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BETTIE MARTIN IRON MINE AND OLD'S FURNACE NORTH GARDEN, VIRGINIA[1]

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The Bettie (Betty, Betsy) Martin iron mine is located on the northeast slope of Cook Mountain, about 0.5 mile northwest of the Southern Railway crossing over State Road 712 (Plank Road) at North Garden in Albemarle County (Figure 1). The mine is on private property and permission should always be obtained before entering, as failure to do so violates trespass laws and is punishable under law. About 10 acres of land were purchased in November, 1767 from John Gillum by three men from Baltimore County, Maryland - Nathaniel Giles, John Lee Webster, and John Wilkinson. Giles and Webster shortly gave up their shares to John Old of Lancaster County, Pennsylvania. More land was purchased in 1770 on what is now Dudley Mountain and along the Hardware River, where supposedly there were rich deposits of iron ore (King, 1983). The Bettie Martin iron mine was opened when the Albemarle Iron Works Company was organized on December 28, 1770 "for construction and operation of sawmill and an iron furnace for producing pig iron and also common and flat castings". An Articles of Agreement was made and implemented. King (1983) notes that a furnace (forge), where Old Lynchburg Road (State Road 631) crosses the North Fork of the Hardware River, was known as Old's forge. The forge further refined the pig iron through heating and hammering with

[1]A similar article by Palmer Sweet was published in *The Magazine of Albemarle County History, 2003, volume sixty-one, pages 56-66.*

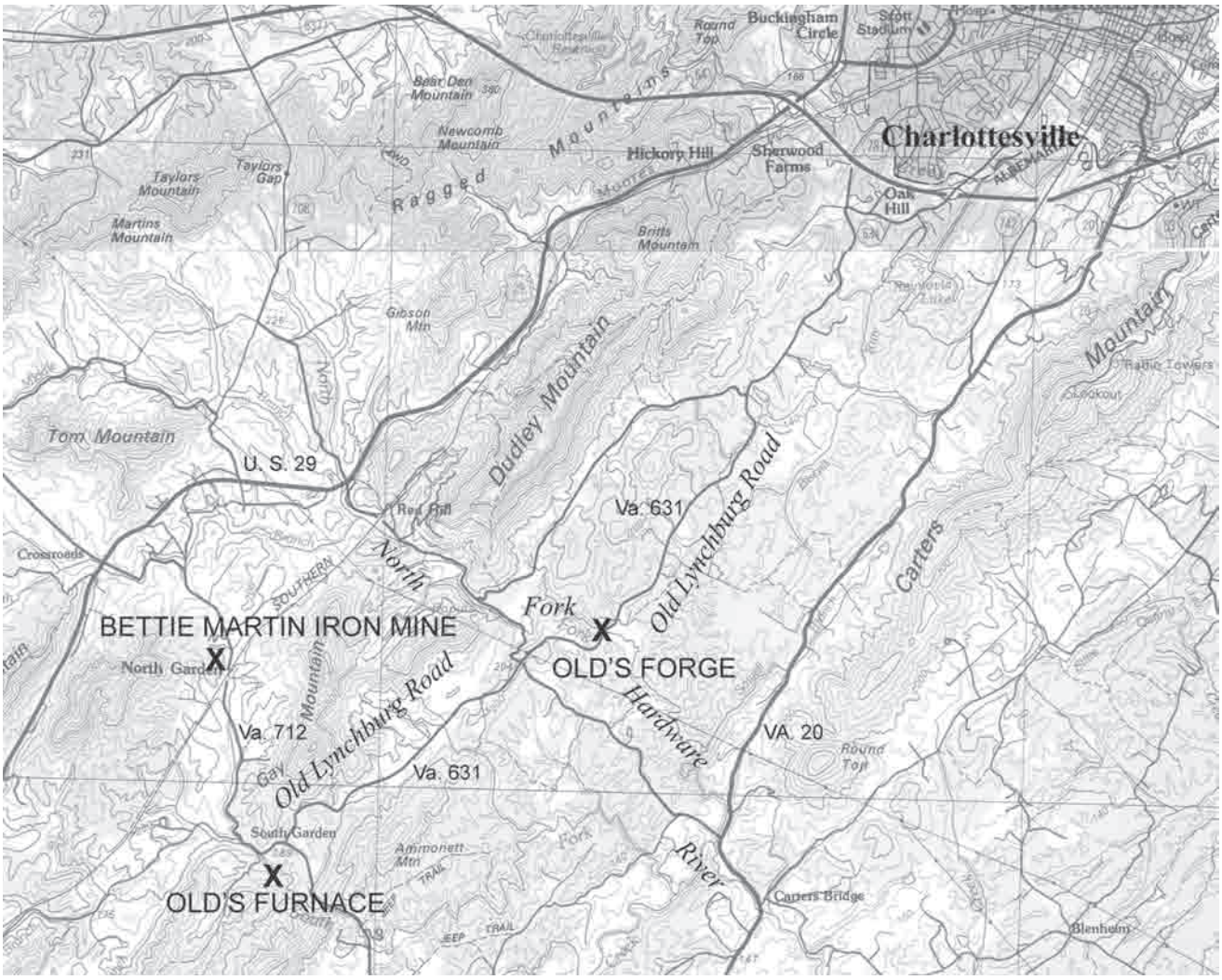

Figure 1. Location of the Bettie Martin iron mine, Old's furnace, and Old's forge in Albemarle County.

