# PENRHYN SLATE QUARRIES ARCHAEOLOGICAL ASSESSMENT (G1349)

# **REPORT NO. 176**

Ymddiriedolaeth Archaeolegol Gwynedd Gwynedd Archaeological Trust

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# PENRHYN SLATE QUARRIES ARCHAEOLOGICAL ASSESSMENT (G1349)

prepared for Alfred McAlpine by Dr. D. Gwyn & A. Davidson illustrated by H. Riley

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Gwynedd Archaeological Report No. 176

## PENRHYN SLATE QUARRIES

#### ARCHAEOLOGICAL ASSESSMENT (G1349)

# 1. INTRODUCTION

Alfred McAlpine are preparing an Environmental Statement to accompany a planning application for an extension to the existing quarrying operations at Penrhyn Quarries, Bethesda.

Gwynedd Archaeological Trust (Contracts Section) was commissioned to carry out an archaeological assessment of all land within the quarry permission area, to form part of the Environmental Statement.

# 2. ASSESSMENT BRIEF

An initial report was requested from Gwynedd Archaeological Trust assessing the importance of all the archaeological remains, ranging from the Prehistoric through to the Industrial period.

The basic requirement was for a desk-top survey and field-search of the quarry permission area. The importance and condition of known archaeological remains were to be assessed and new sites identified. Measures to mitigate the effects of the proposed extension on the archaeological resource were to be suggested.

Gwynedd Archaeological Trust's proposals for fulfilling these requirements were, briefly, as follows:

- a) to identify and record the cultural heritage of the area to be affected by the proposals;
- b) to evaluate the importance of what was identified (both as a cultural landscape and as the individual items which make up that landscape);
- c) to recommend ways in which damage to the cultural heritage could be minimised.

#### **3. METHODS AND TECHNIQUES**

#### 3.1 Desk-top study

Consultation of ordnance survey maps, tithe maps, written records and reference works was undertaken at the Caernarfon office of the Gwynedd Archives Service, where the Penrhyn Quarry Archive is kept, and at University of Wales, Bangor, where the estate records are kept. Both sources proved disappointing; the engineering records are not preserved with the remainder of the quarry's archive, nor are they in any other research collection, and very few plans of the quarry survive with the estate papers. The most useful sources proved to be the quarry's book of newspaper cutting in the Caernarfon Record Office (Ref: PQ133), the quarry's publicity leaflets from the early twentieth century, and the works of amateur industrial archaeologists who were given access to the relevant records when they were still at the Coed y Parc offices, or who were able to talk to quarry staff whose memories stretched back over a number of years.

# 3.2 Field Search

This was undertaken over three days by two members of the Trust staff. Features identified were marked both on the current 1/10,000 OS map and on the 1914 25" County Series XII 12 and 14.

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# 3.3 Report

All available information was collated and transferred onto a single set of maps at a scale of 1:2500 for convenience. The sites were then assessed and allocated to the categories listed below. These are intended to give an idea of the importance of the site and the level of response likely to be required; descriptions of the site and specific recommendations for further evaluation or mitigatory measures, as appropriate, are given in the relevant sections of this report.

In some cases, further investigation may result in sites being moved into different categories. The criteria used for allocating sites to categories are based on those used by the Secretary of State when considering ancient monuments for scheduling. These are set out in Annexe 3 to Planning Policy Guidance 16 (Wales): Archaeology and Planning.

# **3.4 Categories**

The following categories were used to define the importance of the archaeological resource:

# Category A - Sites of national importance.

Scheduled Ancient Monuments, Listed Buildings and sites worthy of scheduling or listing *i.e.* those which would meet the criteria for scheduling (ancient monuments) or listing (buildings) or both.

Sites which are scheduled or listed have legal protection, and it is recommended that all Category A sites remain preserved and protected *in situ*.

# Category B - Sites of regional or county importance.

Sites which would not fulfil the criteria for scheduling or listing, but which are nevertheless of particular importance within the region.

Preservation *in situ* is the preferred option for Category B sites, but if damage or destruction cannot be avoided, appropriate detailed recording might be an acceptable alternative.

#### Category C - Sites of district or local importance.

Sites which are not of sufficient importance to justify a recommendation for preservation if threatened.

Category C sites nevertheless merit adequate recording in advance of damage or destruction.

#### Category D - Minor and damaged sites.

Sites which are of minor importance or so badly damaged that too little remains to justify their inclusion in a higher category.

For Category D sites, rapid recording, either in advance or, or during, destruction should be sufficient.

# Category E - Sites needing further investigation.

Sites whose importance is as yet undetermined and which will require further work before they can be allocated to categories A-D are temporarily placed in this category, with specific recommendations for further evaluation. By the end of the assessment there should be no sites remaining in this category.

# 3.5 Definition of Mitigatory Recommendations

Where a feature of archaeological significance is affected, mitigation measures will be included in accordance with current policies as recommended in PPG16 for rescue archaeology.

For the purposes of this report the mitigation and rescue archaeology proposals have been

divided into various levels of recording, which can be summarised as:

# Level 1: Minimal recording

a. A photographic record of principal external views. The photographs to be dated and indexed. Negatives should be indexed and suitably stored for archive.

b. A brief summary description, related to the photographic record as appropriate.

# Level 2: Basic recording

a. A photographic record of all principal elevations and selected features of particular interest. Photographs to be taken, as much as is possible, at right angles to the face of the feature and should include a scale. There should also be a few general photographs to set the site in context.

The photographs to be indexed as for Level 1 and related to a basic site plan which might be taken from a published OS map as appropriate.

b. A simple description of the visible remains relating to the photographic record.

# Level 3: Basic recording with survey

As Level 2 recording, but to include:

c. A measured survey of the ground plan of the site or structure at an appropriate scale (1:200 for buildings or 1:500 for larger areas where individual buildings are of no great significance).

