NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES
State of New Hampshire, Department of Cultural Resources 603-271-3483
19 Pillsbury Street, 2nd floor, Concord NH 03301-3570 603-271-3558
Voice/ TDD ACCESS: RELAY NH 1-800-735-2964 FAX 603-271-3433
http://www.nh.gov/nhdhr *preservation@nhdhr.state.nh.us*

CHRONOLOGY OF THE DEVELOPMENT OF THE NEW HAMPSHIRE IRON FACTORY COMPANY FROM 1805 TO 1884

JAMES L. GARVIN
NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES
MAY 1994; REVISED AUGUST 1994, OCTOBER 2009

1764 Town of Franconia incorporated.

1794 Jeremy Belknap, writing Volume III of his *The History of New-Hampshire*, mentions bog iron ore and refers to a report that describes a portion of Mount Washington "where the magnetic needle refuses to traverse; this is probably caused by a body of iron ore," but makes no mention of a discovery of such ore near Franconia.

1801 According to research by Duncan C. Wilkie, based on Grafton County court records (63-323, 63-324, 63-325) of 1814, the first forge and dam built on the two-acre blast furnace lot were erected in the summer of 1801 or 1802 by Simon Oakes, Thomas Spooner, and David Applebee. Their dam was located forty feet from their forge. On April 16, 1805, the three sold their property to Daniel Bartlett, a Massachusetts blacksmith. In two sales the same year, Bartlett sold three-quarters, and then the remaining one-quarter, of the forge, land, water privileges, and a coal house to Asa Towne. Towne was an incorporator of the New Hampshire Iron Factory Company (see below).

1805 The New Hampshire Iron Factory Company was incorporated by the New Hampshire Legislature. Named incorporators were Asa Towne, Amos Towne, Solomon Towne, Moses Lewis, Stephen P. Webster, Samuel Hutchings, William Simpson, Joshua Goodale, and Stephen Couch. The operation of the New Hampshire Iron Factory Company began to be referred to as the "Lower Works" after the incorporation of the following.

1808 The Haverhill and Franconia Iron Works was incorporated by the New Hampshire legislature. According to Eliphalet Merrill, writing in 1817 in his *Gazetteer*, these "Upper Works" were "built on the same plan as the former, but their operations are not

yet so extensive." Duncan Wilkie states that the "Upper Works" were located on the Ham Branch of the Gale River, about a mile from the "Lower Works." We know much less about the "Upper Works" than about the "Lower Works."

1809 Elias Hasket Derby of Salem, Massachusetts, compiled a lengthy study entitled "Interesting Facts Relating to Iron Works, compiled by Elias Hasket Derby for the use of the Franconia Iron Company." This hand-written compilation, accompanied by meticulously drawn diagrams and figures, includes copies of forty articles and patents, largely transcribed from encyclopedias and philosophical magazines. Derby's compilation suggests the low level of practical experience possessed by the founders of the company.

1810 A report on the condition of the New-Hampshire Iron Factory Company was written by Joseph Bray of Boston, and published in Salem, Massachusetts. Bray noted that "when the Company commenced its establishment on the banks of the south branch of the Amonoosack, it there owned but two acres of land, on which stood a small forge." This forge, built at a cost of $2,200 by a Mr. Sarjent under the direction of incorporator Amos Towne, had proven insufficient and had been replaced by a new forge shop with four fires and two trip hammers. The company initially had great difficulty in obtaining lumber, common bricks, and limestone for flux; and "the first fire-stone used in the [first] furnace was imported from Connecticut, and the transport alone cost upwards of 20 dollars per ton."

By 1810, according to Bray's detailed inventories, the company owned 5,456 acres (a tract sufficient to supply its entire need for charcoal), a farm, a tavern, a saw- and gristmill, a blacksmith shop, a store at Franconia, and a store at Bath for the sale of its iron products. By this time, the company was taking all of its ore from the Coleby lot on Ore Hill. This ore was described as superior to that from the Howland lot, which the company had previously mined. The Howland lot was made still less advantageous by the fact that the competing Franconia and Haverhill Iron Works owned 15% ("the right of one and a half tenth") of the ore from the Howland lot and used the same road for their ore wagons, to the detriment of the condition of the road.

The company then employed David Smith as its agent. Smith recommended both technological and administrative changes in the running of the company, including the building of a second furnace so that one could be used strictly for the production of pig iron and the other, presumably, for casting hollowware. If the corporate directors chose not to build a second furnace, Smith requested permission to redesign the lining of the present furnace, enlarging the inner diameter by 18 inches and thereby increasing the daily capacity of the furnace by 50%. Smith also urged the employment of a trained bookkeeper, accustomed to double-entry bookkeeping, in order to improve the directors' capacity to analyze their true financial position.

