

FRONGOCH METAL MINE REMEDIATION PROJECT ARCHAEOLOGICAL ASSESSMENT



Prepared by Dyfed Archaeological Trust
For the Environment Agency



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FRONGOCH METAL MINE REMEDIATION PROJECT

ARCHAEOLOGICAL ASSESSMENT

Gan / By

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SUMMARY

One of the largest mines in North Ceredigion, Frongoch is a lead and zinc mine situated near Pontrhydygroes in central Wales. Underground mining started at Frongoch in the mid 1700's and the mine was then worked almost continuously until 1903. It is estimated that with an estimated output of over 100,000 tons of lead and zinc ore, Frongoch was the most productive mine in Ceredigion. From 1924 to 1930 the huge dumps of waste material were reworked on a substantial scale and are now largely removed. The ruins of Cornish engine houses and other mine buildings now stand as a testament to a once thriving industry, whilst surrounding them is a near waste land pitted with the scars of the former mine workings.

Frongoch Mine (NGR SN7213 7440) has been discharging zinc and lead into the River Ystwyth catchment every year for the last century, making it one of the largest sources of heavy metal pollution in Wales. The Frongoch Metal Mine Remediation project has been established by the Environmental Agency to reduce and prevent the extent of metal discharge from the site.

The detailed design of the remediation scheme has yet to be agreed. Given the national importance of the remains of the Frongoch Mine, Dyfed Archaeological Trust Field Services were appointed by the Environment Agency to carry out a thorough archaeological assessment. This assessment will be used during the detailed design stage of the remediation project to enable an acceptable proposal to be achieved.

The archaeological assessment will help to inform the Environment Agency where the archaeology may need to be recorded during the remediation works and identify where archaeological remains may need to be retained in their current state.

1. INTRODUCTION

1.1 Project Proposals and Commission

1.1.1 Frongoch Mine (NGR SN7213 7440) has been discharging zinc and lead into the River Ystwyth catchment every year for the last century, making it one of the largest sources of heavy metal pollution in Wales. The Frongoch Metal Mine Remediation project has been established by the Environmental Agency to reduce and prevent the extent of metal discharge from the site. Although the detailed design stage of the scheme has yet to be undertaken the key components of the scheme are likely to be:

- Perimeter surface drains: purpose of which will be to prevent clean surface water from entering the site (northern perimeter) and contaminated surface water exiting the site (southern perimeter)
- Re-profiling of slag heaps/tailing lagoon
- Creating wetland area (i.e. reed bed system) – its envisaged that this will be situated within the southern sector of the site in accordance with water runoff at the site
- Line and cap certain areas of the site
- Heathland planting

1.1.2 It is possible that construction of the above scheme could cause damage to or destroy any historic fabric associated with the metal mine.

1.2 Scope of the project

1.2.1 The scope of the assessment was agreed with the Environment Agency and consisted of an examination of available sources of information such as maps and published works held in the Historic Environment Record¹ (HER) and a walk over survey of the whole study area.

1.2.2 The aim of this search was to establish how the mine developed over time and where structures were located. The results of this assessment including an illustrative plan of archaeological constraint are intended to identify the extent and character of the archaeological resource.

1.2.3 The assessment should be seen only as the first stage of the archaeological process and does not preclude the possibility that further archaeological participation may be required prior to, or during, the proposed programme of works.

1.3 Abbreviations used in this report

1.3.1 Sites are located by their National Grid Reference (NGR). The full details of references to cartographic and documentary evidence and published sources are listed in the sources section at the rear of the report.

1.4 Illustrations

1.4.1 Printed map extracts are not necessarily reproduced to their original scale and are illustrative only.

¹ Held and managed by Dyfed Archaeological Trust, Carmarthen Street, Llandeilo, SA19 6AF.

2. SITE LOCATION

2.1 Site location

2.1.1 Frongoch Metal Mine is situated in a remote upland area northwest of the village of Pontrhydygroes, Ceredigion (Fig. 1 and Photo 1) at NGR SN7213 7440.