# Level 4: Full photographic record

a. A photographic record of all external and, if appropriate, internal elevations as well as any features of particular interest. The photographs should be taken, so far as is possible, at right angles to the face of the feature and should include a scale. They should be reproduced at a scale where, for example, individual stones may be identified. Steps should be taken to minimise distortion, (*eg* by use of a shift lens) and achieve a consistent scale. These photographs should be supplemented with general photographs showing the site in its setting and, if composite photographs are necessary to cover a large feature or elevation, then general shots of the feature should be included. The photographs to be indexed as for Level 1, and related to a site plan.

b. A general description and a description of all the principal features.

c. A measured survey of the ground plan of the building or site at an appropriate scale as for Level 3.

#### Level 5 Full record

This would normally include the full photographic record as described for Level 4, but would be supplemented by a measured survey surveyed to no more than a 1% error. The record may be supplemented by elevations and sections, where appropriate, drawn at a scale consistent with the plans. Individual features should also be surveyed and drawn to scale. The full record would include a detailed description, including measurements wherever necessary.

N.B. Recommendations within the gazetteer (4.4 below) would only take effect if the site referred to is to be disturbed.

# 4. ARCHAEOLOGICAL FINDINGS AND RECOMMENDATIONS

#### 4.1 Introduction

The fact that Penrhyn Quarry's engineering records are not preserved either at the quarry itself or in any of the research collections has meant that what information survives comes from a number of other primary sources and from secondary sources, including the quarry's own publicity.

#### 4.2 Historical background

Though the history of Penrhyn slate is known to date back at least to the fifteenth century, when Guto'r Glyn wrote a *cywydd* to Dean Kyffin of Bangor asking for a shipload to slates, systematic exploitation only dates from 1785 when the Liverpool merchant Richard Pennant, first Lord Penrhyn, united the Penrhyn and Cochwillan estates, and reinvested the wealth accumulated on his slave plantations in Jamaica in a quarry on the slopes of Y Fronllwyd in a field known as Cae Braich y Cafn. His reserves of capital made possible the development of stepped workings on the hillside and other improvements, primarily a six-mile-long iron railway to the coast in 1800/1801 and a water-driven slab mill along its course at Coed y Parc, which opened its doors in 1802. This was carried out under an enterprising and able manager, James Greenfield.

The fact that the rock lent itself to hand-processing, the room for rubble, the effective transport systems both within the quarry and to the port, all gave Penrhyn an edge over its competitors, and it soon developed not only into the largest slate quarry in the world, but into one of the largest man-made excavations anywhere. By the mid-nineteenth century workings also included a large stepped pit, from which raw blocks were raised by hydraulic lifts, and which emptied into the Afon Ogwen by means of a tunnel over a mile long. Steam locomotives made their first appearance in 1875, when the quarry's internal railway system was upgraded. The old horse railway to the sea was replaced in stages by a steam-worked line, finally completed in 1879.

To house the workforce, the first Lord Penrhyn initially built a model village at Llandygái near the parish church, but the quarrymen chose to settle nearer their place of work. In 1813 the first St Anne's church, now buried by the quarry's tips, was consecrated to serve the needs of the community that was growing up on Coed y Parc, (*Penrhyn Quarry* 7) but by the 1820s quarrymen were increasingly making their homes in the village which grew up around the Bethesda chapel built by the Independents on the east bank of the Ogwen. By the late nineteenth century this had grown to become a small town, which achieved a dismal fame between 1896 and 1903 in a succession of bitter strikes, as much a clash of ideologies as a protest against work conditions (Jones *passim*, Lindsay 1987 *passim*). This terrible conflict dealt the slate industry a near-mortal blow.

The failure of the strikes preceded, and may have led to, a programme of mechanisation within the quarry. From 1912 onwards the long rows of *gwaliau* (slatemakers' sheds), where the quarrymen had processed the raw blocks into roofing slates entirely by hand, began to make way for factory-style mill buildings, such as had long been a feature of other slate quarries. All but the splitting process were henceforth carried out by machinery, electrically powered from the start. Wire ropeway systems were also introduced in 1912, and thus the quarry largely continued until bought by Sir Alfred McAlpine and Sons Ltd in 1964.

Just as Richard Pennant's capital had allowed the old quarry to develop in the period from 1782 onwards, the McAlpine era opened a new phase in its life. Construction of roads to reach the pit and the higher levels began immediately, and by the end of 1965 the railway and ropeway systems were no more and the haulage shafts were disused. The last of the cutting mills erected in the pre-first world war period was taken out of use in 1967.

# 4.3 Archaeology of the Proposed Development Area

N.B. For ease of reference, features are identified by the names of the galleries or working levels on which they are situated; however, the more amorphous remains on the south-eastern side of the quarry are identified simply as "Left Side".

# 4.3.1 Extraction systems and tip runs

Throughout the older workings, remains were noted of the gallery system. The pit has been flooded up to Sebastopol level, drowning Princess May, Lady and Lord. The higher pit galleries, Fitzroy and Workhouse, largely survive, though arrangements at Ponc Sinc Bach and Ponc Sinc were observed to have been largely disturbed by modern construction and tipping.

Only on the Left Side (*i.e.* the south eastern face) of the upper quarry does much remain of the higher gallery system, but it has been much obscured by falls.

The gallery system was effectively devised by James Greenfield, manager from 1799 until 1825 in such a way as not only to facilitate the extraction of usable slate, but also the rapid removal of rubbish, by having tramways from the working face to the tipping cobs on a gradient which favoured the load (Lindsay 1974, 92-3). This system was copied in many now-disused Arfon quarries, most notably Dinorwic, Prince of Wales, Gorseddau and Cwm Eigiau. The area from Ffridd to Agor Boni on the "Right Side" (*i.e.* north-west) at Penrhyn quarry continues to show the relationship between the extraction points and the tip-runs, and as the parent-quarry in this respect, this area must be regarded as of considerable archaeological importance.

# 4.3.2. Rail transport.

It is clear that the bulk of internal movements within the quarry until 1964-5 was carried out by narrow gauge railway, but though rails are known to have been introduced at Penrhyn by 1800, surviving remains were observed to be generally of late nineteenth or early twentieth-century pattern. Wooden sleepers survive in places, and lengths of rail, variously of flat-bottom, T-section and "Thomas Hughes" pattern were also observed. A coal wagon for supplying the locomotives was noted on Agor Boni (77), and a number of rubble wagons survive at the foot of a tip near Braich y Gwair.

