustrates the number and percentage of machine cut and wire nails by probable function. This table suggests that machine cut nails were about equally divided between the four functional categories of shingles, siding, framing, and heavy framing. The wire nails, however, present a different picture. Small shingle common wire nails are almost absent, being functionally replaced by roofing nails (below). The bulk of the nails (52.9%) fall into the general category of framing.

There were 32 wire finishing nails, varying in size from 4d to 10d, with the 8d being most common (N=26, 81.3%). These nails have been included with the common nails in Tables 3 and 4 because of the small sample size. Roofing nails were more abundant, with 133 recovered from these excavations. The size ranges from 3/4" to 1 1/2".

A total of eight spikes were recovered from the excavations, although only one was over 3½ inches in length and most were only fragments. The 1865 Russell and Erwin (1980:253) catalog indicates that spikes ranged in size from 4 to 7 inches. These specimens have been typed as spikes because of their large shank and gross features. Most were probably used in the construction of the various structures on Upper Hill as only one appears sufficiently large to serve as a railroad spike. That specimen, over 6 inches in length and 1/2 inch square, was recovered from square 20R40, level 2a.

Of the 11 staples recovered from the excavation, nine were 2 inch wrought fence staples, one was a 2 3/4 inch wrought staple, and one was a 6 inch wrought staple. The wrought staples are all common sizes, as indicated by their availability in the Russell and Erwin (1980:144) catalog.

Gimlet-point wood screws were found both whole (N=36) and as fragments (N=29). All but one specimen, a fragment of a round head, were the common flat head screw. Lengths recovered include 3/4 inch (N=1, 2.8%), 1½ inch (N=3, 8.3%), 2 inch (N=25, 69.5%), 2½ inch (N=4, 11.1%), and 3½ inch (N=3, 8.3%). Although Walker (1971:87) notes that gimlet-point screws were not introduced until 1834 and were not standardized until 1841, they apparently became popular by the 1860s. The Russell and Erwin (1980:126-127) catalog devotes four pages to screws in 1865.

Furniture Artifact Group

The only furniture items recovered from the Upper Hill excavations are 120 lamp glass fragments. A careful analysis

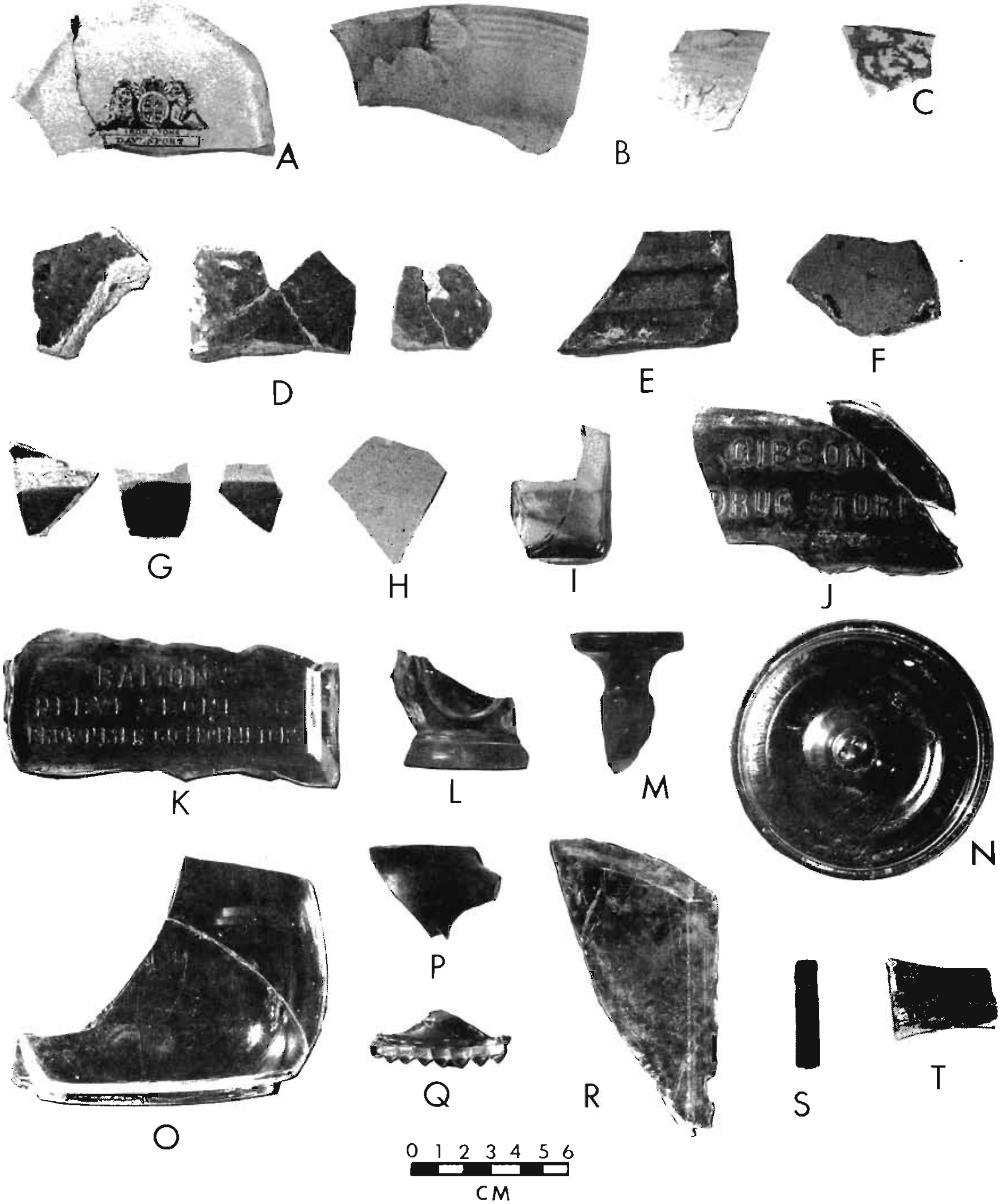

Figure 18. Kitchen, Furniture, Personal, and Tobacco Artifact Groups. A, whiteware with "Ironstone Davenport" mark; B, whiteware with molded rims; C, sponged whiteware; D, alkaline glazed stoneware; E-F, alkaline glazed stoneware, vessel interiors; G, "stacker" jug stoneware; H, albany slip stoneware; I, pharmaceutical bottle base; J-K, panel bottle fragments; L, blown glass bottle base; M, ground glass stopper; N, canning jar lid; O, lantern globe fragment; P, lamp chimney fragment; Q, crimped lamp chimney fragment; R, beveled glass fragment, possible mirror; S, slate pencil; T, pipe stem, Germanic origin.

of the specimens and partial reconstruction of several specimens revealed that both lamp chimneys and lantern globes were present in the collection. The globe glass may represent the use of lanterns in the mine and as such would be appropriately placed in the Activities Artifact Group. It is unlikely, however, that the chimney glass and associated lamps, because of their fragility, would have seen service in the mines. Consequently, all of the lamp glass has been placed in the Furniture category. The chimney glass is uniformly clear, usually very thin, with plain rims (Figure 18P) although three examples of crimped or fluted rims were identified (Figure 18Q). These crimped or fluted motifs appear to be copies of the highly popular "pearl-top" design first employed by the George A. Macbeth Co. in 1883. After Macbeth's merger with the Thomas Evans Co. in 1899, the Macbeth-Evans Glass Company became the nation's largest producer of lamp chimneys (Lewis and Haskell 1981:119-120). The crimped rim examples at the engine mill house therefore postdate 1883. The lantern globes are made from a thicker glass with ground rims (Figure 18O). Many of the specimens are of manganese glass. The 22 chimney fragments represent a minimum of three chimneys, while the 34 globe fragments represent a minimum of two globes.

A number of lamps, using a variety of burning fluids, included chimneys to improve the combustion process. The first such lamp was the Argand lamp, initially marketed in the 1780s, which burned camphine oil (a mixture of turpentine and alcohol). A shade, to minimize shadows, was added by the 1830s, although the Argand-type lamp, often without a shade, continued to be popular throughout the nineteenth century. By the mid-nineteenth century a variety of burning fluids were available including kerosine, which became available in the 1860s (Bishop and Coblentz 1979:107-109). The original engine mill house was constructed prior to the availability of kerosine; later episodes of use, however, almost certainly involved kerosine lamps rather than the more dangerous camphine oil lamps. The chimneys and globes found in the excavations could have been used on either type of lamp, although it is most likely that the crimped glass chimneys, post-dating 1883, were used on kerosine lamps.

Arms Artifact Group

The Arms group includes a single fired percussion cap, seven .22 caliber cartridges, three .32 caliber cartridges, two .44 caliber cartridges, and six 12 gauge shotgun shells. These 19 specimens may have been used by the site occupants, or may have been deposited through time by various hunters. The cartridges, representing Remington, Smith & Wesson, Peters, and U.M.C. Co. brands, span the late nineteenth through mid-twentieth century. Only the percussion cap dates from the mid-nineteenth century.

Clothing Artifact Group

The clothing group consists of 32 specimens, including 18 shoe fragments; nine eyelets, probably from shoe uppers; three buttons, and two fasteners. The shoe parts include three heels, one for a woman's or child's shoe and the others for men's shoes. The remainder are shoe uppers, probably from work boot styles. These remains appear to post-date 1875 (Anderson 1968).

The three buttons are the four-hole, white porcelain variety which correspond to South's (1964:122) "Type 23." The faces and backs are convex with a central portion of the face depressed for the holes. The buttons are 9, 11, and 17 mm in diameter, slightly larger than recognized by South's typology. This style was common during the nineteenth century, peaking in popularity between 1837 and 1865 accourding to South (1964:122). Brockington et al. (1985:222) note that this style maintains its popularity through the second half of the nineteenth century and thus is not useful for dating.