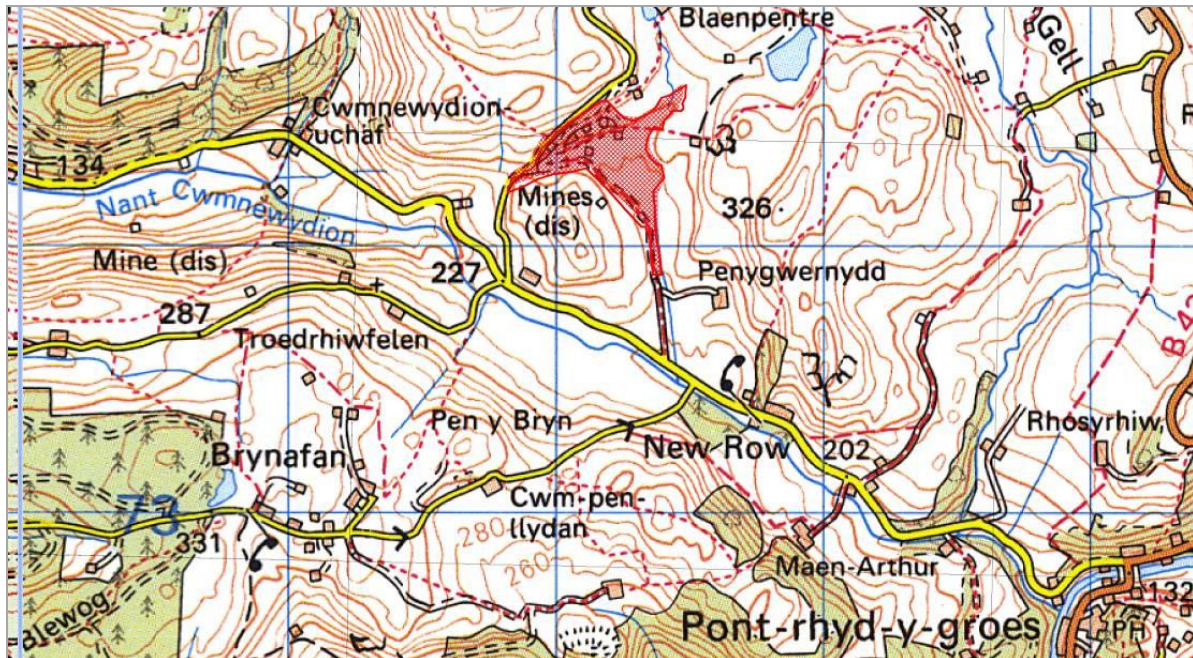


Figure 1: Location map of Frongoch Mine based on the Ordnance Survey. The study area for this project as shown in Figure 2 is shaded in red.

Reproduced from the 1995 Ordnance Survey 1:50,000 scale Explorer Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Dyfed Archaeological Trust Ltd., The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No AL51842A

2.2 Landscape

2.2.1 Frongoch Mine lies within an extensive upland area of moorland between 240 and 260m above sea level. Apart from conifer plantations and small stands of broadleaf woodland, it is virtually a treeless landscape. The field pattern is one of large, irregular enclosures. The earth banks that once divided the enclosures are now redundant or augmented with wire fences.

2.2.2 The physical remains of mining are much in evidence and form an important element of the historic landscape. Frongoch Mine buildings are of national importance, though in a poor state of preservation. The northern part of the site is now used as a sawmill. Associated with the mine are further landscape components such as spoil heaps, reservoirs and leats. The reservoirs in particular are dramatic elements of the landscape.

2.3 The study area

2.3.1 The study area considered within this report is shown in Figure 2 below defined by the blue shaded polygon. It encompasses the whole of the Frongoch Mine including any related shafts, adits, buildings and other structures, as well as the spoil heaps and southern reservoir that lie to the east of the minor road. It does not include the remains of Wemyss Mine that lies to the west of the minor road.

