5.1 The excavation of the blast furnace in July 1949. Notice the prominent retaining wall for Central Street at the left of the photograph. The waterwheel and wheel pit were found below the retaining wall. (Photograph 99 by Richard Merrill, 1949.)

Excavating the Blast Furnace

William A. Griswold

In 1948, Roland Robbins began his notable excavations on an area of land between what was then Central Street and the Saugus River, just south of Bridge Street. Much of the area was completely overgrown with thick vegetation and several old and very large trees. Robbins' excavations proved fruitful almost immediately. He and a small crew of workmen quickly began uncovering the remains of the blast furnace, arguably the most important feature of the Saugus ironworks. Unlike many of the remains uncovered during the project, several elements of the blast furnace were buried by only a small amount of earth and were in relatively well-preserved and complete condition. In these early days of the project, it seemed as though each and every day held a new discovery surrounding the blast furnace and its operation. These discoveries excited not only Robbins, but also surpassed the hopes and expectations of the members of the First Iron Works Association (FIWA), who were determined to reconstruct and memorialize the first successful ironworks operation in America.

At 2'6" a bed of baked clay (now red) with sandstone and some small pieces of charcoal was found. The red clay vein averaged about 6"–9" in thickness. Beneath this clay bed, on the Saugus River side, medium size stones were found. Beneath the clay bed, on the side nearer the Central St. retaining wall, a very fine, pure, white sand was found. I pushed my prod rod down through this sand until it had reached a depth of 5'6" from surface and found no evidence of a foundation. Then I began trenching towards the Saugus River, following the stone base beneath the clay bed. By the end of day I had followed this stone base about 10' from where my digging began. Sod with charcoal in it found under stone 2'10" deep at line where stones and sand met.

Roland Robbins, "Saugus Ironworks Daily Log - 1948," September 14, 1948.

The Furnace Stack

It appeared from Robbins' initial excavations that the majority of the substructure, or below-ground portion, of the blast furnace remained in situ and had not been disturbed. Deposits of baked clay and charcoal were uncovered, as were stones that Robbins would later identify as part of the superstructure, or above-ground portion, of the furnace.[1] While much of the furnace's substructure had been preserved, most of the superstructure was completely gone, having been dismantled intentionally or lost as a result of collapse and decay. Several in-ground features associated with the furnace had also survived nearly intact, including the crucible cavity, casting beds, bellows base, waterwheel, and wheel pit; evidence for other features, like the furnace bridge supports and casting shed uprights, was less intact but also identified by Robbins.

Robbins' excavations revealed that the base of the furnace was approximately 26 feet square, plus or minus a few inches, with two triangular-shaped openings typical of a seventeenth-century blast furnace.[2] He mentions in his log that the base may have been laid out using a link measuring system.[3] The northern opening partially covered the large bellows that injected the blasts of air needed to heat the fire enough to liquefy the iron. This bellows was powered by water that fell from a race and turned a large overshot waterwheel, which Robbins later located just northwest of the furnace.

The eastern aperture opened onto the main work area, which would have been covered to protect the workmen and their casting operation. Once a sufficient amount of liquid iron had been obtained in the crucible at the base of the furnace, the furnace was tapped via a small opening and the resulting flow of liquid iron was channeled into molds of various shapes and sizes in sand casting beds. The members of the Reconstruction Committee debated certain questions. Did the furnace have a forehearth? Was the crucible cavity above or below the level of the casting area?

