

Jefferson County Ironworks

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The nation's westward march took a small but noticeable step on May 10, 1742, when Thomas Mayberry<sup>1</sup> entered into an agreement to "erect a bloomery<sup>2</sup> for making bar iron on the plantation of William Vestal lying on the Shunnandore [Shenandoah] River." Located south of Harpers Ferry, Vestal's Bloomery was the first iron furnace west of the Blue Ridge Mountains. Mayberry was paid "400 pounds Curr. Money of Pennsylvania" for his services and also retained an operating interest.

William Vestal's plantation contained all of the necessary ingredients for an iron works. Besides iron ore, the smelt required a fluxing agent – limestone – which was present. A strong-flowing spring powered the water wheel which, in turn, cranked the bellows. And most importantly, there was a large tract of woodland from which to make charcoal. Depending on ore yield and furnace efficiency, it took 130 or more bushels of charcoal<sup>3</sup> to make one ton of iron.

In 1755, Mayberry received a Fairfax grant for 400 acres near the mouth of the Shenandoah. This acquisition may be indicative of the Bloomery's success. Mayberry may have acquired the land as a woodlot reserve for future charcoal production.

The bloomery furnace was charged with a batch of ore, limestone, and charcoal. As the ore smelted, the free iron formed lumps, or "blooms". The forgemaster pulled the bloom from the furnace with long tongs, then placed it on the anvil and directed his strikers to hammer the bloom into a bar. The bloom was hammered out, folded and welded, and hammered again. This process continued until the slag had been expelled. Typically, these bars measured 2" square by 3' long and weighed 40 pounds.

Bar iron, more commonly known to you as wrought iron, was the raw material that the local blacksmith could use to make axes, hammers, knives, hoes and plows. A skilled blacksmith could forge a sewing needle or fish hook or forks and spoons as easily as he could make the links for a logging chain or hinges for a door. It could be said that Vestal's Bloomery and the local blacksmiths, rather than two major rivers, are what put Harpers Ferry on the map.

George Washington was quite familiar with Harpers Ferry. When just sixteen, he joined the survey party that mapped Lord Fairfax's extensive holdings in the Northern Neck of Virginia (1738). His trip into the wilderness certainly gave him

knowledge of the Potomac River basin. By 1754, he came to believe that a canal route linking the Chesapeake Bay with the Ohio River was feasible.

Washington had a personal interest in western development. Governor Dinwiddie awarded a military bounty of Ohio River land in 1754 to soldiers of the Virginia Regiment who fought under General Braddock. Though it would take years to perfect his land claim, Washington's westward vision had been firmly set.

Upon his return from a trip to Pittsburgh, Washington became an investor in the Potomac Company (1785). Work on what would later become the Chesapeake and Ohio Canal<sup>4</sup> commenced at Georgetown. George Washington hoped that industrial development in the Potomac Valley would in turn spur commerce in the nation's capitol. Washington understood that the capitol – the Federal City as he called it – would never be a great city if it existed solely as the seat of government.

One of the early industries on the upper Potomac was Friend's Orebank, an iron ore mine named for the tract's original owner, Israel Friend. Commissioned by Governor Calvert as an ambassador to the Shawnees in 1725, Friend was one of the first whites to settle west of the Shenandoah. Two years later, he purchased land on the Maryland side of the river from the Indian Chiefs of the Five Nations. This property would become the site of Frederick Forge and later, Antietam Iron Works.

Interestingly, Israel Friend's Antietam tract was measured by "arrow shoots" – a shoot being the farthest distance that an archer could shoot an arrow. The Indians knew nothing of surveying but nevertheless had devised this rudimentary way to measure land area. Friend's land measured 200 shoots along the river with a depth of 100 shoots and then the backside was squared off to intersect with and then follow Antietam Creek back to the beginning point on the Potomac.

