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INTERIM REPORT ON EXCAVATIONS AT THE BEDFORD IRONWORKS CEFN CRIBWR, 1992

JANUARY 1993

REPORT NO.93/006
PROJECT NO. X200

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Acknowledgements

This report was prepared by P F Wilkinson BA(hons), AIFA, (Project Officer, Glamorgan-Gwent Archaeological Trust, Contracts Section) with the assistance of D N Williams BA(hons) and other staff of the Trust. The Finds Report was prepared by J Compton and S Sell. The plan and plates were prepared by P Jones, M Pambianchi, and T Davies.

The author is grateful to the staff of Ogwr Borough Council, particularly Mr Robert Hathaway and Mr Graham Edwards, the staff of Re-Struct Ltd, particularly Mr Ron Morgan and Mr Charles Richards, the staff of Veryard and Partners, Mr Phillip Riden of the University of Wales, College of Cardiff, Mr and Mrs John Mason, and many other people who contributed to the success of the excavation programme. Particular thanks must go the the site supervisor, David Williams, and the excavation team: Marien Bernthal, Gareth H J Dowdell, Russell Edwards, Mark Leese, Roger Linnard, Adrian Phillips, Nichola Tucker and Peter Wright.

1. Introduction

The Bedford Ironworks at Cefn Cribwr were established in the late 1770s by John Bedford, although it is uncertain whether he achieved full production at the site in his lifetime. After his death in 1791 the works were operated intermittently by his son and various lessees. In 1824 the works was taken over by the Bryant family who converted the furnace to steam power and operated it until about 1836. The historical background to the site is fully explored in a report and a book by Phillip Riden (Riden 1992a and 1992b).

The site is the subject of a programme of excavation, consolidation and interpretation being undertaken by Ogwr Borough Council with funding from the Welsh Office Urban Programme. The excavations described in this report were the first season of a programme of excavation which was planned to take place over an extended period. It was the culmination of a long series of studies including historical research (Riden 1992a), a survey of the archaeological remains of the surrounding area (Wilkinson 1992b) and a programme of trial excavation on the site (Wilkinson 1992a). The excavation programme was drawn up on the basis of proposals put forward by the Glamorgan-Gwent Archaeological Trust, Contracts Section (Wilkinson 1992c), a brief set by GGAT Curatorial Section, and an independent consultant's report (Cranstone 1992).

When the excavations described below started in July 1992, much clearance of the site had already taken place and consolidation works by Re-Struct Ltd were well advanced. The excavation team worked closely with the staff of Re-Struct as well as with the consulting engineers, Veryard and Partners, and the staff of Ogwr Borough Council.

Excavation in this first season of work concentrated on areas towards the southern end of the site. These consisted of the calcining kilns, the area around them, the charging structure,

and the top of the furnace, all of which the Trust was contracted to excavate, and the blowing engine house which was examined in addition to the main areas of excavation. In the interests of consistency, the areas excavated were recorded and are described here under the area numbers set out in the original excavation proposals produced by the Trust (Wilkinson 1992c).

In general the results of the excavation are described starting at the southern end of the site and working northwards. This is the direction in which the materials used in the iron-making process would have moved through the works. Although this interim report is not intended to provide a very detailed description of every archaeological context examined in the course of the excavation, selected context numbers are included to act as cross-references to the site archive which contains detailed records.

The report includes proposals for further excavation formulated in the light of the data generated by the work undertaken to date.

References are given in brackets in the text. A list of full references is provided in the bibliography.

2. The Results of the Excavations

Area 5: The Calcining Kilns

The southernmost standing structure on the site was generally presumed, on the basis of its position and appearance, to be a kilnhouse consisting of two calcining kilns separated by a central passageway. The purpose of such kilns is to burn the iron ore with either charcoal or coke to drive off some of its impurities, particularly sulphur. The process also heated the ore in preparation for its use in the blast furnace.

Partial clearance and consolidation of the calcining kilns had taken place prior to the 1992 excavations. However, little detail of their structure was apparent and it was not possible to identify them with any certainty. The structure is rectangular with external dimensions of 10.35m east-west by 5.55m north-south. It survived to a maximum height of 2m above the surrounding ground level prior to excavation. The outer walls are faced with stone including dressed sandstone around the arches and forming some of the quoins at the corners of the structure. The areas between the linings of the kilns and the outer faces of the structure were filled with loose stone. This was presumably intended to allow for expansion and contraction of the structure as it was heated and cooled.

Two horizontal flues were found running through the loose stone fill to the north of the western kiln and emerging through the southern face of the structure. They were lined with specially made bricks similar to, although larger than, those used in the blast furnace venting system described below. It is probable that these flues were intended to provide ventilation to cool the body of the kilnhouse. It is likely that there would originally have been other such flues in the structure but evidence of them appears not to have survived.

The clear internal division of the structure, into two kilns and a passageway, provided three discrete excavation areas.

The West Kiln

The western kiln (004) was largely filled with soil and stone rubble, into which had grown substantial tree roots. Towards the bottom of this fill there were increasing quantities of stone and brick rubble apparently derived from the partial collapse of the structure. Excavation revealed considerable detail of the internal structure of the kiln.

The floor of the kiln measured 1.90m east-west, whilst the length of the floored area from north to south was 2.66m. It was paved with bricks which had been dry-laid in rows, their long axes lying north-south (099). A rectangular iron plate (101) was set into the floor towards its southern end. It measured 1.53m east-west by 0.57m north-south. It lay 250mm, (approximately one brick-length), from the southern edge of the floor, 240mm from its eastern edge, and 130mm from its western edge. The northern boundary of the floor was marked by a kerb of bricks one course higher than the rest of the floor.

The side walls of the kiln were vertical and, towards the northern end, a surviving portion of vaulting showed that they had supported a brick vault faced with a dressed stone arch. The side walls were faced in brick and stone whilst the wall forming the southern end of the kiln was faced in brick and its upper part sloped backwards. The brick facing clearly formed a heat-resistant lining. An iron beam had been set into the side walls, spanning the area between them.

The southern wall of the kiln appeared to be vertical to a height of 370mm above floor level and then sloped back at an angle of approximately 20 degrees from the vertical. The brick facing survived to a maximum height of 1.80m above floor level. The lower, vertical, part of the wall was obscured by an additional

facing of brickwork which showed signs of scorching and heat cracking. The upper, sloping, part of the wall also displayed evidence of scorching.

The side walls were faced with stone towards their northern ends but had a brick face which extended for approximately one metre from their southern ends. Only the bottom three or four courses of this brickwork survived adjacent to its boundary with the stone facing. The alignment of the junction between them could not, therefore, be determined with any certainty. This brickwork, like that of the southern wall, showed evidence of scorching.

All of the surviving brick lining of the kiln was dry-laid in header bond.

The iron beam (078) was set into the brickwork of the side walls at a height of 360mm above the floor. This was at approximately the same height as the vertical part of the south wall, with which the beam lies parallel at a distance from it of 630mm. The beam was 180mm wide and 40mm thick with a lip or flange 40mm high along its southern edge. The visible length of the beam was 1.88m, this being the distance between the two side walls. On top of the beam a single course of bricks (079) was set in clay against the inside face of the flange.

In its north-eastern corner the floor of the kiln was partly covered by a brick-lined drain which is descibed under Area 6 below.

The East Kiln

Upon excavation the eastern kiln (005) was found to be very similar to the western kiln. It too was filled with soil which contained increasing amounts of stone and brick rubble towards its base. Removal of the fill showed that the kiln survived in a slightly more complete state of preservation than the western

one, and it was possible to interpret its original form more fully.

The floor of the kiln measured 2.82m north-south by 1.84m east-west. It was paved with dry-laid bricks set in rows. There was an iron plate set into the floor towards its southern end. It was located 240mm, or one brick-length, from the southern boundary of the floor. Unlike the one in the other kiln, it was 1.84m long, covering the entire width of the floor. With a width of 800mm, the plate was also wider than its counterpart in the western kiln. The brickwork between the plate and the southern wall displayed evidence of scorching.

The south wall was faced with brick. The lower 300mm of it was vertical but above this the wall sloped back at an angle of approximately 45 degrees. All of the wall, but particularly the lower part showed evidence of scorching. There was no evidence of additional brick lining to the south wall as had been found in the west kiln.

The side walls were faced in stone and brick. In the east wall the northern part of the wall was stone faced at the bottom with brick facing above at an angle towards in its southern half. The brick facing extended to floor level from 500mm north of the south wall, southwards. In the west wall, however, the brick facing extended down only to 240mm above floor level, the wall below it being faced with stone. The side walls showed signs of scorching towards their southern ends. The stone facing extended across all of the northern half of the wall up to a height of 1.20m. Above this level were the remains of the base of a brick vault. This was the only surviving evidence of the nature of the roof of this kiln.

Like the west kiln, the east kiln was spanned by an iron beam (085) set into the side walls at a height of approximately 400mm above floor level. The beam differed from that in the other kiln in not having a vertical flange. It was 240mm wide and 50mm

thick, with a total length of 1.84m. On top of the beam were the remnants of a row of bricks set in clay along its southern edge. The bricks were pitched at a slight angle towards the north.

The pitch of the bricks on the beam was reflected in similarly pitched bricks in the side walls immediately above the ends of the beam. In both side wall three courses of bricks, pitched at an angle of about 30 degrees from the vertical, indicate that the bricks on the beam would have supported additional sloping brickwork above them. In the east wall the the bricks had been cut along the same angle, continuing the line of the underside of the sloping brickwork. This indicates that the sloping brickwork supported by the iron beam was at least 900mm high.

A small quantity of charcoal and coal was found deposited in the angle between the south wall and the floor of the kiln. This might be a residue from the use of the kiln.

All of the surviving brick lining of the kiln was dry-laid in header bond.

The northern part of the floor of the kiln was covered by stones and soil, built up against the eastern wall which appeared to be the remains of a badly built drystone wall (106). The end of an iron beam (326), similar to the one described above, was found protruding from the western side of this structure.

Discussion

The surviving evidence from the two kilns suggests that the brick-lined area to the south of each structure constituted the kiln itself. This would have had sloping front and back walls. These were the north and south walls respectively. The side walls were vertical. The front walls were supported on iron beams, an arrangement which would have allowed the residue from the calcining process to be removed through the opening below the beams. The iron plates in the floors of the kilns, which

extended past the line of the front of the kilns would have provided a suitable surface off which to shovel the residues.

The brick-floored areas, in front of the kilns, with their vaulted roofs, would have provided sheltered working areas for discharging the kilns.

Whilst no archaeological evidence of the charging arrangements has been found, it may be assumed that the kilns would have been fed from above, as was the case at a number of other ironworks such as the nearby Tondu Ironworks. Local people report that, about 50 years ago, the western kiln's roof was more complete than it is today and the kiln was used for the storage of hay. A hole in the roof was kept covered with a metal sheet. It is possible that this hole was the kiln's charging hole. The layout of the kilns is generally similar to that of those at Tondu but in the latter case a number of discharging openings served one large kiln. At Cefn Cribwr there are clearly two separate kilns. The Tondu kiln structure was over 4m in height. It is not possible to determine with any certainty the original height of the kilns at Cefn Cribwr. The very large quantities of building debris which one might expect to find if a 4m high structure had collapsed were not found. Such material could, however, have been removed from the site in the past.

The Central Passageway

The cental passageway of the kilnhouse (006) had been partly cleared and repaired prior to the 1992 excavation. This work had mainly involved the rebuilding of the collapsed middle section of its covering brick vault, replacement of the stone facings at the ends of the vault, and the reinstatement of what was thought to have been an opening in the western wall.

The internal dimensions of the passageway were 5.48m in length and between 2.16m and 2.20m in width.

It appeared likely that the principle function of this passageway was to allow access from the south of the works, between the two kilns, to the charging ramp for the furnace. It is along this route that the raw materials which did not need to be calcined for use in the blast furnace would probably have been moved. Excavation of the surrounding area showed that a tramway had lead into and out of the passageway, confirming its function as a routeway. The function of the passageway's vaulted roof is most likely to have been to support a bridge which would have allowed movement between the tops of the two calcining kilns thus facilitating more efficient access for charging the kilns from above.

The floor of the passageway (011) was covered by a thin layer of soil, and brick and stone rubble. Beneath this fill were the substantially intact remains of a dry-laid brick-paved floor with a slight camber. There was a small area of damage to the northern half of the floor surface, and a larger area of damage in the southern half. Close to the south-east corner of the floor a number of stones were set into it, possibly as a result of the replacement of missing or damaged bricks. These stonesincluded a tramway sleeper block which was clearly not in its original position.

A brick-lined gully (012) was built into the floor, apparently as a drain. This crossed the width of the floor at a distance of 2.20m from the northern end of the passageway. It turned to run northwards along the eastern edge of the floor. It then passed through a hole in a later drystone wall, which is discussed below, and into a drain in Area 6. The drain was delineated by two rows of bricks set on edge, and floored by a single width of bricks in its east-west part and by a single brick length in the part that ran to the north.

The two ends of the passageway were partially blocked by drystone walls which were not removed during the excavation but appeared to overlie the brick floor. The one at the northern end (010)

was 500mm thick, and varied in height from 100mm to 300mm. It was composed of randomly laid stone rubble with occasional bricks. It had a hole at the base of its eastern end to allow the drain to pass through it.