Robbins identified several drainage features under and around the furnace. These important drain systems were designed to keep the furnace dry during operation. The critical need for an effective drainage system at ironworks was noted in the Winthrop Papers by Sir Charles Coote, who advised: "Chiefly take care so to place your furnace that there be no water springs or damps under her for it will spoil all which if your ground will not admit, you must make a false bottom with several pipes to carry away the damps and water or springs."[4] Water seepage from both natural groundwater and the water in the raceway and wheelpit was extraordinarily dangerous to those casting iron; the consequences were explosive and catastrophic. As Hartley notes from a passage in ***The Natural History of Stafford-shire:*** "Tis also of importance in melting of Iron Ore, that there be five or six soughs made under the Furnace … to drain away the moisture from the furnace, for should the least drop of water come into the Metall, it would blow up the furnace, and the Metall would fly about the Workmens ears."[5]

Midway along west foundation we dug to a 7' depth on foundation and found the possibility of a canal running from west side of crucible cavity. In the presence of Sanger and son and Blackie, I took two pails of water, colored with bluing and emptied them in the new hole on the west side of the blast furnace foundation. In several moments the color appeared flowing into the bottom of the crucible pit from the base of west wall. It is quite evident that we have located a channel running beneath the furnace . . . .

Roland Robbins, "Saugus Ironworks Daily Log - 1949," April 10, 1949.

Robbins notes the presence of a stone-lined chamber directly below the stone floor of the crucible pit which served to channel water away from the inner workings of the furnace. A western drainage channel, discovered in April 1949, led out of the western exterior wall of the furnace and into the tailrace.[6] This western drainage channel seemed linked to a northern channel that went beneath the crucible pit to the bellows area.[7] Furnace drains have been found at several English furnaces including Batsford II, Chingley, Maynards Gate, Pippingford, and Pippingford II. However, construction of drains was not universal. No furnace hearth drains were found at either Panningridge or Batsford I.[8]

The exterior structure of the Saugus furnace was constructed from locally available granite, as identified by the project's consulting geologist, Dr. Laurence LaForge.[9] The interior portion, or lining, of the furnace was, however, constructed out of heat-resistant sedimentary sandstone, possibly imported from England. On numerous occasions, Robbins notes finding hexagonal spikes which, according to a later analysis by H. M. Kraner of the Bethlehem Steel Company, were an arkose, a sandstone containing feldspar. When intense heat was applied to the stone the feldspar melted and the sandstone shrunk and cracked to produce the spikes, similar to the spikes of Devil Post Pile near Lake Tahoe in California.[10] A very thick deposit of clay separated the sandstone lining of the crucible and the exterior wall of the

5.2 During the excavations, Robbins discovered drains below the blast furnace. (Photograph 456 by Richard Merrill, 1948.)

furnace.[11] Robbins noted that approximately 28" of the clay filling at the Saugus furnace had been baked by the intense heat from the furnace. While showing signs of heating, the permanent exterior wall of the furnace looked unaffected by the heat generated on the inside of the furnace; the clay acted as an insulator keeping the intense heat of the crucible and furnace interior from reaching the permanent exterior wall. [12]