Israel Friend also received a regal land grant of 300 acres<sup>5</sup> in 1734. Narrow in breadth but five miles long, this Virginia property followed the Potomac's meander, lying upstream of Harpers Ferry from River Bend to near Elk Run. This was Friend's Orebank, a rich deposit of brown hematite<sup>6</sup> yielding up to 78% iron.

Israel Friend died about 1750. Despite anecdotes that he produced iron, there is no evidence that he did so. His estate inventory does not reveal any mining tools and there are no historical references to pre-1750 ironworks. Though he did not develop the Orebank, he apparently was aware that he owned a valuable mineral deposit. He sold 100 acres of the original grant in 1746 but retained all of the acreage where iron ore was present.

Enter John Semple in 1763. Semple, owner of Occoquan Iron Works in Prince William County, took control of Friend's Orebank from John Ballendine. Ballendine

had purchased the Orebank from Jacob Friend, Israel's son. Semple had financed Ballendine in the Occoquan venture and when Ballendine defaulted, Semple took over both operations.

To develop the Orebank, Semple built a blast furnace at the confluence of Elk Run and the Potomac. He named it Keep Triste Furnace and began operating in 1764. The words "Keep Triste" appeared in Semple's family motto (Scottish).

Keep Triste was a continuous blast furnace. At 30'-50' tall, this type of furnace<sup>7</sup> is built to run around the clock. And rather than produce bloom iron, the blast furnace operated at a much higher temperature producing cast, or pig iron. When the founder tapped the furnace, molten iron ran out into a series of moulds that looked like a sow with her suckling piglets. Hence, the name.

Pig iron from Keep Triste would have had a high carbon content making it too brittle for general use. Pig iron was refined further in either a puddling furnace or a finery and then rolled or hammered into bars or strips.

Aside from his ventures in iron, John Semple was a man with big dreams. His dreams<sup>8</sup> paralleled those of Washington's when it came to making the Potomac navigable. He bought thousands of acres of land on credit and, in the span of a decade, his empire crumbled. John Semple died in debtor's prison in 1773.

Semple's holdings went through foreclosure in 1786 and the successor owners built a second furnace at the Orebank about 1788. One of the successor owners was Henry Lee, father of Robert E. Lee. Keep Triste Furnace was rebuilt in 1792 and employment at the works expanded to fifty.

Pig iron production continued at Keep Triste until 1800 when two events coincided. The US government purchased the mining rights at Friend's Orebank and wood for charcoal had all but been depleted.

As hoped for by Washington, industry did develop along the Potomac. Various mills took advantage of free water power. Then, in 1799, came the centerpiece of development, gratis the government—the nation's first armory was built at Harpers Ferry. Not merely an arms repository, Harpers Ferry Armory was a manufacturing plant. Rifles would now be made from machined, interchangeable parts, a revolutionary change in technology.

President Thomas Jefferson, himself no stranger to the area, objected to federal ownership<sup>9</sup> of the Orebank. Perhaps Jefferson's objection carried weight. The federal government never mined the Orebank nor did it attempt to manufacture iron.<sup>10</sup>

In 1803, Capt. Meriwether Lewis procured rifles and supplies from Harpers Ferry Armory. The armory also fabricated a collapsible iron boat frame for the expedition. Of his visit to Harpers Ferry, Lewis wrote President Jefferson on April 20th:

“My detention at Harper's Ferry was unavoidable for one month, a period much greater than could reasonably have been calculated on; my greatest difficulty was the frame of the canoe, which could not be completed without my personal attention to such portions of it as would enable the workmen to understand the design perfectly. My Rifles, Tomahawks & knives are already in a state of forwardness that leaves me little doubt of their being in readiness in due time.”

The Model 1803 rifles performed admirably on the expedition. And the spare interchangeable gun locks proved a godsend when expedition blacksmiths could no longer repair the original actions. But the genius of Lewis and his “Experiment”, as the iron boat was called, fell short of its goal on July 9<sup>th</sup>, 1805. He launched the boat on the Missouri River above Great Falls. There was no pine tar or pitch to be found in the area so the soldiers attempted to waterproof the hides that covered the iron frame with tallow. The boat sunk<sup>11</sup> and the iron frame was disassembled and buried in a cache the next day in case Lewis needed it to return home.