The wall at the southern end (009) was of a similar construction to that at the northern end and survived to a height varying from 100mm to 200mm. Both of these walls appeared to post-date the brick floor. Stone rubble, apparently collapsed from these walls, was spread both across the brick floor and across Area 6 adjacent to the ends of the passageway.

The side walls of the passageway were constructed of stone. The character of the stonework changed part of the way up the wall. Measured from floor level, the lower 150mm of both side walls was built of flat stone slabs, while above this level the stones were considerably thicker and there was a much greater variation in shape and size. It is possible that this change reflects stonework of two periods. It might, however, be simply the result of the flat slabs' being used to level the base of the wall in order to increase its stability.

As noted above, work on this structure prior to its excavation included the reconstruction of an opening in the west wall of the passageway. At the time there was some debate as to whether or not there had originally been an opening at this point. It was possible that the impression of the presence of an opening was caused by the unusual way in which this section of wall had collapsed. In the light of the evidence gained from the excavation of the structure, it now seems extremely unlikely that an opening originally existed in this position, as there is no obvious purpose for an opening linking the passageway and the kiln. It is of course possible that, if this opening did exist, it was related to the reuse of the structure after it ceased to be used for calcining.

Evidence from the surrounding area suggested that the brick floor in the passageway was not related to the original use of the structure and might, therefore, relate to its reuse after the closure of the works. A local resident has provided information on the use of the structure for agricultural purposes. About 50 years ago the central passageway was used as a milking parlour for Biddy, a local farmer's only cow. The brick floor with its drain would have provided a suitable surface for such a use, and the damage to the floor is consistent with the type of wear one would expect in a milking parlour. An iron staple set in the west wall would appear to have been used for tethering the cow. It is possible, therefore, that the floor was laid specifically for agricultural use.

The floors of the two kilns were some 400mm lower than the floor of the passageway. Excavation of the surrounding area (Area 6) suggested that the level of this too might originally have been somewhat lower than the brick floor. In addition, the present floor level allowed very little headroom in the passageway. This suggested that the original floor level in the passageway might originally have been lower than that of the brick floor. In order to investigate this possibility a one metre wide trench was excavated across the floor, just to the south of the drain, to a depth of 440mm.

This excavation showed that the bricks of the floor were resting on a layer of silty loam which overlay two other layers of material containing coal dust, mortar, plaster and other debris. These in turn overlay a level surface of clay and mortar which was not excavated further. Resting on this surface, in a narrow trench cut through the two layers above it, was a drain built of flue-lining bricks of the type used in the blast furnace venting system. The trench was filled with the same material as that on which the brick floor was resting. It would appear that the drain was laid, probably immediately prior to the laying of the floor.

The clay and mortar surface found at the bottom of the trench showed no clear evidence of having been used as a floor surface but it is possible that slight depressions noted near its edges could be the impressions left by tramway sleeper blocks. The side walls of the passageway extended down to this level with no indication of foundations. There is, therefore, no clear evidence to indicate that the original floor level was not at this lower level, but if it was, its precise nature is at present uncertain.

Area 6: South of Charging Platform

The area between the present southern boundary of the site and the southern end of the site of the charging ramp was extensively excavated. This, Area 6, surrounds the calcining kilns.

Following removal of surface vegetation, debris and topsoil, it was found that most of the area was covered with coal dust. To the west of the kilnhouse, however, were the remains of a brick-paved surface. The brickwork, which abutted the west wall of the kilnhouse, covered an area measuring 2.45m north-south, with further fragments to the south of it suggesting an original area at least 4 metres in length. Towards the south, at the edge of the surviving surface, two bricks were set on edge as if to form a kerb 1.60m from the kilnhouse. Further to the north, however. the surviving brickwork extended up to 1.80m from the kilnhouse wall. In places the brick surface appeared to overlie the coal dust deposit. In other places the coal dust appeared to abut the brickwork.

From the north-east corner of the kilnhouse passageway a shallow brick-lined gully continued the line of the drain, curving away to the north-east. this was a continuation of of the drain built into the floor of the passageway but of a different design, the side bricks being tilted rather than vertical.

To the north of the central passageway of the kilnhouse, clear evidence of a tramway was found. This consisted of two parallel rows of a total of 18 stone sleeper blocks. These were flat-topped stones each with two holes cut in them at an average of 125mm apart (centre to centre). On some of them there was evidence that the area around the holes had been dressed to provide a flat and level surface on which the rail chairs, or clamps, could be fitted. In the case of eight of the blocks, the iron chairs were still in situ. Each was secured by two iron nails driven into the holes in the stones.

The chairs, of which a number of examples no longer in situ were found lying around the area, were spaced irregularly but appeared to indicate a gauge for the tramway of 1.37m (4'6"). This was the standard gauge of the Duffryn Llynvi and Porthcawl Railway which opened in 1828 close to the southern boundary of the site. The blocks' spacing along the line of the tramway was also irregular but the average distance between the chairs was 1.04m.

In between some of the blocks, iron bolts or nails protruded from the coal dust-covered surface, roughly along what would have been the line of the rails. The area around the blocks contained a scatter of small stones and brick fragments. At the southern end of this stretch of tramway, between the lines of sleeper blocks, were fragments of a paved surface composed of flagstones, thick quarry tiles and bricks. It is possible that this surface related to the agricultural use of the adjacent passageway in the kilnhouse.

Towards the northern end of the surviving tramway, an irregularly shaped but smooth surfaced spread of concrete ran between the two lines of sleeper blocks for a distance of 3.40m. Although level for most of its length, towards its northern end the top of the concrete rose by some 170mm.

The line of the tramway ran almost directly northwards from the central passageway of the kilnhouse to the southern end of the

charging structure. The presence of a sleeper block, apparently in situ, on the charging platform of the furnace, and a number of such blocks amongst the rubble filling the charging structure indicates that the tramway almost certainly originally extended over to the blast furnace. Sleeper blocks surviving in situ to the south of the passageway indicate that the tramway also extended some distance in that direction.

The stretch of tramway excavated to the south of the kilnhouse was represented by five sleeper blocks three of which had three holes rather than two. The alignment of the tramway here deviated from the alignment of the adjacent passageway and the rest of the northern section of tramway. It veered to the east by some 13 degrees. It would seem likely that this represents the beginning of a curve, perhaps to allow the tramway to run parallel to the nearby Duffryn, Llynvi and Porthcawl Railway.

Around the sleeper blocks there was a scatter of stones and brick fragments. At a distance of 2.30m south of the end of the passageway, seven bricks set on end formed a line running east-west between two of the sleeper blocks. Only the top of this line was examined and its function cannot yet be established.

Examination of the opening in the south wall of the charging structure, through which the tramway passed, suggested that the level of the access through the opening might have originally been as much as 750mm lower than the tramway. Excavation of the calcining kilns showed that the floors of the kilns were approximately 350mm lower than the tramway and the surrounding coal dust deposits. In addition, evidence from the central passageway of the kilnhouse suggested that its original floor level might originally have been over 400mm lower than the brick-paved floor.

In the light of this evidence, and since it was possible that the coal dust, rather than being the latest ground surface related to the use of the site as an ironworks, was a superficial deposit

overlying such a surface, further excavation was undertaken. This work consisted of the excavation of two small areas. One was to the north and north east of the east kiln, and the other was to the north of the west kiln.

The first area measured 2m north-south by 2.60m east-west, from the centre of the front of the kiln to the edge of the steep slope of the charging bank. The area was excavated to a depth of 300mm. This showed that below the coal dust on the surface there was a series of layers of coal, soil and clay interspersed with thin layers of coal dust, ash, and areas of scorching. This showed that the original working surface had been at least 300mm lower than the one previously recorded.

Below the level of the upper layers of coal dust and soil, the deposits had been cut by a narrow trench in which a drain built of ventilator bricks had been laid, running north-eastwards from the direction of the central passageway. It would appear most likely that it was part of the similar drain recorded below the floor of the passageway. This suggests that the the drain and the brick floor which overlies it post-date, and possibly overlie, the original working surface of this part of the site.

The second area of excavation extended 3.80m northwards from the northern end of the west kiln and 4m westwards from the western edge of the tramway. Beneath the coal dust were further thin layers of coal dust, soil and clay overlying a spread of concrete similar to that found towards the northern end of the tramway. A slight depression, in which the concrete was stained a darker colour, ran across the surface from south-west to north-east. This gave the impression of having been produced by the movement of people or other traffic along this line.

It appeared that the tramway sleeper blocks were set in or on this concrete surface. It is likely, therefore, that the concrete found towards the northern end of the tramway was part of the same surface.

The concrete surface was cut by a rectangular pit immediately to the north of the kiln. The pit measured 2.50m east-west and 2.38m north-south. Its fill was not excavated and so its depth could not be established. The pit was filled, at least at its surface, with deposits of soil, clay, ash and coal dust, and there was much evidence of burning. As the top of the concrete surface was some 200mm above the level of the floor of the kiln, it would seem likely that the pit was dug in order to allow the kiln to continue to be used after the laying of the surface. This would seem to imply that the concrete surface post-dates the construction of the kilnhouse by some time, but pre-dates the end of use of the kilns.

The concrete surface and the fill of the pit were both cut by a trench containing a brick-lined channel which may be presumed to be a drain. This was a continuation of the drain which had been found in the north-east corner of the west kiln, and ran for at least 4.60m beyond the kiln towards the north-west. The sides were constructed of two courses of dry-laid bricks. In the kiln the floor of the drain was formed by the floor of the kiln. The drain's floor outside the kiln was not uncovered.

The drain was filled and overlain by silt and stones. There was no clear evidence of any original covering over the drain, although its design was similar to that a bricklined channel found just outside the southern boundary of the site in 1991, which had a capping of quarry tiles.

Since the drain cut the fill of the kiln it almost certainly post-dates the end of use of the kiln, and might be related to the agricultural use of the structure.

In general, as a result of the excavations undertaken in Area 6, it appears most likely that the coal dust has been deposited on top of the concrete surface which was probably the latest substantial ground surface related to the use of the site as an ironworks. It is possible, however, that beneath it evidence of

earlier activity could be found, possibly including earlier tramways.

Area 1: The Charging Structure

Between Area 6 and the blast furnace lies the charging structure. Its principle function was to carry a bridge, the charging ramp, from the charging bank (Area 6) to the top of the blast furnace. The bridge would generally have been roofed to form a charging house in which limited quantities of materials for use in the furnace could be stockpiled. The space beneath the bridge could be used for a variety of functions.

The charging structure at Cefn Cribwr was large in comparison with many other sites, with dimensions of 12.15m north-south by 7.20m east-west. Prior to the 1992 excavations, work in this area had been confined to partial clearance of vegetation and consolidation of the exposed stonework. The consolidation work had involved a small amount of excavation adjacent to the south wall and part of the west wall. The work near the west wall revealed the arched top of a small brick-built fireplace. It was unfortunately destroyed by vandals before it could be fully recorded. During the course of the excavation, the highest part of the east wall of the building was found to be in a dangerous condition. it was therefore recorded prior to being dismantled and rebuilt by the stonemasons.

At the time the 1992 excavations began, parts of the side walls were visible but there was no visible evidence of any internal divisions. The bridge carrying the charging ramp had not survived.

Excavation of the charging structure showed that, below the level of the bridge, the building was divided into four rooms running across its width, with a further room on each of the two floors below the northernmost room.

The southernmost internal division formed a room with internal dimensions of 5.85m east-west by 2.44m north-south. Its southern wall was the south wall of the charging structure and acted as a retaining wall for the charging bank to the south. Much of it still retained its render of lime plaster with traces of whitewash. The west wall had clearly been altered at some time in its history. In the north-west corner of the room 400mm of the west wall was built of stone and was 1m thick. To the south of this the wall was much narrower, at 520mm. The lower part of this thinner section was built of stone towards the north, but the upper and more southerly part was of brick. This terminated 1.32m south of the corner to form the reveal of a doorway. The doorway opening was 1.10m wide, the southern side of it being part of the original south wall. It had however been narrowed subsequently by the construction of 190mm wide brickwork against it. This brickwork had collapsed northwards to fill the lower part of the doorway but its original position was obvious. The nature of the brickwork indicated that it was almost certainly contemporary with that forming the northern side of the doorway. The width of the doorway prior to its partial collapse would have been 930mm.

This doorway had clearly been constructed by means of the partial blocking of an existing opening, represented by the end of the wider section of wall to the north and the end of the south wall. A small surviving segment of arch on the south wall indicated that the opening would have had an arched top. The earlier opening would have been 2.04m wide. The construction of the blocking wall, comprising stone at the bottom and brick above and to the south of it, might indicate that the blocking was of two phases.

The east wall of the room was formed by part of the main eastern stone-built wall of the charging structure on which traces of plaster survived. There was, however, a brick-built fireplace (141) set into a gap in the stonework of the wall 880mm wide. There were no obvious quoins in the northern edge of this opening

but the southern edge contained a number of large stones which were more clearly intended to serve as quoins.

The top of the fireplace was formed by an L-shaped iron lintel, or bressummer, 970mm long, the ends of which were set into the stonework. It supported two courses of bricks set on edge. The brick or stonework above this level had not survived. The base of the lintel was 1.10m above the level of the floor. The fireplace, which was recessed 300mm from the face of the wall, had a brick-paved floor and a back wall which was also of brick and survived to a maximum height of 750mm. In front of the fireplace there was a rectangular area of cracked flagstones showing signs of scorching, the width of the fireplace and extending out from it 400mm, clearly the remains of a hearth.

