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Industrial Recording:  
**Parys Mountain 2009-2010**

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GAT Project No. 2015

Report No. 859

March, 2010



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Prepared for  
CADW

March 2010

By  
Tanya Berks



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## SUMMARY

*An archaeological survey has been carried out by Gwynedd Archaeological Trust on behalf of Cadw on three selected sites on Parys Mountain, Anglesey. These sites include the Henwaith precipitation pits, the windmill and associated features and the pearl engine house and associated features. The survey forms the second phase of a wider programme of work, which is intended to link in with work programmes being undertaken by other organisations, including Amlwch Industrial Heritage Trust and Royal Commission on Ancient and Historical Monuments of Wales. The first phase of work included the survey of Parys yard, Mona Yard, Parys mine calcining complex and the Mona calciner engine house (GAT Report 788). The survey takes into account the management recommendations contained in Gwynedd Archaeological Trust assessment of Parys Mountain (GAT Report 292) and is designed to be used in conjunction with that report.*

## 1. INTRODUCTION

Gwynedd Archaeological Trust has been grant aided by Cadw to carry out an archaeological survey of a number of non-scheduled upstanding remains within the Parys Mountain mining complex, Amlwch, Ynys Môn (located between NGR SH90603390 and SH89303250; Figure 01). The programme has been undertaken over two years. In 2008-9 four selected areas were surveyed and a report produced (GAT Report 788, March 2009). Within 2009-2010 a further three sites/areas have been surveyed, namely the areas around the Henwaith Precipitation Pits, the features in the vicinity of the Pearl Engine House and the features in the vicinity of the Windmill.

It is hoped that this project will supplement a survey project of the scheduled areas undertaken as part of an HLF funded project. Whilst the HLF funded project is intended to concentrate upon detailed survey of scheduled areas, this current project supplements

the HLF by surveying monuments close to and related to the existing scheduled areas and by assessing the remains for schedule monument enhancement.

### 1.1. Location

Mynydd Parys, known in English as Parys Mountain, and formerly also referred to as Mynydd Trysglwyn, lies two kilometres due south of the town of Amlwch in the community, formerly the civil parish, of Amlwch on Anglesey (Ynys Môn). It is situated between the A5025 and the B5111 roads, the latter of which runs across the north-west side of the mountain. The mountain is approximately two kilometres long and nearly one kilometre wide, the long axis running nearly north-east to south-west. The highest point is 147 metres above Ordnance Datum, whilst the surrounding area averages 80 m above OD. The mountain was formerly divided between Cerrig y Bleiddiau farm on the east, on which the Mona mine was developed, and Parys Farm on the west, on which the Parys mine came to be worked.

## 2. ACKNOWLEDGEMENTS

The Trust is very grateful to David Jenkins of Amlwch Industrial Heritage Trust and Huw Thomas of Cyngor Ynys Môn for all their help during the course of the project. We are very grateful to Susan Fielding at the Royal Commission on the Ancient and Historic Monuments of Wales (RCAHMW) for the use of the 3D laser scans of the windmill.

## 3. METHODOLOGY

The proposed work was divided into four phases:

- Assessment
- Survey
- Final Drawings
- Final Report

The report will utilise previous work undertaken on the mountain, in particular the assessment undertaken in 1998 by the

Gwynedd Archaeological Trust (GAT Report 292) and the Conservation Management Plan undertaken in 2005. Those monuments lying outside scheduled areas will be assessed according to current guidelines so that appropriate management recommendations can be made.

A full photographic record was taken of all three sites, using a Nikon D40X DSLR. The archive is held by GAT and the Royal Commission on the Ancient and Historic Monuments of Wales (RCHAMW) under the project number G2015. A survey was undertaken of all described sites using a Geodimeter EDM. Further surveys were undertaken where there was evidence of substantial upstanding remains using a Leica TCR805 reflectorless EDM.

Further information was obtained for Henwaith precipitation pits whilst monitoring remedial works undertaken by Cyngor Sir Ynys Môn (Isle of Anglesey County Council). The remedial pipe trench was monitored and photographed for any archaeological deposits and a written record consisting of notes and sketches was made during the watching brief on the 16th december 2009 (GAT Report 845). A location survey was conducted using a Geodimeter pro TCR305 electronic distance measurer (EDM).

#### 4. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

(Sourced from Gwynedd Archaeological Trust assessment of Parys Mountain (GAT Report 292))

##### 4.1. Bronze Age Period

Prehistoric mining on Mynydd Parys was first postulated in 1796, when Christopher Sykes referred to cobblestones and fire-set drift workings, many of which had already been quarried away or buried by the open-cast workings, but which were still a recent memory. He considered that these workings were pre-Roman.

In 1937 Oliver Davies investigated, with a series of trenches, an ancient tip near the Oxen Quarry on the north side of the mountain near the windmill. Within the tip he found twenty-four stone hammers and some charcoal and other artefacts, which he assigned to the "Old Celtic" or Roman Period. A subsequent investigation by the Early Mines Research Group in August 1998 located Oliver Davies' original trenches. The Group carried out further trenching and soon found stone hammers and associated flakes. A layer of charcoal gave dates within the range 2000 - 1500 B.C., the Early Bronze Age, some of the earliest dates for Bronze Age mining recorded in Britain. Excavation has continued underground by the Parys Underground Group, resulting in more finds of stone mauls, charcoal and wood, and a similar range of dates has been obtained (Jenkins 1995; 2003).

##### 4.2 Roman period

The tradition that there has been Roman mining on the mountain is itself an old one; it is first recorded on a map of 1764, which shows "Roman workings", and clearly the belief was impressed on the mines' many visitors. Thomas Pennant was apparently the first to connect this tradition to the discovery of copper cakes at Llanfaethlu and at Caerhun in Dyffryn Conwy. Since then a total of twenty-seven copper ingots which can be ascribed to the Roman period has been discovered in Wales, eighteen on Anglesey (two on Mynydd Parys itself), six in the former Caernarfonshire and three in Clwyd. Analysis has revealed they contain about 98% to 99% copper. The circumstantial evidence for Roman copper working at Mynydd Parys is therefore strong, though no dating evidence has been found so far.

##### 4.3 Medieval and Early Modern

No Medieval mining is recorded at Parys Mountain. It was however during this period that the mountain gained its present name, from Robert Parys the Younger who in 1406

was commissioned by Henry IV to collect fines from the Anglesey supporters of Owain Glyn Dwr. He was given the mountain and surrounding lands as a reward for his services. The first indication of mining after the Bronze Age is a map of Traeth Dulas and Amlwch port, annotated in secretary hand, and otherwise also typical of Tudor cartography, which records that the mines lay one mile distant, possibly at Henwaith (“old workings”), exactly a mile from the port, where later documents also suggest early mining may have taken place. Sir John Wynn on several occasions expressed an interest in the Anglesey copper mines. His letters indicate that mining was taking place on Anglesey in the 1570s for in 1607 he refers to “a great mineral work in Anglesey 28 years ago that one Mr Medley had undertaken by boiling a quantity of iron in water. It made Alum and Copperas and transmuted iron into copper.” Absalom Francis, the mining engineer, who prepared a report on the Mona Mine in 1880, remarked that in an area “300 fms. to the east of the present workings” shafts and workings dating from the seventeenth century, though reworked forty years previously, were still to be seen - and that further to the east again, and reaching almost to the road, there were traces of ancient mining reaching almost as far the road, which forms the eastern boundary. 0.6km east of Carreg y Doll lies the dwelling Henwaith where a map of 1764 shows both current and past operations. When the modern phase of operations began in the 1760s, there are references



Plate 1: ‘One of the copper mines at Parys Mountain’, John Warwick Smith 1970 (British Museum)



Plate 2: ‘One of the copper mines at Parys Mountain’, John Warwick Smith 1792 (British Museum)

to opening out old works, but no dates are mentioned. However, in 1698 there is a reference to “the prince’s mines at Trysglwyn”, suggesting that some working was going on in this period.

#### 4.4 Modern period 1761-1851

In 1763 Messrs Roe and Co. of Macclesfield were negotiating for a lease of the eastern half of the mountain, the farm of Cerrig y Bleiddiau, the site of the future Mona mine, with Nicholas Bayly, the sole landowner, where work had been going on since about 1761. In September and October 1762 Sir Nicholas made significant discoveries and a payment is recorded to a Mr Cartwright, the agent, in 1764. Roe and Co. were granted a lease in 1765 and according to legend the discovery that confirmed the mines’ future was made on 2 March 1768 by an experienced Derbyshire miner called Jonathan Roose in a shaft sunk at Golden Venture. In 1770 Bayly had begun mining on Parys Farm, the western half of the mountain, but ran into lawsuits brought by joint owner, the Rev. Edward Hughes of Llysdulas. These were to grumble on for several years, in the course of which Hughes secured the services of the attorney Thomas Williams. By 1774 Hughes and Williams were in partnership to work the western mountain, which came to be known as Parys mine, and with Williams’ outstanding commercial skills, soon established offshoots in the form of smelters at Ravenhead in Lancashire and in Swansea, warehouses at London, Birmingham and



Plate 3: 'The copper works at Parys Mountain',  
John Warwick Smith 1792 (British Museum)

Liverpool, and works at Holywell in Flintshire, Penclawdd in Glamorgan and Temple Mills in Berkshire. For this he came to be known as "the Copper King", though to his workmen on Mynydd Parys he was always Twm chwarae teg ("Tom fair play"). This re-discovery of the mine in the late eighteenth century led to Mynydd Parys rapidly becoming the most productive copper mine in the world, resulting in a short-lived boom. Such were the numbers of ships using Amlwch as a port at that time that delays were inevitable, and an Act of Parliament was passed in 1793 which allowed for the ports deepening, widening and regulation. Business that had previously been conducted on the western side was transferred to a raw broad quay, quarried out of the rock on the eastern side, where some of the buildings still stand. Following the exhaustion of the mines, due to the availability of cheaper ores from overseas and the increasing cost of deeper mining, production of the mines closed down, the port continued however to become a well known centre for ship-building.

#### 4.5 Post-World War II

Since the Second World War a succession of companies has carried out geological exploration on Parys Mountain. Between 1955 and 1957, Anglesey Mining Exploration Ltd, a subsidiary of New Consolidated Goldfields, carried out a detailed surface and underground geological survey on the Mona and Morfa Ddu Mines. From 1961 to 1962 exploration was continued by Anglesey

Copper Mines (UK) Ltd., a subsidiary of the Irish- Canadian Northgate Exploration Ltd, who carried out further geological mapping and drilled eleven surface boreholes. Canadian Industrial Gas and Oil Ltd (CIGOL) explored the site from 1966 to 1970 with several partners, but despite drilling fifty-two boreholes, no promising reserves were found. On 16 September 1971, the mineral lease for an area of about five square kilometres was granted to Parys Mountain Mines (UK) Ltd. for a term of ninety-nine years from 25 March 1969. A further eighteen boreholes were drilled between 1971 and 1972 by the Intermine Ltd/Noranda Ltd partnership. Cominco Ltd, who began work in 1973, was eventually successful. Having initially concentrated exploration on the traditional bluestone areas, they turned their attention northward and by 1978 had made significant discoveries.

The present owner of the western mountain and the lease holder of the eastern mountain, Anglesey Mining plc, a subsidiary of the Imperial Metals Corporation of Vancouver, was incorporated in 1984 and floated on the stock exchange in May 1998. They sank a vertical shaft adjacent to the proven ore reserves and drove laterals into it to test the reserves. A small building was erected to carry out milling trials. Cementation Ltd began the sinking of Morris Shaft (named after Dr Hugh Morris, the Company Chairman) on 11 October 1988. By September 1990 the shaft was down 300 metres and a 280 metre level had been driven north-westward towards the ore reserves. A series of boreholes has also been drilled to prove the immediate ore reserves in detail. Having confirmed the reserves, operations were suspended, because of the low value of metal prices on the international markets. A large part of the mountain surface has now been leased to Amlwch Industrial Heritage Trust, whose remit it is to conserve the industrial heritage of Amlwch Port and Parys Mountain for future generations to enjoy.

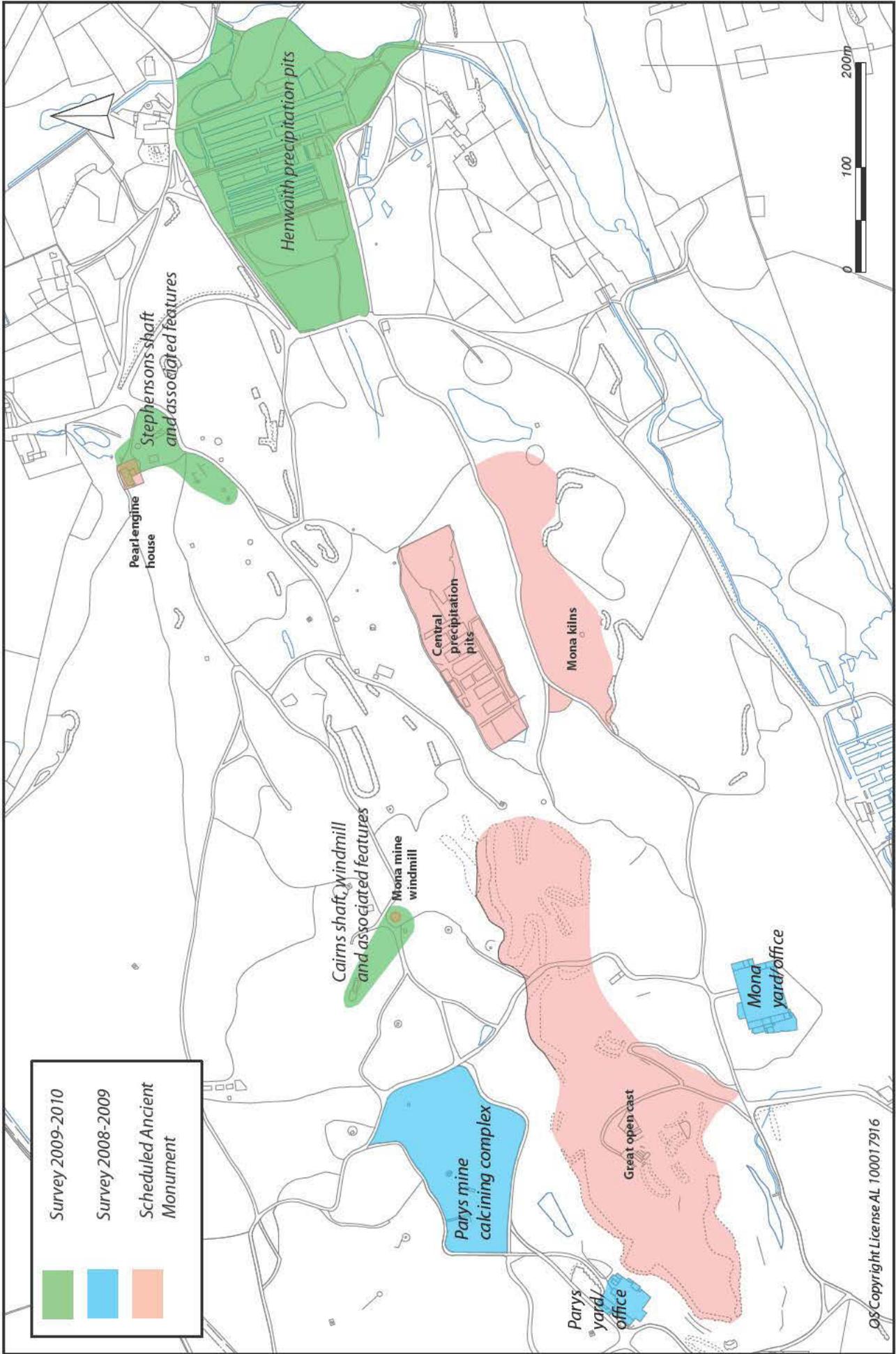


Figure 1: 2008-2009 and 2009-2010 survey location

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## 5. SURVEYED SITES

### 5.1. Henwaith Precipitation Pits

#### 5.1.1. Location

The settlement of Henwaith is located on the north-eastern part of the mountain, linked to the A5025 via two rough metalled original cart track-ways to the north and east. The precipitation pits are located immediately south of Henwaith (figure 2).