Smith was also critical of the staffing of the furnace. He urged the employment of a good founder who understood the casting of pig iron; the employment of good forgers or refiners who could turn cast iron into wrought iron without the waste of time and fuel

caused by current workmen, who were slow and inefficient; the employment of a practiced steel baker who would use the new but idle experimental steel furnace or a larger one to be built; and the building of a new trip hammer shop attached to the company's blacksmith shop. By introducing the manufacture of steel, Smith assured the company's directors that they would have a product that would enjoy an almost unlimited demand and would replay the expense of freighting it all the way to coastal ports, whereas the current products of cast and wrought bar iron and hardware would never command a market beyond the surrounding countryside.

1811 According to Charles T. Jackson, writing in 1841 and again in 1844, the furnace then in operation was "erected in 1811, has been in operation since that time, and produces from 250 to 500 tons of excellent cast iron per annum." As reported below, however, extensive alterations to the furnace were carried out in 1816, so it is difficult to know whether the furnace standing in 1841 was actually built in 1811, or whether this was misinformation.

1816 A report by William P. Page discussed the recommendations made by consultant Isaac Williams, who had been employed at Livingston's Furnace and was called "one of the most experienced Iron Masters in the country" by Page. Williams recommended the rebuilding of the furnace lining and lower parts, but evidently proposed to keep the major walls of the existing furnace intact. Page said that "we . . . went to work, removed the old lining and hearth, had stones for the new Furnace got out and repaired, and in short of three weeks from the time she blew out, had fire in her again." Page's report makes it clear that the furnace he rebuilt had an ovoid inner section, and this agrees with a diagram copied by Elias Hasket Derby about 1809. "Mr. Williams was not satisfied with any part of the old Furnace. It was too low, the shape of the cavity was bad, the boshes were too steep" and "together with the hearth, were badly worn by the fire." The steep boshes precipitated the charge too quickly into the lower portion of the furnace, while the enlarged upper section encouraged combustion too high in the stack. The result, according to Page, was that the old furnace burned "in [an] irregular state, and from what I could learn, it had been more or less the difficulty of all former blasts." In addition to giving the rebuilt furnace a conical interior above the boshes (the shape illustrated in a cross-section published in 1844 by Jackson), Page and Williams raised the top of the furnace from twenty-four to twenty-eight feet in height, narrowing its dimensions from the old. They made a number of changes in the hearth area, and increased the diameter of the blowing piston.

The fact that the furnace had a blowing engine with a piston in 1816 is significant. In his diagram of a blast furnace, Elias Hasket Derby illustrated such a machine and described its pumping cylinder as six feet in diameter. According to Victor Rolando's history of iron, lime, and charcoal manufacture in Vermont, *200 Years of Soot and Sweat* (1992), the builders of the Monkton Iron Company blast furnace art Vergennes, Vermont, considered such an engine in 1808, but "wooden cylinders were so new that no one was found who knew how to make them," and so this furnace was blown by bellows. Rolando further states that "the accepted year for the appearance of blowing tubs in the Northeast is 1835." Yet we seem to see that the furnace at Franconia had such an engine

before 1816, one that possibly survived from the time of construction of the first furnace before 1810 or from the rebuilding that may have taken place in 1811 following David Smith's recommendations.

In addition to the changes he describes being carried out to the furnace and blowing engine in 1816, Page repeated the recommendation, made by David Smith in 1810, that the company erect a second furnace for castings. The older furnace would thereby be managed in a way that would increase the production of pig iron, while the second furnace, an "Air Furnace," would further refine the cast iron during re-melting, permitting thinner and finer patterns to be used and producing a more refined cast product. An air furnace is defined by Victor Rolando as a horizontal reverberatory furnace, not a vertical blast furnace.

At Page's suggestion, ore was then taken from "the Ditch, which had for some years been abandoned, [rather] than at the opening last made near the head of the hill." The miners were instructed to use a smaller diameter stone drill with a less delicate point, thus avoiding breakage of drill points while nevertheless making smaller holes that required less powder in blasting. They also returned to a type of "lean" ore that had previously been thrown aside as worthless, finding that it made good iron when mixed with the purer ore in the rebuilt furnace.

1817 When Eliphalet Merrill published his *Gazetteer of the State of New-Hampshire* in this year, he could state that

> The works consist of a blast furnace with a reservoir of water near the top as a precaution against fire, an air furnace, a steel furnace, a pounding machine to separate the iron from the cinders, a forge with four fires and two hammers, a turning lathe, and a trip hammer shop with four fires and two hammers.

If this is n accurate description, it appears that the recommendations of iron masters David Smith and Isaac Williams had been followed scrupulously by the company's board of directors, providing the company not only with a rebuilt blast furnace but also with a reverberatory furnace for re-melting iron for casting and a third furnace for making steel.