The two fasteners include a single brass snap and an iron fragment which resembles an overall fastener. These items have an extremely wide date range and are still in use today.

Personal Artifact Group

Only four artifacts were recovered from the Engine mill house excavations which fall into the Personal group. They include a fragment of a slate pencil and three perfume bottle fragments. The pencil (Figure 18S) represents a utilitarian object, while the perfume bottles reflect the only luxury items recovered from the site. Two fragments mend and are from a clear, machine made bottle embossed "Nick... Col..." This bottle may represent "Hoyt's Nickel Cologne" (Terry Harper, personal communication 1986). The other example is a light green blown bottle base which evidences a pontil scar. The bottle may represent an early nineteenth century perfume bottle or a small flask (Figure 18L).

Tobacco Pipe Artifact Group

The Tobacco group includes only three artifacts, a pipe stem fragment, a probable pipe tamper and a snuff can. This is a departure from South's (1977) classification, which would include only ball clay pipes in the Tobacco group. These other artifacts were included to maintain the intent of the Tobacco group, which was to recognize and quantify the significance of tobacco use at historic sites. Some who may wish to consider these remains in the following Activities group discussion.

The fragment of a stub stem pipe (Figure 18T) is of some interest as it is an example of late eighteenth or early nineteenth century local Germanic ware (Brad Rauschenberg, personal communication 1986). It is press-molded from red clay and has a mottled green glaze. Bivins notes that the nineteenth century Moravian forms are less often anthropomorphic and hence less interesting than their eighteenth century counterparts. The pipes "were made of both red clay and kaolin; most pipes were left unglazed, but some were offered also with both green and brown glazes" (Bivins 1972:174). The snuff can (Figure 19C) measures about 2 inches in diameter and 2½ inches in height. The thin iron can may have been tin plated and probably had a paper label. The last artifact to be considered is a 16d wire nail which appears to have been bent to serve as a tobacco pipe tamper. The rather small inventory of tobacco related items suggests that either tobacco smoking was a less common activity than it had been in the Colonial period (see also Miller 1983:142), or that a change occured in tobacco smoking habits.

Activities Artifact Group

The Activities group gives evidence of a variety of specialized activities at the engine mill house. The 568 artifacts in this group have been divided into 10 classes, slightly enlarging upon those offered by South (1977). These classes include tools, farm implements, toys, storage items, stable and barn items, miscellaneous hardware, plumbing hardware, machinery hardware, ore reduction hardware, and the class described simply as "other."

The category of tools includes a broken ship's auger, four files, a tin snip blade, a screw wrench, a band clamp, a chisel point, a fragment of a drift or hand pick, a pinch dog, and a screwdriver blade. The ship's auger consists only of the 9-inch shaft, the screw portion being broken (Figure 19G). The 1865 Russell and Erwin (1980:246) catalog lists an 18 and 20 inch twist and ship's augers are also listed by the 1902 Sears Roebuck (1969:502) catalog. In a similar manner all of the tools span the nineteenth through twentieth centuries. The files found are half round and triangular (Figure 19F) styles, primarily with bastard double cuts for fairly rough metal work. The 7¼ inch triangular file had a smoother cut, although it was largely obliterated by rust. The wrench is a "Coe's Patent" screw wrench which is illustrated in the 1865 Russell and Erwin (1980:241) catalog and it also is offered in the 1902 Sears Roebuck (1969:524) catalog as a "Genuine L. Coes' Improved Knife

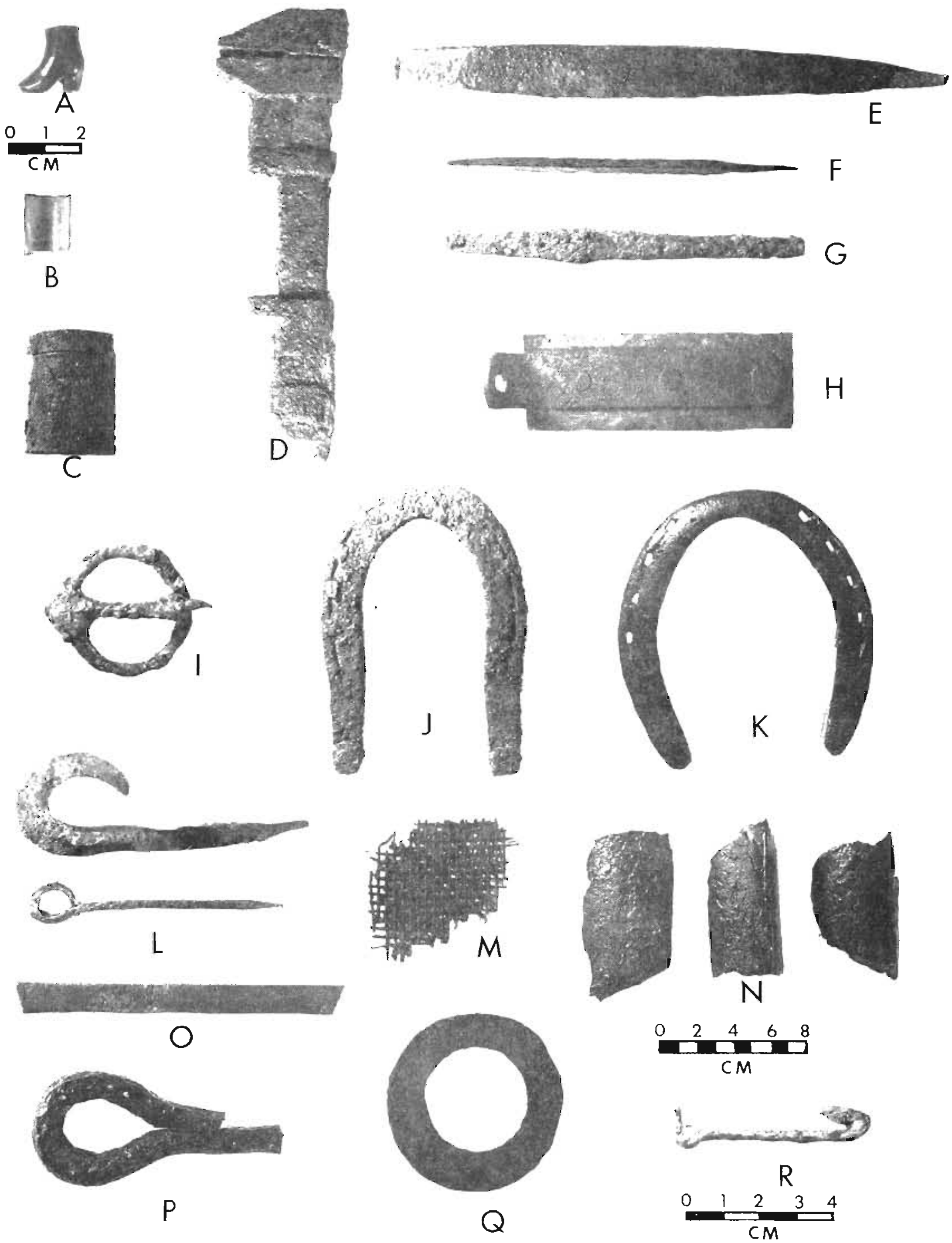

Figure 19. Tobacco and Activities Artifact Groups. A, doll's foot; B, glass boiler tube; C, snuff can; D, "Coe's Patent" screw wrench; E, flat file; F, triangular file; G, ship's auger bit fragment; H, copper band clamp; I, bridoon fragment; J, donkey shoe; K, horse shoe; L, wrought drive hooks; M, woven iron screen; N, collar or boss fragments; O, tappet; P, wrought eye bolt; Q, stamp mill washer; R, belt hook.

Handle Wrench" (Figure 19D). This item originally had a wooden handle and would have opened a maximum of 2 5/8 inches. Its cost in 1902 was $1.11. The single pinch dog identified from the site is rectangular and measures 3½ inches in length and 2 inches in height. Similar items, used by carpenters to clamp wood together when screw clamps will not work, are still in use today. The only tool specifically related to mining is the 115 mm fragment of a drift or hand drift which was recovered from level 4 in square 30R30. Unfortunately, none of the tools are useful for dating purposes, although they present an interesting view of the activities which took place in the various mill structures.

The only farm implement recovered from the work was found on the surface and probably does not relate to the site's mining history. The item is a heavy iron brace about 1.1 m in length which appears to have been part of a plow frame. The part is bent, which may account for its abandonment on the site.

The only toy recovered from the site is a porcelain doll's foot with the bottom portion having a brown glaze that resembles a boot (Figure 19A). The toy foot is similar to those illustrated by Garrow et al. (1983:110) for the mid to late nineteenth century Weathers site in Georgia.

The class of storage items contains 79 can fragments which have been placed in the Activities rather than Kitchen group because of their size. These items resemble 1 gallon paint can parts and consist primarily of seam segments.