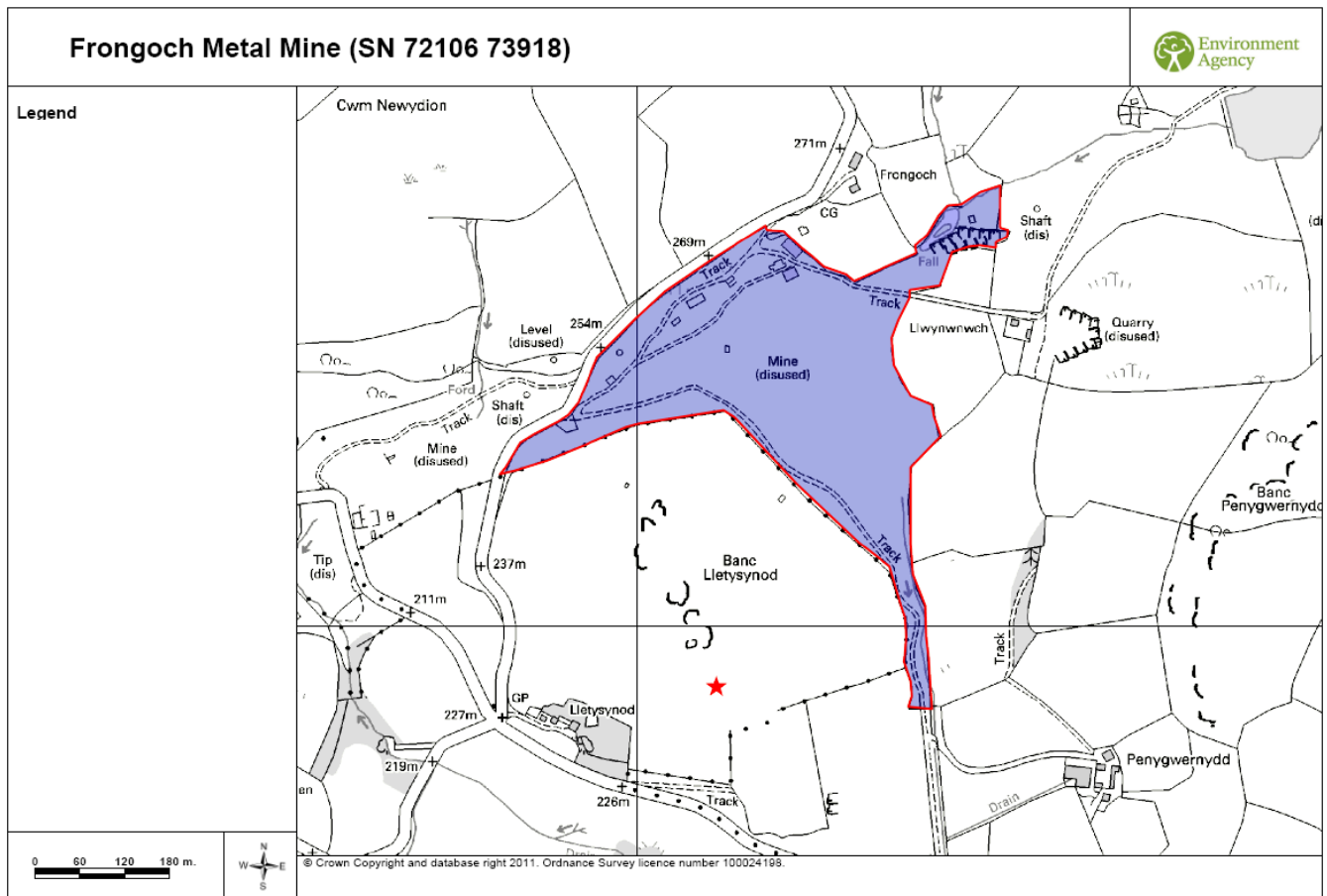


Figure 2: Location plan of Frongoch Mine showing the study area considered in this report coloured in blue. Plan supplied by the Environment Agency.

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Ordnance Survey licence number 100024198.

3. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

3.1 Historical Development

3.1.1 Frongoch Metal Mine was first leased in 1759. However, it wasn't until 1834 that the full potential of the mine was realised. In this year John Taylor & Sons formed a company - the Lisburne Mines - to take over the unexpired lease of the Lisburne Estate that comprised several mines within a mile or two of Pontrhydygroes, including Frongoch. For the next 40 years Frongoch Mine became the biggest producer of lead ore (galena) in Cardiganshire (Ceredigion).

3.1.2 Due to the geographical position of the mine the supply of water to drive the waterwheels that drained the lower levels of the mine was always problematic. Taylor tried to solve this problem by installing a series of steam engines in 1841 and 1863, but the cost of transporting coal from Aberystwyth proved prohibitive and they fell out of use. Additional reservoirs were constructed on higher ground to the north to supply, via leats, more water to the wheels used for pumping, as well as those for winding and crushing the ore.

3.1.3 The Wemyss Mine to the west was acquired, as the lode passed through both properties and the Wemyss adit was extended eastwards to serve both workings.

3.1.4 In 1860 an inspection of Frongoch reported that it was active down to the 78 fathom level and employing a waterwheel of 55ft diameter for pumping. The workings covered a length of three quarters of a mile. The lode varied from 10 to 30 ft wide and had yielded 14,000 tons of lead ore concentrates over the past decade alone.