1823 The *Digest of Accounts of Manufacturing Establishments in the United States and Of Their Manufactures* (1823) describes the production of the Upper and Lower Works under one entry, not differentiating their individual products. According to this document, the iron factories of Grafton County produced "stoves, cooking and parlor; hollow ware, potash kettles, machinery, bar iron, &c." with a market value of $24,500 and part uncertain." The establishments annually consumed 1,000 tons of ore and 300,000 bushels of charcoal with a value of $17,000. They employed 90 men and paid $8,000 in annual wages. Their facilities included "2 blast furnaces; 8 forges; 2 trip hammers, &c.," and were "partly in operation." The amount of capital invested was given as $200,000. The report goes on to note that

> This statement includes two establishments; with respect to one of which it is represented that there is abundance of the raw material in the neighborhood; yet, from the low price of imported iron, the high price of labor, and [the] dull market, the establishment is but partly in operation. And with respect to the other [establishment], it is said that, previously to, and during, the late war, sales were readily effected; but that owing to the general gradual depression of business since that time, the sales have rather diminished, and that the company have a large amount of manufactures on hand unsold.

John Farmer's and Jacob B. Moore's *A Gazetteer of the State of New-Hampshire* (1823) notes that

> The ore is obtained from a mountain in the east part of Concord [renamed Lisbon in 1824], three miles from the furnace, and is considered the richest in the United States, yielding from 56 to 63 per cent, and the mine is said to be inexhaustible. About twelve or fifteen tons of iron are made in a week, and sixty men on an average are employed annually.

1824 The *Report of the Secretary of State, Of Such Articles Manufactured in the United States as Would Be Liable to Duties If Imported From Foreign Countries* (1824) tells us that in that year both the Haverhill and Franconia Iron Factory and the New Hampshire Iron Factory Company were authorized to issue stock to the amount of $200,000. While the New Hampshire Iron Factory Company was listed as producing "bar iron, ironmongery, hardware, etc.," the Haverhill and Franconia Iron Factory was described as producing "iron, & other things which may be wrought from ore." This implies that the "Upper Works" may have produced only wrought iron, possibly by the direct process, rather than both cast and wrought products, yet a newspaper advertisement of the following year (see below under **1825**) lists a furnace among the assets of the company.

1825 *New-Hampshire Patriot* of July 18, 1825, advertised the sale of the Haverhill and Franconia Iron Manufactory (the "Upper Works"), giving the most detailed description of that operation that has yet come to light:

> **NOTICE.**
>
> The Proprietors of the HAVERHILL and FRANCONIA IRON MANUFACTORY, having concluded to dispose of their establishment, offer the whole for sale, consisting of the Mill privilege with 240 acres of land adjoining, with the Furnace, Forge, Blacksmith shop, Grist and Saw Mills, 2 Warehouses, 1 Store, 3 large barns, 6 dwelling houses, one of which is calculated for a Tavern, and another for the Agent there, and the ore hill, with an inexhaustible vein of Iron Ore.
>
> The Mill Seat at Bath and every other portion of their land will be sold on the most reasonable terms, and at very reduced prices, for cash or approved notes with interest.

> The manufactured Stock consists of Bar Iron, Plough moulds, Sleigh Shoes, Tire Iron, Crow bars, Ox Chains, Shovels, Scythes, and a great variety of tools and wrought iron. Iron Castings, viz. Pot Ash and Cauldron Kettles, Pots and Kettles of various kinds, articles for family use, a variety of Plate, Cooking, and Close Stoves, Gudgeons, Cog wheels, Forge hammers and a variety of machinery. Grain, Salt Pork, Cloths, Hats, and a great variety of articles too numerous to mention.
>
> Persons disposed to make great bargains will be pleased to call on the Agent without delay, as the whole will be closed by the 1st of Oct. next. G. REYNOLDS, Agent.
>
> Franconia, N. H. July 18, 1825

It should be noted that a George Reynolds was active in Manchester, N. H., from 1856 to 1860 as a superintendent of the Blodgett Edge Tool Manufacturing Company, and patented a machine for making axe polls in 1858. Perhaps he had previously worked as the agent of the Haverhill and Franconia Iron Manufactory.

The *New-Hampshire Patriot* advertisement suggests strong parallels between the physical plants and the holdings of the New-Hampshire Iron Factory Company and the Haverhill and Franconia Iron Manufactory, with the major difference apparently being that the latter owned much less acreage (240 acres) than the former (which held 5,456 acres by 1810 and 4,500 acres in 1857). To judge by the Joseph Bray report of 1810 on the New-Hampshire Iron Factory Company, and on the *New-Hampshire Patriot* advertisement for the Haverhill and Franconia Iron Manufactory, both companies had a blast furnace, a forge or forge shop, a blacksmith shop, dwelling houses, a tavern, saw and grist mills, and property at Bath, N. H.

1827 According to various modern secondary accounts, perhaps beginning with the WPA book *Hands That Built New Hampshire* (1940) and repeated in Enzo Serafini's "Franconia's Forgotten Iron Industry," *White Mountain Echoes* (Winter 1952), "in 1827 the Upper Works was destroyed by fire and never rebuilt." The following source, however, suggests that the Upper Works was reestablished; this reestablishment is not listed in the *Index to the Laws of New Hampshire* (1886).