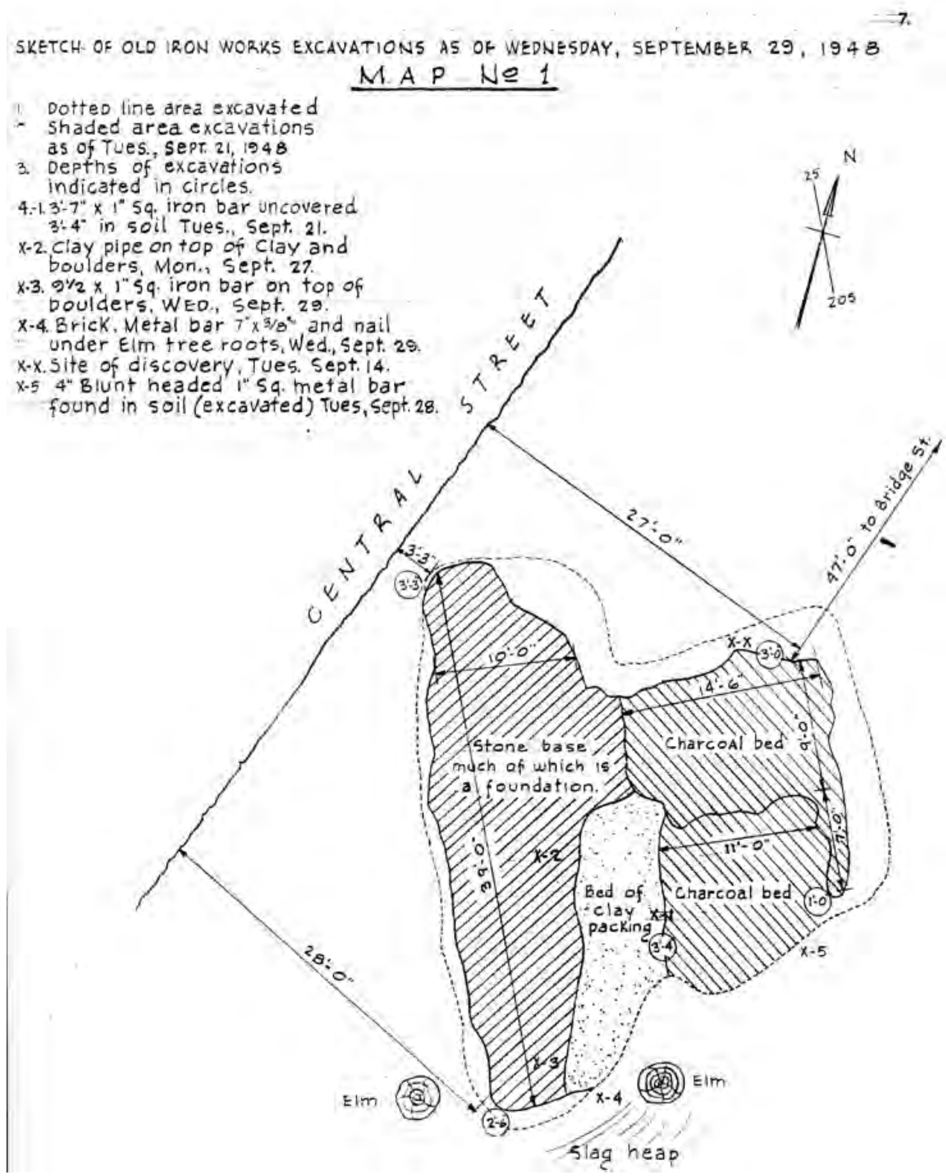
Some liberties were taken for the reconstructed furnace stack since many of the details for the above-ground portion of the reconstruction were not available from the archeological record. To fill in the incomplete details, the Reconstruction Committee relied on examples from elsewhere in the U.S. and from England and consulted specialists on behalf of the project. Although different designs for the furnace openings, the casting arch, and bellows arch existed in other locations (oval, angular, etc.) a rounded half-circle arch design was used for the reconstruction of the Saugus furnace. Some of the surviving furnaces in England of similar date have cast-iron lintels over these openings, but this design element was not incorporated into the Saugus reconstruction.[13] Based on other furnaces, the Saugus furnace stack was reconstructed to a height of approximately 23 feet and the exterior dimension of the stack decreased in circumference from bottom to top; this last detail did have some archeological support.

While it was never clear in Robbins' notes that any supports or holes for supports for the furnace were found, many early English blast furnaces, including those at Batsford, Chingley, Maynards Gate, and Panningridge, were additionally supported at the top by wooden cribbing that extended down into the ground, especially at the pillar, or corner between the two arches.[14] The pillar was known to have been one of the weakest and most problematic elements of the furnace structure. These wooden supports have been documented archeologically, historically, and in some instances on cast-iron firebacks.[15] The casting shed, where the casting would have been conducted, was almost certainly roofed to control moisture. Evidence of roofing has likewise been found at other iron furnaces like Pippingford I and Chingley.[16]

The top aperture of the furnace, or charging hole, had also undergone development in England by the time the Saugus furnace was originally constructed. During the smelting of iron, the top aperture, where all of the ingredients were loaded, commonly belched heated materials that damaged the top stonework. At first the platform of these furnaces around the opening was covered with tiles, but cast-iron plates had replaced these tiles by the end of the sixteenth century. The earliest use of cast-iron metal plates for this purpose is noted in 1591 at Rievaulx in Yorkshire. [17] While no physical evidence existed for the Saugus ironworks aperture, the furnace was reconstructed with cast-iron plates over the charging hole in keeping with the English examples of the period.

