

Penmaenmawr Quarry

Assessment



Report No. 393

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Prepared for

Symonds Group Limited

by

Gwyn, D.

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

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Note: Within modern times stone has been extracted at a considerable number of locations by different companies working under leases from different landowners. Only in 1911 were the workings brought under the one management. The term 'Penmaenmawr Quarry' is used below as a convenient term for the totality of the modern [post-1830] operations. Similarly, the stone quarried is a micro-diorite but is referred to, both locally and commercially, as 'granite'.)

1 BACKGROUND TO THE PROJECT

Gwynedd Archaeological Trust has been asked by Symonds Group Ltd on behalf of Hanson Group of Penmaenmawr Quarry, Conwy to identify the most significant sites of archaeological interest within the Penmaenmawr Quarry permission, and to identify the significance of the quarry, its component elements and the townscape within the context of other similar sites, as part of a study currently being undertaken by Symonds Group to establish the potential of built assets for tourism, community benefit, customer perception and public and media relations.

2 LOCATION

The Penmaenmawr Quarry complex falls within the communities of Penmaenmawr and Llanfairfechan in the County of Aberconwy. The town of Penmaenmawr is situated in the community of Penmaenmawr.

3 METHODOLOGY

The present report has been compiled on the evidence of earlier field surveys and excavations of the quarry and of the surrounding area, in particular the Neolithic axe-making sites, on the evidence of secondary literature (set out in the **Bibliography** below) and on the evidence of a site visit carried out on 29 October 2000.

4 EXISTING STATUTORY PROTECTION

Three structures within the quarry have been listed. These are: the incline drumhouse at Middle Bank, and the incline drumhouse and sett makers' huts at New Bank.

Six structures within the town of Penmaenmawr have been listed. These are: Brynmor and Brynmor Cottage, the Gladstone monument, the Church of Our Lady, Graiglwyd farmhouse, the barn at Graiglwyd and Penmaenmawr railway station.

None of the structures listed in the community of Llanfairfechan are connected with the quarry or with the quarry community.

A number of Prehistoric features to the south of the quarry are Scheduled as Ancient Monuments. These include the Clip yr Orsedd hut circles, field system and associated clearance cairns at SH 7103 7499, which lies within the quarry permission, and a group of cairns outside the permission, within an area defined by SH 7160 7480 – SH 7265 7480 – SH 7264 7440 – SH 7158 7442.

The entire area, with the exception of the town of Penmaenmawr itself, constitutes one of the defined areas of outstanding historic interest in the non-statutory *Register of Landscapes of Outstanding Historic Interest in Wales*, published by Countryside Council for Wales, Cadw: Welsh Historic Monuments and ICOMOS UK in 1998.

4 HISTORICAL BACKGROUND

4.1 Topography

The Penmaenmawr volcanic intrusion forms a prominent, vertical plug-like mass that has been emplaced into country rock consisting of blue-black and grey-black slates and shales of Ordovician date. Originally the summit of the intrusion was capped by two low peaks, Graig Lwyd to the east, and Penmaen to the west, the top of which has since been quarried away. It originally stood at 472m above O.D.; its present height is approximately 345m. These, as well as the hill of Clip yr Orsedd, form part of the prominent chilled margin of the intrusion, whilst the central area is occupied by a flatter basin-like col between the two summits. The north and north-west flanks of the intrusion fall steeply to the narrow coastal belt on which the town of Penmaenmawr is situated.

To the south and east of the intrusion the softer shales and slates of the country rock underlie a gentler open moorland landscape, the upper reaches of which are drained by the west-flowing Afon Ddu. The smaller intrusive outliers of Dinas and Garreg Fawr, also significant archaeological sites, form prominent hills to the south-west of the main Penmaenmawr intrusion. To the south, beyond the open moorland, the higher ridges rise to the main mountain mass of Arllechwedd, dominated by Tal y Fan at 580m above O.D..

