# Part I: Historical Perspective of the Quincy Smelting Works

## *A. Introduction& location*

The QSW is located less than a quarter of a mile east of the Houghton–Hancock lift bridge on Rt. M-26 on the north side of Portage Lake in the historic location of Ripley (NW quarter of NE quarter of Sec. 36–T55N–R34W). It was one of five copper smelters that operated on the Keweenaw peninsula during the late nineteenth and early twentieth centuries (see map 1). Although the QSW was constructed in the midst of the district's greatest boom and prosperity, this is not obvious today considering how singular the site appears along the drastically altered shoreline of the Portage. However, it stands in complete contrast to the other smelter sites whose above ground remains consist of little more than foundations and rubble. The Quincy smelter was one of the last constructed in the district and was the last to shut down in 1971. Its overall historic integrity provides a unique opportunity to examine the local smelting process known historically as "Great Lakes smelting practice." The smelter is within the boundaries of the Keweenaw National Historic Park which commissioned this report to assist Franklin Township with efforts to stabilize historic resources and begin redevelopment alternatives focused on public access and National Park Service (NPS) interpretation. This section provides a brief historical account focused on technological change that affected the site's development and how the land was used over time to support the smelting operation. It also provides a brief explanation of the smelter's historic regional setting within the Keweenaw copper mining district.

## *B. The Quincy Mining Company's turn of the century boom & expansion*

The QMC experienced a period of massive growth and change between 1887 and 1905. By 1905, the company hoisted twelve times as much ore from five shafts than from its two shafts in 1887. Both its copper output and labor force quadrupled, from 450 in 1887 to over 1,700 workers by 1905.[1] In 1890, a new stamp mill was constructed on Torch Lake to replace the original one located in Hancock on the Portage, and the Quincy and Torch Lake railroad was simultaneously built to connect the mines and new mill. A second stamp mill was added at this location in 1899. Quincy also expanded its land holdings significantly with the purchase of the Pewabic Mining Company in 1891 and later the Franklin Mining Company in 1908.

These are but the larger of dozens of projects amounting to millions of dollars invested by the company to modernize and expand its operations. The construction of the smelter in 1898 was one of these, amounting to but $146,617 or less than ten percent of the $1.7 million spent on capital development between 1898–1902.[2]

The growth at Quincy was not unique to the company however, as it was actually the status quo for the entire district. Quincy was most notably paralleled by its rival to the north, the Calumet & Hecla Mining Company (C&H), that underwent similar territorial and technological expansion at the same scale as Quincy. The district's population also exploded during this time as a result of the mining boom and the communities of Hancock, Calumet, and Houghton thrived with the construction of stately theatres, halls, banks, and churches. Houghton county's population at the turn of century was one of extensive ethnic diversity, with 28,150 of its 66,023 residents being foreign born (approx. 45%) comprised of at least fifteen ethnic groups.[3] Several railroads connected the previously remote Upper Peninsula with the rest of the country through Detroit and Chicago, offering daily passenger and freight service by the turn of the century. A local traction rail line ran street cars from Houghton and Hancock through Quincy's housing areas and beyond Calumet affording ample mobility even during the district's deep winter snowfalls. With the erection of new mills and smelters during this period also came the growth of smaller worker communities along the north shore of the Portage, such as Mason, Dollar Bay, and Ripley, near the Quincy smelter.

### *C. The Keweenaw mining district's historic copper smelting in context*

The was an obvious interest in establishing local smelting operations since the beginning of mining in the district due to the substantial shipping charges required to send ore to east coast smelters. Having a capable local smelter would reduce this expense considerably. Local smelting operations were unsuccessful until the establishment of the Portage Lake Smelting Works in 1860, which began to handle a large part of ores from the Houghton county mines. By 1866, however, over half of the district's ore was smelted locally but the rest was still sent out of the area.[4] As the 1880s mining boom began, the need for local smelting was brought to the forefront especially for the larger mines, such as C&H and Quincy. The QMC had sent all of their mineral via ship to the Detroit smelter of the Waterbury and Detroit

