NPS Form 10-900-b
(Jan 1987)

OMB No. 1024-0018

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United States Department of the Interior
National Park Service

National Register of Historic Places Multiple Property Documentation Form

This form is for use in documenting multiple property groups relating to one or several historic contexts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. For additional space use continuation sheets (Form 10-900-a). Type all entries.

A. Name of Multiple Property Listing

Historic and Historic Archaeological Resources of the Iron Industry on the Western Highland Rim

B. Associated Historic Contexts

Iron Industry on the Western Highland Rim 1790s - 1920s

C. Geographical Data

[redacted]

☐ See continuation sheet

D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards for Planning and Evaluation.

Herbert L. Harper — 10/8/87

Signature of certifying official — Date

Deputy State Historic Preservation Officer, Tennessee Historical Commission

State or Federal agency and bureau

I, hereby, certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper of the National Register — Date

E. Statement of Historic Contexts

Discuss each historic context listed in Section B.

While the iron industry was at its height during the 1850s, much of the Western Highland Rim was still rural. It was the geology of the region that made the early development of the industry possible. Iron ore deposits were relatively free of impurities and often found just below the surface or exposed on a bluff, making extraction easy. Limestone which was used in blast was abundant, as was timber, which was needed to make charcoal. Numerous streams traversed the region and next to these power sources were farmlands that could be cultivated to provide food for workers. [redacted]ovided transportation to regional markets. At first iron was shipped locally to foundries or rolling mills. Later shipments extended to the deep south and, finally, into the midwest.

The Western Highland Rim constitutes the [redacted] It is a plateau region sloping from [redacted] and characterized by rolling terrain incised by valleys and traversed by numerous streams (Miller 1974: 5). Topographic elevations average between 500 and 1,000 feet above sea level, but the extremes are over 1,000 feet in the southern part of the region and about 350 feet at its western edge (Burchard 1934: 18). It is bounded on the west by the [redacted] and is passed through by the [redacted]

The great Western Iron Belt occupies, but is not limited to, [redacted] This belt is from [redacted] Although its western boundary is for [redacted] crosses over and occupies portions of [redacted] Within the area of the [redacted]

The rocks underlying this plateau region are limestone containing chert masses, and siliceous and clayey impurities. They belong to the lower levels of the carboniferous system, which are known to geologists as the Siliceous Group and the Lithostrotion Bed (Killebrew 1876: 134). This sub-carboniferous formation is the lower stratum of the Western Kentucky and Indiana coal fields. Many of the streams of the region have cut down through the lower carboniferous stratum, and this has resulted in the exposure of a variety of rocks useful for building and fluxing purposes (Killebrew 1890: 2). A flux was employed in an iron producing blast furnace to promote the separation of the iron from its oxides and some of the main fluxes used by the early iron industry included limestone, clay and chert (Overman 1850: 68).

The deposits, or banks, or iron ores occur in the remaining clay and chert debris more or less over the entire region. These banks vary in the richness of ores and in their extent. Some of them cover square miles of area, and others only an acre or two (Killebrew 1876: 134). Many of the deposits are near the crests of narrow ridges and tend to conform to the upper hill slopes, while others occur on the slopes and well down toward the levels of the valleys (Burchard 1934: 24). Although the ores have a

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the levels of the valleys (Burchard 1934: 24). Although the ores have a general distribution, the counties of [redacted]

The most common kinds of iron ores in the State of Tennessee are referred to as hematite (red), limonite (brown), and magnetite (magnetic ore). Of these, hematite and magnetite are generally peculiar to the eastern part of the state (Born 1936: 63- 64). The brown iron ores appear to be a mixture of hydrous ferric oxides in which the iron is present in the form of the sesquioxide Fe_2O_3 (Burchard 1934: 26). Killebrew (1881: 96) refers to the ores of the Western Highland Rim as "brown hematite" and divides them into grades according to the amount of water they contain, naming these as turgite, gothite (sic), and limonite.

Although brown iron ore, or limonite, is generally widespread throughout Tennessee, the principal commercial development of this resource has been in the Western Highland Rim area (Born 1936: 66). Iron ore production from this region between 1797 and 1930 has been nearly 8,560,000 gross tons, and the production of pig iron in the region's furnaces for the same period has been established at about 4,052,500 gross tons (Burchard 1934: 221-222).

The demand for iron in a frontier setting provided the impetus for establishing Middle Tennessee's earliest ironworks, but such establishment was greatly aided by law. As early as 1788 the North Carolina legislature passed "An Act to Encourage the Building of Iron Works," which provided that the proprietor of such works could receive a grant of 3,000 acres of state land simply by filing an entry and proving that he made a certain quantity of iron within three years (Scott 1821: 403). This same provision continued to apply to the Tennessee region while it was part of the Territory South of the River Ohio (1790-1796), and was used as a model for a Tennessee act of 1809, which required only that the owner build an ironworks and operate it within two years. Such 3,000-acre grants were exempt from taxation for 99 years (Nave 1953: 6-7). While the earliest manufacture of iron in Tennessee occurred in the upper east portion of the state in around 1790, the Western Highland Rim had one ironworks, Cumberland Furnace, that began operation between 1795 and 1797 By 1810, there were two furnaces in Montgomery County and forges in Dickson, Montgomery and Hickman Counties.

Other early attempts to provide iron manufacturers special legislative treatment met with varying degrees of success (Folmsbee et al. 1969: 18; Nave 1953: 7). One such request was made by ironmasters in the Western Highland Rim. This 1827 petition (Legislative Petitions, 1827, No. 9,

Tennessee State Library and Archives) asked that, in times of peace, ironworks owners and hands be exempted from militia duty during periods when the works were in operation. The signers of this petition were Richard C. Napier, E. W. Napier, Thomas Yeatman, Simon Bradford, Anthony Vanleer, Samuel Vanleer, Wallace Dixon, E. D. Hicks, Samuel Stacker, John Stacker, Robert Baxter, Nicholas Perkins, and Montgomery Bell. If the name of James Robertson, the builder of Cumberland Furnace, is added to this list, it may be said to include virtually all of the "founding fathers" of the Western Highland Rim iron industry.

Except for James Robertson, whose involvement with iron manufacture was secondary to his political and other business affairs, the best known of the early Western Highland Rim ironmasters is Montgomery Bell (1769-1855). Like several of them he was from Pennsylvania. Bell came to Middle Tennessee sometime before 1804, and in that year purchased Cumberland Furnace from James Robertson. Within a short time, production at Cumberland Furnace was greatly increased, and Bell eventually built several other furnaces and forges in the region (Corlew 1956: 23).

One of Montgomery Bell's more amazing achievements was Patterson Forge, which utilized a 300-foot long tunnel excavated through solid limestone to provide water power (Narrows of the Harpeth NR 4/16/71). The information concerning this forge helps to provide an understanding of the general nature of early Western Highland Rim ironworks, particularly in respect to the "iron plantation". Patterson Forge, which operated from about 1830 to 1862, was located in a portion of Davidson County that became part of Cheatham County in 1856. Bell owned a house here, which stood on a high bluff overlooking the ironworks. Near the works was a village with housing for the workers, most of whom were slaves (Dalton 1976: 24-25).

Typically, large tracts of land were required for furnace and forge operations because the raw materials were obtained here. Hardwood was needed to prepare charcoal. At least 400 tons of charcoal were needed to produce one ton of iron and a furnace in continuous blast might use an acre of timber per day. Flux, usually limestone, was needed to reduce the ore. It was mined from open faced quarries and then crushed by machine or hand. Iron ore also was often obtained from the plantation site or from lands nearby. A wide variety of occupations were involved in an ironworks operation and most of the workers and owners were housed on the site. Not only were people who were directly involved in the technical or managerial aspects of the operation working but support persons, such as farm workers, were also on the site.Patterson Forge, which was only one of the iron plantations

that Montgomery Bell owned during the first half of the nineteenth century, is representative of the kind of operations belonging to most of the early Western Highland Rim ironmasters.