Was Vestal's Bloomery iron used for the Experiment's frame? The answer to this question is “Yes.” Provided, of course, that armory Superintendent Joseph Perkin bought the wrought iron based on local availability. Keep in mind that he had no lead time to anticipate this project. But the answer might very well be “No.” Given Lewis' meticulous planning, he may have demanded using only the best quality iron – gun barrel metal.

Harpers Ferry Armory purchased gun barrel skelps<sup>12</sup> from Pennsylvania works in the Juniata district and from Connecticut works in the Salisbury district. Though Antietam Iron Works made machine tool castings for the armory from 1827-1830, none of the Virginia and Maryland ironworks were geared to make gun metal.

Connecticut had two major advantages. First, ironmaking had been going on there for a much longer time. And second, the nation's other armory was located at easily accessible Springfield, Massachusetts. Whereas Harpers Ferry had continuing problems with a shortage of skilled workers because of its remote location, the Connecticut River Valley enjoyed a stable force of skilled millwrights. The area teemed with foundries and forges.

Eli Whitney<sup>13</sup> serves to illustrate. When Joseph Perkin died in 1806, Whitney was offered the superintendent's position at Harpers Ferry. He favorably considered the offer but had to decline because he was so involved in lawsuits to protect his cotton gin patents. Had Eli Whitney, a man of such knowledge and innumerable contacts,

accepted the position, then the armory's future would surely have been bright. Instead, the armory's workforce and its arms quality continued to deteriorate until reaching their nadir in 1830.

In 1829, Thomas Dunn, the competent and able manager of Antietam Iron Works, was hired as armory superintendent. He was not popular; he was hired to improve production and quality control. But just six months after his appointment, in January 1830, a former armorer, Ebenezer Cox, walked into his office and shot him dead with a pistol. Cox was executed for the crime but things had gotten so bad that many locals considered him a folk hero. While news of Dunn's assassination may have played well locally, it sent shockwaves through the arms industry.<sup>14</sup>

The last ironworks developed in Jefferson County was in 1839 at Shannondale on the east side of the Shenandoah. Purdue, Nichols and Co. sited the Shenandoah Furnace alongside a stream that has since been called Furnace Run. Shenandoah Furnace produced up to three tons of pig iron daily with a workforce of fifty. Purdue, Nichols and Co. shipped iron pigs overland by wagon, by boat, and also ferried them to Harpers Ferry to load on the train.

Reports say that the furnace burned 200 bushels of charcoal per ton of iron. This amount seems high. On the other hand, the neighboring mountainside was denuded of trees during the furnace's twenty-year run.

Given the reports of charcoal consumption and depleted woodlands, this furnace was probably doomed to fail anyway. But the Civil War began before that happened and the Shenandoah's demise is now preserved in legend. Believing that Confederates were hiding there, the Yankees set the works ablaze.

During the period 1800-1869, the government did not mine Friend's Orebank. But the owners of the Antietam Iron Works did, and did so in a big way. For unknown reasons, the government did nothing until 1837 to prevent its property from being mined by others. When brought to court for a settlement of the question, the court ruled that the United States did not have exclusive mining rights. The government took no action afterward and finally sold its interest in 1869. Friend's Orebank was actively mined by various companies until about 1917.

Antietam Iron Works remained in operation during the antebellum years but its ownership changed hands several times. About 1842, Antietam's owners built a coke-fired furnace at Lonaconing in western Maryland. (Coke is to coal as charcoal is to wood.) In 1845, the company began blending coke with charcoal at Antietam Iron Works.

The introduction of coke as a blast furnace fuel signaled a major change in the industry. Tariffs on imported iron were significantly reduced in 1842 and would later be phased out altogether. The shift from charcoal to coke came about as a result of this. Charcoal had gotten too expensive because of the labor involved in making it.