4.2 Archaeological Background

4.2.1 Introduction

The monuments of the Penmaenmawr outcrop are part of a wider archaeological landscape which encompasses the moorland tract to the south of the quarry and the town. Here an exceptionally rich archaeological heritage documents the way humans have shaped and organised their environment. This landscape was comprehensively studied by Bezant Lowe (1911 and 1927) and more recently in the surveys for the parishes of Dwygyfylchi and Llanfairfechan carried out by the Royal Commission on Ancient and Historic Monuments of Wales and published in 1956. Thematic studies undertaken by the Gwynedd Archaeological Trust have analysed the later Prehistoric and Medieval settlements, and of the Neolithic axe-production site at Graig Lwyd.

4.2.2 Neolithic

The study area forms part of an outstanding Prehistoric landscape, which includes the Neolithic axe-factories.

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The axe-factory on Graig Lwyd was one of the first of its type to be examined in the British Isles. The initial discovery was made by S Hazzledine Warren, an Essex archaeologist, who spent three seasons field walking and excavating in the area between 1919 and 1921. His findings were summarised in three equally important and pioneering papers (Warren 1919, 1921, 1922). Warren also confirmed that axe-fabrication was not confined to the Graig Lwyd source alone but that a complex of sites could be identified on the adjoining Dinas and Garreg Fawr outcrops above Llanfairfechan, and that axe-flaking debitage and rough-outs are scattered widely throughout the two parishes of Llanfairfechan and Dwygyfylchi from sea level up to the moorland. Following more recent studies, these sites can now be seen as one of a number of axe-making factories in upland Britain that were competing for markets in the mainly lowland zones of the western, eastern and southern parts of the island. It was the most productive such site in Wales, and the third most important in the rest of Britain.

Stones were obtained both by quarrying from rock outcrops which demonstrated conchoidal fracture and by exploiting scree deposits. There is also extensive evidence for initial on-site fabrication of axes, in the form of working floors. Excavation of a Bronze Age cairn on the central col within the quarry permission area, revealed evidence for axe-manufacture in the Neolithic period. Elsewhere, debitage and rejected rough-outs have been discovered.

It has been suggested that there might be a causal relationship between the axe factories and the Neolithic henge monuments at Llandygái, and that henge monuments were used as centres of axe trading.

4.2.3 Bronze Age

The Prehistoric landscape also includes a considerable number of sepulchral and ritual sites from the Bronze Age, and possible Bronze Age settlement sites.

Immediately to the south-east of the Penmaenmawr outcrop, and beyond the existing quarry permission lies a group of ritual or ceremonial monuments centered on the embanked 'Druid's Circle'. These monuments, including the ring cairn, the stone circle and an enigmatic triple row 'screen' of boulders enclosing the entrance to this secluded plateau area, lie in close proximity to a putative Bronze Age track that traverses the plateau from the Afon Ddu valley in the west to reach eastwards into the Conwy Valley. Immediately below the plateau the track bisects a small cemetery of ruined barrows of which the Cors y Carneddau tumulus remains a most impressive monument.

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Numerous unenclosed and enclosed hut groups of round houses with associated lynchet boundaries and field systems extend from Graig Lwyd and over the central col. Most are bracketed, on very slim evidence, into the succeeding Iron Age or Romano-British periods. It is quite possible that the genesis of some of these habitation sites may fall into an earlier prehistoric period.

A second Bronze Age track skirts the southern perimeter of the upland, taking advantage of the linkage between the Aber, Anafon and Conwy Valleys through Bwlch y Ddeufaen. The two trackways are further conjoined by at least two north-south cross-routes. 1km to the south of Graig Lwyd is the cairn field of Bryniau Bugeilydd, a group of twenty low stone- and turf-covered mounds scattered within an area of 1000m by 500m and situated at a height of between 360m and 400m above OD. The sepulchral nature of four of the mounds has been ascertained but the remainder may be field clearance cairns.

4.2.4 Iron Age

The most significant monument of the Iron Age was the hillfort of Braich y Ddinas, quarried away in the early twentieth century.

This occupied the highest western ridge of the Penmaen Mawr outcrop at 472m above OD. Knowledge of the site rests on the survey work and part excavations undertaken between 1912 and 1923 (Hughes 1912, 1913, 1915 and 1923) and collated in an unpublished dissertation by Crew (1982). The fort, roughly rectangular in outline, covered an area of approximately 5 hectares. A series of rubble built rampart walls, three on the east and south, two on the west and one on the south side afforded protection to the fort. Internally three major units could be distinguished - the inner core occupying the summit ridge, a narrow flanking corridor covering the middle ground to the east and, beyond, a wider curved outer peripheral zone. These units were again further protected by inner linking walls with the main rampart fortifications.