In addition to those individuals listed in the 1827 petition, the names of Thomas T. Watson, Thomas Kirkman, Robert West, Daniel Hillman and E. H. Lewis would need to be included in any list of leaders of the pre-Civil War industry. Daniel Hillman, the Stackers, and several others were also involved in ironworks in Kentucky. Some of these individuals can only be considered investors, but a number of them were ironmasters who were actively involved in the development of the industry. The Hillmans were also among several early Western Highland Rim and Kentucky iron manufacturers who maintained business interests in Nashville, the major regional center for iron sales (Foster 1931b: 13).

The growth of the iron industry proceeded slowly in Middle Tennessee until the 1830s. From only eight furnaces operating in 1832, twenty-seven had been producing iron by 1835. Forges increased from fourteen in use in 1832 to twenty-five in 1840. Gerald Troost, the geologist for the State of Tennessee, suggested that it was the rich ore deposits and the overall population growth in this part of the state that was responsible for the expansion of the iron industry. Another reason might be that 1835 was when the second state constitution was finalized "and that great instrument had a powerful stimulating effect upon all industry in the state" (Foster 1931b: 11).

By 1840 there was a state-wide total of 99 bloomery forges, refining forges and rolling mills, with 25 in the Western Highland Rim. During 1840, the Western Highland Rim furnaces produced 13,000 tons of cast iron, while the forges (and one rolling mill ?) produced 6,743 tons of bar iron. The 1840 Western Highland Rim industry, including mining operations, employed a total of 1,634 men (an average of 36 employees per ironworks).

Of the nineteen Western Highland Rim furnaces in blast in 1850, the manufacturers census noted that each furnace operation employed an average of 89 men and 6 women. The males were paid an average of $12 per month, the females $5 per month (it is not clear how these figures relate to slaves owned by each operation). Lack of consistency in recording some of the data collected prevents a completely accurate statement of raw materials and products, but these same furnaces had an average annual consumption of about 4,000 tons of ore and 340,000 bushels of charcoal per furnace. The total amount of pig iron produced by these 1850 furnaces was approximately 24,600 tons, about 1,300 tons per furnace operation. Six of them also

produced approximately 1,700 tons of cast iron products, an average of about 283 tons per operation. The 1850 value of all furnace products was $639,477 or an average of $33,656 per furnace operation.

The 1850 census schedules for the seventeen forges in use provide an opportunity to define some of the operating conditions for this predominantly pre-Civil War part of the Western Highland Rim iron industry. The eleven refinery forges each employed an average of 44 men and 2 women. Male forge workers earned an average of approximately $17 per month, females $5 per month. The notably higher monthly wage for male forge workers, compared to furnace workers, is a reflection of the greater degree of physical strength, skill, and experience required to produce wrought iron (Bining 1938: 85). As with the furnace operations, it is not clear how the number of employees and monthly wage figures relate to the use of slave workers.

The raw materials and products figure for the eleven 1850 refinery forges show that each operation used about 1,700 tons of pig iron and 219,000 bushels of charcoal to produce a yearly average of approximately 837 tons of blooms. Two of the operations also produced a total of 50 tons of bar iron. Because some of the forges were included with furnace operations, the total annual value of forge products is not clear, but blooms seem to have been valued at approximately $53 per ton, with bar iron averaging $64 per ton. The six 1850 bloomery forges in Hickman and Lawrence counties employed a total of only 45 men, paid an average of $11 per month. The output of wrought iron by these forges was also relatively small, about 200 tons each for the year.

By the mid-1850s, iron production in the Western Highland Rim was at its peak, and it was predicted that production in 1856 would surpass 50,000 tons of pig iron. Throughout the first half of the nineteenth century, Tennessee had generally been the leader among southern iron-producing states (Foster 1931b: 12), and much of this lead was provided by the Western Iron Region. Contrary to expectations, this situation was soon to undergo a dramatic change.

By 1860 the number of furnaces and forges in the Western Highland Rim had dropped to 13 and 3 respectively. It is significant that this decline occurred a year or more before the start of the Civil War. There seems to be a popular belief among persons familiar with the Western Highland Rim iron industry that its decline was a direct result of the war. Cases of war-time destruction of furnace operations did occur (Stephens 1934: 9; Ash

1986: 34), but the failure of most of the ironworks had to do with general economic conditions that developed throughout much of the United States during 1856 and 1857.

One of the most difficult factors to objectively assess in terms of the decline of the Western Highland Rim iron industry is what has been called "The Slave Insurrection Panic of 1856" (Wish 1939). Toward the end of 1856, rumors of pending slave uprisings were widespread across the South, but a major focal point of hysteria was the Stewart-Montgomery County area of Tennessee. In particular, blacks working at several of the ironworks in the area were implicated in a plot, or plots, to overthrow their masters and escape to the North. The Cumberland Ironworks and its associated furnaces owned by Woods, Lewis and Company as well as Louisa Furnace are frequently mentioned in newspaper accounts concerning these supposed plots (e.g., Memphis Daily Appeal, December 5, 1856). Whether or not any such plots actually existed may never be known. What is known is that a number of blacks were arrested, several were whipped, some confessions were obtained, and some number of slaves, perhaps 4 to 10, were hanged or otherwise killed. By early 1857, fears of an insurrection had subsided (Stephens 1934: 9; Wish 1939: 210-222; Dew 1975).

Stephens (1934: 9) suggests that the "threatened uprising" of 1856 contributed to the closing of many of the smaller furnaces in the Western Highland Rim. Perhaps so, but a factor of even greater consequence to the small operators must have been the steadily rising price of slaves during the same year (Wish 1939: 206). This inflation in the price of slaves, was connected to even broader economic conditions, and by 1857 there was a major nationwide "economic panic." This panic of 1857 had an especially serious impact on the iron industry from Pennsylvania to Missouri (Norris 1972: 136) including in Tennessee.

Another problem with furnaces and forges is that they were usually large operations that included vast areas of land, but they were often owned by only one person or by a small partnership that lacked stability and/or professional management skills. This arrangement left many iron manufacturers dependent on "commission merchants" in nearby cities who would work at distribution of the product. Operations were very expensive and often ran on credit. Skilled workers were in short supply, and laborers were costly, as was hiring slaves from farmers. Economic depressions had occurred in 1837 and 1857, rivers were navigable only part of the year, and roads were often in poor condition. When the ore or forests adjacent to an operation ran out, the company might close because it was not economically

feasible to transport raw materials more than a short distance. In the rural areas of the state banks were few and the iron manufacturers had to compete with businessmen in the cities for credit or loans.

For several years iron manufacturers were supposed to have met annually in Clarksville, yet there was no formal trade association to promote the industry or share information and concerns. On October 10, 1854 thirty furnace, forge, and rolling mill proprietors from Tennessee and Kentucky held an Iron Convention in Clarksville. The members attending the convention resolved to form an association to promote the iron industry and to consider problems such as competitive hiring practices and obtaining credit from banks. They also set up a committee to collect statistics on the industry. It is not known how often the convention actually met.

In 1859, a comprehensive guide to the furnaces, forges, and rolling mills of the United States was published by the Secretary of the American Iron Association, J. P. Lesley. Lesley (1859: 130- 137) provides a short description of 11 forges and 42 furnaces in the Western Highland Rim, most of which had already ceased to operate. They also provide an overview of regional iron manufacturing technology during the late 1840s and 1850s period. All of the forges described by Lesley are refinery forges (with the possible exception of Hurricane Forge in Humphreys County). Five of them had steam-powered hammers. The rest were water powered. All of the furnaces listed by Lesley were charcoal fueled. In terms of their blasts, 36 were steam-powered cold-blast, 4 were steam-powered hot-blast, 1 was steam-powered hot or cold-blast, and 1 was water-powered cold-blast. This last, the Jackson Furnace in Dickson County, had not operated since 1854, and Lesley (1859: 136) gives the kind of concluding statement for it as for several others, "it will probably never make iron again."