Inclines on the counterbalance principle survive at a number of places; at Ffridd the drumhouse, though clearly long-disused, contains the drum and brake gear (1). Elsewhere substantial winding-houses which possibly allowed for both counterbalance working and electrically-powered uphaulage survive on Ffridd (12), on Twlldyndwr (34), and, in very poor condition, on the left side of the quarry (83). These seem to be of a similar pattern, with sufficient clearance to allow locomotives to pass through them, and with a first-floor motor-room, which in the case of (34) still retains its machine bases.

On Twildyndwr level remains of "blondin" aerial ropeways were observed, in the form of houses for the electric motors which powered them and slate-built strongpoints to land the wagons as they were lowered (46, 47, 49, 50), as well as a curious little structure which may have existed to tension the cables (45).

Locomotive sheds were observed at several points - a two-road example on Red Lion (101), and others on Twlldyndwr level at both (37) and (40)

#### 4.3.3 Water balance shafts.

From documentary evidence it is clear that from the mid-nineteenth century to 1965 blocks of raw slate were raised from the pit to the dressing areas by means of eight water-balance lifts in vertical shafts, whereby each of two shaft-cages included a tank, one of which, when filled with water at the shaft-head, could raise a wagon and its load in the other cage by reason of its

superior weight. Once the wagon had been wheeled off the cage at the summit and the tank on the cage at the foot of the shaft emptied, the process could begin again. Water would be drained off through a tunnel leading out of the workings.

Water-balance technology for up-haulage in shafts dates back to 1753, when Chatershaugh colliery on the River Wear used a simple system whereby a bucket of water raised a lighter basket of coal, but it was in the coal industry of South Wales that the method became common, and over sixty such balances were in use in Glamorgan alone by mid-nineteenth century, before they gradually yielded to steam winders. They were never common in the North Wales slate industry, though examples are known to have existed at Alexandra quarry, Pen yr Orsedd, Pen y Bryn (Cloddfa'r Lôn), Oakeley and possibly also elsewhere (Richards, *passim*). Their use was inevitably limited to self-draining workings, which in practice meant quarries or shallow mines on hillsides.

Of "George" and "Douglas" on the south-east of Red Lion, beneath Agor Boni, little was ob served to remain. The "Douglas" shaft has been filled in to within a metre or so of the summit, and though the "George" shaft appears to be intact, the headframes in both cases were completely missing. However, slate supports for the feed-system to the tanks in the cages survive for both shafts, and a tank survives in one case.

A shaft complete with lift machinery and head-frame was observed *in situ* near the office, the "Sebastopol" shaft (85), recently repainted and in excellent condition. The cages were not noted, though they may remain intact at the foot of the shaft, and the feed-system is incomplete, but otherwise it is a remarkable survivor, even down to the "ship's wheel" controls, and forms a potent visual reminder of Victorian engineering skill. Unlike "George" and "Douglas", the large tank which fed the cages is here carried on iron girders. Of its near-neighbour, "Fitroy", nothing remains, nor of the Sinc Bach shaft. Of "Lord", the shaft itself survives, emerging on the surface in an impressive slate strongpoint (59, 65), as well as the remains of a tank, heavily overgrown, at its foot. The only ironwork, however, was a number of plummer blocks and lengths of rail at the shaft-head lip. The nearby "Lady" has disappeared completely.

The most nearly complete survivor, however, is "Princess May" on Ponc Sling (82), which re tains a cage, with a water-tank above the platform for the men and the wagon, and all its piping, and a feed-tank on girder supports, like "Sebastopol". Again, the "ship's wheel" controls survive. "Sebastopol" and "Princess May" appear to be the only survivors of water-balance lift headgear in the Welsh slate industry, and as such are likely to be of national importance.

Unfortunately, ascribing precise dates to them is difficult. The eight lifts were constructed at Penrhyn from 1848 according to one source (Abbott), June 1852 according to another (Boyd 26). In any event, their introduction came as a consequence of work beginning in the pit, and the need to haul raw blocks of slate up to the processing levels at Red Lion and Ponc Sling. They are said to have been suggested by Robert Stephenson, the railway engineer, at a time when he was working on the Chester and Holyhead Railway, under construction from 1845 to 1850 (Abbott). This is quite possible; Owen Thomas of the Union foundry, Caernarfon, supplied some of the material for the Britannia Bridge, which would have afforded him a chance to become acquainted with Stephenson. That Thomas was capable of producing first-rate castings is demonstrated by the fact that he was invited in 1852 to produce girders for the new Houses of Parliament. (Lloyd 11)

Owen Thomas went into partnership with Jeffreys Parry DeWinton in 1854 (Lloyd 18) if not earlier (verbal information from Dr Michael Lewis) and the firm was thereafter known as DeWinton until its demise in 1903. Of the eight water-balance shafts which operated at Penrhyn quarry, "George", "Douglas", "Lady" and "Princess May" are credited to DeWinton (Abbott 93). It may be that the others were built by Thomas before the partnership was established, or by another engineering firm at a later date.

A possible clue is provided by their names; "Sebastopol" presumably commemorates the allied capture of the Crimean fortress on 11 September 1855 (compare "Malakov" level in the quarry) and "Princess May" the birth in 1867 of a daughter to Francis Duke of Teck and Princess Mary Adelaide of Cambridge, the future wife of King George V. "Lord" and "Lady" may commemorate the elevation to the peerage of Col. the Hon. Edward Gordon Douglas-Pennant in 1866. However, the names are in fact those of the quarry levels which they served, which may well have been in production before the shafts were installed.

Logic would suggest that "George" and "Douglas" are the oldest, as the shallowest. "George", the deeper, reaches the level of the drainage adit, driven in 1849-50 which empties at Tan ysgafell, north of the quarry (Lewis pl. 12). Another argument for their being the first is that they have been sunk where the original Red Lion dressing level would have led to the quarry gallery, before 1865, when tipping began to build up the extensive area which survives to this day (Boyd 78). They also seem to have been unique in having slate supports for the feeder tanks. They may therefore date from the 1848-1852 period.