*tances to the copper works at Mynydd Parrys, which when plotted, places the works on the eastern edge of the mountain, quite possibly at Henwaith. The precipitation pits are first shown on a map of 1764, and more clearly on a map of c.1815-1819. The latter shows a sequence of pits occupying the west part of the present system, but only extending as far as two rows of precipitation pits east of the holding pond (1) (see figure 7). Interestingly, the pits are orientated on an east to west axis, however by 1889, when the first OS map was produced,*

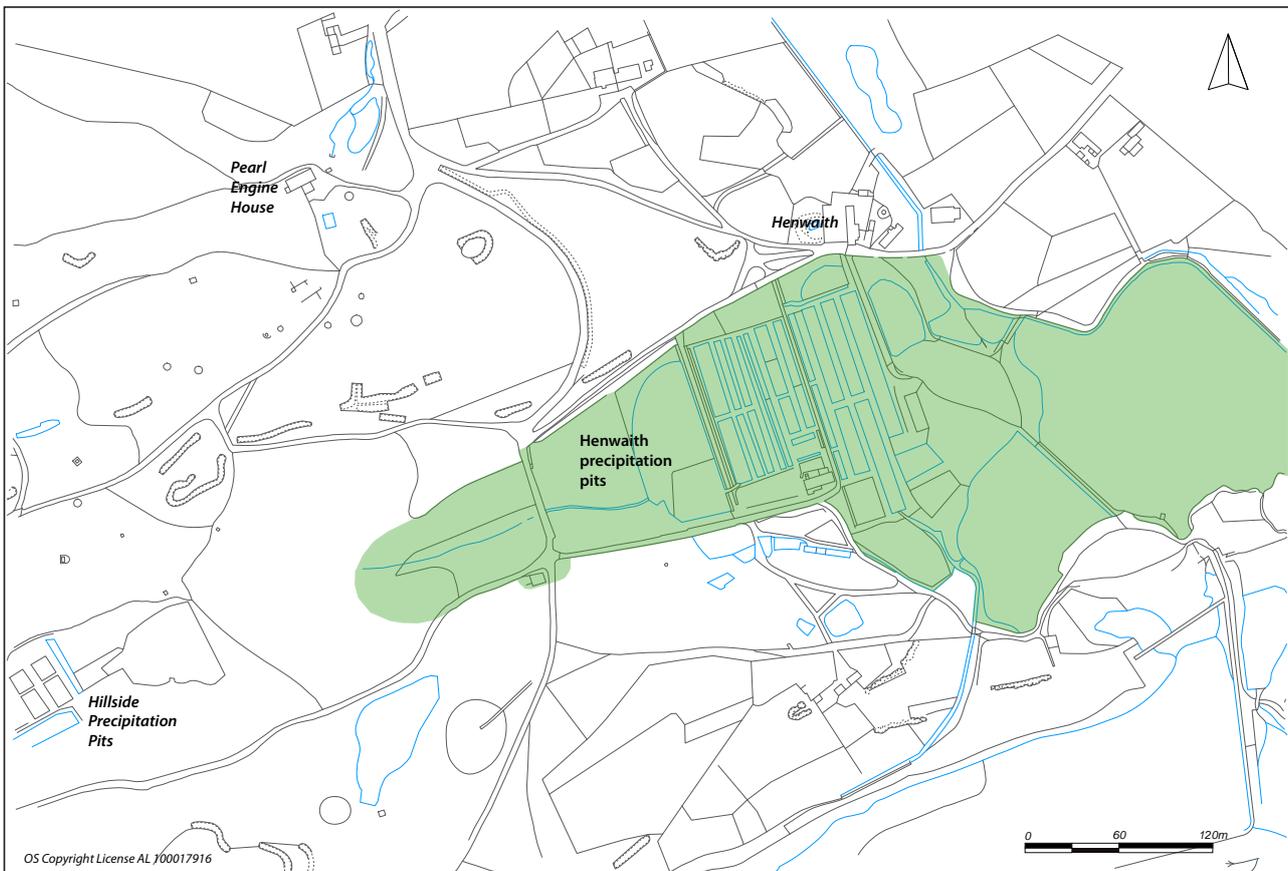


Figure 2: Henwaith Precipitation pit location

#### 5.1.2. Historic background

*Mining at Henwaith was certainly in operation during the first half of the 18th century, although it is likely to have a longer history than this, as a map of 1764 shows evidence for earlier workings. Moreover, a map dating to the time of Queen Elizabeth I (c.1580) held in the Public Records Office depicts the ports of Amlwch and Dulas and gives dis-*

*the pits had been extended to the east and re-designed to orientate on a north to south axis, as they are seen today. Furthermore, several ancillary structures are added to the site which include potentially two furnace buildings (39, 28) and four probable drying rooms (55, 56, 57, 60).*

Ample archaeological evidence survives of the precipitation of copper by iron in wa-

ter, in the form of extensive chequer-board patterns of shallow ponds, some covering many acres, often in conjunction with larger and deeper lakes for the extraction of ochre. Precipitation was a low-cost method which sought to extract the copper ore from waters flowing out of the deep mine or which had been passed through the tips, either as rainwater or deliberately by sparging. This method was carried out from before the end of the 18th century as it was described by Bingley in 1800:

*'The water is raised by means of wooden pumps, and stored in reservoirs specially prepared for its reception. Here it desposits any clay and grit contained, and when clear it is tapped off as required into their precipitation tanks. These tanks are filled with old iron, and the cupreous water is allowed to flow first into the head "pit," and from it continuously flows through a series which is lengthened or shortened as found necessary with the varying strengths of the water passing through. Four times a year the precipitate thus obtained is thus collected. The water is first drawn off, all the iron is then placed upon the "backs" of the wavy bottom, and the copper attached to it is washed away by throwing violently against it by means of scoops the water still remaining in the hollows. This process accomplished, the precipitate is allowed to subside, and the clear water is drawn off by taking out the plugs placed in the middle of each trough. The precipitate is then carried in casks to a pit, where it gradually acquires the consistency of soft mud, and is then taken to a reverberatory furnace where it is dried and made ready for smelting. The water afterwards flows into large reservoirs, some of several acres extent, and there by a natural process deposits a sediment of sub-persulphate of iron, or precipitated yellow ochre. Some thousands of tons of this article are annually sold; it is used largely as a gas-purifying material, and considerable quantities are calcined for the production of the various iron oxide paints and Venetian red. These mineral waters must have is-*

*sued from the ground for a very long period, for south of mountain there is an extensive peaty tract, portions of which are cupreous, while others contain so much ochre as to produce an excellent gas purifying material. When the price of copper was so high the cupreous peat was largely burned, and the ashes thus obtained, containing from 2 to 4 per cent. of metallic copper, were smelted with others ores of the mine. The streams of water proceeding from the mine are of a deep port wine colour when first pumped out, they gradually become lighter in colour as they deposit the ochre; when they enter the sea they impart to it a yellow tinge, which sometimes stretches out a mile or more into the channel'.*



Plate 4: the precipitation pits at Dyffryn Adda on the mountain in 1900.

This system has been practiced at a number of copper mines in Europe, particularly at Hern Grundt in Hungary, but is said to have been first adopted in northern Europe at one of the County Wicklow copper mines when a miner left his shovel in the water and found that it attracted copper ore but that the iron itself came to be eaten away. Equally possible is that it was devised at Mynydd Parys and exported to Ireland; after the Macclesfield Copper Company lost the Parys lease in 1785, they took out a lease of Cronebane mine in County Wicklow, and may have taken Parys miners over with them (Mining Journal 1878). In 1791 they took out a lease on Llanberis copper mine, where precipitation was also tried (Cowman 1994). The

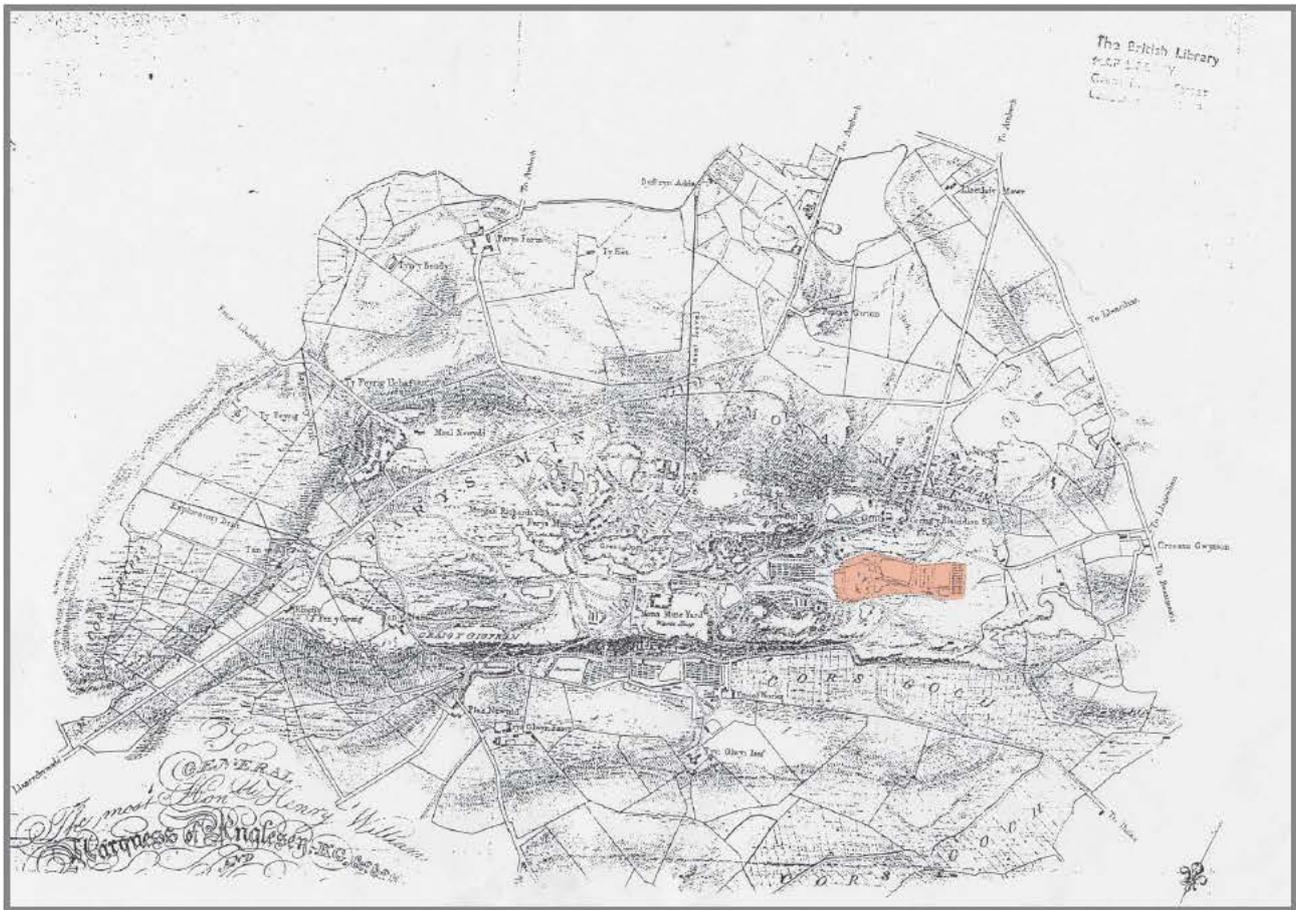


Figure 3: c.1815-1819 Parys and Mona Mines (British Library)

date for its introduction to Mynydd Parys is uncertain, though at the Mona mine it was clearly no later than 1772, (P. Crew 1976). Whilst the various methods of extracting the ore at Mynydd Parys have their parallels elsewhere in the archaeology of copper mining, they have to be sought far afield. No other copper mine site in Britain made use of open casting to the same extent as Mona and Parys, and precipitation is only found at a small number of sites, including Hern Grundt, Rio Tinto and the Arklow mining region in Ireland.

The precipitation pits at Henwaith are first shown on a map of 1764, although mining had been in operation at Henwaith at least from the first half of the 18th century. The pits can be seen more clearly on a map of c.1815-1819 (figure 3). This map shows a sequence of pits occupying the west part of the present system, but only extending as far as two rows of precipitation pits east of the holding pond (1). Interestingly, the pits

are orientated on an east to west axis, however the first edition ordnance survey map of 1889 (figure 4), shows that the pits had been extended to the east and re-designed to orientate on a north to south axis, as they are seen today. Several ancillary structures were also added to the site during this period, including potentially two furnace buildings (39, 28) and four probable drying rooms (55, 56, 57, 60).

The extensive influx of heather encroachment on the western pits (30) suggests that this area went out of use before the rest of the site. This possibility is reinforced by the fact that the precipitation system appears to be operated on a north to south division, with two water feeds entering the pits from culverts in the embankment (31) to the west. It is not known when the pits were last used, but it seems likely that work continued into the early 20th century.

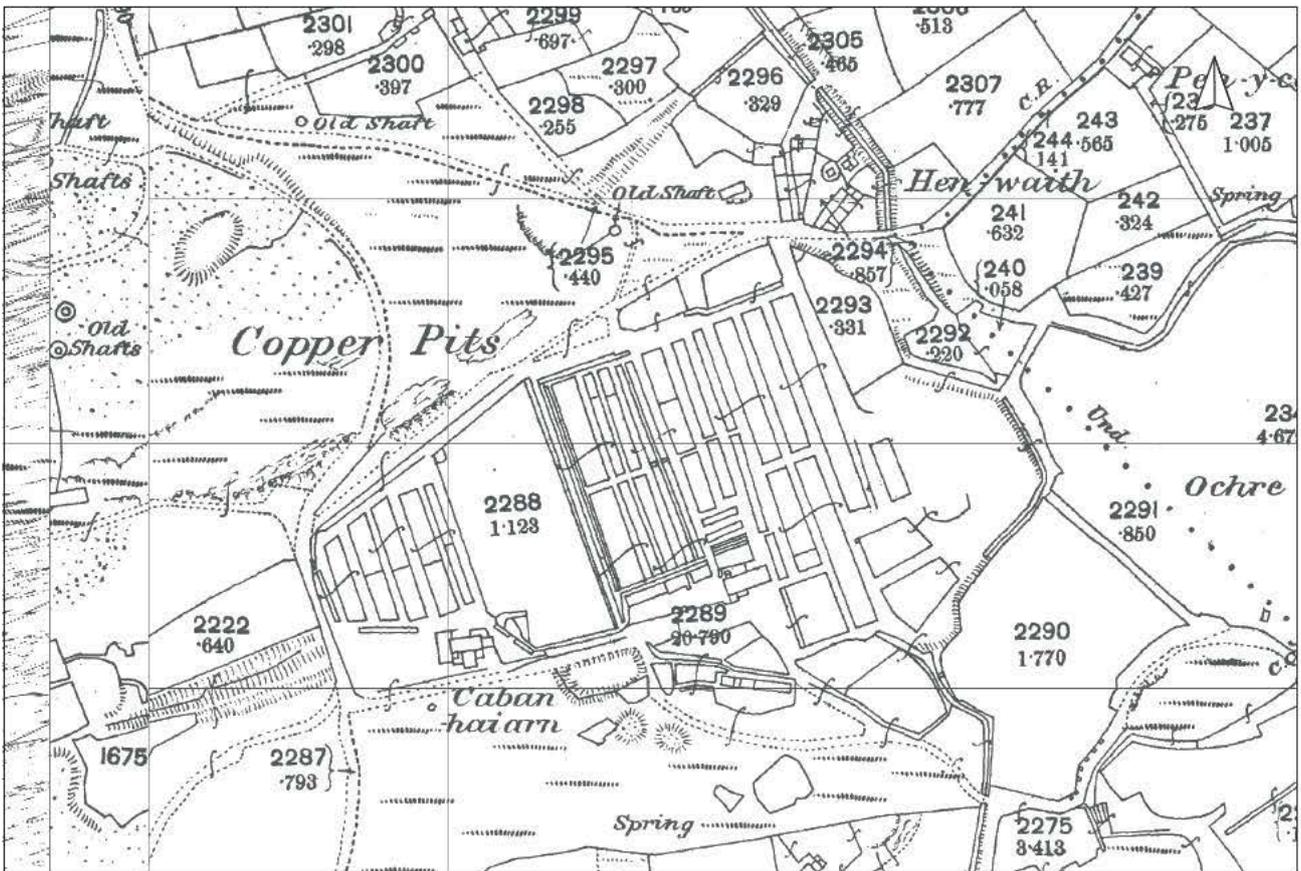


Figure 4: Anglesey 25" County series. 1889. XXI.5 (Scale 1:5000 @ A4)

### 5.1.3. Description (figure 5)

The features which make up the precipitation system at Henwaith include reservoirs, leats, drying floors, ochre ponds and the complex pattern of precipitation pits. These reflect the need to get copper rich water from the mines, hold it until it is needed, then feed it through the pits. The copper ore was then taken from the pits and dried, and the precipitate water drained into large ponds for ochre extraction. The iron supplies were

stored on site, whilst horses and carts were needed to move the ore off-site to the port. It is the series of rectangular shallow pits, however, which form the most obvious feature on-site. There are remains of some 37 pits at Henwaith, though approximately 10 of these lie at the west end of the site, and are now so covered by heather as to be invisible from the ground. This small group must have gone out of use earlier than the larger eastern group.