Most of the furnaces still operating in 1860 were among the largest producers of pig iron in 1854. The largest 1860 iron-making operation was that belonging to Woods, Lewis, and Company in Stewart County, which included two furnaces, a rolling mill and a forge. Stephens' (1934: 9) suggestion that it was the smaller furnace operations that suffered most from the social and economic turmoil of the late 1850s seems basically correct. In some ways an even more dramatic decline in iron production is represented by the 1860 forges, which dropped to three in number. There was one last refinery forge in Lewis County (Chief Creek Forge at Napier Furnace), operating in 1880, after which forges ceased to exist as part of the Western Highland Rim iron industry.

The post-Civil War period was a time of readaptation and change for the Western Highland Rim Iron industry. Improvements in transportation made

possible by railroads began to have some impact during the 1850s (Foster 1931b: 12), and railroad construction was resumed soon after the war. The major period of railroad influence was from the late 1880s into the early 1900s. Beginning about 1888 a number of branch lines were constructed in the Western Highland Rim specifically to serve furnace and mining operations (Sulzer 1975: 131-145). One example of a major post-war industrial development is the Tennessee Coal, Iron, and Railroad Company. Reorganized by Arthur S. Colyar from the Sewanee Mining Company, it not only became a leading producer of coke and iron by the 1880s, it also extended rail lines into Tennessee and Alabama, built new blast furnaces, bought coal and iron lands, and later helped to launch the southern steel industry. The company was run by Colyar and several Nashville businessmen including James C. Warner, Alfred M. Shook, and Nathaniel Baxter, Jr. These improvements in transportation aided the development of relatively large company-owned villages or towns and made possible such technological changes as the use of hot-blast coke furnaces, the coke being brought into this region from the coal fields of East Tennessee and elsewhere.

By the mid-1800s, a new trend in furnace technology was firmly established, but was still considered experimental. The main ingredients of this technology were the use of coke (produced from coal) for fuel, a hot blast, and new types of furnaces (Overman 1850: 119, 174 and 428). Coke was a more efficient fuel to use in blast. Apparently, the first combined application of these innovations in the South occurred in 1860, when a new ironclad cupola-type furnace was built to replace an older furnace on the same site in Chattanooga, Tennessee (Swank 1892: 290). This new "Bluff Furnace" used a hot-blast stove and Tennessee-made coke for fuel. The Bluff Furnace operated for only a short time, and it was not until 1867 that another coke furnace was built in Tennessee, also in the eastern part of the state (Swank 1892: 291).

In reverse manner it was now deemed more practical to export pig iron than to refine it locally. One of the more graphic examples of this post-Civil War export trend is the pig iron brand. An example of this is the Napier Furnace brand. According to the American Iron and Steel Association directories (1894: 39, 1896: 38, and 1901: 224), during the late 1800s, bars of pig iron bearing the Napier brand were handled by agents in Pittsburgh, Philadelphia, Buffalo, Cincinnati, Cleveland, Chicago, St. Louis, Birmingham, and even as far away as San Francisco.

During the post-Civil War years many iron manufacturers in the Western Highland Rim continued to operate. However, while the raw materials for the manufacture of iron were still available, there was a decline in demand for pig iron and increased competition from other areas of the country.

The demand for stronger rails helped lead to improved methods for the manufacture of steel and the increased use of steel over iron for other products. Lack of a good railroad system in the region meant that other areas had an advantage in transporting pig iron for steel manufacturing. Improved transportation elsewhere also meant that it was now easier for companies to expand their control to other aspects of manufacturing (raw materials, refining, marketing) thereby eliminating middlemen and cutting costs.

In the 1870s and 1880s there were fewer furnaces operating in Tennessee than before the Civil War but a sizable percentage of them employed either a hot-blast charcoal or hot-blast coke technology. The first Western Highland Rim hot-blast coke furnace seems to have been constructed in 1879 (American Iron and Steel Association 1880: 56), but lack of coal resources in this region favored the continued use of charcoal. Even so, technological changes, especially having to do with hot-blast equipment, are frequently noted in the 1880s and 1890s American Iron and Steel Association directories.

The first post-Civil War inventory of Western Highland Rim furnaces is taken from the published statistics of the ninth census (Walker 1872: 732-734). The average number of employees per furnace in 1870 was 102, the average total annual wages per furnace was $34,500, and the average total annual value of products was $110,293.

In 1888 (American Iron and Steel Association 1888: 47-48), only charcoal furnaces were operating in the Western Highland Rim, but some major changes are evident. Several of the furnaces operating in 1880 had been abandoned and three new tall-stack furnaces had been built in Hickman County. The six furnaces listed are: Cumberland in Dickson County; Standard (or Goodrich), Warner and Aetna (New Aetna) in Hickman County; and Bear Spring and LaGrange in Stewart County. Only Cumberland and Bear Spring furnaces had the shorter old-style stacks (37 and 38 feet), and Bear Spring was the only regional furnace still using a cold blast. These two operations had an annual capacity of only 4,000 and 5,000 net tons of pig iron. The Standard, Warner, Aetna and newly rebuilt LaGrange furnaces had stacks ranging from 45 to 65 feet tall. Their respective annual capacities for pig iron production were 7,000, 12,000, 15,000 and 18,000 net tons.

Throughout the nineteenth century Nashville continued to serve as a market for much Western Highland Rim iron. Especially during the second half of the century, Nashville had numerous foundries and machine shops that produced a wide variety of train, mill, and farm machinery parts. From 1888 to 1892, Nashville had the only two western Middle Tennessee furnaces

known to have operated outside the Western Iron Belt. Eventually owned by the Southern Iron Company, in 1890, they produced 36,000 tons of foundry pig iron from Lawrence County ore, using both East Tennessee coke and locally made charcoal. Apparently due to the problem of obtaining good quality ore, and probably transportation costs, the Southern Iron Company dismantled them in 1892 and used the parts to erect two furnaces at Mannie in Wayne County (American Iron and Steel Association 1888:48, 1890: 41, and 1894: 72; Foster 1931c: 11). By 1894,the number of furnaces operating in the Western Highland Rim had increased to ten. All of them were hot blast and two of the new furnaces were fueled by coke.

Most of the Western Highland Rim furnaces were now owned by an organization known as The Southern Iron Company, headquartered in Nashville. The increase in number of furnaces and their corporate consolidation was the result of a very complex series of events, spearheaded by James C. Warner of Nashville. The price of iron lands increased, as did speculation in these lands. Warner in association with numerous individuals (including John P. White, John P. Williams, A. S. Colyar, Robert Ewing, L. S. Goodrich, A. M. Shook, Nathaniel Baxter, Tennie Hillman, and Warner's sons Leslie and Percy Warner) had operated several iron companies, including serving as president during the 1880s of the Tennessee Coal, Iron and Railroad Company. It was also during Warner's period of influence that a successful, though short-lived, attempt to make steel from southern iron was carried out at Chattanooga, Tennessee, using Western Highland Rim pig iron (Foster 1931c: 12; Killebrew 1897: 35-71). Warner sold his iron properties to the Southern Iron Company in 1889, the same year the company was reorganized. Unfortunately this reorganization occurred when steel was beginning to be used in place of iron and the company did not prosper.

By 1896 (American Iron and Steel Association 1896: 36-38), the Buffalo Iron Company of Nashville had become the owner of those furnaces previously owned by the Southern Iron Company. Two of them, Warner and Aetna in Hickman County, were inactive (note in American Iron and Steel Association 1896: 246) and apparently did not actually operate after 1893. The old Bear Spring Furnace in Stewart County had again been reopened as a cold-blast charcoal furnace.

Ownership of the seven operating furnaces on the Western Highland Rim was again diverse in 1901. Of the nine operating furnaces in 1904, only two, Bear Spring and Dover No. 2, were cold blast charcoal furnaces. They produced a low phosphorus pig iron. All other operating furnaces now utilized the hot-blast technology. The industry continued to decline, so that by the 1930s only three operations remained. These were Cumberland Furnace in Dickson County, Warner Furnace in Hickman County, and Rockdale

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Furnace in Maury County. Rockdale Furnace continued to operate into the 1940s, and was the site of development of a twentieth-century product known as "ferrophosphorus," an alloy of phosphorus and iron (Burchard 1934: 211-214). This was a product of some importance to a few regional furnaces in the 1920s and 1930s.