The category of Stable and Barn includes three horseshoes, one mule or donkey shoe, six horseshoe nails, one possible strap, two fragments of bridoons, one ring which may be harness related, and a possible wagon wheel wrench. The single donkey or mule shoe is described on the 1865 Russel and Erwin (1980:250) catalog as a light mule pattern and the size is a "No. 2 - 12 oz." (Figure 19J). Sparkes (1976:29), however, notes that mule shoes have pointed heels, so that they resemble a large metal staple. The donkey shoe, in comparison, "tends to be similar to the horseshoe, but is smaller, lighter (7 - 12 ounces) and longer in relation to its width, similar to a school boy's large magnet" (Sparkes 1976:29). Based on this description and the accompanying figures, the engine mill house specimen would appear to be a donkey shoe. Two of the three horseshoes are probably fore shoes in the Southern Pattern (Figure 19K). One measures 140 mm in length, while the other measures approximately 150 mm. Both have noticeable wear on the ground surface side and one retains a number of the horseshoe nails. The third horseshoe, while also of the Souther Pattern, is probably for a hind foot as it exhibits calkins on the heels. Reese notes that, "[f]or carriage and draught horses, calkins (a turning up and elevation of the heel) may be put on the hind shoes to enable them to dig their toes more firmly into the ground, and urge themselves forward and throw their weight into the collar with greater advantage" (Reese 1847:1179-1120; see also Chappel 1973:102). Sparkes, in distinguishing between draught and riding shoes, notes that both may have calkins or side clips. Draught shoes, however, tended to have up to 20 holes around the shoe, while riding shoes had only three or four nail holes on each side of the shoe. The draught shoes are noticeably heavier and frequently had concave upper surfaces and convex lower surfaces (Sparkes 1976:25-27). Two fragments of twisted wire bridoons (bits) each with a single iron ring, were recorded (Figure 19I). One ring is 9 cm (3½ inches) in diameter, the other 7 cm (2 3/4 inches), so these fragments represent two different bridoons. Similar bridoons are illustrated in the 1865 Russel and Erwin (1980:263) catalog as "Twisted Wire Bradoons [Bridoons] with Malleable Iron Rings." In the 1895 Montgomery Ward (1969:339) and 1897 Sears Roebuck (Isreal 1968:760) catalogs only double twisted wire styles are offered. The 1½ inch diameter ring appears to be a harness ring, commonly available in sizes ranging from 5/8 to 3 inches. The final artifact has been tentatively identified as a wagon wheel wrench (Jeff Howell, personal communication 1985). The item is made from two iron bands, each measuring 1 1/8 to 1 1/2 inches in width and 1/8 inch thick. One piece has been rivited onto this hoop to form a handle about 10 inches in length. Bailey (1975:25) illustrates a similar artifact, calling it a "traveller."

Miscellaneous hardware includes bolts, nuts, lag screws, washers, set screws, chain links, grommets, hooks, electrical insulators, riveted metal, wire, bar stock, sheet or plate metal not identifiable as a machine part, strapping, angle iron, lead stock, and various unidentifiable metal fragments. Most of these items were hand wrought and were probably made at the site for specific uses. In spite of this, the items found on the site are remarkably standardized, which suggests considerable care on the part of the blacksmith (see Richardson 1978:4:225-237).

The collection includes 28 bolts, dominated by large square head machine bolts which range in size from ½ to 1 inch. Only four examples of lighter weight oval or beveled head carriage bolts in 3/8 or 7/16 inch diameters were recovered. Only one example of a hex head bolt (3/4 inch diameter) was recovered. Fourteen examples of nuts were recovered, all but one being square. Sizes range from 7/8 through 2½ for bolts from 7/16 to 1 inch. Also recovered were nine examples of nut and bolt combinations. This category included three specimens of 1½ inch square nuts on 3/4 inch bolts which had been torched free, and a third identical combination which had been sheared. The remainder were corroded together and ranged in size from a 1½ inch square nut with a 3/4 inch bolt to a 2 inch nut with a 1 inch bolt. The 19 washers include three small (½ x ¼ inch) brass specimens, with the remainder representing larger iron varieties. These range in sizes from 1 1/8 x 1/2 inch for 7/16 inch bolts to 2 1/4 x 1 1/8 inch for 1 inch bolts. Two large, unusual sizes are present. One measures 3 1/4 x 1 3/8 inch and is probably for a 1 1/4 inch bolt. The other is a 4 1/2 x 3 inch lock washer, which could accomodate up to a 2 5/8 inch bolt. The five lag screws recovered range in size from 3/8 x 1 3/4 inch to 3/4 x 9 1/4 inch. All of these fastening divises emphasize the industrial nature of the site and the heavy machinery found within the engine mill house.

Seven set screws were recovered, ranging from 3/8 to 9/16 inch in diameter. Nineteen examples of chain were found, all but one representing individual broken links. Links vary from 1½ to 2½ inches in length and ¼ to ½ inch in wire diameter. The ¼ inch chain would have a breaking strength of about 4250 pounds, while the ½ inch chain would be expected to withstand about 13070 pounds. The chain above ¼ inch in diameter is described as ox or log chain (Russell and Erwin 1980:256-308). These chain links may be connected to the use of the arrastra within the 1854 structure. Two hand wrought eye bolts or hooks were recovered. One is a 5/8 inch bolt fragment (Figure 19P) made in the typical fashion (Richardson 1978:3:170), while the other is small drive hook 130 mm in length. Eight hooks are identified from the excavations, including two iron cup hooks and six drive hooks varying in length from 100 to 150 mm in length (Figure 19L).

The excavations produced three brass grommets, probably from an unidentified rubber item. A single porcelain tubular insulator was also recovered, although there is no evidence of Upper Hill ever having had electric power. Likewise, 11 rebar ties were found, although there is no evidence of any reinforced concrete in the site vicinity. These items probably represent debris accidently deposited on the site during the twentieth century.

A sizable quantity of "merchantable iron" was recovered from the excavations. These remains consist of flat (or bar), plate, round (or rod), band (or strap) and wire stock available during the nineteenth century either on the open market or from mills. They represent "stock" items probably not forged by local blacksmiths (see Richardson 1978:4:265-268). Six examples of round stock, in diameters of 7/16, 1/2, and 5/8 inch, were found, in addition to one example of oval stock (½ x ¼ inch). Thirteen specimens of wire were identified, with gauges varying from 3½ to 13. The most common wire was 11 gauge (N=5). Flat (or bar) iron is quite common, accounting for 27 examples. Thickness ranges from ¼ to ½ inch and the width ranges from 1 to 2 inches. Several examples of square bars (1½ inch) are included in this category. There is considerable uniformity, with 20 specimens (74%) falling between 1 and 1½ inches in width. The band or strap metal exhibits less regularity with the 17 specimens varying from 1/16 to 3/16 inch in thickness and from 3/4 to 1 1/2 inches in width. These dimensions apparently are not standard and may represent either forged material, or banding brought in on crates or on other containers and not actually stock metal. The seven metal plate specimens vary from 3/16 to 1/2 inch in thickness.

Two specimens of riveted metal were found, both constructed of strap metal. Their function is unknown. In addition, 11 unidentified and unidentifiable metal items have been placed in the Miscellaneous Hardware catagory.

Three specimens were recovered which represent lead stock. One is a cylindrical bar about 70 mm in length, while the other two represent flattened lead fragments. Lead was used in plumbing work (see Sears Roebuck 1969:652) as a solder, so these items may be related to the following artifact class.

The class termed Plumbing Hardware includes pipe, reducers, flanges, fittings, plugs, steam valves, and pump parts. Seventeen artifacts were recovered, not including the possible solder discussed above. Pipe size ranges from 3/4 to 1 inch, although the other artifacts provide evidence of pipes up to 4 3/4 inches in diameter. Only the two stoppers were brass; the remainder of the plumbing items were steel or cast iron.

A total of 54 specimens were placed in the category termed Machinery Hardware (representing 9.5% of the Activities group). These items are all believed to represent parts from a boiler, steam engine, or the gearing necessary to operate the mill. It is probable that this catagory is under represented, although the presently recognized items reveal the variety present at the site.

There are five fragments of curved iron plate, 3/16 inch in thickness, which may represent boiler plate or associated covers. Similar items include a possible boiler or stove door measuring 9 3/4 x 10 inches with three holes. Cast into the metal is the designation "N233." Another plate measures 1/2 inch in thickness, while another broken example, measuring 8 1/2 x 10 x 2 1/8 inches, may represent part of a bed plate, perhaps for the steam engine. Several unidentified cast iron machine parts were recovered, as well as a set screw mount, a fly wheel excentric and rod fragment, a grease fitting, and two bushing fragments. Two additional items suggest fabrication at the site. Both consist of an irregular wrought washer and about 2 1/4 inches in diameter with a 3/4 inch rod through the washer and hammered over at the end. The function of these items is unknown at present.

There are 13 examples of a light green tinted glass tube recovered from the excavations (Figure 19B). This tube is 1/2 inch in diameter and probably served to indicate the water level of the boiler or its reservoir tank. These remains do not appear to belong to more than a single tube.

The most abundant artifacts in this category are belt hooks (Figure 19R). These items, which look something like staples and which range in size from 1 1/2 to 2 1/2 inches in length, were used to connect the ends of drive belts. Identical belt hooks are illustrated in the 1865 Russell and Erwin (1980:268) catalog. The bulk of the belt hooks from the engine mill house excavations are at the larger end of the available sizes, which suggests, quite reasonably, that the belts used in the mill house were rather large.

Of considerable significance is the Ore Reduction Hardware category, since the artifacts in this class provide a clear view of one major activity taking place on Upper Hill. Of the 46 items in the class, 17 are wedges, five are wire screen, six are tappet keys, 14 are stamp collar or boss fragments, and four are stamp mill washers. Most of these items are clearly associated with stamp mill construction or operation.

The wedges are fairly regular in size, ranging from 50 to 200 mm (2 to 7 3/8 inches) in length, 25 to 50 mm (1 to 2 inches) in width, and about 6 mm (1/4 inch) in thickness at a central point. The average measurements were 125 x 32 x 6 mm (5 x 1 1/4 x 1/4 inches). Many of the wedges evidenced flattening from being hammered into position and several were scored during the forging process so they would hold better. It is obvious that these items were driven into place, frequently under considerable pressure and they were expected to hold. The sizes are so consistent that they all appear to have been used for the same purpose. It seems likely that these items were used in the ore milling process, probably on the stamp mills. Five examples of woven iron mesh were recovered from the excavations (Figure 19M). These fragments are all identical and probably represent a single piece. The screen is approximately a No. 5 mesh, with 6 openings per inch. Such mesh was readily available in the nineteenth century (Russell and Erwin 1980:389). This mesh, however, seems coarse for a stamp. D. Appleton and Company (1852:367) suggests screen with holes between 1/12 and 1/20 inch, while Egleston (1887:1:174) suggests at least 30 holes per inch. It is possible that Posselt used a larger screen since the ore was to be further concentrated on the shaker tables prior to processing in an arrastra or Chilean mill. Alternatively, this screen may be from placer mining boxes.

