IRON INDUSTRY OF THE EASTERN ADIRONDACK REGION

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Introduction

Developments in mining and iron smelting in the Adirondack-Champlain region (Figure 1) commenced with effective American settlement after the 1812-1814 war, and in some instances preceded it. Iron ore had been observed on the lakeshore near Crown Point as early as 1749 by Swedish naturalist Peter Kalm (1770).

The crude ironworks on the manor of British military officer, Philip Skene, at Skenesborough (Whitehall, NY) at the head of Lake Champlain smelted ore from the vicinity of what later became the Cheever Mine a few miles north of Port Henry, NY (Morton, 1959). At the mouth of the Saranac River on Lake Champlain, Zephaniah Platt and associates operated a Catalan forge or bloomery in 1798 using ore from Vermont. In 1801, an ironworks was erected at Willsboro Falls on the Boquet River.

Catalan Forge

Adirondack and Champlain iron makers employed two methods for smelting iron, each with centuries-old European

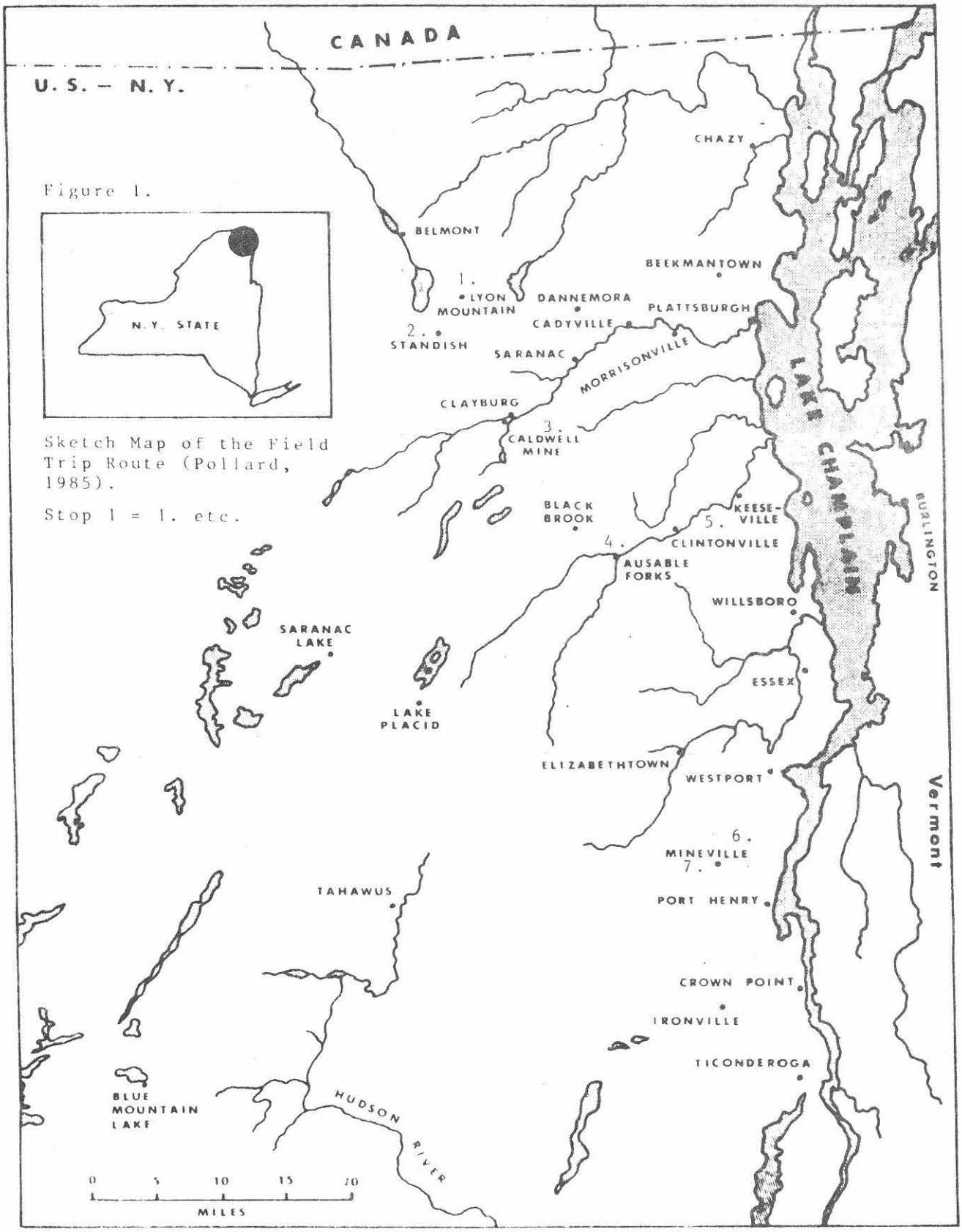

Figure 1.

Sketch Map of the Field Trip Route (Pollard, 1985).

Stop 1 = 1. etc.

antecedents. The Catalan forge or bloomery, the older and simpler apparatus, resembled a blacksmith's hearth (Hunt, 1870). The raw materials of finely crushed and calcinated or roasted ore, crushed limestone or marble, and charcoal were shoveled into a heavy cast iron firebox that was surrounded by fire brick and provided with a chimney (Glenn, 1987). An activated bellows forced an updraft that intensified the heat while a bloomer stirred the charge with a long-handled rod. The ore was heated to a semi-molten state as the smelting process separated impurities from metal. The metal was gradually worked into a pasty, ball-like mass that was repeatedly hammered on an anvil to expel impurities. Heavy trip hammers, driven mechanically by water-driven wheels, were used for this. Following successive reheatings and hammerings, the loupe or iron mass was shaped into a bloom or billet, a nearly pure, malleable form of wrought iron (Chahoon, 1880). These blooms were in great demand among regional blacksmiths and nail factories (Chahoon, 1875 and Egleston, 1880).

Blast Furnace

The alternate technique employed a blast furnace (Figure 2), a hollow inner chamber or tunnel open on both ends, lined with fire-brick, and supported by a stack of heavy cut stone. The stack, square at the base and top, tapered upward in the shape of a truncated pyramid. All raw materials were fed through the tunnel head or top from a "charging bridge". As the alternating layers of iron ore, limestone, and charcoal (later coke) descended through the furnace, they encountered the forced ascent of heat and gases liberated by the burning of charcoal/coke lower down in the tunnel (Richards, et. al., 1895). The rising gases (including carbon monoxide) readily united with oxygen in the ore, thus leaving a spongy mass of iron. The hot gases formed by that process were expelled from the top of the stack into the atmosphere in the early years, but were later captured and conducted through downcomer pipes to be used as fuel in heating ovens.