Only one totally new furnace operation was started after 1907. This was the Anna Furnace at Collinwood in Wayne County, which only lasted a few years around 1920. Collinwood was also typical of a trend beginning in the 1920s whereby a few iron furnaces were operated as parts of wood by-products plants, which also produced wood alcohol, acetic acid, and tar. Such was the case with the last furnace to operate in the region, a revised version of the Warner (or Wrigley) Furnace in Hickman County, which continued into the 1950s. Iron was now produced as a by-product, as a result of having an excess of charcoal available from the primary production.

Special product demands and subsidiary attachments permitted the continued, but limited, production of iron in the Western Highland Rim for many years beyond what could have been its final demise in the early 1900s. Cumberland Furnace, which participated in every major phase of the regional industry, struggled to continue operating until the 1930s. From 1900 on, Tennessee's contribution to America's total iron production was of such relatively minor consequence (North 1902: iron and steel production graph) that any number of factors could have disrupted the ability of any operation to obtain a profit from its work. People who remember Cumberland Furnace in operation equate loss of the railroad line with its demise. The effect of major changes in transportation and other changes in technology, which developed out of the post-World War I environment, are probably as sound an explanation as any for the absence of a Western Highland Rim iron industry today.

F. Associated Property Types

I. Name of Property Type Processing Resources

II. Description

III. Significance

IV. Registration Requirements

[X] See continuation sheet

[X] See continuation sheet for additional property types

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F-I. NAME OF PROPERTY TYPE: PROCESSING RESOURCES

F-II. DESCRIPTION

No forges or furnaces associated with the Western Highland Rim iron industry are extant, however, a stone structure believed to have held a refining forge is located on the Belleview Furnace site (40DS23). Most sites contain concentrations or scatterings of glassy slag, iron dross, charcoal, or iron ore fragments. Several sites retain limestone building foundations or the remains of brick and limestone furnace stacks. Portions of earthen or limestone dams still stand at a few sites. Roadbeds, races, the remains of brick lined boshes, charging pylons, retaining walls, and limestone watergates are features observed on the surveyed properties. Usually situated adjacent to water, present day ground cover of these sites includes remote wooded lands, cultivated fields, parks, residential lots, and urban areas. Sites such as Cumberland Furnace (40DS22), Belleview Furnace (40DS23), Bear Spring Furnace (40SW207), Bellwood Furnace (40SW210), Brunsoni Furnace (40SW219), Rockdale Furnace (40MU487), Warner-Wrigley Furnace (40HI147), Napier Furnaces (40LS14), and New Aetna Furnace (40HI149) contain historic buildings associated with the iron industry.

The heart of the pre-Civil War southern iron industry was the cold-blast charcoal furnace, which produced pig iron and sometimes other cast iron products. The older furnaces in Middle Tennessee were often referred to as "hillside furnaces" (Stephens 1934). They were built adjacent to hills in order to facilitate the loading of limestone flux and charcoal. The tapered stone stacks were generally twenty-five to thirty feet in height. At first they were open at the top, but later furnaces had brickwork over the tunnel-head. A wooden bridge connected the tunnel-head, where the charges were made, to the hillside.

The furnace stack was simply a type of container for the reduction of iron ore, which occurred in the presence of a continuous blast of air that caused the charcoal to burn with sufficient temperature to "melt" (actually chemically reduce) the iron present in the ore. The stack's outer shell, usually in the form of a truncated pyramid with arched openings on each side, was made from hand-cut blocks of locally available stone, such as limestone in Middle Tennessee. There was also an inner lining constructed (in a circular plan) of heat resistant material, usually either sandstone or fire brick or a combination of both. A space between the inner and outer walls was filled with stone chips, clay, coarse mortar, furnace cinders, or sand for insulation. After several months of continuous use

the inner lining would wear out, requiring that the operation be shut down so that the lining could be replaced (Bining 1938: 78-82; Weitzman 1980: 144).

The interior space was narrow at the top, gradually widened into the bosh, and then abruptly narrowed again. A cylindrical crucible below this section led to the base or hearth of the furnace. Blast entered through tuyeres located just above the hearth. In an area located between the timpstone and a damstone, the molton metal ran out into the casting floor adjacent to the runout or casting arch of the stack. This floor was covered with sand and was roofed or enclosed in a casting shed. Impressions were made in the dampened sand with wooden pattern molds. Most commonly the molten metal was made to flow through a main feeder depression called the "sow" and then into side depressions called "pigs." At other times, or perhaps simultaneously with the casting of pig iron, functional cast iron objects were made.

During the blasting process both molten metal and slag accumulated in the hearth at the bottom of the furnace. Slag, which formed from some of the impurities in the ore combining with the limestone flux, floated on top of the molten iron. Periodically this slag was tapped off (Wiggington 1979: 79) or drawn off over the damstone with cinder hooks (Weitzman 1980: 146). As it cooled it was broken into irregular lumps and usually discarded near the furnace. The color of slag indicated trace materials found in the ore. Blue slag indicated the presence of manganese, grey slag had a large amount of graphite carbon, and dark slag had little graphite carbon. Abandoned furnace sites often have large concentrations of this glass-like slag. Especially when a furnace was not working well there was a considerable loss of iron, which became part of the slag. Some ironworks utilized stamping mills for crushing furnace slag, or forge cinders, in order to obtain the iron which they contained. The iron recovered by this process was reused in the blast furnace or in a forge (Bining 1938: 85).

Essential to the location of early furnace operations was a dependable stream of water for water power. A dam was constructed and a water wheel used to power the air blast machinery. Very early furnaces used a simple bellows, comparable to an oversized fireplace bellows, but by the end of the eighteenth century these had been largely replaced by the double cylinder "blowing tub" (Weitzman 1980: 156). One of the more obvious technological changes that affected the pre-Civil War furnaces in the Western Highland Rim was the use of steam engines to power the blast equipment. This probably began in the early 1840s, and by the mid 1850s water-powered blasts had virtually ceased to exist (Safford 1856: 52-53; Lesley 1859: 1340-137).

Furnaces and forges had various types of buildings attached to them, including casting sheds and bridge houses. At first the bridge house was merely an open bridge leading to the furnace, later a shed, windscreen, and roof were added to the structure. The more elaborate bridge houses contained apparatuses such as steam boilers, heated by the waste furnace heat, which provided steam for the blast machinery. There might also be heat exchangers for providing hot-blast, which by the mid-nineteenth century was in use in some charcoal furnaces (Weitzman 1980: 142-143).

A major product of the early iron industry was malleable wrought iron bars, needed by blacksmiths and others to work into finished wrought iron tools and utensils. Wrought iron could be produced directly from iron ore or from pig iron. Overman (1850:243) discusses several devices for producing wrought iron, including the oriental (or Persian) forge, the Catalan (or bloomery) forge, the German (or refinery) forge, the finery (or run-out) fire, and the puddling (or reverberatory) furnace. Only one of these, the refinery forge, was widely used in the Western Highland Rim. There were also a few early bloomery forges in the region, and in the mid-1800s possibly two "finery fires" and at least two puddling furnaces.

The bloomery forge was used to produce wrought iron directly from iron ore. The purer the ore, the more readily iron could be extracted by this method. Overman (1850: 245) notes that this type of forge was used extensively in Vermont and New Jersey, states containing large quantities of magnetic ores. In Tennessee, magnetite occurs primarily in the upper east portion of the state. From the 1790s until the late 1800s, this region contained numerous bloomery forges (Nave 1953). In contrast, the absence of this purer grade of iron ore in the Western Highland Rim probably explains why few bloomery forges existed here.

The widespread development of blast furnaces meant the eventual end of bloomery forges, but they continued to survive in some areas much longer than might be expected. One such region was upper East Tennessee. The kind of isolation that permitted the survival of bloomery forges until 1880 did not last for many more years. By 1896 it was reported that there was only one such forge active in the south. By the 1890s, even the terminology for forges was somewhat twisted, so that what had formerly been referred to as refinery forges were called "bloomaries" (American Iron and Steel Association 1894: ix). Forges of the refinery type were common before the Civil War, but ceased to exist soon afterward on the Western Highland Rim.