Within these ramparts a settlement consisting of between 100 and 170 round, oval and rectangular stone built houses had been constructed in the area east of the summit. Hughes investigated seventy-nine of the houses and recovered pottery, stone tools, metal objects, coins and animal bones. Most of the objects broadly belong to a period of occupation in the Romano-British period between AD 100-400. Close analogies exist between Braich y Dinas and the other great stone rampart fort of Tre'r Ceiri in the Llyn peninsula. Both contain Bronze Age foundation cairns, are defended by rubble built defences, share evidence of intensive and possibly permanent habitation which continued during the Roman occupation.

Numerous settlement sites and cultivation plots from the Iron Age are evident within the quarry permission. Their relationship with the hillfort remains ambiguous, and it is difficult to assess the extent of native settlement or to measure the intensity of exploitation that would have occurred in this upland zone during the Iron Age and the succeeding Romano-British period. An area which includes three hut circles, a field system and clearance cairns has been Scheduled as an Ancient Monument (Cn 205).

4.2.5 The Roman Period

The main Roman transport axis ran to the south of Penmaenmawr; however, within the present quarry itself two Roman coin hoards have been discovered.

The Roman road from *Canovium* in the east to *Segontium* in the west follows the same route as its Bronze Age predecessor from Ro Wen to Bwlch y Ddeufaen. From Bwlch y Ddeufaen it is uncertain whether the road continued west via the Anafon and Aber Valleys or descended directly to Llanfairfechan along the Gorddinog valley.

Two Roman coin hoards have been found in the quarry permission. The first was discovered in 1871 on the summit of the Graig Lwyd Quarry (SH 7128 7536) during the clearance of a small mound of stones. Approximately sixty coins were found, ranging in date from the reign of Vespasian (AD 69-79) to Antoninus Pius (AD 138-161) and possibly as late as Commodus (AD 180-192). Unfortunately the whereabouts of this hoard is not presently known. The second hoard was discovered on the western flank of Penmaen above Llanfairfechan at Pinehurst (SH 689 755). Amongst the twenty-one surviving coins are examples belonging to Victorianus I (AD 265-268), Laelianus (AD 268) and to Carausius (AD 286-293).

4.2.6 Post-Roman Period to the Late Medieval Period

Direct archaeological evidence for human activity from the Post-Roman and Late Medieval periods is scant.

Medieval settlement may include a number of long huts, platform houses and, more infrequently, houses with associated outbuildings, which are widely and singly dispersed throughout the moorland area to the south of the quarry. Two long hut sites with associated remains have been recorded within the quarry permission, one on the col, the other, which may include a corn-drying kiln, at SH 7057 7557, within the active quarry. Upland land use in the Medieval period may be associated with the seasonal movement of stock from the lowlands in winter to the higher pastures in summer, and possibly the long houses were summer dwellings on upland stock stations. Transhumance as a mode of economic existence lasted perhaps into the late eighteenth century as new farming practices involving the shepherding of sheep were being introduced.

Enclosure of common land on the west front of Pen Penmaen, as denoted in the Tithe map of 1847, can be ascribed to the Williams-Wynns of Wynnstay, the wealthiest landowners on North Wales, in whose hands it remained from 1680 until 1803. Enclosure made a positive contribution to the great increase in sheep farming that took place from the eighteenth century onwards and still dominates the farming practices of the uplands today.

4.2.7 The Modern Period

The Modern period is dominated by the quarrying of stone on an industrial scale, by the development of a workers' settlement, and by the development of the area for tourism. The town and quarry of Penmaenmawr constitute an outstanding Victorian landscape.