Plate 5: Pond 1 and 2 facing north-east

The Henwaith precipitation system, like that of the two other principal precipitate systems on Mynydd Parys, operated on a west-to-east system. That is to say, the copper enriched water was fed into the system from the west and the spent water was siphoned out of the system into settling reservoirs to the east, with the copper precipitate being obtained in gradients of purity which declined as the process moved east. The operation on this basis is entirely due to the exploitation of the natural gradient of the mountain and the ready availability of a source of

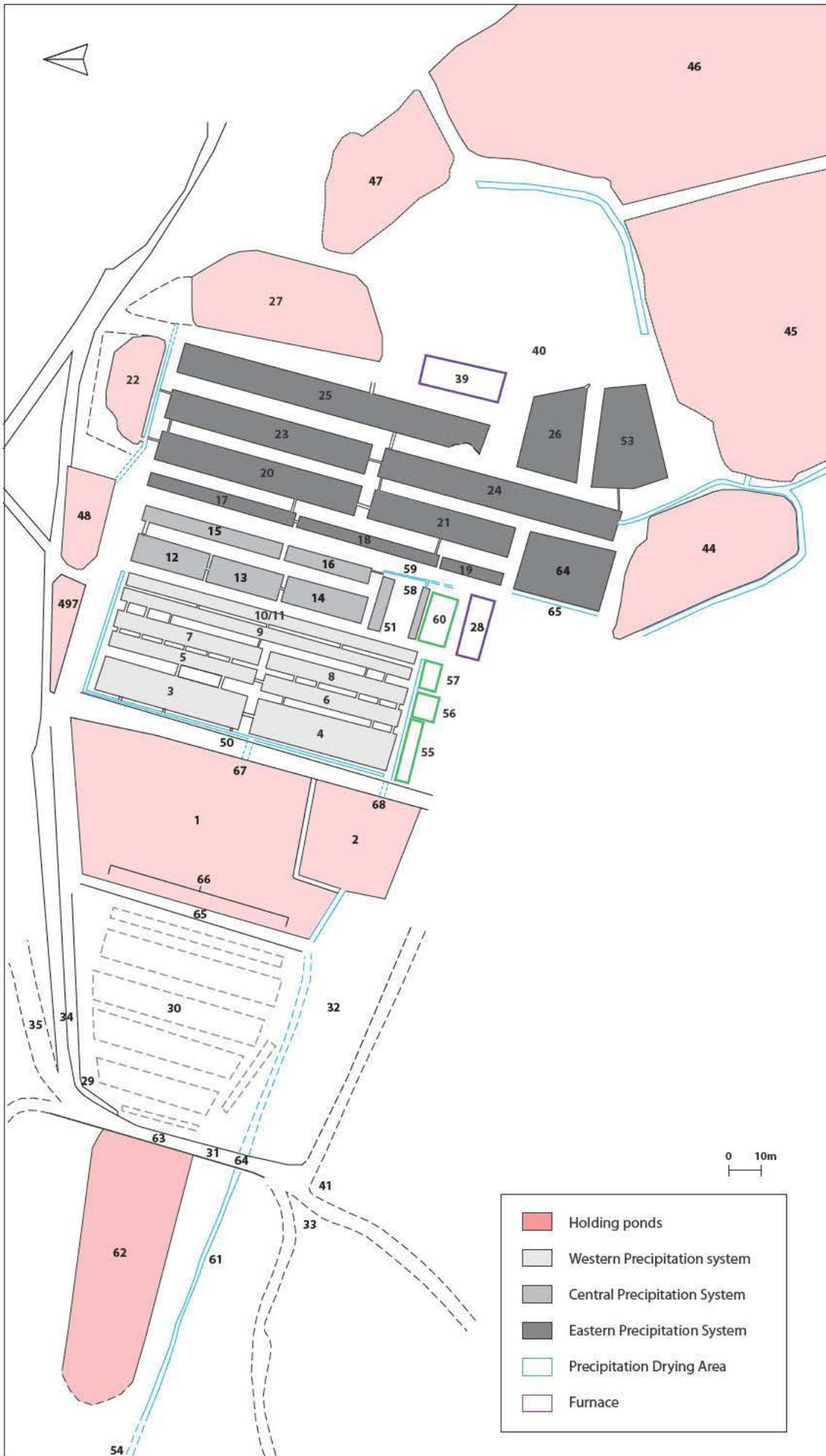


Figure 5: Feature location at Henwaith Precipitation pits

copper enriched water. In the case of the Henwaith pits, the water would have been supplied largely from the Mona Mine. There exists on the mountain a complex system of leats and ditches which were used to catch water either running off from the surface or pumped up from underground, and these almost certainly helped feed the Henwaith pits, though it has not been possible within this study to examine these in detail. The other principal source was along the Mona adit. Water from lower levels was pumped up to the adit, and this then flowed along the adit and out onto the mountain, where it could be stored for use in the precipitation pits. Shortly after 1800 the Joint Level was built, which took all water out towards Dyffryn Adda, where there is another series of pits. However it was possible to pump water into the Mona adit. Shortly after 1880 a dam was built within the Joint Level, which caused the water level to rise inside the mines, and down the Mona adit. It largely remained in this form until the de-watering in 2003 when the Joint Level dam was removed, and the water once again flowed down to the north through Dyffryn Adda.

The Henwaith pits, as mentioned above, consist of a small group of western pits (feature 30) which are now overgrown, a large storage pond which is now divided into two (features 1 and 2) and a larger system of some 27 pits. East again were large ponds (44, 45, 46, 47) where ochre was extracted after the precipitation process had been completed.



Plate 6: Ponds 3, 5 and 7 facing south. Pond 3 shows evidence of an undulating base and well preserved sluice gates

The source of water for the western pits has not been identified, though it was probably held in an elongated pond (62) which lay west of the pits, and was separated from the pits by an embankment (31). A culvert (63) leads through the embankment. East of the pits, and separating them from the storage pond (1) is another embankment (65), through which there are three small culverts (66) leading into pond 1.

Ponds 1 and 2 also appear to have been fed by a separate leat (61) which by-passed the western group of pits. The subsequent movement of water through the pits is difficult to understand. This is partly hampered by the use of underground capped drains, for which there are no surface indications, through a drain (50) runs the west side of the embankment, and appears to have been the principal method of disseminating water through some of the ponds.

After settling in ponds 1 and 2 the water was directed into the first set of pits, and left for several months before being drained into a lower set of ponds. This is described by Bingley in 1800;

‘The pits in which the copper is precipitated from the mineral water are in ranks, one row beneath another, accordingly and the declivity and the extent of the ground admit; the water is let off from one set of pits into another, till the water has let go all the copper it held in solution. The water that runs from the lowest or last row of precipitation pits is conveyed into reservoirs where the decomposed iron subsides’.

Michael Faraday in 1819;

*This water is pumped up by a steam engine into large reservoirs and it is let down by sluices from there into small tanks placed side by side each about 12 feet long, 8 wide and 18 inches deep. Into these tanks is thrown old iron of all sorts, hoops, nails, saucepans, etc., and they frequently procure what they call iron from the iron works,*



Figure 6: Sluice gate and capped drain location.

*but it is generally a mixture of slag and iron containing about half its weight of the latter. In this state the iron and water remain in contact for some time being turned now and then to expose fresh surfaces to their mutual action and then the water is drawn off and fresh let in. The waters are not thrown away after having been once over the iron but that which has been acted on in the highest tank is let down into a second where there is more iron and then again into a third, fourth and fifth in all of which there is iron until it is so poor as not to be worth working any longer. The result of this arrangement is the production of copper in these tanks occasioned by the play of affinities which takes place between the substances’.*

Ponds 3, 5 and 7 contain undulating bases of blocks of stone or burnt clay. The reason for this is described in the Mining Journal 1878;

*‘Four times a year the precipitate thus obtained is thus collected. The water is first drawn off, all the iron is then placed upon the “backs” of the wavy bottom, and the copper attached to it is washed away by throwing violently against it by means of scoops the water still remaining in the hollows. This process accomplished, the precipitate is allowed to subside, and the clear water is drawn off by taking out the plugs placed in the middle of each trough’.*

The group of some 27 ponds which make up



Plate 7 : Sluce gate 70 facing east

the contiguous group east of holding ponds 1 and 2 appear to be divided into three distinct groups. The ponds within each group are linked by sluices, but the links between the three different groups are less clear, and the feed system for each group is also far from clear. Pits 3 to 11 form one set, and these appear to have been fed directly from pond 1 through the central culvert and into a drain (50). The relationship between ponds 1 and 2 is not clear, nor is it clear if pond 2 fed a separate group of pits.

There is no clear link between pits 3 to 11 and pits 12 to 16. They were obviously operated separately, but the feed for the lower group has not yet been identified. Similarly the feed for the third group of pits (17 to 25) cannot be clearly identified, though a drain system does run along the north side through ponds 49, 48 and 22 which may have fed this group.

The precipitation system at Henwaith shows 27 (70-96) examples of wooden sluce gates. These were relatively simple affairs, consisting of two upstanding wooden posts (approximately 30cm x 5cm x 5cm) with a horizontal board placed between the posts to allow the control of the water flow. There are also 4 examples of stone capped drains (997-100), but it is likely that many more are still to be discovered, and these hold the key to understanding the flow of water between the groups of pits.

At present a complete understanding of how the pits worked is not possible. That they were used sequentially is clear from the contemporary descriptions. The layout of the pits suggests that each group formed its own complete system. That is, if we take the western group as an example, water was let into the first two pits (3 and 4), then after a couple of months these were drained into the two lower pits (5 and 6) and so on until pits 10 and 11 were reached, when it was drained off into the large ochre pools to the east. Given the decreasing size in pits within the group and the presence of

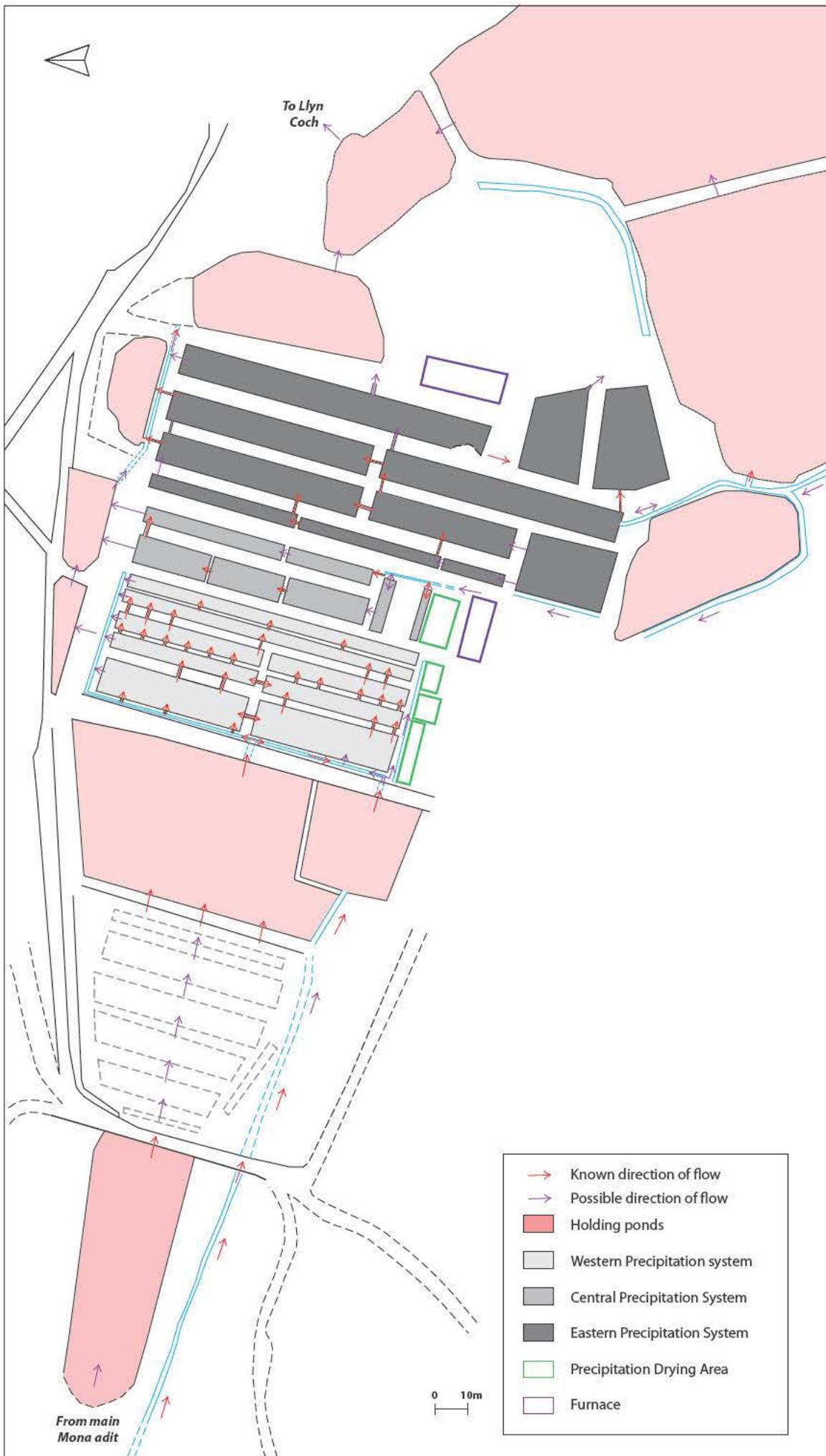


Figure 7: Direction of flow at Menwaith Precipitation Pits

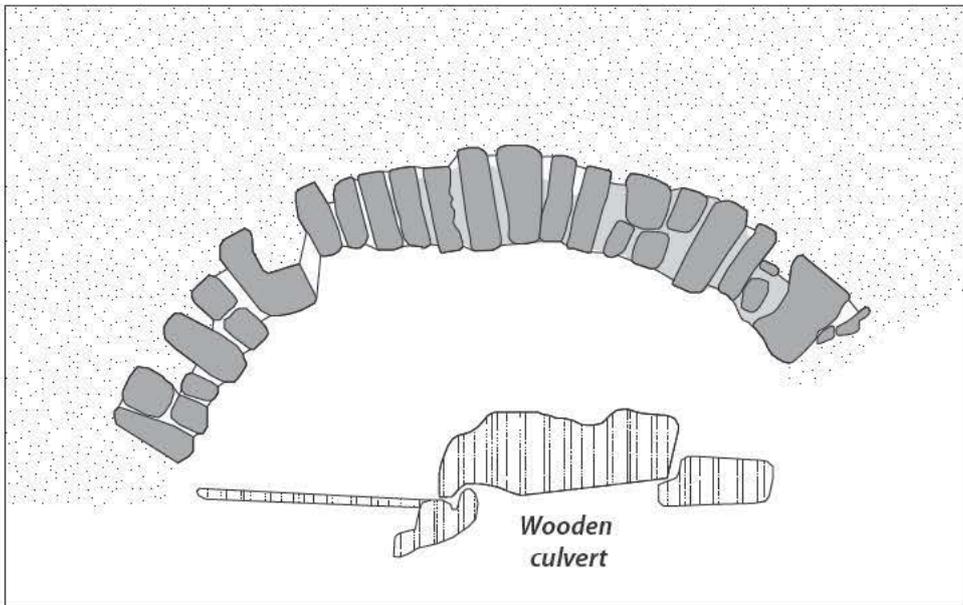
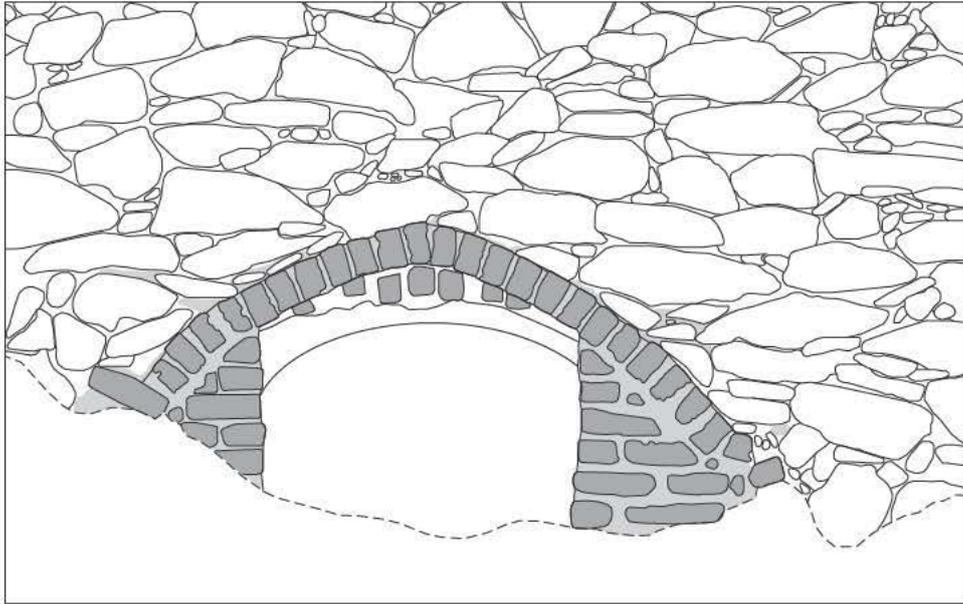