The metallic iron and the limestone melted along with the various impurities it absorbed. This molten matter then trickled into a catchment basin or hearth at the base of the furnace. The more dense iron settled on the bottom while the liquid lime-rich impurities floated on top as scum. A clay plug in the hearth wall was removed periodically, allowing molten iron to pour forth to cool in molding troughs. The scum was drained through a separate taphole and allowed to solidify as slag. The solid metal, pig iron, a carbon-rich and relatively brittle product, required subsequent reworking in a puddling furnace or refining forge to remove excess carbon and render the metal strong and malleable.

Although the blast furnace technique entailed a two-step process, it was more efficient for smelting large quantities

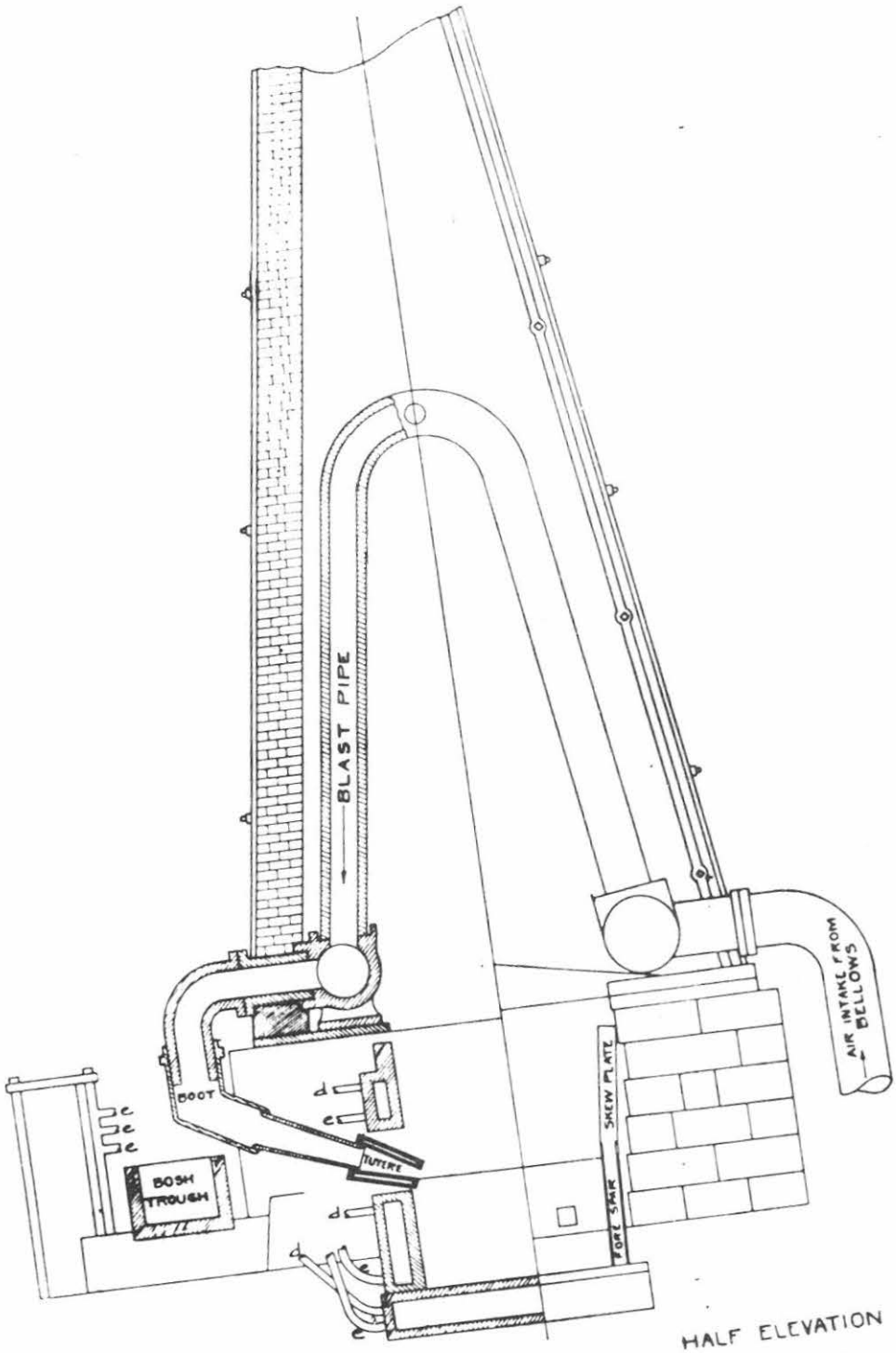

Figure 2. (Linney, 1934)

of ore. Both processes were employed in the Adirondack-Champlain region. The bloomery was widely favored, and during the second half of the 19th century this region became the greatest and last stronghold of the bloomery smelting process in the United States. The reasons for this included: (1) initial investment and operating costs were low; (2) it produced the quality of iron sought by regional blacksmiths and nail-makers; (3) many smelting operations were of necessity small in scale because it was impractical to haul the large quantities of charcoal required for blast furnaces long distances; (4) it was subject to practical operation on an intermittent and seasonal basis and thus could be successfully synchronized with seasonal farming, lumbering and charcoal making; (5) given the abundance of local ore, efficiency with respect to raw-material consumption was not an overriding priority; and (6) advances such as the introduction of the hot-air blast improved the efficiency of the process and extended its useful life in the Adirondack-Champlain region.

Raw Materials

The iron industry spread westward from the shores of Lake Champlain as settlement advanced up the river valleys. In many instances, iron accounted for initial settlement, spurred population growth, and promoted overall economic development in these remote areas. Although this region offered relatively little in the way of agricultural assets, it was well endowed with the resources needed for an iron enterprise. First, numerous deposits of magnetite were discovered in the granitic gneisses of the Adirondack foothills. These deposits were variously described as occurring in bodies, shoots, masses, pods, beds, veins, sheets, and lenses. They were readily detected by the behavior of a simple surveyor's compass and later by magnetic dipmeters. Secondly, the high-gradient rivers that emanate from the hundreds of lakes and ponds in the mountains and flow to Lake Champlain and the Hudson River offered excellent water-power to drive bellows, air compressors, trip-hammers, and other machinery. The great mantle of virgin forest formed the third ingredient as it offered an ample supply of wood for making charcoal. Charcoal was the primary smelting fuel used throughout most of the 19th century in this region. Finally, an availability of Grenville marble in the Adirondack region and Ordovician limestone in the Champlain Lowland provided the necessary fluxing material for the smelting process (Kemp and Ruedeman, 1919).

Primitive transportation methods made it difficult to import iron products from outside of the region. Thus, ironmongers seized the opportunity to supply local markets. The Adirondack-Champlain region eventually grew to attain a national ranking in the iron business, however, it was not unusual in its possession of all prerequisites for iron making; many regions throughout the eastern United States

maintained iron-working enterprises of varying magnitudes in the late 18th and early 19th centuries.

Early Years

Thus, with a superb resource base at hand and settlers arriving in the early 1800s, the growth of the iron industry was inevitable. The early ironworks were concentrated along the Saranac, Ausable, Bouquet, and Schroon Rivers. Later the Chazy Valley in northern Clinton County and the Towns of Moriah and Crown Point in Essex County emerged as important centers of iron making.

