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CWM DWYFOR COPPER MINE
THE COLLECTION AND UTILISATION OF WATER

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Abstract: Amongst the several mine sites in the Pennant valley, in Gwynedd, perhaps the best known is the controversially conserved water wheel and associated equipment of the Cwm Ciprwth mine, still thankfully extant. At the head is Cwm Dwyfor, a classic example of glacial topography, wherein lies one of Wales' lost causes, the Cwm Dwyfor Copper Mine. Arguably the site could be described as the mine which had everything but produced nothing. Today, we are left with a beautiful set of remains: shafts and adits; wheel pit and crushing mill; dressing floors, buddle and waste tips; a method of transportation and an adequate supply of water for power and process. In fact a complete outfit. Considering this mass of evidence, overkill by comparison with other sites, two questions remain unanswered. How did the complex function and surprisingly, why has it attracted so little published research? Perhaps the two are related?

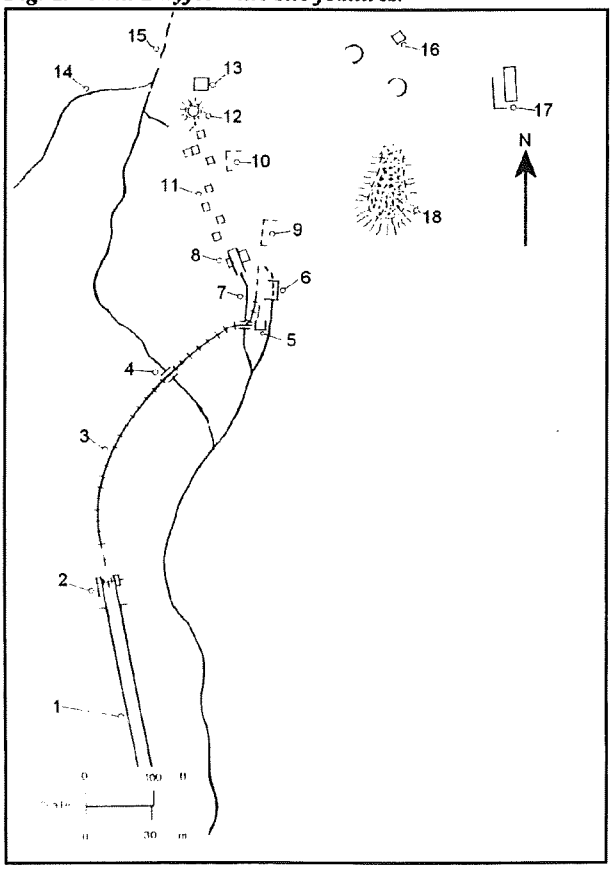
Introduction

Cwm Pennant, in the county of Gwynedd, is a pleasant valley some nine miles north of Porthmadog. It receives few visitors, largely because it has no exit and the only road is extremely narrow. Perhaps its main claim to fame is the connection with Eifion Wyn, the local shepherd poet, who bemoaned the fact that life was too short to take advantage of all its beauty.

There is much to interest the informed, from the walker, the naturalist, the geomorphologist and the student of past industrial activity. At its head lies the fine example of glacial topography, Cwm Dwyfor (NGR SH 542 506), where the abandoned structures of a copper mine (Fig. 1), whilst plentiful and magnificent, provide few positive answers to its limited span of operation. It was operated by Adventurers from prior to 1840 to 1848, then by The Mining Company of Wales. In 1858 it was owned by the Cwm Dwyfor Copper ands Silver-Lead Mining Co Ltd. Despite being linked by railway soon after the 1872 Railway Act, it closed briefly in 1876. It finally went through a short phase of re-working, closure and abandonment in 1877, its auction, advertised in the *Mining Journal*, showing it had a 35 feet diameter, 4 feet wide water wheel, which operated pumping, winding and crushing gear. This was together with rails, chairs, sleepers and rolling stock and tools. The site was obviously well cleared of all these at or since its abandonment.