Figure 8: Culverts 63 and 67 both facing east

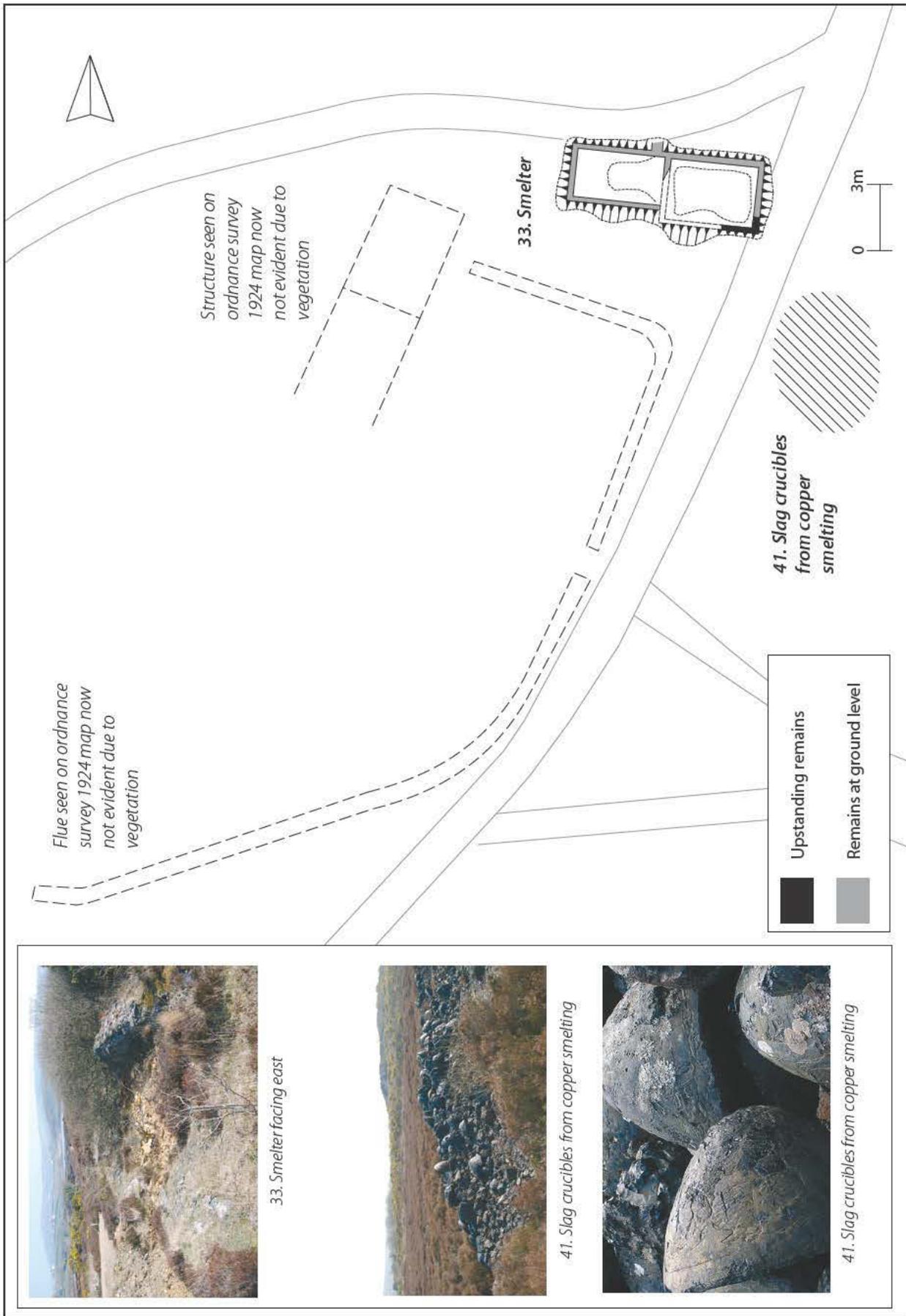


Figure 9: Feature 33 smelter

sluice gates between each of the pits this does seem likely. The other two groups would have been similarly worked. A less likely scenario would see all of the first group of pits filled simultaneously, and the water subsequently drained into the second group and then the third group. The lack of connections between the groups, however, makes this unlikely.

Clearly visible on the plan are a group of pits on the south side which are orientated east-west, and at right-angles to the remainder (features 55, 56, 57, 60). They are depicted on the 1889 25" OS map but not on the earlier c.1815-1819 map. These structures appear to have been added to the site as it was expanded west and redesigned sometime between 1819 and 1889. These structures are quite well preserved and incorporate a stone block base and stone walls. In the northern walls of these structures there is surviving evidence of culverts running into the precipitation pits. These pits may be best interpreted as the remains of drying rooms where the extracted precipitate was dried out prior to smelting, with any excess cupreous water being channelled back into the pits.

A number of other ancillary structures also exist. South of the western group of pits lie the remains of a stone structure depicted on the c.1815-1819 map. It is again depicted on the 1889 OS 25" map where it is labelled 'Caban Haiarn'. From its name, therefore, (roughly translated as 'iron cabin') it may have been where iron was stored prior to it being thrown into the precipitation pits.

To the east of the precipitation pits lie the remains of a structure (39) first depicted on the 1889 25" OS map. The structure is orientated north to south, and has stone walls existing to a height of 2.0m. In the eastern wall there is a flattened brick arch doorway which is large enough to accommodate a cart, and despite heavy vegetation encroachment, evidence of burning can still be recognised on the internal face of the

south wall. This structure is best interpreted as a furnace for either drying or smelting the precipitate extracted from the pits. Further to the southwest lie the poorly preserved remains of another stone structure (28) also first depicted on the 1889 map. This building is smaller but given its proximity to the probable precipitate drying rooms to the north, is also likely to have been a drying room or furnace.

#### *5.1.4 Conclusion*

The Henwaith precipitation site is a remarkably complete system, containing reservoirs, drains, pits, holding ponds, drying rooms and furnace houses. The system appears more complete than the others on the mountain, including the scheduled Hillside precipitation system. The scarcity of remains of similar type within the United Kingdom confirms the importance of these remains. This site is therefore considered to be of national importance.

#### *5.1.5. Gazetteer of features with Henwaith precipitation system*

The gazetteer below lists the principal features within Henwaith precipitation system and correspond to figure 5. The features are identified by a number unique to this study, though they are also cross-referenced to their PRN (Primary Reference Number of the Historic Environment Record held by Gwynedd Archaeological Trust). The pond numbers correspond to a study undertaken by Cyngor Sir Ynys Môn.

#### **1. Holding Pond**

**NGR: SH 44983 90657**

**PRN: 30398**

This feature is separated from feature 2 by a bund, probably of stone or brick, which is currently obscured by sediment. A retaining wall some 1.0m high surrounds the pond, with at least three integrated culverts on the western side so as to be fed from precipitation pits (30) to the west (plate 8)



Plate 8: Pond 1 facing north

## 2. Holding Pond

NGR: SH 44995 90615

PRN: 30399

This pond is fed directly by a leat (61) and culvert (64) in the southern end of embankment/cart road (31), seemingly independent of precipitation tanks to the west (30). The water from pond 2 then feeds through culvert 68 in embankment 69, but where it continues after this is a little unclear. It either feeds into precipitation pond 4 or filters through a capped drain into a system lower down in the eastern precipitation ponds.

## 3. Precipitation Pit (Western precipitation system)

NGR: SH 44997 90694

PRN: 30399

This pond is stone built and full of sediment. It has an undulating base created by rectangular stone blocks. There are 3 wooden sluice gates in the western wall, and is fed by drain feature 50 to the west. 3 known culverts with wooden sluice gate remains are integrated into the eastern wall to feed precipitation pit 5.

## 4. Precipitation Pit (Western precipitation system)

NGR: SH 45012 90652

PRN: 30399

A stone walled pond containing a great amount of sediment. This pond appears to be fed either directly by drain 50 or from pond 3. Stone walls are two courses high in places but obscured by sediment.

## 5. Precipitation Pit (Western precipitation system)

NGR: SH 45008 90697

PRN: 30399

This pit is narrower in width than precipitation pits 3 and 4, and is fed directly by at least two culverts one with a surviving wooden sluice from precipitation pit 3 to the west. Has a stone retaining wall which utilises smaller cobbles than ponds 3 and 4 in its construction. It has an undulating base created by rectangular stone blocks. The pond feeds into precipitation pit 7 via six culverts with wooden sluice gate remains. The feature is filled with sediment.

## 6. Precipitation Pit (Western precipitation system)

NGR: SH 45021 90654

PRN: 30399

This pit is identical in dimensions to pits 5, 7, and 8. The stone retaining wall is in fairly poor condition, surviving only to around two courses high, however a large part is obscured by residue. There is some evidence of a possible stone block base, and the pit appears to be fed by at least two culverts from tank 4 to the west. This pit subsequently feeds into tank 8 to the east.

## 7. Precipitation Pit (Western precipitation system)

NGR: SH 45015 90699

PRN: 30399

This pit has the same dimensions as precipitation pit 5, and is fed by six culverts from pit 5 all with surviving wooden sluice gates. It is



Plate 9: Ponds 7 and 8 facing north

filled with sediment, but has some evidence of an undulating stone block base. It feeds into precipitation pit 9 by four culverts one with a surviving wooden sluice gate (plate 9)

#### **8. Precipitation Pit (Western precipitation system)**

**NGR: SH 45029 90656**

**PRN: 30399**

This pit is identical in dimensions to pits 5, 6, and 7. The stone built retaining wall is in poor condition and survives only to two courses high. There is some evidence of a possible stone block base, however the vast majority is obscured by sediment. The pit is fed by five culverts from pit 6 to the west, three with surviving wooden sluices and likewise feeds into pit 9 by at least three culverts to the east (plate 9).

#### **9. Precipitation Pit (Western precipitation system)**

**NGR: SH 45030 90676**

**PRN: 30399**

This pit is narrower in dimensions than precipitation pits 7 and 8, but appears to be one single tank stretching the length of the site, thus being twice the length of other tanks. However, the depiction of this tank on the 1889 25" OS map shows a distinct division in the centre of the tank suggesting it was originally two tanks. It is not clear whether the pits were later developed into a single pond, or that heavy deposition has simply hidden this division. Despite heavy sediment deposition, there is evidence of a possible stone block base. The pit is fed by tanks 7 and 8 by at least six culverts, but the pit retaining walls are in a poor level of preservation. This pond then filters into ponds 10/11.

#### **10. Precipitation Pit (Western precipitation system)**

**NGR: SH 45027 90701**

**PRN: 30399**

This precipitation tank resembles feature 9, however there does appear to be a division between this pond and tank 11 to the south, although there is a culvert in the middle feeding from pond 9 which seems to be in

the wrong place if there are two ponds here. However the evidence for two ponds is supported by documentary evidence in the 1889 25" OS map. The retaining walls are poorly preserved and there is a large sediment accumulation, making the culverts out of the pond untraceable, although it maybe argued that this pond does not filter to the east into ponds 12, 13 and 14 and may have filtered into drain 50 to the north which then fed into settling pond 48, therefore this would be the last pond in this series.

#### **11. Precipitation Pit (Western precipitation system)**

**NGR: SH 45041 90659**

**PRN: 30399**

This pit has poorly preserved stone retaining walls and is filled with thick sediment. The tank could possibly to feed into tank 14 to the east but there is no evidence for a culvert. It is also possible that this pond fed through into pond 10 and on through to drain 50 and into settling pond 48. It is likely that there was also a culvert to exchange water with tank 10 to the north.

#### **12. Precipitation Pit (Central precipitation system)**

**NGR: SH 45033 90716**

**PRN: 30399**

This pit is shorter but wider than pits 9, 10, and 11. The retaining walls are in a very poor state of preservation. There is a culvert with a surviving wooden sluice gate in the north-east of this pond and a culvert linking it to pond 13.

#### **13. Precipitation Pit (Central precipitation system)**

**NGR: SH 45039 90695**

**PRN: 30399**

**This pit is very similar to pit 12, being shorter but wider than tanks 9, 10, and 11. The retaining walls are in a very poor state of preservation. The culverts feed from pond 12 and 14.**

#### **14. Precipitation Pit (Central precipitation system)**

**NGR: SH 45047 90672**

**PRN: 30399**

The pit retaining walls are poorly preserved, only one course high in places and thickly covered in sediment. A culvert feeds from pond 13, but no other culverts are evident.

### **15. Precipitation Pit (Central precipitation system)**

**NGR: SH 45046 90712**

**PRN: 30399**

This pond is narrower than ponds 12, 13 and 14 and has evidence of a culvert from pond 12 with a surviving wooden sluice gate. Poor wall preservation has made other culverts impossible to identify. The eastern retaining wall is two courses high in places, but not present in others.

### **16. Precipitation Pit (Central precipitation system)**

**NGR: SH 45057 90680**

**PRN: 30399**

Poor wall preservation has made the culverts difficult to identify. The eastern retaining wall is two courses high in places, but not present in others. The pond is thick with sediment. The pond possibly fed into pond 15 but there is evidence that this pond feed from the strange configuration of sluices in drain 59 to the south. This sluice arrangement is not understood due to the build up of sediment.

### **17. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45056 90715**



Plate 10: Pond 22 facing west



Plate 11: Pond 23 facing north

**PRN: 30399**

This feature is narrower than most of the tanks present. The retaining walls are mostly gone. There are the remains of a wooden sluice gate with tank 18 to the south. The feature was possibly fed by pond 18.

### **18. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45069 90672**

**PRN: 30399**

The retaining wall survives to one course. The pond appears to be fed from the south by tank 19, and in turn feeds into tanks 17 and possibly 21 as well. A culvert in the ponds south east corner shows this pond feed into pond 20. A surviving wooden sluice is evident in the south east of this pond feeding to pond 21 and between 17 and 18.

### **19. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45080 90639**

**PRN: 30399**

This feature is much smaller than the other tanks, is overgrown with vegetation. This pond is on a higher level than tank 18 and may possibly have fed into it. The walls are difficult to observe as overgrown with vegetation and it is unclear where this feature gets a water feed from. It could possibly be argued that drain 65 maybe the water feed into this pond and therefore into this system.

### **20. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45069 90713**

**PRN: 30399**

This feature is a large and well preserved tank. It was most likely fed by tank 17 and 21 and feeds into tank 23 and drain 52 and thus into holding pond 22. A with wooden sluice gate remains between pit 21.

### **21. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45087 90657**

**PRN: 30399**

This pit is very large and well preserved. It is rock cut on its eastern side and is constructed of stone and mortar on its remaining sides. It has wooden sluice gate remains to the north with pit 20, and to the north east with pit 24. There is evidence of a possible stone block base.

### **22. Holding Pond**

**NGR: SH 45068 90760**

**PRN: 30399**

A semi-circular settling pond fed by drain 52 at its southwest end. It is separated from drain 52 to the south by a 0.8m thick double-skinned retaining wall, constructed of medium sized, angular stones set on edge. The 1889 25" OS map depicts a second holding pond of similar dimensions to the west (48) which may well have drained this feature in some capacity. However deposition and vegetation encroachment has made this feature untraceable on the ground (plate 10).

### **23. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45082 90716**

**PRN: 30399**

This pond is poorly preserved and very few stones of the retaining wall remain. The pond appears to be fed by pond 24 and 20. There is wooden sluice gate remains with pit 24, and potential culvert remains with drain 52 (plate 11).

### **24. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45104 90648**

**PRN: 30399**

This pit is large and fairly well preserved. There is evidence of a possible stone block



Plate 12: Pond 25 facing north

base. The pit appears to have been fed via culverts from pit 21, has wooden sluice gate remains with pit 23. There are the remains of a wooden sluice gate to the south, leading into a meandering stone built channel which drains into a large settling reservoir to the southeast (plate 12).

### **25. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45099 90709**

**PRN: 30399**

This pit is the largest tank on site, and is rock cut with a course of capping stones. The pond still was a leading from pond 24 with a surviving wooden sluice gate. There are capped drains leading from pond 25 to holding pond 27 and precipitation pit 26. There is slight evidence of a possible culvert between pond 25 and drain 52 which leads into holding pond 27.