The stonework of the east wall behind the back of the fireplace had not survived, making it impossible to judge whether the opening occupied by the hearth was one cut into the wall specifically for the fireplace, or whether it occupied a pre-existing opening such as a window.

The floor of this room was composed largely of concrete but with several patches of irregularly laid brickwork. The north wall, which appeared to be a later insertion into an earlier structure represented by the outer walls of the charging structure, was built of stone rubble and survived to a height of almost 2m. It contained an 840mm wide doorway, 800mm from its eastern end, which allowed access to the room to the north. The wall also contained a small niche just to the west of the doorway.

The fill of this room consisted of soil containing a large quantity of stone rubble as well as bricks and tree roots. Tramway sleeper blocks were also found amongst its fill.

The room immediately to the north of this (127) measured 2.30m north-south and had a maximum length of 5.91m. Its floor was largely composed of concrete and patches of brickwork and quarry tiles. Towards the western end of the room the floor was paved

with flagstones, many of which were cracked. Along its northern edge the floor dipped slightly to form a shallow gully. This floor was overlain towards its western end by two areas of evenly laid brick paving. The paving appeared to be the remains of a floor surface which had once entirely covered the earlier floor surface beneath it. The rest of this later surface had apparently been removed deliberately, probably when the works closed.

The threshold of the doorway from the room to the south was marked by stone flagging which was raised a little above the general level of the main areas of surviving floor in the two rooms. This also implied that they had probably been covered by a later floor surface.

The western end of the second room appeared, like the first, to have been formed by the blocking of an earlier opening. The opening had been blocked with stonework which, being thinner than the existing wall, had created an alcove into which the stone flagging of the floor extended. This alcove was 520mm deep and 940mm wide. To the south of it a small fireplace had been built into the thickness of the wall. It was some 700mm wide and built of brick. The brick arch forming the top of the fireplace had been found in situ by the stonemasons, some months before the excavation, but had been destroyed by vandals before it could be recorded. The floor, sides and back of the fireplace all displayed evidence of scorching.

At the eastern wall of the room there was an opening (129). This was 1.90m wide at the west face of the wall but narrowed as it went in. Its base was 200mm above the general level of the floor. There was no evidence to suggest that this had been a second fireplace. The east face of the wall was missing, but the surviving depth of the opening suggested that originally it had passed right through the wall. There was no visible evidence on the outer face of the wall of any means of access to it. It therefore appears most likely that it had been a large window.

The walls of the room showed traces of plaster and whitewash. The room's northern wall was very similar in construction and material to the southern wall and would seem likely to be contemporary with it. They both appeared to post-date the main outer structure.

The room was filled with soil and rubble composed mostly of stone but also containing some brick. The fill included a number of tramway sleeper blocks. Part of the fill consisted of the remains of the north wall, the upper part of which which had collapsed southwards. It had mostly fallen in one piece to produce a gentle curve which gave the impression of forming a carefully constructed archway or barrel vault. For a wall to collapse in this fashion is quite unusual. It has been shown elsewhere (Wilkinson 1981) that this type of feature can occur where a wall has fallen against trees or bushes which have then gradually bent under the weight to allow the wall to fall slowly and gently. There was some evidence of tree or bush roots beneath the wall which might support this hypothesis. The surviving remains of this wall indicated that its original height had been in excess of 4m.

To the north of this room there was a third room (128). It was of similar dimensions to the other two measuring 5.40m by 2.68m. There was no direct access to it from the room to its south. The only surviving evidence of access was a doorway in the western wall. This was 1.40m wide, had a shallow pointed arch and clearly appeared to be an original feature of the outer structure.

Much of the eastern wall was faced with brickwork. This was found to be only one brick thick. Behind it was a void was filled with soil and mixed rubble. This was removed showing that the sides and base of the void, which was at approximately the same height as the level of the floor of the room, were scorched. It would appear likely, therefore, that this was a blocked up fireplace. For reasons of safety, after rapid recording, this

feature was filled with new corework, preserving the brick blocking in situ.

The floor of the room was mostly composed of concrete which was cracked and patchy, particularly towards the centre of the room. Where the concrete was missing there was stone rubble. Adjacent to the northern perimeter of the room, an area of the floor 900mm wide was generally in a better condition than the rest of it. The boundary of this area was marked by long cracks where the level of the rest of the floor had dropped by more than 100mm. It appeared that the higher part had been supported by the wall which was found to lie beneath it, whilst the rest of the floor had dropped as a result of subsidence. At the eastern end of the room the concrete floor was overlain by a thin layer of soil and stones on top of which a brick floor had been laid. This too showed evidence of having slumped, but it appeared that some subsidence had occurred prior to the floor's construction.

The subsidence of the floor of this room appeared to be related to a number of other features which were recorded during the course of the excavation. A crack was found to run north-south across the middle of the floor of this room. There were also cracks on approximately the same line in the wall below the northern edge of the floor (the south wall of room 135), the two internal partition walls already described, and in the southern wall of the charging structure. It was also noted that the east wall of the structure was leaning outwards, and this had caused a gap to develop between it and the partition walls and floors. This evidence suggested that the movement of the east wall had caused the movement, cracking and settling of the rest of the eastern half of the building. It was initially assumed that this movement had occurred after the site had ceased to operate as an ironworks. The evidence of the brick floor would seem to indicate, however, that some of the movement occurred before the floor was laid, implying that the building was still in use. If the site was still an ironworks at this point, the movement of

the building could have been a contributory factor in the decision to cease operations.

The northern boundary of room 128 was marked by stonework which sloped towards the north and formed the springer for a vault. There was no evidence of a wall in situ on this line. However, masonry which appeared to have been derived from a wall was found in the fill of the room. The on angle of repose of this stonework suggested that it had fallen from some distance above floor-level. It is likely, therefore, that the northern wall of the room had been constructed on top of the lower courses of the vault.

A small part of the south-eastern corner of the vault survived in situ, the rest having collapsed. It was built of stone and had formed the ceiling of a room (135) which lay to the the north of room 128 and one storey lower. The north wall of the room was formed by the south face of the blast furnace. Slight indentations in the east and west walls of the room indicated the line of the vault. No evidence of the springer, which must have existed in the face of the furnace, had been found when its face was restored prior to the excavation. It appears that the section of face which had fallen away had probably done so as the vault collapsed beneath it. The base of a large alcove which survives in the upper part of the furnace face would have been at approximately the same level as the upper face of the vault. This implies that the vault probably supported the floor of a room above it.

Room 135 was 5.30m long, east-west, and 2.60m wide. To the level of the base of the vault it was filled with an averages of 3.5m depth of fill. Rubble apparently derived from the vault was found in this fill, generally occurring closer to the centre of the room towards the bottom. This implies that the vault collapsed from the middle outwards towards the ends over a period of time. Some of this material was found within a fan of red, heat-fractured stone fragments and dust which appeared to have

fallen out of the back of the furnace. It appeared that this had been part of the core of the furnace and had fallen out as the stone facing, along with the vault, gave way.

Large sections of masonry from the vault were found around the edges of a large hole in the middle of the floor of the room. It is likely that the floor of the room gave way under the impact of the vault and parts of the furnace falling onto it. This floor was itself supported on a stone vault which formed the ceiling of another room below it. The vault was quite shallow, possibly as a result of settling, and was overlain by a small amount of levelling material. The floor to the east of the hole showed some evidence of much-decayed wood as well a quantity of coal-dust.

In the south-eastern corner of the room the was a stone-built platform or plinth. it was 720mm high and almost exactly 1m square. There was no obvious evidence of its function.

There were openings in both of the end walls, adjacent to the face of the furnace, That in the eastern wall was only 460mm wide and was topped by a double arch. There was no evidence of any means of access to this opening on the outside. It might, therefore, have served as a large window, rather than as a doorway.

In the western wall of the room, the remains of a double arch of a similar size, and at a similar level to that in the eastern wall were observed. It was clear, however, that the opening beneath it had been partly blocked and a new opening made a little lower down the wall. This was 1.26m wide and its base was some 250mm below the top of the vault supporting the floor of the room. There was no evidence of a step constructed to allow easier access. The arches of this opening, the one it replaced and the one in the east wall, were all supported on very shallow springers in the face of the furnace. The arch of the eastern opening had been displaced by the outward movement of the east

wall. The east and west walls of the structure met the furnace at a straight butt joint, with no evidence that they had bonded in.

A number of the cooling vents of the furnace opened into this room from the face of the furnace which formed the room's north wall. Much of the face of the furnace was in a perilous condition and required urgent attention from the stonemasons.

The room's south wall, a small part of which had collapsed apparently as a result of the cracking caused by the movement of the building, contained a small rectangular hole. This appeared to be a weep-hole to drain water from behind the wall. It appeared that this wall probably retained fill deposited around the rock outcrop on which the charging structure was constructed.

Removal of debris from around the furnace prior the main programme of excavations had, on the eastern side of the charging structure, exposed the remains of an arched entrance to a room below the one just described. Subsequent removal of debris to the west of the structure, showed that there was a similar opening on that side. When the room above it was excavated, it was possible to see into this lower room through the hole in the floor. It was not completely filled with debris but clearly contained a considerable depth of fill, much of which had fallen through the hole in the vault.

Removal of the top of the fill of this room, to allow consolidation of the stone facing of the furnace, uncovered the top of a well-constructed archway in the face of the furnace. It is likely that this was the top of a blowing arch, implying that the furnace was blown from three sides. This would seem to confirm the hypothesis that the openings at each end of this room allowed the blowing pipes from the engine house to pass behind the furnace so that it could be blown from the south and from the west sides in addition to the east side.

In the course of the excavation of the charging structure no conclusive proof was found of the method by which the top of it was bridged to carry the charging ramp. The presence of springers for arches on the southern wall of the structure and the top of the southern face of the furnace would suggest that it was by means of arches. The spacing of the internal partition walls would have been suitable for supporting arches, and there is clear evidence that arched vaults were used elsewhere in the building. These walls were not bonded into the side walls, and appeared to be later. They were also a little thin for arch supports although probably not impossibly so, given their fairly close spacing. There was, however, no clear evidence of any material which might have been derived from collapsed vaults in the material filling the structure, although sleeper blocks from the tramway were found.

It is possible that what had originally been an arched bridge was replaced by one of a different construction, perhaps of iron or timber, in the latter days of the ironworks. This might have been removed following the closure of the ironworks and the sleeper blocks discarded in the rooms below.

If at some time there was an arched bridge utilising the springers noted above, the level of its upper service would have been rather higher than the earlier of the charging platforms on the furnace (see below).

Area 12: The Blast Furnace

Although monitoring, and some recording, of the clearance works carried out by Re-Struct Ltd took place, Excavation of the blast furnace was confined to the top of the structure. Clearance of the vegetation and topsoil revealed a number of features.

Although the upper courses were missing, the brick lining of the furnace survived in remarkably good condition. Behind it was core-work mostly comprised of loose stone, but with a few furnace

bricks. This was surrounded by a circular wall (400) faced with dressed stone which had been scorched red by the effects of heating. On the northern side of the furnace this wall had corework built up against its face. This suggested that it had been covered in the later life of the furnace. Towards the south-west, traces of stone flagging projected from this wall giving the impression of a platform at this level. It was noted that this was at approximately the same height as the ledges on the inner faces of the side walls of the charging structure and also on its south wall.

The apparent platform was overlain on its southern side by a 1m thick deposit of stone, mortar and soil. On top of this was a thin layer of soil and coal dust. On this were laid the remains of a thick-tiled surface (389). To the south-west of the tiles there was a stone sleeper block. The stonemasons had earlier found a matching sleeper block to the south-east, but this had been removed by vandals before it could be recorded. It was quite clear that this surface had been the charging platform of the furnace and had been served by the tramway which had been recorded adjacent to the calcining kilns. No evidence of the top of the furnace above this level had survived.

Although this appeared to have been the latest charging platform of the furnace, it appeared from the evidence of a possible platform lower down that an earlier charging platform might survive beneath it. The material of which the later platform was composed was unstable and unsuitable for consolidation. As a result of this, and following consultations with Cadw: Welsh Historic Monuments, the platform was removed and the structures underneath were examined.

Beneath the stone, mortar and soil over which the platform had been built, there was a hard surface composed of stone rubble and mortar. This was at the same level as the traces of stone flagging noted above. All of the surface might originally have been flagged. The wall faced with dressed stone which is also

noted above (400) was found to extend under the later platform. There was a gap in it which measured 2.01m wide at its outer, southern, face and narrowed to 1.68m at its inner face. The stones of the terminals of the wall each side of the opening were carefully cut and dressed to fit. The surface of the platform extended into the opening.

The evidence found in the excavation of this platform suggested that it was a charging platform which clearly pre-dated the one above it. The remains of the opening in the wall would have been the doorway through which the furnace was charged. This access to the furnace was found to have been blocked by the core-work and brick lining of the furnace. This indicates that the raising of the level of the platform coincided with a major remodelling of the top of the furnace.

On top of the earlier platform there was a stone structure the purpose of which was not immediately apparent. It was a rectangular mound of mortared stone rubble, 125mm wide at its base and narrowing towards its top. It was approximately 520mm high and was aligned east-west, It lay about 500mm to the south of the charging doorway and its western end was 550mm to the east of the line of the western edge of the doorway.