Men continued to dismantle the furnace. Joe and I worked along with them. I took pictures of the permanent furnace wall just to rear of face wall about crucible pit. (While the face wall had been repaired from time to time, the permanent wall to its west and south sides showed no evidence of repair work. It did show red clay (burned) extending to the rear of the front of the face walls for 42". But this clay had been discolored, or burned, by the intense heat from the furnace crucible and hearth areas. It was similar in appearance to the clay which had packed the furnace sandstone lining—but it was still soft in texture not solidified as was the clay which packed the furnace lining. *The face wall was about 14" in width. The heat penetrated beyond this for about 28" depth. Even at el. of crucible pits stone floor the furnace heat penetrated beyond permanent wall for some distance, burning the clay about stones of furnace structure. However heat appeared to lack several inches from reaching the depth of penetration noted about 3' above the crucible pit floor.*

Roland Robbins, *"Saugus Ironworks Daily Log - 1951," July 20, 1951.*



5.3 Drawing in Robbins' daily log, September 28, 1948, showing his 1948 excavations at the blast furnace. Note the level of detail Robbins presents concerning the various features and deposits encountered.

The Bellows, Waterwheel, and Wheelpit

In mid-October 1948, shortly after Robbins had identified the furnace base, he began excavating the remnants of the bellows on the north side of the furnace. The remains consisted of large, intact timbers laid in a V-shaped arrangement with the narrow portion of the V ending near the "pipe," as Robbins called it, and crucible. Several leather pieces "in as good shape as the day they were buried" were also uncovered in the area, as were nails, wooden wedges, and a hinge-like piece.[18] Robbins also found wooden fragments of what he considered to be either cams for the bellows or fragments of the paddles for the waterwheel. Below the timbers, Robbins also found a layer of blue-gray clay and sand, possibly used to control drainage.[19]

The bottom timbers for the bellows formed a roughly wedged-shaped, plank-sided base. The two primary north-south supports were double plank-sided members approximately 17 feet long.[20] These two members were connected by another timber measuring approximately 14 feet, 2 inches in length, and 14 inches in thickness. Another, shorter timber, approximately 7 feet, 8 inches in length, had fallen across the north-south supports, but evidently was not part of the base construction. Robbins speculated that this cross member and others around it had fallen into these positions after the blast furnace had been abandoned.[21]

Correspondence between members of the Reconstruction Committee indicates that there was some initial confusion as to the identification of the bellows support.[22] For a time, Robbins thought that the bellows base might have been some sort of sluice, or drainage feature.[23] Its shape seemed to indicate that it might have been used to channel water into the drainage channel discovered below the crucible cavity. This analysis was further supported by the location of the tuyère, or 37-inch-long connecting funnel, between the bellows and the crucible cavity, which had been found out of position. [24]

Robbins found the tuyère near the blast furnace at Saugus with its larger end covering one of the channels under the crucible cavity.[25] This led some individuals involved with the project to speculate that this odd-shaped pipe might have been involved with the drainage system. However, a number of the members of the Reconstruction Committee believed that this "pipe" was the furnace tuyère that had simply been moved out of position.[26] Ultimately, those who believed the pipe was a tuyère and those who believed the wooden frame was a support feature for the bellows convinced the others.

