Chapter 4
The Ironworks Study

Study Methodology

Ironworks on an industrial scale commenced in Vermont a few years after the end of the Revolutionary War and ended about a century later. During that 100-year period, blast furnaces, bloomery forges, and foundries made or worked iron in all of the state's 14 counties. A majority of the blast furnaces and bloomery forges lay west of the Green Mountain range, generally in the valley of the Otter Creek.

Because few business records of these industries remain, it is not known for sure where all that iron went. Some Vermont iron found markets in local foundries and mills, but most probably ended up in works at Troy, New York, and Boston. Some iron might even have found its way to markets in Québec. Research into 19th-century canal and railroad records could provide some answers. Other sources of information might be hidden away in state or federal tax records, papers of incorporation, and banking and financial papers. All that remains now of these iron-making operations are the historical records as gleaned from dozens of town, county, and state histories, and their physical remains along mountain and valley streams.

Archival and field information that follows is the result of work done mainly from 1978 to 1988. When this project began in 1978, the author knew of only two blast furnace sites in Vermont: one at East Bennington with the ruins of two collapsed stacks and the other at East Dorset. The sites were visited, neighbors were queried, and some libraries were visited where card files were inspected for anything related with the iron industry (and card files yielded meager results). Files were eventually created while studying town, county, and state histories, trade journals, and maps. Frequent trips were made to the University of Vermont (UVM) Special Collections Library and the Vermont Historical Society (VHS) Library, with the purchase of many new and used books on local history in the process.

Trade journals and reports that provided 19th-century operating and production figures and descriptions for forges and foundries throughout the United States were of immense value. Many of these are found only outside Vermont. Also used were 19th-century county and town histories plus currently published and reprinted histories, publications of historical societies and museums, business directories, and U.S. Census reports. Much ambiguity in the historical descriptions of ironworks was encountered.

One of the more intriguing items was a short article published by the VHS in 1953 by State Geologist Elbridge Jacobs on the subject of ironworks, in which he claimed the following locations and dates of blast furnaces in Vermont:

Tinmouth	1783	Sheldon	1798	Dorset	1831
Bennington	1786	Vergennes	1799	Fairfield	1831
Pittsford	1791	Swanton	1799	Tyson	1837
Fair Haven	1797	Forest Dale	1810	Bennington	1853
Chittenden	1797	Manchester	1821	Pittsford	1859

Blast furnaces were built at many of these locations; forges were in use in others; both types were found at some of the works (Jacobs 1953:130). Jacobs' source of information was a manuscript sent to him by Charles Rufus Harte of New Haven, Connecticut. In an April 5, 1955, letter to Richard S. Allen of Albany, New York, Harte wrote that what he sent Jacobs was "a copy of a series of abstracts from various Vermont town histories, and for their accuracy—other than to the copying—I accept no responsibility, and of the furnaces I have very little personal knowledge."

Harte was otherwise an accurate and thorough historian of ironworks in New England, and authored a number of valuable articles and booklets on the subject in the 1930s and 1940s. He visited Vermont in August 1935 and photographed furnace remains at Manchester ("the merest trace"), East Dorset ("a beautiful little stack"), Pittsford ("behind a little mill on a side-road"), Brandon ("just south of where [Route] 7 crosses a big brook"), and Forest Dale "the Green Mountain stack, which was in very good condition").

Archival research has not uncovered the same historical references Harte said he was using or the photographs he took. Researching similar-named town histories in other New England states has likewise failed to resolve many of the iron-making site claims made by Jacobs and/or Harte. But this does not mean the data are incorrect. Many iron-making remains are still waiting to be rediscovered in Vermont.

Three series of maps were used to determine the existence, location, and time period of the ironworks. These were the 1796 to 1838 James Whitelaw maps of Vermont; the 1854 to 1859 Scott, Rice, McClellan, Walling, etc., county maps; and the 1869 to 1878 F. W. Beers county atlases. The Whitelaw maps used a Mars symbol ♂ (which in alchemy stood for iron) to indicate iron-making sites without differentiating between forges or blast furnaces. The county maps identify bloomeries and furnaces by owner or company name. Additionally, they display foundries, machine shops, mines and ore beds, raceways, dams, and buildings on village, town, and county scale. Maps with ironworks information were compared, site by site, directly to each other and to county, town, and state histories and gazetteers, ironworks reports, and ironworks-related articles. With this information, the sites were located as closely as possible on current USGS topographic maps and the effort then shifted out of the house and library and into the field.

At first thought, the search for an 18th- or 19th-century stone blast furnace does not seem so difficult that it requires a technique. In terms of its massive size, a blast furnace is about the height of a two- or three-story structure. Blast furnaces were usually made of large stone blocks, were surrounded by other structures and waterpowered devices, and thus should be in the midst of an acre or so of stone foundations. And some standing blast furnaces were quickly located in the field. But a collapsed furnace today resembles no more than a low, brush-covered mound. It can be as deceptively difficult to locate as a fully standing 30- to 40-foot-high stack in the heavily foliated

Vermont countryside. The location of the few obvious blast furnaces, such as Bennington and East Dorset, were made right from the truck window. The more difficult ruins resulted in many hours, and sometimes many weekends, of hiking through brush and wading in streams.

An electronic metal detector was tried with no satisfactory result. Iron-making and ironworking sites have become recipients of all manner of discarded machinery, some from later industries at the same site, some from trash dumped into waterwheel pits, cellar holes, and abandoned waterways (flumes, canals, and raceways). Searching for ironworks by inspecting the general area with a detector took time better spent looking for more accurate surface clues. One alternative to electronic metal detectors is dowsing. It was not tried but is claimed to have been used with some success around the world to find such things as buried pipes and cables, so why not a forge site (Hume 1969:36-39)?

The most obvious artifact at an iron-making site is the standing or nearly standing blast furnace ruin. The less obvious is slag, that ubiquitous waste by-product of the iron industry. But slag can be a misleading artifact. Good blast furnace slag is usually multicolored with a glassy surface. It will shatter easily if struck, and its slivers will injure unprotected eyes, hands, and feet. The slag can be shades of blue, green, black, and gray. Some slag will betray its former molten state through ripple marks on the surface or holes left by gas bubbles. Some glassy blast furnace slag might contain pieces of stone, iron, or charcoal, but most will not. Blast furnace slag is lighter in weight then bloomery forge slag, which is much heavier for the same size and much less colorful. Because the process of making bloomery iron (wrought iron) does not involve the high temperatures of the blast furnace process, bloomery slag does not appear glassy or multicolored. The lower bloomery forge temperature also results in an incomplete smelting process, resulting in a product that at one end of the bloom is more iron than slag, while at the other end is more slag than iron. Bloomery slag (the waste end of the bloom), therefore, contains much iron; the slag is much heavier and darker than blast furnace slag. Heavy, dark slag will usually indicate the site of a bloomery, and this slag is more often then not loaded with high levels of iron, unburned charcoal, and bits of stone.

Archeological analysis into historic blast furnace slag has been done by Professor John R. White of Youngstown State University, Ohio, who has shown that in addition to its chemical attributes, "the slags have visual attributes such as color, texture, and porosity which likewise provide clues to their use, temperature, effectiveness, etc. The effectiveness of the slag is a primary indicator of the efficiency of the furnace operation and the iron-making process" (White 1980:55). The type of fuel, whether charcoal or coal, for example, can be determined in the laboratory through slag analysis, thus affording further interpretive data on the state of the technology at the given iron-making site.

The extensiveness of slag heaps also indicates the degree of blast furnace activity. But slag accumulations at later blast furnaces were trucked for use as fill or mixed with tar for use in road building. Slag is useful for locating the ruins of collapsed blast furnace sites, first by finding the random pieces of slag along streambeds in the suspected area of the furnace, and second by following the slag indications upstream until none is found. Since slag and everything else washes downstream, note the increased number of slag finds in the streambed as the inspection proceeds upstream. A marked drop in slag finds signals the time to search for the site itself. But this technique is not always foolproof: bits of slag were tracked a quarter-mile up the Konkapot River, right past the actual forge site at New Marlboro, Massachusetts, to the back fill of a stream-side cemetery. In this case, the slag existed both upstream and downstream of the forge site.

Since early blast furnaces and bloomery forges depended on waterpower to produce the necessary draft, they located alongside dependably flowing streams, usually next to a major falls or rapids. With abandonment of the operations, most of the remaining artifacts worked their way into these streams and were washed farther downstream by yearly cycles of spring freshets augmented by ice movement. The streambeds in the vicinity of mills, therefore, became the depository of all manner of industrial artifacts (and contemporary domestic trash). Inspection of suspect streambeds for artifacts is therefore an essential part of a search for and inspection of the industrial site.

The best time to inspect the stream is late summer, preferably during an extended rainless period when water level and turbidity are low. A clear, sunny day is necessary to see the stream bottom clearly, strolling knee-deep into the stream, working upstream, keeping the sun behind if possible. Each side of the stream was inspected and the middle crisscrossed. Water deeper than knee-high significantly reduced bottom visibility. Care was taken not to step on glass or trip on underwater hazards.

Since the stream probably eroded new channels in the past century, inspection of eroded shorelines and accumulating sand and gravel bars aided in determining where a previous channel might have been and, therefore, where older wash may have accumulated. Heavy iron objects such as mill machinery, gearing, large bolts, braces, and shafts were usually found in deepest midstream or stranded in deep pools. The immediate bottoms of falls, if they are accessible, were good places to inspect. Relatively lighter objects such as bricks and slag were found closer to shore, although slags loaded with iron were also found in deeper pools.

Access to streams was easiest at a bridge, but high stone abutments and steep embankments sometimes caused problems. Residents rarely refused permission to walk through a driveway or backyard to gain access to fields and streams. Neighborhood children were usually quite knowledgeable about what was in streambeds and where "treasures" could be found. At Pittsford, however, hours were spent in a fruitless search for some "old machinery" in Furnace Brook until it slowly became apparent that the kids were talking about the rusted remains of an ancient Volkswagen, partially buried in a midstream sandbar. Another good technique was to inspect stream bottoms with binoculars from the center of bridges. This was especially fruitful when the pools were deep and a bright sun was directly above (midday). Drivers do not expect to meet people standing on narrow bridges, so care was taken not to get squeezed by trucks or run down by cars. I wish I had a better answer for the Vermont State Highway patrolman who stopped and asked why I was leaning out from the middle of the concrete bridge at East Middlebury.

Scaled sketches of the streams were made as inspections proceeded. Pencil was superior to ink; water drops smeared the latter. The general shorelines and gravel bars, rapids, quiet pools, and major boulders were sketched. Landmarks such as bridges, houses, and large trees were identified for later reference. Compass checks maintained orientation of zigzagging streams. When an accurate measurement could not be made, distances were paced between dependable reference points (but not trees, which might be cut down or washed away). All artifact finds were located on the sketch whether in question or not, saving a repeat inspection months later when the water was usually higher (and colder). Special attention was paid to evidence of marks such as machined cuts and drilled holes on ledges in the stream and on the shore.

Remains of dams were evidenced by stone block or concrete abutments at facing sides of the stream, although an abutment may have remained on only one side. Early dams were sometimes indicated by only a few one-inch-diameter holes drilled into underwater ledge. When one was found, I looked for others or a series of them every few feet across the stream. They usually marked the base of a dam and usually, but not always, were located at the top of a falls to increase the head. Corroborative evidence, such as remains of an earthen dam that might still exist high up the shore adjacent to the drilled holes, was also checked. The dam might not be directly related to an iron-making site, but a documented reference to a forge built so many feet downstream from another mill and dam often proved the value of the find. And just as a good mill site may have supported a succession of small mills, so may have the dam, with washouts by periodic freshets resulting in repeated reconstructions and possible enlargements.

A knowledge of dam-building technology and water privilege rights was helpful in further interpretation of dam sites. While searching for an 18th-century iron-making site in the La Platte River at Shelburne Falls, two iron rods were discovered, securely imbedded about twelve feet apart in a ledge on opposite sides of the center of the stream. The rods might have been anchors for cables that added support for a high dam, the remains of which stood on one shore about 50 feet downstream. Although remains of three dams (and a possible fourth) were found at Shelburne Falls, the exact location of Ira Allen's 1792 forge still remains a mystery, probably because it was destroyed by freshets and a succession of mills that followed at this excellent waterpower site.

Results of the Ironworks Study

Forty-three ironworks sites were reported to the State Archeologist during the 1978–1990 period of the overall state-wide study of ironworks and are now part of the Vermont Archeological Inventory. Five other sites, at which inconclusive or no positive surface evidence was found but subsurface material might exist, have been reported to the State Archeologist in the Field Site (FS) category. In-progress archival and field work continues at 51 more sites. The total number of ironworks sites studied is therefore 99 at this writing.

Table 4-1. Ironworks Sites

Site No.	Principal Name	Evidence of Associated Components* Blast Furnace	Bloomery Forge	Foundry	Iron Mine	Charcoal Kiln
Addison County						
AD-146	Monkton Iron Company	Yes	No		Yes	
AD-299	East Middlebury Iron Works		Yes	No		Yes
AD-300	Orwell Furnace	Yes				
AD-339	Eagle Forge		Yes			Yes
AD-340	Little Otter Furnace	Yes				
AD-404	Richville Forge	?	?			
AD-406	Sawyer's Forge		Yes			
AD-407	Salisbury Forge		Yes			
AD-414	Brooks Edge Tool Company			Yes		
AD-415	Wainwright/Davenport Foundry			Yes		
AD-416	Holley Forge		Yes			
AD-417	Lewis Creek Farm Forge		Yes			
AD-430	North Ferrisburg Forge		Yes			
AD-431	Doreen's Forge		Yes			
AD-432	Barnum/Nichols Forge	No	Yes			
AD-493	Baldwin Creek Forge		Yes			
AD-FS50	Ackworth Bloomeries		No			
AD-FS86	Franklin, (etc.) Forge	No	?			
AD-IW01	Downing Forge		No			

Table 4-1. Ironworks Sites (Cont.)

Site No.	Principal Name	Evidence of Associated Components* Blast Furnace	Bloomery Forge	Foundry	Iron Mine	Charcoal Kiln
Addison County (Cont.)						
AD-IW02	Nichols Forge	No	No	No		
AD-IW03	Vergennes Iron Company			Yes		
	White's Forge		No			
	National Horse Nail Company			Yes		
AD-IW04	Belding/Drake Furnace	No	No			
AD-IW05	Brooksville Pocket Furnaces	No				
AD-IW06	New Haven Mills Forge		?	?		
AD-IW07	Barnum Forge		No			
AD-IW08	Fuller Forge		No			
AD-IW09	Scott, (etc.) Forge		No			
AD-IW10	Scott Forge		No			
AD-IW11	Burnham Forge		No	No		
AD-IW12	Munson, (etc.) Forge		No			
AD-IW13	Fergusson Forge		No	?		
AD-IW14	Upper Lewis Creek Forge		No			
Bennington County						
BE-9	East Dorset Furnace	Yes			Yes	
BE-10	Bennington Iron Company (East)	Yes	No	No	Yes	Yes
BE-11	Bennington Iron Company (West)	Yes				
BE-35	North Dorset Furnace	Yes			No	Yes
	Allen Foundry			Yes		
BE-36	Burden Furnace	Yes			Yes	Yes
BE-64	Fassett and Hathaway Furnace	Yes				
BE-IW01	Bennington Forge		No			
BE-IW02	Woodford Furnace and Forge	?	No			
BE-IW03	Nobel's Forge		No			
BE-IW04	Dorset Village Furnace	No			No	
BE-IW05	Factory Point Furnace	?			No	
BE-IW06	Sage and Olin Furnace	No				
BE-IW07	"the Pup"	No				
Caledonia County						
CA-20	Paddock Iron Works	No			Yes	
CA-IW01	Joes Brook Forge					
Chittenden County						
CH-FS70	Spafford Forge		Yes			
CH-IW01	Ira Allen Forge		No			
CH-IW02	Shelburne Falls Forge		?			
CH-IW03	Stanton Forge		Yes			
CH-IW04	Seeley Forge		No			
CH-IW05	Milton Forge		No			
CH-IW06	Burlington Manufacturing Company		No	No		
Franklin County						
FR-67	Keith Furnace (West)	Yes			No	

Table 4-1. Ironworks Sites (Cont.)

Site No.	Principal Name	Evidence of Associated Components* Blast Furnace	Bloomery Forge	Foundry	Iron Mine	Charcoal Kiln
Franklin County (Cont.)						
FR-68	Keith Furnace (East)	No			No	
FR-149	Rock River Furnace	Yes				
FR-163	Barney Forge		No		No	
FR-IW01	Missisquoi Forge		No			
FR-IW02	Fairfield Furnace	No				
FR-IW03	Brainerd and Gadcomb Forge					
Grand Isle County						
GI-IW01	Goodwin Forge					
Lamoille County						
LA-IW01	Cady's Falls Forge		No			
Orange County						
OR-IW01	Randolph Furnaces					
Orleans County						
OL-3	Boston and Troy Iron Company	Yes	?	No		
OL-IW01	Phelps Falls Forge		No			
Rutland County						
RU-41	Green Mountain Iron Company	Yes	Yes	No	No	Yes
RU-57	Granger Furnace	Yes		No	Yes	Yes
RU-76	Tinmouth Channel Furnace	Yes			Yes	
RU-77	Rathbone Furnace	Yes			Yes	
RU-87	Chipman Forge		Yes			
RU-97	Chippenhook Furnace	Yes				
RU-99	Colburn Furnace	Yes				
RU-153	Gibbs and Cooley Furnace	?			No	
RU-162	Willard and Perry Furnace	Yes			Yes	
RU-171	Packard Mill/Forge		Yes			
RU-195	Gamaliel Leonard Forge		Yes			
RU-217	Conant Furnace	?			Yes	Yes
	Brandon Iron & Car Wheel Company	?		?		
	Howe Scale Company			?		
RU-FS17	Lyon's Works	No	No	?		
RU-IW01	Forge Flats		?			
RU-IW02	Miller Forge		No			
RU-IW03	Wallingford Furnace	No				
RU-IW04	Allen Forge		No			
RU-IW05	Carver's Forge					
RU-IW06	Dan Smith Forge		No			
RU-IW07	Castleton Forge		No			
RU-IW08	Joslin and Darling Forge		No			
RU-IW09	John Burnham Forge		?			
RU-IW10	Keith Furnace	No				
RU-IW11	Larnard's Forge					

Table 4-1. Ironworks Sites (Cont.)

Site No.	Principal Name	Evidence of Associated Components* Blast Furnace	Bloomery Forge	Foundry	Iron Mine	Charcoal Kiln
Rutland County (Cont.)						
RU-IW12	Sutherland Falls Forge		No			
RU-IW13	Spud Leonard Forge					
RU-IW14	Pittsfield Iron & Steel Company				Yes	No
Washington County						
WA-25	Rice's Furnace	No			No	
WA-IW01	Davis Forge					
Windham County						
WD-38	Somerset Forge		Yes			
Windsor County						
WN-51	Tyson Furnace	Yes	No	No	No	No
WN-FS14	Upper Falls Forge		No			
WN-IW01	White River Iron Company	No	No			

* Yes = some surface evidence
No = no surface evidence although component is documented
? = questionable field evidence
(blank) = no component association, or not field-checked

Table 4-1 lists the 99 ironworks sites that have been researched. The table lists the sites by county, and numerically within county by site identification number. Sites unreported (IW numbers) are those whose ruins or remains have not been found or where inconclusive evidence exists to positively identify the site. The table lists the site identification number, its principal name, and whatever ironworks components are associated with the site. Note that the area of component association in the table disregards geographic distance: if the component can be connected to the site by documentary association or by direct physical evidence, it is an associated component.

Following table 4-1 are sections that divide the state into northern, central, and southern districts, described in the Introduction in the front of this book ("Presentation of the Study"). In these sections, the history of the ironworks site and the descriptions of whatever physical remains exist are presented, within each section by county, and within each county, either in chronological sequence when practical, grouped to reflect a geographic proximity, or in a north-to-south sequence. Grouping does not reflect any commonality that might have existed when the ironworks were in operation, but aids in describing them. Accompanying maps provide a geographic sense of the physical disposition of the sites and ruins, without compromising the exact location of the site.

WARNING to Hikers and Explorers: Although appearing sturdy, furnace ruins are in fact fragile. Climbing about them loosens stones, weakens walls, and significantly contributes to their progressive deterioration. Blast furnace ruins can collapse without warning and crush people under tons of stone.

The Northern District

This district contains 22 ironworks sites, giving it an average density for such sites in the state. No iron-making sites are known to exist in Essex County. Blast furnaces account for eight of the iron-making sites, a notably higher percentage than in the central and southern districts.

Ironworks in Franklin County were generally centered in Highgate and Sheldon. A furnace site in Highgate is supposed to have dated to the Revolutionary War period, possibly earlier according to local tradition, and might have been that found alongside Rock River in the northern part of town. The site's proximity to the international boundary coupled with confusion of the boundary's exact location during that period might indicate furnace operation by Canadians. The furnaces at Sheldon were built by Alfred and Israel Keith following successful furnace ventures at Pittsford in the 1790s; previous to that, their father operated a blast furnace in eastern Massachusetts. The Keiths were also involved in iron making in New York State. Very little of these early Vermont ironworks remain to be seen.

The town of Troy in northeastern Orleans County was a wilderness when the Boston and Troy Iron Company went into operation there in the 1830s. Yet this remote site in the shadow of Jay Peak endured long, unproductive winters and inadequate transportation to make its mark casting stoves. It also cast heavy iron posts for the boundary between the United States and Canada, some of which are still there, continuing to do their job.

Chittenden County owes most of its earliest ironworks to the efforts of Ira Allen, who sought to attract buyers for his tracts of land in northern Vermont by building mills on the many plentiful streams and rivers through rent-free arrangements for prospective buyers. Politics and bad timing eventually undid Ira Allen's plans and he lost everything. Some of his forges were built alongside the Winooski River in the vicinity of the falls, just downstream of today's Route 7 bridge. This area has undergone intensive industrial development during the past 200 years, proving the soundness of Ira Allen's choice for mill seats. In addition to mill construction on the rocky precipices overlooking the falls, blasting into the rock ledges for water-power tunnels and dams has changed the face of the falls since Allen's forges made iron there. Early-20th-century views of the falls are on display inside the west end of the main Champlain Mill building at Winooski. Across Main Street (Route 7) at the Winooski end of the bridge is stairway access to a small park and a path to the ledges overlooking the falls. The bottom of the falls (the Salmon Hole) is best accessed by walking around the west end of former mill structures (now condominiums) along West Canal Street. Care must be taken, however, not to explore during spring thaw when the swift water is high; the vertical (and sometimes slippery) ledges are not fenced.

The blast furnace site at Waitsfield in Washington County is intriguing not only for the lack of physical surface evidence but also because it was unsuspected, discovered by chance during archival research.

CALEDONIA COUNTY

CA-20 Paddock Iron Works (St. Johnsbury): In 1815 at the western edge of the St. Johnsbury village, Joseph Fairbanks built a dam across the river. By the fall of 1815 a sawmill was operating at the dam and in the following spring, a gristmill. By 1818 Joseph's nephew Huxham Paddock had a trip-hammer and foundry operating at Sleepers River. His contract called for waterpower sufficient to drive a trip-hammer, grindstone, and two pairs of bellows, indicating the possibility of a bloomery (Child 1887:327).

Thaddeus Fairbanks, Joseph's son, built the Fairbanks Iron Works in 1823, continuing the industrial development near the Sleepers River dam. The works produced stoves and plows. The next year another son, Erastus, gave up his unsuccessful general store and joined the iron company, forming the E. & T. Fairbanks Company (*Fairbanks Standard* 1980:5). It is unknown what the Fairbanks foundry contained in the way of types of hearths for melting and casting, but the smelting of ore by blast furnace is doubtful. A blast furnace had been in operation since 1805 at Franconia, New Hampshire, less than 25 road miles to the southeast, smelting iron ore that was mined in that vicinity since the 1790s (Serafini 1952:15). Iron needed by the Fairbanks to cast their stoves and plows probably came from these Franconia forges until increased demand for iron by the new scale business encouraged Paddock to construct a blast furnace nearby. The E. & T. Fairbanks Company then went on to make its name in the manufacture of the world-famous Fairbanks Scale, operating today in St. Johnsbury as the Fairbanks Weighing Division of Colt Industries.

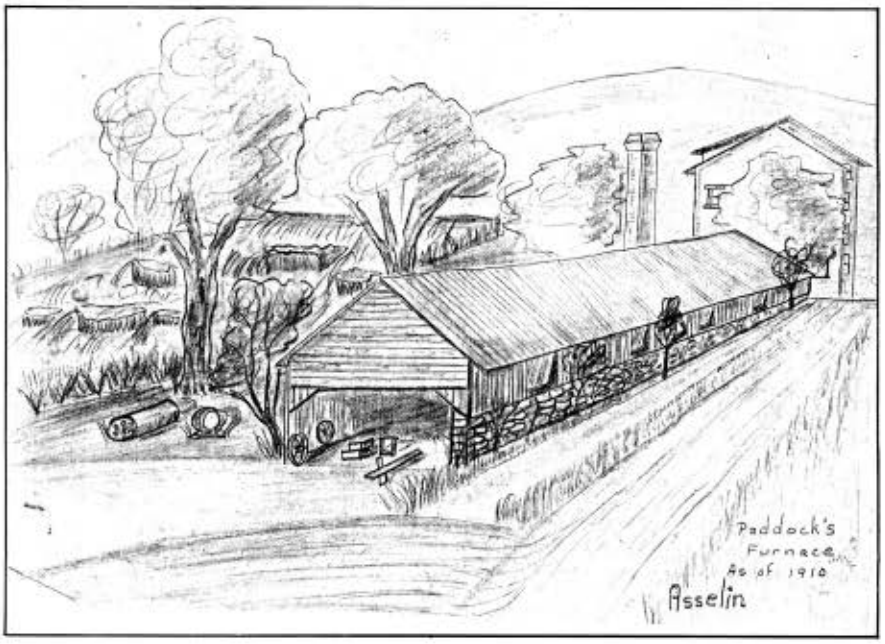
Across the village and up the Passumpsic River from the Moose River was Arnold's Falls, named for the builder of sawmills and gristmills here in the late 1780s. Another sawmill was built by James Ramsey and Allen Kent in 1820, and some started to call it Ramsey's Mills although references to "Arnold's Privilege" persisted to 1830 (Fairbanks 1914:146). Following Ramsey and Kent, the mills were purchased about 1822 and expanded by Hiram Jones and Sargent Bagley.

In 1828 the Fairbanks were already selling off some of their foundry work (wagon manufacture) "to concentrate on other projects—and the new scale was already being ordered by customers" (*Fairbanks Standard* 1980:7). That same year Huxham Paddock moved his foundry works from Sleepers River to Arnold's Falls where he built a blast furnace and extensive works to make bar and cast iron (Fairbanks 1914:147). Hiram Jones and James Ramsey, who had been operating mills earlier at the falls, took the contract for the construction of the main forge building, employing a large force of men. As the business expanded many houses were built about the complex and the community came to be called Paddock Village.

The rise and demise of many ironworks industries, not only in Vermont but in the entire country, were affected in large part by domestic economics and tariffs. Following the Peace of 1814, imports of English-manufactured goods reached such alarming proportions that a great protectionist tide rose, specially favoring cottons, woolens, glass, and iron goods. One of the highest import tariffs occurred in 1828, the year that the Fairbanks started shifting more of their business toward the manufacture of scales and Huxham Paddock decided to expand and relocate his ironworks to the Passumpsic.

History records that Paddock's blast furnace made a high-quality iron. Fuel for his furnace and forges was charcoal, obtained from the plentiful supply of hardwood in the surrounding hills. Most of the ore was carted in by oxen from Franconia, New Hampshire. Lesser amounts came from Piermont, New Hampshire and Troy, Vermont. Some bog ore came from Lancaster, New Hampshire (Child 1887:315). Experiments in combining these different ores resulted in an iron that was used to manufacture stoves and hollowware (Fairbanks 1914:147). "Paddock made a box stove which was safe, a good cooker and a very good heater. He made plow points and fitted them into the plows made in his wood shop. He made barrel hoops for the barrel factory where my great grandfather once worked. Andirons were a necessity as were kettles and cooking utensils. He made horse shoe irons, nails, flat iron for hinges, and even iron fences were called for, items necessary to a fast growing community unlinked as yet to any transportation system except for an occasional stage and ox carts" (Asselin Jan. 1963:34-35).

In conjunction with the blast furnace and foundry, Paddock established a machine shop which specialized in mill gearing. "The establishment of Mr. H. Paddock consists of a blast furnace, and a machine shop for finishing every description of



4-1. *Sketch by Dr. E. D. Asselin showing what remained of the foundry at Paddock Iron Works by 1910. The Passumpsic River and rapids are seen in the background (courtesy Vermont Historical Society).*

mill gear and ordinary machinery" (Thompson 1842:157). In one shop was a turning lathe considered at the time superior to any other in the state (Child 1887:315). It was capable of turning a shaft 3 feet in diameter by 14 feet long. Iron and wood turning lathes, as well as cylinders, spindles, gears, cranks, gudgeons (heavy iron pivots), pumps, shafts, hubs, and nails were all manufactured by Paddock.

Fire struck in 1841, as reported by *The Caledonian* on March 2: "Last Tuesday the quiet citizens of our village were startled by the cry of fire. It proved to be the building covering the blast furnace owned by Mr. Paddock, which was nearly all destroyed. Although there were other buildings contiguous and attached to the one on fire, no essential damage was done to them. . . . As the furnace was not injured, the loss is trifling—not more than one or two hundred dollars."

The works were operated by Huxham Paddock until his death in 1845 (Child 1887:315-316). In 1843 his only son, John H., in company with John C. Paddock and Newell Woods, assumed the business under the name of J. C. and J. H. Paddock & Company. The next year Woods retired. About 1849 Joseph Fuller (John H.'s uncle) became a partner, and the next year John C. withdrew from the firm, leaving John H. Paddock to continue the business.

In an 1849 report, James Hodge described the blast furnace at St. Johnsbury village (among 10 he listed as then existing in Vermont) as being "closed." Hodge further commented that "the number of furnaces in the state which, if not actually in blast, will probably go into operation again in more prosperous periods of the trade. . . . Several of these . . . are soon to go out of blast in consequence of want of demands for their products" (Hodge May 12, 1849:290). Two comprehensive iron trade reports of the 1850s, however, fail to mention any ironworks at all in St. Johnsbury (Lesley 1858:77; 1859:25-27).

Since Hodge listed the blast furnace at St. Johnsbury already closed in 1849, chances are that it never again went into blast in the 1850s due to the poor economic state of the iron industry following the nationwide depressions in the 1850s. (The furnace might have gone out of operation as early as 1840 following the Panic of 1837). That the blast furnace was mentioned as being undamaged by the 1841 fire and was described in Zadock Thompson's 1842 account does not necessarily mean that it was at those times in actual blast. Because of the death of the works founder and the partnership shuffles between 1843 and 1849, however, the year 1845 is a good approximate date for the furnace shutting down, followed by Hodge's "closed" in 1849.

The 1875 Beers map shows location of the foundry, machine, and pattern shops of the Paddock Iron Works, although this was not the actual name of the works at the time. The map also indicates Paddock Iron Works buildings on the north side and just downstream of the dam. A foundry and machine shop next to Luke Buzzell's office was directly across the river from the Paddock Iron Works, but just upstream of the dam. Buzzell was one of a succession of owners after the Paddocks (Child 1887:476). The ca.-1828 blast furnace would most likely have been built downstream of the dam, on the north side of the river alongside today's Concord Avenue.

Sometime after 1870, Michael Hynes, owner of the Acme Iron Works at Paddock Village and manufacturer of brass and iron fittings, succeeded John H. Paddock, ending the Paddock connection with the iron business (Fairbanks 1914:476). Paddock's 1828 machine shop was leased in 1876 by O. V. Hooker and Daniel Thompson (Hooker & Thompson Company). Hooker formed O. V. Hooker & Son's Machine Shop, across the Passumpsic River at the north end of Railroad Street in 1878; that same year he came into control of what remained of Paddock's ironworks (Fairbanks 1914:476). The foundry continued until about 1895, replaced by Hooker's foundry

across the river, nearer to the railroad siding (Asselin 1963:34-35). In 1937 it was being identified as the Hooker-Reed Company (Smith 1937:22).

What remained of the foundry on the original side of the river fell into disrepair. By 1910 only a decaying building was left: "It was torn down soon thereafter for safety reasons. It was of heavy construction and covered with wide pine boards with no shingles. The smelters must have thrown a lot of heat for the men to be able to work in such a loosely constructed building in that climate. Now all that remains of this once formidable industry is the old stone wall. The other shops are still standing and have been in use as wood working shops, once a shirt factory and the like. Paddock, which was perhaps Vermont's greatest industry, is but a legend today" (Asselin 1963:34-35).

Inspection along the river shore just off Concord Avenue in 1979 failed to locate anything positively identifiable with a blast furnace. The "old stone wall" remains of the foundry north wall prevent the street from slipping into the river. The shoreline is littered with much slag, pieces of waste iron, small castings, and firebrick. These all appear to have been associated more with the foundry. Most likely, the old blast furnace was razed and its masonry reused for additional foundry building construction. Curiously, the day the area was inspected, a small, modern-day blacksmith shop stood on the site of the old foundry.

CA-IW01 Joes Brook Forge (Danville): An ironworks operated around 1810 at Danville, about 10 miles west of St. Johnsbury. The 1810 Whitelaw map shows an ironworks on Joes Brook, a quarter-mile upstream of South Danville and associated with the names Blanchard and Lowell. Nothing more is known of this early ironworks. No attempt has been made to locate the site.

ORLEANS COUNTY

OL-IW01 Phelps Falls Forge (Troy): The first major discovery of good quality magnetite in the town of Troy was in 1833, although there had been much conjecture for two years before of the possibility of rich iron ore in the town. The ore was dug on a hill a mile east of the Missisquoi River, two miles northeast of Troy village. The next year a forge was built by local people on the river at Phelps Falls, along the River Road, a mile north of today's Route 100. Iron ore was reduced here for a year. The forge, ore rights, and machinery were sold during the winter of 1834–1835 to Binney, Lewis & Company of Boston. Binney was Dr. Amos Binney, son of Colonel Amos Binney, the navy agent at the Boston Navy Yard; both were connected with the Strafford Copper Works (Abbott 1973:2). Lewis was Samuel L. Lewis, a sea captain and shipowner in Boston.

Binney, Lewis & Company made bar iron until 1841, at which time the forge and other local mills were purchased by Cortes Phelps and Madison Stebbins (Child *Orleans* 1883:288.55). At this time in poor health, Binney retired the next year from his copper activities and died in 1847 (Abbott 1965:242). That same year the company's property was divided between Phelps and Stebbins with no mention made of the forge. It had probably never been operated during the period of this partnership, since it was reported that the works lay idle and in ruins for many years (Child 1887:288.49). No evidence of the site was found in a 1980 field inspection.

OL-3 Boston and Troy Iron Company (Troy): In November 1835 two companies were chartered by the state to make iron at Troy: the Boston and Troy Iron Company, by partners John Williamson, Hezekiah H. Reed, Thomas Reed, Jr., Augustus Young, and John Spalding; and the Boston and Vermont Iron Company, by partners James C. Dunn, Daniel D. Brodhead, Amos Binney, and Samuel L. Lewis (*Acts Passed* 1835:121-124). There is confusion over which company built the blast furnace since both were chartered by the state to make iron. But the Boston and Troy Iron Company is thought to have been connected more with the mining part of the business, and the Boston and Vermont Iron Company with smelting. Dividing the mining and smelting between two companies might have been a cozy business arrangement. The Boston and Troy Iron Company purchased over 1,200 acres of land, including 20 acres of ore beds. A blast furnace, boardinghouse, and other buildings were erected two years later, two miles downstream from the Phelps Falls forge, which was still in operation at this time.

The operations failed in 1841 after expenses outran profits. The land, ore beds, and furnace buildings passed by mortgage to Francis Fisher of Boston, who refired the furnace in 1844. That year he produced 600 tons of pig iron and castings. One chief product was iron boundary markers, which were used along the Vermont and Canadian border (Bearse 1968:373). Shortly after 1844, Fisher also built a forge to manufacture bar iron. Stoves were also cast here, but the one called the P. P. Stewart No. 6, as referenced in a town history of Troy, is incorrect; it was made in Troy, New York (see chapter 2).

By the mid-1840s a community called Troy Furnace had developed about the furnace works, complete with its own post office (Thompson 1842:174). Ore was then brought to the blast furnace from beds owned by W. W. Huse in the town of Jay, west of the furnace. In 1846, when the furnace shut down due to the unfavorable tariff, Huse was in charge of the ironworks. The Orleans Iron Company organized in 1847, attempting to get the ironworks back into operation, but nothing ever came of the iron industry in Troy again. The post office at Troy Furnace closed its door in 1851 (Swift 1977:371).

One continuing problem at the works was the high percentage of titanium in the ore (Hemenway vol. 3 1877:326). This was also a problem with the rich magnetite ores of New York's Adirondack Mountains, where similar frustrations with smelting occurred in the same period of time. The titanium made smelting difficult and expensive. It was the beginning of the time when the iron-making technology demanded a higher quality of inexpensive pig iron. The remote location of the Troy furnace from rail and water transportation, plus the short blast season, also contributed problems and led to the demise of the works.

The 30-foot-high ruin of the stack was barely standing when last inspected in 1980 along with Dr. Peter Thomas of the University of Vermont, and Vermont State Archeologist Giovanna Peebles. The site is a few minutes walk over the hill through pastures west of River Road about halfway between Routes 100 and 105. Here in the midst of caved-in cellar holes and a scattering of slag (one "bear" is about two feet wide) the stack crumbles bit by bit, visited only by fishermen and a stray cow or two. The wide flume, which leads to the furnace,

4-2. *A view of the partially collapsed ruin of the Troy blast furnace stack in 1982.*

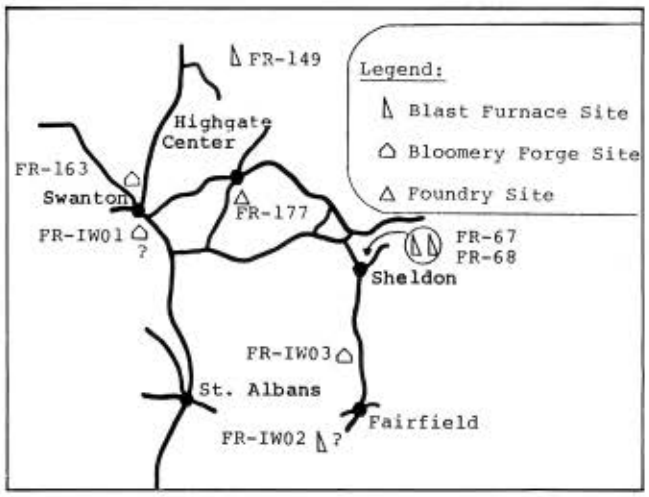
was used around 1900 to convey logs down the river, around the falls. The flume might be a deepened and widened version of the original flume that was dug along the same path. If recent speculation on a nearby hydroelectric project becomes a fact, the remains of this rich archeological and picturesque site could become flooded. The Missisquoi Valley Historical Society on Main Street in North Troy has several relics of the industry (Butterfield 1977:1).