"Sebastopol" reaches the same level as "George", and "Fitzroy" as "Douglas". No documentary evidence survives for the depth of Sinc Bach, but it may have only from Sinc Bach level to Red Lion. "Princess May" is the deepest, and therefore possibly the most recent.

Clearly, none of the water-balance lifts predates the two surviving examples elsewhere in Wales from the South wales collieries. The oldest of all is preserved at Cwmbyrgwm near Abersychan, dating from 1820, consisting of a cast-iron frame supporting a pulley wheel on timber beams, now a Scheduled Ancient Monument (*Amgueddfa* 10 Spring 1972 p. 5). One from the Bryn Pwllog colliery, Blaencarno in the Rhymney valley dates from c. 1830 and was acquired the National Museum of Wales in 1935 (accession number 35.348) and which became part of the holding of the Welsh Industrial and Maritime Museum when it was set up in 1957. It is now to be seen, re-erected, at Big Pit, Blaenavon (vi from Miss Caroline Charles, Welsh Industrial and Maritime Museum, RCAHM [Wales] *Collieries of Wales: Engineering and Architecture*, 65-8, 76, 161). This is a more sophisticated version than Cwmbyrgwm, being of all-iron construction, but even so it is not built to the same sort of scale as "Sebastopol" and "Princess May". The two Penrhyn examples illustrate the final phase of development of this type of machinery, and their value is heightened by their association with the engineer Robert Stephenson.

#### *4.3.4 Other hydraulic machinery*

It is likely that the large transporter incline (54) operated on the same water-balance principle as the lifts, as an uphaulage incline for tipping rubble, since early maps (e.g. the 1914 25" o.s. XII 10) show rails connecting it balance-shafts at its foot and to tip-runs at its summit. However, insufficient remains to confirm that this was hydraulically operated.

Below Ponc Sling a compressor house was noted, containing a pelton wheel built by Gilbert Gilkes of Kendal 1929 operating a vertical two-cylinder 1500 cubic foot capacity compressor built Fullerton, Hodcart, Barclay of Paisley in 1919 (123).

# 4.3.5 Electrical supply

Evidence for early electrical power at Penrhyn was noted in the form of two sub-stations on Agor Boni and a further two on Red Lion, all of typical pre-first world war design. One of the Agor Boni stations is of a pleasing "pagoda" construction, whilst the others are simple rectangular structures with pitched roofs.

Electrical power was introduced at Penrhyn on 11 May 1912 (PQ133, *Master Builder* June 1912), in the form of an alternating current generated by the North Wales Power and Traction Company at Cwm Dyli and transmitted by means of their no. 7 line from Dinorwic quarry, which led down through the Right Side of the Quarry, roughly parallelling the incline system to a sub-station near Red Lion level. Later power lines were added in the 1920s - to Bethesda,

to Capel Curig and to Bangor (UWB Penrhyn SS2226). The innovation may be connected with the appointment as manager in May 1911 of Hobson, (PQ133, *North Wales Chronicle* 03.02.1938) who came from Pen yr Orsedd quarry, Nantlle, a site which had been an early user of electricity. The new energy source was used to power the new mills for slate-production and also to operate three ropeways from Malakov level (PQ133, *Master Builder, loc cit*)

# 4.3.6 Mills and hand-processing sheds

On various levels remains were noted of the *gwaliau*, the booths for hand-processing raw-blocks into roofing slate which were once universal at Penrhyn. Few survive in particularly good condition, and may other examples survive from elsewhere in the industry, most notably the neighbouring Dinorwic quarry.

Four mill buildings survive in re-use on Red Lion level, as well as the gable end of a fifth, and one, roofless, on Ffridd. All are long, low buildings with a depressed gable, built with a transverse arrangement of tramways in mind. A number of badly dilapidated structures which seem to have been a mill or mills were also observed on the Left Side.

Though there had been slab mills on the course of the railway to the Port from as early as 1802, mills to produce roofing slate were only introduced from 1912 onwards - much later than in any of the other major Welsh quarries. These are described as having been designed for a total of 100 tables and dressers, though the remains of the one surviving mill on Ffridd suggests that dressers were never installed here, and that the sawn blocks continued to be trimmed with a *cyllell bach*.

# 4.3.7. Domestic accommodation

Little evidence was observed for domestic accommodation within the confines of the quarry pre-1965. The area recorded includes the remains of a row of dwellings known as Tai'r Mynydd and a dwelling Tros yr Afon, marked as early as 1840 (UWB SS2214), predating all the other dwellings on Mynydd Llandygái. They are constructed on the original Coed y Parc land, whereas the other buildings are on enclosed common land. The road on which Tai'r Mynydd are built, and the higher Gefnan road, disappear under the tips, suggesting that they are early footpath access to the quarry.

The Mynydd Llandygai settlements were notorious examples of a lease system which favoured the landowner, in this case Lord Penrhyn, at the expense of the tenant. Leases of plots were for thirty years, in which time the tenant was expected to build a house to an approved pattern; at the end of that time the houses became the landlord's property without any compensation due to the tenant (Lowe 62-3).

# 4.4. Gazetteer of Archaeological Sites

N.B. The sites are arranged by level, starting with Red Lion level, then down to Ponc Sling, then upwards via Ffridd etc to Holywell, then the sites on the Left side, and finally the sites outside the present quarry working area.

#### 4.4.1 Red Lion Level

**57. Office, Red Lion level** *Category B* Attractive building, still in use as office. Now with extension to rear.

#### 58. Lift, Red Lion level Category A

"Sebastopol" water-balance shaft, and associated headframe supported on tubular girders; water tank survives, though part of the feed system to the cages is missing. One cage survives at the foot of the shaft, the other is missing. Recently repainted.

Recommendations: Preservation in situ.

**59. Lift strongpoint, Red Lion level** *Category C* Strongpoint which supported the headframe for water balance lift over shaft (60).