### **26. Precipitation Pit (Eastern precipitation system)**



Plate 13: Pond 27 facing north



Plate 14: Embankment 31 facing west.

**NGR: SH 45129 90643**

**PRN: 30399**

A square shaped pit, rock cut with partially surviving stone retaining walls. It has a well preserved culvert in the southeast corner for drainage into a settling reservoir 69 to the east.

### **27. Holding Pond**

**NGR: SH 45118 90730**

**PRN: 30399**

A sub-circular settling reservoir to the east of the precipitation pits. The western edge of the feature consists of a 1.5m high revetment wall. There is no evidence of a culvert in the western wall from pond 25 and it is also fed by holding pond 22 to the north-west. This pond drains east into reservoir 71 (plate 13).

### **28. Precipitate Drying Furnace**

**NGR: SH 45066 90628**

**PRN: 30400**

This structure is very overgrown with heather and is obscured by subsidence and debris. The structure appears to have had a stone block base and stone built walls, however the majority of the walls are beneath general demolition material. There is a frequency of industrial slag, and a possible entrance into the structure facing south.

### **29. Adit**

**NGR: SH 44887 90653**

**PRN: 30401**

An adit cut through bedrock. The opening is 2.0m high and 1.0m wide, and has iron railings immediately within the adit mouth.

### **30. Western precipitation system location**

**NGR: SH 44919 90642**

**PRN: 30398**

Approximately ten precipitation tanks are indicated on the 1889 25" OS map, situated between holding pond 1 and embankment 31. The area is completely overgrown with heather, with only hummocks available in the vegetation to indicate the presence of the pits.

### **31. Embankment**

**NGR: SH 44886 90617**

**PRN: 30402**

A substantial stone-built embankment carrying cart road 35 north to south across the hillside precipitation systems. It stands 4.0m high and has a stone built stairway 1.5m wide at its north-eastern side, presumably to give access to precipitation pits feature 30 below. The embankment has two brick built arches, the southern (64) of which feeds water into holding pond 2 via a stone built leat. The northern (63) arch is larger and almost certainly fed into precipitation system feature 30 to the east (plate 14).

### **32. Structure**

**NGR: SH 44949 90604**

**PRN: 30403**

This structure is identified as Caban Haiarn on the 1900 25" OS map; however only a mound remains littered with broken pot, glass, bricks and stone. The walls are untraceable.

### **33. Smelter**

**NGR: SH 44890 90571**

**PRN: 30404**

A stone-built smelter, surviving up to 2.0m high, visible as a wall exposed in a bank of earth and contiguous building. There is the trace of a small reservoir in the structure, possibly for smelting, and immediately to the east is a pile of slag globules. This is the only smelter site so far discovered on Mynydd Parys.

### **34. Retaining Wall**



Plate 15: Furnace 39 facing west

**NGR: SH 44900 90678**

**PRN: 30406**

A stone retaining wall, 2.0m high in places retains road feature 35. The wall runs south-west to northeast and has suffered some subsidence at the south-western end.

### **35. Road**

**NGR: SH 44913 90716**

**PRN: 30407**

An engineered cart road retained by feature 34.

### **36. Hammer-stone find spot**

**NGR: SH 54038 90803**

**PRN: 30408**

An area in which a number of possible hammer-stones have been noted by Owen J. Owen (local farmer) and in which flints and possible slag were also observed. This area is near the dwelling Henwaith, and was described in 1764 and in 1880 as the site of early workings.

### **37. Shaft**

**NGR: SH 45025 90782**

**PRN: 30409**

A shaft is marked and identified as such on the 1889 25" ordnance survey, which appears to have been in filled since.

### **38. Adit**

**NGR: SH 45025 9080**

**PRN: 30410**

Completely overgrown with gorse bushes, however a depression can be observed between the vegetation, as can a small mound of spoil.

### **39. Furnace**

**NGR: SH 45130 90675**

**PRN: 30411**

A roofless and dilapidated stone building orientated north to south, heavily overgrown, with traces of burning on the internal walls on the south side. The building measures 27.0m by 8.0m in plan. A flattened brick arch doorway in the east facing longitudinal wall is large enough to accommodate a cart (plate 15).

### **40. Stone-floored Area**

**NGR: SH 45155 90653**

**PRN: 30412**

A small portion of a stone and concrete floor to the immediate southeast of furnace building 39. The limits of this feature are unknown due to heavy encroachment of heather. The proximity of this feature to the furnace building 39 suggests it is an associated work-yard.

### **41. Flue**

**NGR: SH44899 90572**

**PRN: 30405**

Originally visible as two low parallel walls, approximately 50.0m long and 0.6m apart, which carried gases away from smelter feature 33. However the area is densely overgrown with vegetation and the feature is no longer visible.

### **42. Holding pond**

**NGR: SH 45118 90730**

**PRN: 30399**

Large almost square possible holding pond, which is extremely overgrown with vegetation and therefore difficult to identify. It is a possibility that water fed too or from this pond into leats to the south or into reservoir/holding pond 44. This pond could also feed into or out of ponds 19 and 21. It is shown on the 1889 1st edition OS map.

### **43. Drain**

**NGR: SH 45118 90730**

**PRN: 30399**

Drain which runs to the west of settling pond 42. Its function is unknown due to a large build up of vegetation but it is either asso-

ciated to holding pond 42 or it links to the leats to the south and pond 19. It is shown on the 1889 1st edition OS map.

#### **44. Holding pond or reservoir**

**NGR: SH 45118 90730**

**PRN: 30399**

This holding pond/reservoir is now under a great deal of vegetation. It is unclear whether this pond feeds into or feeds from the precipitation ponds to the north. The 1st edition 1889 map shows that the leats to the east and west are associated with this pond.

#### **45. Reservoir**

**NGR: SH 45118 90730**

**PRN: 30399**

The reservoir collected water after the precipitation process had been completed. Water still collects in these reservoirs. Reservoir 45 is fed through leats from the south east of the precipitation system leading from pond 24. It is also fed from pond 44 and feeds into pond 45. There is also a possibility, through the evidence of leats, that water also filtered from the Dyffryn Coch precipitation pits which are located to the south west.

#### **46. Reservoir**

**NGR: SH 45118 90730**

**PRN: 30399**

The reservoir collected water after the precipitation process had been completed. Water still collects in these reservoirs. Reservoir 46 is filtered through from reservoir 45 and reservoir 47.

#### **47. Reservoir**

**NGR: SH 45118 90730**

**PRN: 30399**

The reservoir collected water after the precipitation process had been completed. Water still collects in these reservoirs. Reservoir 47 feeds from a leat from holding pond 27 and feeds into reservoir 46.

#### **48. Reservoir**

**NGR: SH 45118 90730**

**PRN: 30399**

The 1889 25" OS map depicts a holding pond in this location with similar dimensions to holding pond 22. However deposition and

vegetation encroachment has made this feature untraceable on the ground. The map suggests that this pond drained into drain 52 and then onto pond 27. There is a possibility that the central precipitation ponds drained into this holding pond.

#### **49. Reservoir**

**NGR: SH 45118 90730**

**PRN: 30399**

The 1889 25" OS map depicts a holding pond in this location which seems to be narrower than holding ponds 22 and 48. However deposition and vegetation encroachment has made this feature untraceable on the ground. There is a possibility that this holding pond was connected to drain 50. There is also a vague possibility that the western precipitation ponds drained into this holding pond.

#### **50. Drain**

**NGR: SH 45118 90730**

**PRN: 30399**

A stone built drain to the east of retaining wall for holding ponds 1 and possibly 2. This drain runs the length of precipitation tanks 3 and 4, and is fed by a brick arched culvert from holding pond feature 1, where evidence of wooden sluice gates remain. It was possibly also fed by holding pond feature 2, but this area is obscured by sediment.

#### **51. Precipitation Pit (Central precipitation system)**

**NGR: SH 45056 90657**

**PRN: 30399**

A small stone built pond running east to west. The retaining walls are poorly preserved, with many stones missing. The pond is full of residue and it is unclear what it is fed by or indeed what it feeds into, though the use of drain 59 could be a possibility.

#### **52. Drain**

**NGR: SH 45062 90748**

**PRN: 30399**

A stone built drain runs into holding pond 22 to the north. It quite probably drained tanks 17, 20, 23, and 25 to the south. The drain continues into pond 27 and evidence



Plate 16: Drying area 55, 56 and 57

through the monitoring of remedial works undertaken by Cyngor Sir Ynys Môn (Isle of Anglesey County Council) during the laying of a drain showed that this drain continues as a capped drain into pond 27.

### **53. Precipitation Pit (Eastern precipitation system)**

**NGR: SH 45136 90626**

**PRN: 30399**

A sunken pit with a well preserved stone block base. A 1.0m high retaining wall of concrete and stone surrounds this feature. The pit is fed by a well preserved culvert from pit 24, suggesting that this feature is a precipitation pit as opposed to a precipitate drying room. The pit probably drained directly into the main settling reservoir 45 to the east.

### **54. Main Mona adit**

**NGR: SH 45136 90626**

**PRN: 30399**

The main Mona adit allows the filtering of the water from the whole Mona mine through a leat into pond 2 of the precipitation system.

### **55. Structure**

**NGR: SH 45024 90624**

**PRN: 30399**

This structure is rectangular and lies at a higher level than the precipitation ponds to the north, having a very well preserved stone block floor. It may well be the same feature as structure 56 and 57, but there is limited evidence for a stone built partition wall between the two. The structure has a leat which feeds directly into tank 6 to the

north; however this structure does not appear to have a water feed, suggesting it is not a precipitation tank. It seems likely that this structure is actually a precipitate drying room, and the leat structure is to return excess water back to the precipitation tanks. The structure has a poorly surviving stone wall to the north, with the southern and gable walls being obstructed by industrial tipping and vegetation encroachment (plate 16).

### **56. Structure**

**NGR: SH 45037 90628**

**PRN: 30399**

This structure is rectangular and very similar to structure 55 and 57, and may well be part of the same feature. It has a poorly surviving wall to the north, and the southern and gable walls are obstructed by debris. The structure has a very well preserved stone block floor, and has a stone leat in its northern wall which appears to run onto the walkway between precipitation pits 8 and 9, possibly having originally fed into a second leat (plate 16).

### **57. Structure**

**NGR: SH 45048 90632**

**PRN: 30399**

This structure is very similar to structures 55 and 56, but is smaller and square in plan. It also has a very well preserved stone block floor, and also lies at a higher level than the precipitation pits located to the north. The northern wall survives as much as three courses high and has a stone built leat which feeds into pit 11 to the north. The gable walls and southern wall is obscured by debris (plate 16).

### **58. Precipitation Pit (Central precipitation system)**

**NGR: SH 45058 90650**

**PRN: 30399**

A narrow and small pond running from east to west, with evidence of a possible stone block base. The pond has poorly preserved stone walls, but a well preserved wooden sluice gate and culvert at the eastern end, feeding into or from drain 59.

### 59. Drain

NGR: SH 45067 90657

PRN: 30399

A narrow stone built drain with a well preserved western wall, but almost nonexistent eastern wall is fed into by wooden sluice gate remains from pond 58 to the west. Sluice gate remains to the northeast suggests that this drain fed into tank 18, and possibly also tank 16 to the north. Due to vegetation encroachment it is difficult to ascertain where this drain is flowing from. It could possibly flow from leats to the south or drain 43.

### 60. Structure

NGR: SH 45062 90639

PRN: 30399

This structure is similar to structures 55, 56, and 57 further to the west. The structure is square in plan and has a stone and mortar wall surviving to a maximum of 1.0m and six courses high on the western gable, with the remnants of an internal plaster. It has a well preserved stone block floor, and is probably a precipitate drying room. The southwest corner appears to have an entrance or exit into the structure wall.

### 61. Leat from Mona main adit

NGR: SH 45067 90657

PRN: 30399

Copper enriched water from the main Mona adit flows in this leat to the south of holding pond 62 through culvert 64 in embankment 31 and continues to the south of the first precipitation system 30 into pond 2.



Plate 18: Culvert 64 facing west

### 62. Possible holding pond

NGR: SH 45067 90657

PRN: 30399

Holding pond which is fed by an unknown source of water although this may also have been the main Mona adit. The pond is unrecognisable in many places due to sediment build up and the use of the pond by bike riders. There is an embankment to the south of the pond. The water continues through culvert 63 in embankment 31 into the first set of precipitation ponds (plate 17).

### 63. Culvert

NGR: SH 45067 90657

PRN: 30399

Culvert in embankment 31, which feeds water from pond 1 into the western precipitation system through drain 50. On the eastern side the culvert is of re-pointed red brick 200cm in width and 180cm in height. On its west side the culvert is much narrower at 20cm in width and 180cm in height which

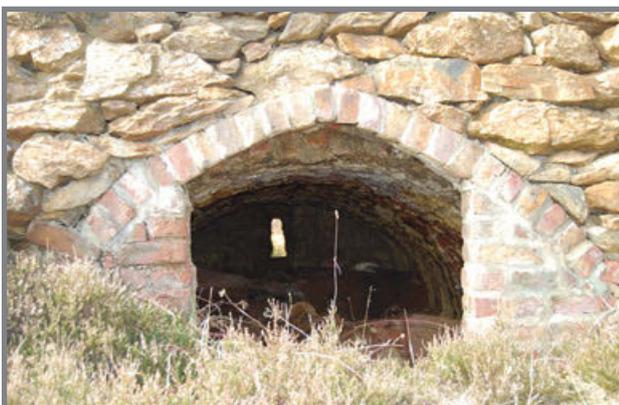


Plate 17: Culvert 63 facing west



Plate 19: Example of stone culvert 66 facing west



Plate 20: Culvert 67 facing west

would have channeled the water creating a greater pressure in the flow of water to allow the movement of water through the first precipitation system.

#### **64. Culvert**

**NGR: SH 45067 90657**

**PRN: 30399**

The southern stone constructed culvert in embankment 31 of which feeds water into holding pond 2 via a leat feeding water from the main Mona adit. This culvert is 120cm in width, but masked by a large amount of vegetation therefore its depth could not be ascertained (plate 18).

#### **65. Embankment**

**NGR: SH 45067 90657**

**PRN: 30399**

A substantial stone-built embankment standing at 4.0m high and constructed of stone blocks. The embankment has at least three purpose made stone culverts (66)



Plate 21: Culvert 68 facing east

40cm high by 30cm wide feeding water from precipitation system 30 to pond 1.

#### **66. Three stone culverts**

**NGR: SH 45067 90657**

**PRN: 30399**

These culverts measuring 40cm in height and 30cm in width are stone lined and incorporated into the embankment (65) which feed water from precipitation system 30 to pond 1.

#### **67. Culvert**

**NGR: SH 45067 90657**

**PRN: 30399**

Stone lined shallow curved arched culvert 100cm in width and 40cm in height with a surviving wooden culvert to the west consisting of both upright wooden posts and a vertical board which would have controlled the flow of water (plate 20).

#### **68. Culvert**

**NGR: SH 45067 90657**

**PRN: 30399**

This culvert has been totally destroyed and only exists as a gap in embankment 69 and 100cm in width (plate 21).

#### **69. Embankment**

**NGR: SH 45067 90657**

**PRN: 30399**

A substantial stone-built embankment standing at 4.0m high and constructed of stone blocks. The embankment has culverts, the southern (68) of which feeds water from pond 2 into either drain 50 or further down the precipitation system. The northern culvert (67) feeds water from pond 1 into drain 50 and then which flows into precipitation ponds 3 and 4.

#### **70. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 30x15x10cm.

#### **71. Wooden sluice gate**

**NGR: SH 45067 90657PRN**



Plate 22: Sluice gates 75 and 76 facing south east

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 35x15x-10cm.

### **72. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 30x15x-10cm.

### **73. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 30x10x-10cm and 30x20x10cm. The sluice gate measures in total 40cm in length, 10cm in width and a maximum of 30cm in height.

### **74. Wooden sluice gate**

**NGR: SH 45067 90657**



Plate 23: Sluice gates 77 and 78 facing south east

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x15x15cm and 20x15x15cm. The sluice gate measures in total 30cm in length, 15cm in width and a maximum of 20cm in height.

### **75. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 30x10x-10cm and 30x20x10cm. The sluice gate measures in total 40cm in length, 10cm in width and a maximum of 30cm in height (plate 22).

### **76. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 30x15x-10cm (plate 22).

### **77. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 30x15x-10cm (plate 23).

### **78. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x15x-



Plate 24: Sluice gate 81 facing east

15cm and 20x15x15cm. The sluice gate measures in total 30cm in length, 15cm in width and a maximum of 20cm in height (plate 23).