FRANKLIN COUNTY

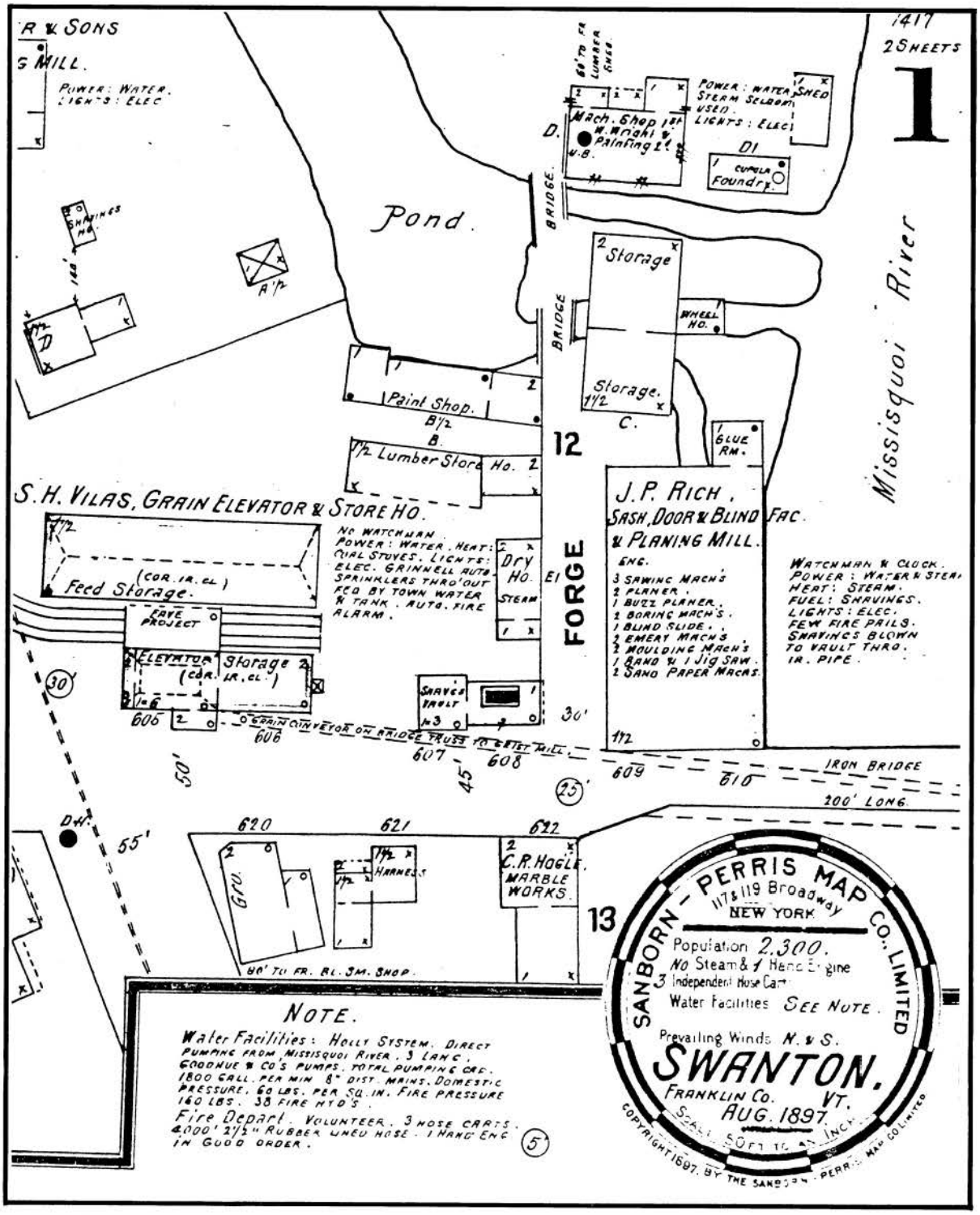
FR-IW01 Missisquoi Forge (Swanton): Among all the forges and mills that Ira Allen contemplated and contracted, it is difficult to determine which actually were built and operated, built and offered for lease, or not built at all. He advertised in 1789 at Swanton to lease the lower falls of the Missisquoi for iron making with terms being the usual seven years rent-free, followed by repurchase (Wilbur vol. 1 1928:520). But the 1793 accounting of his forge holdings at Shelburne and Colchester make no mention of a forge among his sawmills and gristmills at Swanton or "Hyegate" (Wilbur vol. 2 1928:53).

Although no firm evidence has been found that iron was actually made at Swanton before Rufus Barney built his forge there in 1799, one reference had large mills and a forge at Swanton by Ira Allen in 1797 (Graham 1797:159). And the previously mentioned ca.-1772 Metcalfe map (chapter 1) also showed the possibility of forges here at that time.

FR-163 Barney Forge (Swanton): Rufus and Elisha Barney of Bennington began construction of a forge at Swanton in 1799, following purchase of a half-interest in 200 acres of land on the west side of the Missisquoi River near the falls (Aldrich *Franklin* 1891:405-406). The Barneys built a forge, a forge dam on the river, a long flume from the dam to what became the forge pond, and from there a channel to another dam below the forge and thence downstream to the river. The channel essentially cut across a curve in the river, creating Goose Island. Whitelaw's 1810 map shows the ironworks at the site as described. The manufacture of iron commenced in November 1800. In 1803, Rufus Barney divided his half-interest in the forge between his son, Lemuel Barney, and his son-in-law. Iron was made in considerable quantities from abundant local bog ore beds. The iron was sold principally to blacksmiths in the neighboring towns. Much iron was also made into tire-iron (wagon-wheel rims), sleigh shoes (runners), plows, and mill iron. Common bar iron sold for $7 per cwt for nearly 20 years (Hemenway vol. 4 1882:1023).



4-3. *Franklin County ironworks sites.*



4-4. *The 1897 Sanborn map of a part of Swanton village, showing the inlet to the forge pond at the end of Forge Street (today's Foundry Street). Notice the Wright Machine Shop and foundry cupola on Goose Island (top) with notation that power was by water. The planing mill was replaced by a gunpowder factory and later by a marble plant. By that time the inlet and most of the forge pond had been filled in.*

The forge burned about 1816 and was rebuilt. It was run mostly by Lemuel Barney until 1821 when a new forge was built just west of the 1816 site. Elisha Barney and Robert Foster worked the forge until 1824 when it was purchased by R. L. and H. W. Barney. A new forge was erected by F. H. and L. H. Barney in 1849. This new forge was a better design and was acquired entirely by F. H. Barney after a few years. It made blooms "for the southern market" (Troy, New York?) until 1868, at which time the forge was removed and a circular sawmill erected in its place.

Reasons for failure of the 68-year-old forge at Swanton were claimed to have been the exhaustion of the bog ore beds, which up to 1835 could be shoveled from the surface of the ground, and also the scarcity and dearness of wood for making charcoal. But competition from ironworks in favorable locations was also a factor. The Walling 1857 and Beers 1871 maps show the main dam, forge pond, the forge, forge brook, and Goose Island. The 1871 map identified the site as "Old Forge," with much of Goose Island and many houses and lots in the area belonging to members of the Barney family.

Remains of the forge pond and tailrace that ran downstream to the Missisquoi River were still visible at the site as recently as 1985. The tailrace is marked by a distinct tree line; the forge area is filled with refuse. The old forge pond is swampy and is slowly being filled for an adjacent parking lot. Some bits of slag were found, but no other ironworks artifact. The trace indication of a foundation at the site of the forge may be forge-related or may have been associated with later mills at this site. Foundry Street, at the south end of the "island," indicates a more recent foundry operation.

FR-IW02 Fairfield Furnace (Fairfield): In a short paper published in 1953 on the subject of ironworks in Vermont, then-State Geologist Elbridge Jacobs included in the list of towns and furnaces "Fairfield, 1831" (Jacobs 1953:130). Jacobs' data source was Charles R. Harte. A thorough archival search has failed to find any forge or blast furnace in Fairfield, and the history and location of Fairfield furnace/forge remain a mystery.

FR-67 and FR-68 Keith Furnaces (Sheldon): Four years after Israel Keith sold his Pittsford furnace property, he established another ironworks, nearly 90 miles to the north. He and his brother Alfred built a blast furnace at Sheldon (FR-67) on the east bank of the Black Creek.

Some sources indicate construction date of the Sheldon blast furnace as 1798, but the consensus is 1799. The Keiths later built a forge and also made potash kettles. People came from as far as 200 miles away to line up for their kettles, loading them on wagons while still hot from the mold. The business did so well that employment exceeded 100 men, and for a long time the iron was referred to as "Sheldon currency" (Hemenway vol. 1 1867:372, 378). Ore initially came from bog ore beds in Highgate, but a large ore bed was discovered and worked 1½ miles east of the furnace.

By this time the Keith family's skill in building and working blast furnaces was so well known that their aid was sought by others. While the Monkton Iron Company was building at Vergennes in 1808–1809, a Mr. Keith was associated with the operations there. Then George Parish came to Vermont and offered Keith and two other Vermonters, Ebeneezer(?) Marvin (of Sheldon?) and (?) Sykes, the use of his furnace at Rossie, New York, and all the iron they could make in three months, in exchange for showing him how to run the furnace (Hough 1853:450). Accepting the offer, Keith "made a very handsome thing out of it, besides showing his New York friends 'how to do it'" (Hemenway vol. 1 1867:378). Keith references were

4-5. *A section of the abandoned tailrace of the Barney forge at Swanton, about a quarter-mile downstream from the forge site. The race, when used, cut across an inside curve of the Missisquoi River, creating Goose Island, to the right, which has long since returned to the mainland and lost that identification.*

4-6. *Is the collapsed archway of an old blast furnace in there? Did the later woolen mill here at Sheldon village build on the foundation of the earlier blast furnace?*

most likely to Alfred Keith, understood to have the technical skill with respect to building and operating blast furnaces; Israel was usually the one to bankroll the operations.

Israel Keith eventually retired from the furnace business, returned to Pittsford, and continued his law practice in U.S. and Vermont courts. Alfred Keith continued to run the Sheldon furnace business and in 1823 he built a new blast furnace (FR-68) across the river (west side). He donated the land on which the Episcopal church still stands, next door to his house.

4-7. *A large piece of cast iron, possibly a crude pig, among the foundation stones of the woolen mill ruins at the Sheldon furnace site.*

He died in 1840 at age 72 (Ashton 1979:20) and was probably buried in the church cemetery next door. A 1983 search failed to locate his gravestone, although his house is standing. His son Alfred, Jr. (there were many Alfreds in the family) continued the Sheldon family industries, running the gristmills and sawmills on the east side of the river and maybe the blast furnace on the opposite shore. By 1859 both furnaces were still standing but out of operation (Lesley 1859:25).

The site is 500 feet downstream of the concrete bridge. What is visible at the site today are the trash-filled ruins of Alfred Keith's later gristmill. As recently as 1979, what was believed to have been the remains of one arch of the furnace was hinted at beneath the north wall (Richard S. Allen to author, 1979). Partial collapse of the walls since then has made confirmation of this impossible. One interesting discovery was a piece of pig iron that is a part of one of the walls of the old gristmill. After many unsuccessful searches for blast furnace slag following the initial 1979 visit, some was finally found in 1987 on the west side of the river opposite the gristmill ruin, eroding out of the riverbank. This area contains many stone and concrete walls and features not related to the ironworks but to later industries. Exact location of the two Sheldon blast furnaces remains a mystery.

FR-IW03 Brainerd and Gadcomb Forge (Sheldon): Following a major iron ore discovery in Sheldon in the 1830s, owners of the mine property, Lawrence Brainerd and W. O. Gadcomb, built a bloomery forge to work the iron. They produced bar iron that was used in the area although some was shipped to Albany and Troy, New York. Lack of direct railroad connections and insufficient local demand for the blooms are reasons given for closure of the forge (Brainerd 1884/1885:689-691).

Exact location of the forge is unknown but most likely it was in the vicinity of the mine and near Black Creek, about a

4-8. *A view looking east at Highgate Falls, probably in the late 19th century, showing the O. E. Sheridan foundry immediately downstream of the bridge. Stoves, plows, machinery, and hollowware were cast here (courtesy Franklin County Historical Society).*

mile away. Brainerd and Gadcomb were from St. Albans and the ore was shipped to the St. Albans Iron and Steel Works in the 1870s. No field attempt has been made to locate the site. L. R. Brainerd & Company was also involved in lime kilns at a quarry near Swanton (see chapter 8).

FR-149 Rock River Furnace (Highgate): In addition to blast furnaces at Pittsford and Sheldon, either (or both?) Alfred or Israel Keith was also involved in making iron in Highgate as a part-owner with Abel Drury in an early blast furnace located in the northern part of Highgate (Hemenway vol. 1 1867:258).

There is a furnace mound ruin in northern Highgate at Rock River, claimed to date to the period of the Revolutionary War (Leader 1973:2). This might have been the "first furnace built in Highgate" but built much later, and by Abel Drury, in 1807 (Hemenway vol. 1 1867:255). Drury advertised the Highgate furnace on January 6, 1808, in the Burlington *Vermont Centinel:* "Iron Hollow Ware. A large quantity on hand and for sale, consisting of potash kettles and all kinds of small ware."

Although there is sufficient evidence pointing to a blast furnace operating in Highgate as early as 1807, the Whitelaw map does not show an ironworks here until 1821. By 1825 ore from Highgate was being reduced at a furnace operated by Benjamin F. Hollenbeck and Luther K. Drury (Anderson 1939:142-143). Location of the furnace is unknown; it may have been the one at Rock River. The furnace was a productive operation; cast iron sold for 17¢ a pound (compared to scrap iron, which then sold for 1½¢ a pound). The advent of the railroad, which brought cheaper iron into the area, is the cause given for the furnace's demise.

Also involved in an ironworks at Highgate around the 1810–1815 period were Jacob and Matthew Saxe, sons of John Saxe (of Saxe's Mills). They learned the iron business in Highgate,

4-9. *Six-foot-diameter iron hoops are all that remains of the wood headrace that powered mills at Highgate Falls.*

4-10. *Replacing the covered bridge at Highgate Falls was this beautiful lenticular-design iron bridge, recently abandoned and replaced by a modern concrete bridge about a quarter-mile downstream.*

there being a deposit of iron ore known locally as the Furnace Lot (Saxe 1930:20). The brothers later moved to Chazy, New York and became associated with a blast furnace that was built in 1809 by Alfred or Israel Keith at Salmon River, just south of Plattsburgh. The Plattsburgh assessment roll of 1811 listed Luther Drury owning 3½ acres and half-interest in a furnace, possibly that at Salmon River. The assessment also listed "Keth & Wood" as owner of 18½ acres and a furnace (Hurd 1880:187). Another reference had Elisha Clark operating the Salmon River blast furnace in 1813 and Luther Drury manufacturing potash kettles, stoves, and hollowware in Plattsburgh in 1817 (Porter 1941:213). Jacob Saxe eventually became sole owner of the furnace in 1820. It was washed away by a freshet 10 years later (Allen 1983:86). Matthew stayed at Chazy, but Jacob moved back to Vermont, settling at Sheldon where he operated a mineral spring under the name Saxe & Company (Hemenway vol. 1 1867:380).

The Rock River furnace mound is on the west side of the river, downhill from the town road at a point about 300 feet northwest of where the road turns sharply north. The vicinity was a candidate for gas exploration in the early 1980s and when last visited in 1986 was posted against trespass. Just downstream from the furnace mound are the abutment remains of a road crossing. On a knoll across the river is the Stimet cemetery.

Remains consist of a mound-type concentration of large stones, blast furnace slag, and charcoal marking the probable furnace site. Bits of slag and charcoal were also found by shallow digging in the vicinity; larger, baseball-size slag is in the river. The vicinity of the furnace grounds, between the road (to the west) and the river (to the east), is open land. The property owner lives about a half-mile north but is extremely uncooperative.

GRAND ISLE COUNTY

GI-IW01 Goodwin Forge (Grand Isle): Out on Lake Champlain at the island town of Grand Isle, a forge was operated along Mill Brook in the early 1800s. Nothing more is known about the forge except that Isaac Goodwin produced plows and domestic utensils here until 1838 (Thompson 1842:28). No field attempt has been made to find the site.

CHITTENDEN COUNTY

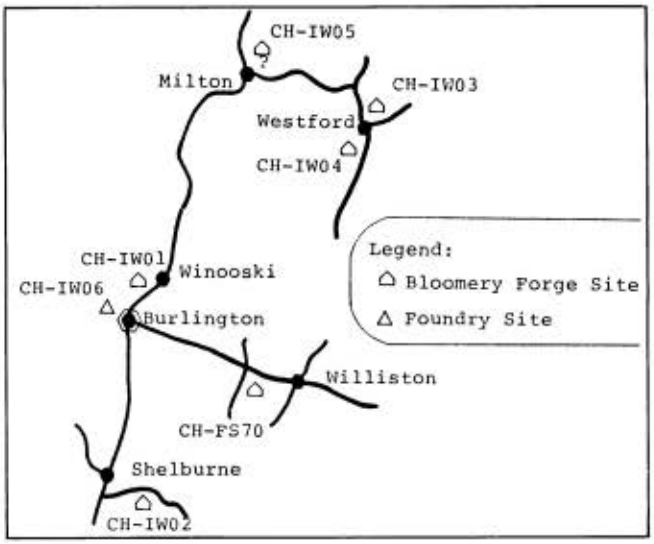
CH-IW06 Burlington Manufacturing Co. (Burlington): For some years up to 1865, the East Middlebury works (AD-299) ran in connection with Israel Davey's other operation, the Fair Haven Iron Works (RU-FS17). In July 1865, Davey and Benjamin Nichols sold their bloomeries at Salisbury (AD-407) and East Middlebury to the Burlington Manufacturing Company, which had a rolling mill and foundry in Burlington. This company was formed in 1865 and went into operation the latter part of that year (Neilson 1866:235).

The Burlington Manufacturing Company also had interests in forges at Clinton County, New York. For a time in 1866, it leased the Ticonderoga Iron Company, which was formerly managed by a Vermonter, William Calkins (Allen ms 1982). Iron blooms from these forges were made into nails, marble saws, and merchant iron at Burlington.

The company's rolling mill contained three trains of rollers, four heating furnaces, and a hammer in one large 75- by 155-foot wooden building. The adjoining nail shop was built of brick and housed 46 nail and spike machines. The entire works was run by four steam engines and had the capacity of making 6,000 tons of iron products a year. The mill and foundry were located along Champlain Street, about where the old Vermont Spool and Bobbin Company building stands (today a condominium). The company superintendent was Jacob D. Kingsland, native of Fair Haven and a former partner there with Jacob Davey in 1829. Kingsland had also been connected with ironworks at Keesville, Essex, and Dannemora, New York. After leaving Burlington, he established a nail factory at Vergennes (Allen ms 1982; Adams 1870:143).

The Burlington Manufacturing Company reorganized in 1872, dropped out of the ironworks business, and concentrated on the manufacture of marble (Child 1882:103-105). The ironworks end of the business became part of the Pioneer Mechanic's Shop Company, which came under the control of Benjamin S. Nichols in 1868. These shops were located at the foot of Cherry Street between Battery Street and the railroad tracks.

CH-IW01 Ira Allen Forge (Colchester): When Ira Allen returned to Colchester following the end of the Revolutionary War, he commenced development of the waterpower resources of the Winooski River with the construction of a dam, along with two forges "and a furnace," which produced bar iron, mill irons (machinery hardware), forge hammers, and anchors (Rann 1886:555). Allen contracted for other such mills in Vermont where waterpower and raw material made them practical. His usual arrangement was to lease the mill rent-free, typically for seven years, with an offer to buy it back at a fair market price. One lessee was Aaron Brownell, who leased three forges and an anchor shop for £5 monthly plus a part of the iron made (Wilbur vol. 2 1928:27). Joseph Mozier leased one fire in the forge for 50s. a month (*Calendar* 1939:53). Brownell then leased another anchor shop and a forge, for £60 and £50 a year



4-11. *Chittenden County ironworks sites.*

(*Calendar* 1939:55). In 1791 correspondence between Ira Allen and Jacob Johnson, the latter agreed to build a forge at Burlington (*Calendar* 1939:30). By early 1792 Allen was busy designing the largest forge he had constructed to date and he ordered a hammer, bellows, etc., from Connecticut. In March he contracted to build a large new anchor shop in Colchester.

Included in an itemized list of Allen's mills at Burlington dated November 8, 1973 were two forges and an uncompleted anchor shop (Wilbur vol. 2 1928:28). A lease offer he published January 3, 1794 mentioned the newly built college (University of Vermont) at Burlington plus mills and an ironworks at the Winooski falls within two miles of the bay. Bog ore from the nearby shores of Lake Champlain was initially used at these forges. When this was depleted, ore beds opened in parts of Colchester, most of them bog ore beds in swamps and ponds. One such bed was in the northwest corner of the town, about a half-mile west of Colchester Pond, per the 1857 Walling map of Chittenden.

The 1796 Whitelaw map indicates ironworks along the Winooski River in the vicinity of the falls on the Colchester side; the 1810 map shows them on the Burlington side. A 1986 inspection of the river below the Route 7 bridge was made and, as expected, nothing related to an Ira Allen-period ironworks was found. The falls area has undergone extensive industrial development, completely changing its appearance since Ira Allen's days. The river tumbles over some small rapids, then plummets over the major falls through a narrow gorge just below the bridge. Whole trees have been seen running this gauntlet during spring thaw. Whatever forge slag was discarded here 200 years ago has long since washed downstream to the river flats and is hidden in sand and gravel bars.

CH-IW02 Shelburne Falls Forge (Shelburne): In 1792, the day after contracting for the anchor shop at Colchester, Ira Allen contracted with Israel Burritt to build a 40- by 50-foot forge house (Wilbur vol. 2 1928:27). Allen was to furnish the boards, logs, irons, nails, and bricks for the chimney, leather for the bellows, and "two barrels of pork and 20 gallons of rum while the work is doing" (*Calendar* 1939:36). The forge was located by the 1796 Whitelaw map at a dam in the La Platte River. The forge was at Shelburne Falls, on the south side of the river opposite a sawmill; both were above the falls. In a description of a flood in 1852 that washed away all mills at this site along with many mills farther downstream, no mention is made of the forge.

The river at Shelburne Falls was inspected above and below the bridge in 1980 without locating any specific iron-making related evidence. Some bits of badly corroded iron and burnt-end brick were found, which might be from a blacksmith shop that stood just northeast of the bridge in the 1860s. A number of dam footings were found above and below the bridge.

CH-IW03 and CH-IW04 Stanton and Seeley Forges (Westford): Two forges were making iron in the early 1800s at Westford. The first (CH-IW03) was built by Joshua Stanton sometime between 1795 and 1810; it appears on the 1796 Whitelaw map. Ore for the forge was mined from beds in Colchester and mixed with harder magnetic ore from New York. Magnetite was boated to Burlington and carted to Westford. Regardless of the expense for these logistics, business was good enough to justify erection of another forge a few hundred feet farther downstream. The final owner was Stanton's son-in-law Luke Camp, who operated both forges until his death about 1810. The ore beds at Colchester also failed at about this time (Rann 1886:696).

A field trip and interview with the late Irene Allen at Westford (May 15, 1979) placed the first forge just west of the upper bridge over Brown's River. Swimmers reported seeing some underwater machinery here, but no ironworks artifact was found. She also said that a second forge (CH-IW04), built around 1800 by John Seeley, Jr., of Westford, was probably in the vicinity of the lower bridge. Some slag, a burned hearth brick, and the underwater remains of a wood crib for a dam were found about midway between the bridge and remains of another dam.

CH-IW05 Milton Forge (Milton): A forge was in operation in Milton on the west side of Miner's (or Poor Farm) Falls on the Lamoille River (Carlisle 1975:43). The date of the forge is unknown but since it drew ore from the Cobble Hill area about 2½ miles south, the forge probably operated in the 1820–1840 period. The site was searched for in 1980 but not found.

CH-FS70 Spafford Forge (Williston): An elusive forge site was found in the eastern part of Williston, built by General Jacob Spafford, one of the town's first settlers (Rann 1886:657). The forge is identified on the 1810 Whitelaw map as "Gen'l Spafford." It appears to be on Allen Brook and to have been buried under the southbound lane of the Interstate (I-89). Site inspection in 1980 resulted in finding some bits of slag and maybe a headrace in the heavy undergrowth, about 200 feet upstream from I-89. Although a small brook today, it is generally believed that most Vermont creeks ran more heavily in earlier years judging from the numbers of mills that once operated on streams that are today only a trickle.

WASHINGTON COUNTY

WA-IW01 Davis Forge (Calais): At East Calais, Nathaniel Davis operated a nail factory along the Kingsbury Branch in 1812 (Hemenway vol. 4 1882:161). In addition to his trip-hammer shop where he turned out scythes and hoes, his forge made cut nails from iron ore that was dug from ledges a short distance west of the village (Bliss 1954:268). The ore, however, was not sufficient to justify the costs. Nail production lasted only two years. No field attempt has been made to locate the forge.

WA-25 Rice's Furnace (Waitsfield): About two miles south of Irasville, along the east side of the Mad River, Edmund Rice owned a blast furnace that may have operated here as early as 1816. Rice came to Waitsfield in 1803 from Charleston, New Hampshire, and was a cabinetmaker and early merchant, prominent in town until his death in 1829 (Jones 1909:26). Associated with Rice at the furnace were Edward Fales, Theophilus Bixby, James Selleck, and others. The furnace smelted ore that was brought in from Orange County, making iron kettles among other items. The works also included a foundry, which housed a trip-hammer. In the great freshet of 1830 the works, together with a dam, were washed away and never rebuilt. Thomas Poland later constructed a small sawmill on the site, which he operated until it, too, suffered the same fate as its predecessor (Jones 1909:66).

The site was inspected in 1986 with no visible surface indi-

cations found of the ironworks, the later sawmill, or the dam. Neither slag nor charcoal could be found on the ground or for about 100 feet along the river at the site, or at another point about a mile downstream at the Route 100 bridge. Except for good historical accounting that pinpoints the location of the ironworks, no surface remains betray the site of this furnace/forge site. The older house standing at the site was probably that of Thomas D. Poland, who ran the sawmill (Beers *Washington* 1873:55).

LAMOILLE COUNTY

LA-IW01 Cady's Falls Forge (Morristown): In 1826 when Joshua Sawyer started a plan for the opening of an iron ore bed in Elmore, he erected a forge a little south of today's hydroelectric station at Cady's Falls in Morristown (Mower 1935:67). But the operation was plagued by problems with the ironworkers, with the iron itself, and finally in 1828 with nature, as a flood brought disaster to the forge. Sawyer deeded his destroyed forge property and the ore bed to the Lamoille and Elmore Iron Factory and Mining Company. The forge site was thereafter used by various mills; the 1859 Lamoille County map shows a starch mill occupying the site and the 1878 Beers map shows it unoccupied. The village of Morrisville purchased the site in 1895 and built a hydroelectric station either directly on or very near to the north end of the old forge site.

No remains of the forge were visible during a 1979 visit although the steep shores of the Lamoille River were not checked for slag. Local residents knew nothing of any iron-making activity here, but there are locally in existence some iron implements and fireplace andirons that were made at Cady's Falls forge from Elmore ore (Sanders 1953:242).

The Central District

The central district contains the majority of the iron-making sites of the state. Addison and Rutland counties alone contain 63 sites, which is about two-thirds the number of ironworks sites in the entire state. The major blast furnace operations centered in Rutland County while the state's major bloomery forges were in both Addison and Rutland counties.

By the mid-19th century, five bloomery complexes in the central district had become nationally known for the quality iron they produced:

Ackworth Bloomeries (West Lincoln)	ca. 1828 to 1865
East Middlebury Iron Works	ca. 1831 to 1890
Fair Haven Iron Works	ca. 1812 to 1870
Salisbury Forge	ca. 1847 to 1870
White's Forge (Vergennes)	ca. 1847 to 1857

Israel Davey, owner of the Fair Haven Iron Works, bought the Salisbury Forge in 1854 and took Benjamin Nichols as a partner in 1862. These two forges then merged and became the Fair Haven Iron Company in 1867. The next year, the company became part of the Burlington Manufacturing Company, which by then also owned the East Middlebury Iron Works. The Ackworth Bloomeries and White's Forge were never part of these transactions.

A number of pocket furnaces also operated in the central district. Pocket furnaces have been variously defined and illustrated to be about 5-foot-high stone furnaces with full-size blast furnace capability in regard to smelting iron ore. In some cases these diminutive furnaces could have been production units. They were also used to test the ore as an alternative to the expense of building a full-size furnace. For some unknown reason, there was a concentration of pocket furnaces in the Brooksville area (see AD-IW05).

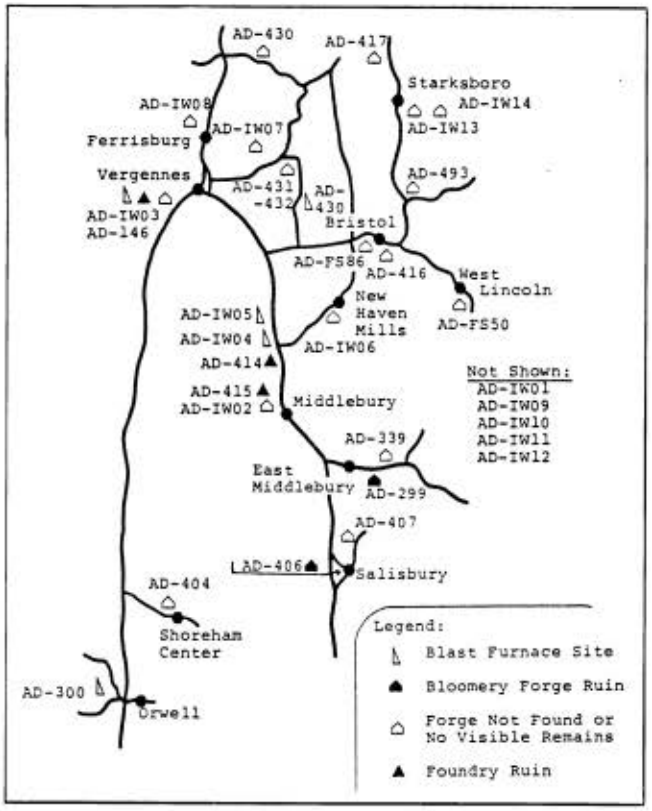
Seven forges were built and operated in and around Bristol village from 1791 to the 1850s. Since no principal name could be found for some of the works, these have been arbitrarily named for owners of record. The forges were contemporary with (and probably similar in design to) the forges at Lincoln. The principal source of ore for these forges was the Bristol ore bed, on a mountain in the northwest corner of the town. Ore was mixed with magnetic ore from Crown Point and other places on the west side of the lake (Munsill 1979:107). The Bristol ore bed is a few miles south of the Monkton ore bed and part of the same geologic system (Adams 1845:22). Ore beds were found in other parts of the town but not in quality or size that justified the expense of mining them. The low price of foreign iron forced the ironworks of Bristol and Lincoln out of the business in the 1850s, never to open again. Many checks for slag were made in and along the New Haven River from Lincoln to well below Bristol village, especially during drier summer months. But the finds were relatively well-distributed small pieces of waterworn slag that could have come from any of the forges along this stretch of the river.

ADDISON COUNTY

AD-IW01 Downing Forge (unlocated): The 1832 manufacturing returns of Vermont listed a forge in Addison County under the name of T. Downing (Kelley 1969:877-907). All other forges in the county included in the returns can otherwise be accounted for. No reference to this ironworks can be found in the county. Inspection of the Downingville area does not suggest any good site for a forge. In 1792 a James Downey, Jr., was involved in a forge at Fair Haven belonging to Gamaliel Leonard (RU-195). But the location of Downing's 1832 forge in Addison County remains a mystery.

AD-300 Orwell Furnace (Orwell): It was at Fair Haven that Matthew Lyon established an industrial base around a series of falls along the Castleton River (RU-FS17). These industries, which became known as Lyon's Works, included extensive ironworks, and there is confusion about whether a blast furnace was part of it. Lyon did, in fact, build a blast furnace and it is supposed to have been in operation in 1788, doing a "considerable business" (Smith 1886:557). But that blast furnace was in Orwell, not Fair Haven. In all the information concerning Lyon's Works at Fair Haven, although there are many references to a furnace or blast furnace, nothing can be found to indicate a blast furnace erected or operating there. The Orwell furnace site is 15 miles north of Fair Haven, and the 1796 Whitelaw map shows a road direct from Fair Haven to the furnace.

During a 1981 inspection of the site along East Creek, exactly where the 1796 Whitelaw map indicates an ironworks, furnace slag was found in a pasture along with burnt bricks, waste iron,



4-12. *Addison County ironworks sites.*

stone walls, and indications of a head- and tailrace. The site is nearly halfway between Fair Haven and Lyon's iron mine near Port Henry, and also much closer to Lake Champlain. East Creek flows a few dozen feet from the furnace site and is lake-level to within 100 feet of it. Lightly laden ore boats might have negotiated the shallow creek at one time.

A committee of the Vermont Assembly recommended in 1791 that the Lyon blast furnace in Orwell be repaired and set in blast, indicating that the furnace was out of operation at the time (Austin 1981:162). The Orwell stack probably suffered from poor ground insulation that allowed surface dampness to cause a "cold hearth," resulting in a large number of defective castings. And at some times of the year the stream ran too low to drive the waterwheel (Boltum 1881:10). Inspection in 1981 found that the ground at the suspected furnace site was only a few feet higher than the nearby pasture, which had a spongy, soggy feel underfoot. Yet at the time (Labor Day weekend) the creek was running quite low. Lyon's continuing petitions to the state assembly may, therefore, have been unsuccessful attempts to replace the ailing Orwell stack with a better site in Orwell (or maybe Fair Haven?).

AD-406 Sawyer's Forge (Salisbury): Both Connecticut and Vermont have a town of Salisbury, and both towns have an iron-making history. But one recently published history has laid claim to iron cannon and shot being cast in the Vermont town during the Revolution when in fact it was nearly deserted for fear of marauding Tories and Indians (*Gazetteer* 1976:76). To confuse matters, Ethan Allen (of both Connecticut and Vermont fame) built the first blast furnace at Salisbury, Connecticut, at today's Lakeville village. Salisbury iron was a quality of iron unique to that Connecticut-Massachusetts-New York area and, except for Samuel Keep, has nothing to do with making iron in Salisbury, Vermont.

The first forge in Salisbury (Vermont) was built by Thomas Sawyer in 1791. He had already built a sawmill, gristmill, and tavern in the community known as Sawyers Mills per the 1796 Whitelaw map. Three years later some trip-hammers were built nearby. The works were converted to a shovel factory around 1813 by Harry Johnson, which was possibly operated 20 years later by A. Johnson (Smith 1886:605-606).

Forge construction was directed by Samuel Keep, an iron maker who was born in Salisbury, Connecticut. He arrived at Salisbury, Vermont, via Crown Point and stayed on to work in the bloomery. In 1795, John Deming of Middlebury bought the mills and tavern of Sawyers Mills; Sawyer then moved to New York. Deming and a later partner, J. Woodward, sold to Hascall and Nelson in 1813. Patrick Johnson eventually bought the forge and took Jonathan Kendall as partner, then sold to Ellery Howard and son. They operated the forge until 1853 when it closed in the midst of the nationwide slump in the iron market.

Investigations at the forge site by Salisbury historian Max Petersen in 1976 resulted in finding pieces of iron and hardware, and the collapsed chimney and hearth of the refinery part of the forge (Petersen 1976:16-17). The forge site is on the north shore of the Leicester River, just below the Central Vermont hydroelectric power generating station in Salisbury village. Much slag, charcoal, firebrick, and very heavy pieces of castings were seen during a 1986 inspection.

AD-407 Salisbury Forge (Salisbury): A more modern bloomery was built at Salisbury sometime between 1843 and 1849 by A. B. Huntley but it was abandoned due to financial reasons after making only a few hundred tons of iron (Smith 1886:607). The new forge was about a half-mile upstream of Sawyer's Forge (AD-406). Forges were described as being at many waterfalls near here in 1855, most likely all part of Huntley's forge operations (Swift 1859:15).

Israel Davey, by then owner of forges at Fair Haven, bought Huntley's forges in 1854 and took Benjamin S. Nichols as partner in 1862. The forges merged with the Fair Haven Iron Company five years later, the next year becoming part of the Burlington Manufacturing Company, which also owned the East Middlebury Iron Works, five miles north of the Salisbury Forge (Petersen 1976:25).

Like its sister operation at East Middlebury (AD-299), the Salisbury Forge contained three bloomery hearths, three waterwheels, and a side-lift hammer. Capacity of the Salisbury Forge in 1866 was about 750 tons. In 1864 some 280 tons of iron were made from 500 tons of ore and about 75,000 bushels of charcoal. Chunk iron made from Port Henry ore was used at the Burlington works (Neilson 1866:232-235).

The forge at Salisbury was one of five (others at Fair Haven, East Middlebury, West Lincoln, and Vergennes) known throughout the industry for producing a high-quality wrought iron by the direct bloomery method. Neilson reported in 1866:

Production		Production	
Year	Tons	Year	Tons
1854	200	1860	0
1855	300	1861	0
1856	300	1862	0
1857	200	1863	0
1858	200	1864	280
1859	200	1865	450

With the end of the economic stimulus of the Civil War and the postwar drop in iron prices, quality iron was yielding to cheaper iron from other parts of the country. Israel Davey died in 1869; the Salisbury Forge closed the following year.

Remains of the forge lie just downstream of the Central Vermont dam, about a half-mile northeast of the village. Slag, charcoal, and the race reveal the course of the waterpower system from the falls to its return to the river. A spool factory, which followed the forge at the site, detoured the race, visible by its extension where the race starts to turn toward the river. Ruins of a more recent mill are just downstream of the forge site.

4-13. National Standard *September 11, 1827 (courtesy Sheldon Museum).*

AD-339 Eagle Forge (Middlebury): Roger Nobles operated an early forge along the upper Middlebury River in a deep gorge a mile upstream of East Middlebury. Dates of operation are not known for sure, but the forge was in operation as early as 1810 (Smith 1886:342). In 1827 Nobles advertised plows for sale at the Eagle Forge. The forge was abandoned soon after and was washed away by the 1831 freshet.

The river was inspected upstream of the Route 125 bridge in 1984, hiking upstream on North Branch Road and taking an old road that forks off to the right a few minutes walk from the bridge. Up the road is an area of charcoal, which extends from the trail for about 50 feet toward the river and 50 feet along the edge of the road. Other features in the area include a 40-foot-long by up to 9-foot-high stone wall; large (2- to 3-foot-diameter) stones laid in a line, possibly anchoring the shore end of a dam; two levels of ground (the trail and a lower level adjacent to the bottom of the 40-foot stone wall). A path, cut into the face of the charcoal-covered ground, allows swimmers access through the area to the river, here about 25 feet below road level. There is much evidence of recreation activity all along the road. According to local tradition, the charcoal once burned underground for many weeks before it was extinguished (Victor Rolando paper, 1984). Slag was found in the river during a later field inspection. About 20 to 30 feet upstream of the end of the 40-foot wall, some walnut-size pieces of magnetic iron ore were found, lying where they appear to have fallen from a wagon that might have been carrying ore along the old road. The ore might have come from Crown Point, since that ore was later carted to a forge that operated a few years later below the bridge.

About 200 feet upstream, another stone wall, much less obvious (about two feet high by 10 feet long) was found. No charcoal or slag was found here. Although a narrow path continues another 100 feet, then pinches out in the narrowing gorge at the base of a high cliff, the road itself appears to end here. Topography of the opposite shoreline hints at a bridge having been here, with the low stone wall being the remains of the bridge abutment on this side of the river. No companion feature was seen on the immediate opposite shore; the river is about 15 to 20 feet wide and one to two feet deep here, but most likely much deeper during spring thaw. Farther upstream on that opposite (south) side, the road can be found again, very faintly, still heading upstream. This might have been a predecessor road to the present Route 125 highway or maybe an old charcoal road for the forge(s) below.

Could the charcoal area have been connected somehow with the forge operations at a later period below the bridge? Considering the available space to store charcoal and ore at the later downstream forge site (AD-299), it is doubtful that the downstream forge would have carted these materials upstream to store them at this space-limited location. It is possible, therefore, that this charcoal area is the approximate site of the Eagle Forge, and that this was a bloomery forge operation, since in the early 1800s plows were still being made by hammering wrought-iron plates to form mold boards. With a high cliff on the shore opposite the charcoal area, it was a good place to build a dam, hence the line of large stones along the shore immediately downstream of the site. The old road continues its level about 25 feet above the present river level for about 200 feet upstream to stay above the level of the backed-up forge pond above the dam. There might have been some connection between this forge and Nobel's Forge (BE-IW03) in Pownal.

AD-299 East Middlebury Iron Works (Middlebury): Shortly after the Eagle Forge was washed away by the 1831 freshet, another forge was built downstream and nearer the village by George Chapman (Fenn vol. 13 n.d.:30). George Chapman was followed sometime before 1846 by Middlebury merchant Asa Chapman, who along with some other Chapmans was also running a forge in Lincoln (*Walton's* 1846-1850).

Asa Chapman ran the forge at East Middlebury until about 1850 at which time the operations became Slade, Farr & Co (*Walton's* 1850). Chapman also maintained a ledger, which he titled the *Teaming Book*, in which he recorded the daily comings of wagon loads of charcoal and ore, and the departures of wagon loads of iron (Sheldon Museum Library). The period

covered is from August 1845 through October 1848. In the 18 months from April 1846 to October 1847, 396 tons of ore were recorded arriving on 393 wagon loads, about a ton of ore per wagon arriving nearly every day. In the 1860s some ore came from as far away as Seven Islands (Sept-Îles), Québec (Hunt 1870:279-280). But most appears to have been dug at Crown Point, boated across the lake to Vergennes, then shipped by wagon to the forge. Shipped to Vergennes from the forge during that same period were 226 tons of iron in 249 wagon loads, or slightly less than a ton of iron per wagon leaving every other day. In a 2½- month period, it was recorded that "Coal received of John Maganity" was 1,730 bushels in 21 loads, which averaged about 80 bushels of charcoal per load. Altogether, the names of 57 teamsters are recorded hauling ore, charcoal, and iron to and from the forge. It was truly a busy place when all the woodchoppers, miners, colliers, blacksmiths (to service the horse teams and the tools of miners and ironworkers), boatmen, bloomers, and their families are considered. Forge operations either directly or indirectly affected the livelihood of over a hundred people.

The ledger recorded that a freshet destroyed the forge on October 30, 1847. The following month one iron shipment was made; no further shipments were made until May 1848. An itemized list of costs to rebuild the forge totals $1,661.47. When operations resumed, the forge received 249 tons of ore and shipped 187 tons of iron from May through October 1848. Production ratios of the older to newer forge (1.75 to 1.33 tons of ore per ton of iron) calculates to a significant 23.7 percent increase in efficiency of the forge. Technical improvements had obviously been incorporated into the new forge. The ledger bookkeeping system does not allow comparison of charcoal efficiencies.