Six examples of tappet keys were recovered (Figure 19O). The tappet on a stamp mill is a hollow cast iron piece which fits on the stem. It forms a projection "upon which the cam catches and lifts the stem." (Egleston 1887:1:167). The keys are pieces of metal about 2 x 2.2 x 35 cm (7/8 x 1 x 16 inches) which "when driven home, fasten it securely against the stem" (Egleston 1887:1:168). The examples from Upper Hill are smaller than those described by Egleston for a "California stamp mill," measuring about 1 x 1.7 x 15 cm (1/2 x 5/8 - 3/4 x 6 inches). The smaller size probably is the result of a smaller, less sophisticated stamp mill being used by Posselt. In addition to these keys, 14 stamp head, boss, or collar fragments were also recovered (Figure 19N). According to Egleston,

> [t]he head, boss, or socket. . . .is a cylinder of tough cast iron, from 8 in. to 10 in. in diameter, and 1.5 in. to 20 in. high. . . .It has in both ends conical openings . . . to receive the stem and the shoe (Egleston 1887:1:169).

The examples recovered from this work reveal a poor cast iron with many ash holes. Using such a poor grade iron would result in brittle collars, subject to breakage, in spite of Egleston's statement that the "head lasts a very long time, being rarely ever ruptured" (Egleston 1887:1:169).

The last items placed in the Ore Reduction Hardware catagory are four washers which appear to represent stamp mill spacers. Three measure 3 3/4 x 2 1/2 x 5/8 inches (Figure 19Q) while the third is an ogee washer which measures 4 x 1 x 1 1/4 inches. These items have direct parallels on the more advanced California stamp mill.

The last class to be considered is termed simply "other." South (1977:96) indicates this class should be used for those remains which reflect specialized debris. Included in this category are 130 welding drops which resulted from the use of a cutting torch. Presumably this activity took place when the remnants of the equipment were being dismantled for salvage, probably prior to the mid-1940s. The three torched nut and bolt combinations probably date from this same episode.

Floral and Faunal Remains

These excavations yielded 12 animal bone fragments, primarily from disturbed contexts. The remains have not been studied in detail because of the small sample size and potential for disturbance. A brief examination reveals several bird remains, probably representing domesticated species, in addition to remains from commensal species.

Greater attention was paid to the ethnobotanical remains, which represented partially decayed timber members from the various engine mill house structures or wood being burned by the boiler or to heat the structure. Twelve specimens of non-carbonized woods, primarily from architectural contexts, were isolated for study, while 22 more isolated examples of carbonized wood were also examined. These hand-picked samples were examined under low magnification (7 to 30x) with larger pieces of wood and wood charcoal identified, where possible, to the genus level, using comparative samples, Panshin and deZeeuw (1970) and Koehler (1917). Wood samples were broken in half to expose a fresh transverse surface. The results of this analysis are shown in Table 5, which is organized by provenience.

Pine (Pinus spp.) dominates the collections, being the only wood definitely attributable to architectural remains. The non-carbonized wood evidenced only moderate decay and little insect activity which suggests that the remnants are largely from heartwood. The carbonized samples include small quantities of oak (Quercus spp.) and maple (Acer spp.) in addition to the pine. Several of the specimens are definitely small branches, probably used as kindling.

The lack of variety in woods recovered from the engine mill house is to a large degree expected. Pine was, and is a primary timber used in construction (Panshin and deZeeuw 1970:457). In addition, heartwood pine may have been chosen for its decay resistant properties, especially when it was to be in contact with the soil (Panshin and deZeeuw 1970:457). The historic accounts of the Reed property certainly suggest that pines were a dominant resource, probably because of second growth in abandoned fields (Knapp 1973:87). The oak and maple species are present as minority types. Maple is commonly a bottomland species, being found in swamp areas, on slow-draining flats and depressions, and along small sluggish streams such as Little Meadow Creek. Oaks are found in a variety of environmental contexts and on both moist and dry soils. Today oaks tend to be found in the drier upland areas (Fowells 1965).

The absence of coal or slag on the site suggests that the boiler was run on wood, a view supported by Sacchi (1980:19) based on his excavations of the boiler pit. Although coal would have provided a better, more uniform fire and Graves notes that "[i]t is seldom economical to buy firewood for industrial use" (Graves 1919:26-27), wood was probably used at Upper Hill because of its ready availability on the Reed tract. The oak would have provided about 84% of the heat value of coal, maple about 73% and pine about 80% (Graves 1919:29-30).

Pattern Analysis

Generally industrial archaeologists do not provide much information concerning the artifact pattern evident at a site. Yet, South has succinctly stated that "we can have no science without pattern recognition, and pattern cannot be refined

Provenience	Woods Identified	Comments
	NON-CARBONIZED WOODS	
b497-5R20, trench	Pinus sp.	"lighter wood" knot
b525-5R20, trench	Pinus sp.	
b153-20R20, 2a	Pinus sp.	wood sill in SW
b179-20R20, 2a	Pinus sp.	wood sill in N
b182-20R20, trow	Pinus sp.	wood sills
b223-30R20, trow	Pinus sp.	wood sill in N
b379-50R20, 4	UID wood	scattered
b605-20R30, 2a	Pinus sp.	
b1055-30R40, 4	Pinus sp.	scattered on flat rock platform
b1072-30R40, trow	Pinus sp.	scattered on flat rock platform
b1217-10R50, 1	Pinus sp.	scattered on rock apron
b1506-10R60, 2a	Pinus sp.	scattered on rock apron
	CARBONIZED WOODS	
b496-5R20, 1	Pinus sp.	
b524-5R20, trench	Pinus sp.	
b552-5R20, 2a	Pinus sp.	
b31-10R20, 1	Pinus sp.	
b59-10R20, 2a	Pinus sp.	
b243-30R20, 2a	Pinus sp.	
b259-30R20, 4	Pinus sp.	
b270-30R20, 4	Pinus sp.	Branch
b317-40R20, 4	Pinus sp.	
b456-60R20, 3	Quercus sp.	
b720-50R30, 1	Pinus, sp.	
b732-50R30, 4	Pinus sp.	
b759-50R30, 4	Pinus sp., Quercus sp., Acer sp.	
b792-50R30, trow	Pinus sp., Quercus sp.	Pinus branch
b900-10R40, 2a	Pinus sp.	
b1054-30R40, 4	UID wood	
b1071-30R40, trow	Pinus sp.	
b1146-60R40, 4	Pinus sp., UID wood	
b1366-60R50, 2	Quercus sp., Pinus sp.	
b1437-5R60, 2a	Pinus sp., Quercus sp.	
b1505-10R60, 2a	Pinus sp.	
b1523-20R60, 1	Pinus sp.	

Table 5. Analysis of handpicked wood samples.

without quantification" (South 1977:25). Certainly there is no need to demonstrate, through comparison with the Carolina Artifat Pattern (South 1977), that the engine mill house is not a domestic structure. Nor is it wise, or even possible, to establish some sort of "gold mine industrial pattern" based on limited work at this one site, as such an act would be naive at best and particularistic at worst. Rather, the quantification of artifacts by discreet groups will aid in the understanding of activities which took place at the site and may, eventually, aid in revealing patterned regularities at industrial sites in general.

Table 6 provides a synopsis of the recovered artifacts and quantifies them by functional group. The largest artifact group is that of architectural remains, which accounts for 73.9% of the recovered artifacts. The large proportion of architectural remains is a result of the abandonment and decay of wood frame structures with only salvage of selected materials. That some salvage took place is perhaps indicated by the absence of "major" or "fancy" architectural items such as door or window hardware. White and Kardulias observe that "[t]he absence of normally ubiquitous construction material, e.g., window glass, fancy hardware, window frames, plumbing, etc. supports the contention that they were removed prior to a planned demolition and conversely argues against the normal dilapidation of the structure" (White and Kardulias 1985:74).

The abundance of kitchen artifacts (10.84%), especially when compared to the Activities group (11.61%) is at first glance unexpected. It, however, is probable that much of the mining related hardware was salvaged from the site immediately prior to each cessation of mining activity. That there was a final site "clean-up" which removed large quantities of hardware is evidenced by the debris encountered in the boiler pit (see Sacchi 1980). Sometime after the 1920s there was a large quantity of material deposited in the boiler pit, much as White and Kardulias (1985:72) discuss the systematic filling of cisterns with available household refuse and razing debris. It should be further noted that a bias may be introduced to this pattern analysis by the unfortunate, albeit unavoidable, exclusion of the boiler pit artifacts.