By 1820, significant mining operations were being carried on at Arnold Hill, which opened in 1806, in south-central Clinton County (Hardy, 1985) and in Essex County's Town of Moriah at Cheever north of Port Henry (Warner and Hall, 1931) and in the Town of Newcomb (at Tahawus near the headwaters of the Hudson River (Masters, 1923). Small surface pits had yielded modest quantities of ore in a number of widely scattered localities elsewhere.

Major regional development was inaugurated in the 1820s by the imposition of a tariff on imported iron and by the opening of the Champlain Barge Canal at Whitehall in 1823. The latter provided an all-water transport connection between the Champlain Valley and the Hudson River. Direct access to the burgeoning industrial city of Troy, New York provided a major market for Adirondack-Champlain ores and smelted iron. Additional markets were also secured further south in the Hudson Valley, throughout southern New England and in Pennsylvania and Ohio.

Middle Years

By the mid-19th century, the iron industry was a multi-million dollar enterprise. It attained a position of dominance in parts of the Adirondack-Champlain region and ranked among the leading iron regions of the country. The basic geographic pattern was an elaboration of that established earlier. The primary mining operations were mostly subsurface drifts such as those at Arnold Hill and nearby Palmer Hill in the Ausable River Valley, the Cheever Mines, and the Mineville-Witherbee developments. Numerous secondary and relatively small enterprises were active in and near the Saranac River Valley and at points scattered across northern, eastern, and southern Essex County (Glenn, 1977).

The Ausable Valley stood out as the prominent corridor of iron-making, rolling mills, foundries, and fabricating industries. Horse-shoe nails were the chief finished product. Ausable Chasm, Keeseville, Clintonville, Ausable Forks, Black Brook, and Lower Jay were all thriving centers of iron making and/or fabricating. To the north, the Saranac Valley formed

another primary subregion (Hurd, 1880). South of the Ausable Valley, Port Henry stood out as the dominate node of smelting, with smaller works located inland in the Town of Moriah; at Ticonderoga; and in the Schroon Valley of south-central Essex County (Watson, 1869 and Smith, 1885).

The Peak Period - Mining

The peak period of the Adirondack-Champlain iron enterprise was ushered in by and during the Civil War. Iron markets continued to remain strong after the Civil War in response to the rapid urban-industrial growth of the Northeastern United States and the birth of the Steel Age which significantly increased the demand for iron. Continued expansion of the nation's rail network and the replacement of iron trackage with steel rails created huge new markets. These factors sustained favorable conditions for the Adirondack-Champlain iron industry until the early 1880s.

In 1880, when the United States Bureau of the Census officially recognized the region as one of the ten leading iron regions of the country (Pumpelly, 1886), Clinton and Essex counties together produced 724,000 tons of iron ore (slightly over nine per cent of the national total). This represented 30% of the Nation's magnetite production. In 1870 and 1880, New York was the third most productive iron ore producing state, surpassed only by Pennsylvania and Michigan (Moravek, 1976).

Essex County's output of 631,800 tons of iron ore exceeded Clinton County's 92,200 tons, but even Clinton County ranked 13th among iron-ore producing counties in the country. Essex County was only surpassed by Marquette County, Michigan, whose output of 1,346,400 tons represented 16.9% of nation's iron ore. Three of the most productive mines in the United States were located in Essex County in 1880. The Mineville-Witherbee complex, centered in the Town of Moriah, constituted the most significant mining district in the Adirondack-Champlain Region, as its production of 465,740 tons of ore accounted for nearly two-thirds of the total. The Cheever and Lee mines also in the Town of Moriah produced 51,000 tons of ore in 1880, and a new group of mines opened at Hammondville in the west-central portion of the Town of Crown Point in 1872, yielded 112,000 tons of ore in 1880 (Kemp, 1908).

In Clinton County, the Palmer Hill mines continued to produce with an output of 36,670 tons of ore in 1880. The Williamsburgh-Petersburgh (Tremblay) mines near the junction of the north and south branches of the Saranac River produced 8,850 tons of ore. Arnold Hill, long an important mining center, was only active for a small part of the census year, yielding a mere 1,845 tons.

Those sites had been joined by a major new enterprise at Lyon Mountain (Miller, 1926) in the west-central portion of the county. There in the Town of Dannemora, 30 miles west of Lake Champlain, plans for a substantial enterprise were laid in the late 1860s and implemented in the next decade (Linney, 1934). Lyon Mountain emerged as a leading mining center after rail connections were secured in 1879 and the operation became the object of vigorous promotion by the Chateaugay Ore and Iron Company. In 1880, Lyon Mountain yielded nearly 45,000 tons of ore. A more representative picture of the status of the Lyon Mountain enterprise can be seen by examining the production figures for the years following the 1880 census. In 1882, the first full year of operation by the Chateaugay Ore and Iron Company, production soared to more than 240,000 tons. Production for the three years from 1882-84 inclusively averaged 216,500 tons per year. In addition to the above, a number of small pits, scattered throughout the two-county region, were worked, but their aggregate yield was inconsequential in the overall industry (Pumpelly, 1886).

The Peak Period - Smelting

The iron content of the ore approached 70% iron in a few cases in the Mineville-Witherbee area, not far below the 72.4% iron in pure magnetite. It averaged 55% region-wide. In some areas it dropped to as low as 25-30%. Regardless of its iron content, all Adirondack non-titaniferous ores were considered exceptional in the sense that even the leanest could be beneficiated by magnetic separation and concentration processes to 65%-70% iron content.

The zenith of iron-smelting and associated enterprises also occurred in the 1860-1885 period. No fewer than 50 blast furnace and bloomeries operated in 1880. The region's relative position in iron-smelting was far less impressive than it was in mining. Although Clinton County accounted for nearly 85% of the nation's bloomery iron in 1880, the vast bulk of American iron was being made in blast furnaces by that date. By 1890 Clinton was the only county in the country still producing wrought iron by means of the antiquated Catalan forge. The U.S. Census noted that its charcoal blooms and billets were highly esteemed in outside markets for use in the manufacture of plate, sheet iron and fine grades of steel. Clinton County's production of pig iron in 1880 was minimal, but Essex County produced 66,725-ton of iron. While it was important locally, this represented slightly less than one percent of the national total of 7,265,140 tons.

The heart of iron smelting and associated fabricating industries during the 1860-1885 peak period was still found in the Ausable Valley. To the south the primary centers of pig-iron making included the long-established blast furnace operations at Port Henry and two modern, coke-fired works producing Bessemer pig iron near the shores of Lake Champlain

in the Town of Crown Point that opened in the early 1870s. Those blast furnaces were operated by the Crown Point Iron Co. in conjunction with its major mining activities at Hammondville. The established smelting and secondary works north of the Ausable Valley continued unchanged from that of mid-century with a number of new enterprises. The principal new enterprises were established in the Chazy Valley at Altona and vicinity, at Standish (Figure 3) a few miles south of Lyon Mountain, and at Popeville, on the outlet of Lower Chateaugay Lake 12 miles northwest of Lyon Mountain. Popeville's 22-fire bloomery operation, reportedly the largest of its kind in the world, converted the low-phosphorus Chateaugay magnetite from Lyon Mountain into superior quality blooms and billets (Pope, 1968).