The modern exploitation of the Penmaenmawr outcrop for stone begins in the 1830s and grew to be one of the largest and most productive units of stone-production in the British isles. In the first instance it amounted to surface extraction of stones from the unconsolidated scree slopes, which would be flaked into setts and carried to the coast by mule, where they were loaded as ballast on ships bound for Liverpool. Within a decade two independent quarries had been developed, one on the Eastern flank (Graig Lwyd) and the other occupying the western extremity (Penmaen). Both initially produced setts although crushing mills were established in the 1890s onwards supplying the railway ballast market. The two quarries were amalgamated under the same management in the early part of this century and the joint operations linked by a quarry railway. In the late 1930s the Old Graig Lwyd Quarry closed and sett production came to an end.

The modern quarry at Penmaenmawr occupies the western part of the outcrop and concentrates on producing aggregate for road construction and ballast for railway engineering. A new crushing plant was installed in 1983 and the present output of the quarry is 600,000 tonnes per annum. The planned reserve of the quarry concession is approximately 40,000,000 tonnes, giving an estimated life span for the whole operation of sixty years.

Since 1984 extensive landscaping of old faces, crushing plant, storage hoppers and tips has been undertaken on the redundant part of the Graig Lwyd Quarry.

Extraction

Methods of extracting the rock at Penmaenmawr were typical of the stone industry world-wide. The earliest method made use of a hand-borer or 'jumper' (Welsh *jympar*), to create holes approximately 75mm deep. Once a line of grooves had been cut, wooden wedges were inserted and soaked until they expanded and split the stone. Later, holes were bored out near a vertical joint and filled with powder; the explosion would displace large rectangular blocks along horizontal joints, which could then be extracted. Mechanical rock-boring was introduced to the Penmaenmawr quarries unsuccessfully in 1872, and successfully in 1895.

By the mid-nineteenth century Penmaenmawr stone was being worked in stepped galleries or benches. Whilst this had long been an accepted way of working large stone quarries, the regular and comparatively small and shallow benches developed here, as well as at Penmaenbach and Trefor, may owe something to the techniques of the local slate industry, where benches were introduced by James Greenfield, manager of the Penrhyn Slate Quarry from 1798 to 1825. This obviated the need for large cranes to lift the rock which were a feature of, for instance, the Portland stone quarries or the freestone quarries of Aberdeen quarries.

The only features relating to the extraction of the rock itself, apart from the galleries, are the blast shelters which formed temporary refuges for the men. They are small, crudely-built structures.

Processing

At the Penmaenmawr quarries, as elsewhere, processing of stone for the production of setts (rectangular blocks for use as road-material) was carried out by hand. Sett-makers would work either individually or possibly in groups in huts which were either arranged together in long rows, or, in one instance, in free-standing structures facing away from each other, so that chips of stone would not hit other workmen. These huts also differ from the majority in that they are irregularly constructed, with a boulder incorporated into the structure at one point, and also walls can be found that are curved and not of equal length. Possibly these were built unofficially by the men themselves, or they are very early, or both. They are in poor condition. Sett-making came to an end when Old Graig Lwyd Quarry closed.

One level produced a small amount of flagstone which exploited a small area of rock with unusual regular disc-jointing. This process, however, never warranted mechanisation, so the circular and swing saws which were a feature of the Scottish freestone industry and in the stone quarries of Bath and the Forest of Dean were never to be found at Penmaenmawr.

However, when the quarry entered the roadstone and railway ballast market, substantial crushing plant was introduced. Of the six plants, remains survive at only three, Braich Llwyd, Fox Bank and at Bonc Jolly (Penmaen), and only this last has left any sizeable remains. These consist of a substantial series of brick and stone bases built into the hillside for a gravity-assisted series of crushers. At least two different types of brick were used, and the walls are recessed in blind panels in places. Some holding-down bolts for machinery survive, and oil-stains show where plummer blocks were anchored.

Storage hoppers also survive below the site of the demolished Penmarian mill, incorporated into the landscaping plan and filled with trees. This substantial concrete structure also has the unusual feature of a large clock face, visible for some distance.

Power systems

The Penmaenmawr quarries required little in the way of mechanical prime movers (other than locomotives) until crushing mills were introduced from 1893 onwards. Setts were shaped by hand, and the topography of the quarry made possible the use of low-cost gravity transport systems. Steam was introduced to power the first crushing mill, and electricity was introduced in 1913, following the establishment of the North Wales Power and Traction Company's plant at Cwm Dyli.