1829 A government publication, *Documents Relative to the Manufactures in the United States* (1832), tells us that "The Upper Works of Franconia, in Grafton County, was established in 1829" (see below under **1832**). This apparently refers to a second company that was constituted after a fire in 1827 (see above under **1827**). The report further lists this company's products as bar iron only, implying that the blast furnace mentioned in the newspaper advertisement of 1825 may have been inoperative or that the company converted the total product of the blast furnace to wrought iron.

1832 *Documents Relative to the Manufactures in the United States* (1832) gives the following information about the Upper and Lower Works:

The New Hampshire Iron Factory Company. This factory is located in Franconia, in the County of Grafton. It was established in 1805. The value of real estate, water power, buildings and machinery, is $50,000, the original cost of which was $200,000. The expense of manufacturing 300 tons of castings and 130 tons of bar iron, is $27,200, the sales of which amount to $34,000.

The Upper Works of Franconia, in Grafton county, was established in 1829. The value of real estate, water power, buildings and machinery, is $10,000. The expense of manufacturing 50 tons (gross) of bar iron, is $3,250, the sales of which amount to $5,500.

The New Hampshire Iron Factory Company have not, until lately, been successful. The articles formerly manufactured were of an inferior quality, but at present they are preferred, and the blacksmiths in the neighborhood of the works, set a high value upon the bar iron for many purposes.

It is impossible to ascertain the number of persons employed in these establishments, as the ore is dug and transported to the works by contract, and the labor is mostly done by the job. When by the month, the lowest rate is $10, and boarded; and the highest rate by the month is $14, and boarded. When employed by the day, the rate is $1 per day, and boarded. The article of bar iron is sold in Boston at 90 to 100 dollars per ton, and the laborers are paid at the work in bar iron, at $140 per ton. The present rate of profit of the New Hampshire Iron Factory Company is 15½ per cent. per annum, and that of the Upper Works 22 ½ per cent. The hollow ware is sold in New Hampshire at 6 cents per pound.

The manufacturers of these establishments at Franconia are so remote from the points of importation, that they are entirely out of foreign competition, within a circle of 50 miles.

1832 An article in the *New-Hampshire Statesman and State Journal* (Concord, N. H.) on September 29, 1832, gives an eyewitness description, which apparently first appeared in the *Charlestown Aurora*, of the Lower Works. The apparent reference here to a "brick furnace" seems likely to describe a brick lining of a stone blast furnace, as described earlier, rather than meaning to imply that the blast furnace was actually an "immense brick cone." This article further describes the blowing engines in use at the furnace.

Visit to the Iron Works at Franconia, N. H.—We embraced an opportunity, some time since, of visiting this establishment, situated on the west branch of the Ammonusuck river, about 15 miles from Bath, N. H. The agent, Capt. Putnam, is a very kind and gentlemanly man, and accompanied us over the different departments. The mine is distant thee miles from the furnace. At the mine the ore costs $4 per ton; 75 cents per

ton is paid for teaming, and 25 cents per ton is the cost of burning (or *fluxing*) with lime stone, preparatory to blasting—so that the ore, when ready at the furnace, and for the furnace, costs about $5 per ton. Two tons of ore, nearly, are required to produce one ton of iron, though the ore has averaged for some years nearly 60 per cent.

The blasting furnace is kept in operation about six months in the year. Charcoal is the only fuel used in the establishment. The furnace is of brick, conical, and perhaps thirty or forty feet in height—ten or twelve feet in diameter at the base, and two or three feet at top. To prepare the furnace for the ore, this immense brick cone is filled with charcoal from the top, and kept burning, night and day for ten days, when alternate charges of ore and coal are continued night and day, perhaps for six months, or until the furnace requires repairs.—Of charcoal between two and three hundred thousand bushels are annually used. The preparation and transportation of this article gives employment to many hands, and the demand for it enhances the value of woodland in the neighborhood.

The furnace is kept in blast by the transmission of a strong current of air, by apparatus of peculiar construction. Water power is employed, and puts several air forcing pumps in motion. By these pumps the air is forced into a large reservoir, furnished with a floating piston, on which there is a great weight. The pressure of this piston on the air, forces a regular, equal and strong current thro' proper tubes to the furnace, or to several furnaces. The magnitude of the machinery for these immense bellows is truly surprising, when compared with its use and effect. The water power is used for other purposes, as turning and hammering, both with *tilt* and *trip* hammers.

The iron being disengaged by the fire from the ore, becomes liquid, and is used for castings from the furnace, or prepared for making wrought or bar iron. The furnace and casting Department are in the same building.—When it is to be made into bars, the iron undergoes another process called *flourishing*—perhaps from its appearance, for after it is flourished it is rough and ragged, and *prickly*, like a teazle. This process, and that of hammering it into bars, separates the carbon and oxygen from the iron, and it then becomes wrought iron. It requires about 28,00 [*sic*] pounds of cast iron after flourishing, to make 2000 of bar iron. At this establishment there are four furnaces for the manufacture of bar iron, at each of which about 500 lbs. can be made per day—one ton by the four—two hands to each furnace. The process of drawing the iron, by the tilt hammer of monstrous size and great power, is exceedingly hard and hot work.