Copper Company between 1856–1872. When this company constructed a local smelter in Hancock in 1860, the Quincy shipments were split between the two smelters.[5]

This arrangement plagued Quincy's management who sought total control over the quality of their product and they seriously considered constructing their own smelter as early as 1884. The closing of the Detroit plant of the Detroit and Lake Superior Smelting Company in 1887 left Quincy to turn to other firms and by this time C&H erected its own smelter on Torch Lake in Hubbell in 1887, and the Tamarack and Osceola Mining Companies opened a joint smelter at Dollar Bay in 1889. Soon after in 1890, this smelter merged with the Hancock smelter to form the Lake Superior Smelting Company which then handled the Quincy ore locally (see map 1). The acquisition of the Pewabic mines by Quincy in the same year brought the issue of handling increased production and taking overall control of its operations to the forefront again, and in 1892 Quincy contracted with James R. Cooper to erect a smelter. This contract with Cooper was terminated before it got off the ground however, due to a five–year contract with the Lake Superior Smelting Company that Quincy was able to negotiate favorably beginning in 1893.[6]

The five–year contract gave Quincy time to concentrate on developing its new mines and to lay plans for its own smelter to begin operations in 1898 after the contract expired. In 1897, Quincy signed a new contract with Cooper to construct a smelter for less than $10,000 and to operate it for five years beginning in 1898. However, the company continued to seek other options, including purchasing an existing smelter and continuing to negotiate smelting contracts with outside firms.[7] As economic historian Charles Hyde points out, after the smelter was constructed at a cost of $147, 617, smelting costs dropped from $15.30 per ton to $10.06 per ton between 1887–1901 amounting to a $50,000 savings in that time, or about 30% of the smelter's construction cost, just within its first two years of operation.[8] This shows that economically speaking Quincy was finally successful in lowering its smelting cost and therefore its overall production cost. In fact, in 1905 the QSW was noted for achieving the lowest smelting cost in the district of just $5.25 per ton.[9]

Given the boom experienced at the turn of the century in the Keweenaw, the QMC was late in taking control of its own smelting operation. By 1898 three local smelters had already

been operating for at least a decade, including that of Quincy's largest rival C&H, and the huge Michigan Smelter was added to this in 1904, soon after construction of the QSW. The impetus for constructing the smelter was largely economic, but given the Quincy management's penchant for meticulous control over its operations taken with the predictability of financial savings, it is surprising that the company did not act sooner to construct its own smelter.

### *D. Phase 1: Establishment of the Quincy Smelting Works, 1898*

#### *1. Choosing the site location*

Nearly every mine in the district operated its own stamp mill, but few were productive enough to justify the expense of constructing its own smelter. The few smelters that were built were clustered near the locations of the largest mines, such as the C&H smelter in Hubbell, which was also situated near its stamp mill in Lake Linden. These smelters were located on the waterfront, not so much because of their need for water in the smelting operation such as in the case of stamp mills, but because of their dependence on shipping. Massive quantities of coal brought in by ship were necessary to run the smelters, and massive amounts of finished copper needed to be shipped out after smelting.

Several sites were considered by Quincy for the location of its smelter, including property on Torch Lake near its stamp mills for the additional savings in transportation costs. However, Quincy did not own enough land there, and Cooper was opposed to the idea based on a clause in his contract that guaranteed a location on Portage Lake, not on Torch Lake. His fear was that although haulage distance would be saved, the additional shipping charges for operating on Torch Lake would be more expensive than transporting the mineral between the stamp mill and the smelter by rail.[10] He was more interested in locating the smelter on Quincy's new parcel of land on the Portage.