Since this feature wouldnot only have blocked clear access to the charging doorway but also overlies the platform, it would appear most likely to have been built after the doorway went out of use. It has no obvious function in relation to the use of the furnace. It might, therefore be related to some use of the site between the decommissioning of the furnace and its refurbishment. If it had spanned the whole width of the platform it might be argued that it was constructed to provide a firm foundation for the later charging platform. This was not the case, however, and there was no evidence to suggest that part of it might have been removed. It is possible, of course, that it was a temporary structure, involved in the refurbishment of the furnace, which

was left in place when the new charging platform was built; perhaps the base of a crane.

Details of the furnace which were exposed by the stonemasons were recorded. These included a number of vents which survived as spaces in the core-work. There were also larger vertical flues which were found to run through the core in three of the corners of the furnace. In the south-eastern corner, considerable collapse and reconstruction had occurred and no flue could be seen. Square flues which vented the top of the tapping arch and the eastern blowing arch were also found.

Although no excavation was carried out in the tapping arch, the need for the structural engineers to assess its stability required the digging of a small trench just in front of the face of the furnace at the eastern edge of the arch. This showed that the face of the furnace at this point had been subjected to severe heat cracking. Some of the stonework appeared to have fallen away, or to have been removed, and had been replaced by brickwork. This too had been severely cracked by heat. It is possible that this scorching had been caused by very hot material being piled up against the wall; perhaps this area was used as a temporary repository for slag as it was tapped from the furnace.

Area 2: To the West of the Charging Structure

The area immediately to the west of the upper part of the charging structure was excavated and recorded. It was covered with a mixture of soil, stone and brick rubble, other debris and vegetation. The depth of deposits varied from 200mm to 1m. Beneath this overburden was a layer of compact soil and mortar with a small number of flagstones overlying it. This was interpreted as being the last working ground level before the site went out of use. It is likely that it was originally all flagged, or surfaced in some other way, and that this surfacing material was removed at the time the site was abandoned or subsequently.

Area 3: The Blowing Engine House

The blowing engine house had not been included in the main programme of excavation for 1992. However savings of time elsewhere in the programme allowed it to be excavated partially. Documentary sources indicate that the blowing engine was a steam engine of Boulton and Watt type and was install in about 1824. It is likely, therefore, that the present engine house was constructed at the same time. Most of the western half of the north wall is missing. It is likely that it was demolished to allow the removal of the engine after the works closed around 1836.

The engine house was clearly divided into two halves by a thick wall which appeared to have a doorway in the middle allowing access between the two halves. The building was filled with soil and debris to approximately the same level as the surrounding ground surface. This was a little higher than the base of the doorway in the building's east wall. The debris contained a large amount of stone including a number of very large dressed stone lintels which had clearly fallen from their positions over openings in the walls. One appeared to have fallen only a short distance from the top of the apparent doorway in the central dividing wall.

Removal of the debris revealed a large square flat-topped stone in the middle of the eastern half of the building, the top of which was at the same level as the threshold of the doorway in the east wall. The stone had four round holes through it near its corners. As the stone weathered, marks composed of iron oxide appeared on its surface in the form of a circle which joined the four holes and other marks around them. This appeared to indicate where a round iron object had stood. Comparison with engine houses elsewhere such as Moira Engine House in Leicestershire, suggested that this stone had been the base for the main cylinder of the engine which would have been secured by bolts through the holes in the stone. If this was the case, the

drive rods from the beam would have descended in the middle of the western half of the building, and the central dividing wall would have served as the bob-wall, supporting the fulcrum of the beam.

The stone for the cylinder was found to be supported on a stone-built pier which crossed the building from north to south. Each side of it were deep wells, whose floors could not be uncovered because of severe waterlogging. It is likely that these served as the wells in which the condenser and air-pump would have been located. The long sides of the western well had narrow ledges along them in which holes had been cut adjacent to the opening through the bob-wall, perhaps for the bolts for the condenser and air-pump mountings. This opening was found not to be a doorway. Its base was not a flat threshold but consisted of an inverted arch (Plate 9). This had been partly blocked at its western side with brickwork.

In the eastern well an opening with an arched top was observed low down in the east wall, directly below the doorway noted above. This was completely underwater and could not be fully recorded in the time available. There was also a smaller opening in this wall, just below the level of the doorway, adjacent to the north-east corner of the building. There was a corresponding opening, directly opposite it, in the central pier, and another one at the same level in the north wall adjacent to the north-west corner of the western well. It is possible that these openings carried the pipes from a boiler house, probably located to the north-east of the engine house. A second opening running through the central pier, low down at its southern end, could not be fully investigated as it was underwater.

There was clear evidence that the wells had originally been floored over at the level of the doorway in the east wall and the top of the cylinder mounting block. Beam sockets in the east wall and the bob-wall, and grooves in the central pier either side of the cylinder mounting block, indicated the positions of

two beams running east-west. Over these had been set joists which were held in sockets in the north and south walls. Some of the joist sockets had been reduced in size by the insertion of bricks. Floor boards would presumably have been laid on top of the joists.

Whereas the western well was largely filled with stone, bricks and decayed mortar, the western well was filled with a uniform deposit of small stone fragments, shale fragments, and mixed clay and silt. This was clearly deliberate infilling and appeared most likely to consist of mining waste. It is most likely to have been derived from the drift mine or mines which lay adjacent to the engine house in the early part of the 20th century.

The upper part of the fill of the western half of the engine house was removed down to a point at which flat stonework was found in the central area of the room. It was found that the wide brick archway, which had been visible in the west wall, formed the top of a wide opening which extended downwards for some distance. It had been blocked with two phases of walling. The lower part was mortared whilst the upper part was of drystone walling. Before it was blocked up, this opening would appear to have served to accommodate the pipes from the blowing cylinders which were probably located in this half of the building. The pipes would have passed through the opening and one would then have turned to the north to serve the eastern tuyere, whilst others would have continued through the lower room of the charging structure to serve the southern and western tuyeres.

Available time and resources did not allow full recording of all the structural features exposed in the course of this work, but none is under threat of damage, alteration or concealment in the foreseeable future.

Trial Trenches

Following consultations with Cadw: Welsh Historic Monuments, a limited amount of trial excavation by means of machine-dug trenches was undertaken. The purpose of these was to gather information on the nature and condition of buried remains on the site and the depth and nature of overlying deposits, so that informed decisions could be made on future excavation and conservation strategies for the site.

Trial Trench A

This ran east-west from across Area 9, from a little to the west of the mid-point of the west wall of the casting house. Throughout most of the length of the trench, it cut through debris and topsoil up to 500mm thick, below which was natural sand and gravel. Towards the casting house this was cut through by the sloping edge of what appeared to be a pit in which the casting house had been built. The cut was filled with soil and mixed debris.

Trial Trench B

This trench ran across the width of the casting house approximately a third of the way along its length from the furnace. It showed that this part of the casting house was filled with a depth of about 1m of mixed soil, stone and brick rubble, slab and other debris. Beneath this were found deposits of casting sand and evidence of lines of brickwork, which might be the edges of casting pits.

Trial Trench C

This trench ran from the mid point of the north wall of the eastern half of the engine house, northwards across Areas 7 and 8. It was found that over most of its length the overburden,

composed of soil, rubble and other debris, was less than 300mm deep. Beneath this, a number of stone and brick walls was found as well as a brick-lined drain. Towards the southern end of the trench, the overlying deposits deepened and there was clear evidence of the sloping edge of a large pit in which the engine house appears to have been constructed.

Trial Trench D

This ran north-south to the west of the blast furnace and was dug prior to mechanical grading work in that part of the site. Its main purpose was to establish the presence or absence at this location of evidence of the foundations of a second furnace which documentary sources suggest might have existed on the site (Riden 1992a, 1992b). Below the topsoil and rubble, only sands and gravels subsoil, and bedrock were found.

The Adits

There is evidence from cartographic sources, and from information from local residents, that there was at least one adit, open in the early years of this century, to the south of the engine house. Three possible adits were visible in the rock outcrop in this location. These consisted of wide gullies running directly towards the base of the outcrop, with banks each side of them faced with drystone walling. The gullies were largely filled with soil, rubble, and other debris. Some of the fill of the easternmost gully was removed and it was shown that no adit was present. Part of the fill of the middle gully was also removed. This showed that the drystone walling lining its sides continued down for some distance.

Further clearance of these features will require advice on safety to be sought from the British Coal Corporation.

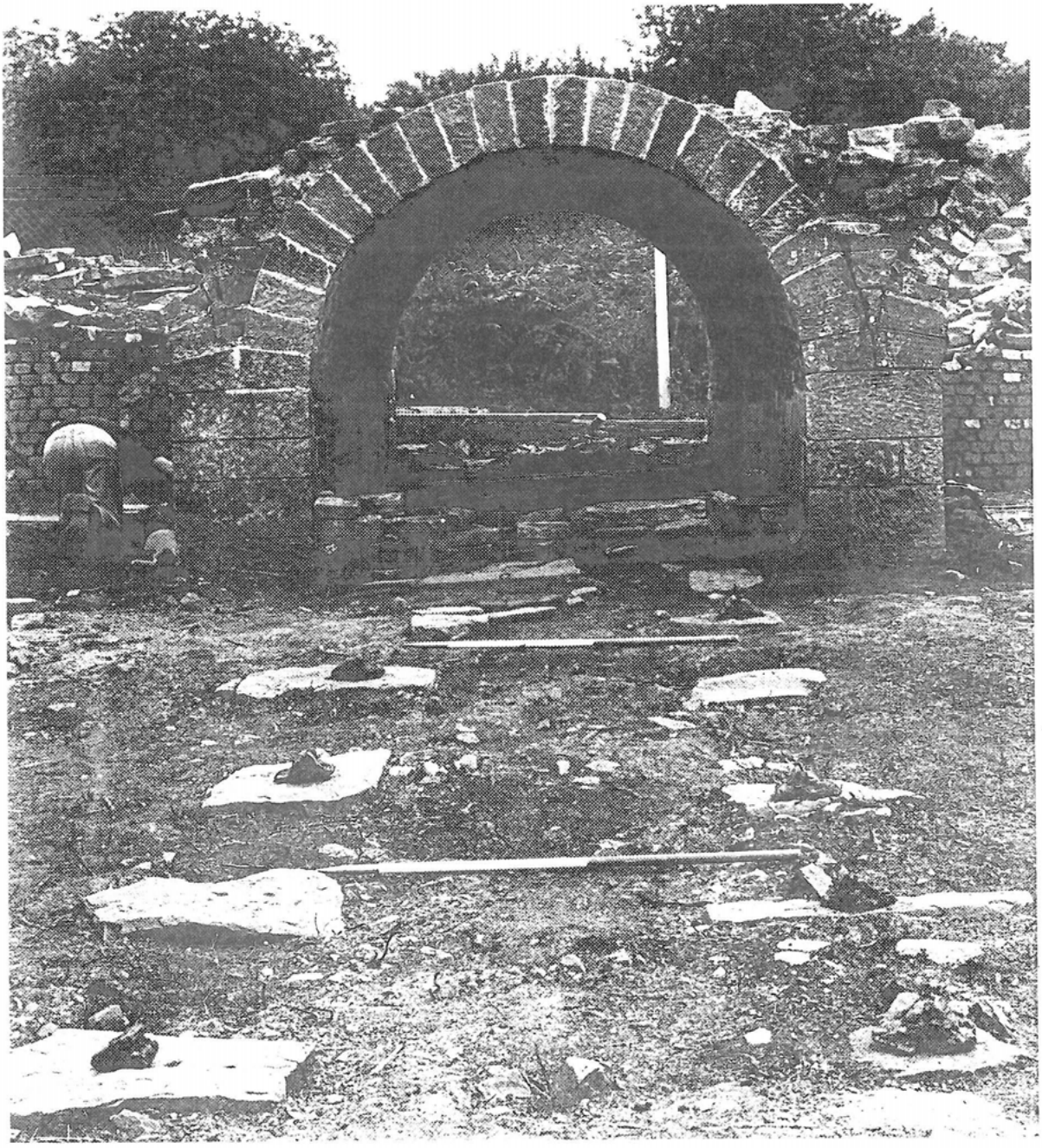

Plate 1: Tramway and passageway, from the north.