Throughout this peak period, significant quantities of regionally produced bloom iron were rolled, slit, and converted into horse-shoe nails at Saranac and Plattsburgh on the Saranac River and at Ausable Chasm, Keeseville, Clintonville, and AuSable Forks on the Ausable River (Moravek, 1976). The region's pig iron was shipped to markets throughout the Northeast.

If we consider all the phases of the iron industry together, including mining, ore processing, charcoal-making, smelting and product fabrication, the industry dominated the region during the peak period. A labor force of 8,000-10,000 was engaged in one or more phases of the iron industry which formed the lifeblood of some 50 villages and hamlets. The enterprise dominated life in whole corridors and subregions as levels of prosperity paralleled the ebb and flow of economic tides in the iron industry. In some townships, up to 85% of the labor force was engaged in iron, and the products of that endeavor constituted nearly 95% of the value of all manufactured goods. At its zenith, the iron industry stood unrivaled as the economic cornerstone of the region. In numerous iron townships, the 1880 levels of population and relative prosperity remain all-time highs to this day (Moravek, 1976).

The Industry in Decline

The momentum gained by the iron industry during the Civil War was sustained into the early 1880's by the brisk markets generated by railroad construction and by great urban-industrial developments of the northeast. It declined rapidly thereafter. Many Adirondack-Champlain ironmongers blamed the collapse of the industry after 1885 on detrimental tariff policies. A nation-wide financial panic in 1893 was a mortal blow to many struggling enterprises. Nationally, the iron and steel industry was undergoing revolutionary change. Sweeping changes made the Adirondack-Champlain region an industrial dinosaur wholly ill-adapted to the new industry. Bigness emerged as the hallmark of the new era. The scale of both

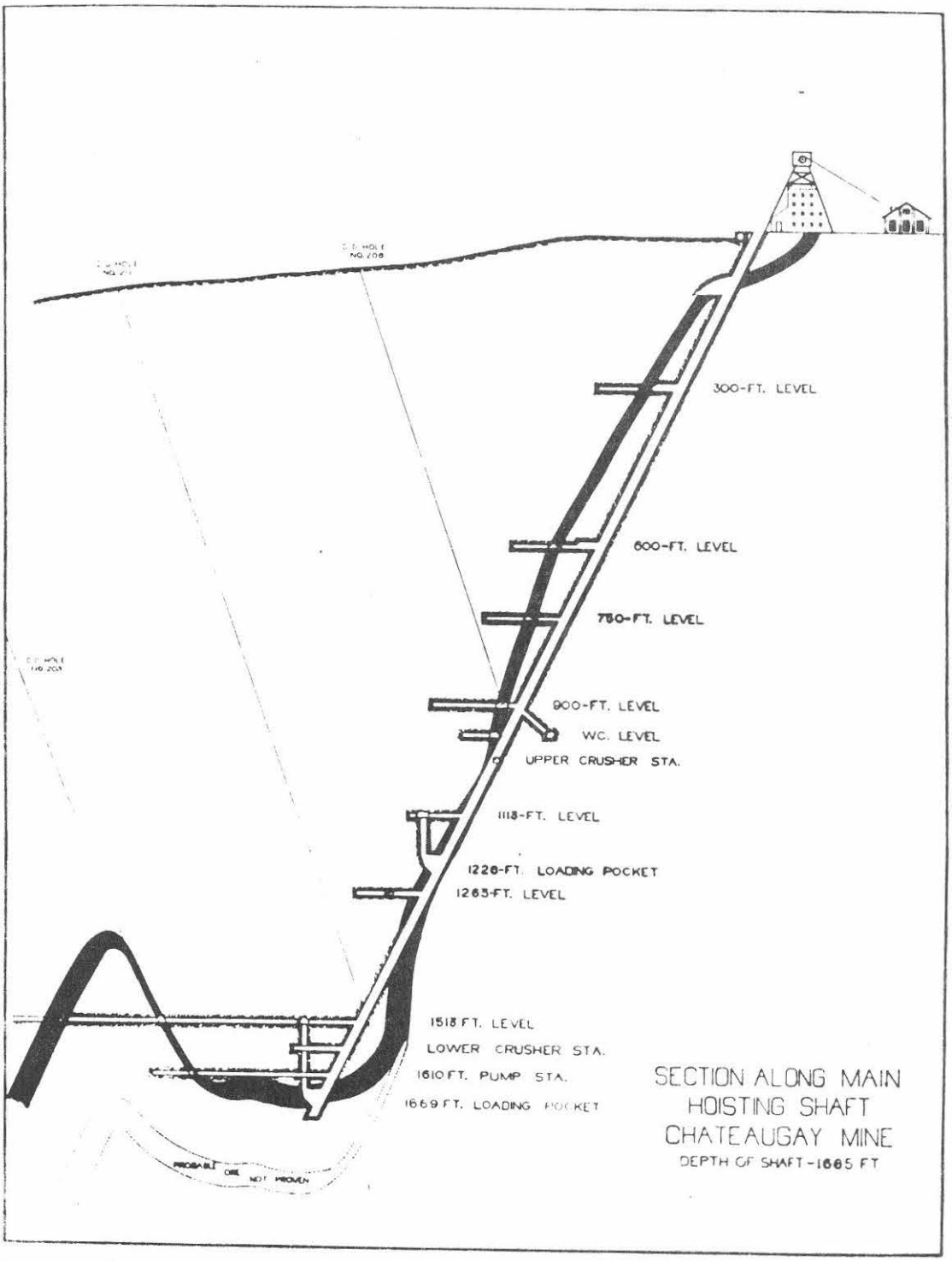

Figure 3. SECTION ALONG MAIN HOISTING SHAFT, CHATEAUGAY MINE (Linney, 1934).

mining and smelting in new iron regions created economies of scale that were unattainable in the Adirondack-Champlain region.

In the mining phase, production shifted to the Lake Superior Region with the opening of the Mesabi, Vermillion, Cuyuna, Gogebic, Marquette and Menominee iron ranges of northeastern Minnesota in the 1890's (Walker, 1979). Immense quantities of rich, untapped ores could be surface-mined, handled in bulk by modern power machinery, and shipped via Great Lakes freighters. Mining and delivery costs per unit were a small fraction of those incurred in the small-scale underground mines of the Adirondack-Champlain region. Moreover, in numerous cases ore deposits once viewed as "inexhaustible" in the Adirondack-Champlain region had in fact become largely depleted.