Quincy officially acquired the Pewabic Mining Company mines and lands in 1891 after a six year period of intense litigation. This followed an 1884 stockholder referendum posed by Quincy's president Thomas F. Mason that forced Pewabic to sell its property. Mason then bought it for $710,000 and sold it to the QMC for $1,000,000.[11] A parcel of waterfront land along the north shore of the Portage was included in the purchase where Pewabic had set up

its stamp mill in the early 1860s (see map 2). The Pewabic stamp mill was connected to its mines on Quincy hill by a gravity tramway and was located adjacent to shoreline property of the Franklin Mining Company. The Franklin had a similar arrangement as the Pewabic, with a stamp mill and gravity tramway up to its mines on Quincy hill that were north of the Pewabic's (see map 3 for an overview of this early shoreline arrangement, and map 4 for a plan of the stamp mill location relative to the Portage). Both of these stamp mills deposited their stamp sand (waste tailings) into the Portage, thereby extending the shoreline there (see map 5). Because of the proximity of the two mills, their stamp sand deposits had run together and merged by 1886 (see map 6, area labeled as Pewabic and Franklin Dump). The Franklin stamp mill burned down in 1898 and a new one was immediately constructed in 1899 in a new location at Dollar Bay (see map 7 and photo 1 of the original Franklin stamp mill)[12]. When Quincy was ready to construct its smelter in 1898, the Franklin mill on the Portage was no longer operating and it owned the adjacent Pewabic land, therefore the tailings deposit along the shoreline was complete. It was there that Quincy settled on constructing its smelter in agreement with Cooper's contract.

### *2. Initial construction & the basic smelting process: structures, layout & technologies of the works*

Construction began in 1898 with the dredging of the shoreline and the insertion of pilings for the loading dock. Foundations were laid for the two main buildings of the works, the cupola furnace building and the reverberatory furnace building, and these sandstone structures were completed later that year. As soon as the reverberatory furnace building was competed, work began on the construction of three furnaces and their 75 ft. smoke stacks. The dockside warehouse, cooper shop, cooper stock building, coal shed, charcoal house, sand house, assay office, coal dock, oil house, scale house, and a barn were all completed by the end of 1898. (see Appendix D, HAER maps for reference). The blacksmith shop and engine room were included with the cupola furnace building. The main office building, ice house and iron house were completed in 1899.[13] Shortly thereafter in 1902, the long railroad warehouse was added for the temporary storage of incoming mineral to allow some of the moisture to dry out of it before charging it into the furnaces. All of these structures were constructed west of the property line with Franklin Mining Company, as shown on the 1898 historic map "Quincy

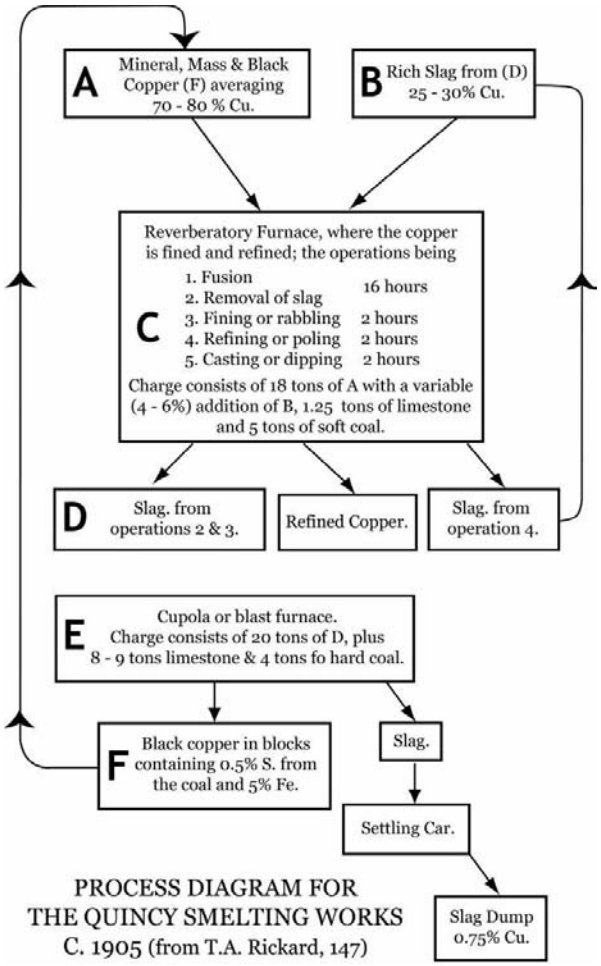
Smelting Works" (QD 1076). This initial set up of the smelter composed the technological process described below, which was the contemporary process employed for Lake Superior ores at the other smelters in the area.