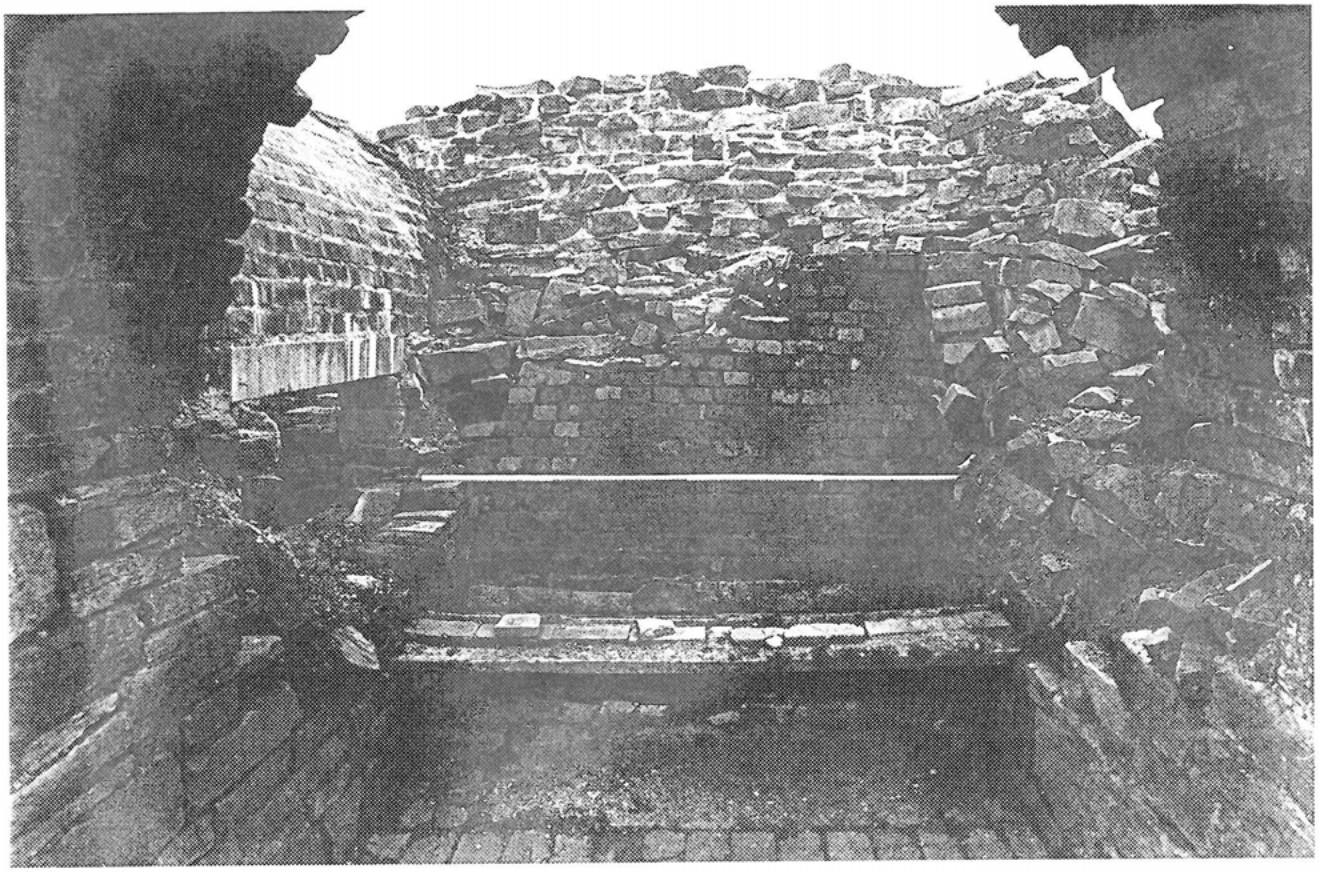

Plate 2: The western calcining kiln from the north.

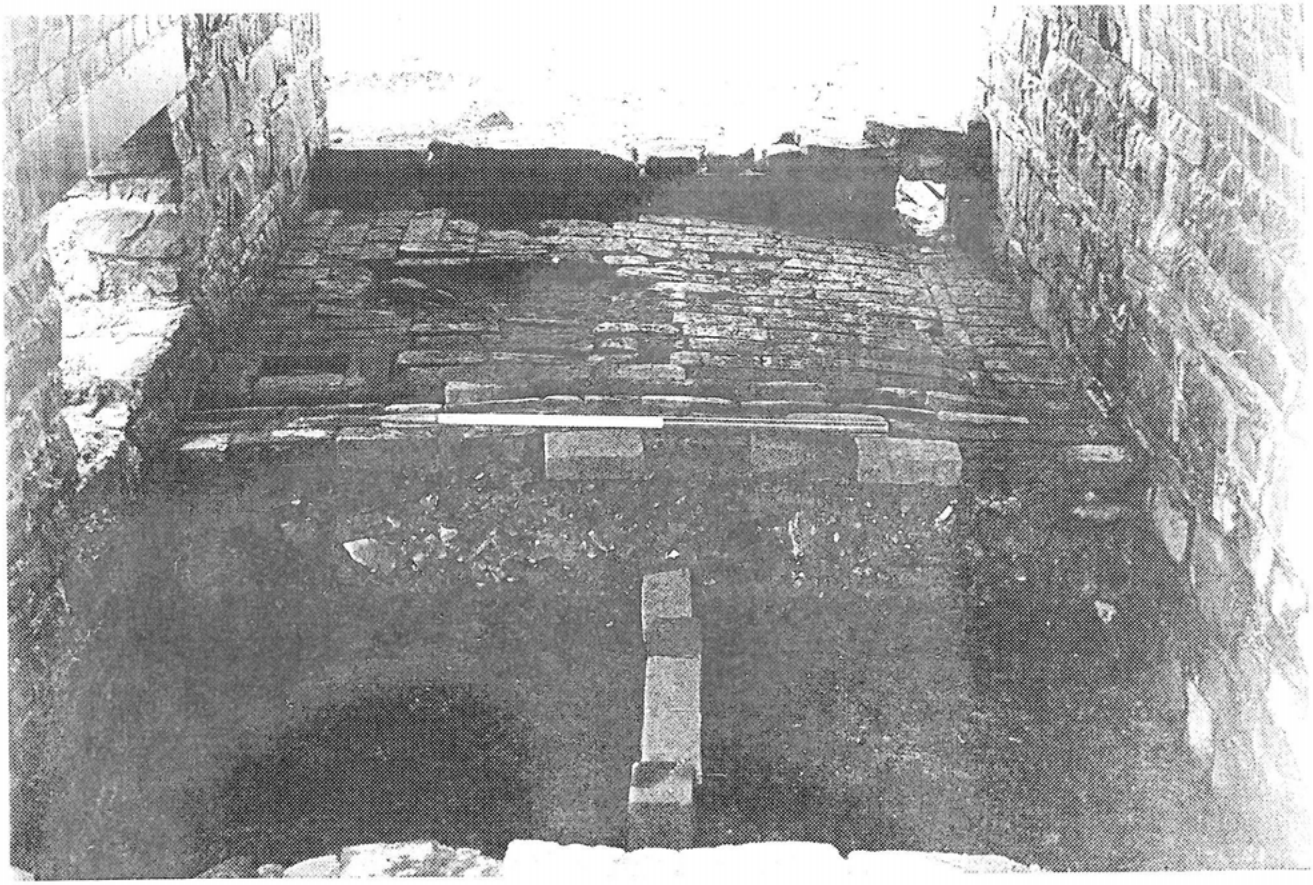

Plate 3: Section through floor of central passageway showing underlying drain, from the south.

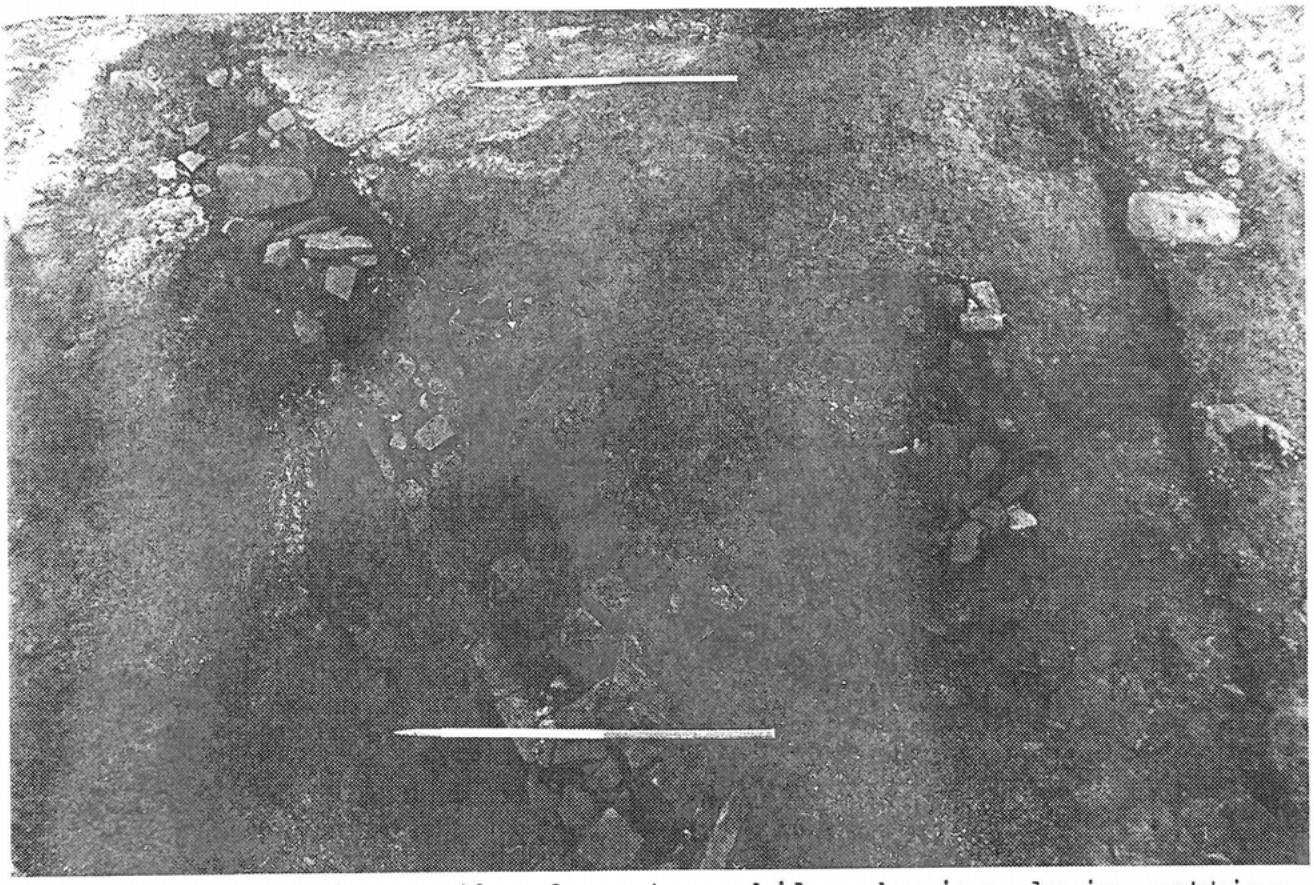

Plate 4: Area to north of western kiln showing drain cutting outline of pit in concrete surface.

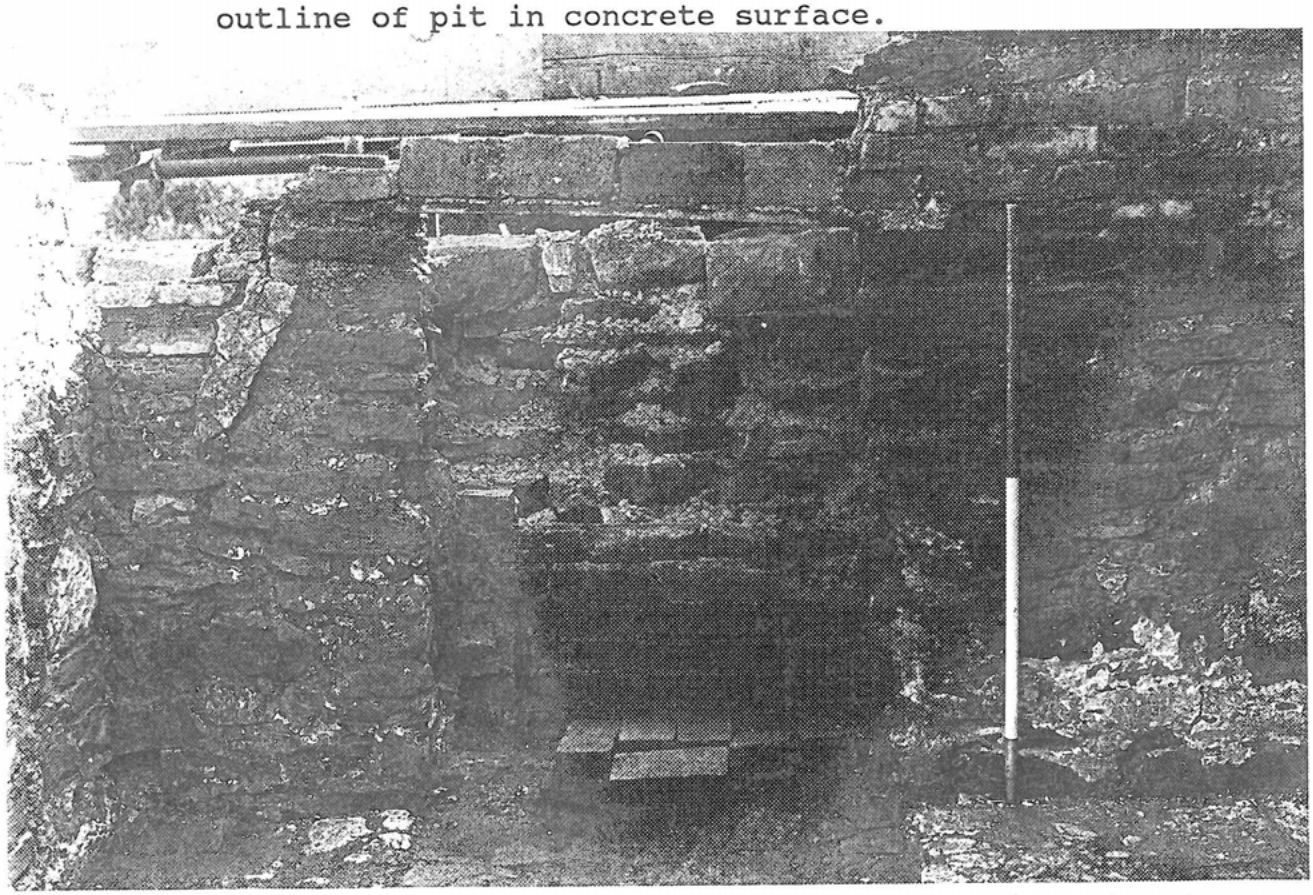

Plate 5: Fireplace in southernmost room of charging structure, from the west.