3.1.5 By 1879 it was clear the mine was past its best and the Taylors disposed of the mine and the lease was taken up by The Frongoch Mine Ltd. The salvation of the mine at this time lay in the enormous reserves of zinc blende that lay untouched within the workings. Over the next 20 years 50,000 tons were raised, together with several tons of galena.

3.1.6 An attempt by a Belgian company 'the Societe Anonyme Miniere' in 1898 to use electrically driven equipment was short lived, and with decreasing productivity and rising costs the mine was put up for sale in 1903.

3.1.7 The demand for metals rose during the First World War and led people to consider the vast waste-dumps of material that surrounded the mine workings accumulated in the previous century. The waste dumps were removed and treated for the lead and zinc that had once been deemed not worth recovering.

3.1.8 From 1924 to 1930 the dumps were reworked on a substantial scale. Up to the mid 1950's a small dressing plant was used to reclaim lead and zinc ore from what was left of the dumps.

3.1.9 For some years there has been a saw mill on the northeast part of the site. The wood shavings from the mill have covered large areas of the dumps in this area and in 2003, as a result of this encroachment, a few hundred tons of the dump material were moved 200m further south on the mine site.

3.2 Cartographic Information

Tithe Award map of 1847 (Figure 3)

3.2.1 Bick (1986) describes the map as showing the engine house built in 1841, as well as the office and other buildings and above these buildings a long leat terminating in a possible water wheel close to the location of the Engine Shaft. The leat has a second branch ending just southwest of the engine house.

Ordnance Survey 1st edition 25" map published in 1888 (Figure 4)

3.2.2 The map shows the considerable change that had occurred at Frongoch Mine over the intervening 40 years. A full range of mine buildings is depicted. On higher ground to the northwest are the pumping engine house built in 1863 by John Taylor, as well as the older engine house of 1841, a crusher house lies to the east and to the west is an office. To the far west lies the smithy building. To the southeast on flatter ground is an extensive area of dressing mills, stores, a winding house, stamp mill, tramways, circular buddles, and slime pits. Further southwest a reservoir has been constructed. This map would appear to show the furthestmost extent to which the mine buildings reached on the southeast.

Ordnance Survey 6" map of Cardiganshire published in 1891 (Figure 5)

3.2.3 Little change is depicted on this map published in 1891. The buildings described above are still extant and, apart from a new set of 3 circular buddles to the southeast of the central store building, no additional construction is shown as having been undertaken.

Ordnance Survey 1st edition 25" published in 1905 (Figure 6)

3.2.4 Sometime before 1905 major changes had taken place. Frongoch Mine is now labelled as disused. Gone is the extensive area of dressing mills, buddles and slime pits. All the dressing of the ore was now undertaken at the new mill at Wemyss to the west and a tramway runs east to west from Vaughan's New Shaft to the dressing mill at Wemyss, passing through a tunnel under the road.

Ordnance Survey 6" map of Cardiganshire published in 1906 (Figure 7)

3.2.5 Very few changes are shown on this map published in 1906 from that depicted in 1905.

Ordnance Survey 6" map of Cardiganshire published in 1953 (Figure 8)

3.2.6 By 1953 many of the features and buildings depicted on previous maps are no longer illustrated. However, these include buildings that are still extant today so it is difficult to know how accurate a representation this map is of the condition of the mine buildings at this time. A surviving few buildings can be recognised including the stamp mill, the winder/crusher to the north of Vaughan's New Shaft, Engine Shaft, and the office. However, for the first time the reservoir is not shown in outline and the tramway to the west of Vaughan's New Shaft has been removed, as has the dressing mill at Wemyss.

3.3 Industrial Archaeology

3.3.1 The continuous development that has occurred over the years at Frongoch, followed by the large scale removal of the waste dumps in the 1920s has left a varied collection of ruins dating from the mid-19th century through to the early part of the 20th century. These include the remains of three engine houses, a crusher house, a stamp mill, a winding house, the 'old' dressing mill, the structures and earthworks associated with at least 10 working shafts, a larger open-working, two powder magazines, the earthworks for a series of watercourses and a substantial reservoir, structures and earthworks associated

with various ore preparation processes, sundry offices and stores, and the earthworks of a tramway linking the mine with a later dressing mill at Wemyss. There are no structures that can be attributed to the period before the Taylors acquired the mine in 1834.

3.3.2 Most of the buildings are situated on higher ground along the northwest edge of the study area, but from beneath the tips and dumps across the rest of the area can be seen the walls of other structures that are not always as easy to identify.