A shaft-driven waterwheel powered the bellows. While the cams on the shaft would have raised, or expanded, the bellows, heavy counterweights attached to the bellows would have compressed it and forced air out through the spout and tuyère and into the furnace. While no evidence of the huge wooden shaft was found during the excavation, much of the waterwheel, wheel pit, and tailrace were discovered in situ. The preservation of approximately forty percent of the waterwheel and most of the wheel

The iron pipe at the pit was removed today and placed in the attic of the Old Iron Works House. It was found to be funnel shaped, 3' long with a 2" diameter at one end and a 5 3/4" by 4 1/2", egg shaped, diameter at opposite end. It was a metal piece that had been folded round and had had a metal band placed around its middle. I placed a stone in the hole it had occupied and larger boulders upon it. The iron pipe apparently had set on the top of the channel that ran from pit to the converged end of the beam and plank trough. The base of channel is stone. While clay and soil had partially obstructed this channel, nevertheless by pouring water in the soil at the converged end of the trough it ran through the channel and into the pit. This would indicate that such were the intentions at the time of the construction. Further excavation at the converged end of trough may locate the other end of a channel cut through the pit's walls . . . . So the outline of the blast furnace has been determined and many of its mysteries solved, however, the purpose of the plank and beam trough shall have to be determined. There seems but little doubt but that the bellows were located above the trough. Whether water drained beneath them thru the channel or thru the iron pipe, or whether the blast from the bellows was dispersed thru the iron pipe into the channel and up from the bottom of pit shall have to be determined.

Roland Robbins, "Saugus Ironworks Daily Log - 1948," October 16,1948.

5.4 The blast furnace and bellows base October 1949. The view is to the south. (Photograph 110 by Richard Merrill, 1949.)

pit and tailrace was phenomenal.[27] Even more fantastic, Robbins found several other waterwheels and wheel pits during the next few years (see Chapters 6, 7, 11, and 13). Robbins was elated when the waterwheel was discovered, as he notes in his later book ***Hidden America*** (1959):

> That weekend it rained, which helped to make the water-wheel site more easily workable. So on Monday I went to work with spade, putty knife, and trowel in the charcoal-strewn vein. In mid-afternoon I struck wood. Pushing my hands into the freezing, waterlogged earth, I felt the contours of a thin board, and as I scooped away the soil I felt other surfaces, angling off from the first board. The first image that occurred to me was a box, and then, as I cleared away more of the wood, I dared to hope that my dream of finding at least part of the water wheel preserved had come true. I looked down at the ancient saturated boards, gummy with mud; they seemed to form a water-wheel bucket. I dug on until long after darkness closed in and found a three-foot wooden arm extending into the furnace wheelpit; my bucket was twenty inches by fourteen inches by ten inches deep. Even if I found no more, these dimensions could help to establish the size of the wheel which had helped to get this pioneer industry started.[28]

The overshot wooden waterwheel was estimated to be approximately 16 feet in diameter when discovered by Robbins in February 1951.[29] The spokes that radiated out from the center of the wheel supported the buckets, which were used to catch the water and turn the wheel. One of Robbins' March 1951 log entries indicates that each of the buckets were approximately 12 inches apart and supported by wooden rungs that ran from one side to the other on the wheel.[30] Animal hair had been used to caulk the joints of the buckets.[31] The wheel itself was estimated to be approximately 30 inches wide; water would have been delivered to the wheel from a penstock at the top. The overshot waterwheel was quite popular at ironworks of Saugus' vintage. As noted above, the overshot wheel was the most efficient of the various waterwheel types, compared with the breast wheel and the undershot wheel, and thus capable of providing more power to the bellows.

The remains of the original furnace waterwheel were found in a wooden wheel pit large enough to accommodate the bottom portion of the 16-foot-tall by 30-inch-wide waterwheel. Because water backup could actually slow the wheel, the wheel pit would have been cut significantly deeper than the waterwheel required to allow water to flow freely to the tailrace once it had been released from the buckets on the waterwheel. The rectangular wheelpit was solidly constructed of wood and contained internal supports to allow it to retain the soil all around it.[32]

Robbins excavated the soils that had collected in the wheelpit as he uncovered the waterwheel remnant. The fill had either washed in or had been purposefully deposited after the facility went out of use. Rob-

Today's work hit the jackpot! While I had expected to find about 25% of the waterwheel cradled in the race at least 40% of the wheel was found there today! Also 2 more spokes were found protruding up from the section of wheel resting at bottom of the race. That makes total of 3 known spokes. The spokes found today were the 2 large base timbers which held the waterwheel's bearing structure. At the northerly end of the race I located the other end of the remains of the wheel. The distance between the both ends of the wheel was between 12'-13'.