In reality the kitchen artifacts represent relatively minor quantities of intact or reconstructed items and not all are necessarily domestic in nature. For example, the 153 ceramics (which compose about 29% of the group total) includes only the 12 refined earthenware vessels, eight stoneware containers, and two coarse earthenware containers, for a total of 22 items. Of these, at least six of the stoneware vessels may have been used to hold mercury. While this material was apparently shipped

	1987		Total	
Kitchen				
Ceramics	19	153	172	
Wine Bottles	—	18		
Canning Jars/Lids	—	7		
Patent Medicine Bottles	—	95		
Pharmaceutical Bottles	—	6		
Metal Cans	5	37	42	
Indet. Bottle/Containers	125	213	338	
		529	678	10.84% [11.52]
Architectural				
Window Glass	20	179	199	
Wrought Nails	—	8		
"Modern" Cut Nails	408	2004	2412	
Wire Nails [← UID nails 300]	21	1332	1353	
Spikes	—	8		
Staples	—	11		
Wood Screws	—	65		
		3607	4356	73.90% [73.99]
Furniture				
Lamp Glass	—	120		
		120		2.46%
Arms				
Cartridges	1	12	13	
Shotgun Shells	—	6		
Percussion Cap	—	1		
		19	20	0.39%
Clothing				
Shoe Fragments	1	27	28	
Buttons	3	3	6	
Fasteners	1	2	3	
		32	39	0.66%
Personal				
Slate Pencil		1		
Cologne, Perfume Bottles		3		
[Thimble 1; Scissor blade 1]		4		0.08%
Tobacco				
Pipe		1		
Snuff Can		1		
Tobacco Tamiper		1		
		3		0.06%
Activities				
Tools	1	12		
Farm Implements	—	1		
Toys	—	1		
Storage Items	40	79	119	
Stable and Barn Items	2	15	17	
Miscellaneous Hardware	18	213		
Plumbing Hardware	3	17		
Machinery Hardware	17	54		
Ore Reduction Hardware	5	46		
Other	11*	130		
		568	669	11.61%
[709 *excluding 1115 metal frags]			4882	[5887]

Table 6. Artifacts recovered from the Engine Mill house excavation.

in wrought iron cylindrical containers with screw carrier caps (Petsche 1974:68), an examination of The Charleston Museum's apothecary collections revealed at least one stoneware jug used to store mercury. Likewise, much of the bottle glass classed as pharmaceutical or indeterminate may represent reagent bottles for asseying ore. It is unlikely that many domestic activities took place in the engine mill house; it is more likely that domestic items were brought into the structure from elsewhere and were simply cast aside when broken.

The relatively insignificant Arms group includes a number of items which most likely were deposited on the site independant of the ore processing activities. Most of the cartridges and shotgun shells are fairly recent, probably post dating the site's active period of mining.

As previously mentioned, luxury items are quite uncommon at the site, probably because of their general absence among miners of the nineteenth century (see Glass 1985). The Clothing, Personal, and Tobacco Groups combined account for less than 1% of the site's artifacts and in the collection of over 4800 artifacts only the three cologne bottle fragments can be truely characterized as luxury items.

Status and Lifestyle Observations

It is dangerous to speculate on the status of the Reed miners using the sparse data present at the engine mill house. Although the present work has begun to illuminate ore processing at the Reed Mine, it can offer little concerning the people who worked in the engine mill house or below ground. It is imperative that future work explore the cabins of the miners in order to allow statements to be made concerning the lifestyle of nineteenth century miners.

At the present time our understanding comes almost entirely from historical sources such as those recently summarized by Glass (1985) for the Gold Hill Mine. Glass notes that nineteenth century deep mining (as opposed to placer mining) "required the coordination and management of a large group of workers with various skills and occupations" (Glass 1985:429). The workers were divided into the categories of "underground" and "top ground" forces with each composed of both skilled miners and unskilled laborers. The "top ground" miners performed the skilled jobs relating to the power and milling technology, presumably such as tending the boiler, overseeing the degree of stamping, and loading the Chilean mills and arrastra. The "top ground" laborers who might include both whites and black slaves, would perform the manual work, such as supplying wood to the boiler, ore cobbing (chipping waste rock from the ore) and carrying ore to the mill

(Glass 1985:430). Most supervisory miners were foreign born Cornishmen, professional miners who immigrated from England to work in American copper and gold mines during the nineteenth century.

The wages paid to these individuals, according to Glass (1985:438), were good by antebellum standards, ranging from about $10 to $64 a month, depending on skill, age, and experience. Slaves, obviously, were paid the least, professional Cornish miners, the most. The "average wage for all workers-miners and laborers- was around $20.00 per month, the prevailing wage at most mines in North Carolina" (Glass 1985:438). In spite of this, miners rarely owned real property, were frequently unmarried, and lived on a diet of bacon (salted pork fat), meal and molasses (Glass 1985:438, 442, 446). In many respects, then, the nineteenth century North Carolina miner does not appear to have lived a lifestyle dramaticly different or distinct from the "plain folk" or yeoman class (cf. Owsley 1949), at least based on the historical documents.

Little is known, or will be known, about the miners or laborers at the Reed Mine without further substantial archaeological studies, since little historical documentation on the mine exists. Questions concerning wealth, status, and ethnicity can be investigated through an examination of the artifacts left behind by the miners. The existing evidence from the engine mill house, while sparse, is quite interesting. The few refined earthenwares reveal an abundance of undecorated whiteware. Although the sample of plates is quite small (N=6) and the context is not domestic, it is assumed for the purposes of this initial study that the remains are representative of those which will be found at the mine's domestic sites. At the present time there are no better data with which to work. Future studies at the cabins may reveal index values at variance with the index of the engine mill house. Such a discovery would require generation of testable hypothesis to explain the differences. The engine mill house ceramics reveal an index value of only 1.15 (Table 7)(Miller 1980).

Type	CC Index Value	# Recovered	Value
CC	1.00	4	4.00
Sponged	1.20	1	1.20
Ironstone	1.69	1	1.69
		6	6.89

$6.89 \div 6 = 1.15$

Table 7. Index values for plates from the engine mill house, combined 1855 and 1861 prices.

This value is below that obtained at the early nineteenth century Franklin Glass works (Miller 1980:12, 36) and the mid-nineteenth century Moses Tabbs tenant site (Miller 1980:14, 35), which suggests the use of very inexpensive wares by the miners an/or laborers at the Reed Mine.

Although price indexes have not been established for locally made earthenware and stoneware ceramics, it seems reasonable that these local items were less expensive than other ceramics. Consequently, if the redwares and various locally made stonewares are domestic in nature, rather than somehow related to ore processing, the ceramic collection contains even more inexpensive ceramics. Only the single example of decalcomania decorated "Hotel Ware" or semi-porcelain may have been noticeably more expensive than the remainder of the collection. It again should be emphasized that the collection from the engine mill house is not domestic in origin, so these results must be cautiously interpreted.

The rarity of alcohol bottles, such as ale, whiskey, or even patent medicines, may be the result of prohibitions against drinking while on the job (see Glass 1985:438) or they may be a reflection of the strong Methodist background of the Cornish miners. Future work at domestic sites may provide significant data on the ethnicity of these Cornishmen.

Given the extensive use of mercury by the "top ground" miners to amalgamate gold, it is appropriate to briefly speculate on their health and well-being. Mercury, a silvery liquid at room temperatures, was used to trap the gold, which formed a white, pasty amalgum. To separate the gold and mercury the amalgum was distilled by heating the material to the boiling point of mercury --356.6°C. Mercury, however, emits highly toxic fumes (Sax 1979: 797), and vaporizes at temperatures as low as 10°F(-12°C). Nielsen (1980:26) notes that both the liquid and the vapor are toxic because of their solubility, lack of charge, and membrane permeability. The "[i]nhaled vapors ... diffuse rapidly through the alveolar membranes into the blood and are systemically transported to body tissues, including the brain."

Although acute poisoning is possible, more common is chronic poisoning caused by long-term exposure to low levels of mercury and its vapors. The Department of Labor notes that while "the body is constantly getting rid of mercury in the urine, feces, and perspiration, steady exposure can cause a slow build-up that can result in illness, personality changes, and eventual disability" (U.S. Department of Labor 1975:3). Exposure to the vapors at a level of 1.2 mg/m^3 or higher (the equivalent of the contents of 24 small clinical thermometers dispersed in a closed 100 by 100 by 15 foot room) for short periods can cause pneumontis, chest pains, dyspnea and coughing (Nielsen 1980:26). All of these symptoms are associated with a variety of problems and although the effects of mercury poisoning were known in the nineteenth century, it is unlikely that the miners would have received any specific treatment, other than patent medicines. It appears that even "top ground" mining was exceedingly dangerous.

Distributions

A review of the vertical and horizontal distributions of artifacts at the engine mill house reveals that some artifacts exhibit tight distributions suggestive of well preserved (although not "fossilized") episodes of cultural behavior, while other artifacts have an apparently random distribution. Previous discussions have suggested that the site experienced at least three building and use periods, with clean-up and salvage occurring after each period. In addition, the mining, cobbing, and ore processing all created large quantities of waste rock and soil which had to be periodically removed from the structure and its immediate vicinity. The site has been affected by the normal environmental processes of bioturbation and erosion. It further has been subjected to the distructive influences of both the public and previous archaeological studies. Faced with all these influences, particularly those associated with mining, it is somewhat surprising that patterning is recognizable. Certainly, as Honerkamp and Fairbanks (1982) indicate for urban sites, "disturbances" are part of the archaeological reality at this one example of a nineteenth century ore processing site.

Three artifact classes from the Architecture group, cut nails, wire nails, and window glass, were examined for their distribution over the site. It was anticipated that the 1854 structure would have been built using primarily cut nails, while the later buildings would have used primarily wire nails, which became more common in the 1870s. The ca. 1880s Kelly engraving shows three windows on the north face of the still standing 1854 structure (Figure 5) so it was presumed that window glass would at least be present in the northern tier of squares (the N60 line). No windows appear to be present in the last structure, which stood into the 1920s, so it seemed unlikely that window glass would be abundant in the southern squares adjacent to the boiler pit (the N10 line).

