



# Welsh Mines Society

(Member of the National Association of Mining History Organisations)

NEWSLETTER 51

Winter 2004



**5M long Alder wood drainage launder – Copa Hill.**  
*Dated to 1900-2000 BC [Ref. N/L #50, Item 50.]*  
*Photo credits; Simon Timberlake*



**Bronze Age opencast – Copa Hill,**  
**Cwmystwyth**  
*As excavated by the EMRG 1986-1999*

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### **Editorial Thoughts**

1. Time moves on, and we find ourselves not only starting a new year of mining adventures, but also with a Society which has seen a most important change amongst its ranks – see **Item 6**.

**Honorary President:** DAVID BICK, The Pound House, Newent, Gloucester, GL18 1PS.  
**Chairman:** MOLE (AKA John Hine), 'The Grottage', 2 Cullis Lane, Mile End, Coleford, Glos., GL16 7QF  
**Secretary/Treasurer:** DAVID ROE, 20 Lutterburn Street, Ugborough, Ivybridge, Devon, PL21 0NG.  
**Editor:** MIKE MUNRO, 64 Bron Awelon, Garden Suburb, Barry, Vale of Glamorgan, CF62 6PS.

[www.welshmines.org](http://www.welshmines.org)

Contributions continue to be produced by the ‘faithful few’ – please do keep them coming... Despite an ‘Excess’ of material (some is being carried over to the Spring N/L) there is however a dearth of WMS field meet reports. If you’re lucky enough to be able to attend, please do think about dropping me a few lines on what you saw – don’t be put off about not knowing all the technical or historical details, these can easily be sorted !

The provision of a supplementary publication was mentioned in the last Newsletter. Its absence has been due to various reasons, one of which being the request by David Bick for an ‘Occasional Journal’ as a vehicle for some of the longer works he (*and others such as George Hall & Simon Hughes*) has in hand. It would indeed be perhaps more appropriate to place some of the longer articles, which have appeared in recent editions of the WMS & WMPT Newsletters, in such a publication. (*This is not the first time this has been proposed, but material wasn’t quite as abundant then as it now appears to be – if you have any potential articles, please do get in touch.*)

It does however bring with it an additional draw on my resources – something, which after much soul searching I’m simply unable to commit to whilst also handling the Newsletter. If perhaps someone is prepared to take on the Newsletter, I would happily commit to taking care of an ‘Occasional Journal of the WMS’ – any takers ?!

*Mike Munro & Bronwen Dog* 🐾

## Events – Dates for Your Diary

*(Note that details of forthcoming WMS & WMPT meets, complete with links to maps indicating meeting points etc., are always posted on the WMS/WMPT web pages as soon as they are confirmed.)*

### 2. WMSoc. 2005 Programme

#### **Winter Meet – Sunday 20<sup>th</sup> March 2005.**

Hosts: **George and Nheng Hall** Tel./Fax. (01584) 877 521

George and Nheng Hall have again offered the use of their home, ‘Abilene’, for an informal indoor one day ‘winter meet’. Arrive at any time from 10:30 a.m. onwards, tea and coffee will be provided. If you want a buffet lunch these will be available, cost ca. **£6.00** (pay on the day) but need to be booked **a week in advance**, otherwise just turn up and bring a few slides – **all members**, not only those who regularly attend field meets, are welcome !

‘Abilene’ can be found on Sheet Road, Ludlow, Shropshire, SY8 1LR. To get there – Sheet Road goes into Ludlow from the southern of the two roundabouts on the Ludlow bypass (A49), ‘Abilene’ is about 200 yards down on the right, the third house beyond the N.F.U. Mutual Office.

#### **Summer Field Meet – Weekend, 11<sup>th</sup>-12<sup>th</sup> June 2005.**

Location: **Snowdonia.**

Organiser: **Peter Cloughton** Tel. (01437) 532 578 Fax. (01437) 532 921

Headquarters for Saturday evening meal and accommodation: The Royal Goat Hotel, Beddgelert, Caernarfon, Gwynedd, LL55 4YE.

Tel. (01766) 890 224/343, Fax. (01766) 890 422, e-mail: info@royalgoathotel.co.uk

A discount on rooms has been arranged as long as more than 20 people use the hotel – £40.00 per person (£7.00 single supplement). There is, however, plenty of alternative accommodation in the village, plus a campsite.