Roland Robbins, "Saugus Ironworks Daily Log - 1951," February 23, 1951.

5.5 Robbins excavating the furnace waterwheel in March 1951. Two of the spokes projecting from the interior diameter of the wheel can clearly be seen as can much of the wheel pit. (Photograph 309 by Richard Merrill, 1956.)

bins noted numerous artifacts and artifact fragments in the fill, along with a large charcoal deposit that he speculated had accumulated outside of the wheel pit during the operation of the furnace. After the furnace was abandoned and the retaining walls on the north and west of the wheel pit had collapsed, this charcoal had been washed into the pit.[33] The fill supported the remnants of the waterwheel; as soon as the fill began to be removed, the various parts of the waterwheel and wheel pit began to disintegrate. The waterwheel was conserved by Professor Elso Barghoorn and is currently on exhibit in the museum at Saugus Iron Works NHS (see Chapter 11).

To the north of the furnace, Robbins found the remains of retaining walls used to stabilize the soils and prevent soil migration into the furnace area. [34] The only element remaining from the northern portion of the retaining wall was a beam. However, it showed signs of having joined a north-south beam at a perpendicular angle. Robbins speculated that this beam would have been part of another retaining wall, which may have kept material from washing into the bellows and waterwheel area. It is likely that the revetment wall may have also channeled free-flowing water away from the furnace as at Astly, Worchestershire.[35]

Earlier work along the west side of the furnace had offered a harbinger that the waterwheel, wheel pit, and tailrace might be found. An April 1949 log entry by Robbins notes that he had discovered a portion of the tailrace. [36] The trench that Robbins excavated on the west side of the furnace was 10 feet below the working surface of the casting area. At this depth, Robbins uncovered a portion of the bottom of the tailrace that appeared to be four feet deep and three feet wide. Constructed out of wooden planks on the sides and bottom, Robbins speculated that the top of the tailrace may also have been covered with wood. He noted in a later May entry that the tailrace was supported by upright and cross beams.[37] No large stones were discovered in the fill of the tailrace, which led Robbins to conclude that the furnace had been dismantled after the tailrace had been filled. Several of the timbers used in the tailrace construction also showed signs of fire, indicating that a conflagration of some sort may have occurred before the tailrace had gone out of use.[38]

The digging to west of furnace wall penetrated to a depth of 10' below apparent floor level of furnace. Located was evidence of a possible tailrace running parallel with west foundation and flush to it. It is possible its construction consisted of planking flush against bottom of foundation, held in place with beam uprights. Its width seemed to tapper [sic] *towards south end of west foundation. It was about 3' in width. Its depth appears to have been about 4'. The bottom being lined with wood, possibly beams or planks. Indications are that wood planking covered its top. The distance from the top of furnace foundation to the apparent top of this wooden structure was about 6'. This and the structures 4' depth places a depth of 10' from top of foundation to present knowledge of its depth.*

Roland Robbins, "Saugus Ironworks Daily Log - 1949," April 24, 1949.