That ratio of 1.33 tons of ore to 1 ton of iron output was quite superior in comparison to other forge outputs of about the same period. At the Salisbury Forge the ratio was 1.75:1 while at the West Lincoln forges it was 2.10:1. By comparison, at the Pittsford and Plymouth blast furnaces the ratio of ore to iron was 2:1 (Neilson 1866:217-218, 232-233). Variations in local ore quality would have affected these ratios.

4-14. *Foundation remains of the forge at East Middlebury, possibly the waterwheel pit.*

After Slade & Farr operated the forge, Israel Davey came into control. Davey now also owned the Salisbury Forge, about five miles to the south, in addition to his ironworks complex at Fair Haven. Soon after taking over the East Middlebury Forge, Davey took Benjamin S. Nichols as partner, and they sold the works in 1865 to the Burlington Manufacturing Company. According to Neilson, production through 1865 was:

Production		Production	
Year	Tons	Year	Tons
1854	50	1860	400
1855	50	1861	400
1856	300	1862	400
1857	300	1863	400
1858	300	1864	400
1859	400	1865	500

By 1866 the forge was called the East Middlebury Iron Works and had three bloomery hearths, each with its own waterwheel, and one side-lift hammer. The forge consumed 100,000 bushels of charcoal and 700 tons of Lake Champlain ore in 1864. Annual capacity of the forge was estimated at 750 tons. The main product at the time was billets, which were rolled by the Burlington Manufacturing Company (Neilson 1866:232-235).

Three large waterwheels were supplied by a head of water from a dam upstream from the bridge. Ore still came down the lake from Mineville, New York, but now traveled by railroad to Middlebury Village, and finally by wagon to the forge. The process was reversed for shipping iron to Pennsylvania and New Jersey, where it was converted into steel. The forge complex consisted of a large charcoal and ore shed, the forge building, and a smaller waterwheel house. Iron was drawn from three hearths every three hours, cooled in a circular mold, hammered into a large block 6 inches thick, then cut into 6-inch-square by 18-inch-long 1-cwt blooms (Fenn vol. 13 n.d.:30).

Charcoal was made up the Middlebury River North Branch in Ripton where 60 to 100 men worked cutting trees, tending the kilns, and driving teams. About 9,000 bushels of charcoal were made annually in kilns owned and operated by the East Middlebury Forge Company (Smith 1886:593-594). Built sometime previous to 1859, the kilns were still operating when the forge went out of business. A nearby boardinghouse fed and housed the charcoal workers.

Subsequent to the Burlington Manufacturing Company ownership, the forge continued sporadic operation. The 1871 Beers map identified the owners as Williams & Nichols. Andrew Williams was from Plattsburgh; Harvey J. Nichols was works agent. They rebuilt the works in 1880, annual capacity then being 1,300 tons of charcoal blooms for steel manufacture (*Directory* 1882:169). When it was abandoned in 1890, the forge was the last iron-making operation remaining in Vermont (Swank 1892:113). Around 1900, the hammerheads, tuyeres, waterwheel, shafts, etc., all weighing about 500 tons, were purchased for scrap. At that time, it was reported that the forge building was still standing (Patch 1918:158).

Traces of the forge were still visible in 1985, just downstream of the Route 125 bridge over the gorge. For 100 feet below the bridge there are piles of black, rusty slag mixed with charcoal. A path leads from the highway diagonally through the site. East of the path are the stone wall remains of the forge, coal house, wheel pit, and the long tailrace. A state plan to relocate the Route 125 bridge 100 feet downstream might impact this historic site. Charcoal kilns that probably serviced the forge were found in 1983 near Dragon Brook, about two miles north (chapter 6, AD-314).

AD-IW02 Nichols Forge (Middlebury): The earliest ironworks at Middlebury village was at Frog Hollow, where Jonathan Nichols built a forge, trip-hammer shop, and gun factory in 1794 on the west side of the falls (Smith 1886:284-285). Ore for the works came mainly from Crown Point, mixed with some local ore from Monkton. Jonathan was joined by his brother Josiah two years later and, together with Daniel Pettibone and Ezekiel Chapman, discovered a process for welding cast steel, which they patented in 1802. The same year a federal contract for 1,000 guns was filled and delivered by the gun shop.

The shop was just northwest of the base of the falls under fill that today is a parking area in Frog Hollow along the Otter Creek. Three buildings identified as "Forge, Furnace & Trip Hammer" were drawn on a map in 1885 by Henry L. Sheldon of the first industries at the falls nearly 100 years before (Sheldon Museum Library). Much iron was made and worked here, and the works changed hands many times, eventually coming to Rufus and Jonathan Wainwright, Jr. They built a furnace (cupola?) on the site of the former forge soon after the end of the War of 1812, where stoves were cast (Smith 1886:325-328).

Areas of the parking lot, falls, and lawn behind the Old Stone Mill were inspected in 1984. Slag was found along the shoreline just upstream of the site of Nichols' gun shop and Wainwright's pre-1826 stove foundry. The eroding shoreline has exposed slag for 20 to 30 feet along the shore from the edge of the hillside lawn to well into the creek. Associated with the slag are firebricks of a period later than either the Wainwright or Nichols operations. The site area has been backfilled, hiding from view any slag remains on the older, now-buried shoreline. All archival references to "furnaces" at the falls hint at cupola furnaces rather than blast furnaces. But the possibility remains that for a short time around 1800 a blast furnace may also have operated near the falls prior to being displaced by a cupola.

AD-415 Wainwright/Davenport Foundry (Middlebury): Soon after the end of the War of 1812, Rufus and Jonathan Wainwright, Jr., built a furnace (cupola or air furnace?) on or very near the site of the former Jonathan Nichols forge, which had already changed hands many times (Smith 1886:325-328). In 1821 they advertised cook, parlor, and box stoves and trimmings, caldrons, kettles, andirons, and hollowware. Their offer of terms for cattle, horses, or grain with "a liberal discount for cash" reflected the continuing problem of lack of hard money, nearly 50 years after Ira Allen's similar offers in his ironworks ventures.

Fire destroyed the works in the summer of 1826 along with nearby gristmills and sawmills. A new foundry was built on the east side of Paper Mills Falls, a mile downstream. The

R. & J. Wainwright,

HAVE now on hand and will keep for sale, during the present season, a general assortment of

STOVES,

consisting of

Cook, Parlour Shop and Sheet-Iron Stoves,

—ALSO,—

Stove Pipe,

and Trimmings of every description.

☞ Cattle, Grain, and a few good Horses, will be taken in payment for the above articles.

Middlebury, Sept. 18, 1821. 5—tf

4-15. National Standard *October 2, 1821 (courtesy Sheldon Museum).*

December 1841 issue of the *Middlebury People's Press* announced that E. & A. A. (Edward and Alonzo A.) Wainwright were selling cooking, box, and parlor stoves, plows and plow irons, and hollowware "that have been manufactured at this furnace for the last 20 years."

In April 1844, Wainwright made a detailed description of these works (which included a "new building") for fire insurance purposes:

> The following is a description of the buildings belonging to Edward Wainwright situated in Middlebury at the lower falls on the East side of Otter Creek and one mile north of the village. The buildings are situated in relation to each other as follows: —the furnace stands immediately on the bank of the creek—and is 80 feet 10 inch by 30 feet 4 inches and one story high, and the roof is covered with sheet iron plates except 17 feet of the north end. The pots for smelting iron [are] placed in the south end of the furnace and in said furnace are two stoves for heating the same. Attached to the south end corner of the Furnace is a wing 11½ feet in breadth by 16 feet 2 inches in length. This wing is a wheel house and covered with sheet iron. Within 1 foot of the wing stands over the floom [*sic*] a building that is two stories high, is 24½ feet in length by 17 feet 4 inches in breadth and within the said building no fire is kept. North end of this building 21½ feet distant stands the coal House.
>
> The coalhouse [is] directly east of the furnace distant 41 feet 2 inches. The new building stands immediately upon the bank of the creek somewhat west of north of the furnace, 41 feet from it. It is 50 feet 4 inches by 30 feet 4 inches and 2 stories high and is warmed by three stoves. The lower story is used as a machine shop—the upper story for joiner

shop for making stove patterns, &c. Northeast of this last building stands the horse shed, 11 feet from it (*Vermont Insurance* 1844:No. 502, Bk. 2).

The "pots for smelting" would appear to indicate the presence of an iron-smelting blast furnace, but no mention is made elsewhere in the description of a necessary ore house. The building dimensions and distances between buildings, to the inch, are an archeological find.

Five months later, a fire consumed the "furnace building and coal house containing Lehigh (coal) and charcoal plus valuable patterns, tools, &c." (Sheldon, Bk. 178). The loss was $2,000, of which $1,600 was covered by insurance. The loss included the 80- by 30-foot furnace building, valued at $450 (*Vermont Insurance* 1844:No. 504, Bk. 2). The works were rebuilt and continued until the death of Jonathan Wainwright in 1845, at which time Jason Davenport bought the business. An 1849 advertisement listed machine castings, mill cranks and gears, stoves, caldrons, kettles, sleigh shoes, and wagon boxes for sale at the furnace. Davenport continued the business until about 1866.

Inspection of west side Paper (Pulp) Mills Falls in 1985 indicated evidence of the many mills that operated here at one time in the form of an impressive, deep raceway cut into solid rock, scattered bricks, many dozens of nails of all sizes, and many iron rods still firmly implanted in the stream bedrock just downstream of the covered bridge. On the east side of the falls, next to the headrace that leads to the hydroelectric power station, a 1986 inspection during lower-water conditions located some surface patches of slag-appearing material and significant stone wall foundations, which could be the remains of the Wainwright/Davenport foundry operations.

Upstream at Middlebury Falls, standing evidence of the former industrial activity of the village still exists, but no surface remains of the former Wainwright Foundry (or the Nichols Forge) can be found.

AD-146 Monkton Iron Company (Vergennes): The importance of the great falls of the Otter at Vergennes was recognized at an early time. The first mill here was a sawmill constructed in 1764 (Smith 1886:642). The next year a contract to build a gristmill was made. Considerable contention for these early mills ensued between New York and Vermont interests, including quasi-military actions by Ethan and Ira Allen just previous to the Revolutionary War. Mill construction at the falls proceeded vigorously following the war.

The year 1786 is mentioned as the date of the first ironworks. This forge might have been built by Gideon Spencer of Bennington, who moved to Vergennes that year (Smith 1886:646-647). Ore came from local beds (and Skene's ore bed in New York?), mixed with magnetic ores from northern Vermont (Highgate) and New York. A description of Vergennes in 1788 includes a small forge on the east side of Otter Creek, probably Spencer's (Smith 1886:649). The works changed hands many times, coming to Jabez G. Fitch in October 1789. It was seized the next year by a sheriff's return on a writ against Fitch in favor of some Québec merchants. The property included the residence of a bloomer, one forge with "every implement necessary for operating" one coal shed, and a blacksmith shop (Smith 1886:653). Azariah Tousey operated another forge on the west side of the creek above the falls in 1799 (Smith 1886:662).

IRON FOUNDRY
AND
MACHINE SHOP

The subscriber having purchased the *Wainwright Furnace*, would respectfully inform the public that he is now ready to execute all orders for

Castings of every Description:

Such as *Machine Castings, Mill Crank and Gearings, Stoves*, and *Stoves Plates of all kinds Caldron and other Kettles, Sleigh Shoes, Waggon Boxes, &c., &c.*

FORGE CASTINGS OF ALL KINDS CONSTANTLY ON HAND.

TABOR, EAGLE, and almost every variety of *Plough* castings on hand, or furnished at short notice.

THE MACHINE SHOP

Attached to the Furnace, contains facilities for business, and *competent workmen* are employed; and he feels confident in saying that all kinds of Machine work will be done in a workmanlike manner, on short notice, and at prices to correspond with the times.

All orders addressed to the subscriber at the office of DAVENPORT & NASH, or to LEONARD WALKER, *Machinist*, on the premises, will receive prompt attention.

1:1y JASON DAVENPORT.

Middlebury Lower Falls, May 1, 1849.

4-16. Middlebury Galaxy *August 7, 1849 (courtesy Sheldon Museum).*

These operations were all in place and operating when a gentleman arrived in 1807 from Boston to effect the transformation of the iron industry in Vergennes.

The Monkton Iron Company was exceptional not for what it did or did not do, but for the wealth of historical data the company left behind. The trials and failures of a group of Boston investors trying to turn a profit from an ambitious venture nearly 300 miles away is laid open by the record of papers and ledgers on file at the Bixby Memorial Library at Vergennes. In 1932, Adella Ingham authored an unpublished manuscript titled *In The Days of The Monkton Iron Company of Vergennes, Vermont 1807–1830*, which documented her research into Monkton Iron Company letters and ledgers that had recently come into the possession of the Bixby Library through the generosity of Philip C. Tucker III. As the assistant librarian, she took on the task for personal interest, as only so many valuable little histories are ever written. Not enough credit can

be given for efforts such as these, in a period when research grants were rare and the Comprehensive Employment and Training Act (CETA) was yet a lifetime away. Through her writing we can follow the daily frustrations of the company and its few slim successes. But were these frustrations reserved for the Monkton Iron Company alone? Nowhere else has such an explicit record been found of another Vermont ironworks operation. We know only bits of information; a starting date here, an abandonment date there, some tonnages and topics of interest someplace else. Everything between this scattered information can only be conjectured. But just as we must be careful not to conclude that the Vergennes ironworks experience was typical for others in Vermont, we must also be careful not to conclude that the others were more successful. A majority of ironworks ventures in Vermont had a short life. Many died in infancy.

By 1807 Boston had become one of the busiest ports on the coast, with merchant ships carrying on trade with ports as far away as China. And though their main attention was directed out to sea, it was not uncommon for Boston merchantmen to look inland for opportunities. That summer found Perkins Nichols of Boston buying up tracts of land in Vermont. Variously identified as an engineer, lawyer, and merchant, he was impressed by the potential of the falls at Vergennes and the proximity of iron ore beds a few miles away at Monkton. He was also an associate of a group of other Boston merchants who organized themselves later that year as the Monkton Iron Company (Seaburg and Paterson 1971:199-219).

The company consisted of Stephen and George Higginson, Francis Bradbury, James and Thomas H. "Colonel" Perkins, Benjamin Welles, Perkins Nichols, and William Parsons. Colonel Perkins, the major force behind the partnership, was a Boston merchant who built a fortune in sea trade, canals, bridges, politics, land speculation, and mining. In December 1807 an embargo on foreign trade was put into effect. Shipping dropped to zero and the port of Boston was starting to take on the appearance of a ghost town. The Monkton Iron Company appeared to provide a timely outlet for the Boston money men to put now-idle capital back to work. But because they were relative amateurs when it came to the iron business, the venture proved a financial disaster. They had the political and financial acumen to become the leading spokesmen on the Boston waterfront, but did not have the skill to run a successful iron business. Their hiring of men to supervise the construction of the ironworks through secondhand advice was in complete contradiction to their methods of operating a successful shipping business and it cost them endless problems. But you could not prove it by the people in and around the little community of Vergennes, who knew a good thing when they saw it; or to the U.S. Navy, which a few years later was rewarded with an unexpected tactical coup.

By mid-1808 construction of the furnace hearth had commenced with the expectation that it would go into blast before winter. Construction took place near the southern end of the falls, right side when facing upstream. (The 1810 Whitelaw map indicates an ironworks on the opposite side, not on this side until 1821.) Attempts to speed up the work were protested by the local workers who demanded higher wages despite the high unemployment at Boston caused by the embargo. With summer, many workers left for haying. The wheelwright who had been hired in March to construct the waterwheel machinery had not yet arrived by July. Waterwheel construction went ahead anyway with local supervision. The wheelwright finally arrived in September and the next month the furnace was completed, but the December date for going into blast was thwarted by an early and unusually cold winter that froze the Otter Creek. Work shut down until spring.

The plans were to build a blast furnace, some forges, plus rolling and slitting mills and nail machines. The company was going to operate every phase of the production: from mining and charcoaling to smelting and refining, thence to casting, machining, and finally, marketing. Even a company store and employee library were planned.

> Work on dams, flumes, and the beginnings of a blast furnace was begun as soon as the property came into the hands of the Company. Laborers were hired for the construction work in Vergennes and fifteen or twenty were set at work at the ore bed in Monkton. They spent much time clearing away the earth to prevent its falling in when the blasting was begun. A boarding house was built and a family hired to manage it. Irish and Canadian laborers worked for the small sum of ten dollars a month "and found" [food and lodging].
>
> Well-wooded land was to be had at four or five dollars an acre, and that was an important consideration. The fuel used in the furnace and forge was charcoal and large quantities had to be provided. Mr. Bradbury bought up tracts of woodland in surrounding towns and hired men to cut the timber and convert it to charcoal. Some of the tracts purchased included as many as five hundred acres. He also advertised for charcoal and many settlers went into the business of making it. A boarding house for the laborers in Vergennes was built. At about this time the Company opened a general store in Vergennes.
>
> In March 1808 we find record of a man named Butler cutting a thousand cords of wood at two dollars a cord and another gang of men cutting twelve hundred cords at the same price. How fast the original forest must have been disappearing! Houses for storing the charcoal were now necessary and eventually there were fifteen such houses. Blacksmith shops in Vergennes and Monkton were found to be needed when the ore and charcoal were being brought in to Vergennes. A farm in Ferrisburg, with a small forge near by, was owned by the Company. Here cattle, sheep and hogs were raised to furnish food for the employees.
>
> Mr. Bradbury was a very busy man. He bought timberland, got out timber for the construction in Vergennes and contracted for charcoal, supervised the work at the ore bed and at the Ferrisburg farm, to say nothing of the building of dams, flumes and the blast furnace in Vergennes. Small wonder that he protested that he could not attend to the retail shop. He did not feel competent to select the articles to be kept in a country store and begged the officers of the Company in Boston to put in a man accustomed to such trade. This man was provided and the store stocked and in operation. This was in January, 1808. . . .
>
> In November 1808 more than a hundred men were em-

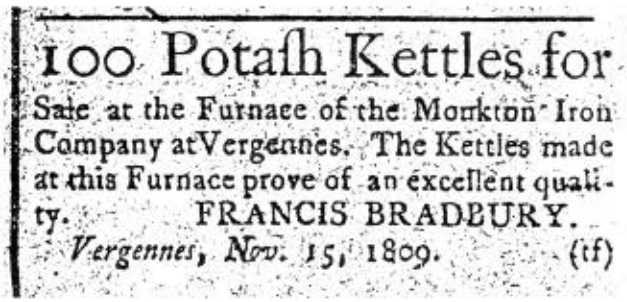
ployed by the Company; colliers, miners, carpenters and masons, and all bought their supplies from the company store. Charcoal was bartered for store goods. . . . Many pairs of oxen and horses were used in drawing the ore from the ore bed to Vergennes and in bringing in the charcoal. . . .

The Company was now running three boarding houses and the matter of provisions was important. Evidently much wheat was then raised in the country round about and frequent mention is made of buying it by the bushel for the boarding houses. Beef, pork and shad were bought by the barrel. Candles were an important item to provide and were often mentioned.

Contracts were made for raising the ore at the Monkton ore bed for seventy-five cents a ton. At the lake ore bed it was one dollar.

Several spans of mules were bought in Hartford, Connecticut to take the place of oxen and were the first to appear in this part of the country. At one time the Company owned thirty-seven oxen, twenty-nine horses and seven mules. Great effort was made on the Ferrisburg and Monkton farms to raise hay and oats for the horses and cattle owned by the Company. Much hay had to be purchased however.

An orchard of five hundred apple trees was planted on the Monkton farm and it is said the remains of it may still be seen (Ingham 1932:5-13).



100 Potash Kettles for Sale at the Furnace of the Monkton Iron Company at Vergennes. The Kettles made at this Furnace prove of an excellent quality. FRANCIS BRADBURY.
Vergennes, Nov. 15, 1809. (tf)

4-17. Middlebury Mercury *May 30, 1810 (courtesy Sheldon Museum).*

The furnace was fired on May 11, 1809 after the repair of the winter ice damage to some of the waterpower equipment. Nine days later the furnace was warm and stabilized. The waterwheel started turning, the bellows began their rhythmic creaking and puffing, and the blast began. An inability to control the speed of the waterwheel caused a hotter than desired blast and some small cracks in the hearth, resulting in fears that it might burn out prematurely. During the early summer the charge was slowly increased with no serious problem, and the yield climbed from 1½ tons to nearly 2 tons of iron a day. But this was far less than the 4½ tons that had been expected. On August 6 the furnace was shut down to rebuild the hearth. The chance to make a killing in the iron market was slipping away. Cheaper iron from Europe was now arriving at Boston with the lifting of the embargo the previous March. In early September the furnace again shut down for repairs.

In two months the hearth was repaired and the furnace was once more back in blast. A month later, results of the repair became evident as the yield rose to 3 tons a day, but still over a ton a day less than hoped for. And although the potash kettles being cast were not moving too well, the stoves were beginning to attract a market; some profits meant some cheerful news in Boston. But just then the tymph stone broke. Failure of the tymph stone forced another shutdown and a time-consuming cooling-down period. Furnace repairs were completed in mid-January 1810; the furnace was refired, then shut down again to replace another burned-out hearth. By June the furnace was back in operation for the fourth time in a year, surviving a leaky flume and the sudden illness of its operators. After a month the creek level dropped and the waterwheel slowed to a stop. With this stoppage, some repairs were made, one of which was to improve the regulation of the blast pressure. By the end of October, the furnace was again in blast, followed by another problem, and shut down at the end of November. A month later, ice stopped the refinery wheels from converting cast iron into wrought iron and on the first day of 1811 everything came to a halt.

So it went at Vergennes with the iron company continuing its unprofitable trial and error ways until the War of 1812 caught up with Vermont. Early in 1813, a contract was made with the government for 300 tons of shot for the small fleet of gunboats on Lake Champlain. By that summer the works were producing 7 tons of iron and 12 tons of shot a week at a cost to the government that approached four times the expense to the company. It had finally struck on a way out of the dilemma of profitless years: a U.S. defense contract! "In December 1812 the United States government ordered three hundred tons of cannon shot from the Company. In February 1813 Mr. Welles writes to George Bamford of the Ordinance [*sic*] Department [at] Albany. After a long dissertation on the sizes of cannon shot he goes on to say: 'Nothing could afford me higher gratification than to see you at our works. They are the largest in the U.S. and our stock of ore, coal and pigs is so great that we could at once go into very large business for the government' " (Ingham 1932:25-26).

The statement about the company being the largest in the U.S. has been quoted many times in books and magazines and taken as fact. Many large ironworks, however, were also operating during the War of 1812 in northwestern Connecticut, the Hudson River highlands of New York, just south in New Jersey, and throughout many parts of Pennsylvania. Almost all were situated on better transportation routes to more effectively support the American forces along the east coast. That the Monkton Iron Company might have been equal in size to some of these could be true; that it was the largest of them all is doubtful. Most likely, Benjamin Welles was "puffing" to the government agent in hopes of furthering his company's financial gain.

Commodore MacDonough's little fleet of warships went into winter quarters up Otter Creek, conveniently close to the ironworks, and in January 1814 received authorization to construct new gunboats. That September the newly outfitted and armed gunboats sailed out to the lake, thrashed the British fleet at Plattsburgh, and sent the invasion army packing back to Canada. "The battle of Plattsburg in which Commodore Macdonough defeated the British took place September 11, 1814. In October

Mr. Perkins wrote Mr. Welles: 'I believe in my heart that Macdonough saved our works, but I believe too that our works saved his ships by furnishing a large supply of shot. So that I think it is an even bargain'" (Ingham 1932:35).

Hostilities ended three months after the battles on Lake Champlain, and the sweet taste of victory at the ironworks proved short-lived when it was realized that the company had lost its most profitable customer.

> The Company was making wire of different sizes and mention is made of stoves. They are described as "common shoemakers' shop stoves, double stoves with ovens, 3 ft single stoves with ovens and mechanics' stoves." The prices were $40, $30, $28 and $12. Machines were set up for making screws, but there was no market for their product. . . .
>
> Following the period of great activity on the lake came a period of financial depression. The Company made every effort to collect bills and turn into money their varied stock of iron. Debts were put into the hands of collectors and at least one man was imprisoned for debt. The Company continued to make sheet iron and wire but could find little market for them (Ingham 1932:35-36).

The forges continued making stoves, hollowware, and other hardware. But with European iron once more arriving at Boston much cheaper than nearby Monkton iron, the works shut down in 1816. An October 2, 1816 item in a Boston newspaper noted that "the extensive Iron Works, water rights, mills, and estates belonging thereto, situated in the town of Vergennes, state of Vermont" were for sale to anyone who wanted to form a company to carry on the business. It was during this time that 15-year-old Philip C. Tucker was hired and became company assistant clerk and bookkeeper.

> [Mr.] Tucker remained in charge of the Counting-house and Works. It was a position of much responsibility and care. To enumerate the duties required of this sixteen-year-old boy: the care of the counting-house, correspondence and bookkeeping, watchful supervision over the grist mill and at least weekly division of the grain brought in, frequent visits to the Ferrisburg farm, the Monkton ore bed and farm where there was stock to be cared for, and occasional visits to the lake property to prevent depredations on the timber land. All the buildings and machinery of the Works were to be inspected and kept in repair.
>
> He made constant effort to sell iron and iron products and advertised in Burlington and Middlebury papers. The matter of the taxes on the New York lands caused him much anxiety and several trips to Essex and Albany New York. Every means was taken to collect bills and many notes were sued. Detailed accounts of all events and conditions at the Works were written to Mr. Welles in Boston, yet this very busy young man found time to read and make notes on the books read.
>
> An ironworker in Fairhaven, Vermont offered to buy the scrap iron, viz., thick and sheet iron trimmings, ends of bars and whatever blacksmiths' scraps there were at $2 a hundred weight, and it is a sad commentary on the condition of affairs that the Company was glad to accept this offer.
>
> Some pine timber on the Company's land was sold at this time to Capt. Sherman of the Steamboat Company.
>
> The year 1816 was a barren year. All crops were so poor that the stock on the farms could not be wintered. Mr. Tucker sold all the sheep except the merinos. There were eighteen head of cattle and no hay to feed them. On the advice of a business man, Mr. Booth, Mr. Tucker considered killing them and salting the beef to be sold in Canada, but he found there was an embargo on salt beef and pork. He then decided the thing to do was to drive them to Canada and sell them on the hoof. In November 1816 this young lad on horseback, with a drover starts on this long trip driving eighteen head of cattle. . . .

Sale 1 cow	$ 18.00	
Sale 17 beef oxen weighing 12150 lbs at $3.70	449.77	[*sic*]
Less exchange Bradbury	6.00	
	$461.77	

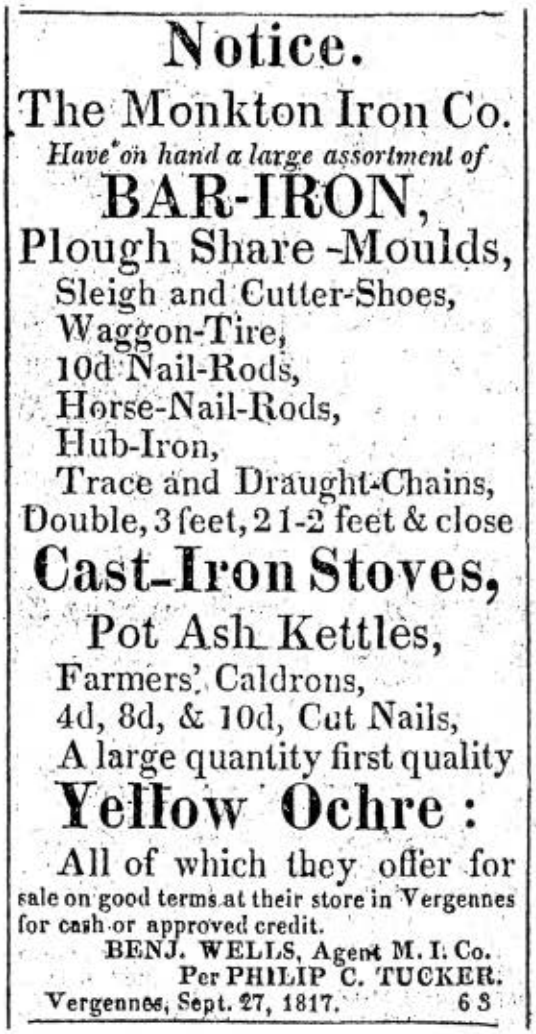
Expenses P.C. Tucker driving horse and 18 beef cattle to Montreal

Common exps.	$ 68.19	
Ferry across Lake Champlain and River St. Lawrence	18.75	
Destruction of cabbage gardens	5.00	
Assistance catching runaway cattle	1.75	
Duties	11.25	
Stowell's bill services selling	5.00	
Drover's wages	16.00	
	$125.66	[*sic*]
[net]		$336.11

> It is plainly to be seen that every effort to raise money on the personal property of the Company was being made (Ingham 1932:38-44).

Government thoughts for a while in 1817 of establishing an arsenal near the Canadian border stirred some hope among the Boston merchants that they might yet get bailed out. When President Monroe inspected the extensive (but idle) ironworks he was not impressed. The arsenal was built elsewhere although 11 years later an arsenal did become a reality for Vergennes. When the works closed down it consisted of the blast furnace, a cupola furnace, eight forges, a wire factory, a rolling mill, plus gristmills, sawmills, and fulling mills. An 1817 advertisement mentioned a large number of cast-iron and wrought-iron products on hand and for sale. In his travels through Vermont in 1819, Levi Woodbury arrived at Vergennes on Thursday, May 14, and made the following observation of the ironworks there: "Below the Falls, but so near as to have all its machinery turned by water from above are situated very extensive Iron works. They are at present suspended & decaying. One building contains 8 or 9 chimneys and bellows &c. for making bar-iron. The furnace, the outhouses &c. are 12 or 15 in number. Both bar and cast iron were manufactured here. The ore was dug on the New York side of the Lake & is not I should think the best quality" (Fant 1966:49).

"For a short time in August 1821 the Air Furnace was revived and moulders put to work making castings. Mr. Tucker assured Mr. Welles that he had 'furnished the furnace roof with proper ladders and kept the water buckets continually full. . . .' About this time Tucker sold for the Company a piece of land in



Notice.

The Monkton Iron Co.

Have on hand a large assortment of

BAR-IRON,

Plough Share Moulds,

Sleigh and Cutter-Shoes,

Waggon-Tire,

10d Nail-Rods,

Horse-Nail-Rods,

Hub-Iron,

Trace and Draught-Chains,

Double, 3 feet, 2 1-2 feet & close

Cast-Iron Stoves,

Pot Ash Kettles,

Farmers' Caldrons,

4d, 8d, & 10d, Cut Nails,

A large quantity first quality

Yellow Ochre :

All of which they offer for sale on good terms at their store in Vergennes for cash or approved credit.

BENJ. WELLS, Agent M. I. Co.
Per PHILIP C. TUCKER.

Vergennes, Sept. 27, 1817. 6 3

4-18. National Standard *October 15, 1817 (courtesy Sheldon Museum).*

Vergennes, six rods by five, for $450 which he thought a very good price in Vergennes" (Ingham 1932:45-46).

Not until after the opening of the Champlain Canal did the iron business revive to any degree in Vergennes. By that time, Amos W. Barnum had established himself as one of the city's leaders, holding a number of political posts, including mayor from 1824 to 1828. Barnum saw the value of the Champlain Canal toward promoting the commercial interests of the city's harbor and started a Tow Path Company for towing canal boats to and from the lake, seven miles down the Otter Creek. The towpath was used for several years until the advent of the lake steamers. He and others succeeded in organizing the Bank of Vergennes, which was rechartered the National Bank of Vergennes in 1865. Besides Barnum, the directors included Thomas D. Hammond, brother of Charles F. Hammond, one of the Crown Point Iron Company founders. When Barnum resigned, William Nash replaced him. Nash was a New Haven industrialist and owned a forge at New Haven Mills. Barnum also owned interests in the Stevens House and the American Hotel.

Barnum leased some of his land on the northeast side of the falls in 1824 to Alfred T. Rathbone, who built a blast furnace on it that same year. (Rathbone's father, Wait, had built blast furnaces in Clarendon (RU-97) and Tinmouth (RU-77) some years before.) Stoves and hollowware were cast by Alfred Rathbone, who also advertised to sell tea kettles, spiders, andirons, and plow irons (*Vermont Aurora* July 15, 1824; *National Standard* July 28, 1824). Soon after, Rathbone leased his furnace to Hector H. Crane (Smith 1886:677). In the fall of 1825 and early 1826, Crane published the following advertisement:

> Vergennes Blast Furnace—The subscriber informs the public that he has put his blast furnace in complete operation, and is prepared to execute orders for machine castings, from one pound to fifteen hundred pounds, at the Troy prices. He has on hand, a complete assortment of Hollow Ware, such as kettles holding from 2 quarts to 15 gallons, pots of various sizes, Spiders, Pans, Basins, Skillets, Bake Pans, Tea Kettles, Andirons, and Cast and Wagon Boxes. He will be ready in the fall to accommodate his customers with Parlor, Shop, and Cooking Stoves, and Potash and Caldron Kettles. The above articles with the exception of the Machinery Castings will be sold upon the approved credit, or for almost any kind of country products, on as reasonable terms as they can be had at other Furnace in any part of the country. Merchants can be furnished at the Troy prices (*Vermont Aurora* Sept. 22, 1825; Jan. 6, 1826).

The reference to Troy prices reflected competition with Troy, New York, the result of the newly opened Champlain Canal.

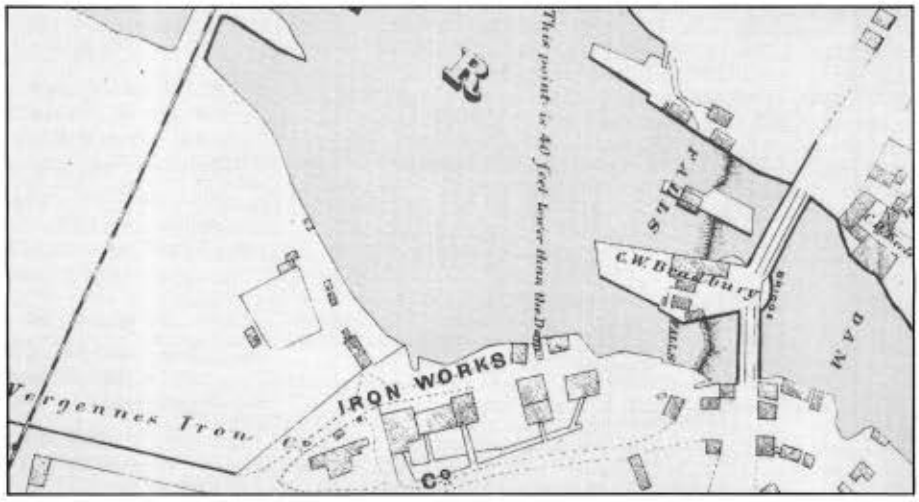
Alfred T. Rathbone, who had built this furnace on land leased from Amos Barnum, ran afoul of the law about 1826 when he found himself "financially over-extended." His creditors had him jailed (he escaped briefly) and he lost his furnace in the ensuing court action.

Barnum's ironworks interests also included ore beds in Monkton and near Moriah, New York, and 1,200 acres of timberland near Westport, New York, where the Sisco Furnace operated (*Vermont Aurora* June 18, 1829). Yet despite his vast holdings, he died a poor—and childless—man at age 57 (Smith 1886:676).

After the sale of its property on the falls in 1831, the Monkton Iron Company still owned 2,300 acres of land in New York and 1,500 acres of timber tracts in Vermont. New York acreage no doubt was bought by iron interests there, such as Colburn who owned a blast furnace at Moriah and who bought the nearby Monkton Iron Company ore beds (Ingham 1932:49-50).

The "old furnace" was still standing at Vergennes in 1849, but it is not known for sure if it was that owned by the Monkton Iron Company (Hodge May 19, 1849:305). The 1853 map of Vergennes indicates the ca.-1830 flume cut by Ward, leading from the falls to the site of the Vergennes Iron Works.

The area suspected to have been occupied by the Monkton Iron Company is generally believed to have been on the south side of the Otter Creek, at and just below the falls, although some (or all) operations could have been on the north side as indicated by Whitelaw's 1810 map. Both sides have been thoroughly surface-inspected many times at various times of the year from 1978 to 1990 without finding anything that can be firmly associated with the Monkton Iron Company. Both



4-19. *The Vergennes Iron Company on the south bank of the Otter Creek in 1853. Note the flume which runs behind the works, the only visible remains of the works today (Wall and Forrest* Map of Vergennes *1853).*

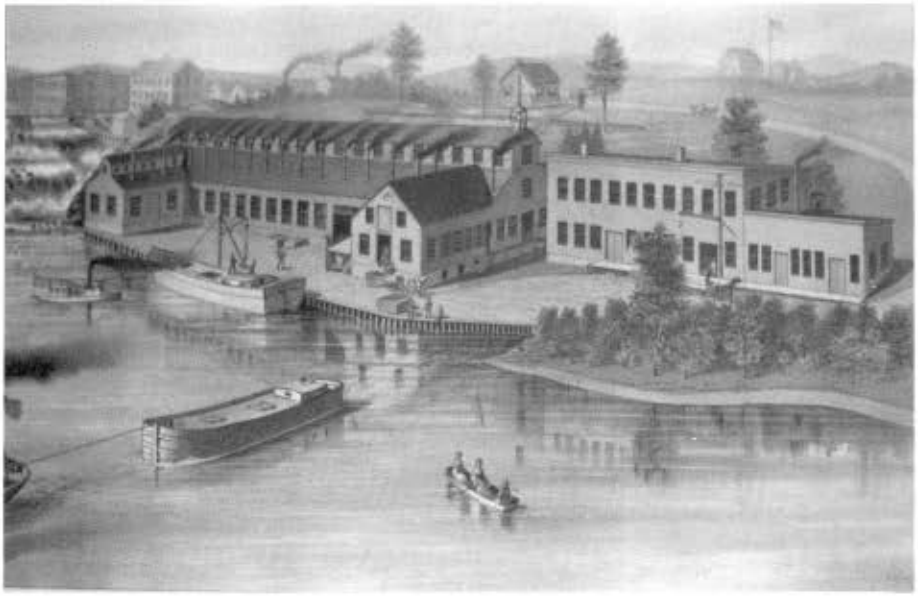
sides of the falls have undergone successions of industrial development and each have left bits and pieces of their existence behind in the form of miscellaneous castings, slag, firebrick, foundation walls, and various telltale cuts and modifications to the ledge at the base of the falls. Who knows what industrial artifacts lie at the bottom of the creek below the falls. What surface evidence remains today that can be connected with an ironworks most likely is related to the Vergennes Iron Company and/or the National Horse Nail Company (see AD-IW03, following).

AD-IW03 Vergennes Iron Company/White's Forge/National Horse Nail Company (Vergennes): When John D. Ward bought the lease of the Monkton Iron Company in 1831, he built a foundry and a flume to power it, commenced the hiring of a large number of men, and carried on a renewed iron business. He sold the works in 1836 to Appolos Austin, William H. White, and Henry Hewitt, who formed the Vergennes Iron Company (Smith 1886:689).

One of the former owners of the Vergennes Iron Company, William H. White, built a bloomery in 1847. The forge operated marginally for 10 years, although it did become widely known throughout the Northeast. Annual production was 75 tons of iron from 1854 to 1856 and 50 tons in 1857 (Neilson 1866:232-235). These were poor economic years nationwide.

When the Vergennes Iron Company ceased operations in 1857, iron making came to an end in Vergennes. The property was bought by the Vergennes Water Company in 1866 to promote the industrial resources of the area. Two years later the National Horse Nail Company was organized, probably moving into the former buildings of the Vergennes Iron Company at

4-20. *The falls at Vergennes (left) and the south shore of the Otter immediately after the Civil War. Left-center: the National Horse Nail Company (before the first fire); right-center: the machine shop and the foundry of the Vergennes Machine Company; right edge: Kendall & Miles sash and door factory (courtesy Bixby Memorial Library, Vergennes).*



4-21. *The National Horse Nail Company at Vergennes, built after a fire in 1882 but burned again in 1902 (Geo. H. Walker & Co., Lithographer).*

the base of the falls, on the south side of Otter Creek. It continued the iron business there, much more successfully than the ill-fated Monkton Iron Company. The horse nails were made by the "cold cut" process, with nails cut out of cold iron plate. The nail was called National and was unique in being the first horse nail put on the market that was pointed and ready for driving. Previously, nails needed pointing before they could be used (Bixby Library files, p. 18). A ca.-1870 painting (by Rowland E. Robinson?) of the falls and harbor shows a cluster of industrial buildings at the site of the foundry near the bottom of the falls; the cluster includes what appears to be foundry, machine shop, and furnace buildings.

Fire destroyed the entire works on February 9, 1882. The works were rebuilt the next year, the new "hot forged" process substituted for the old, and the horse nail renamed the Champlain. When run at full capacity, the works' 80 employees could turn out 600 tons of horse nails annually.