a trip hammer, producing bar iron, which was malleable. Bar iron became the source metal for the blacksmith to make wagon tines, horseshoes, hinges, nails, and tools. A foundry was strictly a casting operation, in which pig iron was smelted and cast into the desired product (Brady, 1991). Although reports do not specify a foundry, the late Tom Brady found fragments of partially worked wrought iron and an oval slab of iron, approximately 2 inches thick and about 16 inches across (Reynolds, 2003). These pieces, and the need for iron products, suggest a foundry was associated with the forge.

The mine was opened in early 1771, with William Cabell, Edward Carter, Alexander Trent, and Thomas Walker investing 500 pounds each, and John Wilkinson putting up 1000 pounds. The company bought many parcels of land, perhaps for additional yet unproven mineral deposits, or for wood to supply charcoal for a furnace. The iron was mined and hauled by wagon about 2.5 miles to the south-southeast to the Old's furnace, located just east of "Pancake Falls", north of the South Fork of the Hardware River. The location of this furnace has been described as "below the Falls and south of Garland's Store" (King, 1983). The furnace is on private property and permission should always be obtained before entering, as failure to do so violates trespass laws and is punishable under law. The furnace was begun

by John Old, who formed the Albemarle Furnace Co. in 1771, with eleven stockholders putting up a total of 2000 pounds. One of the stockholders was Thomas Jefferson, who invested 100 pounds; Dr. Thomas Walker (Peter Jefferson's doctor) invested 300 pounds. Dr. Walker was also one of the administrators of Peter Jefferson's estate in 1757, and guardian of the children including Thomas. He was also in the House of Burgesses from Albemarle County with Thomas Jefferson from 1770-1774 (Disbrow, 1940). The other investors were James Buchanan (300 pounds), Dr. William Cabell (200 pounds), Colonel William Cabell (200 pounds), Joseph Cabell (100 pounds), Edward Carter (300 pounds), Allen Howard (200 pounds), Nicholas Lewis (100 pounds), John Scott (100 pounds), and John Walker (100 pounds). As with many Colonial industries, Great Britian wanted ore mined and smelted, but discouraged Colonial manufacture, preferring to ship finished products to the Colonies at a handsome profit. This was somewhat cleared up by the British Iron Act of 1750, which ruled that pig iron could be shipped into England duty free from the Colonies (Condit, 1959). However, it appears that it was still illegal to produce and distribute iron-wares for local use and therefore furnace production records were loosely maintained (Lewis, 1979).

The iron ore at the mine occurs in a salt and pepper-colored granitic rock (biotite gneiss of the Lovingston Formation). There are eight primary minerals in the ore body: magnetite, ilmenite, apatite, biotite, grunerite, hornblende, zircon, and garnet (Dagenhart and Maddox, 1977). The magnetite was a suitable iron ore, but in combination with the ilmenite introduced an unwanted amount of titanium. Apatite is a granular mineral that may be white, green, or brown in color and contains appreciable phosphorus, which is detrimental in iron manufacture as it makes the iron brittle at room temperature (written communication, J. Brothers, 2001). The quality of the ore was poor because of the titanium and phosphorus content. Liberating these elements from the iron required more charcoal to heat the ore; therefore more wood had to be cut. The operation became unprofitable. As is usually the case in a failed operation, Wilkinson, the manager of the mine, was charged with inefficient management. He counter-charged that he was never allowed a free hand nor placed in control for sufficiently extended consecutive periods to develop the property adequately. The project was finally abandoned.

The Bettie Martin mine was idle for about a century, until 1870, when Andrew Hunter of Michigan and several local citizens reopened the old mine. During the Civil War, Hunter had picked up a piece of the unusually heavy iron ore while on sentry duty at the Southern Railway Depot in North Garden. Hunter employed W. N. Durrett and Lorenzo Sibert to work the mine, however the mine was again abandoned after about a year when the quality of the ore proved unprofitable. A chemical analysis made around 1882 noted that the ore contained 52.52 percent iron, 10.97 percent silicon dioxide, and 6.55 percent titanium dioxide (Bowron, 1882).