3.3.3 The northwest section of the mine site, adjoining the road and containing two of the engine houses along with the crusher house and an office, is designated as a Scheduled Ancient Monument (Ceredigion 146).

3.3.4 The main buildings within the scheduled area are working from south-west to north-east:

1) An office, the last phase of which was built c.1900. This building has largely collapsed (Photo 4) apart from the main masonry areas of the walls.

2) A pumping engine house c.1863. On its southeast side are 2 balance bob pits running in almost opposite directions, adjoining the shaft itself. The building is largely reduced to the main areas of masonry walls, and of these the more solidly-built pump house (on the northeast) survives better than the adjoining boiler house and coal store (Photo 5). The pumping engine house chimney collapsed during a storm in 1990.

3) An older engine house, somewhat more ruined than the other. The northwestern room appears to have been built from larger stones, more solidly than the remainder, and this survives best, together with a corner of the northern room (Photo 6).

4) A crusher house, originally constructed around 1860, and later used as a winding house, perhaps after it was extended in about 1900. This building survives to a height of about 3m and a makeshift building has been constructed within the three walls of the original building. The wheel pit on the south side is nearly intact (Photo 7).

3.3.5 Other fragmentary structures are to be seen across much of the northern part of the study area, which undoubtedly still offers considerable potential for the survival of sub-surface archaeological remains, despite the loss of much surface evidence. The southern half of the complex was occupied in the main by extensive spoil tips and a large reservoir that supplied water to the ore-processing works at the Wemyss Mine, to which it was connected by a leat that is visible for much of its course. The area of spoil tips has been greatly disturbed during the 20th century and the reservoir has long been drained and its site is now barely identifiable.

3.4 Site Visit

3.4.1 A site visit was undertaken on 25.01.12 to assess the extent of any surviving archaeology on the ground. With the aid of an earlier survey of Frongoch Mine carried out in 1993 by Dyfed Archaeological Trust the current condition and extent of buildings and structures could be evaluated. In general the above ground archaeology has deteriorated significantly since 1993.

3.4.2 This has been caused by a combination of factors, including the former use of the site as an off-road driving course and the removal of spoil as hard core. However, the processes of natural erosion and decay have impacted on many of the standing structures at the mine, including those that have been "protected"

by Scheduled Ancient Monument status for many years. The present use of the northern section of the mine as a large, working saw mill complicates the management of the site as the buildings of the sawmill operation are intermixed with some of the old mine structures and large woodchip waste tips are obscuring some parts of the mine (although these are unlikely to be causing damage to sub-surface features).

3.4.3 Passing through the Iron Gate which leads into the upper workings, one passes a heap of spoil on the left, at the top of which is a rubbish filled depression. This is Williams Shaft that has opened up since 1993 when it was not visible (Photo 3)

3.4.4 The condition of all the buildings within the area of Scheduled Ancient Monument Ceredigion 146 has worsened. As the wooden lintels are rotting so the walls are sagging and many of them are sitting at precarious angles. The foundations of the large pumping engine house appear to be seriously undermined as observed within the north face of the engine shaft, where water pours into the shaft below.

3.4.5 Just north of the scheduled area, running along the bottom of the steep slope that rises up to the road to the north, appears to be a rock cut leat or aqueduct.

3.4.6 In the area to the south and east of the saw mill there has been much moving of waste tips, including those of the saw mill and there are large dumps of rubbish, including many porta-cabins, steel lock ups filled with rubbish and old machinery that obscure archaeological features and in some cases appear to be compromising the survival of any remaining buildings (Photo 16).

3.4.7 The majority of buildings and other structures recorded in 1993 were identified during the site visit, although a store building recorded as lying approximately 80m southeast of the large pump engine house is no longer visible. In 1993 the eastern wall of the office stood to over 1 metre high.

3.4.8 To the southeast of the line of the former tramway evidence of circular buddles (ore cleaning devices) (Photos 11 & 12) and slime pits can be seen protruding through the ground. There also appears to be evidence of a series of rectangular slime pits protruding through the ground surface further to the southeast that were not recorded during the 1993 survey, but are shown on the 1888 OS 25" map. This would suggest that archaeological features survive well below ground level (Photo 13).

3.5 Previous Archaeological Work

3.5.1 The site was surveyed by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) in 1984.

3.5.2 A detailed survey of the remains of the mine buildings was undertaken in 1993 by Robert Prothero Jones on behalf of Dyfed Archaeological Trust. This information has been added to the HER.