The 1885 Sanborn map shows the main foundry building parallel to and between the Otter Creek and the raceway cut into solid rock. This race was cut in 1831 by John D. Ward, who had bought the lease of the Monkton Iron Company and built a foundry that eventually became the Vergennes Iron Company. A flume branching away at a right angle from the main raceway drove a waterwheel and blower at the east end (upstream) of the building. Sixteen forges are shown inside this end, eight to a side. The other end contained a machine shop and rooms for finishing, sorting and packing, and shipping. Two separate buildings housed a foundry and a forge for splicing the nail rods.

On Wednesday evening, October 29, 1902, another fire struck, again completely leveling the works, nearly taking the nearby shade roller factory with it: "It was a terrible but magnificent spectacle to see the rolling flames enwrapping the doomed building, everything being reflected luridly in the waters of the Otter Creek, so near at hand, yet powerless to save the works" (Bixby Library files, p. 18). This time the company chose not to rebuild, joining the many others that had succumbed to fire. The site lay abandoned for nearly 20 years until the hydroelectric potential of the falls was discovered, first by the Burlington Traction Company to power its trolleys and later by the Green Mountain Power Corporation.

4-22. *The middle section of the flume below the falls at Vergennes, tunneled through solid rock. This flume supplied water that powered the foundries at the base of the falls.*

4-23. *An abandoned turbine at the upstream end of the tunnel at Vergennes.*

Most of the flume remains are still there today, cut into bedrock in some places and tunneled through in others. The easternmost (upstream) tunnel section is about 8 feet high, 12 feet wide, and 83 feet long. There are concrete walls at the eastern end (facing the falls) that show a vertical sluice gate existed here. Some 27 feet farther west is the middle tunnel, 66 feet long. Then comes a 150-foot-long cut that ends at the entrance to the westernmost tunnel. This tunnel is also faced with concrete that indicates another sluice gate operated here. Inside the tunnel (not explored) is a six-foot-diameter iron pipe that ends 27 feet inside, beneath breakdown. It is suspected that beneath this breakdown is a vertical shaft that leads downward to the turbine. The tailrace back to the Otter Creek cannot be located and probably lies beneath fill. Total length of the tunnels and cuts is about 353 feet.

Near the western end of the raceway, much dark, heavy slag can be seen partially buried under the fill. Lighter, blast furnace slag can be found along the stream bank immediately downstream of the hydroelectric station. There are also some pieces of firebrick from Troy, New York, similar to those found at the blast furnaces and lime kilns elsewhere in Vermont. Both shores of the Otter Creek have experienced fires and floods many times, and much earth has been moved about recently to build the waste treatment facility. Closer to the falls is a modern hydroelectric generating and substation switching complex, reflecting the continued industrial vitality of the Great Falls of the Otter.

AD-IW04 Belding/Drake Furnace (Weybridge): Three miles north of Middlebury Falls is Beldens, at a falls on the Otter Creek. Joseph McKee built a sawmill here in 1791 and sold it to David Belding two years later. Belding added a gristmill in 1794 and a small furnace the next year, building up an industrial community (Smith 1886:719). Belding's furnace was one of many small ironworks that operated in this area in the very early 1800s.

Arriving here about the same time as Belding were Asoph Drake and Ebeneezer Scott. They married Belding's two daughters and became associated with their father-in-law's industrial pursuits (Smith 1886:715-716). The vicinity became known as Belding's Falls and the community was established on the Weybridge side of Otter Creek. Items cast and wrought here included nails, spikes, plow irons, and frying pans (*Drake Papers* 1802). The works may have operated until 1806. After the railroad was built north from Middlebury on the east side of the Otter, the community followed the industries to the New Haven side and became known as Beldens (Swift 1977:53).

AD-414 Brooks Edge Tool Company (New Haven): Before the disastrous 1830 flood washed away nearly all the mills along the New Haven River, a number of factories and shops thrived at what was then called Beemans Hollow. These included a trip-hammer shop, carding shop, blacksmith shop, two sawmills, two wagon shops, and two pocket furnaces. Fifteen years after the flood, an industrious blacksmith, Barzillai Brooks, moved to the hollow from New Haven Mills with his four sons, started making edge tools, and eventually established a company that produced fine axes and cutting tools (Smith 1886:537).

Barzillai and all his sons eventually became partners in a family operation, and the prosperous little community that grew around the works became today's village of Brooksville. "To the census enumerators in 1850 they reported using 40 tons of iron, 10 tons of steel, 100 tons of coal for firing the furnaces, and 20 grindstones. Eighteen men were employed, and the factory's output was 35,000 axes valued at $30,000" (Farnsworth 1984:146).

Following the retirement of the elder Brooks in 1866, one

of the sons, Norman, along with two others, organized the Brooks Edge Tool Company. They built the forge and trip-hammer shop just below the falls (remains of which exist today) and production flourished (Rucker Aug. 1981:3). "An average worker earned $225 a year in 1860, $500 a year in 1870. . . . Although a variety of edge tools were made, the company's specialty was axes—as many as 50,000 a year, sold wholesale for $11 a dozen" (Farnsworth 1984:146).

On September 7, 1877, the following description of the works was published in the *Middlebury Register*:

> This is an institution. It always has been. It existed before Brooksville did. The Brookses have always run it. They probably always will. The men employed in the shop are strong, robust, healthy looking fellows, but it is an unwelcome fact that men engaged in this business seldom live to a very great age. It is unhealthy business. Where the disease known as the "grinder's consumption" fastens upon its victim, it works slowly but surely till death. There are few ax factories in America, but the few supply the great demand. This factory is not among the largest, though they sell their wares over almost all the northern states.
>
> Persons in this vicinity having a holiday could not spend it more pleasantly or profitably than by looking through these shops. The managers are gentlemen and will treat you with courtesy.
>
> The factory is now in full blast. The tools manufactured are axes, hatchets, and a queer looking thing with an ax on one end and a hook on the other, used by firemen. They get their "polls" from Cohoes, New York. The first forgers, those who draw out the "bit," are the veterans, Messrs James Nott [Nutt?] and John Shedrick. They are among the few who learned the business at this place, who are at work in the shop now. The most of the men came from the larger factories in New York. Mr. George Keyes and helper take the axes from the first forgers and draw the bit down finer. Mr. Tom Ryan and helper make the other tools. These men with a quick eye and ready hand make a handsome hatchet out of the rough bar of iron. The axes then undergo the inspection of the manager, Mr. Norman Brooks, who with a strong pair of glasses to detect the slightest mark of poor material or careless workmanship, looks them over, and if such is found, back it goes to the forgers. The grinders then have the axes; then the temperer, who places them over a hot fire and heats them to the right heat, which no one can tell but he. Mr. Frank Brooks is the temperer, and while watching his axes, he will tell you a jolly story.
>
> From the tempering room the axes go to the grinders again and then the polishers. The polishing is done with emery fastened by glue upon a wheel, which at swift speed makes the sparks fly every time the axe touches it. In this room we find Mr. Tom Stringham and Sidney Raymond, the old grinder, who has taken to this branch. The axes then go into the finishing room, are wiped off, stamped "N. C. Brooks, Brooksville, Vt.," varnished and bronzed or painted, and hung upon a beam to dry. Then dusted, labeled and each done up in a separate paper wrapper, boxed up and sent to the depot or store room.
>
> The company have two large store rooms. They make their own boxes, but get their helves from Sandusky, Ohio. They put handles on comparatively few of their tools. Mr. Will Brooks is overseer of the finishing or blacking room as it is called. Here also we find Mr. John Barton, who has worked in the shop off and on ever since he was "so high." . . . J. S.

The 1871 Beers map of Brooksville identifies the Brooks Edge Tool Company axe factory (forge) and other company buildings on the south side of the river, and a finishing and carpenter shop, the residence of N. C. Brooks, and more company buildings on the north side. Altogether, 13 buildings appear to be connected with the company or the Brooks family. A road is shown leading from the main street westward to a depot at the Rutland & Burlington Railroad.

Fire struck the works in 1881, destroying many buildings but not touching the forge. The *Middlebury Register* of May 20, 1881 described the excitement:

> Fire in Brooksville—Last Tuesday morning, about two o'clock, the little hamlet of Brooksville was awakened by the alarm of fire, and turned out to find the roof of one of the buildings of the Brooksville Edge Tool Company on the east side of the dam blazing up. It had gained such headway that it was soon seen that nothing could be done to stay it and in a short time all the buildings in connection with the finishing shop, where the fire started, were blazing. The wind blew strongly from the northwest and the flames speedily lapped up the house and barn of James D. Nutt standing nearby. It was feared for a time that the fire would extend to the covered bridge, over the New Haven River, and help was sent for to Middlebury. The steamer was hitched up and had got to the further slope of Chipman Hill when word come that the danger was past, and the steamer returned to its quarters. There was from 8 to 1000 dozen [*sic*] finished axes in the building, of which all but a small portion was thrown out, little damaged so that the loss on the finished stock is not large. The total loss of the Edge Tool Company is less than 5 thousand dollars on which there is seventeen hundred dollars insurance. . . .
>
> There will be but a short delay on the part of the Edge Tool Company in filling orders, as the vacant room in the forge shop on the opposite side of the stream will be speedily fitted for the grinders and polishers, who will probably be able to go back to work next Monday. The work of rebuilding will begin at once, and in a short time things will be as lively as ever.

Within a month, contracts had been let for rebuilding the stone- and woodwork, and in August it was reported that Norman Brooks was in Troy, New York, negotiating for several car loads of iron. The axe trade was described as being "very brisk" (*Middlebury Register* June 17 and Aug. 5, 1881); brisk enough that in 1883, Frank B. Brooks opened a store in the community, later operated by Norman Brooks (Smith 1886:537-538). Two years later when Norman Brooks retired, production was 4,000 axes per year. But the business declined soon after, closing the works sometime in the 1890s. *Walton's Vermont Register* listed the company for the last time in 1892.

Brooksville today is a small, quiet community on a section of highway called Dog Team Road, long since bypassed on

the east by a two-mile stretch of Route 7. Downstream of the concrete bridge over the New Haven River are a series of low falls and rapids that, when dammed, provided power to drive the industries. Sparse indications remain of these old pursuits; however, sharp eyes and patient inspection will reveal an abandoned turbine here and there, some firebrick and slag, and pieces of coal and millstones hidden amid the thick (and thorny) underbrush along the shores of the river. Remains of the dam are seen in a line of iron rods along the top ledge at the upper falls.

At the south end of the dam site, a deep cut into ledge can be followed downstream in tall weeds for 100 feet to the stone foundation remains of the axe factory. This cut might have been for a headrace in earlier years; a ca.-1907 photo shows an approximately three-foot-diameter pipe following the cut, supplying waterpower to the turbine at the downstream end of the forge building (Farnsworth 1984:145). On each side of the river at about this place stood the Brooks' factory buildings. They were later used by the Vermont Marble Company, until 1920 (Farnsworth 1984:246).

Bits of rusted iron and slag are found in shoreline crevices; one crevice yielded a badly corroded axe head of undetermined manufacture (it looks nothing like the Brooks axe on display at the Sheldon Museum in nearby Middlebury). And a bit farther downstream, ALMON SHEDRICK VIIIC [1892?] is chiseled into the broad upstream side of a flat ledge, barely readable, having been washed and worn by nearly a century of ice and gravel flow.

AD-IW05 Brooksville Pocket Furnaces (New Haven): Many small furnaces, called pocket furnaces by some, were built to "test" the local ores as well as the local market. Two such furnaces operated just downstream from Brooksville before 1815 (Smith 1886:537). One was on the north side of the river at the village where it was run by a Mr. Aiken. Nearby was a trip-hammer shop where scythes, hoes, and other tools were made. The other pocket furnace was across the river and just downstream, operated by John Wilson who also ran the sawmill immediately upstream. Nearly all these small industries were washed away in the great New Haven freshet of 1830. The vicinity was also the site of the later Brooks Edge Tool Company foundry and operations.

Inspection of the area in 1986 resulted in finding nothing related to blast furnace operations. The New Haven River area between Bristol village and the river's confluence with the Otter Creek has yet to be completely inspected for evidence of more blast furnaces and forges. This winding 10-mile stretch plus the Beldens area of the Otter Creek could still yield sites of up to four very early "pocket" blast furnaces.

AD-IW06 New Haven Mills Forge (New Haven): A forge (possibly a blacksmith's shop) was built somewhere in New Haven by Timothy Allen and Ezekiel Buttolph "at an early year." Another forge was run by David P. Nash at the mills from about 1794 until "worn out," the last remnant—the anvil block—washed away in an 1831 freshet (Beers *Addison* 1871:4). William Nash may also have been connected with this forge.

Inspection in 1984 of the remains of the many mills that operated at New Haven Mills resulted in finding some slag at scattered locations on the shore and in the riverbed. Due to later industrial development of the area, no positive evidence could be found of a furnace or furnace site.

AD-340 Little Otter Furnace (New Haven): Francis Bradbury of the Monkton Iron Company at Vergennes became interested in one of the small New Haven furnaces in 1808: "There is a furnace now at New Haven about 5 or 6 miles from the Ore Bed. It is small but might answer well for pigs [pig iron]. It may now be purchased very cheap" (F. Bradbury letter to T. H. Perkins, April 5, 1808). The ore bed mentioned was the company's mine at Monkton, northeast of New Haven. Belding's 1794 furnace would have been farther away, more like 10 miles, even had it still been in operable condition in 1808. Brooksville (then known as Beemans Hollow) likewise was too far away. One good possibility was a blast furnace on the Little Otter Creek, and within the stated "5 or 6 miles" of the Monkton ore beds.

Bradbury mentioned a New Haven furnace in three letters in 1808: April 5, June 9, and October 25. In the June letter a Mr. Washburn is mentioned as the owner of the furnace; the October letter states that the furnace is in blast and doing well. Bradbury further wrote in the October 25, 1808 letter that "it would have been very well in my opinion to have purchased that furnace as I recommended last spring, to have stopped the spirit of others interfering with us, they take much coal [charcoal] that might come to us & continually seeking out ore, that may eventually diminish our establishment."

Bradbury's "Mr. Washburn" might have been Abisha Washburn of Middlebury, who was engaged during the Revolution by the State of Massachusetts to cast cannon at Salisbury, Connecticut. Following the war, he returned to Middlebury and built some of the earliest mills there (Smith 1886:259, 270). He died in 1813 so he was alive when Bradbury wrote his 1808 letters. At the Salisbury Cannon Foundry (Connecticut) in 1777 were a Jonathan Washburn, molder, and also an Abijah Washburn, who performed unspecified duties (Middlebrook 1935:43-44). From an anecdote found among Henry Sheldon's notes at the Sheldon Museum: "He [Washburn] was a founder and used to cast cannon for the Revolutionary War. A neighbor coming into his furnace one day asked him which fire he thought was the hottest, this one here in the forge or that fed by the evil one in the regions below. 'Jump in sir, jump in and you can try them both in half a minute' was his instant response" (Polly Darnell note to author, March 26, 1986).

Along the Little Otter Creek in northern New Haven is the site of an early Vermont blast furnace. Remains of an earthen dam is just east of the North Street bridge. A recent history of New Haven mentions a furnace and casting house that stood here from about 1801 to 1810 owned by Gamaliel Leonard and others, and previously in 1800 by John Gilbert, Ephraim Hubbell, and Jose Gorsline (Farnsworth 1984:250-261).

If Gamaliel Leonard "and others" included the elusive Mr. Washburn it is still a mystery. Leonard previously built and operated a forge along the Poultney River west of Fair Haven (RU-195), and prior to that worked at the Lenox Furnace, Massachusetts. Hubbell was owner of the gristmill originally built by Strong & Chipman on the island in the Falls of the Otter at Vergennes. Hubbell sold the gristmill to Bradbury in February 1810 (Smith 1886:663).

John Gilbert could have been the Job Gilbert whose name

appears in 1797 in connection with a petition for relief from civil prosecution in which he stated that he "has for a large number of years been prinsapley imployed & conserned in erecting furnises stocking putting & continuing them in blast which has been attended with grate expense & loss" (Soule vol. 11 1962:33). Job Gilbert came from Mansfield, Massachusetts, where extensive ironworks operated before the Revolution (*Vital Records* 1933:31). During the war he was a captain and by 1781 was owner of a blast furnace at Lenox, Massachusetts (Wood 1969:67-68). He sold the Lenox works in 1783, bought them back in 1785, then sold them again in 1787, at which time he disappears from Berkshire County records. The 1797 Vermont petition, therefore, places this experienced ironmaster at Little Otter Creek. The possibility that John and Job Gilbert were the same person is further supported by another reference to John Gilbert owning the Berkshire Furnace at Lenox in 1783 (Pearse 1876:49-50). Gilbert was also involved with William Gilliland and New York tracts of ore-bearing land between Crown Point and the Bouquet River. Although he was considering digging ore in the Adirondacks in the 1780s, he was not planning to transport the heavy ore to his furnace in Lenox, some 150 miles south, at a time before the Champlain Canal was in existence. He had written to Gilliland in March 1783 that he would like "to be concerned in iron works at Lake Champlain," and doubled the offer of a competitor for an ore bed owned by Gilliland (Allen ms 1980:10). By the 1790s Gilbert was making iron in New Haven along the Little Otter Creek.

Inspection of the Little Otter furnace site in 1984 resulted in finding the remains of a dam just east of the North Street bridge. From the topography, a sizeable millpond could have been created, sufficient to power water-driven bellows machinery. The dam, however, might date to an industry that followed the furnace because slag was found in the body of the dam. Slag and charcoal were found in the vicinity and on both sides of the road. According to John Peters, a gardener plowing Ray Martin's garden across the highway to the west unearthed some slag, but this has not been confirmed.

The furnace could have been on the south side of the creek, tucked into the side of a low hill that gave charging access to the top of the furnace. At the top of this hill are the faint remains of a road. There is also sufficient flat area at the bottom for the casting shed. This is the only practical site in the immediate area considering proximity to waterpower and access to the furnace top. If this is the correct site, the furnace hearth was almost level with the creek's flood plain. Major iron ore beds existed to the northeast in the Monkton/Bristol area, and limestone for flux was conveniently available in the area, all maybe solving Francis Bradbury's "mystery" furnace of 1808.

AD-432 Barnum/Nichols Forge (Ferrisburgh): This is one of a number of small forges that operated along the many falls of the Little Otter Creek in Ferrisburgh, New Haven, and Monkton, taking advantage of local waterpower and exploiting the iron ore mined in the region: "The ore smelted in all the forges of this region was brought from the other side of the lake, except a small portion taken from an ore bed in Monkton, which was of an inferior quality" (Robinson 1934:245, writing about the forges in Ferrisburgh).

The site is along the Little Otter Creek in the proximity of the bridge that carries the Monkton Road across the creek, three miles east of Vergennes. The present bridge is about 150 feet downstream of the old Monkton road crossing referred to in the following:

> Just below the bridge was a forge built by Major Richard Barnum, longer ago then Mr. Luther Carpenter, who was born in the neighborhood, and is now in his ninety-first year, can remember. In 1805 Major Barnum sold the property here to Caleb Farrer, and he sold in April 1807, to Perkins Nichols, of Boston. Nichols sold the same year to Bradbury, Higginson, Well[e]s and others, all of Boston. A coal house, forge, and sawmill are mentioned in the deed (Smith 1886:446).
>
> The forge belonged to the Boston Iron Company together with 400 acres of adjacent land and the Monkton ore bed, whereby hangs a tale of the Yankee smartness. While the Boston Company were negotiating for the purchase of the ore bed, some of its members met the then owners at the forge on an appointed day to see the quality of the ore tested. During the process of the smelting, 30 silver dollars were secretly dropped into the loop, one by one, by a bloomer who was in the confidence of his employer, and the product was of such excellent quality that the Bostonians at once closed the bargain, and came into possession of a mine so worthless that it was soon abandoned. The story has its moral, for the instigator of the fraud, after cutting a great figure for a time [probably Amos Barnum of Vergennes], died in poverty (Robinson 1934:245).

Many inspections were made of the vicinity from 1979 to 1987. Evidences of the forge are scattered concentrations of up to baseball-size pieces of slag eroding from the north bank of the creek, just downstream of the old crossing, and larger pieces scattered along the creek bed in the marshy field 200 feet downstream from the present bridge. The forge site would appear to be, from the disposition of the slag finds, somewhere between the present and former crossing, most likely closer to the former crossing. Associated with the slag eroding from the shore are small bits of charcoal. The slag and charcoal are located along a strata about three to four feet below the surface and run along 20 feet of shoreline. No other forge-related features were seen. The older crossing is evident on both sides of the creek. Although covered by a thick growth of brush, the old road can be followed uphill north to where it rejoins the present road near the top of the hill.

A. T. Keller toured a number of ironworks sites in New England during the 1930s, photographing what remained of them and providing a valuable record of the state of the sites during that period. One of his photos identifies this as the "site of the Monkton Iron Company's charcoal furnace" from the description on the back of the photo. Many attempts to relate the photo to specific terrain features have failed, although it does generally appear to have been taken near this crossing. Construction of the present bridge, earthen ramps leading up to it, and highway straightening in 1950 have drastically disturbed the furnace site. Freshets might have also contributed toward destroying what remained of Barnum's forge/blast furnace site.

AD-431 Doreen's Forge (Ferrisburgh): There was another

forge farther upstream of the older Monkton Road crossing: "There was a forge on the Little Otter Creek a little above where the Monkton road crosses the stream. I cannot learn by whom it was built or operated" (Smith 1886:446).

The site was found in August 1987, about 1,000 feet upstream of AD-432. Evidence of the forge is a 10-foot-square concentration of up to fist-size pieces of slag on the north side of the creek and half that on the south side. The slag is associated with the remains of what appears to be a washed-out dam. The shoreline topography does not appear more superior here than the rest of this area of the stream with respect to advantageous location of a mill seat. But a dam of moderate height at this point could back up enough water to create a significant millpond in the low-lying swamp just upstream. Lack of head to turn an overshot waterwheel was probably more than offset by quantity of water to power a breast wheel. No charcoal, iron, or iron ore could be found; a shallow depression that might be a cellar hole was found within reasonable proximity of the site.

AD-IW07 Barnum Forge (Ferrisburgh): About a mile downstream from AD-432 is Walkers Falls, the site of a sawmill and tannery works whose remains are still visible. About 600 feet farther downstream was a forge built by (Richard or Amos?) Barnum. The place was called Dover, and small hand-operated nail and axe factories operated here. By 1866 all traces had disappeared (Smith 1886:446). Field inspections in 1980 and 1983 found no slag or evidence of iron making.

AD-IW08 Fuller Forge (Ferrisburgh): Farther downstream from AD-IW07 and west of Route 7 is a major falls at the village of Ferrisburgh, known as Fraser's Falls from John Fraser's sawmill here in the 1820s–1830s. A forge was operated just upstream of the falls early in the century by one of the Fuller family (Smith 1886:446). Attempts to find this site in 1985 were foiled by high water.

The Fuller family of Ferrisburgh was involved in many ironworks exploits in Vermont and New York (see chapter 1, "The Marriage Connection").

AD-430 North Ferrisburgh Forge (Ferrisburgh): The site of a late-18th- to early-19th-century bloomery forge was located along Lewis Creek in 1987 through information provided by the following historical accounts:

> At the upper part of the falls, at Ferrisburgh "Hollow" there was a forge early in this century, owned by one of the Fullers. This was on the "minister's lot." In 1822, Robert B. Hazard leased of the Baptist Church a portion of it thereabout, and built a woolen factory, which afterward came into the possession of his brother, William Hazard who in 1832 leased it to Theodore D. and Edmund Lyman. Theodore D. Lyman leased the factory to Edward Daniels in 1864. In 1884 it was burnt, while run by John Vanduysen under lease from Daniels (Smith 1886:447).
>
> Presently, one comes to the Hollow, long ago cursed by John Nutting when he lost his holding through a defective title. But in spite of his curse, it came to have a forge, with the best and busiest gristmill for miles around. . . .
>
> The Forge, which stood thereabouts (of the woolen mill) at an earlier date, was owned by some of the Fullers (Robinson 1934:230-232).

The site is about a quarter-mile upstream of where the Hollow Road crosses Lewis Creek at North Ferrisburgh. Evidence of the forge is slag eroding out of the shoreline in the vicinity of stone walls, these most likely the remains of the later woolen mill. Some large (basketball-size) pieces of slag were found, with the slag distributed over a 50-foot section of the shoreline. No slag was found upstream of the site. No dam remains were found, although the 1871 Beers map of Ferrisburgh shows a dam at or near the site.

AD-FS50 Ackworth Bloomeries (Lincoln): In contrast to its present quiet, rural environment, nestled high up a mountain along a cold and bubbling stream, West Lincoln in the early 19th century was a major hub of industry which included a number of nationally known bloomeries among its many mills. These forges were contemporaries of bloomeries at Salisbury, East Middlebury, Fair Haven, and Vergennes.

In the early 1800s the community was called Ackworth, from a town in New Hampshire that Joseph Blanchard, Isaac Houston, and William and Andrew Mitchell left in 1827 to come to Vermont. (Esther Swift locates Ackworth at Rocky Dale, in Bristol.) About 600 feet east of the bridge at West Lincoln they built a bloomery and a sawmill. The forge started making bar iron the next year. About the same time or possibly a year earlier, Henry Soper and Philetus Pier built a forge another 500 to 600 feet farther downstream from these forges (Smith 1886:492-493). Both forges were probably on the north side of the river. They operated only a few years, being carried away in July 1830 by a flash flood, which washed away the fully stocked coal house, stacks of ore and iron, and the sawmill, as well as houses, the original bridge, and many acres of top soil. Both forges were rebuilt that same year.

The upstream forge was built on or near its former site. The 1857 Addison County map shows forges just upstream of the confluence of Isham Brook and the New Haven River. The downstream forge was relocated about 300 feet farther downstream from its original site, probably where the map indicates a forge and dam. This forge was built by Oliver W. Burnham of Vergennes, who became part owner with Pier just before the flood. He became sole owner of both forges around 1840 and continued to make iron until he died about 1860. The operations were continued by his heirs.

A thrifty little manufacturing village developed about the forges and other mills as men with capital invested here. It fast became the business heart of the town. Iron ore came from the Adirondacks across Lake Champlain, and the hauling of ore and iron to and from the forges gave steady employment to a great many people who owned teams. The charcoal was furnished mostly by those who owned and cleared woodlands in the nearby forest. The wealth of the town previous to 1850 was to a great extent due to the ironworks and it was the nucleus of about the only business in which large sums of money were annually paid to employees. When the forges were run to their full capacity, they were capable of making 300 tons of iron yearly to each fire. The forges were enlarged in 1843 and again in 1854. In 1856 the ironworks was managed by O. W. Burnham (Lesley 1859:149). In 1858 there were four fires and two hammers operated by two waterwheels (Lesley 1858:75).

Neilson reported in 1866:

Production		Production	
Year	Tons	Year	Tons
1854	672	1860	0
1855	560	1861	0
1856	616	1862	150
1857	80	1863	150
1858	0	1864	160
1859	0	1865	100

[The forges were] owned up to 1856 by Oliver W. Burnham. About [1856] the owner died, and the bloomeries became the property of the heirs. Very little was done until about 1863, when the fires in one of the bloomeries—there were formerly two—were started up. In 1864 the bloomery was purchased by Lincoln, Cain & Co., and operated by them until December 1865, when it was abandoned. A saw and stave mill now occupies its site.

In 1865 the forge contained 5 forge and 3 run-out fires, 2 trip-hammers, and 2 waterwheels (Neilson 1866:235).

Neilson also reported that in 1864 the forges consumed 34,500 bushels of charcoal, 336 tons of Lake Champlain ore, and five tons of scrap iron. In a description of another flash flood in October 1869 that carried away or damaged mills, no mention was made of the forges (Smith 1886:560). A clapboard and stave mill appear next to the dam and millpond on the former forge site in the Beers 1871 map of Lincoln village.

The stream has been inspected in West Lincoln as well as farther up and downstream many times, especially during low-water periods, but nothing significant has been found to indicate the existence of such an extensive ironworks operation here at one time. Stone walls along the shore might have been associated with the forges or with later mills. Occasional bits of slag, rusted iron, and charcoal can be found in the stream from hundreds of yards upstream of the village to places among the downstream boulders to Rocky Dale, and as far downstream as Bristol.

AD-IW09 Scott, Munsil, and Eaton Forge (Bristol): The first of Bristol's two early forges was built in 1791 by Amos and Cyprian Easton, Amos Scott, and Gordon Munsil (Munsill 1979:107-110). It was located on the west side of the New Haven River and stood near today's bridge just downstream of the village. In addition to bar iron the forge made plows, crow bars, and tire iron (wheel rims).

Remains of the forge were probably destroyed by construction of the Bristol Manufacturing Company in the late 19th century, the ruins of which still existed when inspected in 1983. No evidence of a forge was found.

AD-IW10 Scott Forge (Bristol): Bristol's second forge was built by Ebenezer and Amos Scott soon after and near the first forge, on the west side of the stream. It made similar hardware, some used locally and some shipped to Troy, New York to pay for goods purchased there (Munsill 1979:108). Its remains probably suffered the same fate as the first.

AD-FS86 Franklin, Arnold, and Hobart Forge (Bristol): On April 5, 1808 Francis Bradbury of the Monkton Iron Company wrote to Thomas H. Perkins of Boston about progress with construction of their blast furnace at Vergennes. The letter included a reference to stone lining material for a furnace at Bristol: "I also have heard of a slate stone on the border of the lake that may answer for the lining. This can be examined when Mr. Bates comes up. I think also it best to say nothing of this slate for a furnace at Bristol, my avocations at present are so many that I cannot attend to it as it ought to be." Was Bradbury referring to the possibility of building a blast furnace at Bristol in addition to the one at Vergennes? Might he have been considering improving an existing furnace at Bristol?

This might have been Bristol's third forge, built in 1802 along the river at the base of the village by John Arnold, Henry and Joshua Franklin, and Nehemiah Hobart. It made bar iron for many years but might have had a blast furnace in addition to the bloomeries. The forge was successful in spite of its cramped location between the river and the high bank that is immediately behind buildings on the south side of Main Street. Partial and full owners included over a dozen men. Forge workers came from as far as the iron districts of Salisbury, Connecticut to work here. Seven proved an unlucky number for this forge. It burned in 1809, 1816, and 1823, and was rebuilt each time. The end came, of course, seven years later in 1830 when a freshet that ravaged the New Haven River valley finally destroyed the stubborn ironworks. Only the deeply imbedded foundation pilings remained by the 1860s to mark the spot (Munsill 1979:110).

One day in 1808, the owners of the Monkton Iron Company rode over from Vergennes to inspect their ore beds in Monkton and "a furnace in the neighborhood" (Seaburg and Paterson 1971:205). It is unclear whether "the neighborhood" meant Monkton, Bristol, Ferrisburgh, or somewhere else. The 1802 forge at Bristol was the closest one to the ore beds, but we now know that there also had been a blast furnace only three miles away along the Little Otter in nearby New Haven (AD-340).

The river and shore at Bristol village where the forge and/or furnace operated was inspected in 1983 with no evidence found of either. The river starts curving south just downstream of the site, and to reduce shore erosion here a high stretch of riprap was laid up against the shore, significantly disturbing the suspected area of the site. Disturbance has also been caused by trash dumped down the high embankment directly on the forge site. Somewhere beneath Bristol's trash and riprap might be the buried ironworks.

AD-493 Baldwin Creek Forge (Bristol): The fourth forge in Bristol was erected in 1832 by Thurston and James Chase, George C. Dayfoot, and Nathaniel Drake up Baldwin Creek in the northeastern part of town. Waterpower was poor, especially in summer months, but some profit was made at the forge by Thurston Chase and Philo S. Warner (Munsill 1979:110).

Since 1981, many checks were made for slag in Baldwin Creek in and below Chase Hollow. Chase Hollow is a deep ravine through which Baldwin Creek runs after it crosses into Bristol from Starksboro, paralleling Route 17. Up to fist-size pieces of forge slag were finally found in 1990 along the bank of the stream about 100 feet downstream of the present Route 116 bridge. A single slag find was made between the bridge and the concrete abutment of the former bridge, just upstream. All slag finds were on the east side of the stream. Along the

east side of the stream downstream of the bridge is a wide, silted-in area, under which the forge site might lie. Inspection of current and older maps indicate at least three bridges were built in this proximity, all contributing in part to disturbing the forge site.

AD-416 Holley Forge (Bristol): Bristol's fifth forge was built by Enos Soper, Chester Buel, and Henry Soper (who also owned a forge in Lincoln). It was on the north shore of the New Haven River about a mile upstream of the village. The 1857 map of Addison County indicates the forge opposite the home of Winter H. Holley, who owned it for a while (Munsill 1979:111).

The site of the forge was inspected in 1980, behind and adjacent to a mobile home park on Route 17. Here were found many pieces of slag, some charcoal, and a dozen three-foot-diameter iron hoops that held a large wooden pipe together that might have powered the forge waterwheel. Further remains of the forge may possibly still lie beneath the wall of domestic trash that lines the shore behind the mobile homes, or under the woodlot adjoining the park to the east.

AD-IW11 Burnham Forge (Bristol): The sixth forge in Bristol was built by Oliver W. Burnham of Vergennes (who also operated the forge at West Lincoln). It operated briefly up Baldwin Creek near the Starksboro town line and had a brief life (Munsill 1979:111). This site also remains unlocated.

AD-IW12 Munson, Dean, and Gaige Forge (Bristol): Bristol's seventh and final forge was built a half-mile downstream of the village by Luman Munson, Bennet B.Dean, and Datus R. Gaige. A dam and flume conveyed waterpower to the forge, located about 500 feet from the main channel, safe from freshets. Ownership changed hands while bar iron production varied through good times and bad. The principal market was Troy, New York. The forge was out of operation by 1860 (Munsill 1979:112).

A few pieces of slag-appearing material were found near here in the river during a 1982 field inspection, but they could have washed down from any of the many forge sites farther upstream. The site of this forge has not been found.

AD-404 Richville Forge (Shoreham): In the kitchen of the Penfield Homestead Foundation Museum at Ironville in Crown Point, New York, is a beehive oven with a heavy cast-iron door, on which reads:

PATENT
C. RICH SHOREHAM VT.
NO. 2.

Since the Penfield house was built in 1828, a furnace of some sort was producing castings during that time somewhere in Shoreham. The 1796 Whitelaw map indicates an iron forge, gristmill, and sawmill at a point where today's Shoreham Center is. It was named Richville in earlier years.

A high dam today backs up the Lemon Fair River, creating Richville Pond. But a century ago two other dams existed a short distance farther downstream. In 1785, Thomas Rich of Warwick, Massachusetts purchased land at the falls near the upper of these two earlier dams. The next year he constructed a sawmill. Jacob Atwood moved into the community in 1788 and a few years later built a forge at the north end of the same dam. A few years later another forge containing two bellows and four hearths was built 100 feet farther downstream where the other dam stood. In 1797 Ebenezer Markham built a nail factory and trip-hammer shop on the north side of the upper dam, possibly right on the site of the earlier Thomas Rich forge. The nail factory was later converted into a cloth factory (Smith 1886:622-623). Ore for the forge was mined a half-mile to the northeast, but the ore's high sulfur content forced its mixture with ore from Crown Point, in order to produce bar iron (Goodhue 1861:94). (Matthew Lyon also used some ore from Shoreham, making castings from it at his blast furnace at Orwell, five miles south.) Along with Thomas Rich came his 16-year-old son, Charles. In addition to owning and operating many mills, Charles Rich went on to serve in the U.S. Congress for 10 years. He died in October 1824, from complications caused by standing too long in the Lemon Fair River while fixing one of his mills (Goodhue 1861:189-190).

Charles Rich (Jr.), son of Charles Rich (the congressman), is probably the "C. Rich" whose name appears on the cast-iron oven door at Ironville, since the senior Rich died four years before the Penfield homestead was built. But nothing substantial can be found about any Richville furnace and/or foundry or the involvement of any Charles Rich with an ironworks beyond that intriguing oven door at Ironville. Charles W. Rich of the same family was born in Richville and moved to Swanton in 1840. There he opened quarries and built many lime kilns, establishing a successful lime-burning business (see chapter 8).

Ruins of the mills at Richville were inspected in 1986. High stone wall ruins and two breached dams were found in heavy underbrush, just below the modern dam. Some bits of charcoal and slag were found on the north side of the river, about 100 feet below the remains of the lower dam, but of an insufficient amount to confirm this a site of an early blast or cupola furnace. Later mills obliterated surface traces of the forge, sawmills, and gristmills that the Whitelaw map indicated here in 1796.

4-24. *Door of the beehive oven at Penfield Homestead Foundation Museum, Crown Point, New York, made in a Richville foundry at Shoreham.*

It is an interesting area to explore.

AD-IW13 Fergusson Forge (Starksboro): A forge was built in Starksboro about 1819 by Elisha Fergusson and Samuel Bushnell in the south part of the village (Smith 1886:635). The 1857 map of Addison County indicates that they also operated a foundry about a half-mile east of the village. Zadock Thompson reported in 1842 that a forge in Starksboro produced 60 tons of bar iron annually. In 1857 the village works were identified as the furnace of Fergusson & Sayles, and by 1871 only David Fergusson was associated with the village works; he consolidated the works a few years before.

The suspected site of the village works, just behind the village general store on Route 116, was visited in 1980. Some bits of slag were found along with broken pieces of a cast-iron stove, not necessarily a product of the forge/foundry. There were also some forges upstream of the village (see AD-417).

AD-417 Lewis Creek Farm Forge (Starksboro): In response to a landowner's invitation to inspect what looked like slag, surface indications of an early-19th-century forge were found at the Lewis Creek Farm in 1986 (Fred Elwert letter to author, Oct. 22, 1985). Basketball-size chunks of slag in association with pieces of red brick were found in the field downhill behind the farmyard. What appears to have been a berm or dam created a small millpond here; a forge might have stood on the low knoll. It is difficult to believe the small brook that today flows through the site had ever been sufficient to create a workable millpond, which adds support to the theory that Vermont streams and brooks ran higher in earlier times.

AD-IW14 Upper Lewis Creek Forge (Starksboro): According to an early account, Lewis Creek is formed "by the confluent waters of three springs which are not more than 20 rods apart, and which unite after flowing a short distance. Not more than a half-mile from its head, this stream once turned the wheels of a sawmill, fulling mill, two forges, and two trip-hammer shops. These have long since passed away" (Smith 1886:629).

Lewis Creek was inspected in 1990 from just below the Route 116 bridge to near its southwest source, off Ireland Road, and two places in between without finding any slag. At a point about a half-mile east of the highway, one mill foundation was found (containing a liberal amount of trash) but not of the forge variety. An early forge site might yet be waiting for discovery up Lewis Creek.

RUTLAND COUNTY

RU-IW01 Forge Flats (Chittenden): In a short paper published in 1953 on the subject of ironworks in Vermont, then State Geologist Elbridge Jacobs mentioned a number of towns where furnaces operated, explaining that blast furnaces operated at some and forges at others. The list of towns and furnaces included "Chittenden, 1797" (Jacobs 1953:130). Jacobs' data source was Charles R. Harte (see chapter 4, "Study Methodology"). Research has failed to reveal any blast furnaces in this town, but a forge and possibly an ore roaster did operate here. There are many historical references to a blast furnace being built in Chittenden in 1792 by a Mr. Keith of Boston, all of which can be traced back to Graham's 1797 history. It is unknown why Graham made this mistake, unless the exact location of the Chittenden-Pittsford town line was unknown at that time. But the 1796 Whitelaw map clearly shows the blast furnace in question over the line in Pittsford. In the mountains near the Pittsford town line, there was extensive iron mining, and in the 1880s various companies were formed to exploit iron ore beds in Chittenden.

At Holden was a community known as Forge Flats in the 1880s (Smith and Rann 1886:553) and the town's first "iron forging plant" was located here (Swift 1977:387). Field inspection has failed to find the site of this forge although some slag was found in 1984 just downstream from the fish hatchery in Furnace Brook.