From the time that cast iron, which is too brittle for many purposes, first began to be made in blast furnaces there was a need to refine it. Early American refinery forges were modeled after those used in Europe, particularly in England (Bining 1938: 83). In America the refinery forge was often part of a larger iron plantation, but such forges were also operated as independent ironworks (though still dependent on regional furnaces for their raw material, pig iron). Like the blast furnace, a forge operation might be the center of an iron plantation surrounded by supporting activities and buildings.

Forge buildings were probably constructed of stone with packed earth floors. As with the operating of early furnaces, early forges were dependent on good water power to operate their blast equipment and trip hammers. As was also true of mid-nineteenth-century furnaces, by the 1850s (Lesley 1859: 215-216) steam engines had become common as sources of forge power, particularly to operate the hammers. Forges varied in size. Some had only one "fire" or forge hearth and one hammer, while larger works might have four or more hearths and two or more hammers (Bining 1938: 83). The vast majority of early refinery forges used a two-step process known as "finery" and "chafery" (Frurip et al. 1983: 10).

By the mid-nineteenth century some changes in the terminology and technology for the production of wrought iron from pig iron had occurred. Overman (1850: 249) illustrates a "German refining forge," which he describes as "the most successful method of manufacturing charcoal wrought iron." He describes a "finery fire", also called a "run-out fire", which was a type of furnace for attempting to purify poor quality pig iron before using it in a refinery forge. This type of forge caused a lot of waste (Overman 1850: 256-257).

Lesley's (1859: 147-218) descriptions of refinery forges in Tennessee and other parts of the South usually state that they have one or two "forge fires" and a proportionate number of "knobling fires," anywhere from 2 to 18. Apparently the "chafery" process, which produced relatively small bars of wrought iron, usable by blacksmiths, had become rare. Forges now employed "knoblers" who made "blooms", which were often shipped out of the area for additional reworking (Norris 1972: 55). By the second half of the nineteenth century, the term "forge" was used to refer to an establishment that made wrought iron directly from ore, while the term "bloomery" was for "works which make blooms from pig iron or scrap for sale" (American Iron and Steel Association 1894: ix).

Though some forges, particularly early ones, produced wrought iron for local use, much of it was transported to a rolling mill to be reduced into

smaller stock. In many such operations both rolling and slitting mills were combined under one roof. In the Western Highland Rim region both rolling mills and nailerie were rare (Lesley 1859: 259).

An alternative to the refinery forge was a device called a puddling ore reverberatory furnace, which was recommended by Overman (1850: 259-260) as the best of all methods for converting pig iron into bar iron. His illustrations show a low, rectangular structure made of brick and iron, with a fire box at the front and a 30 to 40-foot chimney at the rear (Overman 1850: 260-267).

By the late 1800s, most of the rolling mills in the South included puddling furnaces as part of their operation. Several of these were located in the Knoxville to Chattanooga area of East Tennessee (American Iron and Steel Association 1880: 134; 1888: 138; and 1890: 142). In the Western Highland Rim, the known use of this device is limited to two at the Cumberland Rolling Mill (40SW206), which operated before but not after the Civil War.

Another type of iron industry operation with limited use in the Western Highland Rim was the foundry. As noted above, blast furnace operations sometimes produced cast iron products in addition to pig iron. A more desirable product could, however, be made by remelting pig iron in an "air furnace." This allowed for the removal of impurities, and a more controlled casting process. Like the blast furnace, foundries did some casting on sand floors, which worked well for large flat objects with only one decorative face. Much foundry casting, though, was carried out using flask molds. These were rectangular boxes without bottoms or tops, into which damp sand was rammed around a wooden pattern. The two halves of the mold were then separated and the pattern removed. When the mold was reassembled, there was a cavity bearing the impression of the pattern, into which the molten metal was poured (Kauffman 1966: 37-39).

Foundries were usually located in cities where they operated on a day-to-day basis according to demand (Kauffman 1966: 38).By the late 1800s (Tennessee State Gazetteer and Business Directory 1890: 934) most of the foundries in Middle Tennessee were concentrated in Nashville, which is outside the Western Highland Rim region. Even as early as 1860 (Nashville City and Business Directory 1860: 66-67), combined foundry and machine shops were operating in Nashville and other Middle Tennessee towns. This sort of specialization represented a departure from the more traditional aspects of "iron production." The only extant example of a foundry surveyed is the Clarksville Foundry and Machine Works.

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F-III. SIGNIFICANCE

Processing resources are being nominated under criterion A, B, C, and D in the areas of industry, architecture, historic archaeology, and engineering. Most of these resources are historic archaeological sites containing the remains of furnaces or forges. Processing resources, community resources, and extractive resources are sometimes found on the same site.

Under criterion A, processing resources are significant for their association with the industrial development of the region. The iron industry on the Western Highland Rim was often the reason for the establishment and continued growth of a community. It became the main economic force in the region. When the industry ceased to operate in any given area, it usually resulted in a slowing or complete stop in the growth of a community. Usually former processing sites were abandoned and no new commercial or industrial activity replaced them. Resources significant under criterion A have a strong association with the beginning and demise of the industry, diverse kinds of industrial development within the industry, and about the broad developmental patterns throughout the region or in a specific locality.

Those processing sites that are eligible under criterion B will be strongly associated with an individual who made an important contribution to the industry. Many ironmasters played pivotal roles in the establishment of an iron works, continued development of it, or made a major technological change in the industry. Richard C. Napier, Samuel and John Stacker, Anthony and Samuel Vanleer, Henry Hollister, Daniel Hillman, Montgomery Bell, and James Warner are examples of significant individuals. These men were often the originator of one or several furnaces, ran the largest or most productive ironworks, helped to consolidate the industry, or made innovative technological changes.

Although most processing resources are historic archaeological sites, the remains of stacks may retain enough integrity to have significance under criterion C in the area of engineering. They provide visible examples of design and construction techniques that were important to the iron industry. They may be representative of innovative engineering and construction techniques or be representative of standard techniques. Few examples of either type are extant today. Architecturally, a resource may depict a type, period, or method of construction, such as a commercial or industrial building used in the manufacture and distribution of iron or iron products.

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Under National Register criterion D, the historic archaeological resources in this thematic nomination are significant for their information potential in understanding the development of the iron industry. For many sites there is little or no information available from the written records. The nominated sites can confirm and/or supplement information from written sources and help to better understand the history of the iron industry. The sites are important in gaining information about both the broad historic patterns in the surveyed area and to site specific questions.

The study of the stratigraphy of slag and dross on these sites may yield valuable information on how or if the ironworks at these sites attempted to keep pace with technological changes in the industry. Because the amount of slag or dross and the color and type of slag (glassy or porous) denotes the type of blast or forge and the type of ore used, the study of it may provide insight into the operation of the furnace or forge when changes in the industry were occurring on a broader scale. It may reveal a pattern of decline over many years or denote specific critical periods in the history of the iron industry, such the 1850s, when the industry was both at its height yet rapidly declined, or the 1920s when few furnaces were operating solely to produce iron. A comparison of these sites may aid in understanding if and when this decline occurred locally or if it was characteristic of the entire region.

The study of the remains of stacks, building foundations, dams, and transportation structures (road beds and rail beds) has the potential to yield valuable information on the development or decline of a site by showing if an ironworks attempted to expand or utilize new production methods and materials. Especially when there is no written documentation about the particular site, the study of this data can aid in understanding the operation.

Deposits of iron or salamanders (associated with the final blast of a furnace) indicate the type of product made at a site. The study of this data may reveal how technological changed affected the final product or about what the product can tell us about the process by which it was made. The presence of slag and dross on these sites may reveal information on how this combination operation affected the development and demise of the industry.. A comparison of data collected from these sites could provide valuable information on the interaction or exchange of products and information between sites. Because many furnaces and forges were owned by one company and individuals often owned parts of many ironworks, it is expected that there would have been a sharing of resources.