The distribution of wire nails, being largely confined to the southern half of the site confirmed the expectation that the later structures would have been constructed using this nail type. Their sparse occurrence throughout the site may be related to repair episodes in the 1870s-1880s while the original structure was still standing. Alternatively, the wire nails in the more northern squares may be related to other, unrecorded building activities. The cut nails show a more general distribution over the entire site, suggestive of the distribution expected for the 1854 structure (Figure 20). The window glass distribution

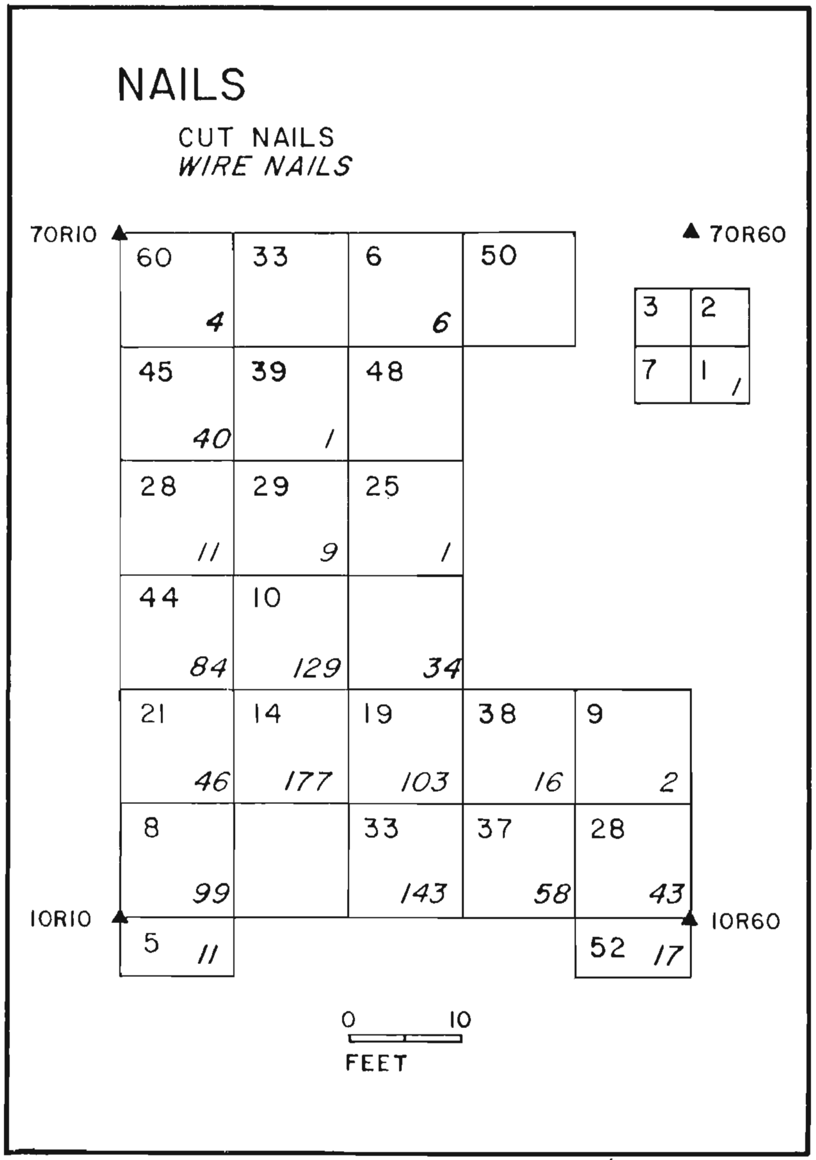

Figure 20. Distribution of nails.

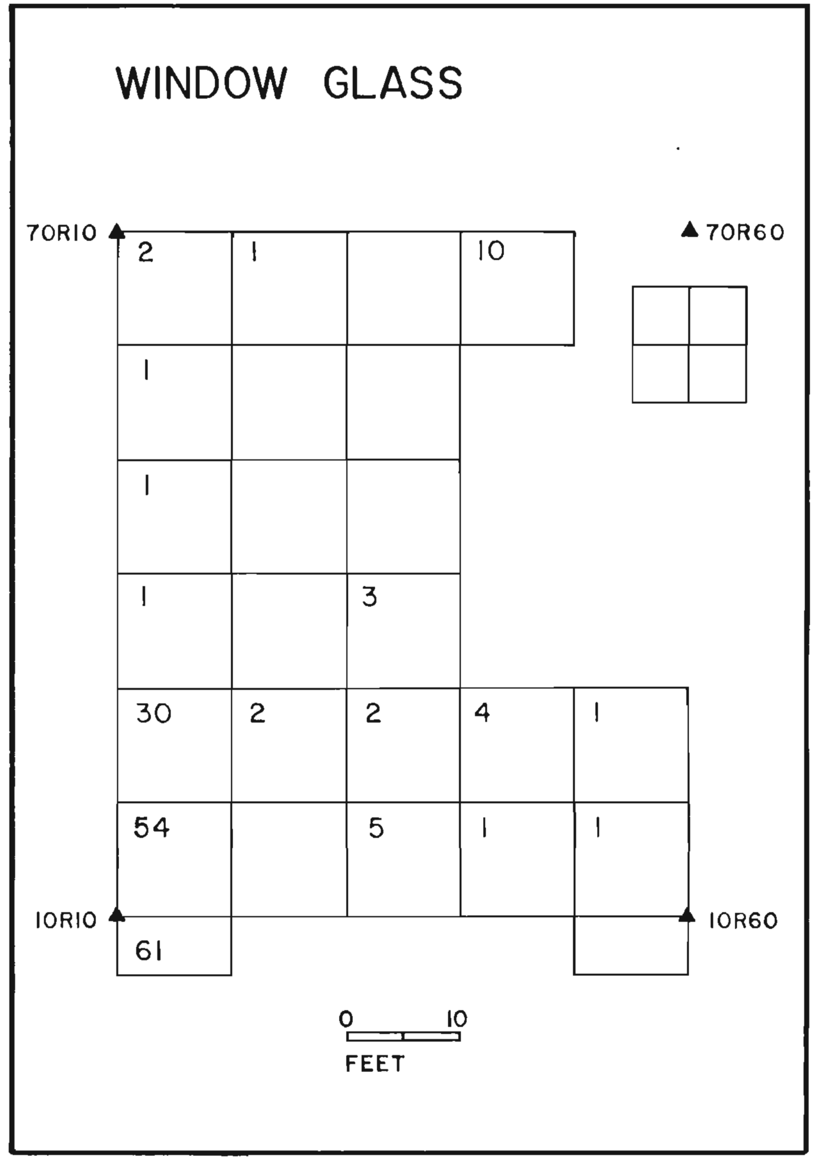

Figure 21. Distribution of window glass.

however, fails to correspond to that expected (Figure 21). Glass occurs sparsely along the N60 line, but is concentrated in the southern squares in the R20 line, in the vicinity of the late nineteenth century structures. No explanation for this distribution is immediately available, although it underscores the need for additional excavations at the site. The rarity of glass along the north line, where the Kelly engraving suggests it should occur may be the result of glass salvage, or it may be that the 1854 structure, while having openings, did not have glass panes.

An examination of the vertical distribution of these architectural remains provides further insights. In the case of the glass, only 27 of the 182 fragments (14.8%) are found in zones reasonably dating to the original 1854 structure. Most of the glass is recovered from the upper deposits which probably accumulated since the late nineteenth century. Why there should be such a large quantity of window glass in these upper levels is unknown, but these data do support the possibility that the 1854 engine mill house did not have glassed windows.

An examination of nails by levels is equally revealing. Of the 649 identifiable nails in Zones 2 and 4, 89 or 13.7% are wire, while 532 or 82.0% are cut. The remainder, all of zone 2, are wrought nails. The 1854 structural zones are clearly dominated by cut nails. An examination of Zones 1 and 2a reveal that they both are also dominated by cut nails. In zone 2a 86% of the nails are cut, although only 57.6% of the nails in Zone 1 are cut. Wire nails form a sizable percentage only in Zone 1 and may have been exclusively used to construct only the last structure at the site.

The discussion of lamp glass from the excavations previously suggested that at least a portion of the collection post-dated 1883. An examination of the lamp glass distribution by square and zone clearly demonstrates that the glass is a late phenomenon at the site. The lamp glass is concentrated in the N10 and 20 lines, adjacent to the boiler pit and in the vicinity of the post-1854 structures. Examined by zones, 117 specimens (97.5%) are found in Zones 1 and 2a.

In the Activities group the distributions of several classes or artifacts were examined, including belt hooks, boiler plate, and machine parts in the Machinery Hardware class; tappet keys, stamp bosses, stamp washers, and wedges in the Ore Reduction class; and the Plumbing Hardware class as a whole. In addition the distribution of chain links and welding drops was also examined, although the sample size was small.

The items composing the Machinery Hardware class are thought to include primarily items from the most recent activities, as the site appears to have been scavenged between periods of mining.

In addition, many items from the earlier periods of mining activity would have been removed from the structure with the periodic removal of rapidly accumulating waste rock.

An examination of the horizontal distribution of the belt hooks, boiler plate fragments, and machinery parts failed to reveal any clear distributions. The belt hooks tended to be clustered in the N10 and 20 lines, in the area of the more recent structures. This is also the area which may have been occupied by the 1854 stamps. The boiler plate and other machinery parts, however, were evenly distributed over the entire site. Both the belt hooks and machinery parts are clearly associated with Zones 1 and 2a. Three of the five boiler plate fragements, on the other hand, are found in zones 2 and 4, associated with the 1854 structure. This association is somewhat surprising as it was assumed that the scattered boiler plate was the result of twentieth century scavenging and dismantling. Such does not appear to be the case and this metal may represent parts from a stove.

The Ore Reduction Hardware items (tappet keys, stamp bosses, stamp washers, and wedges) were found scattered across the site with no apparent clustering. The wedges tend to be associated with Zones 1 and 2a (70.6%), but the other artifacts are evenly split between zones 1/2a and zones 2/4. This may suggest that the site continued to be a repository for broken stamp parts even after no stamp mills were present, perhaps because of the posited blacksmith's operation in the post 1854 structures (Knapp 1973:180).