**Saturday 11<sup>th</sup> June** – *Lliwedd (Cwm Erch) Copper Mine*. In the company of the National Trust’s archaeologist. The mine is located at NGR SH 634 531. [*See also Item 19*]

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**Sunday 12<sup>th</sup> June** – Suggestions welcome ! Please contact Peter Cloughton.

**Autumn Field Meet – Weekend 17<sup>th</sup>-18<sup>th</sup> September 2005.**

Location: **North Ceredigion – The Silver Mines of Mid-Wales**

Organisers: David Bick & George Hall

**Full details of Summer & Autumn meets**, including meeting times and locations, to be announced in the next Newsletter & on the **WMS** webpages – **www.welshmines.org**

**3. Welsh Mines Preservation Trust 2005 Programme**

**Fieldwork Days**

**Apr 30<sup>th</sup>-May 1<sup>st</sup> 2005** (May Day Bank Holiday Weekend) – Working Weekend at ‘*Catherine & Jane Consols*’, Snowdonia.

**July 2005** – Survey of *Waller’s Stamp Mill*, Cwmystwyth. Simon Timberlake has agreed to organise this survey, subject to permission being obtained.

**October 2005** – Working Weekend at ‘*Catherine & Jane Consols*’, Snowdonia.

**‘Heritage’ Open/Activity Days**

**August 27<sup>th</sup>, 28<sup>th</sup> & 29<sup>th</sup> 2005** (Bank Holiday Weekend) ‘Heritage Weekend’ at *Cwmystwyth*, Mid Wales.

Further details of the above WMPT events may be obtained from Graham Levins;

Tel. 01293 510 576, e-mail **WMPTSecretary@Welshmines.org** Details also on-line on the WMPT webpages – go to **www.welshmines.org** and click on the link.

**4. NAMHO Conference 2005** – This is to be held at the Juniper Hall Field Study Centre, Dorking Surrey, over the weekend of 8<sup>th</sup>-10<sup>th</sup> July 2005, and has been jointly organised by the Wealden Cave & Mine Soc., Kent Underground Research Group & Chelsea Speleo. Soc. There is a full and varied programme of field trips, both surface and underground, plus a series of lectures with the theme of ‘*Mines, Quarries and Tunnels of the SouthEast and beyond...*’.

Conference booking forms are available by sending an A4 SAE to :

NAMHO2005 Conference Organisers, 13 Beaufort Road, Reigate, Surrey, RH2 9DQ  
or alternatively, visit the conference web site : <http://namho2005.wcms.org.uk/index.shtml>

**5. NAMHO Conference 2006** – This is likely to be organised by Shropshire Caving and Mining Club. [*SC&MC Minutes 03.12.04*] Perhaps the **WMS** could help out ?

***Other Societies & Organisations***

*If you’re aware of events or trips which other organisations are holding or making to/into Welsh mines, please let me know and I’ll include them in the next Newsletter.*

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**Very Important Announcements !**

**6. New Departures.** After 25 years as Chairman, I feel it is time to hand over to someone younger, and also to reproduce the minutes of the Bi-Annual Field Meetings in the Newsletter.

**Minutes of the Meeting, held on 18<sup>th</sup> September 2004.**

The Meeting was held at Criccieth and 32 members attended the dinner.

Apologies were received from Jeremy and Alison Wilkinson and Ann Hyde. Members all signed a card to Jeremy and Alison expressing deep regret as to their absence.

I referred to the recent successful [WMPT/WMS] field and lecture weekend at Cwmystwyth, where some 50 people attended, mainly locals. There had been a good report in the Cambrian News. Guides and speakers were Simon Hughes, myself and Ivor Richards who showed his dramatic underground photographs. Graham Levins was thanked for organising the event.

The Minutes of the last meeting were referred to and the programme for the next year was discussed; Snowdonia for June 11<sup>th</sup>-12<sup>th</sup>, leader Peter Claughton, in conjunction with John Latham of the National Trust, to include Lliwedd Mine and its machinery. Suggestions for Sunday 12<sup>th</sup> were requested. The September venue would be the silver mines of mid-Wales, on 17<sup>th</sup> and 18<sup>th</sup>, leader David Bick. George Hall kindly offered to organise the accommodation. He also invited members to an 'open day' in March.