The westward migration of mining was accompanied by a geographic shift in the smelting phase. The Steel Age was the result of the development of the modern Bessemer process in the mid-19th century (McHugh, 1980). By the late 19th century steel production was highly concentrated in a few districts on the shores of the Great Lakes and in the Upper Ohio Valley. These areas had marked advantages with the Great Lakes providing access to ore, coal for fuel as coke and markets. The smelting process itself had assumed a gigantic scale that resulted in major economies. These revolutionary developments spelled the permanent doom of local, small-scale, geographically dispersed, antiquated iron-making ventures such as those largely characteristic of the Adirondack-Champlain region and gave rise to modern, integrated, heavily capitalized industrial-corporate behemoths as symbolized, by the United States Steel Corporation, formed in Pittsburgh in 1901, as the nation's first billion-dollar corporation.

The Final Years

By 1900, with two exceptions, the smelting phase was nearly over. Blast furnace operations were continued at Standish and Port Henry until the mid-1930's, but only a few bloomeries remained active after the turn of the century. The last bloomery of record in this region and in the United States survived until 1907 at Standish. Twentieth-century mining was restricted to the Mineville-Witherbee-Fisher Hill area in Essex County and Lyon Mountain in Clinton County. The early nineteenth century mining venture at Tahawus was reactivated, after lying abandoned for a century, during World War II to produce ilmenite (TiO^2) for strategic purposes. The titaniferous iron ore associated with ilmenite was a byproduct and during the 1940's over 100,000 tons per year of this byproduct was shipped to blast furnaces. Greater amounts of concentrated iron ore were sold for use in making high-density concrete and for various other purposes (Stephenson, 1945).

Production levels at Mineville and Lyon Mountain fluctuated in accordance with national economic conditions and the relative competitiveness of other mining regions. The impact of the Great Depression was especially severe. The Witherbee-Sherman Co., long the controlling force in the Town of Moriah, made a decision in 1937 to lease its properties and facilities to the Republic Steel Corporation. Republic was the first national firm to operate in the eastern Adirondack region and it was to control the destiny of the eastern Adirondack iron industry during its final three decades of activity. After purchasing the Mineville-Witherbee-Fisher Hill physical plant and ore properties, Republic modernized and expanded the scale of mining, but shut down the blast furnace at Port Henry. Republic shipped sinter and lump ore directly to its sprawling, modern iron and steel works in Cleveland and to Buffalo and Troy. In 1939, Republic followed the same pattern when it leased and, in 1943, purchased the Chateaugay mines at Lyon Mountain and the blast furnace at Standish (Figure 4). This division was administered separately until the 1950's. Port Henry and Chateaugay were subsequently consolidated into the Adirondack Division of Republic Steel Corp.

The advent of World War II confirmed the wisdom and timing of Republic's Adirondack ventures and full-scale operations continued. By the late 1940s the Adirondack share of the national iron ore output had risen to nearly three percent, up from an estimated 0.6% for the decade from 1918-28. Production of concentrates and sintered ore averaged approximately a million and a half tons per year during the 1940's to 1957 in the Port Henry District alone. While levels of activity fluctuated considerable from year to year, they remained quite stable over the long run until the late 1950's. Production fell to a half million tons in 1958 from an all-time high of nearly two million tons in 1953. It rebounded to some 800,000 tons in 1954 but varied greatly from year to year thereafter. Only in 1965 and 1966 did output ever return to one million tons per year. Comparable data for the Chateaugay enterprise are not available, but the level of activity at Lyon Mountain, while typically well below that of the Town of Moriah, paralleled the trends of the latter. The production gyrations of the late 1950s and 1960s were symptomatic of increasingly troubled times and the weakening competitive position of the Adirondack Division within Republic's international iron-ore mining framework. In the face of declining profitability, Republic decided to phase out its Adirondack operations altogether and permanently. The final shutdowns occurred at Lyon Mountain in 1967 and four years later at Mineville. Substantial reserves of ore remain (Postel, 1952) at both sites and some estimate that the reserves exceed the total extracted. However, mining costs are considered prohibitive under current market conditions and there is little likelihood that either mining center will be reactivated in the foreseeable future.

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ROAD LOG FOR THE IRON INDUSTRY OF THE EASTERN ADIRONDACK REGION

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
0	0	Begin the trip at the corner of Broad Street and Draper Avenue, Plattsburgh, NY just west of the Hudson Hall Parking Lot, SUNY-Plattsburgh campus. Head west on Broad Street, which runs into Cornelia Street (Route 3) and continue west.
1.0	1.0	Cross under I-87 on Route 3.
3.1	2.1	Intersection of Route 3 and 22B. Turn right and continue west on Route 3.
8.0	4.9	Intersection of Route 3 and 374. Cross the intersection and turn left to head west on Route 374 toward Dannemora, New York.

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
13.6	5.6	Pass Main Gate of the Clinton Correctional Facility in Dannemora, New York.
25.8	12.2	Enter Lyon Mountain, New York on Route 374.
26.1	0.3	Turn left at Belmont Street when Route 374 turns north. Belmont Street becomes Standish Road.
26.3	0.2	Turn left at Depot Street.
26.6	0.3	Follow Depot Street uphill with Separator Brook on your right to the gate that marks the entrance to the mine property and park.

STOP 1. LYON MOUNTAIN MINES

Lyon Mountain was the site of the Chateaugay ore beds. During its century-long life as a mining center, it produced more ore in aggregate than any other area in the Adirondack-Champlain Region, except for the Mineville-Witherbee complex

of Essex County. The Prall Vein or Mine 81, an open pit situated two and a half miles to the southwest, was the probable source of ore that supplied a bloomery operating on the Chateaugay River to the north as early as 1803, but the Chateaugay deposits at Lyon Mountain were not discovered until 1822-1823. Development lagged for a full half century due to the remoteness of the area.

In 1868, a group of four Saranac Valley speculators purchased the ore beds and devised plans for an extensive enterprise. In 1873, this interest was transferred to the newly organized Chateaugay Iron Ore Company. Substantial quantities of ore were shipped to the large bloomery erected in 1872 at Popeville. The Chateaugay Railroad Company was formed to construct a railroad from Lyon Mountain east to the rail terminus from Plattsburgh at Clinton Prison in Dannemora. This was completed in 1879. The railroad, mining, and smelting interests were consolidated into a powerful new firm, the Chateaugay Ore and Iron Co. in 1881. This creation launched development on a great scale (Figure 3).

Our excursion will walk by the head frames of the later works and a former employee of Republic Steel who is familiar with the structures will describe their purpose at the time that operations were closed in 1967.

In Lyon Mountain, New York century-old residential structures border the mines, together with the 1920s-vintage standard "company" houses that line Route 374 (Belmont Street). Today's inhabitants, descendants primarily of Lithuanian, Polish, Russian, Italian, Spanish, Irish, and French-Canadian immigrants who labored in the mines and mills, are either retired or, if employed, commute to jobs on the outside, or since 1984, have found jobs on Belmont Street itself at the former public school house, now converted to a minimum-security state prison.