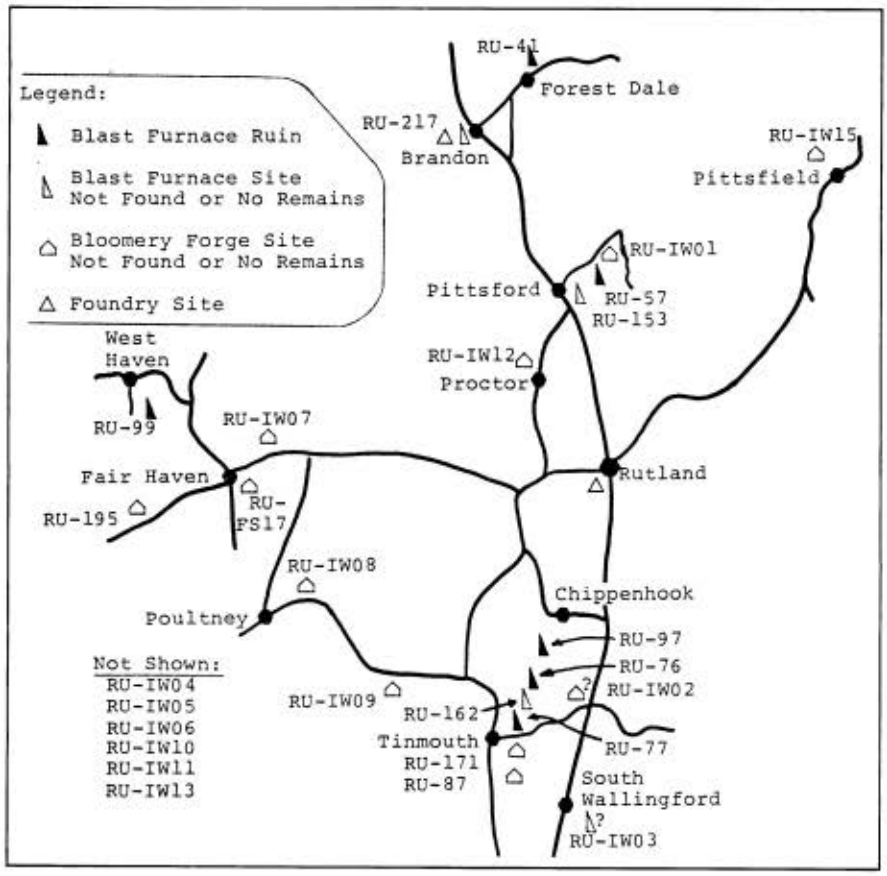
RU-IW02 Miller Forge (Wallingford): Solomon Miller operated an early forge at Wallingford, which also had some Nathanial Chipman interest (Rann 1886:705). After Miller left for Williston in 1786, his son Alexander continued to make hoes, axes, and nails (Smith and Rann 1886:835-836). The forge operated on the site of the stone shop establishment of Batcheller and Sons, on Main Street. (The "Old Stone Shop" is a common landmark to people driving along Route 7 through Wallingford village.) In 1865 good business dictated expansion into larger quarters along nearby Otter Creek and the stone shop was used for tumble-polishing the forks. The 1869 Beers map indicates the location of Batcheller & Sons Fork Manufactory between the Rutland & Bennington Railroad tracks and the Otter Creek.

RU-IW03 Wallingford Furnace (Wallingford): What was once thought to have been a high-quality iron ore deposit existed up Homer Stone Brook, east of South Wallingford. Thompson's 1824 Gazetteer mentioned a furnace in Wallingford, suspected to have been located near these iron deposits, and worked for a time in 1815 (Klock 1976:42). In the 1840s the bed was one of the sources of ore for the blast furnace at North Dorset, where the manganese in the ore in association with the iron became obvious (Hodge May 12, 1849:290). Steel magnate Andrew Carnegie bought the ore beds in 1880, built a railroad spur to the mines, and commenced digging the ore (Klock 1976:42). The iron and steel industry was finally beginning to recognize iron smelting as more of a chemical reaction, thus the need for manganese—previously considered an unwanted impurity—in steel making. Carnegie carted tons of the "black ore" to his Edgar Thompson Steel Works in Pennsylvania, forerunner to the Carnegie Steel Company (and, in 1901, U.S. Steel).

The Homer Stone Brook area was visited in 1984 and some indications of either Carnegie or earlier operations still remain. The hint of a narrow gauge railroad bed can be seen alongside the brook, and farther upstream the collapsed mines are betrayed by surface sinkholes. Here and there are high and dry raceways, probably used in ore-washing operations. But no slag or evidence of a blast furnace was found; it was most likely churned under by the Carnegie people.

RU-87 Chipman Forge (Tinmouth): Tinmouth was an early area of extensive forge and blast furnace activity. Nathanial Chipman was producing bar iron at his forge here in 1786, but difficulties with production and profits forced him to repeatedly sell his farm and forge to his brother Darius (Chipman 1846:66). He fared better in the political furnace, serving eventually in the U.S. Senate.

An ironworks site was found in 1983 near Chipman Lake,



4-25. *Rutland County ironworks sites.*

leading to speculation that the difficulty with production and profits may have been caused by Chipman building it too close to the stream. The site is along Tinmouth Channel about a mile downstream from the outlet of the lake. About where the 1796 Whitelaw map indicates an ironworks, some heavy, black slag was found in the stream. Following the trail of slag a few hundred yards upstream led to the faint remains of a dam and some depressions along the shore. In the streambed where the dam would have been is a wood beam, the possible dam crib. In the middle of one depression that was partially lined with large stone blocks, some fist-size pieces of heavy, black slag were found only inches below the surface. Because the slag is heavy and black, it could indicate the site of a bloomery forge, but could also indicate the site of a poorly operating blast furnace, a blast furnace with a cold hearth. In this close proximity to the stream, its heat could easily have been drawn off by the damp ground beneath it.

An older local resident identified this place as the site of "the old pumpkin mill," where pumpkin seeds were milled at an early time (pumpkin plants were noticed growing in the vicinity of the forge site). He also remembered that most of the land in the area once belonged to members of the Chipman family.

RU-162 Willard and Perry Furnace (Tinmouth): Of the 10 to 12 forges (and/or furnaces) operating in Tinmouth in 1798 (Bishop vol. 1 1868:523), one might have been linked with a dam on Tinmouth Channel in the northern part of town. No trace of the dam can be seen today, but there is much blast furnace slag and charcoal in the vicinity.

The original dam was an earthen affair, which backed up the channel and created a lake three miles long and in one place a half-mile wide. The dam was built at or before 1793; Tinmouth residents claimed that year the start of "fever and ague" caused by "a large pond of water in said town called the furnis pond" (Soule vol. 11 1962:350-351).

The 1796 Whitelaw map shows two ironworks just downstream of this dam. One was possibly the ca.-1793 Federal Furnace (RU-76); the other was probably that of Samuel Allen and Elias Willard, later Elias Willard and Abner Perry (Smith and Rann 1886:830). The one at the dam was probably that of Willard and Perry because it was eventually "taken away" (see later), relocated farther upstream, and later associated with Rathbone.

By 1805 Perry was in partnership with Wait Rathbone, Jr. (son of Captain Wait Rathbone), who came from Connecticut by way of Troy, New York and Middletown Springs in the late 1790s. (Rathbone initially ran a blast furnace (RU-97) with Perry at Clarendon, later opening another furnace (RU-77) with William Vaughan at Tinmouth. In 1805 and 1807 they advertised in the *Rutland Herald* for various hardware. One advertisement read: "Tinmouth: New Furnace in Tinmouth is now completed and in blast—at which place the subscriber has on hand

for sale Potash Kettles and all other kinds of Hollow Ware. All kinds of machinery cast on the shortest notice. Tinmouth, December 20, 1807 Wait Rathbone."

The dam at the furnace was "taken away" in 1815, but it is not clear whether this meant intentionally (by aggravated Tinmouth residents?) or by washout. The furnace "which stood upon it" was rebuilt farther up the stream near the center of the town (Thompson 1842:172). It is doubtful the furnace was actually built directly on the dam, but rather, just beside it.

The site of the dam and furnace were initially located in 1981, followed by repeat inspections to more accurately identify the remains here. The area shows evidence of much disturbance; for example, the old bridge has been replaced by a large new corrugated pipe under the road. Nearby is a section of high, thick concrete wall, a reminder of an unsuccessful 20th-century attempt to again harness the waterpower of Tinmouth Channel. The trench for the foundation of this wall cuts through the old furnace grounds.

RU-76 Tinmouth Channel Furnace (Tinmouth): Previous to 1800, a forge and blast furnace were built in the north part of the town (Smith and Rann 1886:830). On February 1, 1793, Federal Furnace at Tinmouth advertised in the *Vermont Gazette:* "Federal Furnace now in blast, and turns out work equal to any furnace in the United States. Any kind of hollow ware, from potash kettles to the smallest article may be had at said furnace, on as reasonable terms as they can be purchased at any others. Almost every kind of country produce taken in payment." Accepting country produce in payment reflects the scarcity of hard money in Vermont, an economic condition that was to persist for another century.

A furnace mound was found in 1979 about 500 feet downstream from RU-162. Here on the west bank of the Tinmouth Channel is the ruin of what might have been the 1793 Federal Furnace. One furnace wall stands at this ruin with a section of the bosh lining showing through the top, similar to other contemporary Vermont blast furnaces ruins. The late Henry Potter reported finding a cast-iron kettle and other iron items many years ago just downstream of the furnace ruin. Diane and Kenneth Terminini of New Jersey, owners of the furnace site, have indicated their plans for the property will not jeopardize the furnace grounds.

4-26. *The surviving wall of a collapsed blast furnace ruin along the Clarendon River at the north end of Tinmouth.*

Tinmouth Furnace
In Blast.

THE subscribers are now manufacturing, and will keep constantly on hand for sale, at their Furnace in Tinmouth,

Pot Ash Kettles,
Chaldrons,
Cooking & Parlour
STOVES,
together with a general assortment of
Hollow Ware.
—*ALSO*—
Machinery,
of all kinds cast on the shortest notice, and on reasonable terms, for cash or approved notes.

W. Rathbone & Son.
Tinmouth, Aug. 4, 1819. 50tf

4-27. National Standard *September 8, 1819 (courtesy Sheldon Museum).*

RU-77 Rathbone Furnace (Tinmouth): An October 2, 1815 item in the *Rutland Herald* said that Rathbone's furnace was casting clothiers' press plates, hatters' planing kettles, close cooking and other stoves, and machinery. Wait Rathbone, Jr. had taken his oldest son, Alfred T., as partner by 1819, and Rathbone and Son cast many domestic items. On September 8, 1819, W. Rathbone & Son advertised that they had for sale potash kettles, caldrons, cooking and parlor stoves, and a general assortment of hollowware and machinery. Alfred later moved to Vergennes to sell his father's wares and ended the partnership; he eventually built a blast furnace of his own (see AD-146).

Wait Rathbone, Jr. then went into partnership with William Vaughan and continued to do a good business at their Tinmouth furnace (Smith and Rann 1886:830). It may have been from this furnace in Tinmouth that the National Hydraulic Pump Company of Windsor obtained its pig iron (Putnum Dec. 1940:365). Rathbone started selling his interest in the furnace and some of his property in 1828. The Rathbone and Vaughan partnership was dissolved two years later when what was left of the former's properties in Tinmouth and Clarendon was sold. Rathbone moved to Rutland in 1835 and died there in 1847. The last operating blast furnace in Tinmouth, probably Rathbone's, went out of blast in 1837 (Thompson 1842:172).

4-28. *A collapsed blast furnace mound along the Tinmouth Channel, a few hundred yards north of Route 140, typical of what such a mound looks like in the wild. Hardly visible in even moderate underbrush, these sites can easily be missed.*

Rathbone's furnace was inspected in 1979 behind the Jaquay house on Route 140. Next to the 10-foot-high mound of stones that is the furnace ruin is a stone-lined waterwheel pit with its tailrace heading to the stream. Upstream of the ruins is the dam site and the faintest hint of a headrace.

RU-IW04 Allen Forge (Tinmouth): While Ira Allen was contracting for the construction of forges in the Burlington area, he also contracted for the construction of a forge at Tinmouth in 1791. It was to have two hearths in a 50- by 40-foot building, accompanied by a 30- by 40-foot charcoal shed and housing for the ironworkers (Wilbur vol. 2 1928:6). If it was in fact built, it might have been one of the 10 to 12 forges operating at Tinmouth in 1798 as reported by Bishop in 1868, but nothing further is known of it.

RU-171 Packard Mill/Forge (Tinmouth): Surface remains of a bloomery were found in 1986 along Tinmouth Channel among a network of earthen flumes, a concrete race, and the partially standing remains of a wood and stone dam in the high brush just south of Route 140. Many pieces of bloomery slag lie along the stream bank just downstream of the dam; a thick coating of charcoal covers the nearby hillside. Could this be the site of the unlocated Allen Forge (RU-IW04) alongside what might have been an early highway? The 1869 Beers map shows this the location of "A. Packard's Saw Mill." A cheese factory operated here later (Nelson Jaquay comment to author, Sept. 21, 1986). It was a pocket of intense industry in contrast to today's quiet appearance.

RU-97 Chippenhook Furnace (Clarendon): A furnace operated in Clarendon before 1817 doing a good business casting stoves (Smith and Rann 1886:575). *Rutland Herald* advertisements in 1805 and 1807 mention a Clarendon Furnace; in 1805 by (Abner) Perry and (Wait) Rathbone and in 1807 by Rathbone alone. Both advertisements state the furnace in blast, potash kettles and hollowware on hand, and "all kinds of machinery will be cast on the shortest of notice" (Rathbun ms n.d. 38-41).

An interview with the late Henry Potter of Clarendon (Dec. 27, 1984) followed by inspection of the Clarendon River later that day at Chippenhook resulted in finding a furnace ruin a few hundred feet northwest of the Town Road 23 bridge. The collapsed ruin is about a 20-foot-high mound of stones with the bosh lining extending upward out the top, much like the furnace at North Dorset. The furnace was built at the base of an embankment, at the top of which today are the house and yards of Mr. and Mrs. William Bauer. Near the furnace base is a slight depression, possibly outlining the casting shed area.

About 100 feet away is the Clarendon River where 20- by 20- by 6-foot-high stone foundation walls stand immediately next to the river's edge. Mr. Bauer called it "the quenching pit" although it is doubtful that quenching (annealing) was any part of the operations. The foundation looks more like the remains of a waterwheel house, especially since the base of an additional wall is near the middle of the ruin where one end of the wheel shaft could have been supported. A partially collapsed opening near the base of the downstream corner could have let spent water return to the river after turning the wheel.

This could have been Rathbone's Clarendon Furnace, but another furnace ruin might exist elsewhere in the town. While collecting information and making notes for an article on Tinmouth/Clarendon history in 1937, Wilbur Bradder wrote: "Two furnaces at bridge at Chippenhook. Can still see stacks (Herbert Best)." Does this mean that another furnace site exists somewhere in Chippenhook? Or was Bradder confusing this with another bridge a few miles upstream in Tinmouth where two furnace stacks once stood? Might there be undiscovered furnace ruins along the Clarendon River/Tinmouth Channel?

RU-FS17 Lyon's Works (Fair Haven): Born in Ireland in 1749, Matthew Lyon came to the colonies at the age of 15 and worked out his passage as an indentured servant. He was freed a few years later, settled in Cornwall, Connecticut, and married Mary Horsford (whose mother had previously been wife of David Allen, uncle to Ira Allen). He bought his first piece of property at Wallingford in 1773, took part in the storming of Fort Ticonderoga in 1775 with the Green Mountain Boys, and participated in the defeat of Burgoyne at Saratoga in 1777. Soon after, Lyon resigned his commission to attend to the military and political needs of Vermont (Austin 1981:7-32).

Taking advantage of his official position as Clerk of the Board of Confiscation, Lyon commenced to purchase land taken from local Tories and in 1779 petitioned for the grant of the township of Fair Haven in the expectation of developing the waterpower and other natural resources of that area. Within

two years, he owned over 400 contiguous acres, rich in iron and lumber, all around the falls of the Castleton River. He started building mills in 1782 at the falls in Fair Haven and three years later built a dam at the upper falls.

Fair Haven grew to be a major iron-making center called Lyon's Works. The same year he built the dam, Lyon petitioned the state for the scrap iron in the old fort at Mount Independence (Grout 1927:169). Responding favorably, a 1785 Vermont law directed the sale of the remains: "Whereas there are a number of cannon, mortars, mortar beds, bumbshells, carriage wheels of cast iron in and about Mount Independence which are public property, which are rendered unfit for service and may be of service in making bar iron . . . sell the same at public vendue to the highest bidder" (Williams 1966:32).

In 1788 when his forges were busy turning out nails and other hardware, Lyon advertised the following in the October 6 *Vermont Gazette:* "The subscriber takes this method to inform the public, that he has got the nailing business going on with vigor. That he has 8d, 10d, and 20d, nails, for sale for cash, as cheap as they are to be had in Albany [New York], and of a much superior quality. . . . At said works are made for sale, blacksmith's anvils of all sizes, blacksmith's bellows and other tools, clothier screws, all sorts of mill irons, warranted chains of all sizes, most sorts of farming tools of iron."

Ore for the forges came mainly from beds across Lake Champlain near Port Henry where Lyon owned a share as early as 1785 ("Original Owners" April 11, 1885). In the October 6, 1788 *Vermont Gazette*, he published plans for building a blast furnace for casting hollowware and pig iron "without which we cannot have a complete or independent set of iron works in Vermont." A month later, the state legislature authorized him to run a lottery to raise money to erect the furnace. Needing more money to build then he could normally deduct from lottery sales, he proposed to borrow the money paid and three months after the drawing award prizes in hollowware that he would cast. William Griswold of Bennington won top prize (Nordell 1967:51).

Lyon was again searching for money to build his blast furnace in October 1789, requesting state aid for a loan of £800. Whether this was to build a second blast furnace or to finish work on the first one is unclear. The loan petition also requested a purchase of land in Orwell on which to build the blast furnace (Austin 1981:41-42). He already had a lease for the lands until 1792. He was turned down on the purchase request in October 1790, and three months later also lost the vote for his state aid. Attempts to raise money in 1793 again failed.

Did Lyon ever build a blast furnace at Fair Haven? He *did* build a blast furnace and it is supposed to have been operating in 1788, doing a "considerable business" (Smith 1886:557). But that blast furnace was in Orwell (AD-300), not Fair Haven. Lyon's continuing petitions may have been unsuccessful attempts to replace his ailing Orwell stack with another, either at a better site in Orwell or maybe at Fair Haven. In all information concerning Lyon's works at Fair Haven, although there are numerous references to a furnace or blast furnace, nothing can be found to indicate a blast furnace erected or operating at Fair Haven. Many inspections of the Castleton River have likewise failed to reveal any blast furnace slag, from the upper falls to hundreds of yards downstream. When Lyon sold two of his forges on the south side of the Fair Haven works to William Hennessy in 1796, the sale included a hammer, anvil, and coal house (Adams 1870:142). Hennessy could not make a profit and lost the works in 1798 to Abraham Leggett of New York. Lyon, meanwhile, had left Vermont for Philadelphia and in 1800 sold the balance of his works to Edward Douse, of Dedham, Massachusetts. The transaction included the slitting mill and the ironworks, plus an extensive tract of land south and east of the river (Adams 1870:116). In November of that year, Lyon sold his remaining property in Fair Haven to Josiah Norton of Castleton. Norton had previously bought Lyon's paper mill and many acres of land. Dan Smith, who was later to build a forge at West Haven (RU-IW06), leased the ironworks from Douse in 1801. In 1801 he bought them and in 1807 sold to Jacob Davey. More people were involved in these transactions, including William Lee of Poultney who also came into ownership of the two south fires of the forge around 1800 (Adams 1870:117). No mention is made of any blast furnace in Fair Haven as part of all this buying and selling of the ironworks property. Insofar as it is known, therefore, the first blast furnace in Vermont may have been that erected by Lyon at Orwell, and not Fair Haven, as seems to be the historical consensus.

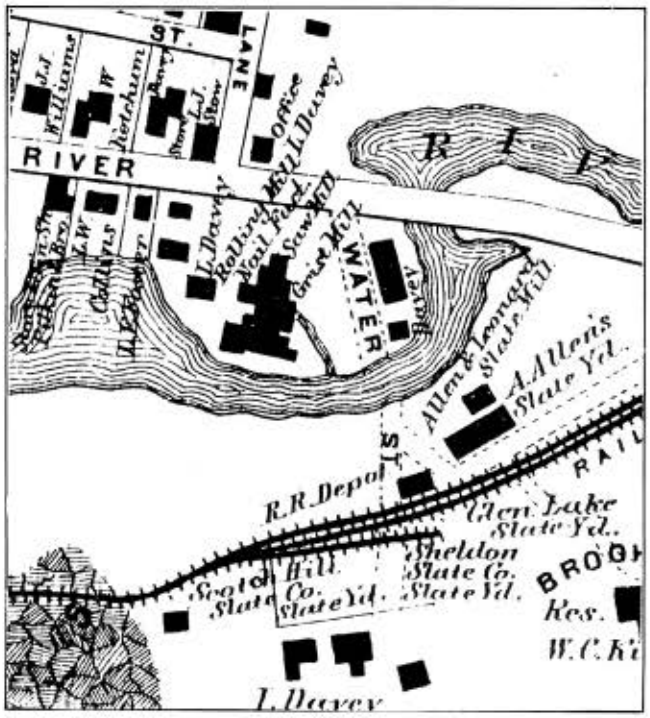
By 1812 Jacob Davey had taken control of the Fair Haven works. Born in New Jersey in 1771, Davey moved to Vergennes in 1800 and to Fair Haven in 1804 as superintendent of the ironworks. He soon purchased acreage in and around the ironworks and by 1812 was involved not only in the iron business, but also in fulling and finishing cloth and operating a sawmill. Davey also speculated in real estate and held local political office (Hemenway vol. 3 1877:732-733).

Davey's works burned in 1815 and were immediately rebuilt, implying that business was good. This was in contrast to the ironworks at Vergennes, which were languishing in the postwar depression. In 1829, Davey sold a half-interest in the works to three investors but bought it all back two years later. By 1842 the ironworks included a number of bloomeries, a rolling and slitting mill, and an extensive nail factory. The rolling mill made nail plates, marble saw blades, horseshoe rod, and bar iron (Thompson 1842:70).

In 1843 the ironworks again burned and were again rebuilt. That same year, Jacob Davey died and the works were sold at auction to Artemas S. Cushman. Jacob's son, Israel Davey, bought out Cushman in 1853 and six years later sold a half-interest to Benjamin S. Nichols, who in turn sold it back to Davey in 1865 (Adams 1870:144).

During this period the works prospered and were known throughout the industry. Production of the rolling mill and bloomery (Neilson 1866:224) was:

Year	Rolling Mill Tons	Bloomery Tons	Year	Rolling Mill Tons	Bloomery Tons
1854	700	300	1860	1,000	300
1855	700	300	1861	1,000	300
1856	700	300	1862	1,000	300
1857	700	300	1863	1,000	300
1858	—	—	1864	1,000	350
1859	1,000	300	1865	1,000	350



4-29. *Israel Davey's rolling mill and nail factory among other mills on the north side of the Castleton River at Fair Haven in 1869 (Beers* Rutland *1869:19).*

The rolling mill consumed 30 tons of anthracite and 700 tons of bituminous coal from Cumberland, Pennsylvania, plus tons of scrap iron and Lake Champlain ore in 1864. That same year the bloomery consumed 80,000 bushels of charcoal and 400 tons of ore. Full capacity of the bloomery was 500 tons. The works were described in 1866:

> [The] forge, billets and bars are made from scrap and from Lake Champlain ore, and sometimes the two mixed. Blowing is done by means of a "Tyler" wheel. There are two blowing cylinders of about 28 inches diameter and 4½ feet stroke. There are two bloomery fires, and a side-lift hammer. Over each fire are three arched pipes for heating blast. There is one tuyere to each fire, nozzle [oval-horizontal] shaped, 1½ inches long and 7/8 high. Hammer weighs about 1400 lbs., and is run by a breast wheel of about 13 feet diameter and 3½ feet buckets.
>
> Charcoal is hauled on an average about 9 miles, and costs (1866) about 12 cents [a bushel].
>
> Rolling mill contains 1 heating furnace, and one 12-inch train of rolls, with which scrap bars, horseshoe, band, and round iron, nail plate, and marble saws are rolled. In the heating furnace scrap piles are heated and rolled bars are reheated. Cumberland coal chiefly is used in this furnace. Capacity of rolling mill, 1500 tons.
>
> Nail factory contains 10 machines.
>
> In all, there are 5 water-wheels: 1 for blowing forge, 1 for rolls, 1 for shears, 1 for nail factory, and 1 for hammer. All except the last are "Tyler" wheels. The water privilege is good.
>
> Product of the works is in marble saws, horseshoes and other iron, and nails. Marble saws are made partly of scrap billets made in forge, and partly of bars rolled from scrap piles. Horseshoe iron is made from the scrap billets.
>
> Product of the rolling mill has for some years been about 1000 tons, about 350 of which are marble saws, some 400 are nails, and the balance in horseshoe and other iron (Neilson 1866:227-228).

Mention of the use of two bloomery fires with three arched pipes for heating the blast indicates the works employed the Champlain Forge principle of operation. The 1869 Beers map of Fair Haven shows the rolling mill and nail factory complex plus a sawmill and a gristmill on the north side of the Castleton River, east of today's Route 22A.

When Israel Davey died in 1869 he was sole owner of the vast ironworks operations at Fair Haven. His nephew, Rufus C. Colburn, continued operation of the works for the benefit of the estate, but this was the post-Civil War depression period and the slate business was fast displacing the iron business at Fair Haven. Within a few years, the forges shut down and became history.

Inspections of the site in 1978 and 1979 failed to reveal any surface indications of where specifically in that four-acre area the ironworks were located. Some forge-type slag was found near the base of the upper falls, but no blast furnace slag could be found. Debris from a succession of slate works generally buries the entire ironworks site, in the midst of which is an underground turbine and a tailrace that are most likely remains of these later industries. In 1986 there were plans for building a hydroelectric power station at this excellent mill site. A historical marker a few blocks away at the village green recognizes the ironworks heritage of Lyon's Works.

RU-IW05 Carver's Forge (West Haven?): One of the earliest settlers of the East Bay-Poultney River area was (Joseph?) Carver, who is supposed to have operated a forge in the area. Carver lived here during the Revolutionary War, and he and his forge might have been present at the time of the Hessian incursion from Lake Champlain into the Castleton area during the Burgoyne campaign the summer of 1777 (Pat Murtagh to author, Aug. 15, 1989). Whether the forge was in New York or Vermont is unknown but it probably was a bloomery, fashioning hardware and tools from local ore for local consumption. A Carver family cemetery is located in New York about a mile southeast of the Cogman Bridge, hinting that the forge might not have been in Vermont. But another cemetery containing Carvers is in Vermont just east of Carver's Falls. Close inspection of the shores of East Bay and in the Whitehall-Hampton-West Haven area might result in slag finds that could aid in locating Carver's Forge.

RU-IW06 Dan Smith Forge (West Haven): Dan Smith, nephew of Dr. Simeon Smith, came to Fair Haven from Suffield, Connecticut, probably in the early 1780s. From 1803 to 1807, he owned and operated the ironworks in Fair Haven that previously belonged to Matthew Lyon. Sometime during the War of 1812, he built a forge at Carver's Falls (Adams 1870:468). He also made nails during a later time in a factory (possibly a blacksmith shop) that was located alongside today's

Route 22A, east of the falls and just inside Fair Haven township (Smith and Rann 1886:862-864). Little else can be learned of this site.

In 1787 Simeon Smith (not Dr. Simeon Smith) came to Fair Haven from Sharon, Connecticut, settling in the west part of town. He built a sawmill on the Hubbardton River; the next year Jonathan Orms built a forge on the New York side (of Carver's Falls?) for Smith (Adams 1870:69). Orms later purchased the forge from Smith and built a sawmill and a gristmill, creating a small industrial complex near the falls that became known as Orms Mills (Smith and Rann 1886:862-864; Adams 1870:446). For a time, Smith also owned a share of the nearby Gamaliel Leonard Forge (RU-195).

RU-99 Colburn Furnace (West Haven): John P. Colburn came to Vermont from Canada with his father and family in 1808, eventually settling at West Haven and there learning the blacksmith trade. In 1817 he bought a half-interest in a scythe factory in Fair Haven where he produced axes and hoes. He married Lucy Davey following the death of his wife in 1824. Lucy was the daughter of Jacob Davey who was then operating the ironworks at Fair Haven. In 1825, Colburn, his father-in-law Jacob Davey, and James Y. Watson built a furnace stack "just below Carver's Falls" (Adams 1870:330-332).

It may be coincidence, but a few miles downstream from Carver's Falls were anchored what remained of MacDonough's victorious Lake Champlain naval squadron. After the War of 1812 the fleet was stripped of its guns and ordnance and the ships were harbored north of Whitehall. In 1819, one of the decaying ships sank at anchor; the next year another sank. The three remaining vessels were towed up the Poultney River and there allowed to sink. In 1825, the same year Colburn built his blast furnace just five miles upriver, the U.S. Navy sold what remained of the fleet for scrap, and all that remained by that time above water was broken up for the iron it contained (Cohn 1984:55). Could Colburn have had that scrap iron in mind when he built his furnace?

About a quarter-mile below Carver's Falls, the Poultney River emerges from a rocky gorge, flows rapidly through some island and shoreline sandbars, and takes a sharp right turn. The result, over the years, has been the creation of a triangular-shaped piece of flat, silted land on the inside curve of the river, the Vermont side, while the river erodes away at the outside part of the curve, the New York side. This triangular piece of land is bounded on two sides by the river and on the other by a high rocky embankment, the continuation of the river gorge. At a point some 300 feet from the river and at the base of the embankment Colburn built his blast furnace in 1825. It has to have been one of the poorest choices for a blast furnace site ever made. The late Paul Doran, who owned the furnace site, said that the river floods the entire area below the embankment every spring. The furnace ruin was found Memorial Day weekend of 1984 after climbing down the gorge by following the trace remains of a road that leads from Doran's farm to the site. (It was later learned that the furnace area is a favorite haunt of rattlesnakes.) The collapsed walls of the ruin are made of large blocks of stone and were probably hoisted into place by a derrick placed atop the nearby embankment. A 10-foot-high section of the 9-foot-diameter bosh remains, with no refractory lining or brick in evidence. Inspection of the bosh indicates two possible arches, one facing the embankment and the other 90 degrees to the northwest, facing what was probably going to be the casting floor, another poor choice considering how low and wet the ground is. The tangle of roots in the silt thwarted attempts to shallow-dig for slag. No evidence was found of head- or tailraces, cellar holes, waterwheel pit, slag, or charcoal. This, plus the lack of refractory material or evi-

4-30. *Colburn furnace ruin at West Haven. Note the lack of a bosh lining, indicating the possibility that this furnace was never fired.*

dence of burning inside the bosh, leads to the conclusion that the furnace never went into blast. Most likely, Colburn discovered his error at the first high water and abandoned the venture.

The ruin of another Colburn furnace that did see service is still standing 30 miles to the northwest at Moriah Center, New York. But this furnace operated from 1848 to 1858, some 17 years after John P. Colburn died. According to Eleanor Hall, Moriah/Port Henry historian, it was probably an Edward or Edmund Colburn (Coburn?) who ran the Moriah furnace (Richard S. Allen letter to author, April 23, 1984). Neither of those names has yet been tied to any of the Vermont Colburns. Other Colburns known to have been connected with the iron business were Charles T., brother of John P., a Pittsford blacksmith; and Rufus C., son of John P., who ran the Fair Haven works after Israel Davey died.

RU-195 Gamaliel Leonard Forge (Fair Haven): Born in Raynham, Massachusetts in 1757, Gamaliel Leonard was a descendant of James Leonard, who landed in this country about 20 years after the Pilgrims and is credited with building the first forge in this country (Adams 1870:426-427). Sometime after the end of the Revolutionary War, Gamaliel Leonard migrated to Lenox, Massachusetts, where he worked at the blast furnace. In 1785, after two years at the furnace, he moved, along with a member of the Fuller family, to Hampton, New York across the Poultney River from Fair Haven.

Leonard bought a 120-acre tract along the Poultney River in Fair Haven, alongside a small falls just upstream of where the old Skene Road crossed the river. (Route 4 today crosses about 100 feet farther upstream.) He moved to Fair Haven in 1786, built a house near the falls, and then a sawmill, the second one in the town. In company with Elias Stevens and Daniel Arnold of Hampton, he built a forge at the west end (just downstream) of his sawmill in 1788. Four years later Arnold sold his share of the forge to James Downey, Jr. In 1802 Stevens sold his share to Simeon Smith.

Downey, from Granville, New York and former worker in Lyon's forge at Fair Haven, sold his share in 1798 to Samuel Atwood (Adams 1870:352-353). Might this be the Downey/Downing who later owned a forge in Addison County (AD-IW01), as reported in the Census of Manufacturers for 1832?

The 1796 Whitelaw map does not show Leonard's forge along the Poultney River west of Fair Haven. Does this mean that the forge was out of operation at that time or that Whitelaw was unaware of its existence? The 1869 Beers map of Fair Haven shows the old Skene Road crossing and a group of buildings in the immediate vicinity, including the sawmill and house of David H. Bristol (whose father bought and rebuilt Leonard's house) on the Vermont side, and a machine shop and woolen mill owned by Bristol and two stores (one owned by an H. Leonard) on the New York side.

When inspected in 1989 a concentration of slag was found just downstream of the mill's still-standing stone foundations next to the falls, a few hundred feet north of the Route 4 bridge. Some pieces of slag were up to one foot thick. Smaller pieces were found along the bank as far as 100 feet downstream. Location of the site agrees with two historical accounts that Leonard built his forge "at the west end of the sawmill" and "below his sawmill." Luckily, the new Route 4 bridge was built just far enough upstream to preserve this interesting site. There is much to see and learn here.

How long the forge operated is unknown. Shares of ownership changed hands up to 1802, although this does not mean the forge was in actual operation then. Speculative buying might have been afoot. Shares of Leonard's sawmill were sold, the mill was rebuilt, and a share of that was sold in 1803. More shares were conveyed and then the mill was swept away by "the great freshet of 1811" (Adams 1870:153). The freshet might have swept away the forge also, marking at least its latest operating year. During these years, Leonard was also associated with a blast furnace in New Haven (AD-340).

Leonard bought the sawmill and rebuilt it after the washout and again sold it, along with three acres of land and the old house where he had lived, to David H. Bristol in May 1842. Bristol later built a machine shop and new dwelling house on the premises, those seen in the Beers map.

Gamaliel Leonard died at Fair Haven on August 7, 1827 and was buried in Low Hampton, New York. His oldest son Charles, born in Fair Haven, married Betsy Colburn, sister of John P. Colburn (Adams 1870:428). It was this Colburn who built the blast furnace at the base of Carver's Falls (RU-99). Another son, Gilbert, operated a "small furnace near Mr Davey's works [RU-FS17] between 1812 and 1820" (Adams 1870:429). Simeon Smith, who bought Elias Stevens' share in Leonard's forge in 1802, earlier owned a forge that operated on the New York side of Carver's Falls (see RU-IW06). DeWitt Leonard, grandson of Gamaliel, published the *Fair Haven Journal*, and together with E. H. Phelps (Leonard & Phelps) published Andrew Adams' *History of the Town of Fair Haven, Vermont.*

RU-IW07 Castleton Forge (Castleton): A forge operated from the 1790s to about 1815 in Castleton, two miles east of Fair Haven (Smith and Rann 1886:541). The forge was located north of Route 4A, at a site that places it near (or maybe under) the Lake Bomoseen dam at Hydeville per the 1796 Whitelaw map. Nothing was found in a 1984 inspection.

RU-IW08 Joslin and Darling Forge (Poultney): Along the Poultney River, six miles south of Lyon's Works, Samuel Joslin and Abel Darling built a forge in 1785 (Smith and Rann 1886:772). The 1796 Whitelaw map shows it about a half-mile upstream of East Poultney. Inspections of the river in 1981 resulted in finding occasional pieces of slag but no forge site or slag concentration.

RU-IW09 John Burnham Forge (Middletown Springs): At Burnham Hollow, in today's town of Middletown Springs, a forge and foundry were operating in the 1790s in addition to a number of other mills, all built by John Burnham, who came from Shaftsbury in 1785. These were all washed away in 1811 after which the forge was rebuilt but not operated as extensively as before (Smith and Rann 1886:653). Bits of slag were found at various places along the Poultney River in a 1981 inspection but no definite ironworks site was found.

RU-IW10 Keith Furnace (Pittsford): Israel Keith came to Pittsford from Easton, Massachusetts, which was an 18th-century ironworks town in its own right. He graduated from Harvard in 1771 and joined the army at Boston two years later (Shipton 1975:549-550). Keith rose to the position of deputy adjutant general on General Heath's staff before resigning his commission in 1778 to resume the study of law. Admitted by the Suffolk County Bar in 1780 to practice before the Massa-

chusetts Superior Court, he married Caroline Jenkins in Boston three years later. He retired from the Suffolk Bar in 1790 and the next summer he was in Pittsford, putting idle money to work building a blast furnace.

The ironworks were built on 3½ acres of land that he bought from Joseph Hitchcock, of which he paid "six pounds lawful money" (*Keith Furnace Lot* Deed, Massachusetts Historical Society, vol. 2, Aug. 3, 1791). He also purchased some land from Ira Allen, "agreeing to pay him with iron and hollowware manufactured by him which was to be delivered at Allen's house" (Wilbur vol. 2 1928:70).

Israel Keith supplied the money; his father Zephaniah and younger brother Alfred supplied the skill and ironworks know-how (Shipton 1975:553). The works made a good-quality iron that found a ready market (Caverly 1872:517). Scotland Keith came to Pittsford in 1795, purchased a share in the furnace, and joined the rest of the family in the firm of Keith & Company (Caverly 1872:270). The blast furnace was built so near the Chittenden town line that many historians, starting with Graham in 1797, credited that town with the site of Keith's furnace (Graham 1797:86). The error has been copied in a number of published histories as recently as the 1970s (Thompson 1842:55; Hemenway vol. 3 1877:547; Jacobs 1953:130; Swift 1977:388). Whitelaw's 1796 map clearly indicates "Furnace" in Pittsford.

Israel Keith sold his furnace property in 1795. Four years later he proceeded to establish another ironworks nearly 90 miles to the north, where he and Alfred built a blast furnace on the east bank of the Black Creek in Sheldon (see FR-67 and FR-68). Returning to Pittsford, he continued his law practice in U.S. and Vermont courts. He died at Pittsford on June 3, 1819 and is buried in the Congregational church cemetery where his tombstone stands in the unmaintained section, barely visible amid the high thorn bushes.

Keith's former furnace property in Pittsford had changed hands many times. These partial and full owners included men who, like the Keiths, also came from Easton. Howard Lothrop invested in the works and became superintendent (Smith and Rann 1886:902). Nathan and Cornelius Gibbs and Edward Kingman, also from eastern Massachusetts, along with Luke Reed, ran the furnace business in the late 1790s until Nathan Gibbs eventually came into full control. Gibbs enlarged the furnace in 1824, making the bosh 8 feet wide by 27 feet high. He improved the property and operated the works until he died later that year (Caverly 1872:517). Nathan Gibbs is buried next to Israel Keith. Andrew Leach, buried nearby in the same cemetery, owned the furnace from 1824 to 1826.

Although it is assumed that Simeon Granger's enlargement of Keith's furnace stack in 1827 completely razed it, an intensive search of Furnace Brook below the site has not been made to eliminate the possibility of an earlier Keith furnace ruin/site in existence. Information from the Massachusetts Historical Society, however, appears to identify the area of the Granger furnace ruin (RU-57) also as the site of the Israel Keith 1791 furnace (David Ingram letter to author, Dec. 2, 1988). Keith's house might have been where only a depression today remains, at the site of Granger's house per the 1854 map of Rutland County, although this has not been proven. Much work remains in finding the homes of Vermont's great ironmasters.

RU-57 Granger Furnace (Pittsford): Simeon Granger was born in 1770 at West Springfield, Massachusetts, moved with his parents to Sandisfield following the Revolution, and there married Phoebe Couch in 1791. In 1801 he moved to Salisbury, Connecticut, where he became involved in the iron business. In November 1826, when he learned that Andrew Leach at Pittsford had put his blast furnace (RU-IW10) up for sale, he bought it. Waiting until dark so he would not be missed, Granger left Salisbury and rode night and day to reach Pittsford and made the purchase. On his way to the town clerk to record the deed, he waved the deed to another prospective buyer just arriving from Salisbury, saying to him "You are too late, neighbor; the property is mine!" (Granger 1893:865). Granger incorporated the business on November 14, 1826 as the Pittsford Iron Manufacturing Co. Partners of record were Lyman and Chester Granger, their father-in-law Cephos Smith, and Egbert B. Smith (*Acts Passed* 1826:98-99). Histories refer to the company as Simeon Granger & Sons.

The Grangers rebuilt the furnace in 1827 and two years later built a foundry nearby and moved into Keith's former house. A number of items were cast at the furnace, including stoves. A few years later the foundry was moved some 50 to 100 feet west of its original location (Caverly 1872:518). In 1834 at age 64, Simeon Granger died, leaving two of his sons, Lyman and Chester, to continue the business.

Lyman Granger had commenced practicing law after graduating from Union College at Schenectady and the Litchfield Law School, Connecticut, moving to Rutland in 1823. With the formation of Simeon Granger & Sons in 1826, he moved to Pittsford and represented the town at the General Assembly during that and the following year. In 1837 his health had already started failing and he sold his interest in the furnace property to Edward L., his brother. Lyman Granger died suddenly two years later while visiting at Utica, New York. Chester and Edward L. Granger formed C. & E. L. Granger, and when Edward L. died in 1846, George W. Hodges came into the business under the firm name of Granger, Hodges & Company.

Due to poor economic conditions, the works partially suspended operations in 1852. At this time the business was incorporated into a stock company, the Pittsford Iron Co., and the village of Grangerville grew along Furnace Brook near the works. In addition to the blast furnace, there was a cupola furnace at the foundry, a blacksmith shop, company store (across from Chester Granger's house), the furnace school, and about 20 tenant houses for the ironworkers. In 1853, the furnace was enlarged to 42 feet high. A 24-foot waterwheel provided the heated blast of 600°F (Lesley 1858:76). Production capacity was 2,600 tons a year, but the furnace smelted only 350 to 1,757 tons a year from 1854 to 1858. The foundry cast 300 tons of stoves a year (Lesley 1859:26). There was no production from 1859 to 1863; only 400 tons were smelted in 1864 (Neilson 1866:218). Why the furnace made so little iron during the Civil War years is puzzling.