Thus the operations of winding the mined ore, its crushing and washing were all reliant on water, the supply of which, as the following table shows, could best be described as adequate and regular:

Fig. 1. Cwm Dwyfor - the site features.



Weather at Cwm Ystradllyn, c.1980

Average monthly temperatures: January 4°C; July 16°C.
Sunshine: Annual Average: 1400 hours.

Rainfall (mm)

January	205	February	145	March	105	April	105
May	105	June	110	July	135	August	150
September	155	October	200	November	195	December	185

Annual Total 1780 mm (70 inches)

Collection of water (Fig. 2).

There are three sources in the primary chain. The main supply (1), which never seems to lessen, even in times of drought, is the spring which is the origin of the Afon Dwyfor. This, along with the leat (3) and any surface run-off, discharges into the now silted remains of a glacial lake (5). The surface run-off is collected over an area approximating to five square kilometres and is obviously of importance only during wet conditions. The leat, possibly of hurried construction, would collect run-off from a further area of some two square kilometres. It may also have tapped the stream in Ceunant yr Allt, a nearby tributary valley, but this cannot be certain.

The lake water is not available to the wheel as its depth is lower than the outflow, any modification of which would deprive the wheel of an already restricted head. It can therefore not be regarded as storage.

The final source is the water pumped from the mine (4). This

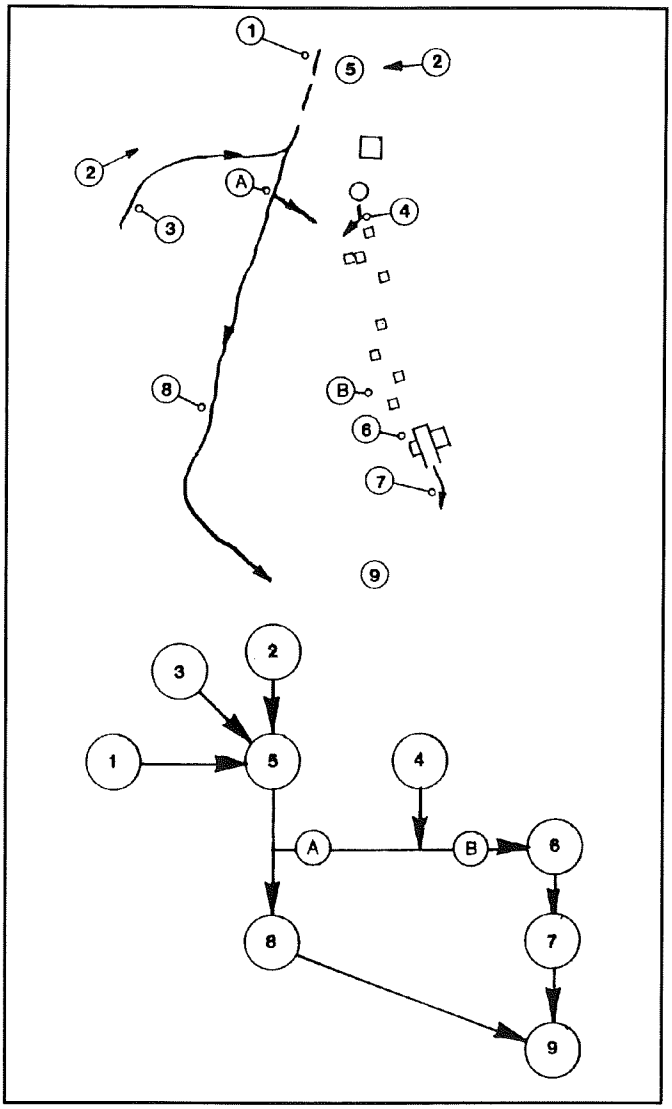


Fig. 2. Water Collection and Control - site relationship.

feeds, via an extant launder, from the engine shaft into the main supply to the wheel. After passing through the wheel, the water runs via a slab lined channel into the river.