F-IV. REGISTRATION REQUIREMENTS

All processing resources must have a strong integrity of association with the development of the iron industry on the Western Highland Rim. They can be important to the industrial development of a single community or to a wider area. These resources should have been in operation during the period of significance of this nomination. By the late 1920s, technological changes resulted in the production of iron being a by-product of other manufacturing processes. Resources that fall into this category are not considered eligible under this particular multiple property theme. Processing resources are comprised of historic archaeological sites and standing buildings.

Resources that are significant under criterion A can be comprised of a mix of processing and community resources that depict the broad pattern of industrial development in the community or region. They may be sites and/or standing buildings. If the resource is a building it should retain a high degree of integrity of materials, setting, location, and association. Processing resources that are sites are usually also eligible under criterion D.

Under criterion B, the property should be associated with a significant individual during the time he had an important role in the industry. Since ironmasters frequently operated in several states, it is important to compare and contrast these resources to determine which one (or several) is the best representation of the individual's significance. The significance may have occurred over time or be related to a specific event, such as an important manufacturing or processing technique associated with an individual.

Only one extant processing resource was surveyed and found to be significant in the area of architecture. The Clarksville Foundry and Machine Works retains its integrity of design, materials, workmanship and setting and it has a strong association with the manufacturing of iron products. Not only the office, but several industrial buildings are extant. Any other resources of this type should retain similar qualities. Several furnace stacks retain their limestone exteriors and brick lined interiors; support pylons may be located nearby. These resources retain sufficient integrity of materials and design to be important as engineering structures. When the stack remains are barely evident, criterion D should be applied.

Most processing resources fall under criterion D. A careful comparison of all of these sites and what research potential they have was done, as it was for all property types. In order to be registered, a furnace site should have at least a scattering of slag and the remains of a furnace stack or building foundations. Since it is rare to find entire stacks or even a clear delineation of the base or edges of a stack, it is enough that the site have limestone rubble. Physical features that are often needed for registration include a source of water and a hillside near the stack. The presence of these natural features add to the integrity of the site. Forge sites must have a scattering or concentration of dross. Combination furnace and forge sites may not have dross on the site. If this is so, there must be written documentation that a forge operated at the site when the furnace was also in operation.

Either historic documentation or on site investigation has determined that the research potential for these sites is high. Many sites are abandoned, forest sites, or used as pasture making the likelihood of subsurface remains and integrity very good. There is no landscape alteration to the majority of each site being nominated. However, where buildings have been erected or roads constructed, portions of the site may have suffered some damage. When the damage has not affected the principal component of the site, the site can be registered. These sites may be composed of various components of the iron works or be only the remains of a stack. When stack remains, dams, buildings or foundations are all located on one site, it will probably be significant under criteria A and D.

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F-I. NAME OF PROPERTY TYPE: COMMUNITY RESOURCES

F-II. DESCRIPTION

Other areas of Tennessee may have been dependent on agricultural plantations, but the iron industry resulted in the establishment of a different type of plantation on the Western Highland Rim. As the demand for iron grew, small furnace or forge operations developed into iron plantations with vast landholdings, laborers and/or slaves, numerous buildings, and a centralized management. Ironmasters were the largest slave owners in the area. Yet when agricultural work was slow they might hire additional slaves for temporary work with iron manufacturing. In post-Civil War years, slave housing was simply converted to tenant or worker housing. Eventually company owned housing (residences or dorms, hotels, commissaries, churches, and schools would be built. If the company owned the store, workers might be paid in script; rival stores would be built nearby. A hierarchy of laborers, managers, office workers, and professionals developed. This was often reflected in the type and location of the housing stock, especially in the later communities. Patterson Forge (40CH87) and Cumberland Furnace (40DS22) are examples of the iron plantation while New Aetna Furnace (40HI149), Napier Furnaces (40LS14), and Rockdale Furnace (40MU487) are examples of company towns.

The community resources, processing resources, and extractive resources were often located in close proximity or connected by roads, railroad spur lines, or tram lines. An ironmaster's residence typically sat on a hilltop overlooking the town and the furnace and forge operations. Since the economy of the plantation or town was dependent on the iron processing industry, most buildings constructed within the area can be considered part of the company town even if built by an individual. An example might be a privately owned store, depot, or a farm that supplied grain to the industry. Worker housing not owned by the company is also likely to be included in close proximity to the furnace or forge site. Most of these towns follow a linear pattern that reflects their relationship to the railroad lines or roads. By the late nineteenth century the railroad had become the main source of transportation for raw materials and finished products. Another factor that influenced the development of the towns was the land itself. Furnaces were built adjacent to hillsides in order to facilitate the loading of ore; a creek or stream was always nearby. These features provided loose boundaries for the communities.

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The exact location of the community resources at some sites is unknown, such as Patterson Forge (40CH87). Other sites, including Bear Spring Furnace (40SW207) and Rockdale Furnace (40MU487) contain representative samples of worker housing built in a linear pattern. New Aetna (40HI149) has only one extant worker's house, but a historic map shows the presence of several buildings erected in a linear pattern along the railroad. Cumberland Furnace (40DS22) retains many resources from the nineteenth and twentieth centuries. Wrigley Furnace (40HI147) is a planned company town with several extant community resources, however, it falls outside the period of significance of this nomination.

All of the architectural resources surveyed are associated with the development of the iron industry during the 1800s until the 1930s. Most of the extant buildings are residences of industry owners or workers, although several stores, churches, a railroad depot, and two company buildings were surveyed in Cumberland Furnace. The foundry and the residences of two foundry owners were surveyed in Montgomery County. With the exception of the ironmaster's residence, the majority of the resources surveyed are log or frame vernacular buildings. Typical residences are one story, sheathed with weatherboard, rectangular in plan (with later additions), capped by gable roofs, and have brick or stone chimneys.

Located in the north-central portion of the Western Highland Rim, Dickson County contains the greatest number of architectural resources surveyed. Most of these are included in the Cumberland Furnace Historic District. Two properties in the district are already listed in the National Register. Overlooking much of the town, ironmaster James Drouillard constructed an impressive Italianate style residence in around 1870 (NR 12/27/77). Ornamental brackets, circular arch 4/4 double-hung sash windows, and a wraparound porch with a turned wood balustrade are the distinguishing features of this house. Situated at the southern edge of the district are the St. James Episcopal Church and School (NR8/22/77). Built by the Drouillard family for use of the residents of Cumberland Furnace, the Gothic Revival style church is delineated by multi-pane pointed arch windows and a pedimented entry comprised of arched, paneled doors. The school is a two story weatherboarded building with a gable roof and 6/6 double-hung sash windows. Sixteen other buildings were surveyed in Cumberland Furnace, although several additional buildings, that were constructed while the furnace was still operating, are included in the district. Of the surveyed properties, three are brick, one is concrete block, five are log, and the remainder are frame buildings. The district includes St. James Episcopal Church and school, the Drouillard House, a railroad depot, another church, worker housing, two buildings used by the company offices, a company commissary, and three stores. The Hand House,

constructed for a company manager, and the two buildings constructed as offices are one and two story brick buildings with gable roofs. Built in 1920, the Cumberland Furnace Depot is a frame building with a hip roof, wide eaves with modillions, bays, and numerous windows. Most of the log residences were built prior to the Civil War. They have half-dovetail notching, gable roofs, brick or stone chimneys, and are often partially covered with boards. Several small, one story, frame residences are scattered throughout the district. Ironmaster Joseph Warner's circa 1910 summer house is included in the district. It is a one story, weatherboarded house with a gable roof, shed roof dormer and a full front porch. In addition to the frame company commissary, two early twentieth century general stores were surveyed in Cumberland Furnace.

Also located in Dickson County are the residence of Ironmaster Richard C. Napier and the Rock Church. Napier's house, built circa 1800 by his father, is a simple two story Federal style building constructed of brick. It still retains its walnut exterior doors, poplar floors, turned wood staircase, picture rails, and fireplace mantels. Rock Church, thought to have been constructed in 1826 for use as an iron forge building, is a one story stone structure with multipane windows and jack arch lintels. Converted for use as a church in 1856, it is included as part of the site for the Belleview Furnace (40DS23).