The Charging Bridge

Two elements possibly connected with the charging bridge were found by Robbins in January 1951. The charging bridge provided access to the furnace opening, allowing workers to move raw materials from the higher ground above the furnace to the top of the furnace stack. Robbins first unearthed a stone wall on the ravine, just west of the furnace.[39] This is the location in which one would expect to find a charging bridge support feature, given the configuration of the Saugus furnace. The wall section was 28 feet west of the western edge of the furnace and was built on the same loam surface on which the other buildings associated with the ironworks were constructed. Robbins did not record the dimensions of the wall nor what type of stone was used in its construction. The second element possibly connected to the

5.6 Robbins working in the tailrace in July 1951. Notice the depth of preservation on the western side of the blast furnace and the upright members of the tailrace. (Photograph 384 by Richard Merrill, 1951.)

charging bridge was a wooden sill.[40] This sill lay just west of the other wall and was constructed parallel to it, but did not contain any mortises. Robbins noted that if it served as a sill, the corresponding vertical members would have been held in position by fill soils that had buried the sill some three feet, six inches below the present surface. Since burying timbers in the ground rather than elevating them on some kind of stone foundation would have fostered quicker decay of the timbers and greater instability for the bridge, this interpretation seems questionable. Robbins noted the unusual shape of the beam, but the discovery of adze marks indicated to him that the timber had not been misshapen by natural elements. These were the only two features mentioned by Robbins connected to the charging bridge.

The reconstructed charging bridge, therefore, was not based on a great deal of archeological evidence. The fact that one would have existed and would have been constructed out of wood did little to inform the reconstruction. Most of the historical examples in both America and England had covered bridges, making the Reconstruction Committee's decision to reconstruct the bridge with an open rather than a covered bridge somewhat controversial.[41] The Reconstruction Committee chose the open bridge because the historical inventories about the ironworks never mentioned a charging house.[42]

Other Features

Robbins uncovered numerous additional features while he was excavating in the vicinity of the furnace, including several amorphous groups of stone. One of the first mentioned was uncovered in the northwest corner of the furnace.[43] Robbins rather quickly attributed this feature to the dismantling of the furnace. Likewise, after much contemplation, Robbins ultimately dismissed a large pile of stones off the southeast corner of the furnace as related to dismantling activities.[44] However, he associated other stone piles and features with specific functions.

Several other amorphous stone features were found to the east of the furnace. Numbered 7, 8 and 9 by Robbins, these stone features were similar to the stone piles found on the southeast and northwest corners of the furnace, except that they did not form well-defined piles. Hartley suggested later casting beds had been rebuilt over the earlier casting beds and that the stone below the new beds would have acted as a sort of dry well, pulling moisture away from the casting area.[45] He noted that the original area used for casting likely would have gotten wet and muddy and that the insertion of the stones would have prevented that. Robbins argued against this idea, noting that no higher casting beds had been found. He instead speculated that Features 7 and 8 may have been the remains of one of the furnace lining reconstructions, performed after the furnace went out of blast.[46]

Robbins also discovered what he believed to be the casting beds at the southeast corner of the furnace. He notes that this area had been dug out and the spoil had been replaced with sand.[47] Such casting beds

This a.m. I located stone evidence on the slope of the ravine just west of the west wall of the furnace. It was resting on the loam surface which existed during furnace operations. (This loam having considerable charcoal in it.) This stone evidence could well have been the foundation of the bridge to the furnace! *From the base of these stones to the west wall of the furnace was 28'. Assuming the furnace tapered from its top, and the stone evidence at the site of the bridge may have been graded rather than constructed (built up) vertically, we could add several feet to this distance. When the old water line was laid it ran across this area, undoubtedly destroying evidence we seek.*

Roland Robbins, "Saugus Ironworks Daily Log - 1951," January 10, 1951.