The surviving red-brick chimney and room for Lancashire boilers at Braichllwyd recalls the provision of stationary steam power in the quarries. The only surviving prime-mover is believed to be the electric motor which formerly drive the intact pump system at SH 6962 7528.

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Transport

Internal transport of materials at Penmaenmawr was variously by sled; by narrow-gauge industrial railway; and by road and conveyor belt.

The sleds used in the early nineteenth century were probably similar to the agricultural slide-cars used in the rural economy. A railway system was installed once workings developed, around 1830, which grew into a complex network, typical in many respects of industrial railways of the period, not least in its use of an extensive system of incline planes. These were engineered on a considerable scale at Penmaenmawr, and form some of the most impressive industrial monuments from the nineteenth century at the quarry, not only the courses of the inclines themselves but the drumhouses (known in Welsh as the *brêc* (from the English 'brake'). These worked on the counter-balance principle whereby loaded wagons pulled up the empties, though some were relaid as hoists; an electric winch in the *brêc bach* at SH 7150 7585, dating from the 1960s when the incline had to be temporarily relaid to haul plant up to Pencoed.

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Apart from an isolated section of 4' 8½" railway on Fox Bank, all the quarry rails were laid to 3' gauge. Though gauges of all sorts were met in the stone industry, 3' was by no means uncommon; it combined maneuverability with the capacity to carry substantial loads. The earliest locomotives in the quarries were vertical-boiler 'coffee-pots' by the Caernarfon firm of DeWinton, effectively a launch boiler and engine mounted on a chassis. One of these locomotives survives at Penmaen East Quarry. Later steam locomotives came from Hunslets of Leeds, a major supplier of industrial locomotives, and by the end of the railway's operations traffic was handled by a number of powerful diesel locomotives. Road lorries and conveyor belts began to take over from the railway system from the 1950s, and rail transport in the quarry ceased in July 1967. A few narrow-gauge sidings at the interchange yard with the British Rail main line saw intermittent use into the 1980s.

As well as the inclines and the locomotive, a number of other railway items survive. These include items of rolling stock, and some locomotive sheds, large rectangular single-road structures built of Penmaenmawr stone.

Originally all but purely local deliveries were sea-borne, but exchange sidings were laid with the main line railway at some stage after its construction in 1848. Sea distribution came to an end in 1955, since when the quarry has relied only on road and rail transport.

Administration

The administrative buildings at the quarry complex are comparatively modest. The present offices at Bell Yard were in existence by 1888, and are typical in that they are situated next to one of the main transport arteries of the quarry, the incline down to the jetty. It is likely that there were other offices elsewhere in the complex when the quarries were under separate administration, but no evidence survives.

Ancillary

A number of ancillary buildings survive in the quarry, which are typical of large-scale industrial undertakings of the period.

The most remarkable survivor is the early twentieth century workshops complex at Braichllwyd, one of the best-preserved examples in Wales of such a site, a testament to the skill of the mechanics and the self-sufficiency of the quarry. Two powder houses also survive. One of them, built in 1906, has a distinctive roof, which curves to a low central spine, with the edges of the roof tilted slightly up, giving the structure an oriental feel. The other includes a detonator house, and is surrounded by a baffle wall.

A number of smithies survive. The smithy was a vital part of any quarry, but where extremely hard stone was extracted, as at Penmaenmawr, blacksmiths needed to be particularly skilled and their

facilities first-rate. Three smithies survive on site, though it is likely that there were many more at various times. These include blacksmith's hearths and quenching tanks.

Domestic and settlement

There is little evidence for modern settlement within the quarry itself, but the town of Penmaenmawr is effectively a creation of the quarries, and the village of Llanfairfechan housed many of the workmen.

The changes and additions to Ty Mawr illustrate changing proprietorial patterns in the late eighteenth and the early nineteenth century, with the purchase of the estate from the Coetmor family by the Smiths of Pendyffryn, and the subsequent arrival of the Darbishire family in the wake of the opening of the Chester to Holyhead railway in 1848. The creation of Plas Mawr in the grounds of Ty Mawr further illustrate the changing social patterns of quarry management and the local élite, and contributes to the overall significance of the quarry and urban environment.