### Appointment of new Chairman

I expressed a wish to retire as Chairman and suggested that in future the office be held for a maximum of three years. This was agreed and David Seabourne proposed Mole (John Hine), seconded by Elizabeth Bennett. The Motion was carried unanimously and Mole was thanked for agreeing to accept the position.



The new Chairman  
says 'Hello'

### Any Other Business

On behalf of the Society, the Chairman presented George Hall with a framed photograph of Glasdir Mill to mark his 80<sup>th</sup> birthday, and expressed appreciation for all he had done for the Society over the years.

Catherine and Jane Consols: Graham Levins stated that there would be a further working party on 30/31 October 2004.

Harold Morris was thanked for organising the weekend's events and Liz Christian for taking the minutes.

David Bick

*[It is impossible for me to do justice to our respected President in just a few words, given not only did he found the Society, but he has contributed enormously to Welsh Mining History. Due to Davids' endeavours as a Chairman of the WMS we have a very distinct, respected and unique society, long may this continue... – Ed.]*

**7. A Thank You...** 'I would like to extend my most sincere thanks to everyone who contributed to the splendid framed picture of the Glasdir Mill that was presented to me at Criccieth on the September weekend. I was completely taken by surprise, but I think David said that it was in appreciation of what I have done for the Society. All that I have done, in fact, is to arrange a few weekends. *[A 'minor' understatement, if ever there was one ! – Ed.]* This has been no burden, and if it had, I have already been more than repaid if they have been enjoyed.

'I can think of three people who have done far more than I have for the Society, David Bick, David Roe, and, though starting more recently, Mike Munro – but then, there is evidently an unwritten qualification in our non-existent constitution, namely, that to be so honoured one has to have reached the advanced age of eighty. It's not always easy to remember one is so old !

'Welsh Mines Society weekends have always been, for me, some of the most pleasurable fixtures of the year, and I hope, in spite of my undoubted antiquity, to enjoy a few more yet in such friendly company as all of you provide. Thank you, everyone.' *George Hall*

**8. WMS Display Boards & Table Top Stand** – The WMS is now the proud owner of its own ‘table top’ (i.e. not free standing) display stand, which was first used with our display boards at NAMHO 2004 in Coniston, the Lake District, last July. If you’re aware of any Local History, I.A., Geological, or similar events being organised, where a WMS/WMPT display would be appropriate, then please do let your Editor know.

**9. Insurance & Subscription Issues** – David Roe advises the current situation :

**Newsletter Only Subscription 2005 – Good News.** If it ain’t broke, don’t fix it. £4.00 seemed an excellent price to pay in 2004 for the joy of receiving the WMS Newsletter, albeit unsupported by Public Liability Insurance – so why change in 2005 ?

If you intend to join us at the Field trip events (and take the other advantages of the BCA insurance scheme) you must pay the appropriate underground or overground insurance premium cover :

**Insurance – More Good News.** The British Caving Association has informed us that the insurance premiums for 2005 will be the same as last year – £18.00 for underground cover and £6.00 for overground only insurance. Those of you who are members of more than one BCA registered club have got even better news – you need only to pay for one insurance with one club. Thus if you are member of another club which is in the BCA scheme (*but only the BCA scheme*) then you do not have to pay twice but we do expect you to provide us with proof at any WMS meet you attend. Proof of insurance cards will be issued by the BCA early in 2005.

Could you please pay your insurance (cheques payable to **Welsh Mines Society**) before **15<sup>th</sup> February** which is when I wish to pay all the premiums into the BCA – late payment causes a lot of additional work for both your secretary and the BCA. Please assist by **paying promptly** to David Roe, 20 Lutterburn Street, Ugborough, Ivybridge, Devon PL21 0NG.

*Please do not pay for more than one years insurance* – it causes havoc in my records.

**10. Slate Correspondence** – Mr J.N. Roberts, *Tanhouse*, Halton Brow, Runcorn, WA7 2HE, has written to say he would welcome correspondence with other WMS Welsh Slate Enthusiasts.