5.7 Several stone piles uncovered during the blast furnace excavations in September 1950. (Photograph 219 by Richard Merrill, 1950.)

would have accommodated sow, hollowware, and flat castings. When the furnace was tapped, the liquid iron would have flowed out and filled depressions in the sand that had been created using hoes or molds. Once these castings had cooled, they would have been broken from the main channels created to distribute the iron. Molten iron also would have been ladled out and poured into molds. Robbins discovered a ladle or two in his excavations, as well as several “ladle-skulls,” or the remains of the liquid iron that cooled and stuck to the ladle before it could be poured into the molds.[48]

Robbins was convinced that he could identify particular activity areas within the casting beds based on the artifacts that he recovered.[49] The discovery of a large sow southeast of the furnace opening led him to believe that this area was used for casting sows. He speculated that the area just north of the alleged sow-casting area was the hollowware-casting area because of the fragments of pots and kettles that he discovered in the sand. His conclusions are probably accurate, although the ironworkers easily could have moved the sand around, almost at will, and cast forms anywhere in the casting bed. English furnace sites also have identified activity areas within the casting sheds and beds. Furrows for sows, without branches for pigs, were also found at Panningridge I and Pippingford II.[50]

Almost directly south of the furnace was the slag pile. This pile contained the by-products of numerous seasons of smelting and was visible from the very start of the project, even without archeological examination. Its size and the fact that it would have contained few if any architectural features probably contributed to its survival. During Robbins’ excavations at Saugus, he sampled the pile and collected pieces of slag for analysis, but only reconfigured the extreme northern end pile’s. Today, the slag pile represents one of the only surviving, and largely unaltered, cultural resources from the original operation of the ironworks.[51]

Some disagreement existed between Robbins and members of the Reconstruction Committee concerning the access route from the casting shed area to the slag dump. Robbins reasoned that some kind of stone ramp must have led from the casting area to the slag pile, as there was quite a difference in elevation between the two. The Reconstruction Committee did not necessarily agree. Evidently, Robbins and Hartley had a spirited debate about this, which Robbins notes several times in his daily logs. For example, on Friday, August 10, 1951, Robbins comments,

> Phoned Hartley in p.m. and pointed out the fact that if the stone ramp was not used as a walkway to the slag dump—then they had to walk out and ***circle around*** the circular foundation [Feature 12] to front of furnace breast, crossing the easterly side of it when swinging back towards slag dump. This would bring them to the foot of the bank which slopes north-easterly from the developed plateau at south of furnace. Here they would find themselves 6’ lower than the plateau and slag dump. Are we to twist

This morning I located the casting bed (for sows and pigs) to the front of the hearth, and running along the southern wall of the breast for about 6’. Preliminary examination indicates it to be about 3’ wide at hearth and about 4’–4 1/2’ wide at its outer extremes. It appears that its top surface was at a level corresponding with the bottom of the lower breast stones. (Possibly these lower breast stones were placed along the bottom of the furnace breast to keep the casting activity 9”–10” away from main breast stones, making for better working room.) For a depth of 8”–9” into this casting bed the sand was red from exposure to heat. It was crusted with metal waste or splatterings. Beneath this evidence the sand was fine and pure (this on a loam surface) for a depth of 4”. (This indicates the possibility of a sow casting bed built on loam surface of about 1’.) Specimens of the top sand of casting bed and the bottom sand of this bed have been removed to my museum.

Roland Robbins, “Saugus Ironworks Daily Log - 1949,” October 14, 1949.

5.8 Robbins' identification of the various activity areas within the casting beds in 1949. View to the southeast. Notice the "stone ramp" just to the right of the center of the picture. (Photograph 405 by Richard Merrill, 1949.)

> our thinking to imagine that a series of steps (of which no evidence was ever located) existed up which they would carry their basket or barrows of slag?[52]

Hartley maintained that the stonework that Robbins referred to as a ramp was really only additional buttressing for the southern furnace wall.[53] Ultimately, the Reconstruction Committee overruled Robbins and did not reconstruct any kind of stone ramp.

The archeological excavations of the blast furnace and attached features clarified the design of the area for reconstruction. The British ironworks historian, H.R. Schubert, ardently believed that the Saugus furnace, and indeed Hammersmith in general, emulated English design. Robbins contended that the design did not necessarily slavishly follow the English plan. Fifty years of archeological research on blast furnaces in England has shown that the Saugus furnace contained some elements of English derivation but at the same time incorporated elements not found on all English sites.