Smelting was an essential final step in a mining company's operations, for after the copper ore was mined, brought to the surface and crushed at a stamp mill, the red metal had to be separated from its rock matrix. Smelting is the process that consisted of melting the ore in large furnaces to separate the metal from the rock. In the furnace, the rock silica (slag) rose to the top of the melt while the molten metal remained at the bottom. The molten copper was tapped off and poured into shapes called wedges, cakes, anodes, and ingots that were then sold as the mining company's final product. The purchasers used the copper as a raw material to manufacture their products, such as conductive wire and ammunition casings.

One of the greatest advantages of the Keweenaw copper district was the relatively simple character of its ores that made the smelting process straightforward and rather uncomplicated. For example, ore treated at the QSW arrived from the stamp mill divided into three grades, the highest containing 70–95% copper and the lowest containing less than 40%. The high grade mineral was primarily either mass copper or "barrel work," that is large , pure pieces that was transported in barrels. The low grade was a fine sand with the consistency of granulated sugar.[14] This was unusually pure ore, some of which was bound together with small amounts of silver. Smelting it was a matter of melting it in reverberatory furnaces and separating it from the slag. The three original furnaces at the QSW treated 36,000 pounds of mineral per month, of which 26,000 pounds was the copper yield. Each melt lasted about sixteen hours, with an additional two hours for poling. At first, furnaces were charged by hand. After the charged melted, it was "rabbled," a manual operation where 16 ft. long paddles were used to splash the copper around in order to introduce oxygen to oxidize impurities. After about two hours of rabbling, the top layer of slag impurities was skimmed off. Then poles of wood, usually poplar, 16–20 ft. long were introduced into the melt for two hours to bond its carbon with the oxides produced in rabbling. At this point the melt was ready to be ladled or dipped. It took about two hours to manually dip the charge from the furnace. Either two men worked together with a two–handed ladle suspended by a chain that

help 90 pounds of copper at once, or it was dipped with hand ladles that held 30 pounds of copper at once.[15]

The slag from this process still contained about 20% copper, so it was reprocessed in a cupola (vertical blast type) furnace. The cupola furnace burned hotter by utilizing a blast of air into the charge while it was melting. Limestone, iron ore dust, and coal dust were added also added to the charge to aid in flowing the copper together to avoid the formation of air bubbles or globules. When the charge was done, it was hand dipped into moulds, and the slag which contained less than one percent copper, was discarded on the slag pile. A typical charge for the cupola furnace at the QSW consisted of twenty tons of slag, forty percent lime, and twenty–two percent coal.[16] The process diagram below shows this early smelting operation at the QSW.



PROCESS DIAGRAM FOR
THE QUINCY SMELTING WORKS
C. 1905 (from T.A. Rickard, 147)

## *E. Phase 2: Early technological & structural change at the Quincy Smelting Works, 1904-1918*

### *1. Expanding production capacity: the Number 5 furnace*

A controversy between Quincy's management and the smelter superintendent Cooper over the method for treating low grade mineral began in 1902 with discrepancies in the incoming and outgoing mineral assays. The management insisted that the low grade be smelted by itself instead of mixing it in with the higher grades. Cooper found it virtually impossible to properly smelt such finely ground mineral efficiently in the reverberatory furnaces and fought the idea, suggesting instead that a separate furnace was necessary to carry this out.[17] In 1904 the high capacity No. 5 furnace was built to specifically handle the low grade mineral, and to provide increased production capacity for contract work. A separate building adjacent to and east of the reverberatory furnace building was constructed to house the No. 5.

### *2. Other changes and additional smelting technology: the briquetting plant*

Other important changes were implemented in 1904 in the method of material handling at the smelter. First, the large sandstone mineral building was constructed with its 460 ft. elevated main line rail trestle to bring mineral shipments to the upper floor of the building where it was dumped into holding bins below. The dried mineral (the building was heated for this purpose) from these bins was loaded into tram cars through chutes to be brought to the furnaces. This building effectively replaced the use of barrels for mineral transport, and superceded the 1902 railroad warehouse. To make room for the mineral building, the cooper shop was moved southward from its original location.[18] Further changes were made by the addition of both an overhead and ground trolley (tram) system that facilitated handling ore between the mineral building and the furnaces, charging the furnaces, removing slag, and dipping the charges. Individual hand dipping was replaced by a trolley system of two–handed ladles that handled 90 pounds of copper at a time. Hand rabbling was also replaced by air blast rabbling, where tubes were introduced into the melt at the appropriate time and compressed air was forced through them.