### **79. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 10x10x-2cm.

### **80. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 10x10x-2cm.

### **81. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 10x10x-2cm (plate 24).

### **82. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x20x-2cm and 20x20x2cm. The sluice gate measures in total 50cm in length, 2cm in width and a maximum of 20cm in height.

### **83. Wooden sluice gate**

**NGR: SH 45067 90657**



Plate 25: Sluice gate 88 facing east

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x15x-15cm and 20x15x15cm. The sluice gate measures in total 30cm in length, 15cm in width and a maximum of 20cm in height.

### **84. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 25x10x-2cm.

### **75. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x20x-2cm and 20x20x2cm. The sluice gate measures in total 50cm in length, 2cm in width and a maximum of 20cm in height.

### **86. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 10x10x-2cm.

### **87. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 20x10x-2cm.

### **88. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 25x10x-2cm (plate 25).

### **89. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 10x20x-10cm and 20x20x10cm. The horizontal board also survives dimensions 25x10cm



Plate 26: Sluice gate 90 facing east

its height cannot be determined due to build up of sediment. The sluice gate measures in total 45cm in length, 10cm in width and a maximum of 20cm in height.

**90. Wooden sluice gate**

NGR: SH 45067 90657

PRN: 30399

Evidence of a wooden sluice gate. Only one vertical post in poor condition survives dimensions 25x10x1cm (plate 26).

**91. Wooden sluice gate**

NGR: SH 45067 90657

PRN: 30399

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 25x15x-2cm.

**92. Wooden sluice gate**

NGR: SH 45067 90657

PRN: 30399

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x20x-



Plate 27: Sluice gate 92 facing west

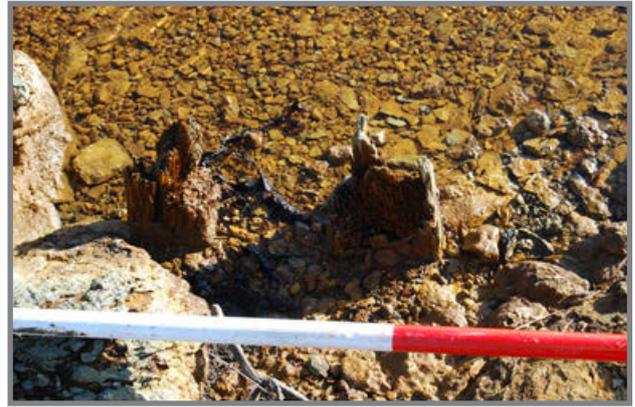


Plate 28: Sluice gate 93 facing north

2cm and 20x20x2cm. The sluice gate measures in total 50cm in length, 2cm in width and a maximum of 20cm in height (plate 27).

**93. Wooden sluice gate**

NGR: SH 45067 90657

PRN: 30399

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 10x10x-5cm and 10x10x5cm. The sluice gate measures in total 40cm in length, 5cm in width and a maximum of 10cm in height (plate 28).

**94. Wooden sluice gate**

NGR: SH 45067 90657

PRN: 30399

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 30x10x-2cm and 10x10x2cm. The sluice gate measures in total 40cm in length, 2cm in width and a maximum of 30cm in height. There is also a stone lined drain to the north.

**95. Wooden sluice gate**

NGR: SH 45067 90657



Plate 29: Sluice gate 95 facing east

**PRN: 30399**

Evidence of wooden sluice gate. Both of the vertical posts survive dimensions 20x20x-2cm and 20x4x2cm. The sluice gate measures to 50 cm in length, 2 cm in width and a maximum of 20cm in height (plate 29).



Plate 30: Stone capped drain 100 facing west

**PRN: 30399**

Stone capped drain flowing east to west from pond 58 into drain 59. The drain has one stone course and a capping stone of 60 x 10cm (plate 30).

### **96. Wooden sluice gate**

**NGR: SH 45067 90657**

**PRN: 30399**

Evidence of a wooden sluice gate. Only one vertical post survives dimensions 14x8x-2cm.

### **97. Stone capped drain**

**NGR: SH 45067 90657**

**PRN: 30399**

Possible stone capped drain leading from pond 25 to holding pond 27.

### **98. Stone capped drain**

**NGR: SH 45067 90657**

**PRN: 30399**

Stone capped drain flowing north to south between pond 25 and 26. The majority of the drain is obscured by sediment, but the capping stone is approximately 45 x 20cm.

### **99. Stone capped drain**

**NGR: SH 45067 90657**

**PRN: 30399**

Stone capped drain flowing east to west between pond 24 and 53. The drain is substantial with three stone courses and a capping stone 30x 20cm.

### **100. Stone capped drain**

**NGR: SH 45067 90657**

## 5.2. Windmill and associated features

### 5.2.1. Location

The windmill and associated features are located to the north of Parys mountain overlooking the great open cast mine to the south.

mining journal states that it took 17 horses to drag the boiler to the top of the hill (MJ 11/12/1880 p1418). In later years the windmill was connected by a system of 200' flat-rods moving on dolly posts to this steam engine at the head of the 270 foot Cairns shaft. An aperture in the windmill also lines up with the Sydney shaft suggesting that the wind

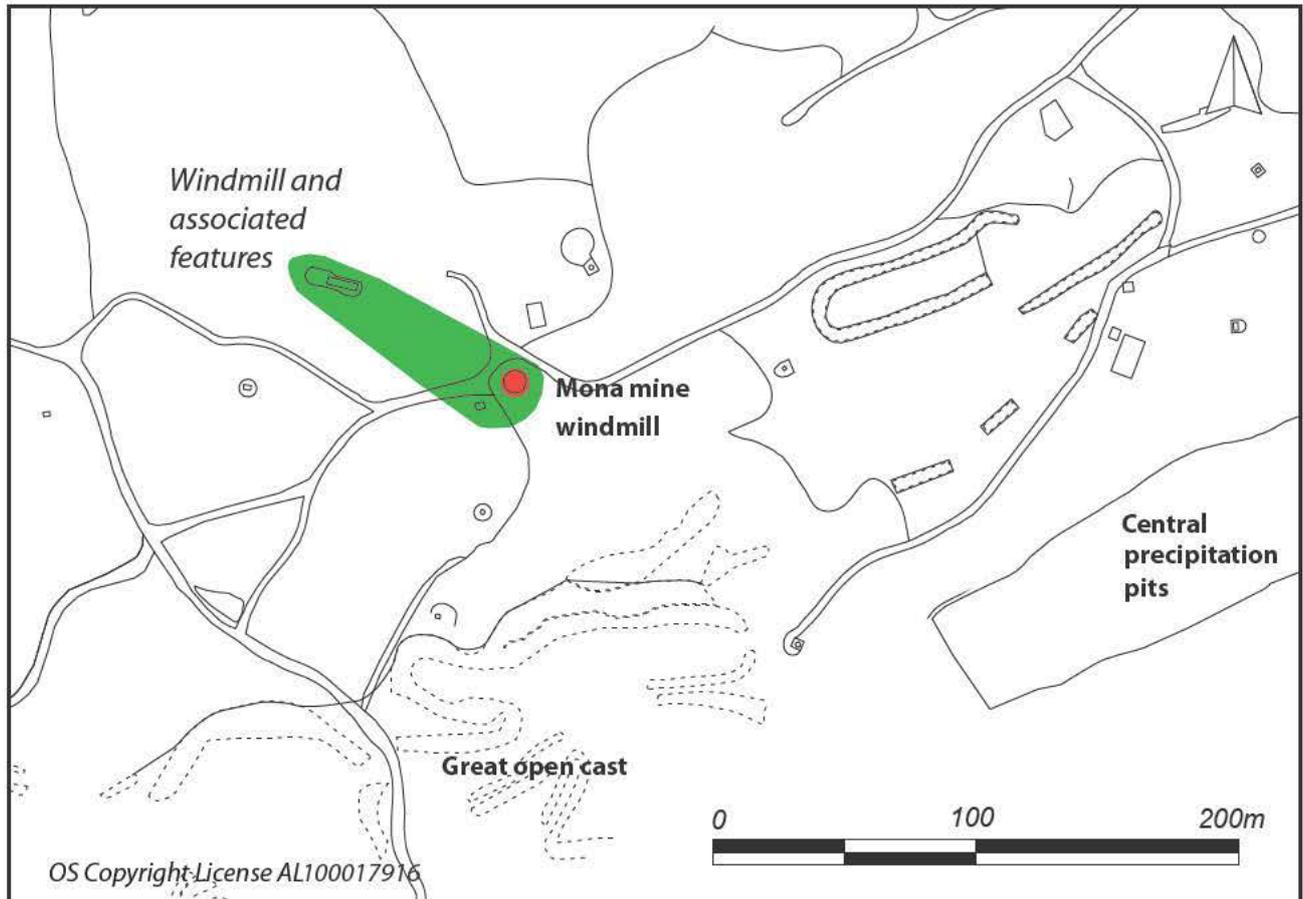


Figure 10: Windmill and associated features location

### 5.2.3. Historic background

A steam winding engine at Mona mine's "New Shaft" (Cairns) is recorded in the period 1865-1870, valued at £260. The windmill was built in 1878, in the hope of reducing pumping costs for the deepening mine shafts by assisting with the pumping of the shaft when it became clear that the Carreg y Doll pumping engine (installed in July 1846) could not dewater this part of the mine on its own. This was of a differential compound type manufactured at the Sandycroft foundry on the river Dee and was used for the first time on 8th December 1880. The



Plate 31: Windmill and Cairns engine house complex 19th century (Griffith O: Mynydd Parys (Caernarfon 1897).)

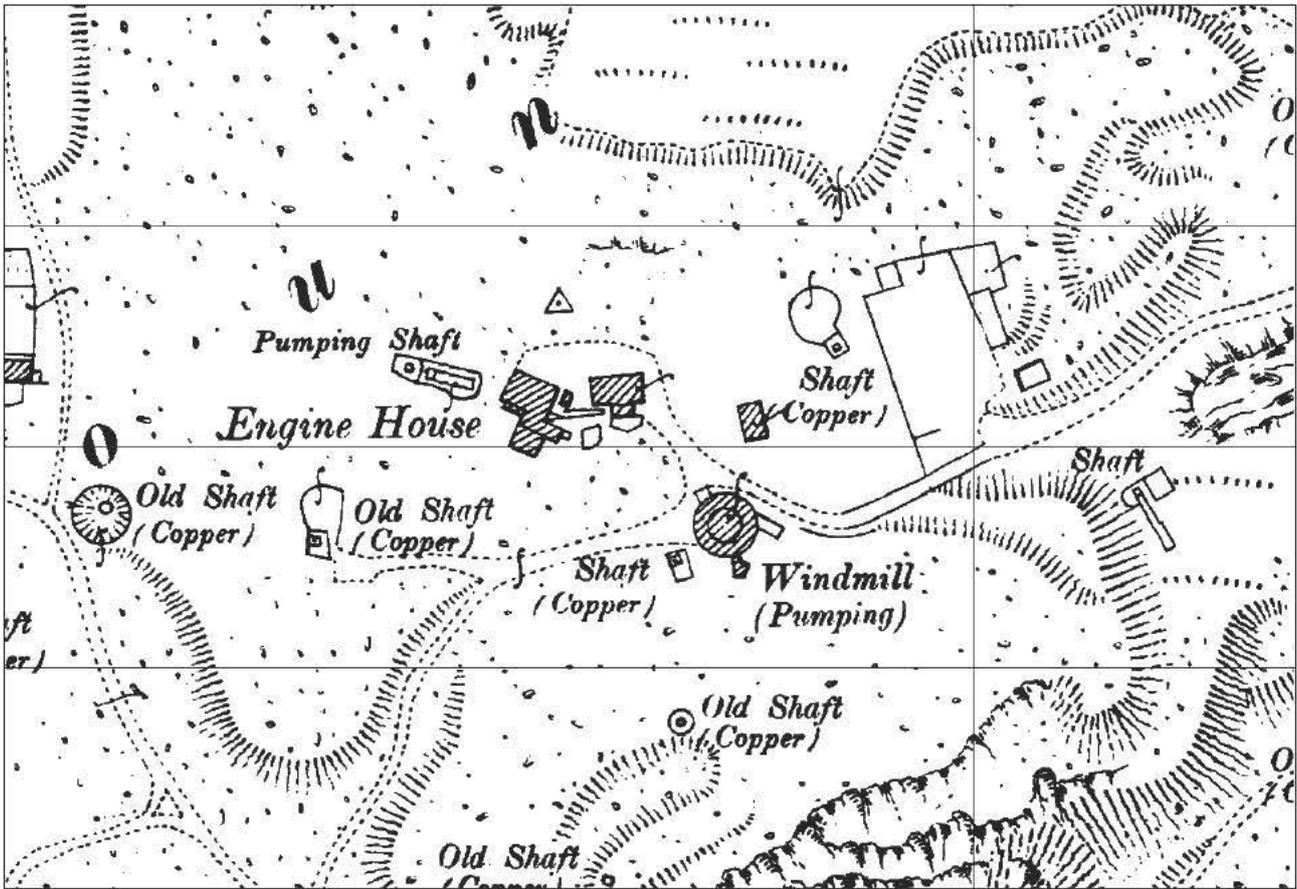


Figure 11: Anglesey 25" County series. 1900. XXI.5 (Scale 1:5000 @ A4)

mill was also used to wind this shaft. The windmill was unique in having five sails and is believed to be the only surviving windmill on an extraction site. The windmill was still operating in 1901. Its importance as the only surviving pump-windmill in an extractive industry in Britain was recognised by scheduling as an Ancient Monument in 1995. The results of a 3D laser survey undertaken by the Royal Commission on Ancient and His-

toric Monuments in Wales (RCAHMW) are included here by kind consent.

#### 5.2.4. Description

The windmill is the most prominent landmark on the mountain, and is visible from a considerable distance. It is a stone-built conical tower mill, which measures 8m in diameter across the base and stands approximately 20m high. Uniquely for Anglesey, it was a five-sailed mill; the cap and all the machinery are missing, but it is believed to have contained an upright shaft driven by bevel-gearing from the sail-shaft, which in turn operated 200' of flat-rods by means of a crank in its foot. The flat-rods operated a pump in Cairns' shaft, and were supported on intermediate dolly-posts.



Plate 32: Windmill and Cairns engine house complex 19th century

There is little remaining of the engine house and associated features apart from a small rubble mound and small foundations to the north of the windmill, but the

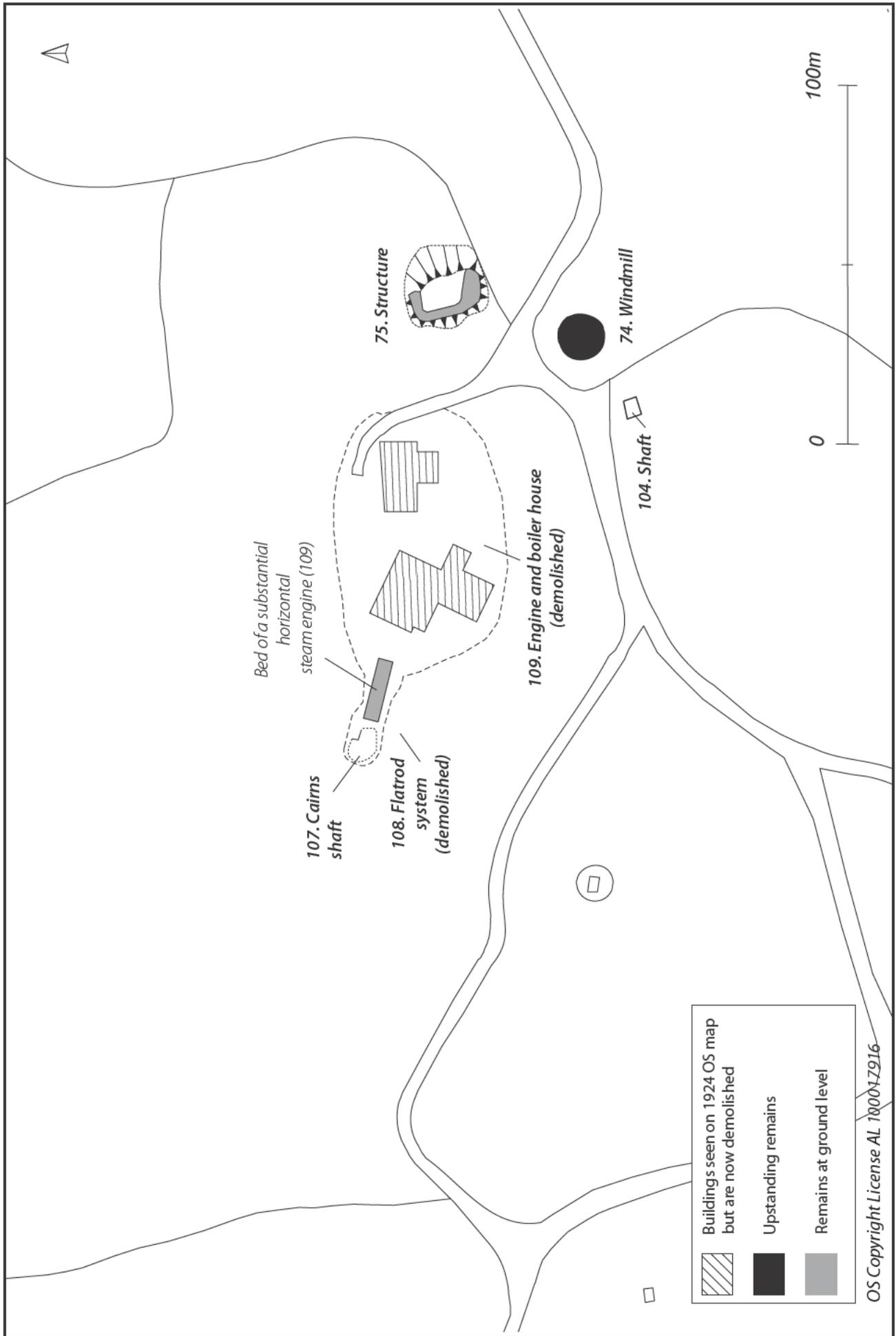


Figure 12: Windmill and associated features.