The Plumbing Hardware class would appear to be clearly associated with the post-1854 structure. Not only are 88.2% of the artifacts found adjacent to the boiler pit, but all of the artifacts are found in Zones 1 or 2a (76% being found in Zone 1). In this case, however, the obvious conclusion may be incorrect. Because of the underground pumps, the boiler, and the steam engine, a great deal of the plumbing would be expecrted immediately west of the mine shaft and in the vicinity of the boiler and steam engine. Since the pumps, boiler and steam engine continued to be used by various mining operations through the nineteenth century, it is unlikely that the plumbing changed substantially through time. It is also unlikely that the plumbing would be salvaged after every failed attempt. It may have remained fairly intact until the mid-twentieth century when much of the machinery was dismantled. This would account for its dominant occurence in Zone 1.

The distribution of welding drops, caused by a cutting torch, is another phenomenon of the mid-twentieth century dismantling of the site. These are found primarily in four squares 10-20R20, 50R20, and 60R30. These are presumably locations of metal which was cut into smaller pieces for easy removal or the location of bolted-down machinery which was cut free. Squares 10-20R20 are within the posited post-1854 structures, so it is probable that the concentration of welding drops in these squares represents the cutting of machinery, and/or perhaps pipe. Squares 50R20 and 60R30, however are outside the structure, in an area which should have had no machinery or plumbing by the twentieth century. There are three photographs, however, which may provide an explanation. These photographs (N.73.5.394, N73.7.26, and Bryson 1936:Figure 36), taken between ca. 1920 and 1940 show a fly wheel, about 12 feet in diameter, with a shaft about 20 feet in length, in the approximate vicinity of these squares. It is probable that this item was cut up for removal, leaving the quantity of welding drops in 50R20 and 60R10.

The last artifacts considered are the 19 chain specimens, 18 of which are individual links. The other specimen consists of five intact links. In an industrial site, such as the engine mill house, chain might have been used for a number of purposes while historical documentation indicates that chain was used in the arrastra and to support the shaker tables. The distribution of chain links therefore may be indicative of these ore reduction processes.

An examination of the horizontal distribution reveals a clustering of links in the northwest site area, with nine of the 19 specimens recovered from square 50R30. The vertical distribution is even more clear with 16 of the 19 link specimens (84%) recovered from zones 2 or 4, associated with the 1854 structure.

CONCLUSIONS

Pre-1854 Activity

There is ample historical evidence that John Reed began underground or "hard rock" mining on Upper Hill by 1831 (Knapp 1973:42-43) and that a horse drawn whim may have been in use by 1834. The ore, however, was not processed on Upper Hill, but was transported to Lower Hill where an arrastra had been erected to wash the ore and amalgamate the gold (Knapp 1973:52). As a consequence, the Upper Hill archaeological record is expected to be sparse for this early period. In fact, the most convincing evidence of this work are the lenses of tailings found beneath the foundations of the 1854 structure. These tailings probably are the result of dumping waste soil and rock on the hill, not of any ore processing. Several small areas of pre-1854 humus were also identified during the study. These light brown loamy clay areas evidence compaction, probably related to the mining activities which took place during the early to mid-nineteenth century. The humus zone, however, contains few artifacts, which suggests that while mining took place on Upper Hill, few if any structures were present, no domestic activity took place, and the industrial activity was sparse. It seems likely that the bulk of the 20 males employed at the mine in 1850 (Knapp 1973:59) were probably working below ground, transporting the ore to the arrastra on Lower Hill, or operating the arrastra.

The 1854 Structure

Although activity was shortlived, there can be little doubt that the Reed Mine achieved its fame in 1853-1854 under the ownership of the Reed Gold and Copper Mining Company and the oversight of Dr. Louis Posselt. Of greatest consequence was the construction of an engine mill house and boiler pit on Upper Hill.

The extensive work probably required the clearing of Upper Hill and surrounding areas. The cut pine and oak almost certainly provided the timbers for the engine mill house and fuel for the boiler. The structure was laid out with its long dimension roughly oriented northeast-southwest, parallel to the Upper Hill ridge line (Figure 22). The entire structure was laid out to measure about 44 by 70 feet, with the boiler pit measuring 11 feet in width and the engine mill house about 59 feet. The foundation was not laid below grade except for those few areas where the natural ground level required a small builder's trench. The stones for the foundation were native to the area, probably coming from the mining activities at one or more of the opened shafts. The foundation, minimally dressed blocks which measure about 1.5 by 0.8 by 0.3 foot, evidences a dry laid coursed random rubble construction. The uphill wall is just under a foot in thickness, while the down-slope wall is about two courses in thickness because of its greater height. The boiler pit was built below grade, with the wall between the pit and engine mill house built to support the horizontal shaft steam engine. The chimney evidences the finest masonry at the engine mill house site, with the stones laid in mortar.

Only two doorways, both on the wall facing the Engine Shaft, have been documented by this study (Figure 22). In those two areas a wood sill was laid on the ground, but there is no evidence for doors. The superstructure was constructed of pine timbers and siding. The archaeological evidence supports the use of 1 by 6 siding, although it is not possible to determine if it was applied horizontally as either lapped or clapboard, or perhaps vertically as either board-on-board or board-and batten. The ca. 1880 Kelly map (Figure 4) suggests that some type of vertical board cladding was used. Although window openings were apparently present, again based on the Kelly Map, the archaeological evidence suggests that they may not have been glassed openings. The only archaeological evidence of roofing consists in the quantity of small nails, which could be used to attach boards, shingles, or a bitumen paper roof. The Kelly map, viewing the engine mill structure from its gable end, provides no information. It does, however, show that the adjacent structures appear to be roofed with boards.

Running down the center of this structure was a coursed random rubble wall about 40 feet in length (Figure 22). This wall allowed each half of the 44 foot wide structure, which was built on a slope to be leveled for machinery. At each end of the retaining wall were 10 feet wide ramps which allowed access from one level to the other.

While the structure housed a variety of specialized equipment through time, including four sets of stamps, three Chilean mills, two shaker tables, and an arrastra, these items have left few indications of their previous locations. In the northwest corner of the structure there is a rock rubble platform, perhaps associated with the Chilean Mills for use as a sump. This portion of the structure also contains abundant sandy slurry from the milling process. A flat rock platform is found in the center of the structure, but its function has not yet been determined. Although the arrastra should have left distinct, recognizable remains, no such indications were found in the 70% of the structure uncovered, although chain links, possibly related to the arrastra's drag stones, were found in the northern area of the structure. Future investigations that open squares 30-50R50-60 and take the entire structure interior down to sterile soil may well answer the question concerning the placement

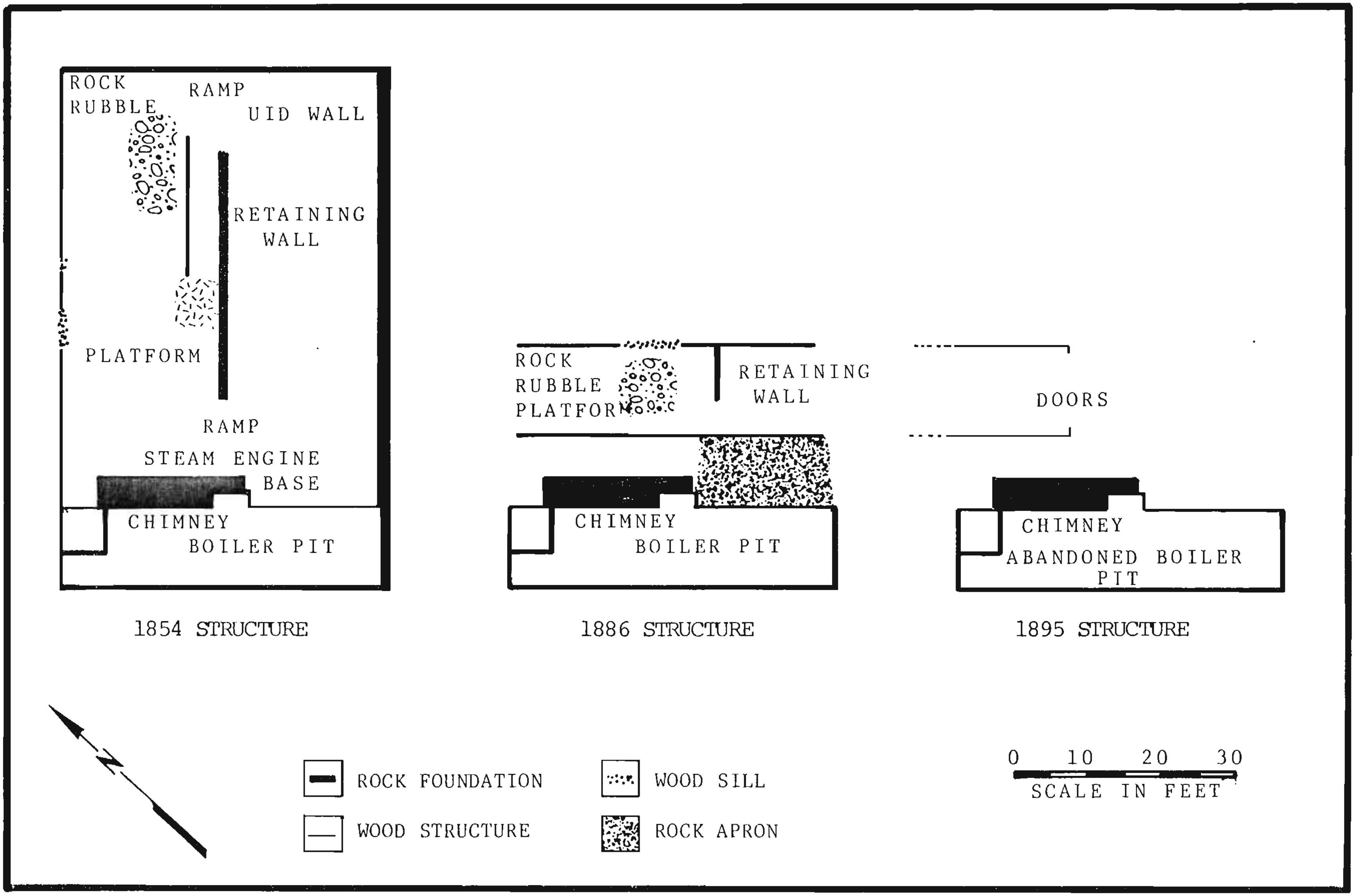

Figure 22. The engine mill house through time.

of equipment. Such work will allow the plotting of sand slurry and the testing of soil compaction by using a penetrometer. This last technique may offer the greatest potential for determining the location of the stamps, which would have caused considerable soil compaction even in the year they were in operation. Penetrometers are commonly available, easy to use, and will provide the estimated unconfined compressive strength in tons per square foot. This testing should be carried out over the entire structure interior.