While references give the Civil War as being the death knell to iron works such as Vestal's Bloomery and Shenandoah Furnace, their closure was already assured by changes in the industry. In 1855, the Soo Canal opened access to the rich iron ores of Michigan and Minnesota. The Bessemer converter was also patented that year. The Bessemer furnace turned iron into durable steel, the metal that the nation's railroads needed for both rails and rolling stock. America's appetite for iron and steel could no longer be sated by local ironworks in tucked-away valleys. The Industrial Age was on.

That Friend's Orebank had such a long run—about 155 years—is quite remarkable.

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1 Thomas Mayberry (also Maybury) was born about 1692 in Herefordshire, England. He is believed to have arrived in America before 1717. He purchased 1000 acres of land in Berks County, Pennsylvania in October 1742. On this land, he established the Green Lane Forge and the Hereford Furnace. He died in 1764 having been known as “the ironmaster.”

One might speculate that Mayberry demanded payment for building Vestal’s Bloomery in Pennsylvania currency because he had already made plans to purchase the 1000 acres land in Berks County.

The Hereford Furnace operated from 1734-1768 and produced the first cast iron cook stove with oven made in America (1767). Green Lane Forge remained in the Mayberry family until it was sold in 1814.

2 A bloomery was a small furnace built with locally available stone and lined with clay. The furnace was fired with charcoal using a forced air draft. This forced air draft (the blast) was necessary to generate the high temperature (minimum 2200° F) needed to smelt the ore. In the bloomery process, the iron is not heated to a molten state as it is in a large blast furnace. Instead, the air blast melts the gangue (minerals other than iron; they have a lower melting point), oxidizes most impurities, and renders the iron into blooms.

The operator located his furnace near a strong flowing spring and used its constant flow to turn the waterwheel rather than depend on the changing flow of rivers and streams. Waterways were valued as transportation routes.

Some bloomery operators installed a helve to hammer the blooms rather hire laborers as strikers. A helve was a water-powered trip hammer. The same waterwheel would have operated the bellows and the helve.

3 Mr. Jack Thorp, a charcoal burner at the Capon Furnace in Hardy County, WV gives the following description of their method of burning or coaling:

A piece of ground was made level for about 90 feet across and sufficient size to hold 30 cords of wood. The lap wood was first placed around the level area and the cord wood piled on the space against it. A chimney was made in three-corner shape, out of cord wood, laid horizontal. The second tier of cord wood laid around it and covered with leaves so as to make the pile airtight and prevent dirt from coming in.

The whole pile was then covered with dirt, 2 or 3 inches thick at the bottom and 7 or 8 inches on the top.

In firing, small pieces of wood were placed in the chimney flue and a bed of hot coals thrown in on this wood. After the fire was well-started, the chimney was filled with wood and the rapidity controlled by a cover over the top of the chimney. When all of the wood was burned out in the flue, more was thrown in. Around the bottom of the coal heap, pipe holes were made and opened and closed so as to draw the fire to the different parts of the mass.

It required six full days of burning before any [char]coal could be drawn. If carefully burned, the yield should be 40 bushels of [char]coal to the cord of wood.

A pit holding more than 40 cords of wood, in Mr. Thorp’s experience, would not give good result in drawing; 400 bushels of [char]coal could be removed at a time, using great care that it did not take too much air and catch fire.

Morland, James R., The Early Cheat Mountain Ironworks, pp. 110-11

4 Canal construction suffered years of fits and starts. The Potomac Valley was remote. The work was rugged. And when the workers got paid, they sometimes headed for a distant tavern, never to return to their canal jobs. Yellow Fever (often referred to as Bilious Fever) was such a scourge in that age that the slightest rumor of an outbreak of the fever caused labor gangs to throw down their shovels and flee.

Beginning at Georgetown, the canal was not completed to Harpers Ferry until 1833—the same year that the railroad arrived. The canal was built to Cumberland in 1850 and that is where it stopped. By then, the Baltimore and Ohio Railroad had crossed the Alleghenies and its track crews were headed toward Wheeling. Unforeseen by Washington, it was the railroad, not a canal, that would link the Chesapeake Bay with the Midwest.