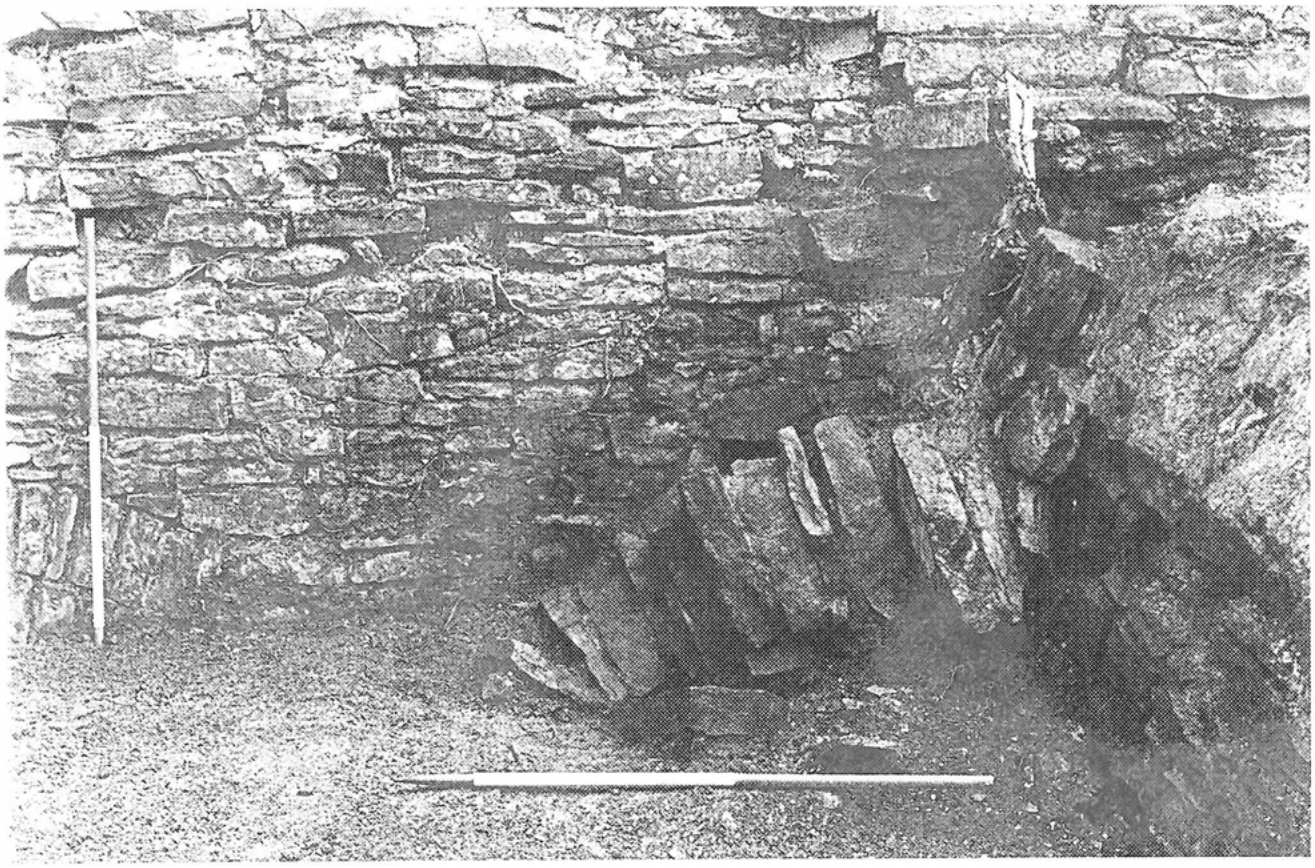

Plate 6: Part of collapsed vault of room 135 in charging structure, from the west.

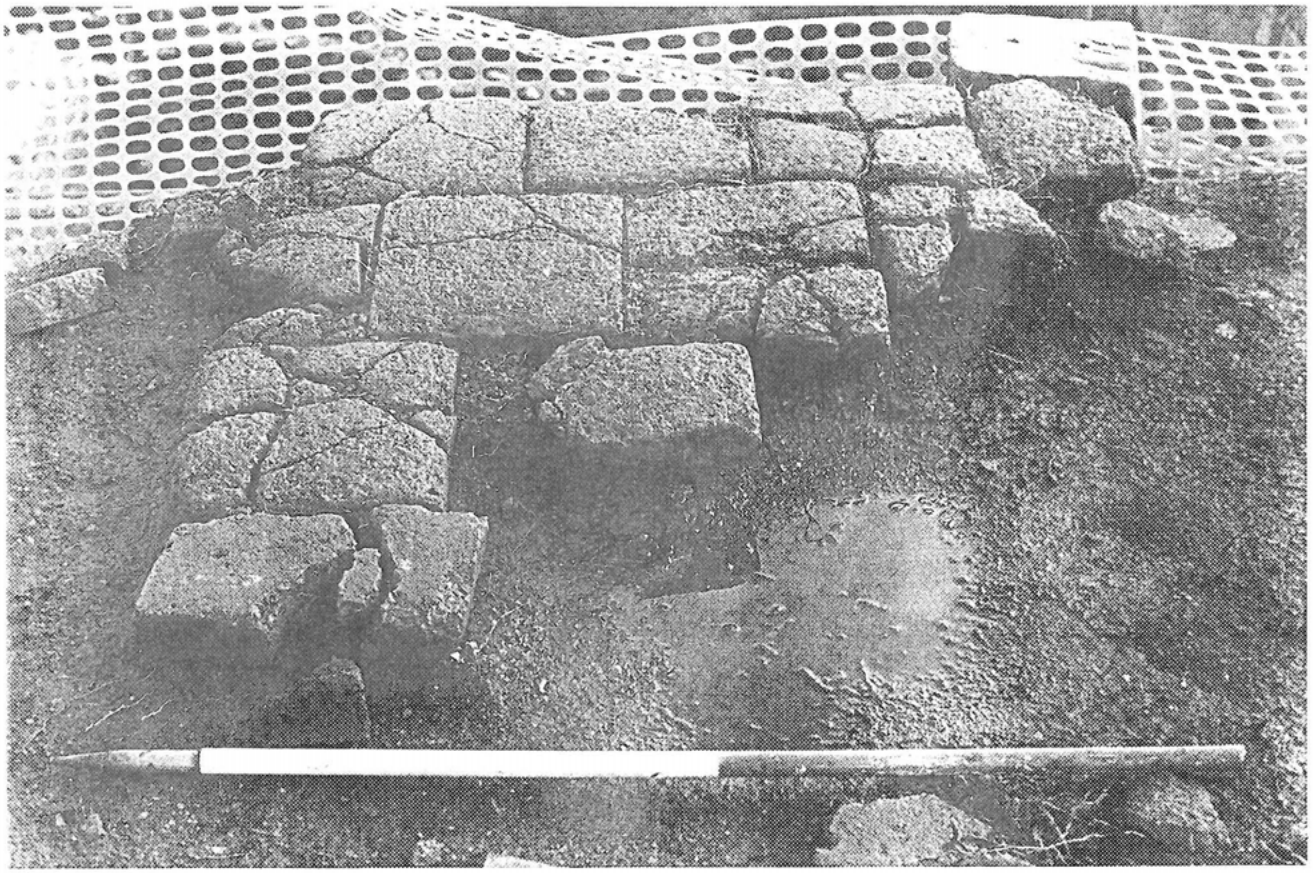

Plate 7: Surface of later charging platform, from the north.

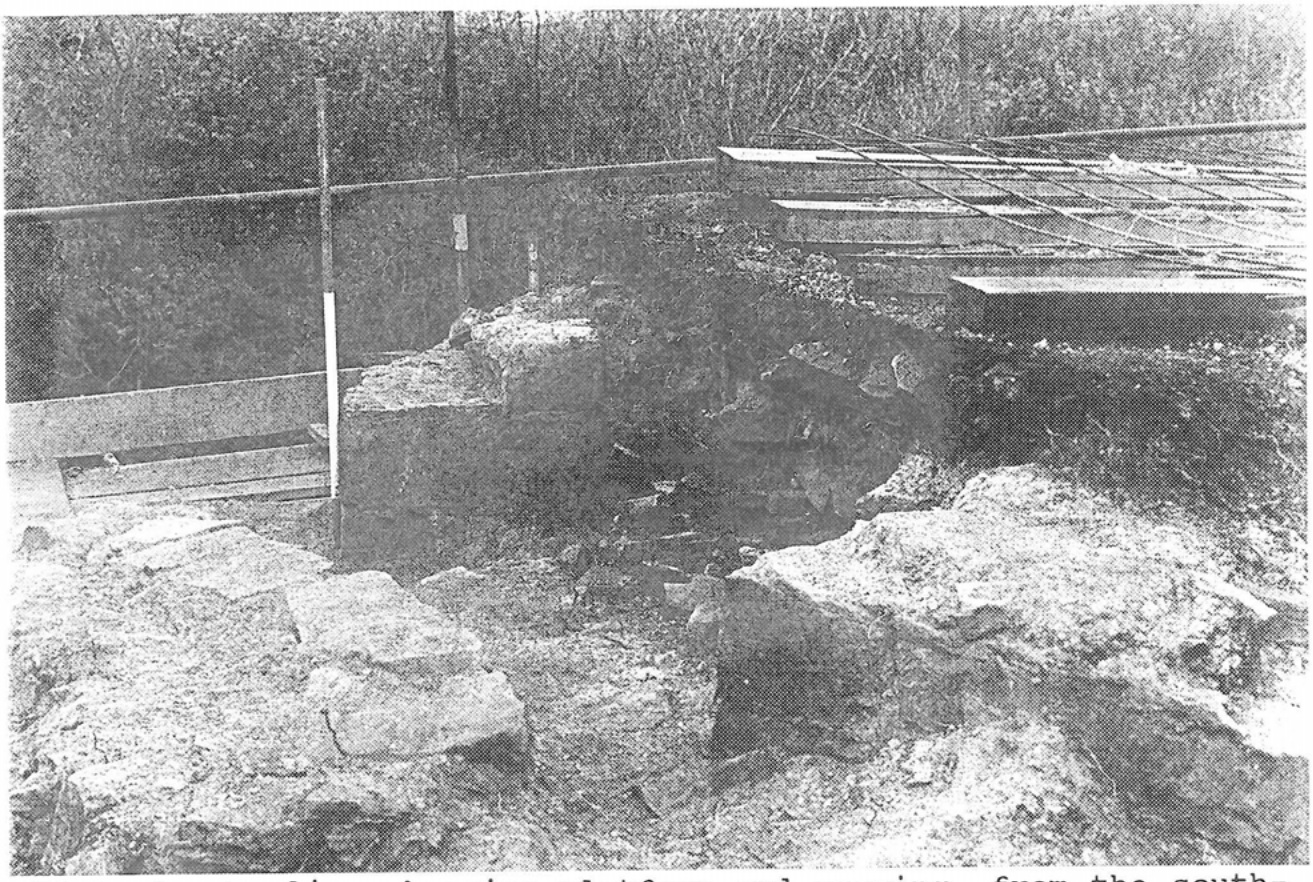

Plate 8: Earlier charging platform and opening, from the south-east.

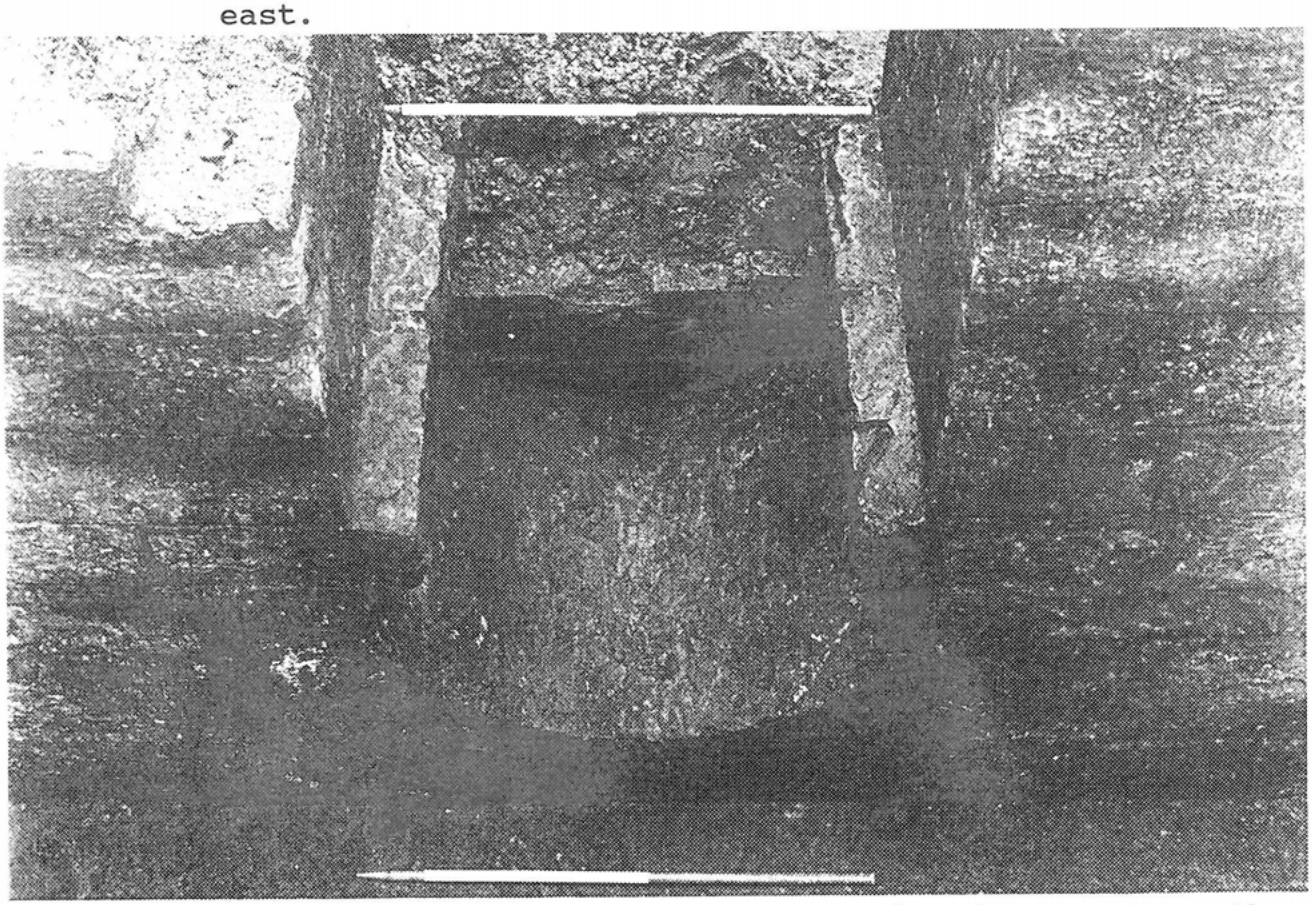

Plate 9: Inverted arch in bob-wall of engine house, from the east.