Penmaenmawr shows the development of worker's housing from the original dwellings of 1834 known as 'New York Cottages', themselves an excellent example of the 'industrial vernacular', through the solid ranges of two-up-and-two down houses constructed by the socially-conscious Darbishire family, to the splendid Arts-and-Crafts-inspired dwellings constructed at the very end of the nineteenth century. Far from resembling the other Caernarfonshire quarry towns associated with the slate industry, Penmaenmawr embodies on a much smaller scale many of the principles found at Saltaire and Port Sunlight, not least in its provision of social infrastructure – the drill hall, places of worship and schoolrooms. It is no coincidence that the Darbishires were Unitarians, members of a church which emphasised the social and civic aspect of faith, the connection to which Titus Salt, the founder of Saltaire, and the Chamberlain dynasty of Birmingham belonged.

Even the holiday resort of Penmaenmawr in part owes its existence to the quarries. Sett-makers are believed to have built and run many of the boarding houses.

5 RECOMMENDATIONS

- It is recommended that any proposed visitor attraction should include an interpretive facility dedicated to the evolution of the historic environment, and that this should interpret a range of sites from all periods from Prehistoric through Roman and Medieval to Modern times.
- It is recommended that the historic environment of Penmaenmawr Quarry, the town and the immediately surrounding area be interpreted both through on-site visits, and exhibitions and displays within a dedicated building.
- It is recommended that further fieldwork and documentary research be undertaken to identify those sites most suitable for interpretation, and to amplify present knowledge of their history and development.
- It is recommended that the following archaeological themes be considered for interpretation:
 - ◆ the development of the Neolithic axe-production sites
 - ◆ the Bronze Age landscape, concentrating on ritual sites
 - ◆ the later Bronze Age and iron Age landscape, including the fort at Braich y Ddinas and smaller settlements
 - ◆ Medieval settlement and farming
 - ◆ the development of the modern quarry
 - ◆ the development of the communities associated with the quarry
- It is recommended that the following areas be considered for period-specific interpretation, subject to access problems and visitor impact:
 - ◆ the eastern Graig Lwyd area, as source of the Neolithic axes
 - ◆ the central col. as site of Bronze Age cairns, late Prehistoric settlement and industrial archaeology
 - ◆ the area below Fox Bank, as site of Medieval settlement
 - ◆ Bonc Jolly, as a site which includes major industrial archaeology features, including the workshops and Penmaen mill
 - ◆ The incline system connecting Bonc Jolly with Penmaen East Quarry
 - ◆ The listed incline drumhouse and sett-makers' sheds at SH 7119 7556 and SH 7119 7558
- It is recommended that the DeWinton locomotive *Penmaen* at Penmaen East Quarry be removed from its present location for safe-keeping and for restoration as part of an interpretative facility, and that surviving examples of rolling stock in the quarry be identified with a view to restoring the better examples and preserving the remainder.
- It is recommended that consideration be given to the use of Ty Mawr as an interpretation centre.
- It is recommended that visitor facilities at the quarry be integrated with town trails and with general amelioration of social infrastructure at Penmaenmawr and Llanfairfechan.
- It is recommended that an archaeological assessment be carried out in advance of any development to assess the impact of any proposals upon the archaeological resource.

6 CONCLUSIONS

The present document identifies the archaeological significance of Penmaenmawr Quarry, its permission area and the town of Penmaenmawr.

The upland area of the quarry permission forms an outstanding Prehistoric landscape, with its Neolithic axe factories, and with its dense concentration of Bronze Age funerary and ritual monuments. It also forms part of a broader landscape in which Iron Age, Roman and Medieval elements are present. The town of Penmaenmawr and the quarry together constitute an outstanding landscape of the Modern and Industrial period, in which it is possible to see not only the techniques of stone quarrying but also the creation of a distinctive community by socially-conscious management.

It is believed that these provide the potential for the presentation and interpretation of the historic environment in any proposed visitor and community development.

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Also information held at Gwynedd Archaeological Trust Sites and Monuments Record.

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