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
26.6	0	From Stop 1 follow Depot Street downhill.
26.9	0.3	Turn left at the Standish Road and immediately cross Separator Brook.
30.9	4.0	Turn right on Ross Street in Standish.
31.1	0.2	Park at the end of Ross Street in front of the only house on the left.

STOP 2. SITE OF CATALAN FORGE AT STANDISH

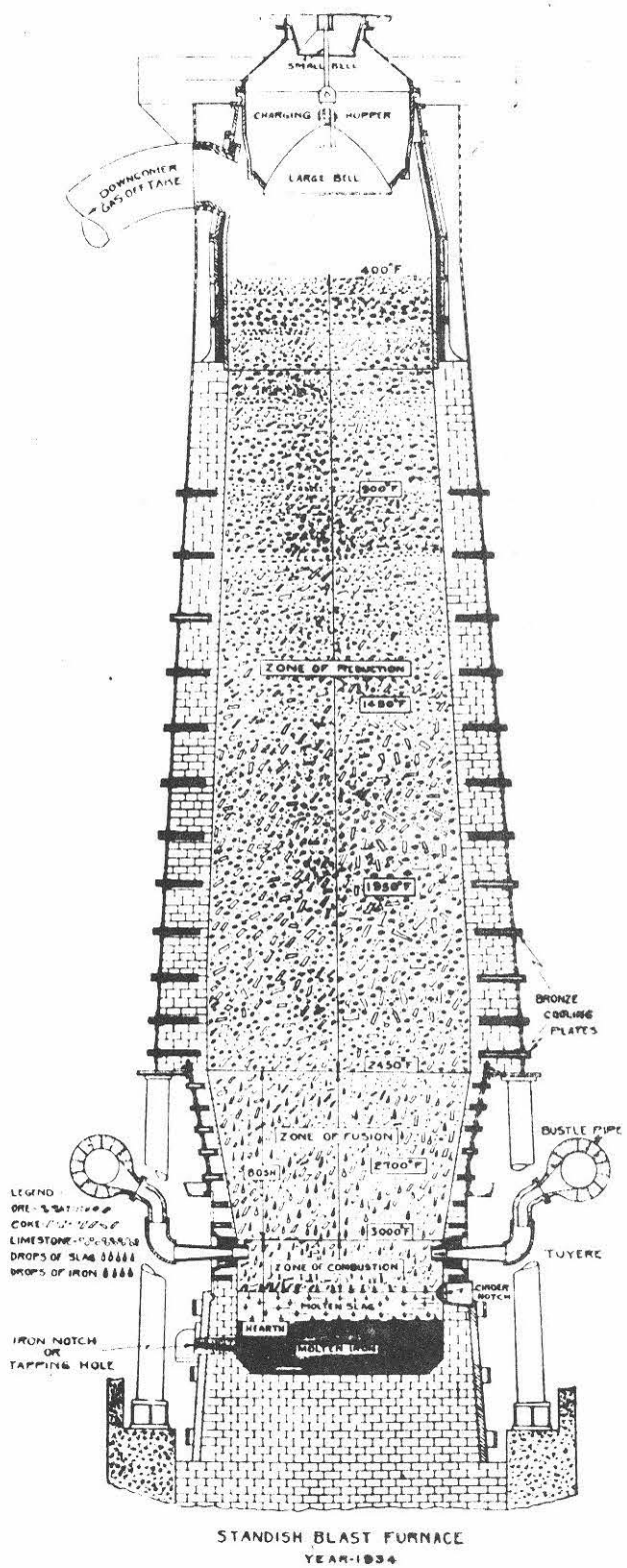
The Chateaugay Ore and Iron Company had an 8-fire bloomery at Standish by 1883. This was enlarged several times until it was shut down in 1907. In 1885 the company constructed a blast furnace (Figure 4) at Standish to produce pig iron in addition to bloom iron (Linney, 1934). The trade name "Chateaugay" quickly gained a highly favorable reputation for excellence. Blooms, pigs, and the celebrated low-phosphorus magnetite were widely sought after, and commanded premium prices everywhere. The crude ore was/is rather lean, averaging only 26%-28% iron content, but was practically free from phosphorus, sulfur, and other chemical impurities, and could be readily beneficiated to 65-70% iron content. Iron and high-grade alloy steels made from Chateaugay ore were renowned for toughness and strength and widely used for the fabrication of wire rope, munitions, ordnance, and other specialties. For such purposes, it was considered unsurpassed in all the world, and steel cables made of Lyon Mountain's ore can be found today in such mighty and notable structures as the Brooklyn bridge, the Golden Gate Bridge in San Francisco, and the George Washington Bridge in New York City.

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
31.1	0	From Stop 2 retrace your route on Ross Street.
31.3	0.2	At the corner of the Standish Road continue east and then south toward Clayburg.
41.6	10.3	Route 3, Clayburg. Turn left.
41.7	0.1	Turn right onto the Silver Lake Road and immediately cross the Saranac River North Branch.
42.0	0.3	Turn left into the NYS Department of Environmental Conservation fishing access parking area and park.

STOP 3. CALDWELL MINE SITE

Ore was discovered at the Caldwell site in 1840 and mining began in 1841. This was the first iron ore discovery in the Saranac River valley and it resulted in the establishment of a settlement named after the original property owner Leander Cadwell. Early newspapers and subsequent histories managed to misspell his name.

Leander Cadwell and Lawrence Myers erected four forges and a separator at the site in 1844. By 1846 this was expanded to



STANDISH BLAST FURNACE
YEAR-1934

Figure 4. Blast Furnace at Standish, NY (Linney, 1934).

six forges, two separators, two trip hammers and a finishing hammer. About 100 men were employed. Myers became the sole owner in 1855 and by 1860 the mine was yielding 1500 tons of iron ore per year. The property changed ownership in 1863 and again in 1873 and the mine was considered "mined out" and closed in 1881.

Historical archaeological research has been conducted by Gordon C. Pollard (Pollard, 1985). The research has produced a map of the eleven-acre site (Figure 5) and has documented the mine, ore processing site, charcoal production and storage, residences and company store. Dr. Pollard will be on hand to guide this portion of the field trip.

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
42.0	0	From Stop 3 turn left out of the fishing access parking area and head south on the Silver Lake Road.
45.7	3.7	Cross the Saranac River.
47.6	1.9	Stop sign at Hawkeye, corner of the Union Falls Road and Silver Lake Road. Turn left and stay on the Silver Lake Road.
55.3	7.7	Cross Black Brook in the hamlet of Black Brook.
58.5	3.2	Turn left on the Palmer Hill Road.
59.1	0.6	Turn left on the Palmer Hill Tower Road.
59.8	0.7	Park at the gate.

STOP 4. PALMER HILL MINE SITE.

Iron ore was discovered at Palmer Hill, in the Town of Black Brook, in 1824-1825 by Zephaniah Palmer. In 1829 he sold a three-eights interest, the eastern extension of ore, to the Peru Steel and Iron Company. Later he sold the western five-eights interest to the J. and J. Rogers Iron Company of Au Sable Forks, NY.