Ore for the furnace was found locally in many places. While Granger was excavating for the construction of his new furnace, good-quality iron ore was found directly underfoot (Hodge May 12, 1849:291). Ore was dug nearby on both sides of the stream and from deep mines at Chittenden, 2½ miles north. These mines remained in operation to 1872. Local ore was sometimes mixed with magnetic ore and boated and carted to Pittsford

IRON WORKS, PITTSFORD, VT.
PRICES OF STOVES, HOLLOW WARE, &C.

Numbers		Diameter of Boiler holes	Length of Fire Arch	Price
1	Farmer & Mechanic Elevated Oven Cook Stove, 3 Boilers	13 in.	22 in.	11.00
2	ditto. " " " " 2 "	14	26	12.00
3	ditto. " with or without back Furnace, 4 "	"	"	15.00
4	ditto. " " " " " 4 "	15	28	17.00
2 to 4	Same Stoves with Mammoth Oven, additional price,			2.00
1	Square Oven Cook Stove, Oven 13 x 14 x 22 in. 2 Boilers	13	22	12.00
2	ditto. " " " 13 x 15 x 22 " 2 "	14	26	13.50
3	ditto. " " " 14 x 15 x 24 " 2 "	"	"	16.50
4	ditto. " " " same, " 2 "	15	28	18.50
2	El. Oven Parlor Cook Stove, 1 boiler 13 in. and 2 "	8½	20	9.00
3	ditto. " " 1 long " 18 " and 3 "	7½	19	9.50
4	ditto. " " 1 " " 18 " and 4 "	7½	19	10.00
7	East'n Queen Air Tight, 2 " " 17 in. and 4 "	7	16	12.00
8	ditto. 2 " " 18 " " 4 "	8	18	15.00
9	ditto. 2 " " 19 " " 4 "	9		17.00
4	Hot Blast Air Tight Cook Stove, 1 long 19 in. and 4 "	8	20	16.00
5	ditto. 1 " 21 " " 4 "	9	21	18.00
0	Air Tight Parlor Box Stove, hearth on side,		18	3.00
1	ditto. " " " hearth on the end or side,		18	4.50
2	ditto. " " " " " "		21	6.00
3	ditto. " " " " " "		25	8.00
4	ditto. " " " " " "		30	12.00
5	ditto. " " " " " "	9 in.	3 ft.	15.00
8	Rail Road ditto. " " - - -		4 ft.	45.00
6	Air Tight Sap Boiling Stove for Pan 28 x 44 inches,		3 ft.	16.00
	Same Stove with false Cap for 25 inch Cauldron and for two boilers 10 x 12 inches,			20.00
	Same Stove with all the above and Large Square oven,			25.00
1	Arch Top, 26 x 30 inches - - - for Kettles of	18 in.		1.50
	Same with 4 Circles and Griddles, - -			2.50
2	ditto. 28 x 40 inches for 2 Boilers and Kettle of	25 in.		3.00
	Same with 7 Circles and 3 Griddles,			5.00
	Arch Mouth, - - - - - - -			1.25
	Oven Mouth, - - - - - - -			
1	Cauldron Kettle, 30 gallons, - - - -	25 in.		5.00
2	ditto. 60 " - - - -	30 "		8.00
	Flat Iron Heater, - - - - for 6 Sad Irons			2.75

Numbers		Diameter at the top	Price
2	Maslin Kettles	7½ in.	0.20
3	ditto. - -	8½	0.30
4	ditto. - -	9½	0.40
5	ditto. - -	10½	0.50
6	ditto. - -	11½	0.60
7	ditto. - -	12½	0.70
	Nest of above six Kettles,		2.70
00	Boiler - - -	9	0.40
0	do. - - -	10	0.50
0 & 1	do. - - -	11	0.60
1	do. - - -	12	0.70
	Nest of above four Boilers,		2.20
2	Boiler - - -	10	0.80
3	do. - - -	11	0.90
4	do. - - -	13	1.00
	Wash boilers - -	15½	2.00
	Pots - - -	7	0.80
	do. - - -	8	0.90
	do. - - -	7	1.00
	Tea Kettles - -	7	0.80
	ditto. - -	8	1.00
0 & 1	Spiders, Flat Bottom	9	.25
1	do. Round "	9	.25
2	do. " "	10	.33
2 & 3	do. Flat "	10	.33
4	do. " "	12½	.50
2	Grid Irons 16 in. long	9	.42
4	do. 17 "	9	.58
6	do. Square		.75
1	Bailed Basin - -	12	.33
2	do. do. - -	12	.50
	No bail do. - -	9	.42
	Bread Basins Round,	9	.33
	do. do. Square,	6 x 9	.42
	Pestle and Mortar,		.67

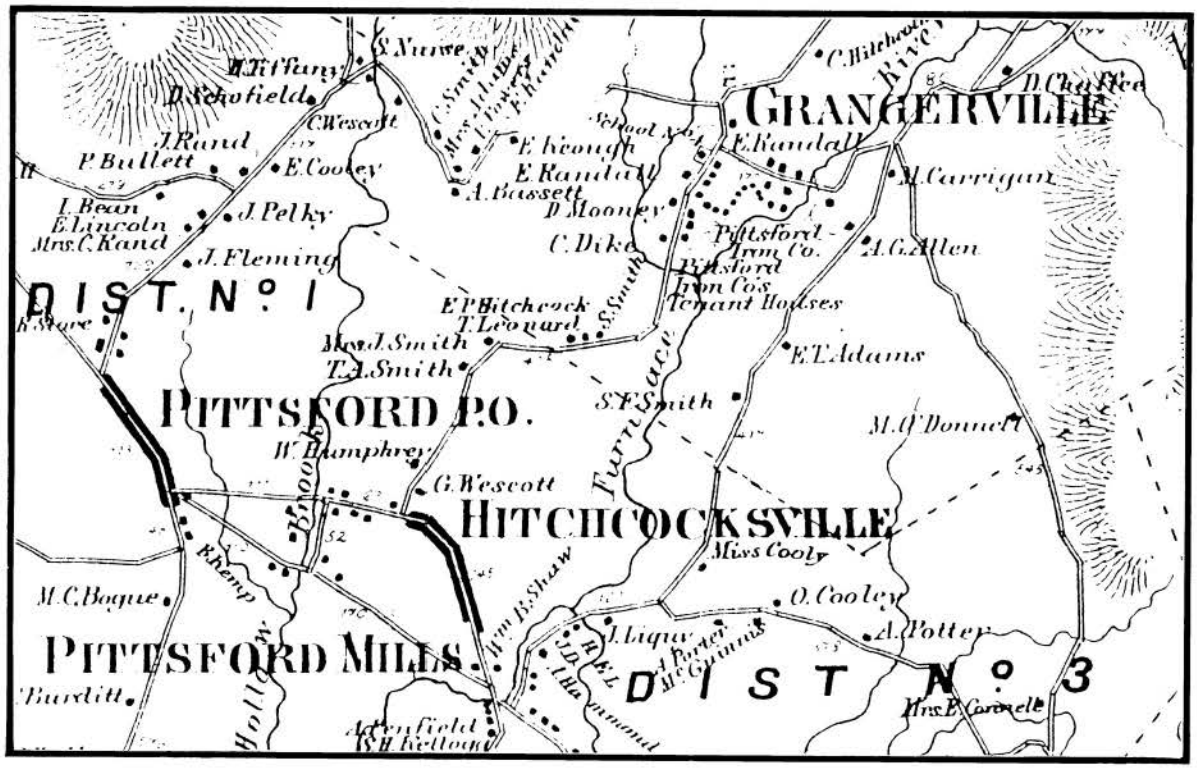
4-31. *Price list of ironware produced by Granger, Hodges & Co. at Pittsford in 1851 (typeset from a poor original; courtesy UVM Special Collections Library).*

from mines in New York. In order to obtain maximum yield from its ore, Granger ran the cooled slag through a stamping machine. A stream of water washed away the lighter vitreous portions of the slag and the heavier iron particles were collected and recycled into the furnace (Hodge May 19, 1849:305).

After the Civil War, a new group of owners called the Vermont Iron Company fired the furnace once again in 1865, but iron prices fell sharply during the post-war period. Jeremiah Pritchard of Boston was running the works in the 1870s when railroad wheel iron and spiegel (pig iron with high manganese content) were being made (Lewis 1876-77:234).

The Mitchell ore bed at Chittenden shut down in 1872; five years later, Chester Granger died at age 81. In addition to his involvement with the ironworks, Granger was one of the original directors of the Rutland & Burlington Railroad, director of the Bank of Rutland, and also representative to the General Assembly from 1862 to 1865; he later engaged in an iron business in Pennsylvania but returned to Pittsford where he retired. The works were owned by Naylor & Company from 1882 to 1886; they were probably gambling on a general improvement of the iron business. The works were called Titan Furnace at this time (Child 1881:179). There is no evidence that the furnace ever operated after 1883, making it the final operating blast furnace in Vermont.

Of other Grangers, Chester's younger brother Rensselaer Dudley Granger moved to Woodstock about 1830 where he was involved in the mercantile business for several years. He later converted his mill into a foundry, making castings and



4-32. *A pocket of industry at Pittsford, including the community of Grangerville (upper right) with the Pittsford Iron Company, company tenant houses, and the furnace school along "Furnace River." Notice the family names associated with the Crown Point Iron Works (clockwise): Dike, Hammond, Penfield, and Bogue (Beers* Rutland *1869:31).*

tools under the name Granger and Swan (Aldrich and Holmes 1891:267; Watson 1967:17). He sold the foundry to Daniel Taft around 1836 (Taft at the time owned and operated foundries in nearby Taftsville). Granger then moved on to Troy, New York, where he was awarded many patents on stove designs, the most famous being Granger's Air Tight Parlor Cook (patent date 1846), cast for many years at Ransom & Company, an Albany, New York stove foundry (Groft 1984:88). William S. Granger, one of Chester's sons, moved to Providence, Rhode Island, becoming treasurer of the Cove Foundry & Machine Company. It was succeeded about 1880 by the Granger Foundry & Machine Company, of which he became president. The company later merged with three other firms to become the Textile Finishing & Machinery Company, a foundry that made machines to bleach, dye, and finish cotton goods (Dodge 1912:204).

In a 1953 interview by the *Rutland Herald,* 86-year-old Pittsford native Patrick E. Mooney related his memories of working at the furnace (McWhorter Oct. 2, 1953:68). He started work there at age 15 and was at the furnace two years until the last blast in the spring of 1883. Mooney said the works was owned by Gillman Pritchard, who lived in an old brick house (the Ironmasters Inn) across the road from the furnace. In 1953, the house was occupied by Pittsford sawmill owner Harry Smith.

Mooney said that about 60 men were employed at the furnace, the mine, and the charcoal kilns. The kilns were operated by Bill Taylor and wood for the kilns—maple, birch, and beech—came from the surrounding hills. He said that the five kilns took 90 cords at a time (which calculates to 18 cords per kiln, low considering the usual 25 to 40 cords per kiln for the period. See chapter 5).

Charcoal and ore were hauled to the furnace by horse teams owned either by the company or by local teamsters. The wagons drew two 3-ton loads daily from a mine in Chittenden. At the furnace, the ore was dumped into a pile where 15-year-old Mooney loaded the ore on a one-horse cart and drove it to the "tophouse." Here the ore was weighed, run over the stack, and dumped in. The furnace had to be charged 13 times in each 12-hour shift. For carting ore from 7 a.m. to 6 p.m., seven days a week, Mooney was paid $1.15 a day. During this 10-hour shift, the men stocking the furnace had to draw enough ore to keep it going around the clock. The firemen and their helpers worked in two 12-hour shifts, one beginning at noon and one at midnight. They received $1.75 a day, which was considered good pay, and their helpers got $1.25 for 12 hours work. In young Patrick's day, "another day, another dollar" was no idle expression.

The furnace sent up flame-colored gases, which at night lit up the yard so one could read a newspaper, said Mooney. It sometimes brought people to the scene, thinking a fire was raging out of control. Every eight hours, men in the casting shed drew out five tons of molten iron and cast it into 100-pound blocks of pig iron: three feet long, three inches wide, and four

4-33. *The old Ironmasters Inn still standing next to Furnace Brook, across the field from the Granger furnace.*

inches deep. These were loaded into wagons and taken to the railroad at Pittsford Depot for shipment to Boston. The men led a rugged existence, said Mooney. "They could stand more in a day than they do now" was his opinion.

Mooney spent 59 years in the same house where he was born at Pittsford Furnace and received his schooling, which ended when he was 13 years old, at the Furnace School. His father was a foreman at the furnace but died when Patrick was in his teens, leaving his mother with six children to support. Pritchard, the furnace owner, "took a little compassion on my mother," said Mooney, giving him his first job.

A long-time Pittsford resident made a sketch in 1945 of the furnace in operation, based on an on-site description by Patrick Mooney. The sketch, however, bears only little resemblance to the present remains (*Pittsford Now and Then* 1980:94).

The wooden buildings where the ore was handled had been torn down by 1953 and made into a sawmill. The company store, which stood near the road, also had disappeared entirely. The blast furnace still stands off Furnace Road, about a mile northeast of Pittsford village. The stack retains most of its iron binders and arch brickwork, but a section of the top of the stack was gouged out by an earthmover about 30 years ago, exposing some of the internal structure relating to the heating ovens that once stood atop the furnace. Associated with the ruin are partially caved-in stone block walls, foundations, and the upstream remains of a dam and headrace. The remains of the Smith sawmill are immediately downstream of the furnace under collapsed boards. Under this woodpile is a large concrete foundation in which a turbine once sat, driven by water that was conveyed into it through the existing large iron pipe. Local tradition holds that Smith used the furnace stack to burn waste wood from his sawmill. The furnace hearth was still choked with rotted boards until cleaned out by owner Allen M. Hitchcock in 1990. The entire furnace area is littered with slag, burnt brick, pieces of waste iron, and charcoal. Domestic trash adorns the embankment adjacent to the furnace. (Over the three-day Memorial Day weekend of 1991, about 30 volunteers from the Northern New England Chapter–SIA and the Pittsford Historical Society, led by Dr. David Starbuck, cut trees and brush, excavated, recorded, and surveyed and mapped the furnace grounds. This was the first of what might become an annual chapter project.)

What has been taken by many to have been the old Granger Homestead, the large brick house across the road from the furnace ruin, is now generally believed by Pittsford historians to have been an inn operated contemporarily with the works by B. H. Trowbridge (Henry M. Paynter conversation with author, May 25, 1991). Granger's house was a few hundred feet to the north, across the road from the company store, according to the 1854 map of Rutland County. Nothing remains of the house today. The old inn was bought by Charles Smith in 1883 (*Pittsford Now and Then* 1980:41). Various members of the Smith family owned it until recently, when Allen Hitchcock bought it. Hitchcock is a descendant of Joseph Hitchcock, who sold the land to Israel Keith in 1791 (Allen M. Hitchcock to author, May 25, 1991). Hitchcock sold the inn to Creg Oosterhart and Mike Greene in 1984; they embarked on the ambitious project of restoring the building to its Federal architectural style. In the process, they discovered some interesting clues about how the building was constructed, but the original construction date remains unknown. Meanwhile, they operated the house as the Ironmasters Inn, a bed and breakfast, until the house again went up for sale.

Many other structures relating to the ironworks era still stand in the vicinity. At the intersection down the highway from the inn is the old Furnace School, converted into a private residence. Westward on both sides of the highway are the former works tenement houses. Ruins of the five charcoal kilns mentioned by Mooney were found in 1986 a mile up Kiln Brook in Chittenden (chapter 6, RU-155). Many other charcoal-making sites

4-34. *Close-up view of the decorative lintels at the Ironmasters Inn, said to have been cast at the Granger furnace.*

4-35. *Front (south) wall of the Vermont Iron Company stack at Pittsford showing front ladder-like face plates, which lock the diagonal binder rods together, stabilizing the structure.*

have been found farther up Furnace Brook in Chittenden.

RU-IW11 Larnard's Forge (Chittenden): Larnard's Forge was somewhere on Furnace River (Brook) in the 1840s. It initially used ore from Granger's ore bed mixed with that from New York, but eventually used local ore alone, yielding an iron of "excellent quality" (Adams 1845:21; Lesley 1859:542). No attempt has been made to locate this forge.

RU-153 Gibbs and Cooley Furnace (Pittsford): Cyrus Gibbs and John Cooley operated a furnace at an early time near the mouth of Ripley Brook (Caverly 1872:519). It was associated with their foundry, built in 1827 on the 1808 site of Amos Crippen's trip-hammer shop, a half-mile upstream of Pittsford Mills. The Gibbs and Cooley furnace might have been one of two furnaces mentioned by Zadock Thompson in 1842 as being in Pittsford. Commonly known as "the pocket furnace," it was this works that supplied Allen Penfield at Crown Point, New York with castings for his ore-separating machines in 1831 (Allen 1967:5).

Inspection of the brook alongside River Road in 1986 resulted in finding much slag that appears to have come from a blast furnace. About a half-mile up the road from Route 7, near the remains of a dam, a high slag concentration exists, indicating a probable site of the furnace. Road construction in the vicinity might have destroyed most of the remains.

RU-IW12 Sutherland Falls Forge (Proctor): The Sutherland Falls Forge was initially owned by an early settler, Peter Sutherland. A record of deeds identifies the property as the Forge Lot and it changed hands nearly two dozen times between 1809 and 1844 (Otto Johnson letter to Richard S. Allen, Feb. 12, 1957). Owners included names connected with the Pittsford Iron Works and also works at Crown Point, New York. Ironworks at Proctor first appear on the 1821 Whitelaw map, on the east side of the falls. The forge made picks and nails in addition to producing bar iron from ore coming from local beds at first, later from Pittsford, and finally from Crown Point (Gale

1922:70). The forge was described as making bar iron and being washed away in 1840 by a freshet (Fred R. Patch letter to Otto Johnson, ca. 1956).

Confusion exists over what seems to be a blast furnace in an 1859 painting of Sutherland Falls by Ambrose Andrews. The painting shows a structure that resembles a blast furnace in configuration, but on close inspection looks more like a structure made of wooden boards and beams that probably contained a waterwheel or turbine and transmitted power by means of a vertical shaft through the middle of the building above it. Inspection of the falls in 1979 indicated little similarity between the painting and the falls. No slag was found.

RU-IW13 Spud Leonard Forge (Proctor): Another forge in Proctor, operated by Spud Leonard, made picks and nails in addition to bar iron (Gale 1922:70). Nothing more can be found of Leonard's forge, although similarity in products prompts speculation that it could have been the Sutherland Falls Forge (RU-IW12) just described.

RU-217 Conant Furnace/Brandon Iron & Car Wheel Company/Howe Scale Company (Brandon): The presence of iron ore in Brandon was recorded in 1787 when a town meeting voted to build an ironworks if sufficient iron ore was found to supply it (Smith and Rann 1886:485). No record of construction follows, but the next year there was a request by the town to lease the ironworks site and its waterpower. It may have been near what was then called the School Falls. By 1790 a forge built there by O. Blake was bought by Simeon Avery, John Curtis, and James Sawyer. A few years later it was reported that Brandon had iron foundries and forges where good bar iron was being made (Graham 1797:83).

One of the first lessees of the forge, Penuel Child, operated it until about 1810, the forge at that time being sold to Roger and Harvey Fuller. The Fullers manufactured shovels at the forge from ore mined at Forest Dale, about two miles east of Brandon village. From their two factories, at Forest Dale and Brandon village, the Fullers' shovels found markets as far away as Boston (*Brandon* 1961:44).

John Conant, age 23, purchased half of the mills and waterpower in Brandon in 1796, soon after he arrived from his hometown of Ashburnham, Massachusetts. He quickly distinguished his presence by founding a congregation of Baptists and holding posts in church and local government. In 1809 he began his first of four terms in the state legislature and in 1841 was a member of the Electoral College that elected President William Henry Harrison (*Brandon* 1961:210-211). Yet for all his community involvement, Conant also found time to become an early industrial leader in his adopted town.

Conant and his father-in-law, Wait Broughton, worked together in their early years in Brandon building mills along the Neshobe River (*Brandon* 1961:44). All this time, a forge was operating nearby, making bar iron from ore that was mined near Forest Dale. About 1810, a major iron ore discovery occurred at Forest Dale that started a significant series of events (Thompson 1842:28; Smith and Rann 1886:490).

The forge changed hands and shovel making became one of the town's major industries. Conant and Broughton also made their first venture into the iron business, building a poorly designed furnace that failed to draw. There is reason to believe they may have planned this to be a blast furnace, but due to the defect converted it into a melting furnace that cast stoves from iron smelted at Pittsford furnace. Conant finally succeeded in putting a furnace into blast in 1820. On October 2, 1821, he advertised that he had on hand a variety of stoves, potash kettles, hollowware, and machinery.

Conant took his two sons, Chauncey W. and John A., into partnership in 1823, forming the company of John Conant & Sons. Cooking stoves remained the main product, while potash kettles, castings, and even some cannon were cast (Hitchcock et al. 1861:824). As recently as the 1960s one of the Conant cooking stoves—"the wonder of the farmer's kitchen" as Abby

John Conant's

FURNACE

is now in successful blast.

HE has a great variety of

STOVES

of the most approved patterns, now ready for sale.

—ALSO—

A quantity of

Ornamental Parlour Stoves, of

Lanes' Pattern,

with *Brass Trimmings.*

—LIKEWISE,—

Pot-Ash Kettles,

Hollow Ware,

AND

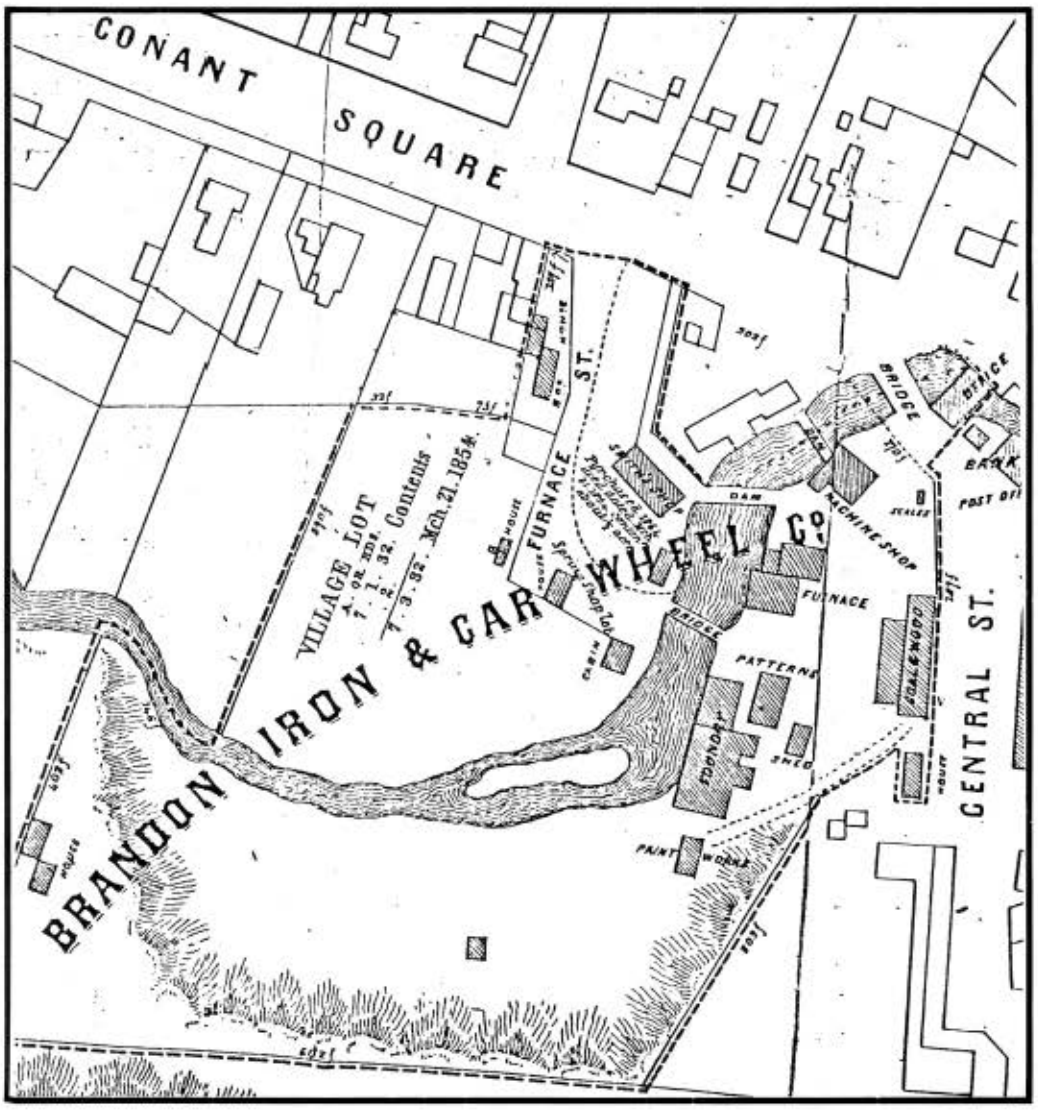
Machinery.

The IRON needs no *recommendation* where his castings have been proved.

N. B. All kinds of Produce will be taken in payment for Ware, and a *liberal discount* made for CASH. ☞Also, a few good Horses will be received in exchange for Stoves if offered within a few weeks.

Brandon, Sept. 10, 1821. 5tf

4-36. National Standard *October 2, 1821 (courtesy Sheldon Museum).*



4-37. *Map of the furnace, foundry, and machine shops of the Brandon Iron & Car Wheel Company in Brandon* (Description *1854*).

Hemenway described them—was still being used in the kitchen of the Congregational parsonage in Brandon. It was described as having "a firebox, box oven, a large circular opening in the rear for griddle and wash boiler, and doors at each end" (*Brandon* 1961:46).

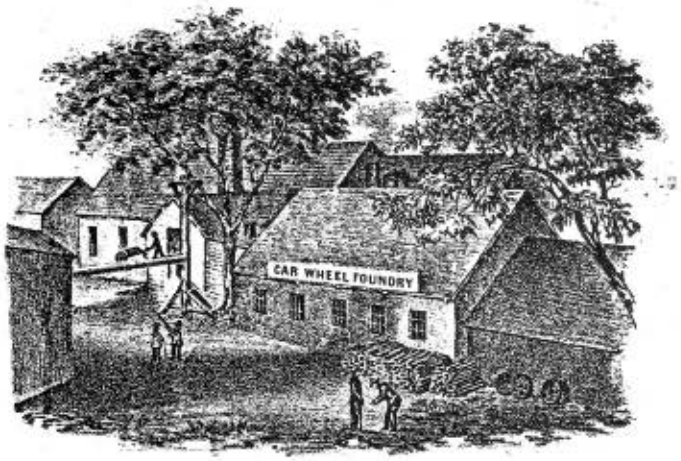
The furnace was enlarged in 1839 to keep up with the demand for stoves. Its 25-foot-diameter by 8-foot-wide waterwheel turned 2½ times a minute, driving a pair of 6½-foot-long by 30-inch-diameter blowing tubs (Lesley 1858:76). When John Conant retired in 1844 the company became C. W. & J. A. Conant, but by 1851 the demand for railroad iron displaced the stove business and the company was sold to the Brandon Iron & Car Wheel Company.

The car wheel company was incorporated in 1851 and eventually owned all the former Conant ironworks property at Brandon village in addition to the mines at Forest Dale. The company's 1851 report listed the furnace property in the center of the village, the ore beds 2½ miles east, the Rutland Foundry next to the Rutland & Burlington Railroad at Rutland, and woodlands for making charcoal and lumber in Brandon, Goshen, Hancock, Ripton, and Chittenden. The company made railroad car wheel iron, car wheels, firebrick, paints, and paper clay, all at Brandon.

The 1852 report described a steam engine at the ore bed fueled by lignite, which was dug nearby. The steam engine raised 3,984 tons of ore that year. The 45½-acre ore-bed property consisted of a 15-horsepower team engine plus shafting, two sets of hoisting apparatus, two chain pumps, an ore-washing machine, and three mine shafts, one 80 feet deep and the others 120 feet deep. There were also four tenement houses.

The 7½-acre furnace property at the village included a store, a waterpowered machine shop, the blast furnace and waterwheel house, coal shed, foundry and waterwheel, furnace cabin, dwelling house, tenement boardinghouse, and barn.

When it ran, the blast furnace averaged about 6 tons of iron



4-38. *The Brandon Iron & Car Wheel Company foundry building at Brandon (*Description *1854).*

a day, but problems with the furnace lining and the blast machinery caused a number of stoppages. The Rutland Foundry property consisted of the foundry, machine shop, steam engine, office, storehouse and boardinghouse, plus tools, patterns, etc., on 2¾ acres of land near railroad tracks.

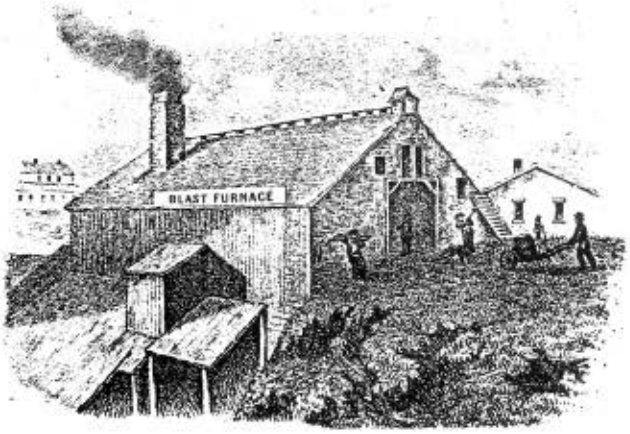
The 1853 report noted that 4,343 tons of ore were raised and the ore lots increased to 102½ acres. The furnace property at Brandon was then 7¾ acres and included two new tenements. Blast furnace repairs were made and in one 118-day run the furnace made 842 tons of iron, a 12 percent improvement over the previous year, while burning 35 bushels less of charcoal per day (*Description* 1854:3-41). Wages at the blast furnace were:

Foreman	.....	$700.00 per year
Fireman	.....	$ 1.50 per day
Molder	.....	$ 1.125 per day
Miner	.....	$ 0.725 per day
Miner's helper	.....	$ 1.00 per day
Woodcutters, teamsters, and ore washers	.....	$ 0.77 to $1.00 per day

The Brandon Iron & Car Wheel Company foundries sold many railroad wheels to the Gilbert Company, which made railroad cars at Brandon in large buildings west of the tracks. Car shops also extended along the east side of Center Street, where other iron parts for the cars were made.

A part owner in the Brandon Iron & Car Wheel Company was Nathan Washburn of Connecticut, who invented successful improvements in railroad wheel designs and manufacturing processes, and owned several foundries in New England and New York in the 1850s that cast railroad car wheels. His design produced a wheel of great strength for the state of the industry

4-40. *The Brandon Iron & Car Wheel Company foundry at Rutland in 1854. Soon afterward, the entire works moved out of Brandon to Rutland, although the Brandon identification remained in the company name. Fire destroyed these buildings in 1856 (*Description *1854).*



4-39. *The blast furnace of the Brandon Iron & Car Wheel Company at Brandon (*Description *1854).*

of the time. Instead of cooling the wheels by immersing them in a pit of white sand, as was then the practice, Washburn cooled them slowly, annealing them in his specially designed ovens. But the year 1856 brought significant changes to the ironworking business at Brandon. A destructive January fire left the car wheel company in ruins (*Brandon* 1961:94).

The Gilbert shops moved to the Troy, New York area in 1857, eventually resulting in the large Gilbert & Company, which made heavy gun carriages during the Civil War. Railroad cars and trolleys were made at its New York shops at Green Island (near Cohoes) until 1893.

Associated with the Brandon works might have been the American Paper Car Wheel Works, which made railroad wheels at Pittsford, and the Hudson Paper Car Wheel Company which also manufactured this wheel at Hudson, New York. This unusual variety of railroad wheel was invented by Richard N. Allen and consisted of a paper disk built up by successive layers

of pasteboard and straw, pressed into hardboard, and dried. The board was then enclosed between two wrought-iron plates under hydraulic pressure and firmly secured with bolts. Last, a steel tire was bolted to the flange of the hub (Ellis 1878:167-168). This incredible design stood up under the vibration and stress of use better than previous cast-iron wheels, averaging 300,000 miles without a failure and adopted by the Pullman coaches for their long New York to Chicago run. (One of these "paper wheels" is on display at the National Museum of American History, Washington, D.C.)

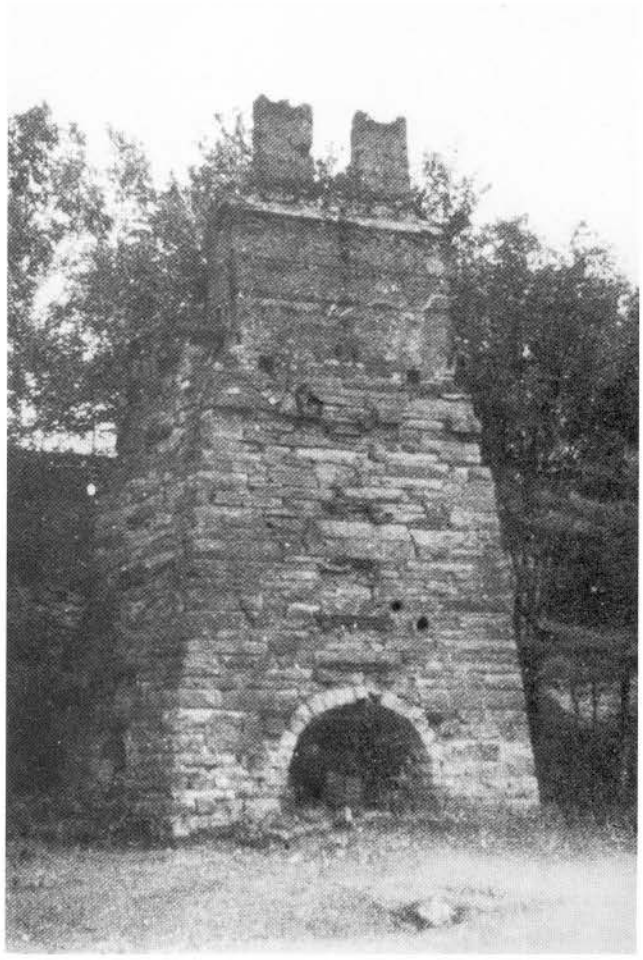
After the fire in 1856, the company ceased making railroad wheels in favor of manufacturing paint and kaolin clay (used in fine porcelain and chinaware). Washburn relocated the car wheel part of the business to his foundries in Worcester, Massachusetts, and later to Troy and Schenectady, New York (Bishop vol. 3 1868:348).

The next year John Howe, Jr., another partner in the old car wheel company, purchased the patent rights of a weighing scale and began manufacturing Howe Scales (*Brandon* 1961:47). The Howe Scale Company moved into the property vacated by the car wheel business, but financial problems bankrupted the company in 1869. Under the name of the Brandon Manufacturing Company, it continued to manufacture scales until political pressure in 1877 moved it to Rutland, ending Brandon's connection with the heavy iron industry (*Brandon* 1961:52).

Few remains identifiable with an ironworks can be found along the base of the falls of the Neshobe where the works were. The usual scatter of slag and pieces of castings remain along the riverbank, in the roadbed alongside, and in parking areas behind buildings along the main street. Foundation stones of the foundry and blast furnace buildings that survived the transitions from the Conant stove to Brandon car wheels and finally to Howe Scales seem now to serve as river shoring and riprap. Even little Furnace Street no longer has a street name sign. A few buildings along the Neshobe date to the period of the ironworks: a ca.-1830 shop on the east side of the brook at Center Street and a ca.-1881 factory building on the opposite side of the brook. The red brick hydroelectric plant on the east bank, approximately where the Conant furnace might have been, dates to about 1912.

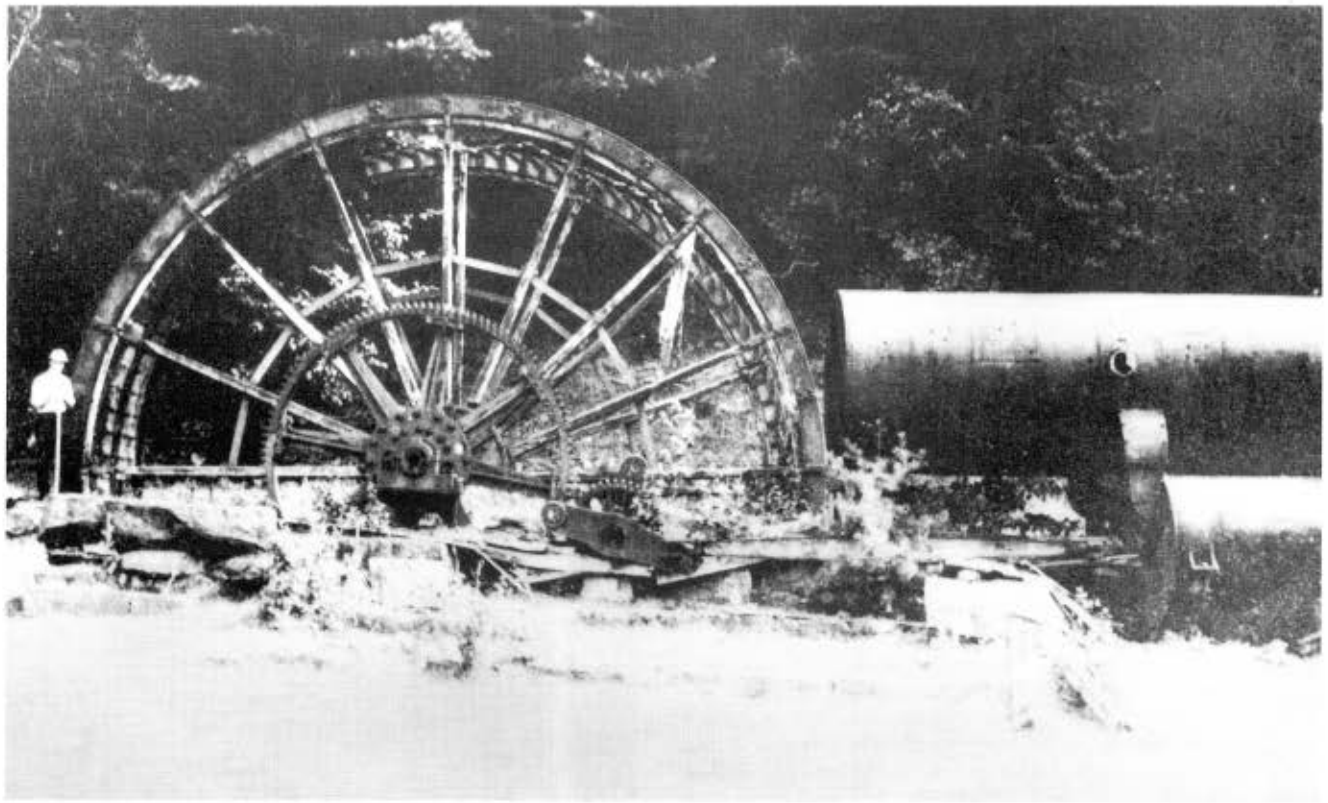
RU-41 Green Mountain Iron Company (Brandon): A few years before Conant built his blast furnace at Brandon village, iron making had commenced near an ore bed located at Forest Dale. John Smith's forge made iron here in 1810 with ore that came from beds dug locally and at Leicester Hollow (Smith and Rann 1886:514; *Brandon* 1961:48). A blast furnace went into operation about 1823 at Forest Dale, smelting ore that was mined a half-mile away (*Brandon* 1961:47). The major output of the furnace was pig iron, but a variety of ornamental iron such as statues, vases, and chairs were also cast. In 1845 the output of the furnace reached 1,200 tons, not including 800 stove castings (Kellogg Nov. 1897:293). This generally equaled the output of the Conant furnace at Brandon for the same approximate time period.

Some names connected with the Forest Dale furnace operations during this time were Stephen Smith of Leicester and Samuel Buell of Brandon in 1824; Royal Blake and Barzillai Davenport in 1827; and Royal Blake and (?) Hammond in 1836. Mr. Hammond might have been Charles Hammond, who a few years earlier was part owner of the Bennington Iron Company, or possibly Charles F. Hammond who operated ironworks at Crown Point, New York, in the 1840 period (or both?). An 1827 record mentioned the ore bed, furnace, and a coal house with 5,000 bushels of charcoal. The diary of DeWitt Clinton Clarke, a relative of J. A. Conant and partner in the Brandon works, mentioned an "Upper Furnace," called the Hammond and Blake Furnace, which was most likely the furnace at Forest Dale (*Brandon* 1961:46-47).