Recommendations: level 2 recording.

**60. Shaft, Red Lion level** Category C "Lord" water-balance shaft. Remains as open shaft, plummer blocks and rail survive around

lip.

# Recommendations: level 1 recording.

**61. Retaining wall, Red Lion level** *Category C* High retaining wall supporting made up ground on Red Lion level.

Recommendations: level 1 recording.

**62.** Mill, Red Lion level Category C Longitudinal roofing-slate mill, former "D" mill, converted to workshops. Bearings for lineshafting visible.

Recommendations: level 2 recording.

**63.** Mill, Red Lion level *Category C* Longitudinal roofing-slate mill, former "C" mill, converted to storeshed.

*Recommendations: level 2 recording.* 

**64.** Mill, Red Lion level *Category C* Longitudinal roofing-slate mill, former "B" mill, converted to canteen.

Recommendations: level 2 recording.

**65.** Mill, Red Lion level Category C Longitudinal roofing-slate mill, former "A" mill, still in use as splitting shed.

Recommendations: level 2 recording.

66. Structure, Red Lion level Category D

Converted to, but not built as, a smithy at its south-east end; the north-west end is used to store core samples.

#### Recommendations: level 1 recording.

#### 67. Structure, Red Lion level Category D

Small rectangular structure with pitched slate roof. Side door at S end - large side windows now blocked. Appears to be relatively recent structure. Electricity connection at gable end. Large workshop door inserted in gable end. Former attached structure at north end now demolished. Function unknown.

**68. Electricity substation, Red Lion level** *Category C* Of pre-first world war design, still in use to supply fullersite plant.

Recommendations: level 1 recording.

**69. Electricity substation, Red Lion level** *Category C* Of pre-first world war design, still in use to supply fullersite plant.

Recommendations: level 1 recording.

**115. Lift, Red Lion level** *Category C* "George" water-balance shaft, fenced off; none of the headframe survives.

Recommendations: level 1 recording.

**116. Structure, Red Lion level** *Category C* Slate support for tank to power water balance lift (115).

Recommendations: level 1 recording.

**117. Smithy, Red Lion level** *Category C* Remains of a smithy, walls remain to eaves height. Hearth *in situ*.

Recommendations: level 1 recording.

**118. Lift, Red Lion level** *Category C* "Douglas" water-balance shaft, filled with rubble to within 1m of surface.

Recommendations: level 1 recording.

**119. Structure, Red Lion level** *Category C* Water tank for water balance lift (118) and slate supports.

Recommendations: level 1 recording.

**120. Hydraulic equipment, Red Lion level** *Category D* Stop-cock arrangement for water-supply system.

Recommendations: level 1 recording.

**121. Weighbridge house, Red Lion level** *Category C* Structure survives, but no machinery. Concrete weigh-pit.

Recommendations: level 1 recording.

**122. Structure, Red Lion level** *Category C* Structure survives intact; in use as store.

Recommendations: level 1 recording.

**101.** Locomotive shed, Red Lion level Category C Two-road locomotive shed, in re-use. Survives intact.

#### **102.** Fullersite plant, Red Lion level Category B

Though much of this is of modern construction, it contains the earlier (pre-1945) buildings associated with the plant, built out of corrugated iron.

Recommendations: level 3 recording.

#### 4.4.2 Ponc Sling

# 82. Lift, Ponc Sling Category A

"Princess May" water-balance shaft and associated headframe. This survives more completely intact than "Sebastopol" in that it includes one of the cages at the surface level, complete with water-tank above the floor for the wagon, the water-supply system is intact, and the "ship's wheel" control system survives in the shed adjacent.

*Recommendations: preservation* in situ.

**94. Bryn Llwyd house, Ponc Sling** *Category C* Two-storey dwelling, now ruinous.

Recommendations: level 1 recording.

#### **123.** Compressor house, Ponc Sling Category B

Contains Gilbert Gilkes of Kendal pelton wheel dated 1929 powering Fullerton Hodcart and Barclay two-cylinder vertical compressor of 1500 cu. ft capacity, dated 1919. Related waterpipes, set in concrete bases, and compressed air pipes survive near the building.

Recommendations: level 3 recording.

#### 4.4.3 Agor Boni

**70. Transformer house, Agor Boni** Category C Tall stone building with pitched slate roof. Out of use but contains transformer equipment.

Recommendations: level 1 recording.

#### 71. Gwaliau, Agor Boni Category D

Row of *gwaliau* between transformer house (70) and the incline (54). Poor condition with only rear wall still standing except for side wall abutting incline. Water channel (72) runs along front.

Recommendations: level 1 recording

**72. Water channel, Agor Boni** *Category C* Concrete open water channel; function unknown.

Recommendations: level 1 recording.

**73. Bridge abutments, Agor Boni** Category C Carried incline (54) over Agor Boni. Bridge gone.

Recommendations: none.

74. *Gwaliau*, Agor Boni *Category C* Row of four booths, in better condition than (71), with roofs and intermediate walls surviving.

#### 75. Electricity substation, Agor Boni Category C

Constructed out of concrete blocks and rendered; ashlar markings. "Pagoda" design with cupola above hipped roof.

Recommendations: level 1 recording.

**76. Weighbridge house, Agor Boni** Category C Roof part fallen but otherwise survives intact. Concrete pit, but no machinery. Small extension at north end.

Recommendations: level 1 recording.

77. Wagon, Agor Boni2' gauge wagon for locomotive coal, end-loading.

Recommendations: none.

**78. Corbelled arch, Agor Boni** *Category C* Triangular corbelled arch takes water channel (72) through incline (35).

*Recommendations: level 1 recording as part of (35)* 

**79. Structure, Agor Boni** *Category D* Round plan; foundations only.

Recommendations: level 1 recording.

**80. Structure, Agor Boni** Category D Rectangular structure 11m by 5m, divided into two rooms. Ruinous - walls stand c. 1.5 m high max. Unknown function.

Recommendations: level 1 recording.