In 1960, a class from the University of Virginia, performed a magnetic survey of the mine site. It is reported that they found a magnetic anomaly centered just southwest of the pit, indicating that the ore body probably extends up the ridge toward the southwest along the trend of the rocks in the subsurface. Presently the mine area consists of a large open cut, about 200 feet long and trending northeast to southwest (Figure 2). The cut is about 35 feet deep in the northwest end and probably 30 to 40 feet wide at the top. A caved shaft is present just up the ridge, southwest of the cut and several exploratory pits are scattered around the mountainside. It is not known how much of the present excavation was done during the 1771-1772 period and how much was done later after the Civil War. Samples of magnetite, ilmenite and apatite can be found, mainly on the dump and in the new logging road on the southwest side of the mine, towards the top of the mountain.

In addition to the Old's furnace and Old's forge, one other operation was also constructed during the 18th Century, located about one mile below Carters Bridge, near a colonial church by

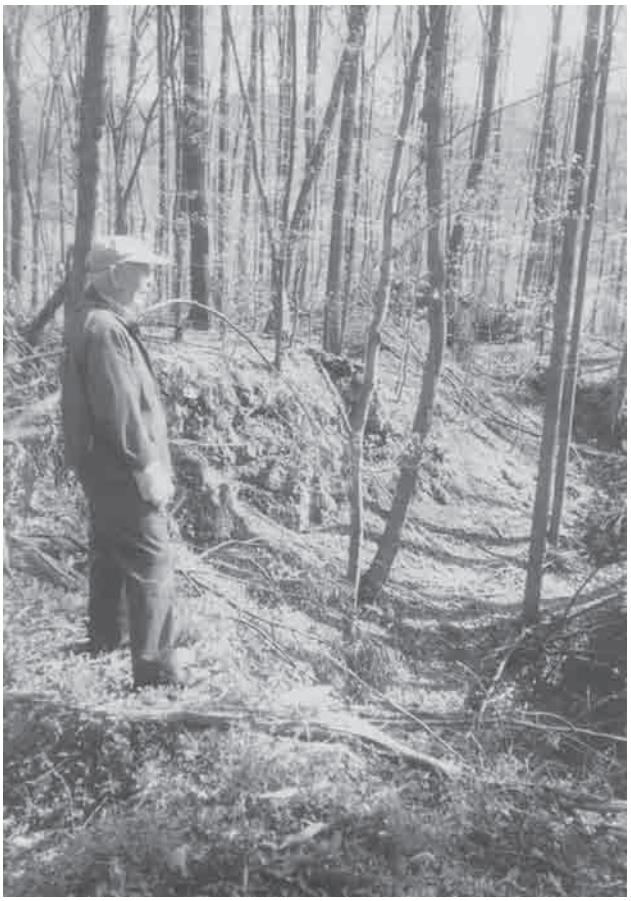

Figure 2. Looking southwest through the open cut of the Bettie Martin iron mine is long time North Garden resident and former mailcarrier, Mr. Jim Napier.

similar name (Forge Church). The forge south of Carters Bridge is located on the historical map of Albemarle County by Massie (1907). It appears that only Old's forge, built by John Old after he acquired acreage in September, 1778, was used to any extent. He worked the forge for a little less than ten years, shutting down in 1787.

Charcoal furnaces required that a furnace stack be situated adjacent to a hill or ridge from which a bridge could be built to the top of the furnace for loading charcoal, limestone, and iron ore. Along with storage for ore, there also had to be an adequate water supply to power the water wheel for the bellows. A reasonably level area adjacent to the furnace was needed to accommodate the casting floor. Most of the work in making iron was in mining, collecting, transporting, and crushing iron ore and limestone, cutting wood, and making charcoal. Quality of the finished product, be it pig iron or ready-to-use iron wares, depended upon the right proportions of materials and optimal furnace temperature as well as the initial quality of the ore (King, 1983). A millrace, or flume, was built along the ridge from Pancake Falls, and cut through rock in some cases, to bring sufficient water to the waterwheel to power the bellows. Much of the rock cut to form the flume on the hillside was used to build the furnace. Remmants of the old flume can be seen where the rock was cut and can be traced back to the Falls (Figure 3). Once in blast, the furnace remained so for six to nine months, depending on the condition of the furnace and the weather. According to several sources, the production of charcoal required an extensive labor force for each operation. A cord of wood

Figure 3. Remains of the old flume or millrace can still be seen along the hillside, just west of Old's furnace site, and east of Pancake Falls.