4-41. *A 1915 photo of the blast furnace at Forest Dale showing how it appeared before its casting arch was dynamited for building stone in the 1950s. Note the heating ovens on top (courtesy Vermont Division for Historic Preservation).*

Brown hematite ore was mined at the foot of a sandy hill to the east of the furnace, and smelted to cast tools, fireplace furnishings, kettles, wagon equipment, and stoves. Even small cannon were cast; all sold throughout the Northeast as far away as Ohio. One shipment to the Chipman Point landing included a number of stoves, 59 axes, 12 draft chains weighing 2,400 pounds, and 5 two-horse wagons, plus an assortment of kettles, skillets, five dogs (heavy iron rods), flat irons, and spiders (cast-iron frying pans with legs), for a total value of over $1,000



4-42. *An impressive 1915 view of the waterwheel and blowing machinery at Forest Dale (courtesy Vermont Division for Historic Preservation).*

(*Brandon* 1961:48-49). At this time beef cost 5¢ a pound.

From original papers at the Vermont Historical Society Library (Jones VHS MSS21 #85), Alvin B. Jones was found to have hauled the following "to the lake" for Royal Blake:

Date	Long Tons Shipped
September 1844 to January 1845	9.93
May 1845 to June 1845	6.99
October 1845	2.31
October 1846 to November 1846	2.43
September 1847	0.98

The record also showed that Jones hauled 201 loads of flux for the furnace from April 1844 through January 1845, which gives additional information on production dates for the Forest Dale operations.

By 1854, when the Green Mountain Iron Company had been organized and the Forest Dale furnace works had been acquired, parlor stoves became the mainstay of production. The company enlarged the inside of the stack to operate it with anthracite coal instead of charcoal, but the experiment was apparently unsuccessful because the furnace shut down that same year. Anthracite fuel gave the iron different characteristics than charcoal, for example, a higher sulfur iron. Many ironworks throughout the country were trying to convert to coal at this time and finding it difficult. More successful were those who completely razed and rebuilt their stack, redesigning it specifically to burn coal. Failure of the company, however, could have been for economic as well as technical reasons. The 1850s were difficult economic times and many ironworks throughout the country were being abandoned.

The Brandon Iron Company built three bloomery forges and a 1,500-pound trip-hammer in 1864, about 400 feet east of the furnace. Blast temperature at the time was 600°F (Neilson 1866:215). The blast was heated by ovens at the top of the stack, which were still visible in the early 1900s. These forges worked ore beds that were located a half-mile away and produced 85 tons of bar iron during their brief two months of life in the spring of 1865. The blast furnace, fired up for the first time since 1854, made 784 tons of cast iron (Neilson 1866:218). By year's end, however, the forges and furnace were quiet, never again to operate. These as well as other buildings of the Brandon Iron Company are located on the 1869 Beers map. A half-mile south, the map shows the shafts of the iron mines where ore was at that time being processed into paint pigment.

The blast furnace stands today, however precariously, in the midst of a growing underbrush. The three smaller, tuyere arches are still relatively intact with some internal breakdown. But the major damage is the breakdown from the north arch, the casting arch. This collapse was not due to natural deterioration but to intentional human destruction. While working on nearby

4-43. *The cavernous stone-lined waterwheel pit at Forest Dale, and the blast furnace standing in the background.*

Route 73 in the early 1950s, a highway construction company needed a source of rock. Told about the old, stone-built furnace, they dynamited it. Mr. Welland Horn, owner of the property, heard the blast and ran over in time to prevent further destruction (Welland Horn conversation with author, May 29, 1989). But the damage had already been done, and over the ensuing years, the forewall collapses bit by bit.

Adjacent to the stack are the stone-block mounts of the blowing tubs, and beyond is the deep, stone-lined waterwheel pit. The 100 old auto and truck tires that were at the bottom of it gave "wheel pit" a whole new meaning before they were removed in 1989. The headrace with its dozens of iron pipe hoops can be followed east to the Neshobe River. The dam site lies 100 to 200 feet farther upstream, marked by iron reinforcement rods deeply imbedded in the ledge.

All around the area and across Route 73, which parallels the former road on the north, the barest remains of cellar holes can be seen, vestiges of the community that at one time thrived about the works. Across the highway from the works stands the beautiful stone house built by Royal Blake, where hinges in the rear, wooden part of the house were made at the ironworks (*Brandon* 1961:157).

On the north side of Route 73, just uphill from the state highway shed, remains of what local residents claim was a "cup" or a casting furnace lie under roadside fill. It has also been described as having been a stone tower that was similar to the blast furnace but much shorter (*Brandon* 1961:48). Could it have been part of the stonework associated with the charging bridge? Whatever it is (was), it remains protectively buried for future study. John Smith's ca.-1800 forge was probably located about 100 yards northwest of the furnace stack, near where the present-day dirt road leads into the furnace property from the hollow.

4-44. *In 1991 the Vermont Division for Historic Preservation timbered up the archways and roofed the top of the Forest Dale stack.*

4-45. *Hardware inside the top of the Forest Dale furnace before it was roofed in early 1991 (courtesy Shelley Hight).*

4-46. *Resurgence tunnel of the Forest Dale stack, about 100 yards northeast of the wheel pit. The large, dark object in the foreground is a "bear."*

4-47. *Upper wall section of Forest Dale furnace, showing protruding stones that supported a building housing the top of the furnace.*

In 1974, a few years after the furnace and approximately 10 acres of furnace grounds were donated to the Vermont Division for Historic Preservation by Mr. and Mrs. Welland Horn, the furnace property was placed on the National Register for Historic Places through efforts of Chester Liebs (and some assistance by the author). The stack was fenced off following the continued deterioration of its north wall but, until recently, the division was unable to do much toward protecting the furnace grounds due to budget constraints. Trash along the stream reflects the numbers of campers who annually use the grounds at will; in the cellar hole of one of the works' tenements was a plastic sheet lean-to. Renewed interest in the furnace and property by the division led to significant activity at the furnace grounds in 1989 in the form of a week of technical recording. A year later another section of the stack, an approximately 10- by 12-foot-square piece of the in-wall, fell out the front of the stack, an ominous sign of the fragile nature of the structure. In late 1990, the division had the stack roofed and the archways timbered. By November 1991, an architect had been contracted and plans were drawn for the stabilization of the stack with an eye on eventual full restoration for an interpretive park.

It has often been difficult to distinguish between some historical references to ironworks at Brandon village and Forest Dale. Ore from the Forest Dale area was used in furnaces at both Forest Dale and Brandon, and corporate ownership and leasing of the mines sometimes overlapped the same time periods. They had similar names: Brandon Iron Company, Brandon Mining Company, and Brandon Iron & Car Wheel Company. DeWitt C. Clarke bought stock in the Brandon Iron Company in 1837, John A. Conant then being the manager. In 1841 the

4-48. *Ornate stove made by the "G. M. Iron Co."*

company ceased to be, appearing to be insolvent, inferring operations at the Brandon village. But at that time the works there were also known as John Conant & Sons, becoming C. W. & J. A. Conant in 1844.

At Forest Dale, the Brandon Iron Company reactivated the furnace in 1864 and built bloomery forges, producing cast and wrought iron. About the same time at Forest Dale the Brandon Mining Company was extracting kaolin and paint pigments from the ore beds nearby. Both are indicated on 1869 Beers maps. Did Conant have some connection with the Forest Dale works in the 1830s through the Brandon Iron Company? Was the Brandon Iron Company of the 1860s a return of the old company or a new company with the old name? Did, in fact, an iron-smelting blast furnace operate with the Howe Scale Company and later with the Brandon Manufacturing Company at Brandon village? Or, after 1856 when the Brandon Iron & Car Wheel Company ceased making car wheels, did the Brandon village works use pig iron made elsewhere, such as from Pittsford or Crown Point?

RU-IW14 Pittsfield Iron & Steel Co (Pittsfield): After the failure of the White River Iron Company (WN-IW01), Julius J. Saltery organized the Pittsfield Iron Ore Company, incorporated March 1880 at Hartford, Connecticut for the purpose of mining ore at Pittsfield and Chittenden (Hyzer 1954:132-133). With capital of about $2,500,000, buildings and machines for crushing and concentrating the ores were put in place and 1,400 acres of the defunct White River Iron Company property was bought. Roads were cut up and down the valley, connecting the mines and charcoal kilns with the main works, which were just over the town line in Chittenden. Eight hearths and one hammer made charcoal blooms, which were shipped out for making steel. The iron was "made by improved Catalan forges from magnetic ore existing in gneiss formation." Officers were William G. Bell, president, and J. Foster Clark, treasurer, of Boston; Julius J. Saltery, superintendent, of Pittsfield (*Directory* 1882:169). When completed, the works were expected to produce about 10 tons of blooms per day at a cost of $35 per ton (including freight) delivered to the railroad at Bethel. The blooms were to have been especially adapted for making a fine grade of steel by open-hearth furnace or for fine-tool crucible steel. The weekly payroll was $400 to $500 in 1881. That same year, the Pittsfield Iron & Steel Company, with Saltery as president, bought the White River Iron Company. French laborers were brought in from Canada in 1882, but a few months later the company shut down, changed hands, and the stockholders were left holding an empty bag. A more sane logging and lumbering operation succeeded in later years, connected by a four-mile railroad to the junction at Stockbridge (Davis and Hance 1976:92).

Inspection of surface remains of iron-mining operations up the Tweed River West Branch at Pittsfield in 1988 found only a cave-like hole in the side of a low cliff and a small stone foundation nearby (the mine is marked on the USGS topographic map). No hearth foundations or charcoal kilns were found nor are their locations known by a local historian.

ORANGE COUNTY

OR-IW01 Randolph Furnaces (Randolph): Ironworks are documented to have been operating in Randolph before 1800, although no firm field or archival evidence of this has yet been found (Swank 1892:132-133). Two furnaces operated in the town in 1842; they could have been either foundry or blast-furnace variety (Thompson 1842:147). The town had two forges and a slitting mill 25 years later, however, supplied by ore mined in the vicinity (Bishop vol. 1 1868:528).

WINDSOR COUNTY

WN-FS14 Upper Falls Forge (Weathersfield): When an ironworks along the Black River burned sometime before 1792, Weathersfield's connection with the iron-making industry of Vermont ended. As early as 1786 an ironworks operated at what later came to be called the Upper Falls. That year Levie (also Levy, or Levi) Stevens sold his interest in the ironworks to Nathan Deane of Cavendish, the agreement mentioning "the new fire . . . cole House and ore houses and lot of land belonging to the works" (Hunter 1984:7). The "cole House" of course referred to a structure where charcoal was either made or stored; the ore houses stored iron ore. The mention of the "new fire" clearly indicated a bloomery forge operation, a "fire" then the common name for a bloomery hearth.

Information provided by Edith Hunter of Weathersfield placed the site of the forge along the north shore of the Black River, within a quarter-mile upstream of the covered bridge. An area up to a half-mile upstream of the covered bridge was inspected in 1985 without finding any ironworks artifact. No slag was found in the river or along the shore; no charcoal, burnt brick or stone, nor pieces of waste iron, flume, or ironworks foundations along the steep riverside embankments on either side of Route 131. The valley is quite narrow here, making a fine location for a dam, one of which stood from the 1830s to 1890s, giving the place its name, Upper Falls, and supporting a number of mills. Ruins of a mill exist on the southern shore, but any mill site on the northern shore anywhere near the river most certainly was destroyed by construction of Route 131. Slag that found its way into the Black River from the ironworks in the 1790s has most likely been thinly scattered by 200 years of water and ice action between Upper Falls and the Connecticut River.

WN-51 Tyson Furnace (Plymouth): In 1922 the Town School District of Windsor published an industrial history of Windsor, researched and written by Guy Hubbard. It was one of a number of social and economic essays and works written by Hubbard that delved into Windsor's heavy industries during the period between the two world wars. As part of his 1922 industrial history, he devoted an entire chapter to the subject of the ironworks at Tyson (Hubbard 1922:47-54), parts of which follow:

> In the latter half of the 18th Century there flourished in Baltimore [Maryland] a wealthy Quaker family, the head of which—Mr. Isaac Tyson—was a merchant and owner of a line of fast "Baltimore Clippers" in the overseas trade. His son, Isaac Tyson, Jr., the greater part of whose long life was to be spent in the study of geology and in the practice of mining and smelting, was born in Baltimore, on October 1, 1792. He began his active career as Supercargo on one of his father's Clipper Ships, and as such it was his bad fortune to be wrecked, and his good fortune to be rescued, on the coast of the south of France.

4-49. *Former works office (left) of the Tyson Iron Company in Tyson.*

While waiting at Bordeaux for the Yankee Consul to arrange for his return passage to Baltimore, young Tyson visited a profitable mine where chrome yellow was being dug. He remembered having noticed a mineral like this during his rambles in the hills of Maryland, so upon returning to his native State he at once investigated the matter, and the result was that he discovered valuable deposits of chromate of iron at Bare Hills, Maryland and in Chester County, Pennsylvania. His father bought up these deposits and in the year 1816 they began the manufacture of chromate pigments, medicines and chemicals in a laboratory on Pratt Street in Baltimore. This proved to be a prosperous business, and in 1822 they removed to a much larger manufactory on Washington Avenue, mentioned by Bishop as one of the large industries of Baltimore. [Bishop was author of a history of American manufacturers in 1868; see Bibliography.]

On February 15, 1827, Isaac Tyson, Jr., patented a method of making copperas by smelting copper pyrites, and in 1829 extensive works were erected at Strafford, Vermont, for the application of this invention and for the production of copper.

In 1833 the younger Tyson sold out his interests in the Baltimore concern, in order to become manager of this new Vermont industry. . . .

In the fall of 1835 when Mr. Tyson, on horseback, was crossing the mountains at the headwaters of the Black River in Plymouth, Vermont, he chanced to notice outcroppings of what to his practiced eye appeared to be rich iron ore of the micaceous and black oxide variety. Early in the following spring he dispatched his confidential agent and mining expert, Mr. Martin of Strafford, to make a careful examination of the Plymouth region, and this gentleman not only located several rich ore beds, but also found near by plenty of limestone for flux, in the midst of forests where high grade charcoal for smelting could be easily and cheaply made—a combination as interesting to an Iron Master of those days as were the discovery of the joint coal and iron deposits of Pennsylvania and Alabama to those of later years. As a result of Mr. Martin's report, Mr. Tyson at once bought up the promising ore beds, the nearby lime quarries, and hundreds of acres of the surrounding heavily forested mountain sides. . . .

On November 10, 1836, Mr. Isaac Tyson Jr., of Strafford, and Messrs. Thomas Emerson, Albert G. Hatch, and Jonas G. Dudley of Windsor, incorporated a company with the ambitious title, "Windsor and Plymouth Ascutney Iron Company," for the purpose of digging ore, and manufacturing and vending iron. . . . Tyson Furnace, like a typical Western mining town, had sprung up almost over night in the wilderness beside picturesque Echo Lake in Plymouth. Here in 1837, Mr. Tyson opened his "Hæmatite Mine" and in the fall of that year put his furnace in blast. . . .

The furnace was of the economical "hot blast" variety and was a handsome stone structure thirty-four feet high and thirty-two feet in diameter at the base, where it rested on three heavy arches. This stack was surmounted by a rounded cupola and a tall chimney. The stack was lined with fire brick and its inner sides sloped together toward the bottom like the inside of a lamp chimney so that the charge could settle freely. A strong tramway led from the bank back of the furnace to a roofed platform called the "top house" about the cupola, so that the carts of charcoal, limestone, and iron ore could be drawn to the top of the stack.

The charging was done by the "top man" through a door in the cupola, the charcoal being first thrown in from large flat flaring baskets upon a two-wheeled barrow. On top of this was placed a layer of broken limestone for flux, then followed the iron ore, dumped in from boxes with handles for convenience in lifting. Several such courses, or charges, four or five feet thick, were added until the stack was filled to the cupola floor.

The ordinary "charge" for the Tyson furnace was twelve bushels of charcoal, from eight to fourteen boxes (about one hundred pounds each) of iron ore, and two similar boxes of crushed limestone. The Plymouth ore contained fully fifty per cent of iron, and under favorable conditions the burning of one hundred bushels of charcoal produced one ton of iron. The blast was run night and day by two groups of men who worked on twelve-hour shifts, and from three to five

4-50. *The photo of Tyson furnace from which Myron Dimmick might have done his painting of the works about 1900 (compare with photo at beginning of chapter 1). The three furnace-like structures in right background are unidentified but could be charcoal or lime kilns (A. A. Baldwin photo; courtesy Barbara Chiolino).*

tons of iron were run off in twenty-four hours.

The "blowing engines" of the Tyson furnace consisted of a pair of enormous tub bellows, pumped by cranks fastened to the opposite sides of an overshot waterwheel, in a wheel house back of the Furnace. The air was delivered by a hundred foot wooden stave pipe fifteen inches in diameter, to a large wooden tank or equalizing reservoir beside the furnace building. From this the compressed air was conducted through a coil of iron pipe in a small heating furnace where it was raised to approximately the temperature of melting lead. This heated air was blown into the furnace through two water-cooled blast nozzles, or "tuyeres," two and a quarter inches in diameter. These entered at opposite sides of the stack, about four feet from the bottom.

The overshot wheel which operated the bellows was thirty-two feet in diameter and five and a half feet wide. It was provided with sixteen buckets, each of which would hold about a hundred gallons of water, which were filled at the top by a wooden flume, and the wheel revolved by the weight of the water, which was emptied out as the buckets approached the bottom. This flume was thirty inches wide and carried the water from the reservoir in the brook half a mile west of the furnace. When the water ran twelve inches deep in the flume the big wheel developed about sixty horse power.

The hub of the water wheel was an iron hooped log thirty inches in diameter, having wrought iron trunnions at each end to which were keyed the bellows cranks. The trunnions ran in wooden bearings and at first much trouble was caused by the friction of the heavy mechanism setting these blocks afire. Finally some rustic genius conceived the idea of drilling the bearing surfaces full of holes, driving hemlock knots

endwise into these holes, and reboring the combination to a smooth bearing. These peculiar "oilless bearings" proved entirely effectual in solving this mechanical problem, as they ran for years with but little friction or wear. . . .

As described by the old residents thereabouts, Tyson Furnace, when in blast, was an awe inspiring sight. The bellows made a dismal groaning and creaking sound which, in damp weather could be heard three miles away, and the flames leaped twenty feet above the top of the stack with a roaring which made Echo Lake a realistic name. While the top man tested the height of the charge with a sort of an iron flail, adding new material as it settled, two furnace men stripped to the waist stood in the arches at the base of the furnace and peered in at the tuyeres to watch the progress of the smelting in order to control it properly. The molten iron gradually collected in the bottom of the furnace while the slag floated to the top and ran over a dam into a slag pit.

When time came to pour off, one of the furnace men would blow a horn, which was a signal for a gathering of the natives to see the molten metal rush forth into the "pig bed." The sight was especially stirring during the hours of darkness, when the flames and glow of the metal illuminated the whole neighborhood. The metal was released by drilling out a fire clay plug in the base of the furnace, and was shut off by an insertion of a fresh one, immediately baked in place.

The pig bed was an open sand mold under cover of a shed, and had a central channel leading from the outlet of the furnace, with basins the size of hundred pound pigs branching out from it.

Some of this pig iron was sold to other foundries, of which there were in olden times numerous ones of small size scattered about the country for supplying the local trade with stoves and hollowware. The sows, as the masses of iron in the central channel of the pig bed were called, and a considerable amount of pig iron, was remelted in a smaller cupola furnace in the Tyson Foundry. This was molded into all kinds of machinery castings, hollow ware and cooking utensils, and into "Parlor Fireplaces," with elevated ovens, which were extensively advertised by Mr. Tyson as an improvement over primitive fireplaces (then commonly used for cooking and heating) and widely sold in northern New England. Box stoves of the "Steamboat" variety were also made in large numbers and may still be found in use in the country districts of Vermont where wood is the popular fuel. One of the vivid recollections of the writer's [Hubbard's] father was his experience sometime about 1850 when as a boy of 14 he was driving a pair of horses attached to a wagon loaded with Steamboat Stoves from Tyson Furnace over the mountains to a store at Windsor. On a steep hill the horses ran away, but he managed to guide the crashing and banging load of stoves at full speed down the mountain until the horses tired themselves out. This was a frequent happening in those days of heavy freight teaming, yet the drivers usually managed to come out on the "top of the heap" in spite of the narrow rocky roads and their primitive wagons, with wheels held by linch pins on wooden axle trees.

The various kinds of ore found in Plymouth in apparently inexhaustible quantities, rendered the location one of the most favorable in the entire country, and as the iron produced by compounding the different ores was considered equal to the best foreign importations, Tyson Furnace was for many years one of the most important iron works in New England. For this reason, very complete accounts of it may be found in some of the older books on metallurgy, and from these accounts much of this information has been obtained.

The Tyson works in the heyday of their prosperity are described as comprising two blast furnaces for smelting and a cupola furnace for remelting, a wheel and bellows house, four charcoal houses, a saw mill, carpenter, pattern, machine and blacksmith shops, a large ware house and office building, a store, a tavern, two barns, two wagon sheds, and sixteen houses containing twenty-three tenements. As many as a hundred and seventy-five men were employed in good times, there being among others; twenty charcoal burners, twenty molders, two firemen, two top men, two plate brushers, one founder, one coal man, one ore picker, one ore roaster, six blacksmiths, ten miners, six teamsters, six farmers, three clerks, an agent and a manager. Others were employed as quarrymen, wood choppers, road builders, etc. The ordinary workmen received from $14 to $18 per month; ordinary molders $1.25 a day; first molders $1.50 a day; and foremen $500 a year. In 1840, six hundred tons of iron were produced at Tyson Furnace, which sold as pig iron at $35 per ton and as castings at from four to five cents per pound [$80 to $100 a ton]. The workmen were a mixed lot—French wood choppers from Canada, charcoal burners from the Black Forest in Germany, Irishmen and negroes. The Irishmen predominated and the remains of the collection of workmen's houses is called "Dublin" to this day.

Isaac Tyson, Jr., operated the Furnace continuously until 1855, when he retired from the business, and returned to Baltimore, where he died in November 25, 1861. The works were idle from 1855 until 1864, when on account of the demand for iron created by the Civil War, they were reopened by the Tyson Iron Company, a Boston corporation who purchased them from the Tyson estate. This concern furnished much of the iron used in construction of the "Monitors."

After the close of the Civil War, this company sold out to the Spathic Iron Company, a Hartford, Connecticut corporation manufacturing edge tools. This company controlled the only other bed of spathic ore then known to exist, this being in Connecticut. This company ran the Tyson Furnace and the Spathic Mine under a German iron master and instead of pig iron, they produced a product called "spiegeleisen" which they converted to cutlery steel at their Connecticut plant. The last blast was run in 1872. . . .

Today [1922] all that remains of "Tyson's Furnace" is the name of the scattered village, which is one of the beauty spots of Vermont; the old warehouse; traces of the flume and waterwheel; a few weather-beaten houses in the settlement of Dublin; an oil painting of the furnace made many years ago by Mr. Myron Dimmick (a workman at the furnace who became a landscape painter); and a few of the old employees over eighty years of age who prefer to end their days amidst these familiar haunts. The stacks have entirely disappeared and their site is occupied by a saw mill.

> Plymouth recently has been much in the public eye as the birthplace of Vice President Coolidge, and his father is one of the old gentlemen who find the town still good enough for them.
>
> When the writer [Hubbard] and others visited the village of Tyson sometime since for the purpose of digging up facts . . . rumors of the revival of the iron business began to fly thick and fast, and the villagers probably saw in imagination their beautiful valley darkened by clouds of smoke, and their peaceful mountain sides torn up by mining operations.
>
> The only possibility of the revival of this extinct industry probably lies in the very "impurity" which caused the old-time iron masters so much annoyance by rendering their castings hard and brittle. I refer to the manganese, now extensively imported for use in making alloy steels, and which exists in great quantities in the abandoned ore beds of Plymouth. As this actually does furnish a possibility of revival I should have used the word dormant instead of extinct in referring to the present conditions. The old time iron masters of Plymouth were exceptionally highminded and public spirited gentlemen, so the people of that town have a good reason to regret their departure (Hubbard 1922:47-54).

In the preceding, Hubbard accounts for *two* blast furnaces during the "heyday of their prosperity," which is the only known reference to two blast furnaces at Tyson. The following 1864 geological report includes descriptions of a hot-air furnace and a cupola furnace. Hubbard might have mistaken reference to the hot-air furnace as being another blast furnace.

> The furnace is a heavy stone stack 34 feet high to the tunnel head, with a cupola of six feet, is 32 feet diameter at base, and is in good working condition, and will be ready for a blast by the first of May. The tunnel head is 2¾ feet in diameter, boshes 8½ feet and slope 50 degrees, and lined with sandstone which is obtained near the works. The crucible, or hearth, is of sandstone, 20 inches on diameter at top and 15 at bottom. The tuyer [*sic*] arch is 8¾ feet wide 7 feet high. The main blast pipe is 15 inches diameter and 103 feet long, and is entirely new. The tuyers are 2¼ inches, the waterwheel is a new overshot, 30 feet diameter, with 5-feet buckets and 10-inch rim, made of wood, bolted and strapped with iron.
>
> The cost of making [one ton of] pig iron is estimated as follows: –
>
> | | |
> |---|---|
> | 130 bushels of charcoal | $ 7.80 |
> | 2¼ tons of ore | $ 5.06 |
> | 12 laborers | $ 3.00 |
> | 1 iron master | $ .75 |
> | Flux | $ .08 |
> | Superintendence | $ .50 |
> | Contingencies | $ 1.00 |
> | Transportation to Boston, Springfield, or Albany | $ 5.25 |
> | Incidental expenses | $ .50 |
> | Cost on market | $23.94 |
>
> This estimate is based upon the supposition that none of the materia! is now owned by the Company, instead of which there is now on hand and paid for more than 2000 thousand [*sic*] tons of ore, 100,000 bushels of charcoal, 200 cords of wood, 100 tons of castings and scrap iron, 50 tons of shot iron and 60 tons of flux. The capacity of the stack is 7 tons per day, but if its average yield should not exceed 6 tons, and if the price of iron should not exceed $60 per ton, we have a daily profit of $216, which would give a dividend of more than 3 per cent a month upon the whole capital stock, or over 36 per cent a year (*Geological Surveys* 1864:5-7).

(At Binney Cobb's foundry in English Mills, about 25 miles to the northeast, small machinery, fire doors, and grates were cast in the early 1800s [Dana 1887:69]. Cobb obtained pig iron from the blast furnace at Tyson [Warren Wood letter to author, Jan. 19, 1986]. No foundry remains or slag were found in a 1987 inspection of English Mills; no further information could be provided by Phyllis Cobb, current owner of the old Cobb homestead.)

Much of the technology of furnace operations at Plymouth came from Tyson's experiences and observations elsewhere. For example, he did much experimenting with sizes and shapes of furnaces and hearths for smelting copper at Strafford. He tried various fuel/flux/ore mixes, searching out improved hearth-lining materials. By the end of 1833 he had a copper-smelting blast furnace in operation using anthracite. The coal was boated down Lake Champlain and went over the mountains by wagon. He borrowed from what he observed at a furnace near Albany, New York, and made a new method of diverting some of the hot exhaust gas from the top of the furnace to preheat the blast.

Tyson pumped blast into his iron furnace at Plymouth at 1½ pounds per square inch. Magnetic ore from Lake Champlain was mixed with local ore and hematite from Tinmouth. The Tinmouth ore was hauled four miles by wagon to Wallingford, then by railroad 34 miles to Ludlow, finally the last few miles by wagon to the furnace. Local magnetite contained too much manganese to make it economical to use. Charcoal was hauled an average of three miles (Neilson 1866:220).

The 1855 map of Windsor County shows the furnace works, the furnace and flume, the line of workers' houses, and the schoolhouse opposite the furnace. The iron mine on Weaver Hill, a small iron ore bed near Plymouth Union, plus vast company-owned woodlands southwest of a small ore bed are depicted on the 1869 Beers map of Plymouth.

Hubbard's 1922 description of the area still describes it today. The District 12 schoolhouse stands up Dublin Road; the old works office is today a residence near Route 100. Next door, another old works structure is the little Tyson Library. Slag and other ironworks-related debris litter the stream down to beyond the highway. The Echo Lake Inn completes the transition from industrial to resort area. Dimmick's painting, referred to by Hubbard, is part of the Vermont Historical Society collection.

WN-IW01 White River Iron Company (Bethel): As a result of Julius J. Saltery of Boston's discovery of gold and magnetic iron ores at many places along the White River, the White River Iron Company was formed in 1878; Saltery appointed himself superintendent. The company purchased property in Chittenden, Bethel, and Pittsfield (possibly Stockbridge?) with plans to construct the reduction works at the junction of Locust Creek and the White River, about two miles west of Bethel

village. Saltery worked out of his office at the nearby Locust Creek Hotel. Supposedly, the works consisted of a steam engine and boiler; shipments of hot-blast pipes, liquidizer, blowing apparatus, and steam hammer were en route. Washing and separator works were complete; foundations for the furnace and liquidizer were nearly ready. The concentrator castings had also arrived.

It was expected that the iron ore would yield 68 to 75 percent iron, adaptable to a high-grade steel. Two tons of magnetic iron sand were expected to produce a ton of iron blooms, fueled by about 150 bushels of charcoal. The magnetic sand was to be run through a concentrator and brought to the furnace by a car. Separation was to be by gravitation action of water, the heavy gold and iron settling out. Gold and iron were to be separated by the "California sluice process." The freed iron sand would be mixed with a measured amount of carbon (charcoal), hoisted to the deoxidizer (sinter) and remain for 24 hours under high heat until thoroughly deoxidized, and finally fed into the open-hearth furnace.

The operation failed two years later when it was discovered that the gold was not sufficient to pay expenses, let alone make a profit. And the iron ore was not in sufficient quantity of the quality needed to justify continued investment. The Edmunds estate at the mouth of Locust Creek was known as the "forge property" until 1917. That same year, F. G. Dutton bought the estate and used the last surviving forge building as a barn ("White River Iron Works . . ." *Herald and News* Aug. 9, 1917:10).

The site of the White River Iron Company, along Locust Creek between Route 107 and the White River, was inspected in 1986. No physical evidence remains to indicate the ironworks activity that took place here just over a century ago. Not even the barn remains today. Washouts, such as that in 1927, succeeded in erasing surface evidences of the industry. The Locust Creek Hotel still stands, today included on the National Register of Historic Places.

The Southern District

Visible ruins of four blast furnaces exist in Vermont's southern district. Of the other six blast furnace sites, half might be archeologically accessible while the other half are probably lost forever due to land development or other site disturbances. No bloomery ruin has been positively identified in the southern district to date although slag finds point to one possible site at Dover.

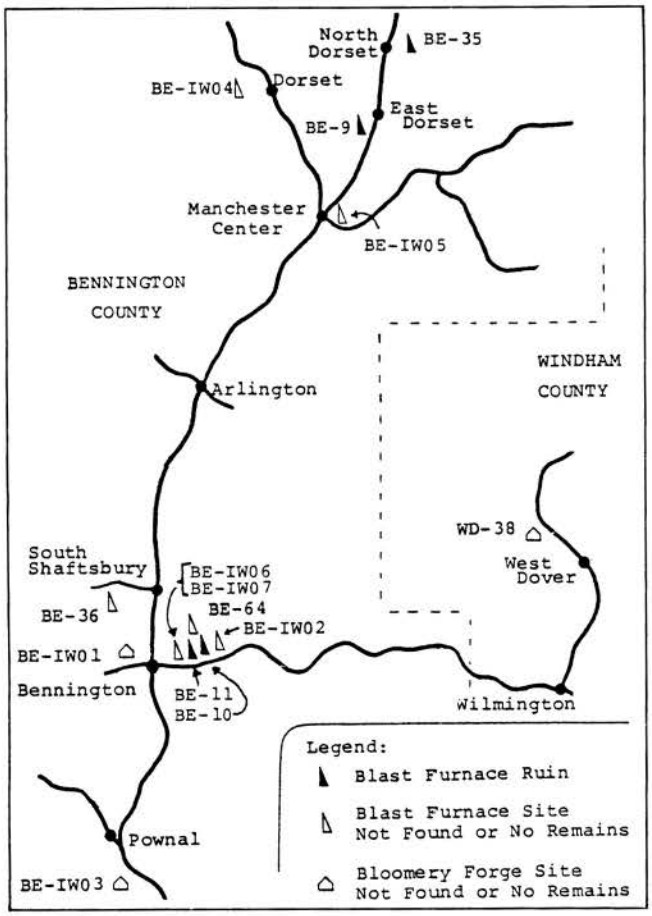
Major iron making in the the southern district occurred in the Bennington-Woodford-Shaftsbury area, where blast furnaces operated from about 1793 to 1873. Proximity to sources of good ore coupled with mountains of forests for charcoal and fast-running streams for waterpower made this area natural for the iron industry. Good roads also connected Bennington with Troy, New York, only 30 miles away.

Remains of the Bennington Iron Company are seen daily by alert drivers about two miles east of downtown Bennington. Just off the north side of Route 9 on private property stands one of the oldest blast-furnace stacks in New England and New York. And at Shaftsbury, after the demise of the Henry Burden & Sons furnace and works, the Eagle Square Company moved in to occupy some of the furnace grounds. But most of what remains of that works is hidden by heavy overgrowth and fill, waiting to be rediscovered.

BENNINGTON COUNTY

BE-IW01 Bennington Forge (Bennington): In 1775 George Keith was mixing ore and making nails at a shop beside Mill Stream in Bennington (Niles 1912:446). This may have been nothing more than a blacksmith forge, since it was not uncommon for individuals to forge small items, mixing local ore with wrought iron to obtain desired metal characteristics. In 1786 he built a forge on land he leased from Eldred Dewey, located about a quarter-mile east of the Dewey house. This forge might have been the first bloomery in the Bennington area (Hemenway vol. 1 1867:137). That same year William Blodgett advertised for sale: "[The] best refined bar iron, per ton or less quantity . . . the above articles will be given for good coal, ore or Pot Metal delivered to the forge" (Spargo 1938:27).

Coal was a reference to charcoal; pot metal was scrap iron (burned-out iron pots). Although physical location of this forge site is not known, historian John Spargo placed it in the village somewhere east of Route 7. The 1796 vonSotzman map of



4-51. *Bennington and Windham County ironworks sites.*

Vermont indicated a forge with names "Blodgete" and "Deweys" at what appears to be the Walloomsac River near the middle of the village. This could have been at the millpond, northwest of the main village intersection (Routes 7 and 9). The 1856 Bennington County map shows this pond with a variety of mills, including two foundries immediately downstream of the pond. The area coincides closely with the location of Keith's 1786 forge. Both the Keith and Blodgett forges are given 1786 starting dates, so it is possible that Blodgett bought Keith's forge that year. Ironworks had a history of changing owners many times, sometimes many times in the same year, even cycling between the same pair of owners.

Inspection of the area just a few blocks from downtown Bennington, in 1983, resulted in finding pieces of slag in the brook next to the Catamount School, immediately above the North Street bridge. This would have been upstream from the millpond and came from foundries that operated in this area in the early 19th century.

BE-64 Fassett and Hathaway Furnace (Bennington): Benjamin Fassett and Simeon Hathaway began building a blast furnace in 1793 along what came to be Furnace Brook. The 1796 Whitelaw map indicates an ironworks along this brook, about 1½ miles south of the Shaftsbury town line where the brook enters a narrow valley. A 1797 advertisement stated the furnace "is now in blast . . . they will begin to cast this day" (Spargo 1938:8).

Spargo insists in his history of iron making that this is not the first furnace in Bennington. Since he does not differentiate between a blast furnace and a bloomery forge, he could be interpreted as stating that the first blast furnace in Bennington was Blodgett's, and thereby, the first in the state. But Blodgett advertised bar iron and Spargo did not seem to be aware of this crucial difference in his analysis of the word forge, reading into the word a definition that encompasses a process that produced both cast and wrought iron.

By 1799 the blast furnace of Fassett and Hathaway came under the control of Moses Sage, Paul Cornell, and Caleb Gifford who operated it until ore beds in nearby Shaftsbury became unprofitable to work. The blast furnace was probably abandoned in 1803, which was the year before Sage and his son-in-law Giles Olin commenced operation of a new blast furnace a mile east of the village.

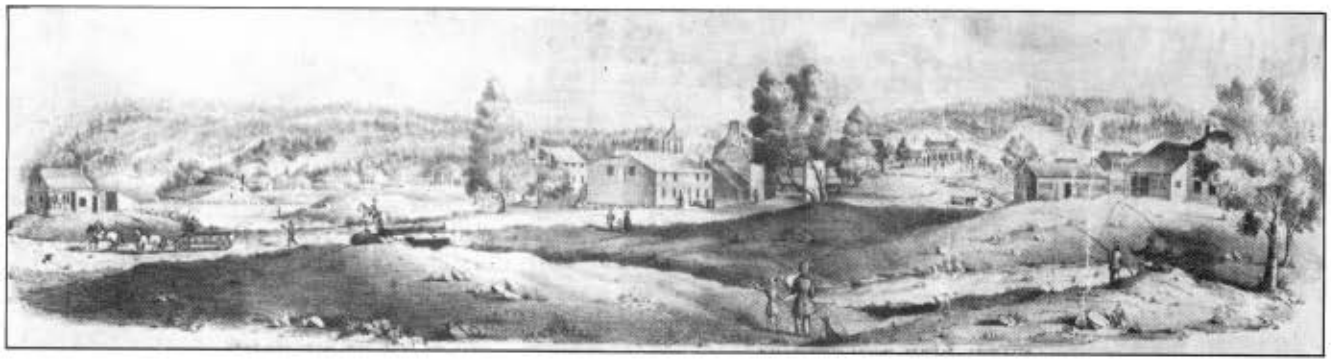
During the summer of 1981, an attempt was made to locate the site of the 1793 blast furnace along Furnace Brook. Beginning at Kocher Drive, a trail of bits of slag was followed upstream in the brook, past the landfill, to the remains of a washed-out dam, about ¾ of a mile to the north. In addition to the slag ending here, finds of slag and charcoal were located among collapsed stone walls immediately southeast of the dam. Here also is what appears to have been an earthen charging ramp that led to the furnace top. More low stone walls, a possible flume, and the barest remains of a ca.-1835 east-west road can be found about 100 feet farther upstream. No slag was found upstream of the dam site; no firm remains of the actual blast furnace were found.

It is possible that the site was later used for a sawmill and both eventually destroyed beyond recognition by nearly 150 years of spring washouts and ice movement. It appears that the furnace was built within 30 feet of the streambed and with its hearth nearly level with the local water table, thus probably accounting for the unprofitable operations here.

BE-IW06 Sage and Olin Furnace (Bennington): After the abandonment of their works on Furnace Brook about 1803, Moses Sage and Giles Olin built a new blast furnace east of the village of Bennington, near some newly discovered ore beds in Woodford. The new Sage and Olin furnace, called Bennington Furnace, commenced operation in 1804 or 1805. Two advertisements by Sage in 1806 offered work for woodchoppers and the sale of potash kettles and hollowware at the Bennington Furnace (Spargo 1938:12). The business continued until 1811 when it was purchased by Thomas Trenor (Trainor?) who ran the furnace on and off until 1819, about which time he probably abandoned it. Spargo wrote that Sage moved to Pittsburgh, Pennsylvania in 1816, possibly building the first blast furnace there. (Research has failed to confirm either his being there or building the first furnace at Pittsburgh.) About 1821, the business was acquired by Seth Hunt who razed the Sage and Olin stack and built a new furnace. As far as is known, later blast furnaces at the site destroyed evidence of this earlier furnace.

BE-10, BE-11, and BE-IW07 Bennington Iron Company (Bennington): The year after he razed the Sage and Olin furnace, Seth Hunt built a new furnace (BE-10) to specialize in the production of pig iron. Soon after he sold the furnace to the Bennington Iron Company (1822). This is the easternmost of the two stacks standing at Furnace Grove off Route 9, east of the village. Partners of record were "Charles H. Hammond, Nathan Leavenworth and their associates and successors" (*Acts and Laws* 1825:87-88). Hammond and Leavenworth are supposed to have been "New York City men." (No connection has been found between this Hammond and those associated with the Crown Point Iron Company, New York, or the furnace at Forest Dale.) Hammond served as Town Representative from Bennington in 1826 although for some unusual reason he does not appear in census reports for 1820 or 1830. Spargo said that Leavenworth and Hammond were Yale College graduates and were "fast friends" before coming to Bennington, but he also believed Hammond did not reside in Bennington (Spargo 1938:19, 23). Charles Henry Hammond and Nathan Leavenworth did in fact graduate from Yale, Hammond in 1815 and Leavenworth in 1778, but the latter died in 1799. Another Charles Leavenworth graduated in 1815 with a Charles Henry Hammond; this Leavenworth died in 1829, C. H. Hammond died in 1850 (*Catalogus* 1886:16, 34).

The Bennington Iron Company also acquired the furnace property of Robinson and Lyman, just over the town line in Woodford. The company erected two more furnaces: a large one, the westernmost of the two at Furnace Grove (BE-11), and later a smaller one about 40 feet away and between the two stacks (BE-IW07). This smaller furnace was referred to as "the Pup." This might have been the cupola built in 1824 to remelt pig iron to cast hollowware and plows in addition to filling orders for custom work. (Two stoves cast here are at the Bennington Museum.) An 1831 advertisement noted the addition of a refining forge to the Bennington Iron Company whose two blast furnaces were then making seven tons of pig daily. This calculates to about 1,000 tons a year, about average for blast furnaces in New England at the time.