The company carrying on these works has been in operation for 27 years. Its capital stock was originally $200,000, and no dividend has ever been declared, though considerable improvement on the establishment, and additions to the stock have been made. The capital of the Company is

> wholly owned in Boston and Salem. For several years past the company have done a good business. The bar iron is said to be of the very first quality, and much superior to the English.
>
> We were highly gratified with the visit to this establishment, and procured some fine specimens of iron ore, and before we left the village were furnished with several specimens of copper ore, from a mine lately discovered in the neighborhood—all of which we intend for the collection now in progress by our valuable Lyceum Institution. We mention this by way of hint to our friends who may have opportunities for collecting specimens.
>
> *Charlestown Aurora.*

1833 E. T. Coke, in his *A Subaltern's Furlough*, Vol. II (New York, 1833), seems to confirm the continued existence of the Upper Works when he states

> I rode out early the following morning to the iron-works at Franconia, about six miles distant. They are the property of a company, and produce metal of a soft, tough quality, considered superior to any in the States. The ore is found in considerable quantities in the hills, three miles distant, and supplies another foundry in the immediate vicinity; both establishments, however, are upon a small scale.

1841 Charles T. Jackson, M.D., issued his *First Annual Report on the Geology of the State of New-Hampshire* in this year, repeating many of his comments concerning the New Hampshire Iron Manufacturing Company three years later in his *Final Report on the Geology and Mineralogy of the State of New Hampshire* (Concord, N. H., 1844). Jackson notes that the "granular magnetic iron ore" then used exclusively by the company contains 69.04% iron, of which 60% was recovered during refining and 9% wasted. The company's agent was then Captain Putnam, who stated that the blast furnace was erected in 1811 and then produced from 250 to 500 tons of "excellent cast iron" per annum, which was partly sold in the form of castings and partly converted to bar iron—100 to 140 tons per year—at the forges.

Captain Putnam reported in 1841 that "the stack of the furnace was built of granite, and is lined with mica slate, which is found in the vicinity" with the hearth stones being made of Landaff quartz rock. The furnace was kept in blast from 16 to 26 weeks at a time, consuming from 200,000 to 300,000 bushels of charcoal each year. Each single charge of the furnace consisted of 15 bushels of charcoal, 280 pounds of iron ore, and one box of limestone for flux. Jackson reproduced the yearly production summary for the year 1838, which revealed that the blast continued 24 weeks that year, 160 bushels of charcoal were required to smelt a ton of ore, and the average yield of the ore was 55.12% of iron.

In the same report, Jackson describes the sourced of limestone used as flux at the New Hampshire Iron Manufacturing Company. He states,

> Limestone likewise abounds in the town of Lisbon, near the S.W. extremity of Mink Pond, and is quarried and burnt for lime in several places. The principal quarries which are wrought belong to Messrs. Orren Bronson, Thomas Priest, David Priest, and Uriah Oakes. . . . Mr. Oakes' quarry is situated 2 miles west from Franconia furnace, and is wrought to some extent for lime. This kiln is built like the one before described, but is of larger dimensions, containing 100 tierces of lime. It is built of the common rocks found in the vicinity, and is lined with mica slate. The walls are from two to three feet in thickness, and the lining is 1 foot thick. The cost of the kiln was $100. He sells his lime for $1.50 per tierce, without the cask, and for $2 when packed in casks. . . . This limestone is situated favorably for supplying the Franconia furnace with a flux to be used in smelting their iron ores, and I believe they obtain it for that purpose.

1844 In his final report of 1844, Jackson reproduced a cross-section of a blast furnace from M. Dumas' *Chimie appliqué aux Arts*, stating that this diagram "represents so nearly the structure and proportions of the Franconia furnace, that I have not thought it necessary to print my sketch, which was made from measurements taken when cold blast was used at that furnace." Jackson went on to say that "the stack of Franconia furnace, by my measurements, is 34 feet high, 8 feet 3 inches in diameter at the boshes, or 12 feet before the lining was put in," and that the boshes were 6 feet above the hearth; the blast arch is 8 feet 8 inches wide; and the casting arch is 11 feet wide.

This description (and the Dumas cross-sectional diagram) indicates that the furnace was then a cold blast furnace with only one blast arch rather than the three arches present in the existing furnace.

Jackson also described Tyson's Furnace in Plymouth, Vermont, a hot-blast furnace, stating that "since a much larger daily product of iron is obtained by less consumption of fuel, the hot blast is applicable to many of our New England furnaces. I understand that the hot blast has recently been introduced, at my suggestion, in the Franconia furnace, but I have not yet witnessed the result, the change having [only] recently been made."