4. CONCLUSIONS

4.1 Archaeological Constraints (Figure 9)

4.1.1 Following the examination of the map and other published sources and the completion of the walk-over survey a constraints map has been drawn up (Figure 9) to identify areas of low, medium or high archaeological potential. This can be used to inform the detailed design stage of the remediation project.

4.1.2 The constraints map shows the study area outlined in brown divided into 6 separate zones of archaeological potential.

Area 1: (Shaded red) Scheduled Ancient Monument -- CED 146.

4.1.3 As described above. This area is protected by statutory legislation.

Area 2: (Shaded pink) Area of high archaeological potential.

4.1.4 The central area of the mine workings including all the dressing floors, mills, and the majority of the mine shafts. There is a high probability that there are archaeological features below the ground surface. Any future works carried out in this area will be likely to have a high impact on the known archaeology above ground and those features surviving below ground.

Area 3: (Shaded green)

4.1.5 Area of medium archaeological potential to the west of the main mine workings. This area includes fewer identified archaeological features above ground, however, several leats are recorded in this area as well as vestiges of the tramway that ran east to west to Wemyss Mine. It is probable that there are archaeological features below the ground surface, but earlier map evidence would suggest no buildings or other large structures were present in this area.

Area 4: (Shaded green)

4.1.6 Area of medium archaeological potential to the east of the main mine workings. This area includes fewer identified archaeological features above ground but does include the opencut with waterfall, Edwards Shaft and Llwynynwch Shaft. The opencut is now fenced off and west of this fence the area has been heavily machine levelled. Although few archaeological features are recorded above ground, below ground features may still survive.

Area 5: (Shaded blue)

4.1.7 Area of low archaeological potential to the southwest and southeast of the mine workings, including the areas of the former reservoir and the vast waste dumps. The waste dumps have now largely been removed and the area is fairly level. There are few known archaeological features in this area but it is still possible that archaeological deposits survive below ground.

Area 6: (Shaded blue)

4.1.8 Area of low archaeological potential running along the northwest edge of the study area. This area of gorse covered rock slopes steeply from the edge of the road to the north down to the more level ground of the mine. Few archaeological features have been recorded in this area apart from what appears to be a leat/aqueduct that runs along the base of the slope.

5. SOURCES

5.1. Cartographic

1847 - Tithe Award map of 1847 for the parish of Llanfihangel y Creuddyn

1888 - First Edition Ordnance Survey 25-inch map of Cardiganshire.

1891 - Ordnance Survey 6-inch map of Cardiganshire.

1905 - Ordnance Survey 25-inch map of Cardiganshire.

1906 - Ordnance Survey 6-inch map of Cardiganshire.

1953 - Ordnance Survey 6-inch map of Cardiganshire.

5.2 Published

Bick, D. 1986, *Frongoch Lead & Zinc Mine, British Mining No 30*, Northern Mine Research Society Monograph.

6. PHOTOGRAPHS



Photo 1: View of mine buildings along north-west edge of Frongoch Mine, with smithy in foreground. Looking north-east.



Photo 2: View of smithy building. Looking south.



Photo 3: View of subsidence around Williams Shaft that has occurred since last recorded in 1993. Looking north-east.



Photo 4: View of office building. Looking approximately south.



Photo 5: View of collapsing walls of pumping engine house built c.1863.
Looking south-west.



Photo 6: View of former pumping engine house built c.1841. Looking west.



Photo 7: View of the crusher/winder house. Looking north-west



Photo 8: View of the opencut situated on the eastern edge of Frongoch Mine,
Looking east



Photo 9: View of part of the dressing mill complex? Looking east



Photo 10: View of red brick and rubble walling supporting loadings on site of head of incline. Looking approximately north.



Photo 11: View of circular kerb of 'buddle' with area of former reservoir in background. Looking south-east



Photo 12: View of circular floor of 'buddle' with area of former waste tips in the background. Looking south-west.



Photo 13: View of remains of rectangular slime pits. Looking east



Photo 14: View of area of former reservoir. Looking east



Photo 15: View to south showing the remaining waste dumps of Frongoch Mine in the back ground and the more recent waste from the saw mill in the foreground.



Photo 16: Collapsing mine building surrounded by redundant steel lock ups and accumulated rubbish.

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Ionawr 2012

January 2012

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*Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw sylwadau
sydd gennych ar gynnwys neu strwythur yr adroddiad hwn*

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comments you may have on the content or presentation of this report*