4-52. *Joseph Hinsdill's 1835 sketch of the Bennington Iron Company looking north from across Roaring Brook (foreground). A forge dam and four charcoal kilns are at left, two blast furnace structures behind the company office at center, and Nathan Leavenworth's house in the right background (courtesy Bennington Museum).*

The first hot blast in the country might have been introduced at Bennington in 1833 (Hodge May 12, 1849:290). Hot blast was the system of preheating the blast air, initially at 250°F, later to near 900°F. James Neilson of England patented the technique in 1828 and William Henry was experimenting with it in New Jersey in 1834 (Harte 1935:47).

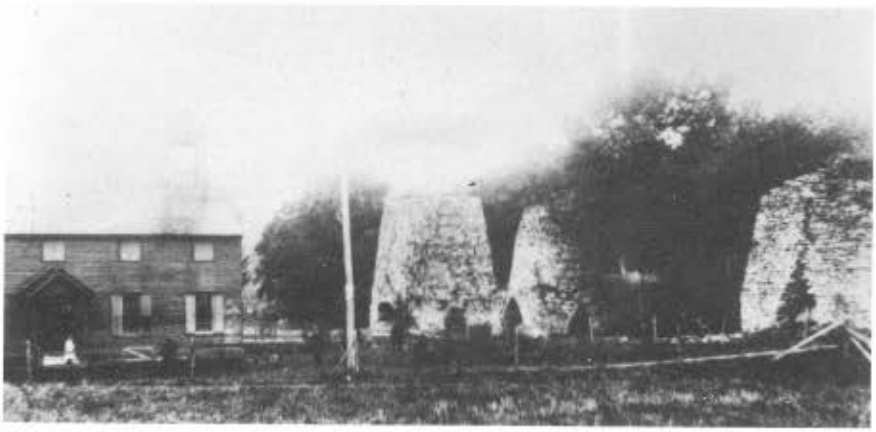
A map of Bennington with some accompanying history and a panorama of the Bennington Iron Company was published by Joseph N. Hinsdill in 1835. The view was drawn from across the south bank of Roaring Brook looking north, viewing the forge, two blast furnaces, what appears to be four charcoal kilns, the business office, and other buildings. The year 1835 would seem to be somewhat early for the charcoal kilns, but Isaac Doolittle patented a charcoal kiln design at Bennington in 1829 (Hodge May 12, 1849:290).

The sketch is a valuable historical and archeological resource for interpreting this early-19th-century Vermont iron industry. It also shows buildings around the furnace stacks, nearly hiding the furnaces from view. These buildings housed the charging and casting operations in addition to blast-producing machinery.

The two furnaces were described in 1849 as being 40 feet high, one 9 and the other 9½ feet across the boshes. They were blown with hot blast, the blowing apparatus consisting of eight tub bellows (probably two pair per furnace). The tubs were four feet in diameter with a 22-inch piston stroke working alternately, driven by a single waterwheel 22 feet in diameter with 12-foot-wide buckets (Hodge May 12, 1849:290).

The Bennington Iron Company failed in 1842 by which time the price of iron had fallen from $66 to $22 per ton. Creditors included banks and merchants in Bennington and in Albany and Troy, New York, plus unpaid employees and farmers. Much litigation followed with the property eventually being purchased by Captain Hamilton L. Shields who leased the furnace to Brock and Hinsdill for three years. They made enough profit to renew the lease another three years to 1853 but then lost it all. No part of the ironworks operated after that. In 1866, the last of the wooden portions of the three furnace stacks burned. "The Pup" collapsed later and was removed in 1890.

Two furnace stacks remain in varying states of collapse at Furnace Grove, off Vermont Route 9 in East Bennington. The large stack, the westernmost of the two, stood in good condition until the early 1900s when the south facade collapsed in the middle of the night with a roar that wakened nearby residents to fears of an earthquake (Van Santvoord 1958:92). It continues to crumble a few stones at a time each spring such that what remains is very unstable. The easternmost stack is the oldest standing blast furnace ruin in Vermont and it too is in poor condition. (The oldest standing furnace ruin in New England



4-53. *The Bennington Iron Company remains about 1880 with "the Pup" in between and the works office at left (courtesy Richard S. Allen).*

4-54. *View of the furnaces at East Bennington, just after collapse of "the Pup" between the two stacks. Note that track for the railroad and trolley had not yet been laid down (courtesy Tordis Isselhardt).*

4-55. *The ca.-1823 (left) and the 1822 (right) stacks about the 1890s, after collapse of "the Pup." Vibrations from the trolleys probably did much to accelerate collapse on the left stack (courtesy Richard S. Allen).*

4-56. *The old works office, now a private home at Furnace Grove in East Bennington; the 1822 stack in the background.*

might be the Falls Brook Furnace at Middleboro, Massachusetts, built in 1735 [David Ingram letter to author, Dec. 2, 1988].) North of the stack are the remains of the headrace and waterwheel pit where the blast machinery was found. The tailrace from this stack goes underground, then resurges beneath the west archway of the western stack. Atop the rise behind this stack is a tall iron shaft made of pig iron, standing vertically in the yard.

In addition to these two furnace stacks, the old company business office still stands at the entrance to Furnace Grove, where account books were maintained for incoming and outgoing supplies and goods. Now a private residence, it looks

4-57. *Ruin of the 1822 stack, the easternmost of the two standing ruins at East Bennington.*

4-58. *Ruins of the ca.-1823 Bennington Iron Company blast furnace, the westernmost of the two standing stacks at Furnace Grove.*

much the same as it did in 1835, with the exception of the missing rooftop tower and bell. The ironmaster's house, built in 1824 and also appearing in Hinsdill's 1835 drawing, was in 1987 The Captain's House Bed and Breakfast, most likely named for Captain Shields.

BE-IW02 Woodford Furnace and Forge (Woodford): Robinson and Lyman were operating a forge and blast furnace at Woodford Hollow sometime around 1802. The works made pig iron, plows, and other agricultural implements. During the Jefferson administration (1800–1808), a large contract was filled, supplying a considerable number of anchors for U.S. Navy gunboats. The ore also came from Woodford, near the furnace and forges. The 1810 Whitelaw map, however, does not indicate this apparently large ironworks complex.

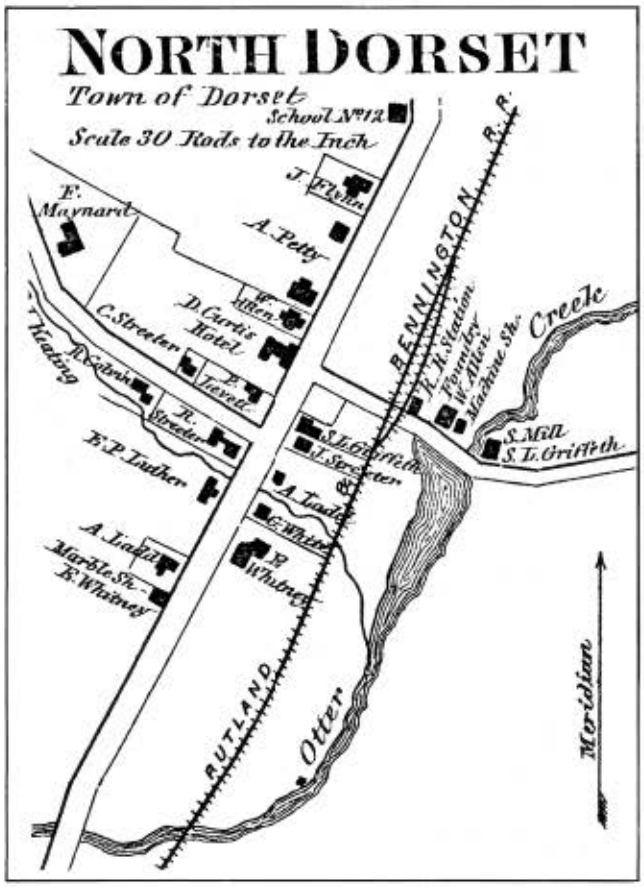
Following acquisition of these works by Hunt and Quimby (the proprietors of the nearby Bennington Furnace), the Woodford operations concentrated on supplying charcoal to the Bennington Iron Company for as long as the latter remained in business, although a forge at the Hollow continued to produce bar iron. Another forge was built later and was operated during the period of operation of the furnaces at East Bennington (Child 1880:26).

A search made in 1983 for the furnace was complicated by remains of a railroad, which was built through here in the 1870s and used slag as fill on which to lay the tracks. The slag might have come from either (or both) the East Bennington and the Woodford Hollow furnaces. There was also some 1950s highway realignment in the area. About 100 feet north of the old railroad bed, nearly on the Bennington-Woodford town line, a possible furnace site has been identified by the amount of slag and brick found there. Much domestic and construction debris is mixed with the slag and brick, further confusing the site. A system of raceways leads uphill from the site to a stream a quarter-mile to the northeast.

BE-IW03 Nobel's Forge (Pownal): The 1796 Whitelaw map indicates a forge in Pownal; it is further identified as "Nobles" on the 1810 map (see AD-339, Eagle Forge). The forge is shown along the Hoosic River at a point that appears to have been near today's Green Mountain Racetrack (dog racing). Comparison of today's Hoosic River bed to that in 1869 indicates the riverbed has shifted westward (Beers *Bennington* 1869:27). One curve of the river that passed east and under the railroad tracks in 1869 now runs alongside the western edge of the tracks. The bypassed river curve is an isolated swamp immediately east off Route 7. Similarly, the next downstream (north) mile of the river has shifted many hundreds of feet westward, hugging the base of the hill on that side of the valley.

Inspection of the river behind the racetrack grandstand in 1983 disclosed a six-foot-high riverbank on the eastern shore containing such mixed fill as contemporary asphalt, brick, concrete, conduit, and glass. This fill might have been dumped here as part of a Hoosic River flood control project, and has served as the base for the construction of the racetrack and its associated facilities. The site of Nobel's forge most likely is under much of this fill, near a small pond at the eastern edge of the racetrack where the riverbed was in 1796. It certainly has gone to the dogs.

BE-35 North Dorset Furnace/Allen Foundry (Dorset): This blast furnace operated at North Dorset as early as 1825, about



4-59. *The W. Allen Foundry and Machine Shop at North Dorset in 1869 (center-right). There was a small iron-making and ironworking community in the early to mid-19th century. Note the sawmill of Silas Griffith (Beers* Bennington *1869:10).*

a half-mile northeast of today's Emerald Lake near the head of the Otter Creek. Daniel Curtis ran the furnace, initially obtaining his ore from a hematite bed some 10 miles away in Tinmouth (*Geological Surveys* 1864:14-15). The ore later came from a bed near East Dorset, and eventually from a mine Curtis opened about 100 feet from the furnace stack (Adams 1845:18).

The 12-foot-high stone mound remains of the collapsed furnace was found in 1981 in the Emerald Lake State Forest. Its outside masonry was probably used in the construction of a later foundry and/or sawmill, whose ruins are also nearby. The furnace bosh rises above the collapsed walls about it, and standing atop the fallen-in stack with its waist-high glazed walls, one feels as if standing atop a castle battlement. The bosh lining is a rough-lain, red-color sandstone. Similar stone has been seen in furnace ruins at East Dorset, Tinmouth, Clarendon, and Troy. Some pieces of red brick lie among the collapsed walls, but none appear burned. There is no visible evidence of an archway; the collapse is too complete. No binding rods or end plates were found.

North and west of the furnace ruin is an area 50 by 70 feet and many feet deep of slag. A hundred feet southwest of the

ruin is the possible site of a mound-type charcoal-making area where chunks of charcoal were unearthed by modern heavy equipment in the process of working a logging road in 1983. Farther up the road are the barest remains of a headrace, starting at a small brook but ending downhill beneath more earth disturbances caused by the same logging operations. The raceway heads toward the blast furnace site, but does not appear to reach it. It may have been used for washing ore or to augment the sparse amount of water in Otter Creek.

Daniel Curtis was also owner of a once-famous hotel at North Dorset, succeeding his father, Elias, at the hotel. Elias was the son of Zachariah Curtis (buried at Pittsford) and a pioneer settler of Manchester who moved to Dorset in 1794. Daniel was in turn succeeded by son John (Aldrich 1889:420).

On the west side of the Otter Creek from the ruin of the North Dorset blast furnace are the remains of the Allen Foundry. Here are various foundation walls, more blast-furnace slag, and bits of iron. Much of the foundry site has been used as a dump for trees, brush, and trash. Remains of the foundry are visible for about 50 feet along the dirt road that passes through the area, east off Route 7. Foundry artifacts lie scattered from this road to about 120 feet north. The entire west bank of the creek at the foundry site is a 6- to 10-foot-high wall of slag. At the north end of this slag is glassy, blue furnace slag. Why the blast furnace slag is found on the opposite side of the creek from the actual furnace site is not known. Did an earlier blast furnace operate on this side?

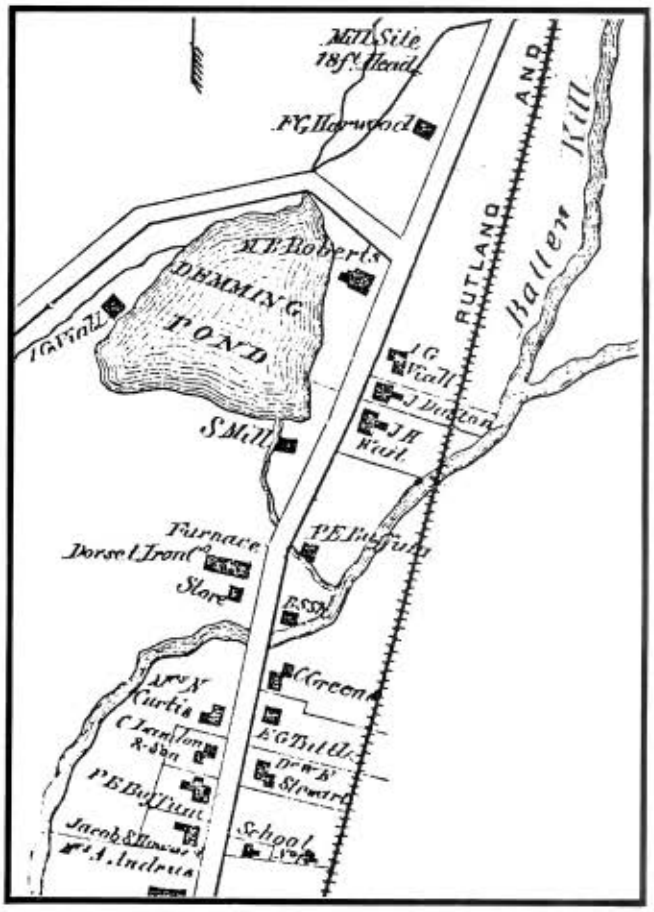
Welcome Allen came to Dorset and purchased "the old foundry property" in 1847 or 1848. This infers that a foundry already existed there, possibly built and operated by one of the Curtis family that previously owned the nearby blast furnace. Welcome Allen operated the business until 1869 and was followed by his son, Florez R. Allen (Aldrich 1889:419). The foundry last appeared in *Walton's Register* in 1894.

The foundry produced various styles of cast-iron stoves (Curtis and Curtis 1974:15). The need for cast iron therefore made a next-door blast furnace practical, at least in the 1840–1850 period before railroads could supply large quantities of cheaper pig iron. The annual capacity of the blast furnace was reported in 1849 to be 1,000 tons, although the furnace was not at that time in blast (Hodge May 12, 1849:290). An 1856 report referenced it as one of "two blast furnaces in Dorset on the Western Vermont Railroad" (Lesley 1858:76).

The 1856 Bennington County map indicates "Allen's Machine Shop & Furnace" at two buildings, side by side but opposite the Otter Creek from today's blast furnace ruin. The Allen "furnace" on this map might have been a cupola for remelting pig iron for casting stoves and tools. The 1869 Beers map of Dorset indicates "Foundry W. Allen Machine Sh." adjacent to two buildings, directly across Otter Creek from S. L. Griffith's sawmill. Griffith was a major producer of lumber and charcoal at Mount Tabor from the 1870s to the early 1900s.

BE-IW04 Dorset Village Furnace (Dorset): Near Prentiss Pond on the western outskirts of Dorset village, a smelting furnace operated "at an early date," of which little else is known (Humphrey 1924:116). Remains may have been scattered or cannibalized for construction of a gristmill which later occupied the approximate site, per the 1869 Beers map of Dorset. The area was inspected in 1984 but no slag or ironworks artifacts were found. This early furnace might have been built a few hundred yards downstream of the pond to take advantage of

4-60. *The mound remains of the Curtis blast furnace along the upper reaches of the Otter Creek in North Dorset.*



4-61. *The Dorset Iron Company blast furnace complex in 1869, just south of Deming Pond (Beers* Bennington *1869:10).*

the narrowing little valley and permit a shorter dam than the present one.

BE-9 East Dorset Furnace (Dorset): About the time the North Dorset blast furnace closed, another was being built by Francis Draper around 1846 or 1849 near East Dorset at South Village (Neilson 1866:217; Child 1880:130). The furnace made iron for eight years, after which it lay idle. It was purchased by the Dorset Iron Company in 1864, possibly the result of demand for iron during the Civil War. By 1866, however, it was still out of blast but reported being in fair operating condition (Neilson 1866:220). The facilities included a 100-foot-long casting house made of marble. This building also contained a large waterwheel and a cupola furnace that was designed for casting stoves. Although the company owned 100 acres of woodland, there was some consideration given in 1866 to converting the stack to burn anthracite. It was still out of blast in 1874 and the following year Draper bought it back, expecting to repair it and resume smelting. He might have planned to use the furnace to support a cupola furnace he owned in Windsor. Draper also owned ore beds a mile north of the furnace. There is no evidence that the furnace was ever fired up after its initial shutdown in 1854.

The furnace stack was still standing in relatively poor condition in 1989. Cathy and Dennis Conroy, owners of the stack, live in the house directly next to it. They cleaned out the interior of the stack in 1987, finding many pieces of tools and a bar of pig iron in the process. During the next year, however, the stack resettled and new cracks opened in the outside walls, causing concern that the stack might collapse at any moment. Stabilizing efforts by the owners are now under way.

The stack can be seen east from Route 7A just south of Morse Hill Road during periods of thin foliage. Much of the bosh and hearth lining is missing, but enough remains intact to see that the lining was of stone rather than firebrick. The front (east) archway is of stone block construction; the south

4-62. *Blast furnace and foundry at East Dorset in the 1890s. The foundry was built of marble; only foundations remain (courtesy Cathy and Dennis Conroy).*

4-63. *The East Dorset stack at South Village in 1991, next door to the owners.*

4-64. *A piece of pig iron (center) found inside the East Dorset stack while it was being cleaned out by the owners.*

4-65. *Details of the hearth at East Dorset after loose breakdown had been removed.*

and north archways have become blocked with stones from the collapsed wall behind the stack. There does not appear to have been a west archway.

The hint of a road can be seen behind the stack leading to the top where a charging platform once stood. The stone embankment wall has collapsed against the back wall of the furnace so that one can now walk from the charging hill to the furnace edge and look directly down into the furnace interior. Some charcoal has been found on the charging hill, probably remains of coal sheds that stood here. Slag from the furnace litters the area and can be found as far away as in the stream under the highway bridge, just to the south.

The forge pond still remains, 100 yards north of the furnace. No trace of the flume that carried water to power the furnace bellows is visible today. All surface evidence was removed by a sawmill that operated later at the pond outlet, and by gravel quarrying in the 1940s just north of the furnace. Foundation remains of the casting house were found in the thick brush adjacent to the stack.

BE-IW05 Factory Point Furnace (Manchester): An 1828 petition for a post office at the "North Village in Manchester" (later Factory Point; now Manchester Center) described the community, which contained "more than thirty families, three retail stores, two tanneries, one Blast Furnace. two woolen factories, and one distillery, all in actual operation besides shoe makers, cabinet and chair makers, blacksmith and other merchants" (Bigelow and Otis 1961:101).

This furnace was also probably that which Harry Whipple of Manchester knew about. Whipple, who delved into local history, had some handwritten papers dated 1829 that discussed "iron furnaces" here. In 1955, it was stated that he could identify the exact spot where the "iron furnaces" (more than one?) were located (Anna B. Buck letter to Richard S. Allen, July 8, 1955). Visits to the local library and research at historical society archives have failed, however, to locate these papers.

The furnace might have gotten ore from an iron mine at Lye Brook, which supplied ore to an iron company in the lower Hudson River Valley a few years later. There was also an iron foundry at the Center, which used scrap iron (Bigelow and Otis 1961:152). No physical remains of the mine or foundry have been found.

During many summer weekends in 1981, all sides of the (then) Route 7 and 30/11 junction were closely inspected, including the streambed in the proximity of the marble bridge in Manchester Center. Fortunately, the sluice gate at the dam was open that summer and the bottom of what is usually a deep millpond was accessible for inspection. On this bottom, downstream of the marble bridge, many bits of blue slag were found. A few larger, walnut-size pieces were found downstream of the dam and the falls. This would normally indicate the former presence of a blast furnace in the vicinity. The upstream trail of slag ended in parking lot fill immediately northeast of the bridge. The slag in the stream had washed out either from the parking lot or from the fill used to raise the approaches to the bridge many years ago. Inspection of the stream for 100 yards upstream of the bridge netted no further slag finds. Slag associated with charcoal, bits of rusted iron, an industrial-size iron-toothed gear, and other unidentified domestic and industrial hardware were found one day in 1987 eroding out of the high embankment behind the Sirloin Saloon Restaurant, about 700 feet east of the bridge.

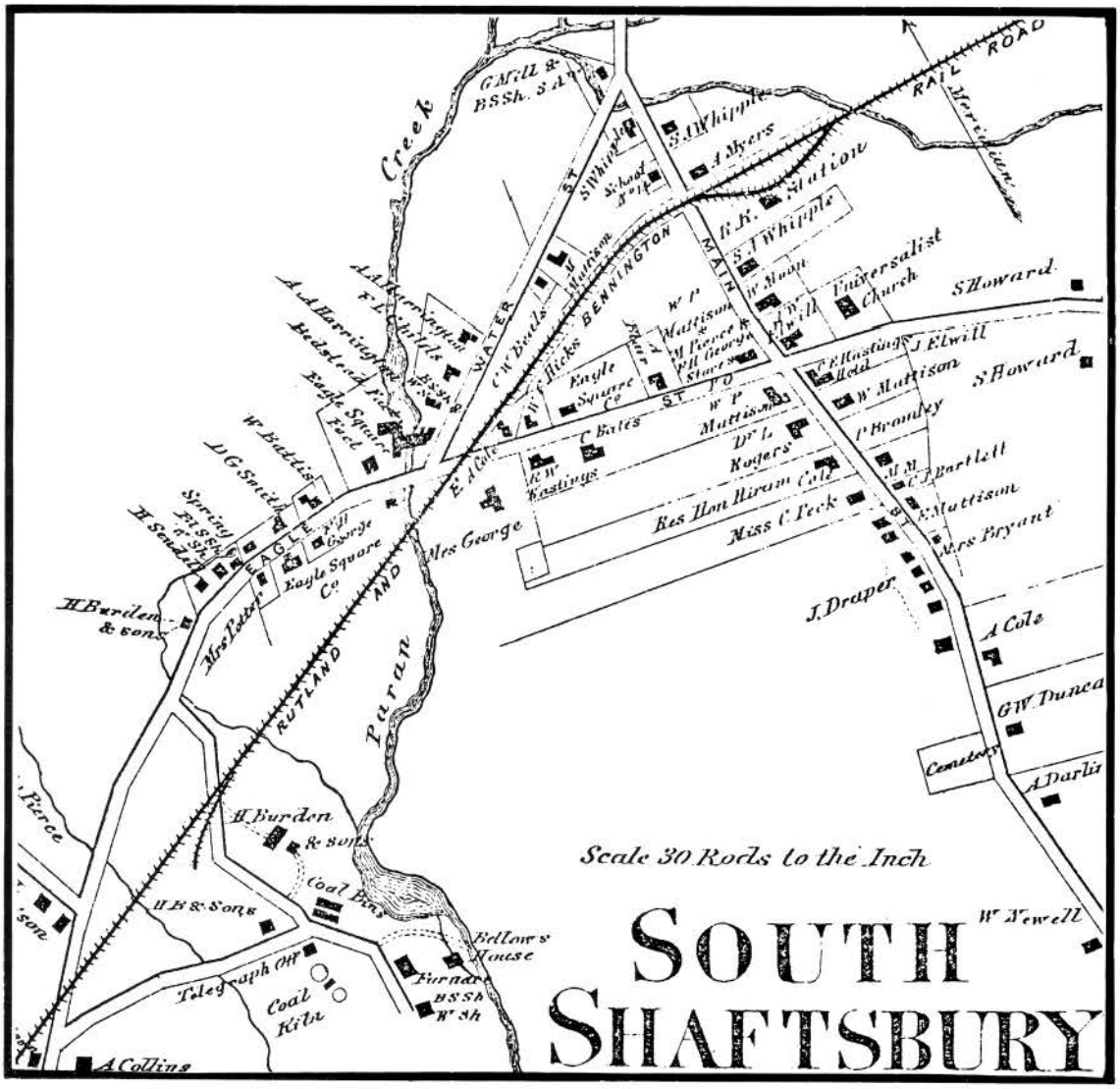
A succession of bridges existed at the Center, starting with a wooden bridge, an iron bridge in 1884, and finally the present marble bridge in 1912, which was widened in 1942 (Bigelow and Otis 1961:20-22). Each bridge was built a little higher over the creek than its predecessor, requiring its approaches to likewise be raised. It is possible that slag from a nearby blast furnace was in part used as fill under these approaches. It was

not an uncommon industry practice to use slag for fill, or mixed with asphalt or cement as a filler.

In a short paper published in 1953 on the subject of ironworks in Vermont, then State Geologist Elbridge Jacobs included in the list of towns and furnaces "Manchester, 1821" (Jacobs 1953:130). Jacobs' paper referenced a "manuscript" supplied to him by Charles R. Harte (see chapter 4, "Study Methodology"). According to Harte, if you traveled up Route 7 (today's Route 7A), you would find only the "merest trace" of the Manchester stack (Charles R. Harte letter to Richard S. Allen, April 5, 1955).

There were also lime kilns in Manchester, which have nothing to do with ironworks, but it does offer a possible explanation for seeing "blast furnaces" in the town in the 1950s (see chapter 8). Lime kilns are another type of furnace whose ruins are sometimes mistaken for iron furnaces. One kiln stood at a place known as Purdy Hill (Purdyville), about two miles south of Manchester Village, which may be one answer to Harte's "merest traces of a stack up Route 7" in Manchester (if in fact Harte ever went to Manchester to see the remains in person, or was told this secondhand).

BE-36 Burden Furnace (Shaftsbury): On April 30, 1827, the *Vermont Gazette* contained an advertisement for the firm of Douglas & Bangs, offering for sale at their Shaftsbury furnace cast-iron plows and castings of any size (Spargo 1938:21). This might have been a cupola furnace, operated by Norman Douglas and Rufus Bangs, both involved in the manufacture of carpenters' squares in Shaftsbury before the Civil War.



4-66. *The Henry Burden & Sons ironworks at South Shaftsbury in 1869, showing the location of the blast furnace near the bellows house along a flume parallel to Paran Creek. Only stone and concrete foundations and walls and scattered slag and brick in an area of heavy brush known locally as the furnace grounds remain today to mark the site (Beers* Bennington *1869:21).*

A blast furnace was, however, built in Shaftsbury in 1863 by Henry Burden & Sons of Troy, New York. It was located west of today's village of South Shaftsbury on Paran Creek. Ore was dug locally and in Bennington. Pig iron from the furnace was shipped to the Burden foundries and to mills along the Hudson River at Troy, where it was used to make railroad spikes, horseshoes, stove castings, and machinery. The 1869 Beers map of Shaftsbury shows the works contained charcoal kilns, coal sheds, bellows house, and buildings that were residences and offices. Production of pig iron was 149 tons in 1863, 1,602 tons in 1864, and 2,315 tons in 1865, the Civil War years. The furnace was 28 feet high by 10 feet across the bosh. The hot blast was driven by an overshot waterwheel by means of two 30-inch-diameter blowing cylinders placed directly over the waterwheel. The blast of 1¼ pounds per square inch entered the furnace through two 4-inch-diameter tuyeres. The furnace consumed 210,160 bushels of charcoal and 3,779 tons of ore in 1864 (Neilson 1866:218-220).

The principal source of ore for the works was an area near the border with New York State about five miles southwest of the furnace. The mine has been variously called the Burden Iron Works and the Burden Iron Company. The ore was transported to North Bennington where it was washed in mills along the Paran Creek.

After the Civil War, Burden leased the works to Troy, New York stove manufacturer George W. Swett who operated it until the business panic of 1873 (Levin 1978:50). At that time the furnace capacity was 3,000 tons a year, making it the largest-capacity blast furnace ever fired in Vermont. Swett continued ownership of the works until 1877, hoping for better times that did not return (*Walton's* 1877:141).

The stack and buildings were razed sometime before 1900. The field of slag and bricks became slowly overgrown and by 1955 the burnt mound that marked the furnace base was barely discernible (Richard S. Allen ca.-1955 note to author, August 1979). An inspection of the furnace grounds was made in 1979 and only the usual slag, pieces of brick, and the dam could be found. Heavy vegetation kept the location of the burnt mound completely hidden from sight.

WINDHAM COUNTY

WD-38 Somerset Forge (Dover): The Somerset Forge was built in 1820 by the Trainor Mining Company, possibly by the same Thomas Trenor who ran the old 1804 Sage and Olin blast furnace from 1811 to 1819 before moving to Somerset (Hemenway vol. 5 1891:350). The forge and mine were in a part of the town of Somerset that later became part of the town of Wilmington and is today the western part of the town of Dover. The October 17, 1826 *Vermont Gazette* noted in an editorial that bar iron made at the Somerset Forge was being sold to a machine shop in Bennington. The forge was apparently competing directly with the local Bennington Iron Company's forges. The costs of transporting the heavy bars over mountains to Bennington and to Troy, New York eventually forced the forge to close (Spargo 1938:22). A tannery was built on the site of the forge, which operated to 1861. The tannery was demolished in 1867 and replaced with a sawmill (Kull 1961:3-4). The 1856 Windham County map locates the tannery where the old road to Somerset crosses the brook, about two miles northwest of West Dover.

Extensive remains of a high, long stone dam that probably powered the sawmill (and maybe the tannery before it) were found here in 1984. Much slag and charcoal were also found along the stream between the dam and the road, betraying the approximate site of the forge on ground disturbed by later industrial activity.

Ore for the forge came from iron mines found in 1984 about two miles northwest on the property of the former Carinthia Ski Area. After failure of the forge, the mines were reworked by some New York businessmen in 1832. They also abandoned the mines after spending much money and effort (see chapter 3).

Note that heavy clothes-pressing irons marked DOVER seen at antique shops or used in homes as doorstops were not made at Dover, Vermont, but most likely at the Dover Furnace in New Jersey.

Summary of Results

Forty-three ironworks sites were reported to the State Archeologist during the 1978–1990 period of the overall statewide IA study and are now part of the State Archeological Inventory. Five other sites have been reported to the State Archeologist in the Field Site (FS) category. Inconclusive or no positive surface evidence was found at these sites, but further study might determine them to have potential archeological value. Archival and field work continues at 51 more sites in the work-in-progress (IW) category. The total number of ironworks sites studied is 99 at this writing. Ironworks include blast furnaces, bloomery forges, and foundries. While some ironworks sites contained one or more of these, other sites contained as many as all three.

A breakdown of the results and distribution of the sites and remains by county is presented in table 4-2. Ruins/remains include standing or partially collapsed ruins, mound remains, or any visible, identifiable surface evidence such as slag, bits of charcoal, or pieces of brick. As the table indicates, a majority of the ironworks were found in Addison, Bennington, and Rutland counties. Although the study identified no ironworks

Table 4-2. Summary of Ironworks Sites and Remains

County	Sites	Blast Furnace Ruins/Remains	Bloomery Forge Ruins/Remains	Foundry Ruins/Remains
Addison	32	3	10	4
Bennington	13	6		1
Caledonia	2			
Chittenden	7		2	
Franklin	7	2		
Grand Isle	1			
Lamoille	1			
Orange	1			
Orleans	2	1		
Rutland	27	9	5	
Washington	2			
Windham	1		1	
Windsor	3	1		
Total:	99	22	18	5

in Essex County, many early foundries are known to have operated there.

The sites of 36 blast furnaces and 66 bloomery forges were researched. Furnace ruins or remains were found at 22 sites (61 percent) while forge remains were found at 18 sites (27 percent). This discrepancy is probably due to a forge's ruin being smaller and easier to raze than a furnace's towering and imposing bulk. Of the 22 blast furnace ruins/remains, 3 were found to be wholly or substantially standing, 6 were partially standing, 3 were mound remains, and 10 had only trace surface remains. Except for a partially standing blast furnace ruin at Troy, the 12 furnace ruins and remains were found along the western slopes of the Green Mountains or in the Champlain Valley. Bennington and Rutland counties account for the most blast furnace ruins; those in better condition are at East Bennington (two), East Dorset, Pittsford, and Forest Dale. All furnace sites are private property except those at North Dorset (Emerald Lake State Forest) and Forest Dale (Vermont Division for Historic Preservation). Table 4-3 shows the distribution of blast furnace ruins and remains by county.

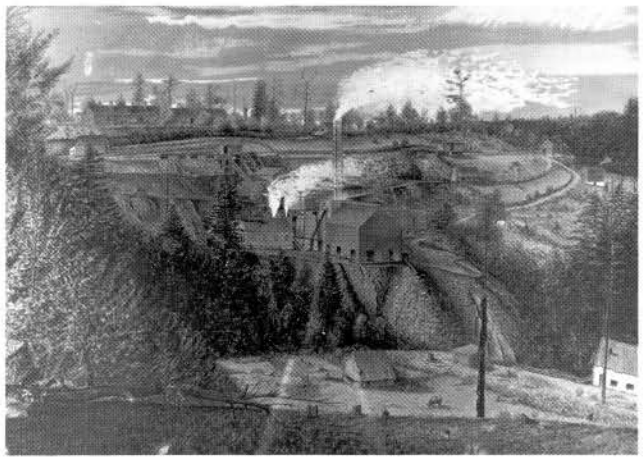
Of the 66 bloomery forge sites researched, only 18 sites yielded any surface evidence. No field evidence was found at 32 sites and 16 more sites have eluded attempts at discovery. Almost all forge sites researched were along the western slopes of the Green Mountains or in the Champlain Valley. Many more operated at an early time west of the Green Mountains and in the Connecticut River Valley; only those at Calais, St. Johnsbury, Cady's Falls (Morristown), and Weathersfield are included in this study. Table 4-4 shows distribution of bloomery forge ruins and remains by county.

Table 4-3. Distribution of Blast Furnace Ruins or Remains

County	Fully Standing Ruins	Partially Standing Ruins	Mound Remains	Trace* Remains	No Field Evidence	Total
Addison				3	2	5
Bennington	1	2	1	2	5	11
Caledonia					1	1
Franklin			1	1	2	4
Orange					1	1
Orleans		1				1
Rutland	2	3	1	3	2	11
Washington					1	1
Windsor				1		1
Total:	3	6	3	10	14	36

*Slag finds only.

Fifteen foundries were also researched although this category of ironworks was not a major thrust of the study. Thirteen foundries were identified through archival and field work to be integral parts of blast furnace and bloomery forge sites. They were researched along with the other ironworks components of these sites and were included with their associated furnace or forge site reports. Two foundry sites not directly associated with furnace or forge sites were researched and included in the study because of their proximity to other ironworks, the amount of archival material found, and the wealth of their field remains.



4-67. *Alluded to be a scene at Burden's iron mine in western Bennington, this 1865 painting by I. Sackett is a romanticized view of the Burden Iron Works at South Shaftsbury, showing the blast furnace and its top oven under the tall, smoking chimney (courtesy Bennington Museum).*

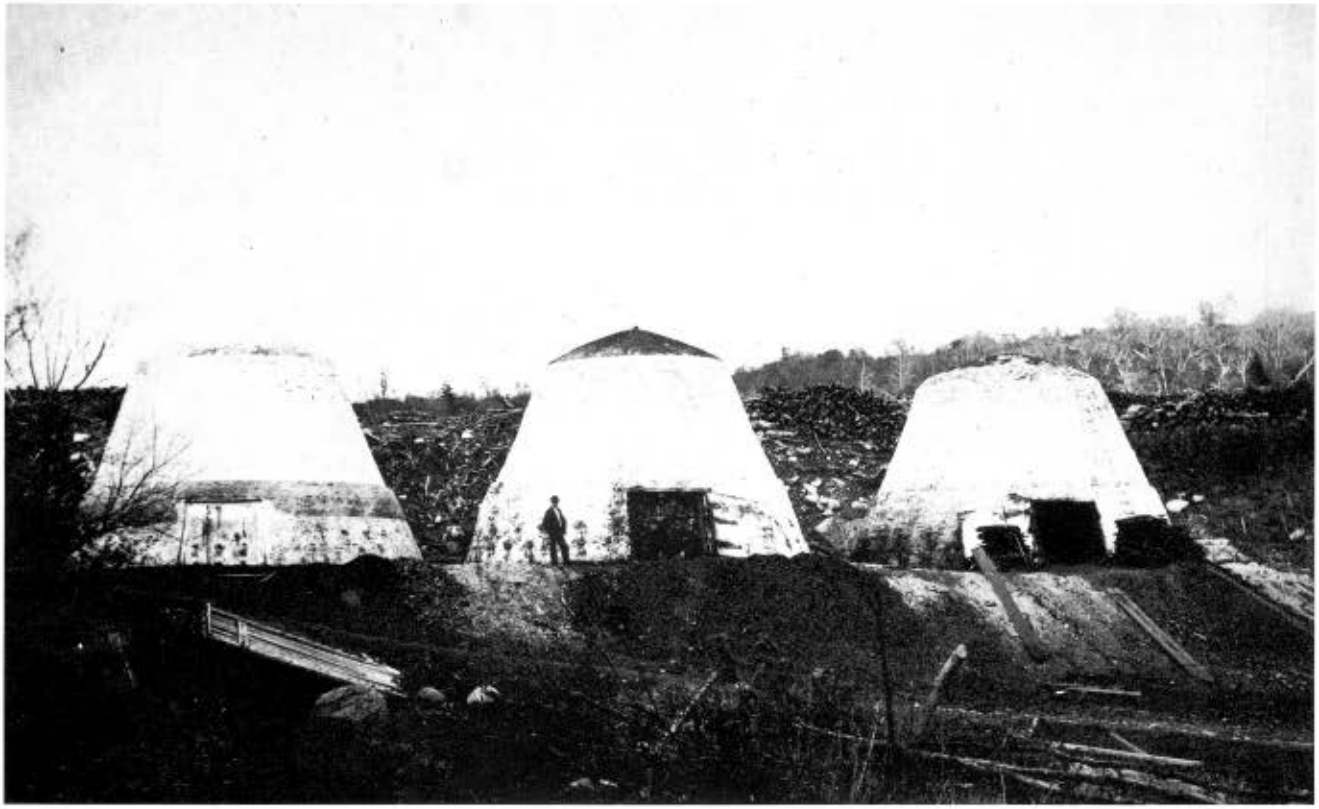
These two were assigned their own site numbers and reported individually. Additional foundries associated with 19th-century stove manufacture included in chapter 2 (table 2-1) are not included in the table 4-2 foundry category.

Almost all ironworks ruins were found to be extremely fragile. Walls of fully and partially standing blast furnaces can collapse without warning on anyone exploring them, crushing a person beneath tons of rock and brick. These stone ruins are especially precarious in springtime when the melting winter ice can cause the collapse of numbers of large, heavy stones and possibly whole sections of the wall. Illegal trespass can complicate attempts to recover medical expenses from injuries. Legal action can also be brought against those who vandalize archeological sites. Those sites on public property are protected by a variety of state and federal regulations. Both the state of Vermont and the federal government actively prosecute violations of historic preservation laws.

Table 4-4. Distribution of Bloomery Forge Ruins and Remains

County	Ruins/Remains	Trace* Remains	No Field Evidence	Unsure of Location	Total
Addison	3	7	15	2	27
Bennington			2	2	4
Caledonia				1	1
Chittenden		2	4	1	7
Franklin			2	1	3
Grand Isle				1	1
Lamoille			1		1
Orleans			1		1
Rutland		5	6	6	17
Washington				1	1
Windham		1			1
Windsor			1	1	2
Total:	3	15	32	16	66

*Slag finds only.



Three conical-type charcoal kilns that supposedly operated somewhere in Stamford. Note bottom sections made of stone and upper sections of brick; the vaulted top is probably brick. These kilns are claimed to be those near the Haskins mill, but appear more like the remains of kilns found up Crazy John Stream (courtesy Stamford Community Library).