Hickman, Houston, and Lewis counties contain only four surveyed residences. Similar to the Napier and Hand Houses, the West House was constructed circa 1812 for use as a residence and headquarters for the family's furnace industry. The two story brick house has a rectangular plan, gable roof, and symmetrically placed fenestration. (It is not included in the nomination because of extensive alterations.) A circa 1880 frame company house at New Aetna Furnace (40HI149) and several buildings that were part of the Wrigley-Warner Furnace (40HI147) are in Hickman County. The Warner-Wrigley site contains a company office built in 1920, several brick buildings used in the operation of the furnace, and much of the town itself.

A circa 1910 company built house is located on the Napier Furnace site (40LS14). The two story frame house has an irregular plan and roofline and was probably a mail-order house. Several superintendents resided in the house.

Rockdale in Maury County contains a collection of vernacular frame residences used as company housing for Rockdale Furnace workers (40MU487). Most are one story with a loft area, weatherboarded, have gable roofs, and front porches. All have undergone some alterations and are situated within the boundaries of the Rockdale Furnace site.

A pony barn used by Byron Forge (40HO21) and three residences were surveyed in Stewart County. Ironmaster Henry Hollister lived in the circa 1820s Greek Revival/Italianate residence located near the Brunsoni Furnace (40SW219). The imposing two story house is embellished by a two story pedimented entry, brackets, and a transomed door. In 1856, ironmaster Samuel Stacker built a large two story weatherboarded residence. Multipane windows, sidelights, and transoms are the distinguishing features on the exterior of this house. Another significant individual in the iron industry was John Bell. His house has paired end chimneys and a symmetrically designed facade. Now sheathed with aluminum siding, it is a part of the Bellwood Furnace site (40SW210).

Clarksville, in Montgomery County, did contain two residences associated with the operators of the foundries. The circa 1860s Drane-Patch House was a two story brick Italianate style residence with elaborately detailed window lintels. Located close to this house is the Drane-Foust House, a circa 1890s residence that displays elements of Colonial Revival and Queen Anne styles. Because Drane lived here after 1935, it is not a part of this nomination. The Drane-Patch House was demolished in August 1987.

F-III. SIGNIFICANCE

Community resources are significant under criteria A, B, C, and D in the areas of industry, architecture, and historic archaeology. While most of these resources are extant buildings, there are several cases when the sites contain a mix of historic and archaeological components. Also, community resources are often found in close proximity to processing resources and, occasionally, extractive resources.

These sites are significant under criterion A because they are associated with the broad development of the iron industry. Beginning with the operations at Cumberland Furnace and continuing into the early twentieth century, the manufacturing and processing of iron resulted in the settlement and development of many portions of the Western Highland Rim in Tennessee. Furnace operations depended on large amounts of land and people, usually resulting in the establishment of support facilities, such as houses, stores, railroads, and farms. Without the iron industry much of this area of Tennessee would not have developed. For many years iron manufacturing was the major economic force and when the industry stopped, development of cities or other industries often ceased.

Under criterion B, several residences are significant because they were the homes of prominent ironmasters or, in one instance, a foundry proprietor. These individuals were important because they initiated the ironworks (alone or in partnership with others), actually ran or managed the company, or made a significant contribution to the industry, such as patenting a new machine. Often the ironmasters owned more than one furnace or forge in several states and, therefore, his residence can be a good representation of the overall importance of the individual (this can be in addition to the significance of an individual's activities at one site). These individuals had pivotal roles in the operation of iron works over many years.

Many of the ironmasters' residences are excellent examples of specific architectural styles. They are usually the most detailed and imposing non-industrial resources in the region. Company towns are also eligible under criterion C because they are representative of a type of construction. A range of buildings, including depots, stores, residences, or offices, combine to present a good example of vernacular styles of buildings used for ancillary services of the iron industry.

Under criterion D, the community resources can yield valuable information on the development of or particular features of the iron plantation or company town and help relate them to the industrial operation itself. What type of building plan or materials were used, how the workers and managers homes were situated in a given area, and why they were constructed in this area may be learned from these resources. Interpretation of these components can help us understand the actual working relationship between different community resources or between community resources and processing and extractive resources and the people who were involved in the industry. The social patterns, relationship between the industrial operations and the residential/community section, may be learned from the study of building foundations and stack remains on these sites.

F-IV. REGISTRATION REQUIREMENTS

For all community resources it must be shown that there is a strong association between the resource and the development of the iron industry from the 1790s to the 1920s. Resources that fall outside of this period of significance are not included in the multiple property nomination, although they may be eligible under a different theme or context. Resources considered eligible under all criteria may be part of a district (a former plantation or company town), or an isolated feature, such as an iron-

master's residence. Historic archaeological remains of buildings or furnaces may be found adjacent to worker or owner housing or there may only be archaeological remains with no extant buildings.

Under criterion A, community resources that are eligible are most likely to be found in districts or on archaeological sites. They often represent the only remaining standing resource of a company or town. These resources should retain strong integrity of association and location. Integrity of design, materials, and workmanship may be compromised but not enough to significantly change the historic appearance of the building. (Integrity of setting for all resources in this nomination is hard to assess because the once industrial areas are now generally rural, even when the pattern of building development is still evident.)

For a resource to be considered eligible under criterion B it must be the building in which the important individual resided when he was active in the iron industry. The association need not be long, since many of the standing buildings connected to the ironmasters are gone (or located outside the geographic area). These buildings may be a part of an archaeological site or district but were sometimes built separately. Again, integrity of association is important. Integrity of materials and design should be evident. The introduction of modern materials and numerous additions, especially to an isolated resource, can compromise its integrity.

Under criterion C, the resource must be a good example of a type or period of construction. Community resources located in a district need not be individually eligible but together should depict the type of housing and commercial or industrial buildings erected when the iron works were operating. For the few properties that are good examples of architectural styles, integrity of design, materials, and workmanship are paramount.

Community resources that may be eligible under criterion D cannot be based on speculation. Evidence must exist that this is the area associated with an iron works. Information gained from this site usually cannot be found in the written record or will supplement such information. The site should not be so (physically) disturbed that overall subsurface integrity is lost. Community resources that are important under criterion D, may also be significant under criterion A for their association with the broad development of the iron industry. An example would be the historic archaeological remains of a company town.

F-I. NAME OF PROPERTY TYPE: EXTRACTIVE RESOURCES

F-II. DESCRIPTION

A sizable volume of literature exists concerning iron ore. The most common kinds available in the eastern United States are usually classified as hematite (red), limonite (brown hematite), magnetite and carbonate. These vary according to their physical form and iron content. Their approximate percentages of pure iron are: magnetite, 72-74 percent; hematite, 70 percent; limonite, 59-60 percent; and carbonate, 48 percent (Bining 1938: 68-69; Council et al. 1982: 35).

In the Western Highland Rim, all early iron ore mining seems to have been carried out in shallow, open mines. The standard mining tools were picks and shovels, with some use of horse-drawn plows and scrapers (Ash 1986: 18). By the mid-nineteenth century, roasting of iron ores was considered a necessary first step in preparing them for use. This was carried out in open piles or rows or in ovens somewhat similar in appearance to a small blast furnace. The roasted ores were usually cleaned by dry screening (Overman 1850: 39-47). Later it became common to clean ore by washing it, using devices such as perforated rockers, troughs, and revolving drums (Ash 1986: 18).

At first the ore was hauled from the mines by wagons or trams mounted on rails and pulled by mules. Around 1892 steam engines known as "dinkies" were used to transport the ore to the washers. Here the ore was dumped into tipples, machines that tipped the trams in order to empty them of ore. Large pieces of debris were broken up with sledge hammers; later, crushing machines composed of large wheels with steel blades were used. The ore then traveled down a water filled chute to the washer where a mild current separated the debris from ore. A mesh screen separated the large pieces of debris and ore, while pulsating jets separated the final particles.

Limestone quarries were also used in iron production but only one quarry, in Cumberland Furnace, is known to have a strong association with the iron industry.