1849 In *A Gazetteer of New Hampshire* (1849), John Hayward states:

> The town [of Franconia] owes its rise and prosperity to the discovery and working of a rich vein of granular magnetic iron ore, which exists within the present limits of the town of Lisbon, at its south-eastern corner. The iron ore is a vein from three and a half to four feet wide, included in granite rocks. The course of this vein is north thirty degrees east, south thirty degrees west, and its dip is to the south-east seventy or eighty degrees. It has been opened and wrought forty rods in length, and one hundred and forty-four feet in depth. The ore is blasted out by workmen employed by a contractor who supplies the Franconia furnaces. The mine is wrought open to day-light, and is but partially covered to keep out the

rain. On measuring the direction of this vein, it was evident that it extended into the valley below, and on searching the hill-side, it was readily discovered in that direction.

1849 Victor Rolando located the following description of the iron works in J. T. Hodge, "Mining," in the *American Railroad Journal* (Henry V. Poor, ed., New York, May 5, 1849, vol. XXII, no. 609, pp. 273-275. This is the only known reference to a Catalan forge at Franconia. A Catalan forge is usually defined as a bloomery forge that receives its air blast from a trompe, a device in which water falling in a closed tube compresses air in the tube and thereby blows the fire without the need for mechanical action. A trompe requires a considerable head of water to produce an effective blast.

New Hampshire

The ores of New Hampshire, like those of Maine, are generally so situated that the expenses of transportation have rendered them of little value. Only one furnace is in operation, at Franconia, which was established as long ago as the year 1811. The ore is manganese oxide, yield sixty per cent. The furnace does but a small business, making only two and a half tons of iron a day. Charcoal is abundant, that made from hard wood costing only four cents per bushel. One hundred and sixty bushels are consumed to the ton of iron. Dr. Jackson states in the *Geological Report* that the ore costs six dollars per ton, of which the extraordinary sum of $5 is for mining. The furnace works with cold blast, and is estimated to be in operation from sixteen to twenty-six weeks per annum. The statistics do not indicate a very skillful management and it is probable that the remoteness of the site from any large market would not warrant more vigorous prosecution of the work. There are several veins of the ore, but the largest do not seem to average more than three feet in thickness, being situated, however, on the side of a mountain, the expense for drainage has been little. The rocks are gneiss, to the stratification of which the veins conform.

It may be interesting to note here the process as conducted in the year 1839, as described by Professor C. U. Shepard in the XVIII vol. *Sillman's Journal*. The works are situated 140 miles northwest from Boston. The two manufactories then in operation are each about four miles from the mine. Ore cost delivered and cleaned, $4.75 per ton; yield of pig iron 50 per cent; of bar iron, made directly from the ore in a Catalan forge, 33 per cent. The annual product of the works was 300 tons bar iron and 300 to 350 tons pig. Principally consumed in the conatry [*sic*], and the balance transported to Boston, at an expense down the Connecticut River of $12 per ton, or over land $25. At Franconia bar iron sold for $112 and pig iron $10 per ton.

> Other localities of iron ore are at Piermont on the western border of the state, where beds of excellent micaceous specular ore are represented to occur of sufficient quantity for working. And again at Bartlett on the eastern border of the state, where are found inexhaustible beds or veins of the mixed specular and magnetic oxides. Both these localities possess great facilities for the manufacture of iron; but the disadvantages of long inland transportation to any large market, which with those consequent to the severities of a high latitude, increased not a little by the great elevation of the country above the level of the sea, will probably long render them comparatively unavailable. Railroads, however, have now been commenced from the coast, which will pass—one of them within a few miles of Piermont—and the other to Conway, within twelve or fifteen miles of the mines of Jackson and Bartlett, so that the objection arising from the expense of transportation will soon be in a degree overcome.

1850 The United States Census of 1850 describes the property as including a water-powered shingle mill, a water-powered blast furnace, a water-powered cupola furnace, a water-powered forge shop with five fires and two hammers, a water-powered machine shop with nine fires and three lathes, a water-powered wheelwright's shop, a water-powered saw- and grist mill, and a horse-powered mine. A cupola furnace is a vertical furnace, akin to a blast furnace in design, for re-melting pig iron. Assuming that the term "air furnace" was accurately used in 1817, this earlier reverberatory re-melting furnace seems to have been supplanted by a vertically oriented re-melting furnace, probably with greater capacity, over the following decades of operation.

1855 Edwin A. Charlton, in *New Hampshire As It Is* (1855) states that

> In December, 1805, a company was incorporated under the name of the New Hampshire Iron Manufactory. The buildings necessary for the prosecution of the enterprise were erected on the south branch of the Lower Ammonoosuc, and consist of a large blast furnace, a cupola furnace, a forge, trip hammer shop, blacksmith shop, and pattern shop. From 20 to 30 men are constantly employed. 250 tons of pig iron and from 200 to 300 tons of bar iron are produced annually. The ore is said to be the richest yet discovered. It yields from 56 to 90 per cent.