Many of the ceramics, such as the "ginger beer bottle," alkaline glazed stoneware, and whiteware, were probably deposited during the use of the 1854 structure. The stub stem pipe fragment likewise was most probably deposited during this early industrial operation. Previous discussions have suggested that a number of ore processing hardware specimens probably dated to the first structure, although the sample is small. The majority of the artifacts, however, date from the mid to late nineteenth century and may have been deposited during any number of mining episodes.

The 1854 structure remained standing into the 1880's as evidenced by the Kelly Map, which illustrates an engine mill house identical in size, shape, and orientation to the 1854 facility. A comparison of the two maps reveals that the miners' cabins, which were found primarily south of the 1854 engine mill house, had been relocated to the north by the 1880s. The office and powder house, however, remained in the same locations throughout this 25-30 year period. In many respects the Kelly map appears to have been copied from the older 1854 map. Mining continued through the 1880s, although the historical documents suggest this mining was sporadic and used little equipment. Whatever condition the structure was in, by 1886 a newspaper account notes that a Chilean mill was "being made ready" on Upper Hill, which suggests that the structure did not contain operable equipment or that the mill was being refurbished.

The 1886 Structure

In the Salisbury North Carolina Herald of January 7, 1886, a brief article reported that a Chilean mill was "being made ready" by Dr. J.P. McCombs and a Captain Gad to process ore from underground mining on Upper Hill. Work apparently continued, at least intermittently, through 1888. The archaeological evidence does indicate that a second structure was constructed at Upper Hill in the late nineteenth century and, lacking any more definitive evidence, the historical date of 1886 will be accepted as the beginning date for this second period of building. While this 1886 structure was definately smaller and probably more poorly constructed than its predecessor, it was not the building shown in a number of twentieth century photographs (Figures 6 and 7). It is also clear that it was used for more than simply storage or as a shelter for the hoist.

The structure was constructed from 5 to 10 feet north of the boiler pit and measured 42 feet in length by 12 feet in width (Figure 22). It rested on poorly constructed dry land rock rubble foundations to the north and south, but lacked stone foundation supports to the east and west, at the short ends of the structure. The foundation rock is well prepared greenstone, apparently robbed from the 1854 foundations, although no effort was made to fit the stones into orderly courses. The absence of stone foundations at either end of the building suggests the ends may have been open or at least had barn doors. There is a wooden sill along the north side of the structure, indicative of another opening.

The construction of the 1886 structure required the complete removal of a portion of the 1854 engine mill house's eastern wall. In addition, the central retaining wall for the original structure was replaced by another retaining wall, about 5 feet east of the first, so that the 1886 structure was also at two levels, with a 5 foot wide natural slope "ramp" connecting the two.

The relocation of the retaining wall allowed a large rock rubble platform to be placed on the upper level, immediately within the north facing door. This platform is very similar to that observed in the 1854 structure and it may be a sump for a Chilean mill. This might explain the newspaper article which noted a Chilean mill was being made ready. Outside the structure, between its southern wall and the boiler pit, a roughly laid rock apron was constructed, measuring about 10 by 20 feet. The purpose of this feature is not immediately known, although it may have served as a storage area.

Less information is available on the construction of this second structure, although the quantity and sizes of nails suggest that it was wood frame. There is an abundance of window glass, and previous discussions on glass thickness support a construction episode prior to 1896. The glass thickness peaks at a date correlation of 1883.99-1888.14. The mean date of this range, 1886.02, corresponds to historical evidence. The reduced quantity of small wire nails (2d-5d) suggests that the roof was no longer wood, but may have been galvanized iron. A small quantity of wire roofing nails are present and may date from this early period.

A number of artifacts appear to be associated with this second structure, including a quantity of lamp glass which postdates 1883. Ceramics from this time period are less common, perhaps because the mining operation no longer represented an intensive industrial experience. While ceramics became less common, it is likely that the use of patent medicine, with the resultant deposition of glass, became more common. Most of the plumbing hardware recovered from the 1895 excavations probably come from this structure, as did a sizable amount of the machinery hardware.

The 1895 Structure

By 1894-1895 the Reed Gold Mine was again active under the "forward looking" management of Dr. Justin D. Lisle. That a third structure was built is clear from both the archaeological evidence and the photographic record; that it was built during this period is only suggested by historical documents, which show increased activity at the site, and interviews with individuals familiar with the site at the turn of the century.

Although Lisle's activity lasted only until 1898, he constructed a 10-stamp mill at the foot of Middle Hill, removing ore processing from Upper Hill for the first time since 1854. It is probable that this Upper Hill structure housed only a hoist and a steam tractor engine, the boiler pit no longer being used. Ore from the Engine Shaft may have been moved to Middle Hill by a tram system, although little evidence of this was discovered during these investigations. That the structure housed some blacksmithing activities is suggested by a hole in the north face of the chimney, which would have provided a flue for the forge. Alternately, this flue may have been used for a stove to heat the structures.

In a sense, the 1898 structure is the best documented building of the three, as it is shown standing in at least two early twentieth century photographs (Figures 6 and 7). The structure measured 12 feet in width, but was only 27 feet in length. It had an attached, but offset, 10 foot square whim house. The photographs show a frame building covered with horizontal wood siding (probably of a simple drop type), and double doors (which moved on an overhead rail) on its east end and on its north face. A narrow door was on its south face, west of the chimney. Another door was on the south side of the whim house. The roof was metal.

This structure was built using the western most 15 feet of the 1886 stone foundations. The remainder of the structure's length may have been supported by log piers or the sill may have rested directly on the ground. Only half of this structure has been examined archaeologically and there is considerable mixing of the 1886 and 1895 remains. Further investigations should be carried out westward toward Engine shaft. Unfortunately, the engine shaft has become greatly enlarged through slumpage, so much of the whim house has probably been destroyed.

Nearby Mining Cabins

During this study, two 5-foot squares (-50R65, -50R80) were excavated in the area shown on the 1854 Partz map as the location of a dogtrot structure with two end chimneys. This structure is no longer shown on the 1880s Kelly map, so the cabins apparently had a short period of occupancy. The structure measured about 48 by 14 feet, with each cabin measuring 18 by 14 feet. Its proximity to the engine mill house and unique construction (it is the only dogtrot shown on the Partz map) set it apart.

While no structural remains were identified, none were expected on the basis of two 5-foot squares. The two squares did produce a small collection of primarily domestic and architectural items. Only one miscellaneous hardware item was recovered from these two squares.

These cabins, clearly tied to the 1854 structure, warrant further investigation as they may provide a domestic assemblage from a mid-nineteenth century mining context. An examination of such an assemblage will answer many of the questions that the engine mill house, as an industrial site,cannot address.

Evaluation of Research Goals

Three goals were initially proposed for these excavations of the Reed engine mill house on Upper Hill. The first goal was to examine the architectural components of the site in order to identify the number of structures, present the dates of their construction, and suggest their appearance. This information was of primary concern to the Historic Sites Section which hopes to integrate these remains into the overall interpretation program. This work has been very successful at meeting this goal as demonstrated by the previous discussions. Future work, however, should complete the excavation of the 1854 structure, continue excavations in the 1895 structure, and should remove Zone 4 soils within the 1854 structure to sterile subsoil clay. In addition, it is essential that a representative sample of domestic refuse be obtained from the cabins. The posited cabin area could be quickly stripped to subsoil and the features plotted; this strategy would allow collection of household refuse and also assist in determining the exact location, size, and construction of the cabin.

The second goal was to better understand the processing of ore in the various structures. A more complete understanding of the internal arrangement and construction features of the 1854 structure is a first step in that direction. In addition, some progress has been made in correlating the historical record and the archaeological features. When the entire 1854 structure has been excavated and all of the tailings have been removed, it is likely that a better understanding of processing activities will be possible. Several lines of research should be pursued in the future. Plotting of soil and slurry types seems to be an adequate alternative to the more time consuming and costly particle size analysis. Once the entire 1854 structure is available for study, the distribution of slurry as opposed to tailings may clearly distinguish different activity areas. Future work should use a penetrometer to study soil compaction over the site area. Finally, additional mercury soil tests should be conducted, perhaps of the subsoil clay, to determine areas of highest concentration within the structure.

The third goal, that of studying the range of non-processing activities, was partially met. As an industrial site, the engine mill house was not expected to contain quantities of domestic refuse. The domestic items found, however, have provided the first archaeological view of nineteenth century North Carolina miners. This preliminary study tentatively has suggested that the 1854 Reed miners had a lifestyle and economic status lower than that of other sites where the Miller Index has been used. Future work at the engine mill house will probably offer little refinement of this current perspective. Both the 1854 Partz and ca. 1880s Kelly maps indicate the location of miners' cabins. These structures will provide a better opportunity for obtaining data on the lifestyle and economic status of typical mid to late nineteenth century miners. The Reed Gold Mine tract offers a variety locales that are not only of considerable research value, but which would enhance interpretation to the public.

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