**81. Shelter, Agor Boni** Category D Small rectangular structure with monopitch roof. No windows, single door. Unknown function.

Recommendations: level 1 recording.

4.4.4 Ponc y Level

**55. Bridge abutments, Ponc y Lefel** *Category C* Abutments only survive, carried Ponc y Level tramway over incline (35).

Recommendations: level 1 recording.

4.4.5 Twlldyndwr Level

**34. Incline drumhouse, Twlldyndwr** *Category B* Well preserved structure, roofed, contains base for electric motor on first floor, accessed by staircase. No machinery. Same as (12) but better condition.

**35. Incline formation, Twlldyndwr to Red Lion** *Category C* Incline powered by (34). Good condition but heavily overgrown.

Recommendations: level 1 recording.

**36. Bridge abutments, Twlldyndwr** *Category C* Abutments only, no bridge survives.

Recommendations: level 1 recording. 37. Locomotive shed, Twlldyndwr Category C Single road locomotive shed with coal siding leading into lean-to structure. Now roofless, but walls remain to eaves height. Inspection pit evident.

Recommendations: level 1 recording.

**38. Water tank, Twlldyndwr** *Category D* Large water tank situated on a slate plinth, derives from (3).

Recommendations: level 1 recording.

39. Weighbridge house, Twlldyndwr Category C

Probable weighbridge, though no machinery or pit survives. May have been converted to an office. Small rectangular structure with chimney in end gable and a lean-to addition on longitudinal side with dual entry porch to original structure and lean-to.

Recommendations: level 1 recording.

**40.** Locomotive shed, Twlldyndwr Category C Survives to eaves height, but roof collapsed. Lean-to coal siding. Inspection pit survives. Overlies large ruined building (42) on south side, of unknown function.

Recommendations: level 1 recording.

**41. Circular blast shelter, Twlldyndwr** *Category C* Circular structure, assumed to be blast shelter. Ruinous condition, wall remains to a height of 2m on south side, but only to foundation level on north.

Recommendations: level 1 recording.

**42. Structure, Twlldyndwr** *Category D* Almost entirely demolished, underlies (40).

Recommendations: level 1 recording.

**43.** Water channel, Twlldyndwr Category C Stone-lined water channel, purpose unknown.

Recommendations: level 1 recording.

**44.** Smithy, Twlldyndwr Category C Now roofless, front wall collapsed, but remainder survives to eaves height. Hearth in rear longitudinal wall. Additional room to left of front.

#### 45. Structure, Twlldyndwr Category C

Concrete mounting, 6m long, 1.5m wide, 2.6m high. Hole through centre bottom with two cams on one spindle, possibly used for tensioning blondin cables on (46) and (49).

Recommendations: level 1 recording.

**46. Blondin motor shed, Twlldyndwr** *Category C* Survives to eaves height, monopitch roof collapsed, large horizontal opening towards concrete platform (49).

Recommendations: level 1 recording 47. Blondin motor shed, Twlldyndwr Category C Slightly larger than (46), roofed; machine bases survive but no ironwork. Possibly also housed a compressor.

Recommendations: level 1 recording

48. Compressed air pipe, Twlldyndwr Category D

Recommendations: none

**49.** Strongpoint for blondin ropeway system, Twlldyndwr Category D Large concrete platform, connected with (46).

Recommendations: level 1 recording

**50. Strongpoint for blondin ropeway system, Twlldyndwr** *Category D* Large concrete platform, connected with (47).

Recommendations: level 1 recording.

**51. Water channel, Twlldyndwr** *Category D* Shallow slate-walled channel.

Recommendations: level 1 recording.

**52.** Weighbridge house and pit, Twlldyndwr Category C Roofed structure. Pit and part of the balance mechanism survives.

Recommendations: level 1 recording.

**53. Retaining wall** Category C Impressive slate built bastion, accommodates incline (54) at SE end.

Recommendations: level 1 recording.

**54.** *Trwnc* incline, from Red Lion to Twlldyndwr *Category C* A transporter (*trwnc*) incline, water-balanced, steeply graded, for uphaulage of rubble from water balance shafts (115) and (118) to the Twlldyndwr tips.

Recommendations: level 1 recording

**56. Bridge abutments, Twlldyndwr** *Category C* Abutments only survive; carried incline (2) over Twlldyndwr tramway.

#### 4.4.6 Ponc Blue

**26. Structure, Ponc Blue** Category D Ruinous rectangular structure, walls survive up to 2m high in one corner. Possibly caban.

Recommendations: none

**27. Tunnel, Ponc Blue** *Category D* Tunnel for tramway to take slate through ridge of bastard slate.

#### Recommendations: none.

28. Smithy, Ponc Blue Category C

Standing to eaves height, but roofless, though chimney survives. Central door with single (blocked) front window. Hearth centre rear.

Recommendations: level 2 recording

**29. Bridge abutments, Ponc Blue** *Category D* Bridge now gone, but abutments stand some 4m high.

Recommendations: level 1 recording.

**30.** *Gwaliau*, Ponc Blue *Category C* Row of eight booths; roof collapsed but walls still standing - c. 1.5m at rear and sloping up to front. Each measures 4.8m wide by 3.2m deep. Small alcoves in at least one side wall in each booth.

Recommendations: level 1 recording.

**31.** *Gwaliau*, **Ponc Blue** *Category C* Five booths, and associated stackyard, as (30) but with some roofs surviving.

Recommendations: level 1 recording.

**32. Structure, Ponc Blue** *Category D* Ruinous structure of uncertain function.

Recommendations: level 1 recording.

**33. Weighbridge house, Ponc Blue** *Category C* Remains of weighbridge house with concrete weighbridge pit. No machinery surviving.

Recommendations: level 1 recording.

4.4.7 Ponc William Owen Level

**16. Bridge, Ponc William Owen level** Category C Bridge over (2), timber supports across slate buttresses with slate bed.

Recommendations: level 1 recording.

**17.** *Gwaliau*, **Ponc William Owen level** *Category C* Ruinous structures.

**18. Weighbridge house, Ponc William Owen level.** *Category C* Structure only survives, no machinery.

Recommendations: level 1 recording.