Mining commenced about 1830 and continued to 1892-1893. The Palmer Hill Mines were initially excavated as open pits but as time passed increasing depth rendered impractical the removal of overburden, and drifts were developed as the companies followed bands of ore ranging in thickness from 10 feet to 20 feet. The deepest set of workings bottomed at a

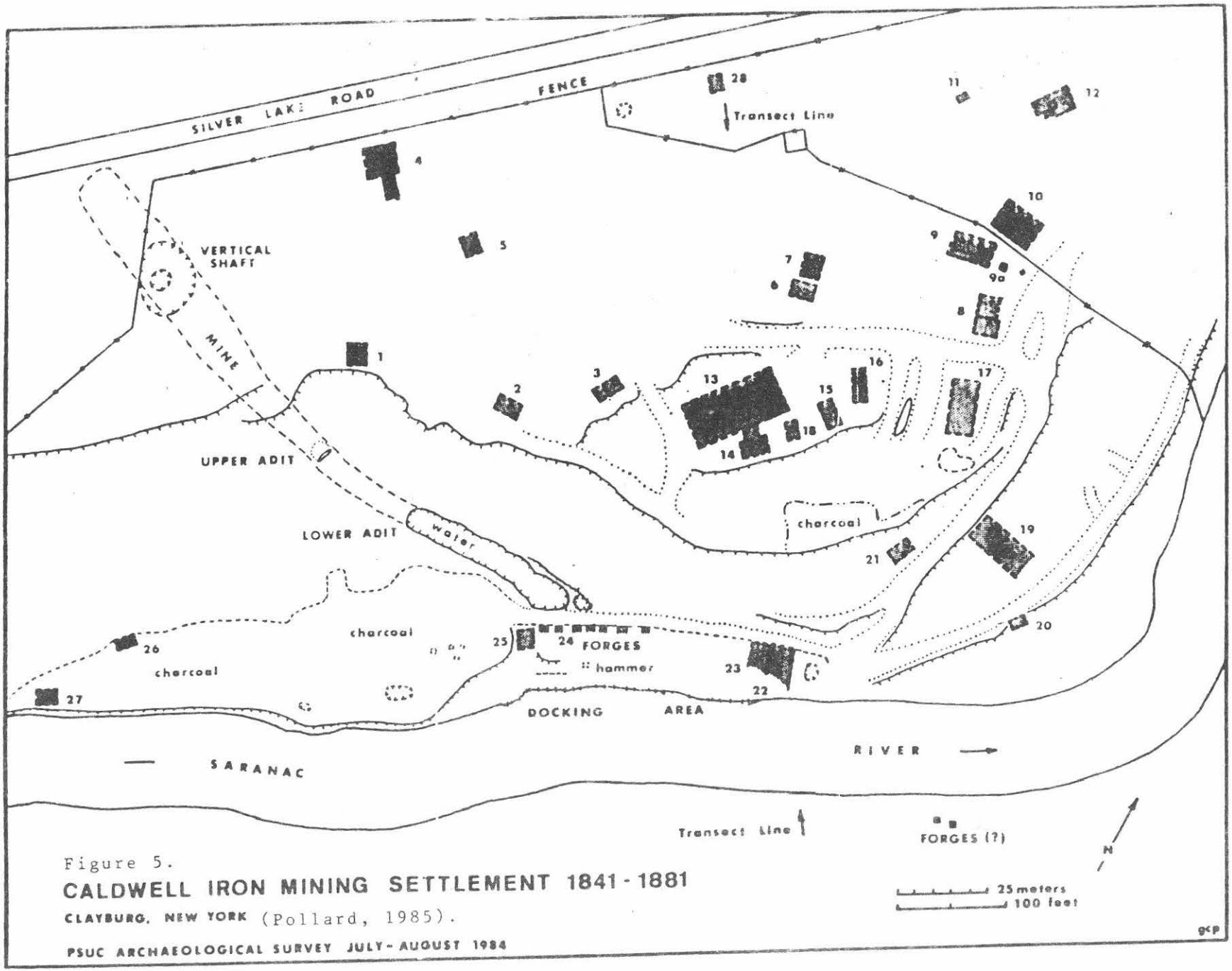


Figure 5.

CALDWELL IRON MINING SETTLEMENT 1841-1881

CLAYBURG, NEW YORK (Pollard, 1985).

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depth of 2,200 feet, down a dip slope that began at 60° and flattened to a nearly horizontal position at the bottom. Other pits extended to a depth of 1,000 to 1,200 feet down dips of roughly 30°. In some cases workings followed shoots of ore across the dip. The texture of Palmer Hill ore was rather fine, and in appearance and mode of occurrence resembled the Chateaugay ores at Lyon Mountain.

Our stop will briefly explore the honeycombed southern brow of Palmer Hill, with its numerous irregular openings and chambers and piles of rock and mine rubble. This site continues to hold a certain fascination, and remains potentially dangerous, to local explorers and students. In places the surface workings have caved in and are inaccessible, but numerous pits do allow access and invite cautious investigation. Deep water fills the lower parts of these "caves," and in some pits ice can be found at any time of the year.

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
59.8	0	From Stop 4 retrace your route down the Palmer Hill Tower Road.
60.5	0.7	Turn left at the Palmer Hill Road.
61.1	0.6	Continue straight at the intersection of the Palmer Hill Road and the Golf Course Road.
65.7	4.6	Turn very sharply to the right at the road to Clintonville.
66.9	1.2	Turn left on Route 9N in Clintonville.

STOP 5. DRIVING TOUR OF CLINTONVILLE.

The Peru Steel and Iron Company was heavily engaged in smelting and iron fabrication in Clintonville, New York and reached its peak prosperity in the 1850s and 1860s when 900 men were employed (Moravek, 1976). The bloomeries, separator and rolling mill occupied more than a mile of the north bank of the Ausable River.

The national decline of the iron industry in 1873 was hard on Clintonville and by 1880 the activities of the Peru Steel and Iron Company at Palmer Hill and at Clintonville were over.