Figure 13: 3D laser scan of the windmill created by The Royal Commission on the Ancient and Historic Monuments of Wales (RCAHMW)

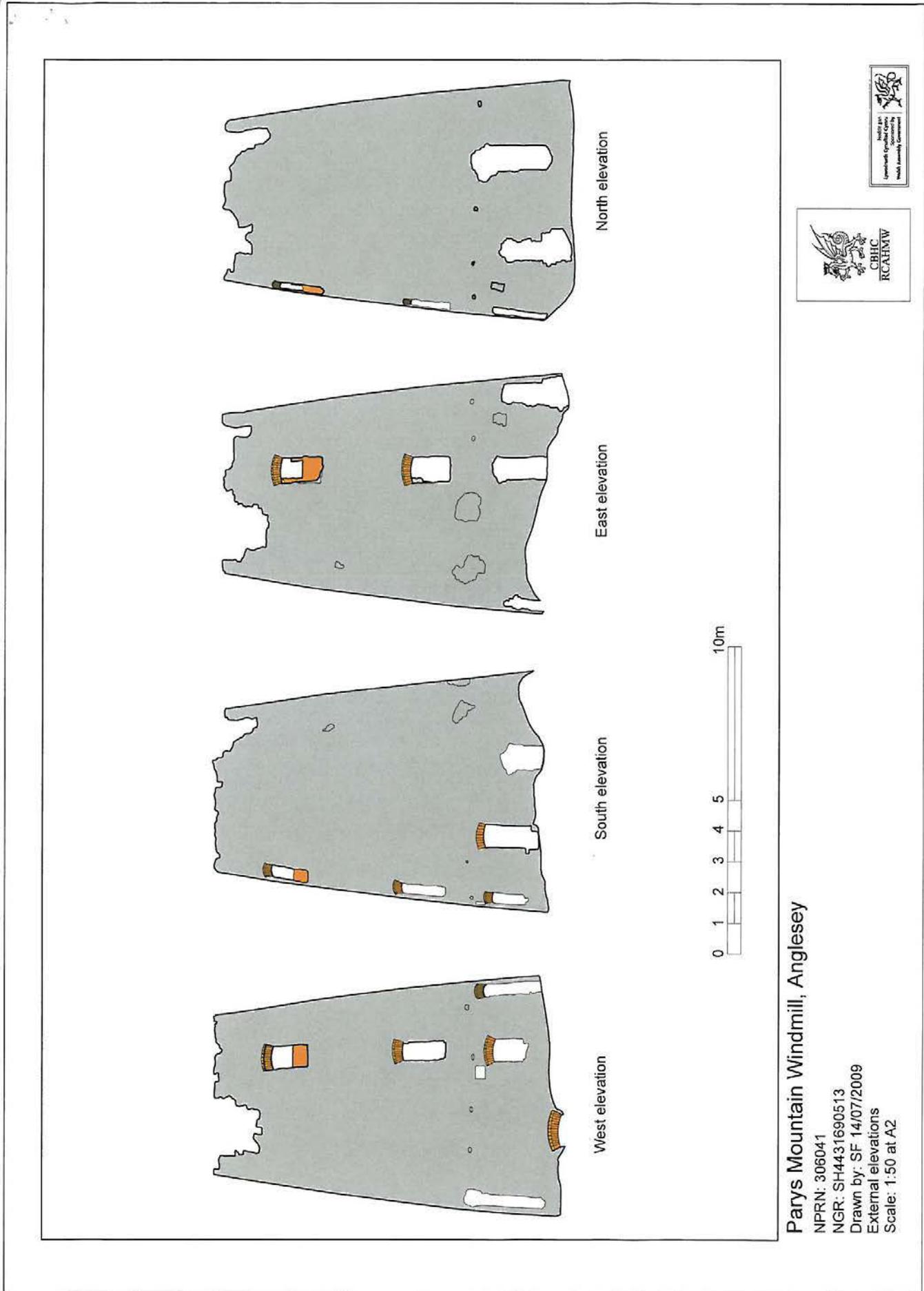


Figure 14: External survey of the windmill by The Royal Commission on the Ancient and Historic Monuments of Wales (RCAHMW)

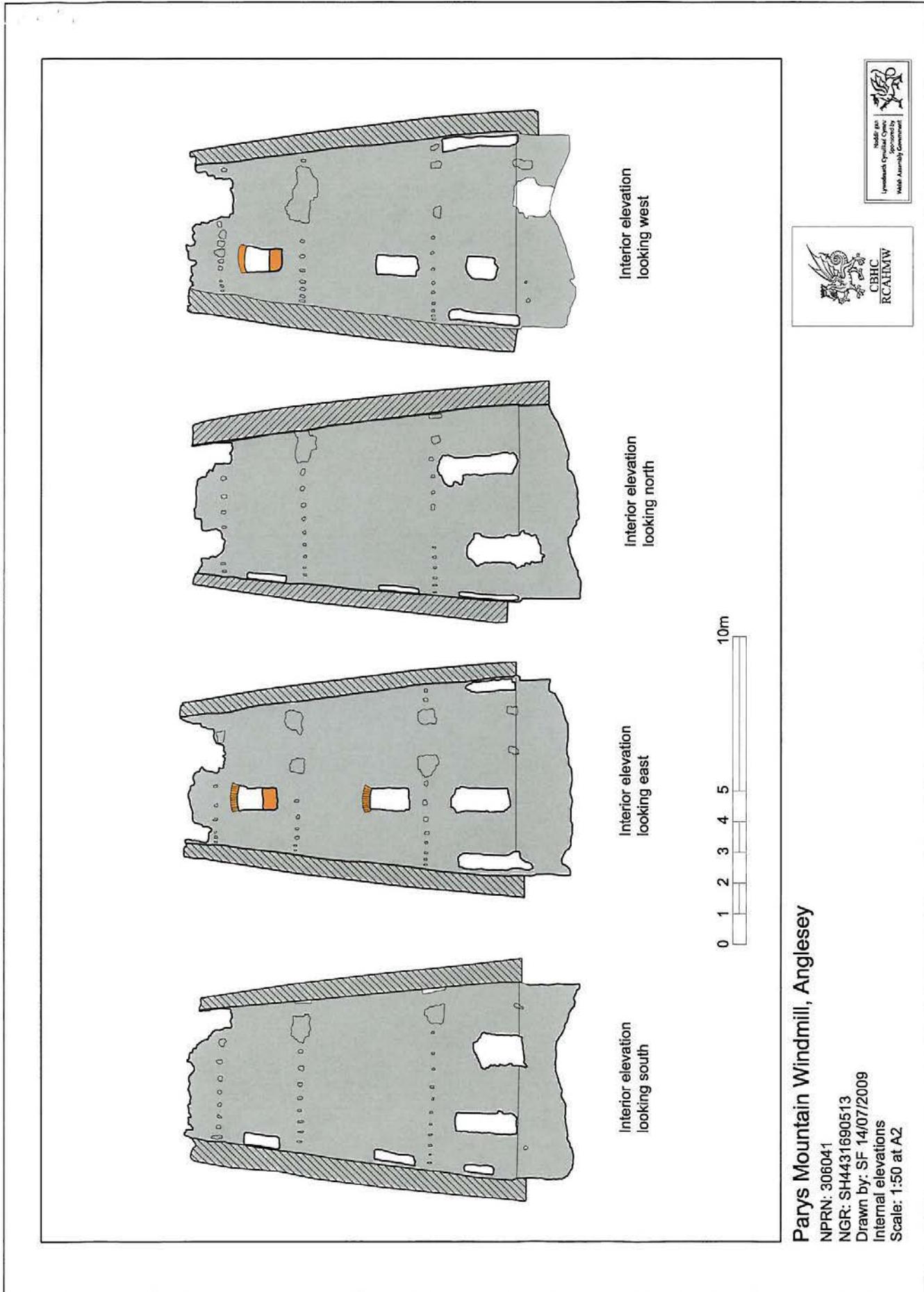


Figure 15: Internal survey of the windmill by The Royal Commission on the Ancient and Historic Monuments of Wales (RCAHMW)

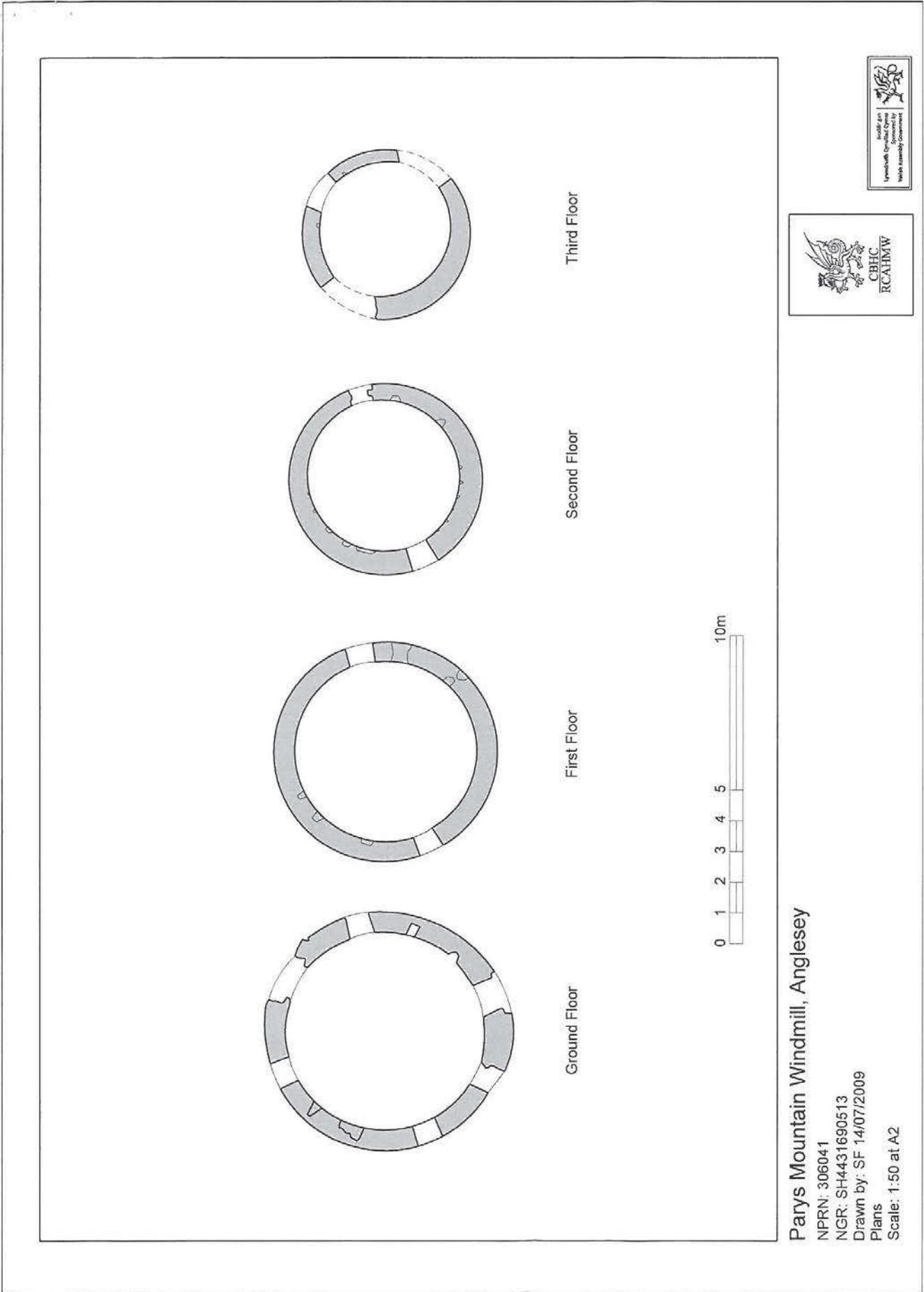


Figure 16: Internal profile survey of the windmill by The Royal Commission on the Ancient and Historic Monuments of Wales (RCAHMW)



Plate 33: Windmill facing south

structures can be seen in the OS 1889-1924 maps. All that remains is the substantial stone base and twisted holding-down bolts of the engine itself which are found at the foot of the Cairns shaft.



Plate 34: Cairns shaft and balance box, associated with the flatrod system pit facing south east

## 74 Windmill

**NGR SH4432 9051**

A windmill constructed in 1878 as an auxiliary to the existing steam engine (109) which pumped Cairns' shaft (107), and which was connected to the engine by 200' of flatrods moving on dolly posts (108). It was unusual in having five sails. It is believed to be the only surviving windmill on an extractive site in the United Kingdom (plate 33).

## 75 Structure

**NGR SH1443 29053**

A severely dilapidated structure, whose walls stand to a maximum of 1m high. There are shattered Cambrian roofing slates within the building.

## 104 Shaft

**NGR SH4430 9050**

Site only, capped, no. 31; an aperture in the windmill (74) lines up with this feature, suggesting that the windmill wound the shaft.

## 107 Cairns shaft

**NGR SH4424 9055**

A bracing timber for a headframe survives on the south of the pit, suggesting that the shaft uphauled as well as pumped. Power was supplied to this shaft from the windmill (74) as well as by the engine (109) by means of a flatrod-system (108) (plate 34).

## 108 Flatrod system

**NGR SH4426 9054**



Plate 35: remains of engine house facing north east



Plate 36: Windmill and remains of engine house facing south east

The site of a flatrod system which connected the Cairn's shaft (107) with the windmill (74) and the steam engine (109). Photographs shows (plate 32) that this was operated on dolly posts, of which no trace was observed, but a substantial balance-box pit, stone-lined, survives immediately to the south-east of the shaft.

### **109 Engine house**

**NGR SH4427 9054**

The remains of a once-substantial engine-house and boiler-room. The buildings themselves have left practically no visible trace, though the stone bed of a substantial horizontal steam engine is apparent, and a number of holding-down bolts are apparent, much twisted. A photograph in Owen Griffith's book shows that the buildings were constructed of stone and roofed with slate. (Griffith O: *Mynydd Parys* (Caernarfon 1897) plate 31) (plate 35 and 36)

### 5.3. Pearl engine house and associated features

#### 5.3.1 Location

The Pearl engine house is located on the north-eastern part of the mountain, close to lôn goppar, a road surfaced with copper slag which led to the port.

grant-aid from Cadw. The engine was purchased by the Mona mine from Neath Abbey ironworks in 1819, and installed on the north-eastern perimeter of the site that year, where it replaced a horse-gin.<sup>104</sup> It first worked on 27-30 March 1819.<sup>105</sup> Faraday describes it as “a small steam engine employed to drain one of the workings of the mine ... good and preserved in very neat order within the house, the outdoor parts were of timber” but adds:



Figure 17: Pearl engine house and associated features location.