would generally produce 40 bushels of charcoal, and on average it required 200 bushels of charcoal to produce one ton of pig iron. One acre of forest would yield about 19 cords of wood. Furnaces of about the same period, in Wythe County in Southwest Virginia, used better grades of iron ore and consumed an average of 750 bushels of charcoal, 12 tons of iron ore, and unknown quantities of limestone to produce about 5 tons of pig iron every 24 hours. About an acre of forest was cleared daily to produce these 750 bushels of charcoal (Mandigo, 1986). With the additional titanium and phosphorus content in the ore from the Bettie Martin mine, additional charcoal was needed to raise the temperature in an attempt to remove the titanium and phosphorus from the iron. It is questionable where the limestone came from, however, there are several old quarries nearby, in the Everona Limestone.. The Farm and Home Lime quarry is located, along with two older small quarries, on the north bank of the Hardware River on Mount Pleasant Farm, east of Keene (Nelson, 1962). Other possibilities are the Hart and Bishop limestone quarries, located northeast of Blenhiem. The chemical composition indicated that the calcium carbonate content is about 74 percent at the Bishop quarry (Mack, 1965). All three of these quarries were operated to produce a burnt lime mainly for construction in the Charlottesville area in the early-to-mid-1800s. Massie (1907) indicates the presence of limekilns near the Hart quarry and to the south of the limestone quarries. Because of their proximity to Old's furnace, limestone for flux may have come from these sites in the 1770s. Some millstones at Kidd's Mill, located on Plank Road (State Road 712) just northwest of the Bettie Martin iron mine, were used to grind limestone (personal communication, D. Martin, 2003).

To begin operations, the furnace was loaded from the "bridge" with charcoal, limestone, and iron ore. The stack was completely filled with charcoal and lighted; it was allowed to "fire" all the way to the bottom. At this time, the bellows were put in operation to begin the forced-air blast required to bring the temperature up to approximately 2500^{o} F to melt the ore. As the ore melted, additional iron ore, limestone, and charcoal were continually added to the furnace. The limestone acted as a flux and would engulf the titanium and phosphorus minerals and produce a slag, which being less dense, collected on the surface of the molten iron. A clay door at the bottom of the furnace would be broken away, usually twice daily, to allow the molten iron to run out onto the casting floor and into molds which formed the pig iron. Slag was extracted through a clay door above the molten iron. Pieces of slag, showing enclosed charcoal with wood-structure, along with the iron impurities can be seen in the river near the furnace site (Figure 4). The slag has been analyzed and indicated 2.6 percent phosphorus; small amounts of strontium, yttrium and zirconium have also been noted (written communication, J. Brothers, 2001). The pig iron formed when molten iron flowed into a casting bed made of sand sculptured to allow the liquid to follow a main trench (the "sow") and then feed into numerous side gutters (the "pigs"). The casting of items such as pots, pans, skillets, mortars and pestles, and stove parts were made using molds in a casting shed (Brady, 1991). After the iron and slag were removed, the clay was packed in again and the furnace was recharged.

Old's furnace had all of this, and probably produced many necessary items for the community through casting of the iron. A letter dated January 16, 1772, from the mine foreman (W. T. Waddell) to Thomas Walker mentions the cutting of 155 cords of wood for the furnace, thus there must have been some production of iron from the furnace (Page-Walker manuscripts, 1770-1805). This letter also documented the use of slaves in at least the preparation for the furnace operation. The operation was short lived, maybe because of financial mismanagement. Wilkinson informed Walker in a letter dated June 28, 1774, that a Mr. Smith had brought a judgment against the company for seven surveys made the previous year (King, 1983).

Bruce (1931) notes that the House of Burgesses extended a loan of 2000 pounds to bolster the Albemarle Iron Company. The

Figure 4. Pieces of slag are still present (center of photograph) in the South Fork of the Hardware River.

legislature secured an obligation of repayment either in the form of pig iron at the current market rates on delivery, or in a mortgage on the third of the company's property. In December, 1777, the members of the Company were Old, John Wilkinson, and Alexander Trent. On that date, the company owned about "8329 acres of patented land well stocked with iron ore, a good grist mill with two pairs of stones, land in Albemarle, Amherst, and Augusta Counties". For a period of four years, Old's property was mortgaged for 1158.6 pounds with interest and in order to carry on the works the three partners agreed in writing to invest in 3000 pounds in stocks on January, 1778 and 300 pounds the following April. The House appointed Nicholas Lewis and John Coles, trustees of the Government Fund of 200 pounds to be advanced gradually to Wilkinson as he should need money to carry on the works (Bruce, 1931).

Evidently only Old's forge was in operation in 1781 when Thomas Jefferson published his Notes on the State of Virginia. Production had likely halted before the court case that dissolved the company in 1796 (Woods, 1901). Presently the furnace site is a pile of rocks, overgrown with trees, in the floodplain, on the north side of the South Fork of the Hardware River (Figure 5). Former landowners of the property have unearthed two cannonballs in the past. The field has deposits of silt and debris from major hurricanes in the early 1800s, 1900, 1933, 1969, and 1972.

Figure 5. Only a pile of rocks, overgrown with trees, constitutes the remains of Old's furnace.

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