1857 According to an advertisement of April 20, 1857, in the *New-Hampshire Patriot*, the entire property was to be sold at auction on May 6, 1857 at the tavern in Franconia, without reserve. The property was described as

> The entire property of the New Hampshire Iron Factory Company, (a large portion of which is only 5 miles distant from the White Mountains Railroad), consisting of about 4500 acres of unimproved land, situated in Franconia and the neighboring towns, mostly covered with a heavy growth of pine, spruce, hemlock, tamarack, and hard wood timber.

> Also, the Blast Furnace, (Pocket Furnace,) Forge, Machine Shop, stone Blacksmith Shop, Wood and Paint Shop, all situated in and near the Mill Pond, which affords ample water power for an extensive manufacturing business.
>
> Also, nine Dwelling Houses, Store and other buildings.
>
> The supply of iron ore belonging to the company is inexhaustible, and it is universally conceded to be in no respect inferior in quality and richness of yield to any in this country or Europe, and the manufacture can be profitably conducted, as in the immediate vicinity of the works there is a constant demand for vast quantities of pig and wrought iron.

It is hard to guess why the term "(Pocket Furnace)" is enclosed in parentheses in this advertisement. Does this term modify the words "Blast Furnace," indicating that the then-existing blast furnace was a pocket furnace, or does it merely refer to a secondary furnace? According to Victor Rolando, a pocket furnace was a diminutive blast furnace, often only five feet high, used either for preliminary testing of ore or for small-scale cast iron production for local markets. Possibly the cupola mentioned in 1855 took the form of such a furnace and the two terms, used two years apart, refer to the same device.

1859 The present furnace was constructed under the supervision of "S. Pettee, Jr.," whose name, accompanied by the date "1859," appears on one of the voussoirs of the northern or casting arch of the four-arch furnace.

Richard Sanders Allen has investigated Seneca Pettee, Jr., and has shown him to have been a leading iron master in southern New England who later moved to Maine. According to Allen's research, Seneca Pettee began his career in iron manufacturing in 1804, when he and a brother, Joseph, arrived at Taconic Mountain in Salisbury, Connecticut. Along with Willaby Dexter, the Pettee brothers finished erecting the King/Kelsey Furnace by 1810. Thereafter, Allen believes, Pettee was involved in building a blast furnace in Richmond, Massachusetts, in 1830.

Next, according to Allen, Pettee and Nelson H. Stevens of Richmond built a 37-foot-high cold blast furnace in North Adams, Massachusetts, in 1846. This was followed by the Cheshire Furnace in Cheshire, Massachusetts, which Pettee and partner Thomas N. Richmond built between 1848 and 1851. Later, according to Duncan Wilkie, Pettee served as agent of the Katahdin Iron Works in Maine in 1856.

According to the United States Census of 1860, the new owners, who incorporated themselves under the name of the New Hampshire Iron Company, ". . . Commenced operations July 1, 1859." The same census indicates that the mining operation in Lisbon employed 22 hands, with a 25-horsepower steam engine, to produce 1,000 tons of iron ore valued at $5,000 each year. This is a marked advance over the census returns of 1850, which described the mining operation as horse-powered, as employing 8 hands, and as producing 500 tons of ore valued at $2,500 in that year.

1863 The *Boston Daily Advertiser* of December 3, 1863 indicates that the property had been sold again.

> The Commercial Bulletin says the Franconia (N. H.) Iron Works have been purchased by a company in Boston and will be put in operation at once. The Franconia ore has a well established reputation, it being similar to the ore used in making iron equal to that in Norway and Sweden, from which the best of steel is made in England. About one hundred thousand dollars have been expended on the works within a year or two. They are now in perfect order, and contain a new blast furnace, a new forge with two trip hammers, and two forge fires, blacksmith shops, &c.

1865 An article on the "Franconia Iron Mine" in *The Granite Monthly* 4 (1881), p. 446, states that "for various reasons the work at the furnace and mine was suspended about 1865 and has not been resumed."

1870 The United States Census indicates no activity at the site; it was "Inoperative at Present," The same census states that $200,000 had been invested in the business and that it was powered by six water wheels generating 60 horsepower.

1878 C. H. Hitchcock, in Part V of his *The Geology of New Hampshire*, notes that the furnace here "continued in blast till 1870," quoting from Jackson to provide other statistics of the former operation.

1881 According to the *Index to the Laws of New Hampshire* (1886), the "New Hampshire Iron Factory Company" was reincorporated as the "New Hampshire Iron Company" in 1860 and again reincorporated as the "Franconia Iron Company" in 1881.