#### 5.3.2 Historic background

The Pearl engine house was a purpose built construction to house the Cornish engine to pump the already existing Pearl shaft, installed in 1819. It is believed to be the oldest surviving example in Wales, and Scheduled as an Ancient Monument in 1995. It has recently been consolidated with

*‘The miners found themselves at first very much embarrassed in working this engine in consequence of the peculiar nature of the waters in this neighbourhood. For being a solution of sulphate of copper they acted on the cylinder and other iron parts of the engine rapidly corroding them and rendering the whole useless. Now they very carefully collect the waters from the higher parts of*

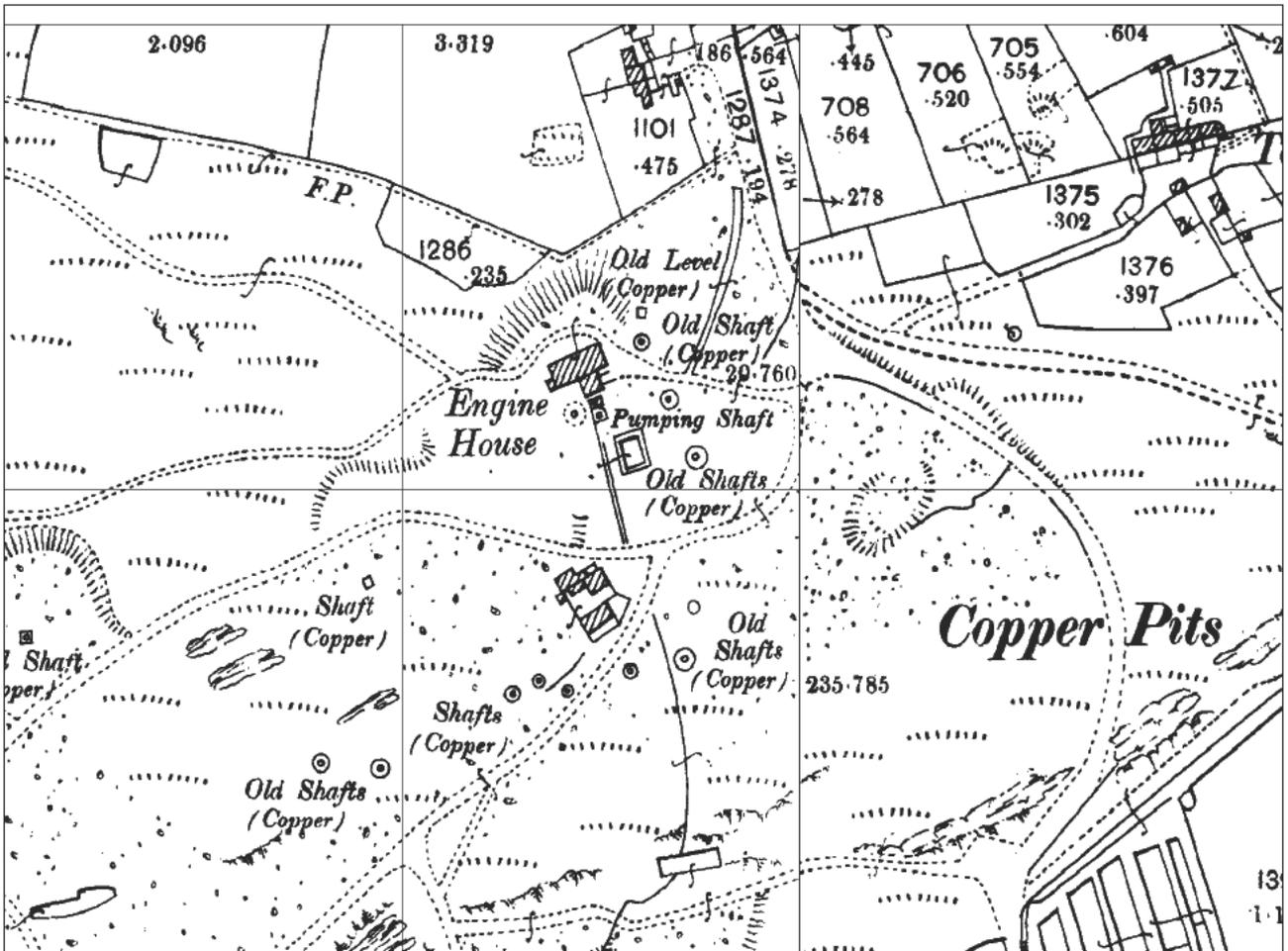


Figure 18: Anglesey 25" County series. 1900. XXI.5 (Scale 1:5000 @ A4)

*the mountain where they are more free from sulphate of copper, and they neutralise what portion of that salt may be in them with the acid also that they contain by lime and they also preserve the condensed water and cooling it in reservoirs they use it again.'*

Effective though lime, and chalk, which they had also been using, may have been, it was

not long before Treweek was on the look-out for cheaper ways of neutralising the acidity of the water, as they were costly and could not be recycled. This engine powered a lifting pump and a forcing pump in a 360' shaft. The original pumps were of iron, for which wooden pumps with brass moving parts had to be quickly substituted.



Plate 37: Pearl engine house 1897

A French visitor of 1826 appears to be referring to this machine when he describes the mine as dewatered by "une seule machine à feu, de la force de 6 chevaux, placée à quelque distance de la grande ouverture." 110 How long it remained in use is doubtful, for the Mona mine wages lists, which survive from 1822 onwards, consistently refer to the steam engine department until 1829, and the accounts refer to men working on the steam engine until March of that year, 111 suggesting it was taken out of use then, and a curious reference of 1819 suggests that the engine was only intended to

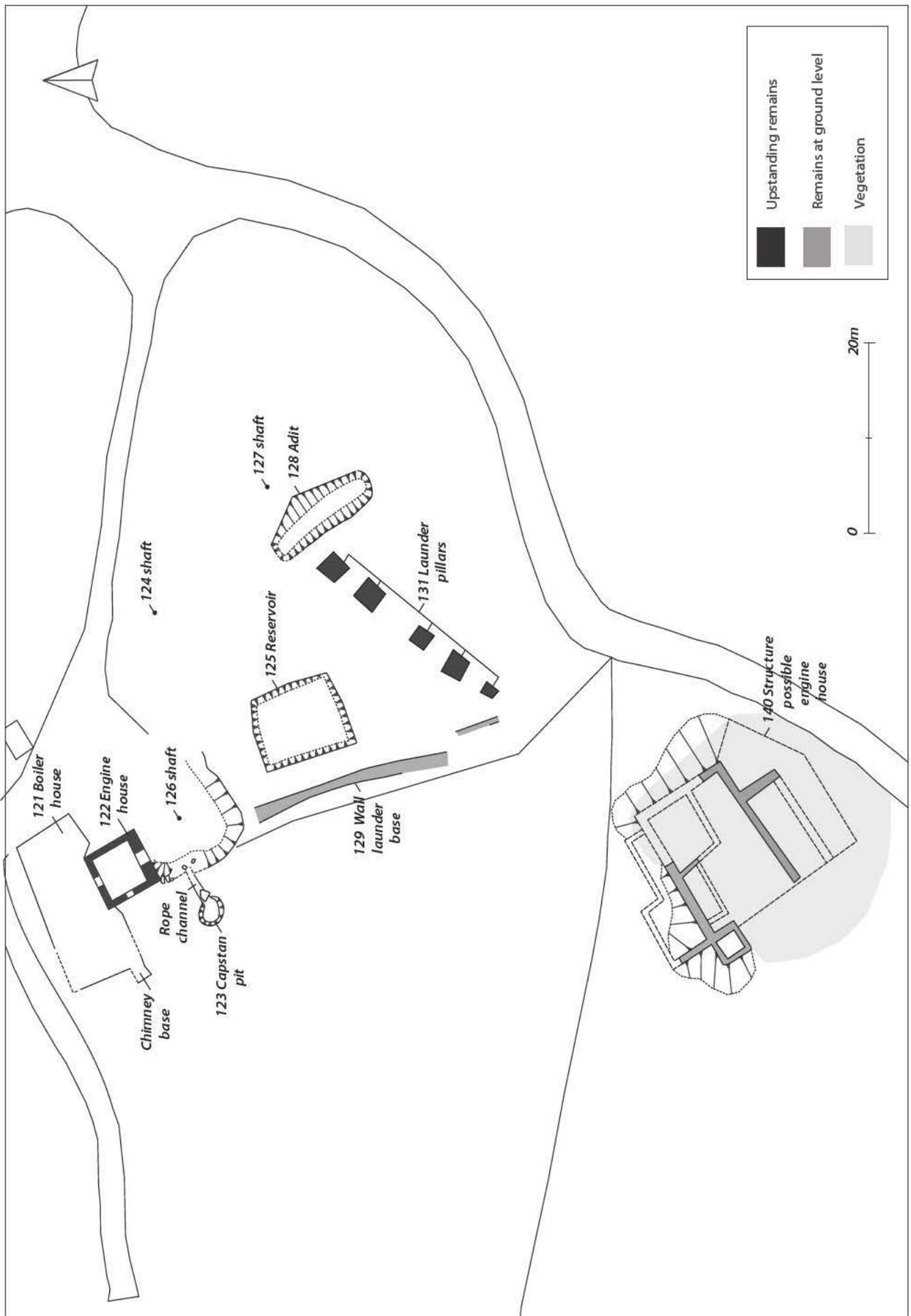


Figure 19: Pearl engine house and associated features



work for ten years.<sup>112</sup> By 1833 the abstracts of dead capital refer to it as “old steam engine”, possibly to distinguish it from a new arrival.<sup>113</sup> In 1853 a 24” engine was bought from the Perran Foundry through Messrs Messrs Hocking and Loam of Redruth, consulting engineers, for a total of £632 and installed in the Pearl engine house,<sup>114</sup> but it was not long before it needed attention, for the spring beams were observed to be rotten in 1857 and had to be replaced. It was still at work “in an efficient manner” in 1880. Though commonly referred to as the “pearl engine”, Owen Griffith calls it “ingian Cerrig y Bleiddiau.” It was valued at between £820 and £750 between 1865 and 1870, suggesting that Hocking and Loam only supplied some parts of the machine, and that a number of components remained from the previous engine. The Gwynedd Archaeological Trust carried out recording work on the Pearl engine house in 1996.

### 5.3.3 Description

The Pearl Engine house stands partially restored. Its chimney was destroyed in a storm a few years ago. The engine house contained a steam driven pump which pumped water from the nearby Pearl shaft. These pumps, operated by the water wheel, raise the water to a reservoir behind the pearl engine house. After feeding the boiler in the engine house the engine pumped more fresh water from the reservoir to another boiler situated at the Cairns boiler house on the top of the mountain. The total lift from the water wheel to the Cairns engine house is about 200 feet. To the south of this feature is a heavily dilapidated and overgrown structure (140) which may also have been an engine house, and which lines up with a row of substantial pillars (131) leading to a pump-shaft (127). The one feature on the mountain which shows evidence of having depended on human muscle alone is the capstan pit associated with the Pearl shaft, which would have been used for raising and lowering sections of pump-rods when repairs were being made (123). This feature

has recently been restored with grant-aid from Cadw

### 121 Boiler-house

NGR SH4475 9078

The site of a stone-built boiler house whose axis runs parallel to the bob wall of the Pearl engine house (122) but has not been built integrally with it. From photographs it appears to have had a monopitch roof. It is very heavily dilapidated. An integral chimney situated in the south-western corner has collapsed into the boiler-house-site. It falls within the Scheduled area.



Plate 38: Pearl engine 122 house facing north

### 122 Engine-house

NGR SH4476 9077

The Pearl engine-house; believed to have housed a beam engine pumping engine constructed by the Neath Abbey Ironworks in 1819, and later to have housed a beam engine of 1853 built by the Perran Foundry through the consulting engineers Messrs Hocking and Loam. An unusual feature is the hooded cowl over the beam, of which traces remain in the stonework. This is believed to be the oldest beam-engine house in Wales. It has recently been consolidated with grant-aid from Cadw. It is a Scheduled Ancient Monument.

### 123 Capstan-pit

NGR SH4476 9076

A pit for a manually-operated capstan to haul pump-rods up and down the shaft for repair and renewal (124); recently (Novem-



Plate 39: Capstan pit 123 facing east

ber 1997) consolidated with grant-aid from Cadw.

### 124 Shaft

NGR SH4477 9075

The site of a pump-shaft, now capped. This is believed to be the Pearl shaft.

### 125 Water-course

NGR SH44779074

A possible water-course, apparent as a stone-lined depression immediately south of shaft (124).

### 126 Shaft

NGR SH447 99077

Site only, capped. no. 14.

### 127 Shaft

NGR SH4480 9075

Site only, capped; this feature lines up with a row of pillars (13 1), and may also be connected with (128).

### 128 Adit

NGR SH4479 9074

An excavation which exposes bedrock, approximately 4m deep, overgrown at its southern end where an entry is visible. It may be the entrance to an inclined shaft, but timbers exposed on the western side suggest that it may have carried a flatrod system supported on (131) to (127).

### 129 Wall

NGRSH44779074

A low (1 m high) stone wall. built partly on

tipped material. There is the trace of circular-plan chimney near the northern limit of the wall.

### 130 Water-course

NGR SH4478 9075

A square-plan pond measuring 7m by 10m, shallow with a stone floor, containing some water, apparently fresh. It is probably associated with the Pearl engine's (122) supply system, and may have been fed by (159). An early photograph appears to show a cast-iron pipe feeding it from the east.

### 131 Pillars

NGR SH4478 9072

A row of five stone-built tapering, pillars, measuring (maximum) 3m by 3m at the base and reaching to a maximum height of 2m. They appear to be too substantial to be launder pillars, and may possibly have carried a flatrod system, possibly from (140), or from (122) by means of a fend-off bob to turn it through an acute angle, to (127).



Plate 40: Pillars 131 facing north

### 132 Structure

NGR SH4480 9073

A roofless structure is marked here on the 1900 25" ordnance survey. Its site is now considerably overgrown with heather. Traces of the first course only of a stone wall are evident on tile south side.

### 133 Feature

NGR SH4474 9079

A depression, heavily overgrown, in built-up

ground, possibly connected with (121) and (122).

### **136 shaft**

**NGRSH 4469 9071**

Site only, capped.

### **138 Shaft**

**NGR SH4473 9068**

Sunk through bed-rock, there are traces of a stone-built collar, and a substantial stone retaining wall to the south-east overlooking the roadway. It is filled with stone rubble to within 4m of the lip. It is associated with the horse-whim circle (139), and they together form the best example of features once common on Mynydd Parys.

### **140 Structure**

**NGR SH4476 9071**

The ruins of a Substantial stone-built structure, very seriously dilapidated and overgrown. It appears to have gone through several phases of use, including an office, which survives as a roofless structure in the western part of the building, and the 1900 25" ordnance survey map shows a cluster of small buildings around an enclosed area. This structure, or set of structures, may, be associated with the pillars (131) that line up with one of the perimeter walls, these are suggested as being, supports for a flat-rod system, in which case it is possible that this structure may have been an engine house of some description.



Plate 41: Structure 140, possible engine house facing north

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### 6.3 Maps

#### 9.3.1 UWB:

Bangor MSS

31584: plan of Parys Mine by Henry Dennis of Rhiwabon, 1859

31590: plan of opencast and underground workings, 1892

31592: plan of Dyffryn Adda precipitation pits and furnace, nd.

31598-601: four copies of plan of opencast and underground workings, n.d.

31602: plan of Parys mine 1815

31603: plan of Mona mine, 1784-86

31604: 6"/1 mile ordnance survey map of Mynydd Parys, n.d.

Llwydiarth Esgob MSS

Fs 639/640/641

M/C

20

3/158

#### 9.3.2. Llangefni Record Office

WCD/118/1

WCD/118/3

WCD/118/4

WCD/118/7

WCD/118/9

WCD/118/14

WCD/118/15

WCD/118/16

WCD/118/19

WCD/119/1

25" Ordnance Survey map (III 15 Anglesey, 1887, 1900).

#### 9.3.3 Hawarden Record Office

Deposit D/KK/534 (Keen and Kelly MSS) -

map dated 1764.

9.3.4 National Monuments Record, Aberystwyth

Map of Parys Mine, H. Hughes, 1815

Survey of Cerrig y Bleiddiau Mountain - map dated 1786

9.3.5 British Geological Survey, Llanfarian, Aberystwyth

D.O. December 1959, PP299/Do, III (Ms plan under varnish, J. Taylor and Sons).

9.3.6 Birmingham Reference Library Boulton and Watt collection 6/6/85

9.3.7 West Glamorgan Record Office D/D NAI M 10/1-6, D/D NAI/M 246/1-3 (plans of parts of 18" steam engine)

9.3.8 Public Record Office, Chancery Lane SP 46/36 MPF 11 - map of Traeth Dulas and Amlwch, late sixteenth century

### 6.4 Unpublished Texts

GAT report 193. Dyffryn Coch Precipitation Pits. 1995.

Gwyn.D.Rh. GAT report 292. Mynydd Parys Copper Mine: Archaeological Assessment

Isle of Anglesey County Council. Precipitation Pits at Henwaith. Mynydd Parys.2008.

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Craig Beuno, Ffordd y Garth, Bangor, Gwynedd. LL57 2RT  
Ffon: 01248 352535. Ffacs: 01248 370925. email: [gat@heneb.co.uk](mailto:gat@heneb.co.uk)