5 Surveyed in 1802 as 398 acres.

6 Found as both ledgerrock and boulders. Hematite boulders, mixed with clay, were found in fissures of the underlying dolomitic limestone formation. Workers sluiced river water to the site wash the clay from the hematite rocks. The ore is also often referred to as limonite.

7 Ideally, the blast furnace, built with dimension stone and lined with clay, ran until it failed. However, we can assume that cold weather iced the waterwheel and snow brought transportation of ore and charcoal to a halt. Valley Furnace in Barbour County was one of the first ironworks to replace its water-powered bellows with a steam engine and fan (1850.)

8 John Semple is also noted as a promoter of the C & O Canal. He had frequent meetings with George Washington about making the Potomac River navigable. Semple's company even opened a channel at one gravel shoal in order to ship ore to Antietam.

9 "Whether this method of supplying what may be wanted will be the most advisable or that purchasing at market where competition brings everything to its proper level of price and quality is for the legislature to decide, and if the latter alternative is preferred, it will rest for their further consideration in what way the subjects of this purchase may be best employed or disposed of." Thomas Jefferson, February 2, 1802 in *A Compilation of the Messages and Papers of the Presidents, 1789-1897*. Vol. 1, p. 335. (From Theriault, William D., *Friend's Orebank and Keep Triste Furnace*, p. 55)

10 In 1820, Harpers Ferry Armory installed a puddling furnace and recycled its considerable reserve of scrap iron and milling machine cuttings. Some 60 tons were recycled that year which was about one-third of the total iron used.

11 From Lewis' journal, July 9, 1805: "... she leaked in such manner that she would not answer. I need not add that this circumstance mortified me not a little; ... therefore the evil was irraparable ... from these circumstances I am preswaided, that had I formed her with buffaloe skins singed not quite as close as I had done those I employed, that she would have answered even with this composition. but to make any further experiments in our present situation seemed to me madness; the buffaloe had principally d[e]serted us, and the season

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was now advancing fast. I therefore relinquished all further hope of my favorite boat and ordered her to be sunk in the water, that the skins might become soft in order the better to take her in peices tomorrow and deposited the iron fraim at this place as it could probably be of no further service to us. ... but it was now too late to introduce a remedy and I bid adieu to my boat, and her expected services.”

Lewis buried the iron frame in a cache but did not retrieve it in 1806 when the expedition was heading home. Archaeologists are searching for the cache.

12 Skelps (flat bars) were manufactured to strict dimensions—1/2” thick x 3” wide x 44” long. They were heated to yellow heat and then curled in a jig until the ends butted together. The seam was welded, thus making the barrel tube. The barrel was trimmed to length, one end plugged, and then trued for straightness. The final step was milling the bore.

Skelps had to be free of any defects lest the barrel explode. The barrels were proof fired before assembly. Using Pennsylvania skelps and then welding by hand hammering, the armory had failure rates of 25%. When the armory began using the Springfield Armory’s mechanical trip hammers to weld Connecticut-manufactured skelps, the failure rate dropped to 10%.

13 Eli Whitney was born in Massachusetts. He owned and operated a musket factory near New Haven, Connecticut and was a pioneer in the manufacture of identical parts.

14 Lemuel Pomeroy, a military contractor in Pittsfield, MA, wrote to Roswell Lee: “We ought to be thankful to that Kind Providence which has cast our lot in a part of the country where the moral sense of the people is our security ... from such outrages.”

Roswell Lee was superintendent of the Springfield Armory (1815-1833) and had been sent to Harpers Ferry as its acting superintendent for about 6 months in 1827 to establish reforms and guidelines. Thomas Dunn was trying to implement Lee’s reforms and policies. As an example of how the working environment had deteriorated, Dunn rewrote the employment manual to forbid loitering, gambling, and drinking on armory property.