3. The Finds

by Joyce Compton and Steve Sell

Material from 23 contexts was submitted for examination. All of the finds occurred in contexts composed of material which had probably been redeposited from elsewhere. Most of the finds might therefore be regarded as unstratified, and cannot be dated, with any certainty, to any period earlier than the early or mid 19th century. The finds can be divided into ferrous and non-ferrous materials, of which the ferrous forms the major component.

a) Ferrous

Most of the ironwork from Cefn Cribwr, where identifiable, appears to be parts of machinery or tools, together with sections of rail, fire bars, etc and a lesser number of ironwork products, for example wrought iron gate fittings etc. These are summarised below by context; a detailed inventory may be found in the site archive.

CONTEXT	NUMBER OF OBJECTS	WEIGHT (Kg)
001	c44	57.663
002	c8	0.296
011	3	0.247
027	c19	13.863
046	c6	1.030
055	4	8.815
056	1	0.260
081	9	0.230
094	c9	3.145
095	12	1.770
097	6	0.382
098	c5	3.054

176	1	0.082
191	5	1.276
193	5	0.920
318	4	3.373
324	19	126.895
338	1	15.000
388	1	0.510
597	1	1.050
601	1	11.500
602	1	2.325
Total		253.686

b) Non-Ferrous

Much smaller quantities of other material were recovered from the same contexts. Context 337 was alone in producing no ironwork.

1. Bottle Glass

125 sherds of bottle glass were noted in 9 contexts, totalling 2.414 kg. Types included beer bottles and a cylindrical wine bottle of possibly 19th century date, but most were for mineral water - several Codd's and one Hamilton Bowler were identified. Marks noted were "Briton Ferry", "Bridgend" and "Pontyclown" (sic).

2. Modern Ceramics

Ten contexts produced a variety of earthenware types, including teapot fragments, mocha ware, blue transfer-printed wares, and one fragment of stoneware inkwell. The 42 sherds weighed 0.342 kg.

3. Local Red Earthenwares

Local Red Earthenwares appeared in only six contexts. These could belong equally to the 19th century or to an earlier period. There were 19 sherds in all, one of which was slip decorated, weighing 0.808 kg.

4. Clay Pipes

Five clay pipe bowls or fragments of bowls were noted; these dated to the early to mid Victorian period.

5. Tiles etc.

4.85 kg of brick and tile fragments were recovered, of which 2.355 kg were fire-bricks; the remainder, apart from a fragment of glazed ridge tile, were all pantiles, most of which were very similar in fabric to the fire-bricks.

6. Other Materials

Other materials included pierced slate and sandstone roof-tiles, fragments of copper alloy oil lamps, two clay marbles and a penny of Edward VII.

Industrial material was almost absent, except for a piece of calcined ore, weighing 0.73 kg, a small fragment of glass slag and a vitrified stone, probably a flux fragment.

4. Summary of Proposals for Further Excavation

A detailed set of proposals for further excavation of the ironworks is given in an appendix. A summary is, for convenience, provided here.

Area 1: Excavation of the room on the ground floor. This will need to be co-ordinated with structural works.

Area 3: Completion of excavation of the engine house. This will require use of water-pumping equipment and the prior excavation of adjacent parts of Areas 7 and 11.

Area 4: Excavation of all of the interior of the casting house. The upper 800mm of the overburden could be removed by machine under archaeological supervision.

Area 6: Excavation of what are believed to be superficial coal-dust deposits and later features to reveal underlying surface.

Areas 7 and 8: Excavation of whole area to examine buildings which are known to exist in the area.

Area 9: Excavate all of area to relieve lateral pressure on walls of casting house and to examine blowing arrangements for west side of furnace.

Area 10: Excavation of whole area to allow completion of consolidation of north wall of the casting house.

Area 11: Excavation of area around engine house, to allow examination of its setting, and of the adits.

Area 12: Excavation of the interior of the furnace and its tapping arch to allow study of smelting process.

Area 13 Clearance of vegetation and overburden from one of the possible coke ovens.

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APPENDIX

Proposals for Further Excavation

The excavation undertaken to date allows informed decisions to be made about a programme of further excavation of the site. Any further excavation should have four principle aims:

1 To enable appropriate and necessary conservation of the remains to be carried out.

2 To increase understanding of the site.

3 Through the execution of 1 and 2 above, to enhance the public's appreciation of the site.

4 To undertake the work without damaging the archaeological integrity of the site

As with previous excavation proposals, the site will be treated as a series of discrete areas. Ideally all of the areas referred to should be excavated as detailed. It would, however, be feasible to excavate only a selected number of the areas at a time. However, for logistical reasons, some groups of areas will need to be excavated in a particular order. A general principle of the excavation should be that, wherever possible, deposits should only be removed as far down as the latest structures or surfaces related to the use of the site as an ironworks.

Area 1

The greater part of Area 1, the charging structure, has now been excavated. It has not, however, been possible to excavate the lowest part, immediately to the south of the furnace, because of safety considerations. It is clearly essential both for the successful consolidation of the masonry of this part of the site, and for a more complete understanding of the blowing arrangements of the furnace, that this area should be fully excavated.

The area concerned comprises a room with an entrance at each end and the remains of a stone vaulted roof which supports the floor of the room above. The central portion of the roof is missing. Movement of the eastern wall has caused it to part company with the eastern end of the roof. There has also been a partial collapse of the masonry of the face of the furnace directly above the hole in the roof. The top of the eastern entrance to the room, and the masonry immediately above and around it, has also collapsed rendering this area potentially dangerous. At least the top, and probably all, of what is thought to be a blowing arch, opening into this room appears to be in a sound condition.

This room is almost completely filled with rubble and soil which will need to be removed archaeologically. This work cannot be undertaken until the unstable masonry in and around the room has been made safe. The work will therefore need to be planned in consultation with the Council's structural engineering advisers. It appears likely that it will be necessary to remove the top one or two metres of fill first, to allow room for the construction of formwork on which to rebuild the missing portion of the roof vault. Once this work has been completed it should be possible to excavate the rest of the fill of the room. This work should be done by hand and is likely to require the use of artificial lighting.

Full excavation of this room cannot be completed until most of the overburden in the adjacent parts of Areas 7 and 9 has been removed to allow free access through the doorways at each end of the room. The eastern doorway will require rebuilding by the stonemasons before it can safely be used.

Area 3

More than half of the engine house was excavated in 1992. It will need to be excavated fully to allow conservation of the stonework to be completed, as well as to allow it to be interpreted fully.

Excavation to date has shown that the floor of the eastern half of the engine house lies approximately 4 metres below the surrounding ground level and up to a metre below the current water table. An estimated depth of fill of one to one and a half metres has still to be removed from this half of the building. The depths involved, combined with the confined working spaces, as well as purely archaeological considerations, mean that the excavation of this part of the site will have to be done by hand. As these deposits lie below the water table there is a constant flow of water through the building. Constant pumping will, therefore, be required to allow excavation, recording and conservation to be undertaken. An arched opening exists at the base of the eastern wall. It might prove necessary to remove material from outside the building, in Area 11, to prevent slippage of this material into the building.

The western half of the engine house has been excavated to a depth of approximately 2 metres below the general level of the surrounding ground. A stone platform towards the centre of this area was encountered at this depth. It has not yet been fully examined. It is likely, however, that the floor of most of this half of the building will lie at a similar depth to that found in the eastern half. It might be possible to remove some of the fill of this part of the building by machine. The greater part of it, however, will require excavation by hand and might be expected to encounter the same problems of confined working spaces and flooding that are anticipated in the eastern half.

Two additional factors need to be considered in planning excavation work in the western half of the engine house: the height of the surrounding ground level in the three large openings which exist in the outside walls; and the stability of the stonework.

There are two openings in the northern wall of the engine house where there is some danger of slippage of soil and rubble into the building from the higher ground level outside. A small

amount of material will therefore need to be removed from just outside these openings, in Area 7, in order to avert this danger.

The opening at the western end of the southern wall, where there has been a partial collapse of the wall, presents a more serious threat because of the height and instability of the soil and rubble deposited immediately outside it. Much of this material will have to be removed before work in this part of the engine house can proceed safely.

Removal of the material in these openings is discussed under the headings of Areas 7 and 11 below.

The stability of the stonework needs to be considered in planning further excavation in the engine house. The opening at the western end of the southern wall, noted above, has been at least partly caused by the collapse of some of the stonework. The bottom of this opening has yet to be located. It is essential that the rest of this opening should be exposed to allow consolidation of the stonework. Excavating it might, however, affect the stability of the wall and the safety of those undertaking the work.

The arched opening in the western wall is largely blocked by dry-stone walling. It would clearly be advisable to remove the material behind it, in Area 7, to relieve lateral pressure on it.

It would be advisable for the last two sections of wall to be inspected by a structural engineer before further excavation takes place.

Area 4

The casting house has previously been the subject of small scale trial excavations close to the walls. In 1992 a machine-cut trial trench was dug across the width of the building to allow the general depth of overburden to be assessed.

The evidence found to date suggests that most of the floor of the casting house is covered by approximately one metre depth of overburden consisting mostly of soil with stone and brick rubble and tree roots. This overlies deposits of casting sand and evidence of what are thought to be casting pits.

To allow consolidation works on the north face of the furnace and the tapping arch to be completed, it will be necessary to excavate the area of the casting house adjacent to it. Further excavation adjacent to the side walls of the building will also be required to allow conservation of the walls to be completed.

Whilst these excavations are necessary to allow the conservation of the structures, the digging of narrow trenches all round the edges of the deposits in the building is likely to have a detrimental effect on both present and future interpretation of the remains. It would clearly be good archaeological practice for these areas to be excavated as part of an open area excavation of all of the interior of the building. Such an approach would have the benefit of increasing understanding of the site and enhancing the public's appreciation of the ironworks as a whole. By following the principle applied to excavation elsewhere on the site, that of excavating only to the level of the latest structures or deposits associated with the use of the site as an ironworks, the archaeological integrity of the site will not be adversely affected.

The uppermost 800mm of overburden could be removed most efficiently by mechanical excavator so long as it is done carefully and under archaeological supervision. the lower levels would need to be excavated by hand.

Area 6

Under the terms of the existing Scheduled Monument Consent, most of Area 6 has been excavated to what appeared to be the latest ground surface below the modern topsoil. This consists mostly of

coal dust, with some ash, brick dust and fragments of a brick-paved surface. The stone sleeper blocks of a tramway also show at this level. Excavation of the calcining kilns, which stand in the middle of this area, showed that the surface of Area 6, as excavated, lies some 300mm above the floor of the kilns. This suggested that the kilns might have gone out of use before the coal dust was deposited. Cadw; Welsh Historic Monuments therefore allowed limited parts of Area 6, adjacent to the northern side of the kilns, to be excavated to a greater depth.

This further excavation showed that the coal dust overlay an earlier surface composed of mortar or concrete. The tramway sleeper blocks appeared to be set into this surface. To the north of the westernmost calcining kiln the concrete surface had been cut by a rectangular pit which appeared to be related to the use of the kiln after the surface was laid. There was also evidence to suggest that areas of wear on this surface will indicate the routes by which people and materials moved around this part of the site.

On the basis of the available evidence it may be argued that the concrete surface, rather than the overlying coal dust and other deposits, represents the latest ground surface relating to the use of the site as an ironworks. Excavation of all of Area 6 down to the level of the concrete surface will greatly advance understanding of the nature and organisation of activity in this area.

It is, therefore, proposed that all of Area 6 should be excavated down to the concrete surface or its equivalent, and that the pits in front of the kilns should also be excavated. Excavation of any later features which cut the concrete surface is likely to provide additional information on any remains which might exist beneath the concrete.