In 1905 the elevated tram trestle from the third floor of the cupola furnace building over the main line tracks to a newly established slag pile was constructed as part of the material handling improvements. A boiler house and new vertical boiler was added to the west side of

the blacksmith shop and engine room in 1905, and a pump room was added to the east side of the engine room in 1906. The steam driven pumps were probably brought from Quincy's original pump house located west of the Portage Lake bridge and were used to pump water from the lake up to Quincy's mines and housing locations. It is most likely that the new boiler was installed to provide the additional steam to operate these pumps. A machine shop was constructed on the west side of the works in 1907.

Low grade slag from the No. 5 furnace had to be retreated in the cupola furnace for maximum efficiency. This process was time consuming and therefore expensive, and did not work out well as hoped. An alternative method for treating low grade mineral was discussed before the No. 5 furnace was built, and was implemented in 1906 after the No. 5 was being used primarily for volume and not entirely for low grade smelting. The briquetting building housed specialized machinery that pressed the finely ground low grade mineral and limestone into hard briquettes that could be treated directly in the cupola furnace. This process was used intermittently over the upcoming years mostly as a supplement to periods of high volume production, but was not an essential part of the process as the Quincy ores and smelting methods changed over time.

### *F. Phase 3: Major technological & structural change at the Quincy Smelting Works, 1919-1921*

#### *1. Tram electrification & materials handling efficiency*

The smelter operated until the next period of major modernization in 1919 without major changes to the layout. Quincy purchased the Franklin Mining Company in 1908, which opened the parcel of land and shoreline east of the smelter for development.[19] This was the area of stamp sands from the Franklin stamp mill that burned down in 1898. Plans for modernization of the smelter were proposed as early as 1914, but were not put into motion until 1919.[20] An extensive electrified tramway was constructed to further simplify and streamline materials handling as the company pushed to take more control over their operations through automated technology, having survived the tumultuous strike period of 1914. This tram system extended into the newly acquired Franklin property east of the works. A reverberatory slag trestle was constructed along the shoreline east of the dockside warehouse, but it is uncertain how this functioned. The Franklin land was primarily used as a

slag dump for reverberatory slag, however, while the north side slag pile probably only took on cupola slag since its beginnings in 1905. There was an attempt to reprocess reverberatory slag beginning in 1920 which would explain the need for separating the slag piles. A small crushing plant was added on to the west side of the briquetting building at this time specifically to crush this slag.

### *2. The casting shed & the Walker Automatic Casting Machine*

The steel frame casting shed was added adjacent to the No. 5 furnace building to house a major piece of automated technology called the Walker Automatic Casting Machine that allowed for virtual elimination of hand dipping of large copper shapes (see photo 12). One operator controlled the movement of prepared sand casting molds under a spout that poured the molten copper directly from the newly constructed No. 5 furnace. The mold was then moved automatically around to the rear of the machine where it dumped into a water filled pit for cooling. A large electric belt conveyor brought the shape out of the pit and it was loaded onto a flat car via a jib crane to be transported to the dockside warehouse. In order to construct the new casting shed, several buildings were moved to the west side of the works: the carpenter shop, the cooper stock building which probably became the material storage shed, and the mold shed.

### *3. Addition of power plant & steam boilers*

The addition of the casting machine, several overhead traveling cranes, and electrification of the tram system called for increased power requirements at the smelter. In 1920, a 250 kilowatt steam driven generator was added in the engine room, and an additional boiler was added adjacent to and south of the 1905 Cook boiler room. This Badenhausen boiler most likely powered the additional steam engine that drove the generator. A 300 horsepower waste heat boiler smoke stack and by–pass stack was added to the No. 3 furnace in 1920 and steam generated from this was used to drive the water pumps at the smelter.