F-III. SIGNIFICANCE

Extractive resources can be eligible under criteria A and D. The resources are significant because of a close association with the production of iron. Mines and their supporting resources are an important part (the first step) in the processing of iron. Mining operations provided employment and resulted in the development of certain parts of the Western Highland Rim. Railroads or roads were built connecting mines to furnace sites and/or towns and this helped establish a wider transportation network than may have existed prior to the mines. The operation of mines over time may provide a good record of changing technology and help establish a clearer understanding of these changes or the operation of the mine during one period of time.

F-IV. REGISTRATION REQUIREMENTS

Most extractive resources have not been surveyed for this multiple property nomination. Only those that are known to exist and are located near processing resources are considered eligible. Extractive resources that are located far away from processing sites are not presently being considered for nomination but additional study of the relationship between these resource types may change this.

The primary focus of this nomination is the processing and manufacturing of iron and iron products; extraction of the ores is a secondary consideration. However, mines or ore beds are sometimes a part of an archaeological or historic site and if their integrity of association with a particular site can be shown, the extractive resources will be included in the site nomination. When the integrity of association is uncertain or the present day location of the mine is uncertain, it will not be considered. Extractive resources may be contiguous to a processing resources site but if there is insufficient documentation on the use of the land between the resource types, a discontiguous boundary may be best. However, often roads, railroad spurs, and buildings connected the various property types.

Mines, ore sheds, any extant support facilities such as tipples, trams, or roadbeds, can be nominated. In most instances only the mine sites are known and the existence of any supporting resource is expected to be rare.

National Register boundaries for all sites have been determined by using the presence of the visible remains of processing resources (furnace stacks and pylons, dams, races, etc.), historic documentation showing the location of resources associated with the iron industry, and site topography and integrity. In addition, all sites contain scatterings of slag or dross throughout the nominated area. When concentrations of slag or dross are located on a site, these are indicated on site maps that accompany the individual forms.

G. Summary of Identification and Evaluation Methods

Discuss the methods used in developing the multiple property listing.

[X] See continuation sheet

H. Major Bibliographical References

[X] See continuation sheet

Primary location of additional documentation:

- [X] State historic preservation office
- [X] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [ ] Other

Specify repository: Division of Archaeology, 701 Broadway, Nashville

I. Form Prepared By

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METHODOLOGY

An initial understanding of Tennessee's early iron industry had been developed during previous surveys conducted by the Division of Archaeology in the 1970s and early 1980s. This included some knowledge of the kinds of primary and secondary sources available for defining the types of cultural resources remaining from this industry. Because iron mining and iron manufacturing are subjects of direct interest to geologists and related specialists, a large body of written information exists that could be used to support a cultural resources survey of any of the various regional forms of the industry.

The development of a study unit based on a cultural resource survey of the Western Highland Rim iron industry was proposed in early 1984 (Smith 1984a). All of the principal ingredients were known to be present, including tight geographical limits, specific time frame, and an apparent large body of associated resources. Unlike past archaeological surveys conducted by the Division of Archaeology, the label "cultural resource survey" meant that this project would also attempt to record surviving buildings related to the theme. This building resource category was the primary unknown at the beginning of the project. Probable site types listed in the proposal (Smith 1984a: 2) included furnaces, forges, rolling mills, charcoal ovens, coke ovens, ore mines, ore processing establishments, and fluxing limestone quarries.

Earnest F. Burchard's (1934) "The Brown Iron Ores of the Western Highland Rim" was the major primer available for developing a preliminary list of the types of remains that would be encountered by the 1984 to 1985 survey. Burchard's study utilized a variety of sources prepared by earlier state geologists. The field work carried out as part of his study took place between 1921 and 1923 and again in 1927, and this included recording of locations of ore deposits, mines, ore prospects, and blast furnaces. The detailed maps and photographs of some of these iron operations as they appeared sixty years ago were of great importance to the 1984 to 1985 cultural resource survey.

Some of the studies used by Burchard and frequently consulted during the 1984 to 1985 survey included geological and industrial research reports by G. B. Troost (1835), J. M. Safford (1856) and J. B. Killebrew (1874, 1876, 1881 and 1890). J. P. Lesley's (1859) The Iron Manufacturer's Guide to Furnaces, Forges, and Rolling Mills of the United States was another major source used by the survey. While some of Lesley's data can be shown

to be erroneous, the fact that he attempted to account for all known ironworks, whether operating or not, made this an invaluable source for site recording.

The same utility is also true for the various issues of the American Iron and Steel Association's Directory to the Iron and Steel Works of the United States (1880-1908). These directories not only provide information about ironworks operating at the time of publication, they also provide termination dates and closing information for "abandoned or long inactive"furnaces and forges. One modern checklist of Middle Tennessee furnaces and forges is also available (Jacobs 1978: 26-33), and was useful for helping develop a complete list of probable sites.

Perhaps the single most valuable source of information used during the 1984 to 1985 survey was a set of geologic quadrangle maps with accompanying mineral resource summaries published or curated by the Tennessee Division of Geology. These maps and summaries are the result of an on-going statewide survey of the state's geological resources. In addition to mineral resources, the sites of some associated industrial operations are shown (e.g., lime kilns and iron furnaces and forges). For the Western Highland Rim region a special effort was made to record old furnace and forge sites whenever these were encountered by the geological surveyors.

Informants were also the main source of information concerning architectural and other cultural resources associated with specific iron manufacturing sites. Local individuals were routinely asked if they knew of houses or other buildings in the vicinity that may have been associated with the iron industry, and an effort was made to locate examples of castings or other products made at the ironworks.

The architectural portion of the iron industry survey of the Western Highland Rim was conducted as an attempt to record a representative sample of buildings associated with this important Tennessee industry. The potential date range for buildings was the same as for other cultural resources, from the 1790s to the 1930s. The oldest building found dates from around 1800. Buildings less than fifty years old were not considered.

The architectural resources associated with the industry were identified by one of the following methods: by their proximity to the archaeological sites visited; by referral from local informants; and by leads followed from research conducted in the State Library and Archives. Also, ten buildings associated with the industry that had been previously surveyed were included in the final inventory.

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The total inventory of recorded buildings is 37 (not including foundry and foundry owner buildings). A total of 75 archaeological sites was found and recorded. There are also 16 furnace and forge sites that are believed to exist, based on historic documentation, but for which physical remains were not found.

Iron ore mines were the most troublesome category dealt with by the survey. At least 279 abandoned iron ore mines are indicated by the geologic resource quadrangle maps for the region. An effort to record all of these could simply not be justified. A sample of ten iron ore mines was recorded. The selection of these was based on special supporting data such as contemporary maps or photographs.

There were also a few minor resources and/or isolated artifacts encountered during the survey work that were of special interest or provided some insight into how the Western Highland Rim iron industry operated. A number of examples of "sugar kettles" were seen in the Montgomery-Stewart County area. Several tombstones of ironmasters were surveyed. At least five of these tombstones commemorate the ironmaster's work in the industry.

The results of the survey are included in a survey report, Tennessee's Western Highland Rim Iron Industry. This survey report forms the basis of the nomination.

Prior to beginning work on the multiple property nomination, all of the sites and buildings proposed for nomination were visited by an historic archaeologist and several staff members from the Tennessee Historical Commission. Pedestrian reconnaissance done at this time checked for integrity of the resources and determined National Register boundaries. Some sites that were not considered eligible for nomination during the initial survey (because of inaccessibility) were considered potentially eligible and were visited to reassess eligibility.

Site topography, legal boundaries, historic maps, and the presence of historic materials were used to determine boundaries. No subsurface testing was done since it was believed that historic documentation and present day surface remains of historic materials were sufficient to determine eligibility. The National Register boundaries were drawn to include only those areas where visible historic resources exist or where documentation showed evidence of the likelihood of below ground remains. However, it must be noted that the National Register boundaries may not encompass all of the historic resources associated with the sites. Because

of the manner in which furnaces and forges operated, encompassing large parcels of land with numerous interrelated components operating, much larger areas should be considered for planning purposes.

Because of a change in technology around the World War I years, when iron manufacturing became a by-product of other operations, it was decided to, generally, end the period of significance for sites and buildings at the 1920s.

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