In the north western corner of Area 6 additional material might have to be removed to relieve lateral pressure on the retaining

wall to the north of this area. A decision on this will have to be made in consultation with Ogwr Borough Council's structural engineering advisers. All of the excavation in Area 6 should be undertaken by hand.

Areas 7 and 8

A trial trench was excavated from north to south across Areas 7 and 8 in 1992. This suggested that remains of stone and brick-built structures survive beneath overburden which ranges in depth from 50mm towards the north, to 700mm towards the south. It appears that the casting house is built in a hollow about a metre below the general ground level of the rest of the site. The engine house is likewise built in a pit some considerable depth below ground level. In both cases the pits appear to extend for a distance of approximately 2-3 metres from the walls of the buildings. It appears that the depth of modern overburden between the engine house and the charging structure is well in excess of one metre.

It will be necessary to excavate areas next to the walls to allow consolidation work to take place and to relieve lateral pressure on them. It would clearly be good practice to excavate as a whole the pits within which the structures are built. Such an approach would serve the needs of both the stonemason and the archaeologist. To allow proper interpretation of these pits and their relationship to the rest of the site, it would be desirable to excavate Areas 7 and 8 as a whole.

The 1847 tithe map shows a large building attached to the east side of the casting house. The presence of the remains of such a building have been indicated by previous trial excavations. It is also a likely that the remains of a boiler house will survive to the north of the engine house. This is the likely site of a hot blast stove and/or hot blast regulator (Riden 1992), and it is likely that much other evidence of activity in the ironworks survives in this area.

There is a sound academic argument for excavating areas such as this. Whilst much of the activity relating to the use of the ironworks must have taken place in 'yard' areas such as this, there has been a marked tendency for excavations of ironworks to concentrate on the main buildings to the exclusion of the areas around them. In the case of Areas 7 and 8, it will be necessary to excavate trenches along their western and southern sides, in addition to the trial trenches excavated previously. Since it is known that most of the area is covered by a thin layer of overburden which has been much disturbed by recent tree clearance and the movement of heavy plant across it, a case can be made for the area to be fully excavated down to the latest deposits and features relating to the use of the site as an ironworks. This will allow the remains to be conserved, while allowing a fuller interpretation of the site which will enhance the public's appreciation of it without damaging its archaeological integrity.

The deeper deposits of overburden around the engine house, the charging structure and the furnace, could most efficiently be removed by mechanical excavator under archaeological supervision. The rest of the material should be excavated by hand.

A report by the Cranstone Consultancy, (Cranstone 1992), notes the presence of a clay mine shaft in Area 7. The existence of a feature of this kind in this location is improbable but care should nonetheless be taken when working in its vicinity.

Area 9

In Area 9, to the west of the furnace and casting house, it will be necessary to excavate trenches next to the face of the furnace, the walls of the charging structure and the adjacent retaining wall, to allow consolidation of the stonework to be carried out. A trench will also need to be excavated next to the western wall of the casting house to allow stonework consolidation and to relieve lateral pressure on the wall.

Trial excavations in Area 9 have suggested that, as in Areas 7 and 8, the western wall of the casting house is built at about one metre below the general level of the surrounding ground. The outer edge of this hollow lies approximately 2 metres to the west of the wall. This would seem to be an appropriate line along which to align the outer limit of the excavation.

Excavation of this area will include the western blowing arch of the furnace. Whilst it will be necessary to excavate it to enable the stonemasons to consolidate the masonry, it will also be necessary for the stonework to be made safe so that excavation can take place. The excavators and masons will therefore need to co-ordinate their work in this area.

Excavation of the southern part of Area 9 will be essential if the remaining part of Area 1 is to be excavated. The doorway into this part of the charging structure is blocked by the overburden in Area 9.

There is a possibility of further evidence of the blowing arrangements surviving in this area.

There appears to be a considerable depth of overburden towards the southern end of this area which might safely be removed by mechanical excavator. The area as a whole would then need to be dug by hand.

Area 10

The excavation of Area 10, immediately to the north of the casting house, will allow the completion of the consolidation works to the north wall. It will also prevent the ingress of overburden through the doorway onto the, apparently lower,floor of the casting house. It may be expected that the level on which the north wall is built will, as elsewhere, be about one metre lower that the surrounding original ground level.

Area 11

Area 11 lies to the south and east of the engine house. The eastern part of it has already been much disturbed during tree clearance and stonework consolidation operations. Archaeological excavation of the area will allow consolidation work to be completed, will increase understanding of the area around the engine house, and will have the added benefit of tidying what is currently a rather untidy part of the site.

The southern part of Area 11 contains what on present evidence appear to be the adits of drift mines. Documentary sources suggest the existence of one drift mine. The visible evidence on the site suggests that there might be two adits, with a third one which was started but never completed. They appear to be filled with a combination of hillwash, stone rubble, and refuse. Clearance of them to reveal their mouth(s) would tidy the area, increase understanding of the site, and add an extra dimension to the public's appreciation of the site. It cannot be recommended, for obvious reasons of safety, that clearance of material should extend into the adits. Even if only the mouths are to be cleared, British Coal should be consulted with regard to safety considerations.

The bulk of the overburden in this area should be removed by mechanical excavator before completion of the excavation by hand.

Area 12

The furnace is currently partially filled with collapsed rubble and deliberately dumped refuse. The clearance of material from the blowing arches will be undertaken as part of the excavation of Areas 1, 7 and 9. Excavation of the tapping arch, while carried out in conjunction with the excavation of the casting house (Area 4), should best be done as part of the excavation of the interior of the furnace as a whole. This work should be confined to exposing the latest working surfaces of the furnace

and provision should be made for metallurgical analysis of any ironworking residues which might be found.

Whilst excavation of the interior of the furnace is necessary to allow the completion of consolidation works in it, the excavations cannot be undertaken until the structure above the level of the deposits to be excavated has been made safe. The borough council's structural engineering advisers will have to be consulted on this matter. The excavation will have to be done by hand.

Area 13

The picnic site to the south of the fenced area of the ironworks lies between the calcining kilns and the course of the Duffryn Llynfi Porthcawl Railway. It is likely that much evidence of the arrangements for preparing raw materials and servicing the ironworks survives in this area. The area is not, however, under any immediate threat of disturbance and should not, therefore, be excavated at present.

The one possible exception to this is the possible row of coke ovens to the south west of the area, close to the footpath on the line of the former railway. The coke ovens, which are known to have existed on the site, are the one major element of the ironworks which have yet to be positively identified. The features which have been provisionally identified as the remains of at least some of them are covered by vegetation and what appears to by patchy topsoil and litter. The clearance of the vegetation and overburden from at least one of the possible ovens would enable their interpretation to be verified. This could be expected to add greatly to understanding and appreciation of the site as a whole.

The possible coke ovens lie outside the present scheduled area. Investigation of a small sample of them would allow an informed

decision to be made about whether or not the scheduled area should be extended to include them.

Summary of Excavation Proposals.

The principal aim of the proposed excavations will be to allow preservation works to be completed while increasing understanding, and the public's appreciation, of the site. Unless safety considerations dictate otherwise, excavation will be confined to the removal of modern overburden and features which post-date the use of the site as an ironworks, thus protecting its archaeological integrity.

In the interests of efficiency, removal of the bulk of the overburden in certain parts of the site may best be undertaken by use of a suitable mechanical excavator. This should be of the tracked Hymac or Poclain type. It should be used in Areas 3, 4, 7, 8, 9, and 11. This must be done under archaeological supervision and with great care. Where there is doubt about the depth of overburden, hand excavation should be employed in preference to mechanical excavation.

Whilst the condition and stability of the standing structures will need to be considered in the excavation of all of the areas concerned, particular matters will need to be considered by the Council's structural engineering advisers. These are the stability of all four faces of the furnace, the tapping arch and three blowing arches, the roof of the lowest room of the charging structure, the eastern entrance to this room, and the western half of the blowing engine house. British Coal should be consulted before the adit(s) in Area 11 are exposed.

Water pumping equipment will be required to allow excavations in the engine house (Area 3) to be completed, and artificial lighting might be required in the charging structure (Area 1). It is anticipated that in Area 1 there will need to be an interruption of the excavation work to allow the masons to carry

out consolidation of the roof. Elsewhere it may be necessary for the masons to intervene to consolidate the structures as they are uncovered. In general, however, it is likely that most of the work on the masonry can be left until after the completion of the excavations.

Resources

The timetable to be followed for this excavation will depend on a number of factors including the size of the team employed in the work, co-ordination with the stonemasons, and the nature of the remains being uncovered. The details of the order and precise method of working are operational decisions which are best made by the project manager at the time. It is, however, possible to gave an indication of the resources in terms of manpower and time which will be required to carry out the work.

The following estimates are based on a team of the same size and composition as that employed on the site in 1992, ie: 1 project manager, 1 supervisor, and 6 site assistants. The estimates also assume that the mechanical excavation of overburden specified above is carried out, and that the various areas will be excavated as part of a rolling programme in one season of work.

Area	Time
Area 1: Charging structure	3 weeks
Area 3: Blowing engine house	2 weeks
Area 4: Casting house	3 weeks
Area 6: Around Calcining kilns	1 week
Areas 7 & 8: North of engine house	4 weeks
Area 9: West of casting house	1 week
Area 10: North of casting house	0.5 week
Area 11: South of engine house	1.5 weeks
Area 12: Blast furnace	1 week

Total time required: 17 weeks

It would of course be possible to reduce the length of time required by increasing the size of the team. In general, however, the sort of timescale outlined above provides greater operational flexibility. This is an important consideration on a site of this nature.

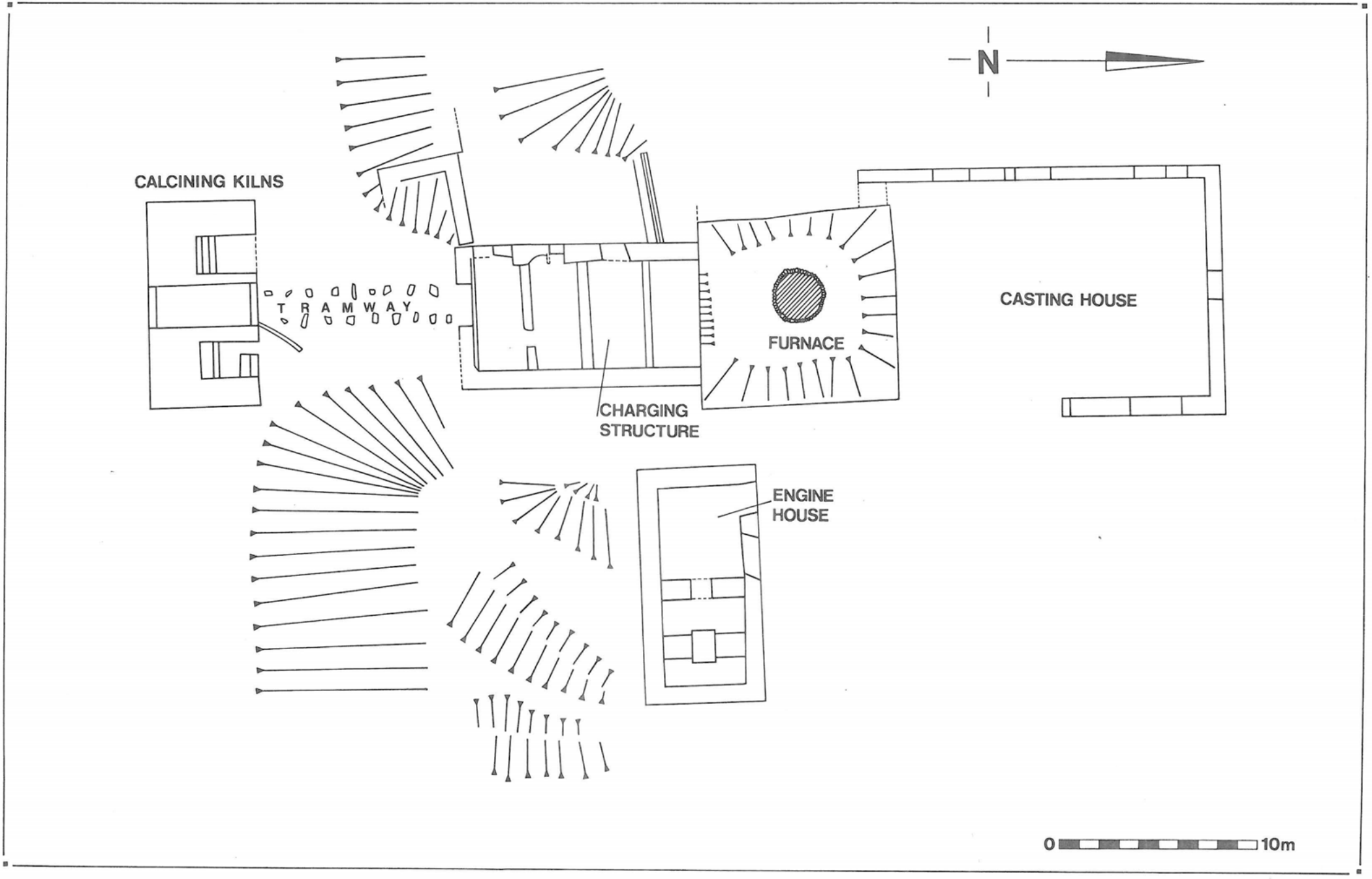

Figure: Bedford Ironworks, Cefn Cribwr