1882 *Independent Statesman* (Concord, N. H.), February 16, 1882:

> **PURCHASE OF THE FRANCONIA IRON PROPERTY**
>
> The negotiations for the purchase of the Franconia Iron property at Franconia, N. H., which have been pending for some little time, have been concluded, and the property has now passed into the hands of a strong syndicate of New Hampshire and Boston capitalists. The financial agents of the syndicate, Messrs. Ransom, Eldridge, and Straine, of Boston, are to be congratulated upon their success in securing this valuable property in the interests of the syndicate. The transaction is to be noted as one of vast importance to New Hampshire interests in promoting the growth of her industrial enterprises. The operations of her iron industry were given great prominence in times past by the successful working of these Franconia iron mines, whose large and valuable product made them famous throughout the country. The organization of a company containing leading men of the State with a large capital, is being perfected, and will

be announced when completed. The development of the property will be begun as soon as the company is organized.

Independent Statesman (Concord, N. H.), March 9, 1882:

THE FRANCONIA IRON COMPANY

In another column will be found a report of the proceedings of an important meeting of gentlemen who recently purchased the Franconia Iron property, held in this city, Thursday, [March 9, 1882] at which the organization of The Franconia Iron Company was perfected, and plans for future operation outlined. The officers selected are strong men, who know no such word as fail in their business enterprises, and the outlook for this new company is exceedingly promising. Should the experiments for manufacturing steel from the ore by the process to be adopted prove to be satisfactory, as they now promise to do, an immensely profitable future is in store for the company, from which our State cannot fail to profit.

Independent Statesman (Concord, N. H.), April 13, 1882:

FRANCONIA IRON COMPANY

A meeting of the Franconia Iron Company was held at the office of Ransom & Eldridge, in Boston, on Tuesday [April 11, 1882] and among those present were Messrs. B. J. Cole of Lake Village, T. H. Ford and Sylvester Marsh of this city, Dr. Spalding and Charles Williams of Nashua. Col. Archer, of the Alexandria, Va., Petroleum Hot Blast Works, was present and gave a detailed explanation of the process of making steel from iron ore, which interested the iron men exceedingly, and resulted in the appointment of a committee to contract with Col. Archer for the erection of Steel Works at Franconia, within ninety days, to make steel by the Petroleum Hot Blast process directly from the Franconia ore, which is ranked as one of the best iron ores in the country. The company also voted to sell $25,000 of the Treasury stock, and no more, and the erection of the steel works are to be vigorously pushed.

1883 The Franconia Iron Company was listed in the Concord Directory of 1883 at "Incorporated 1812" [*sic*], with offices at 72 North Main Street. The officers of the corporation were: Sylvester Marsh, president; Lyman D. Stevens, treasurer; Henry W. Stevens, secretary; S. Marsh, C. M. Ransom, T. H. Ford, Dr. Spaulding (Nashua), B. J. Cole (Lake Village), E. B. Parker (Lisbon), and Charles H. Greenleaf, directors.

1884 Fire destroyed all portions of the iron works except for the main blast furnace.

SOURCES

A Report on the Affairs of the New Hampshire Iron Factory Company. Pamphlet, Salem, Mass.: 1810. New Hampshire Historical Society, 622/N5322

An Act to Incorporate Certain Persons by the Name of the New Hampshire Iron Factory Company. Pamphlet, Salem, Mass.: 1808. New Hampshire Historical Society, 622/N5322

An Act to Incorporate Certain Persons by the Name of the New Hampshire Iron Factory Company with Additional Acts and By-Laws of the Company. Pamphlet, Salem, Mass.: 1842. New Hampshire Historical Society, 622/N5322

Charlton, Edwin A. *New Hampshire As It Is*. Claremont, N. H.: Tracy and Sanford, 1855.

Derby, Elias Hasket. "Interesting Facts Relating to Iron Works compiled by Elias Hasket Derby for the Use of the Franconia Iron Foundry." Manuscript, New Hampshire Historical Society, 622/N55322de.

"Franconia Iron Mine," *The Granite Monthly*, Vol. 4. Concord, N. H.: John N. McClintock, 1881.

Hitchcock, C. H. *The Geology of New Hampshire*. Concord, N. H.: Edward A. Jenks, 1878.

Jackson, Charles T. *Final Report on the Geology and Mineralogy of the State of New Hampshire*. Concord, N. H.: Carroll & Baker, 1844.

-----. *First Annual Report on the Geology of the State of New Hampshire*. Concord, N. H.: Cyrus Barton, 1841.

Merrill, Eliphalet, and Phinehas Merrill. *Gazetteer of the State of New-Hampshire*. Exeter, N. H.: C. Norris & Company, 1817.

Report to the Stockholders of the New Hampshire Iron Factory Company. Pamphlet, Salem, Mass.: 1816. New Hampshire Historical Society, 622/N5322

Rolando, Victor R. Transcription, October 1996, of J. T. Hodge, "Mining," in the *American Railroad Journal* (Henry V. Poor, ed., New York, May 5, 1849, vol. XXII, no. 609, pp. 273-275.

[United States] Secretary of the Treasury. *Documents Relative to the Manufactures in the United States . . . In Compliance with a Resolution of Jan. 19, 1832*. Reprint ed., 3 vols. Burt Franklin, 1969.