**19. Blast shelter, Ponc William Owen level** *Category B* Circular plan with square porch, c. 5m diameter. Heavy slate pitched roof supported on timber beams.

Recommendations: level 3 recording.

**20. Blast shelter, Ponc William Owen level** *Category B* Adjacent, and similar, to (19). There is a central upright wooden support (possibly secondary).

Recommendations: level 3 recording.

**21. Structure, Ponc William Owen level** *Category C* Possible shelter, monopitch roof.

Recommendations: level 1 recording.

**22. Rock cannon, Ponc William Owen level** *Category C* Situated on lip of working gallery, partially destroyed by quarrying. Thirteen holes and connecting firing channels survive.

Recommendations: level 3 recording with measured drawing of holes and channels.

**23. Tunnel, Ponc William Owen level** *Category C* Through bastard slate; to accommodate tramway.

Recommendations: level 1 recording.

**24.** *Gwaliau*, **Ponc William Owen level** *Category C* Four booths, walls remaining up to 1m high, and associated stackyard.

Recommendations: level 1 recording.

**25.** Compressed air pipes, Ponc William Owen level Category C Running alongside water-pipes, approx. 4" diameter.

Recommendations: none.

4.4.8 Ffridd Level

# 1. Incline drumhouse, Ffridd level. Category B

Possibly a very early drumhouse, which may date from the first application of rail transport to Ffridd level. Its relative antiquity is suggested by the fact that it is largely built out of country rock rather than slate. It is of the "through" pattern, with drum and brake intact. It was supplanted by (12), a more modern drumhouse (c. 1912?). The house is in poor condition and structurally unstable.

# **2. Incline, Ffridd level to Twll Dyndwr** *Category C* Counterbalance incline formation in good condition.

Recommendations: level 2 recording with gradient profile.

**2A. Bridge, Ffridd level** *Category C* Slate abutments for bridge over (2).

Recommendations: level 1 recording.

**3.** Water supply system, Ffridd level to Red Lion Category C Water supply system from Llyn Owen y Ddôl to Red Lion, emerges from underneath tips at Ponc Holywell. Intermediate tank situated on Ffridd level. Water carried in cast iron pipes approx. 5" diameter.

# Recommendations: level 1 recording.

4. *Caban*, Ffridd level *Category C* Now roofless rectangular structure, for use by locomotive men.

Recommendations: level 1 recording.

# 5. Lavatory block, Ffridd level. Category C

Monopitch rectangular structure built of slate. Roof now missing. Internal slate fittings still present.

Recommendations: level 1 recording.

# 6. *Caban*, Ffridd level *Category C* Rectangular monopitch structure, now in use as a storeshed. For mill workers.

Recommendations: level 1 recording.

# 7. Mill, Ffridd level Category C

Longitudinal pattern roofing-slate mill, now roofless; steel roof trusses survive, as do slate walls, concrete pillars, site of central electric motor apparent. Probably built for central saw tables, no evidence of mechanical dressers, suggesting that hand-trimming with *cyllel bach* survived here.

Recommendations: level 3 recording.

#### 8. Weighbridge house, Ffridd level Category C

Slate-built with pitched roof. Building survives, although roof partly missing. Concrete bridge-pit, but no machinery.

Recommendations: level 1 recording.

**9. Shelter, Ffridd level.** *Category D* Small slate-built structure with monopitch roof. Entrance through corner.

#### Recommendations: level 1 recording.

# **10. Structure, Ffridd level** Category C

Rectangular structure with monopitch roof, now with most slates missing. Probably originally weighbridge house, although later converted to shelter/caban.

#### 11. Belfry, Ffridd level

Wooden framework c. 3m high used to support bell preserved in quarry office. Used to warn before blasting.

# Recommendations: level 1 recording

#### 12. Winding house, Ffridd level Category C

Large incline winding house with a first floor capable of holding an electric motor to power a haulage drum. Possibly allowed for both counterbalance and uphaulage. No machinery, and now roofless. (34) is a similar and better example.

#### Recommendations: level 2 recording.

**12A. Brakesman's shelter, Fridd level.** *Category C* Small slate-built structure, for men operating (12)

Recommendations: level 1 recording. 13. Structure, Ffridd level. Category D Ruinous structure south of (12). May have been weighbridge.

Recommendations: level 1 recording.

**14. Incline formation, Ffridd level to Red Lion level.** *Category C* A large double-track incline in good condition.

Recommendations: level 1 recording.

**15.** *Caban*, **Ffridd level.** Slate built structure with mono-pitch roof. For labourers working the tip-run.

Recommendations: level 1 recording.

#### 4.4.9 Ponc Smith

# 95. Horizontal sheave, Ponc Smith Category B

Horizontal incline haulage sheave, protected by small mono-pitch shelter. Does not appear large enough to have been primary sheave; possibly this hauled wagons on an incline parallel to (97) to the level below Holywell.

Recommendations: level 3 recording.

**96.** Corbelled arch, Ponc Smith Category C A corbelled arch; carries incline (97) over Ponc Smith level.

Recommendations: level 1 recording.

#### 4.4.10 Holywell Level

**97 Incline, Holywell level to Ffridd level** *Category C* Counterbalance incline; survives intact.

# **98.** Winding house, Holywell level *Category D* Served incline (97); through pattern. In very poor condition.

Recommendations: level 1 recording.

**99.** Office, Holywell level Category C

Marker's office, with the word "Holywell" on the lintel, and the date "July 1894" on the internal plasterwork. Roofed.

Recommendations: level 1 recording.

**100. Structure, Holywell level** *Category D* Ruinous; possibly shelter.

Recommendations: level 1 recording.

# 4.4.11 Left Side

**83.** Winding house, Left Side Category C Large winding house with a first floor capable of holding an electric motor to power a haulage drum. Possibly allowed for both counterbalance and uphaulage.

Recommendations: level 2 recording.

**84. Incline, Left side** *Category D* Incline formation, top end of trace only survives.

Recommendations: none.