## *G. Phase 4: Post war decline& mine closing, 1922-1931*

Production at Quincy peaked between 1909–1911, although it paid its largest dividends during the First World War years of 1916–17 when copper prices soared. At this time the company invested heavily in the purchase of new lands and the improvement of technologies

across the board. It did not foresee the drastic fall of the copper market that ensued in 1921. Copper prices averaged almost 29 cents in 1917, but dropped to 13.5 cents in 1921. For almost every year forward, the company's expenses exceeded profits. The losses mounted heavily after 1926 as copper prices continued to fall drastically from 18 cents in 1929 to just 8 cents per pound in 1931. Quincy was forced to close its mining and smelting operations in 1931.[21] The management was able to hold the company together until 1937 when copper prices rose enough for it to start up mining operations again on a small, tentative scale.

### *H. Phase 5: Smelter reopening & reclamation period, 1945-1971*

#### *1. Changes in production capacity: refining & remelting*

The coming of World War II brought governmental control to the copper market and Quincy was able to win government contracts that steadily increased to pay 20 cents a pound by the end of the war. Following the war, Quincy constructed a reclamation plant to work the copper rich tailings dumped into Torch Lake by its stamp mills since 1890. This operation brought Quincy back into profitability for another twenty–five years with continuous operation between 1943–1967. The smelter also reopened in 1931 and operated until the end of reclamation in 1967. There is little documentation of smelting operations during this time, including accounts in Quincy's annual reports, but the site itself suggests that few if any landscape changes were made in the way of additions. The smelting operation was not nearly as large as it had been, and it is likely that only the No. 3 furnace connected to the casting machine was used. In twenty–five years of reclamation, the company produced 50,000 tons of copper, which is impressive when compared to the 424,000 tons produced up until 1945.[22] Today the furnace is intact and equipped with four natural gas blowers to fire it rather than the original coal firing. This change was made in 1968 to handle the remelting of scrap copper after the reclamation plant closed in 1967.[23] The QMC annual report of 1968 notes that a building from its reclamation plant was moved to the smelter to provide additional storage space for scrap copper, but there is no evidence of this building or its location today. In 1971, the state of Michigan required the QMC to install pollution control devices if it was to continue its scrap melting. The company decided that it would not be financially justifiable to do so, considering that the remelting operation operated at a consistent loss since 1967, and the smelter was shut down.[24]

## *I. Phase 6: Final closing of the Quincy Smelting Works & establishment of the Quincy Mine Hoist Association, 1971–present*

### *1. Status of the smelter after closing*

The closing of the smelter in 1971 proved to be its last days of operation. The Quincy Mine Hoist Association is a non-profit organization established with the help of the QMC in 1971 primarily to safeguard and interpret the No. 2 shaft house and its massive steam hoist along with the property in their vicinity on Quincy hill. The smelter site was not included in this provision, and remained with Quincy's holdings until the dissolution of the company in 1980. The property was then transferred to the Quincy Development Corporation (QDC) in 1986, an independent company organized specifically to manage the sale of Quincy's mining lands.[25] Although the majority of its historic buildings remain at the site, many technological artifacts contained within the buildings have been scrapped or sold, but it is uncertain when this activity occurred. Five buildings at the smelter have been used since its closing, but exactly on what arrangement is uncertain. The carpenter shop is still equipped with modern hand tools and some power tools, and there is a calendar on the wall dated 1986. The machine shop is occupied by the QDC for storage of materials and vehicle for property maintenance. It is shut up and locked, and the building is electrified and is in good repair both inside and out. The QDC used the smelter's office building as its office and the dockside warehouse for storage, but in 1999 their items were removed and the office closed. The Finally, the reverberatory furnace building has been used by the Franklin Township for the storage of tractors, trailers, and other miscellaneous hardware.

### *2. Transfer of ownership to Franklin Township, 1999*

The QSW remained the property of the QDC until 1999 when it was transferred to Franklin Township for $1.00 after the State of Michigan and Franklin Township agreed to forgive unpaid property taxes owed.[26]