The control system (Fig. 3)
When the mine was developed, the river was diverted away from the site of the shaft via a cut and embanked channel (8) which contoured the hillside before descending to the existing river bed. Near the start of this diversion was cut the take off for the wheel. This primary output (A) could be closed off by the insertion of stop boards either in time of flood or when the wheel was out of use. With the wheel stood this would automatically cut off the supply from the pump (4).

There is little evidence to suggest the manner in which water reached the wheel. It is possible that this was via a launder, supported on wooden trestles, or via a rising main utilising pipework. Both were contemporary local practice but the former method is the most likely. The use of the lines of stone piers is unlikely, their height being mainly above the outflow.

Neither is there evidence to suggest the method of secondary control (B). This most probably used the local solution of a flap in the base of the launder (Fig. 3). This would be operated by a system of rods and levers diverting the water before it reached the wheel (5). There is some evidence of a channel to remove the surplus water.

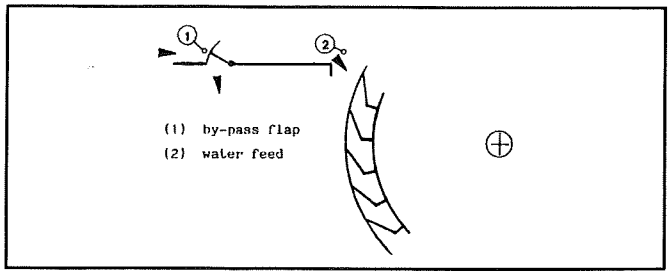


Fig. 3. Water feed and control - local practice for a high breast-shot wheel.

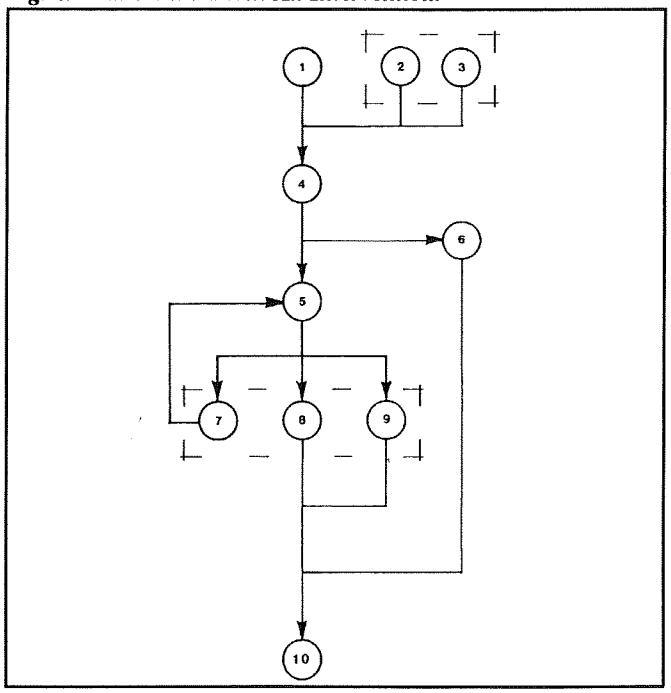
Utilisation (Fig. 4)
The main purpose of the collected water is to drive the wheel. This in turn is used for pumping water from the mine (7), most likely via a system of rods. It would also provide the power for winding the ore (8) from the workings. Again, how this was achieved can be but speculation, no record of any type seemingly having been made and no ground evidence being still extant.

A further use was the driving of the crusher (9). Initially the ore was reduced by hand to a uniform size, the gangue being tipped to form a flat surface by the lakeside between the shaft and a series of opencuts. There are still several deposited layers of crushed material close by the crusher house.

The water was also used for washing the crushed material (6). How it was transferred to the buddle house is unclear, the only remaining evidence being a curved channel leading into the buddle.

In conclusion, one wonders how such a wealth of remains can yield so little positive evidence. Perhaps, hidden in some archive or attic lies the photographs, sketches, maps and notes which will provide the answers. Dream on!

Fig. 4. Water Utilisation: An Intervention.



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