**85.** *Gwaliau*, Left side *Category D* Ruinous condition, in danger of collapse.

Recommendations: level 1 recording.

**86. Weighbridge house, Left side** *Category C* Structure survives but no machinery.

Recommendations: level 1 recording.

**87. Structure, Left side** *Category D* Ruinous, of unknown function.

Recommendations: level 1 recording.

**88.** Mill, Left side *Category D* Transverse pattern roofing-slate mill. In ruinous condition, with walls surviving to eaves height in places.

Recommendations: level 1 recording.

**89. Mill, Left side** *Category D* Transverse pattern roofing-slate mill as (88).

**90. Mill, Left side** *Category D* Transverse pattern roofing-slate mill as (88).

Recommendations: level 1 recording.

**91. Incline, Left side** *Category C* Only part of formation survives.

Recommendations: level 1 recording.

**92.** Corbelled arch, Left side Category C Through incline (91).

Recommendations: level 1 recording.

**93.** Corbelled arch, Left side Category C Through incline (91).

Recommendations: level 1 recording.

# 4.4.12 Structures outside the quarry workings

# 103. Tai'r Mynydd, SH 614652 Category C

A series of dwellings of nineteenth century pattern but with some twentieth-century building material (e,g, concrete and brick) apparent in the rubble. Map evidence (OS 25" County Series, 1914) suggests a row of eight terraced cottages alongside the track, with a series of out-buildings and long allotments below. The houses have been demolished, but some of the out-buildings and allotment walls remain.

Recommendations: level 2 recording with measured plan.

# 104. Tros yr Afon, SH 614652 Category C

A smallholding, seemingly of post 1840 date as it is not marked on either the tithe map or the first edition OS map. Cottage with attached farm building. Walls stand to eaves height but roof collapsed.

Recommendations: level 2 recording.

# 105. Terraced field boundary, SH 615653 Category D

The remains of a field boundary marked by a line of rough boulders also marks a distinct break of slope, seemingly created by ploughing. Whereas this feature is typical of Prehistoric sites, in this instance it could be Post-medieval in date.

Recommendations: none.

#### 106. Structure, SH 61456531 Category

Rectangular structure built at the top of the terrace (105). A level platform with foundation stones c. 4m square is all that remains. "Jumper" marks evident in the stones date the feature to post eighteenth century.

Recommendations: level 1 recording.

#### 107. Bridge, SH 61516531 Category D

A small bridge across the stream, possibly also built to form a dam as it curves upstream to withstand the pressure of water.

#### 108. Pathways, SH 615654 Category D

A sequence of early footpaths, assumed to be for access to the upper levels of the quarry.

#### Recommendations: none.

# 109. Dam, SH 61426551 Category D

A dam on the lower side of a small reservoir. 1.5m high, 3m wide, with sluice in north-west corner. Probably for agricultural use associated with Braich y Gwair.

# Recommendations: level 1 recording.

#### 110. Braich y Gwair, SH 61476553 Category B

A farmstead, certainly of nineteenth century date, and possibly earlier. There are two concentrations of buildings, one to the south-east, which contains the remains of a house, and another group by the side of a stream to then north-west. Buildings mostly remain to eaves height, with roofs now missing.

#### Recommendations: level 3 recording.

#### 112. Track, SH 61506526 Category D

A 2m wide track lined with stone walls c. 1m high. A ford is clearly visible where it crosses the small stream.

#### Recommendations: level 1 recording.

**113.** Steps, SH 61516525 *Category* Steps up the side of the tip at the end of track (112).

# Recommendations: level 1 recording.

#### 114. Structure E of Tai'r Mynydd, SH 61466519 Category D

A series of structures, now part buried under the tips, of which the most obvious remaining is a small structure with a monopitch roof alongside a small stream. May have been a small-holding, but no name is given on the maps.

#### Recommendations: level 1 recording.

#### 125. Leat Category C

This feature emerges from beneath the recent landscaping below the Marchlyn Mawr Dam at SH 61006280, runs NW for c. 300m, turns to the northeast, crosses the Afon Marchlyn Mawr, and continues towards the quarry for 1.1Km. It has been constructed to maintain a constant gradual slope, surviving as a grassed over cutting through ridges of higher ground, or as a line of low slate- and stone-built piers across lower ground. The mortared stone piers of a bridge survive where it crosses the stream, as do the remains of timber supports. The section to the NE of the Afon Marchlyn Mawr appears on a map of the Penrhyn Estate dated 1840, leading as far as Llyn Owen y Ddôl.

# Recommendations: level 2 recording.

#### 126 Sheep fold SH 61336349 Category D

A ruined sheep fold in a slight hollow near the bottom of a steep NW facing slope. Main enclosure 7.1m by 5.7m within walls 1.0m thick, now much spread. "D" shaped enclosure at NE end, 5.0m by 2.5m internally.

#### 5.0 SUMMARY

An archaeological assessment has been carried out of the land within the quarry permission area. The assessment consisted of a desktop study of relevant printed literature and archive sources, and a walkover where all structures within the study area were noted and allocated to a category of archaeological significance. Recommendations were made for each site depending upon its nature and category.

Two sites were allocated to Category A: the two remaining water balance lifts (sites 58 and 82). These are considered to be of national importance, and it is recommended that they are preserved *in situ*.

Nine sites were allocated to Category B (sites 57, 102, 123, 34, 19, 20, 1, 95 and 110), and therefore considered to be of regional importance. It is recommended that these sites are fully recorded (at least to level 3 as defined in the report) if they are to be disturbed.

The remainder of the sites are of local importance or below (Categories C and D) and it is recommended that these are recorded at a basic level (usually level 1 or 2) if they are to be dis turbed.

A number of deserted farmsteads lie within the permission area west of the existing quarry. The most interesting of these is Braich y Gwair, which is one of the nine Category B sites. It is recommended that this site is recorded to level 3.

No prehistoric or medieval sites were noted within the study area, and the continuing operation and expansion of the quarry will therefore have little impact upon the archaeology of the area other than upon the industrial remains and the post-medieval farmsteads described in this report.

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