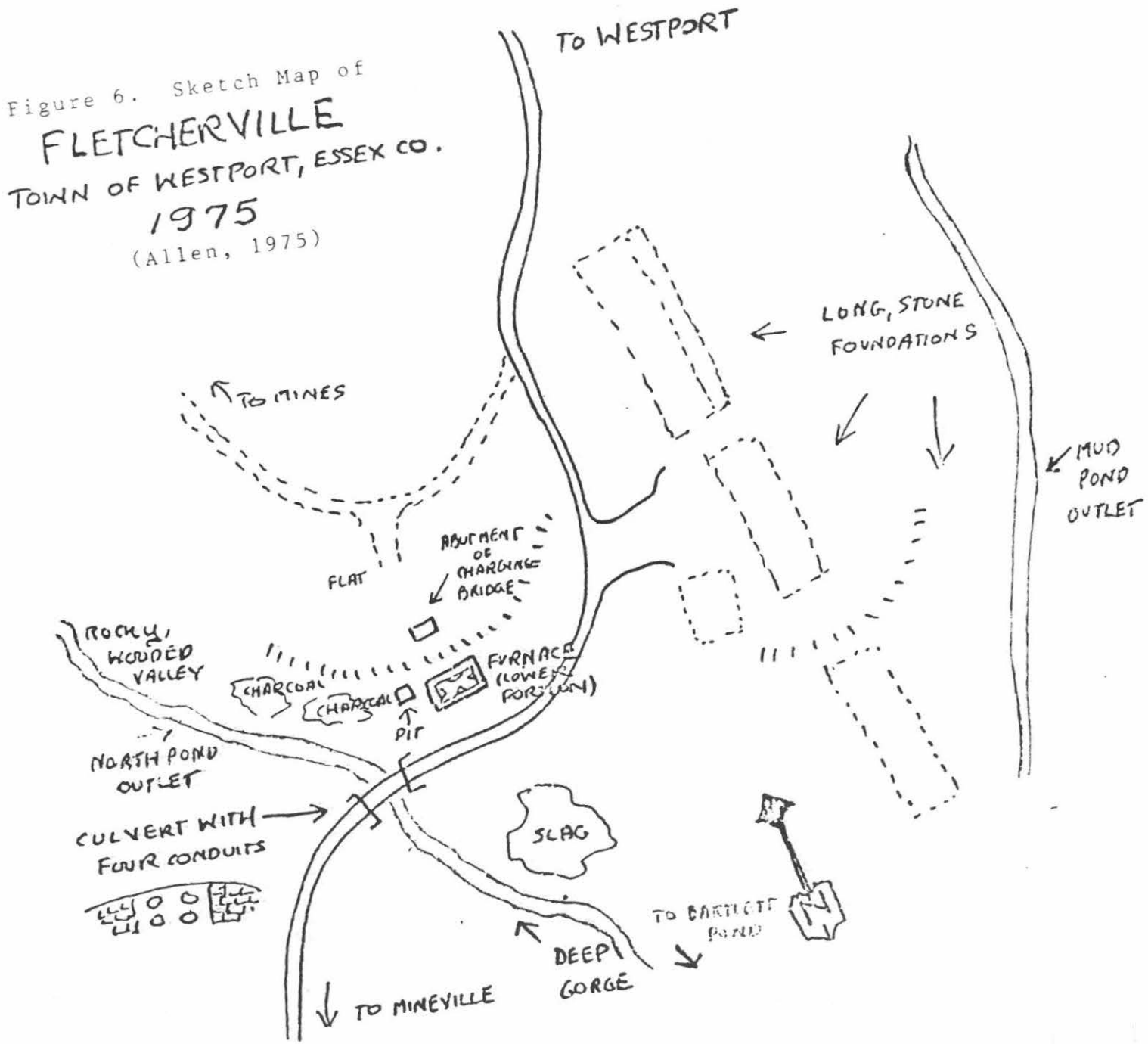
CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
72.4	5.5	At intersection of Route 9N and I-87 (Exit 34) turn right and head south on I-87.
94.1	21.7	Leave I-87 at Exit 31 and turn right on Route 9N to head toward Elizabethtown.
97.6	3.5	As you enter Elizabethtown, at the foot of the hill, turn left on the Lincoln Pond-Moriah Road.
101.1	3.5	Cross I-87 on a bridge.
106.4	5.3	Bear left toward Mineville at the Witherbee-Mineville intersection.
108.3	1.9	Enter Mineville.
108.6	0.3	Turn left on the Bartlett Pond Road.
108.9	0.3	Turn left on the Cook Shaft/Mountain Spring/Nichols Pond Road.
110.2	1.3	Just after the road crosses a culvert over a small stream, flowing from left to right, pull over and park. The old Fletcherville furnace is the overgrown mound on the left side of the road.

STOP 6. FLETCHERVILLE BLAST FURNACE AND SHERMAN MINE.

Friend P. Fletcher joined with Silas H. Witherbee and Jonathon G. Witherbee to manufacture iron in a furnace on Fletcher's 4000 acres of land. Jerome B. Bailey of Plattsburgh, New York built the blast furnace in 1864-1865. It was a stone stack 42 feet high, later increased to 61 feet, on a 42 foot square base. Nearby ten enclosed rectangular brick charcoal kilns were constructed, each capable of charring 65 cords at a time (Allen, 1975).

The town (Figure 6) that sprang up was known locally as Fletcherville, but people in Westport referred to it as Seventy Five because it was thought to be in Lot 75 in the Town of Elizabethtown. A survey showed that it was really in Lot 48 of Westport which then received the taxes.

Figure 6. Sketch Map of



In the early 1870s much of Fletcher's pig iron was shipped from Port Henry to Troy, New York where it was used in the experimental Bessemer steel process for railroad track (Witherbee, 1874). The early success began to fade in the 1870s and after Fletcher's death in 1874 the works closed down.

The Sherman Mine and other small mines on the Fletcher property were occasionally revisited with activity at the Sherman continuing as late as 1921.

Our visit will examine the remains of the blast furnace, charcoal beds, ore roasting kilns, various out buildings and perhaps the Sherman Mine.

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
110.2	0	From Stop 6 retrace your route.
111.5	1.3	Turn right at the Bartlett Pond Road.
111.8	0.3	Turn left at the Lincoln Pond Road and enter Mineville.
112.2	0.4	Turn right at the Rexall Drugstore onto the road to Witherbee.
113.3	1.1	Intersection of Powerhouse Road and Dalton Hill Road.

STOP 7. DRIVING TOUR OF WITHERBEE

The mines of the Mineville-Witherbee-Fisher Hill area in the Town of Moriah have been the most productive iron ore producers in the eastern Adirondacks. Our drive will circle through the sites of the "Old Bed," "21," "Barton Hill," "Harmony," and "Joker" mines of the extensive Mineville Group (Kemp, 1908). These mines were greatly expanded in the 1860s by the Port Henry Iron Ore Company after their initial discovery about 1825 (Warner and Hall, 1931). A variety of interests including the Witherbee, Sherman and Company operated in the area until Republic Steel Corporation took control from 1937 to 1971. Be sure to note the concrete block buildings that incorporate tailings material (Lincoln, 1909).

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
113.3	0	After tour of Witherbee turn right off the Powerhouse Road from Mineville onto the Dalton Hill Road and immediately turn left onto the Tracy Road. The Tracy Road is marked with signs for I-87 and North Hudson.
120.9	7.6	Turn right onto Route 9 and immediately turn right onto I-87 northbound at Exit 30.
169.2	48.3	Leave I-87 at Exit 37 and follow the off ramp to Route 3.
170.2	1.0	Turn right onto Route 3.
171.6	1.4	Bear right at the Y intersection of Route 3/Cornelia Street and Broad Street onto Broad Street.
172.0	0.4	Trip ends at Broad Street and Draper Avenue where it began.