**11. Obituary** – We regret that we have to report the death of George Frude of BUILT Wells, who was one of our longest serving members. Our condolences to his widow.

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### New Members

**12. The Welsh Mines Society** says ‘**a croeso**’ (*hello and welcome*) to the following new members :

Mrs M. Dupree	As B. Dupree (Interests A, Ge, M)
Mr R. Gosling	51 Greenfield Road, Alveston, Bristol, BS35 3NA (Interests C, H, R, S)
Ms J. Gowing	49 Waltham Grove, London, SW6 1QR
Mr M. Coy	<i>Tyn y Cefn</i> , Dolwen, Vale of Ffestiniog, Gwynedd, LL41 4BW (Interests H, IA, M, Mc, S, U)
Ms K. Sauer	64 Bron Awelon, Garden Suburb, Barry, Vale of Galmorgan, CF62 6PS
The Coleman Family	<i>Brynderw</i> , Corris, SY20 9RR
Ms C.H. Smith & S. Oliver	<i>Gwar-y-castell</i> , Llangurig, Llanidloes, SY18 6SN (Interests A, G, H, IA, M, Mc, R, S, U)

## Field Reports

### 13. Joint WMPT/WMS Weekend at Cwmystwyth, 28<sup>th</sup>, 29<sup>th</sup> & 30<sup>th</sup> August 2004

The weekend began with over fifty members and local residents attending the 'Heritage Day' events at the mine on Saturday afternoon. The proceedings began with a talk on the geology of the area from Dr David James, who explained a complex subject in a way that could be understood by everybody. Mineral specimens from the mine were also on display. Simon Hughes then led a guided walk over the lower parts of the mine, stopping at various locations to give an informative talk on the history of the mine.

The 'Heritage Day' continued on the Saturday evening, in the Church Hall (Ysgoldy Goch) with a slide show from Ifor Richards, showing slides of underground views of Cwmystwyth and surrounding mines. This was followed by an interesting and informative talk and further slides by David Bick on William Waller and the Mine Adventurers. Exhibited around the Hall were Simon Hughes's display on Cardiganshire Mining, Geological Plans by David James and a fine collection of relics from the Blacksmiths Shop at Cwmystwyth Mine loaned by Reg Budd.

It was a very successful day, with many local people attending, and hopefully learning a little about their village's heritage and history.

The rest of the weekend was for members of the Society and the Trust to enjoy the delights of Cwmystwyth. On the Sunday twenty attendees were taken on a walk up Copa Hill, as well as exploring surface remains and the ancient open workings, some were taken underground into Alderson's, Herbert's and Cross Road Adits.

The Bank Holiday Monday started with a rescue of a sheep from an open stope on Copa Hill (close to Queen's Adit). The day then continued with an underground tour of Level Fawr, those who came underground were able to see the recently inserted pipe through the collapse on the Kingside Lode.

It was a very successful weekend, and I am hoping to arrange a similar event next summer. I would like to thank The Crown Mineral Agency, Mrs Raw of Ty Llwyd, Cwmystwyth and Mr Morgan of Pentre, Cwmystwyth for granting permission for the weekend's events to take place. I must also thank Simon Hughes, David James, Ifor Richards and David Bick for their assistance in planning the weekend and their contributions to the 'Heritage Day', thanks also to Barry Clarke for his assistance with the 'sheep rescue' and the underground trip into Level Fawr.

*Graham Levins – Secretary, Welsh Mines Preservation Trust*

*[I think that Graham, and all those who helped, are to be congratulated on pulling together an excellent weekend of activities, which considerably heightens the profile of the WMPT/WMS to those outside of the sphere mining interest. I know of at least one new member (Steve Oliver) who joined the WMPT as a result of this event. Such events are not always easy to organise but do a world of good for the cause of mining preservation, and Graham is certainly setting the pace. – Ed.]*

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## News & Developments

**14. Our President on TV** – David Bick is to appear in a kind of antiques road show called 'Name Your Price' on Channel 4, in mid January, with items of mining interest. *David Roe*

**15. An index for the WMS Newsletter** – An index comprising a listing of all mine sites mentioned in the WMS Newsletters, Nos.1 to 50, has been compiled by member Alistar Neill. Initially I would like to place this on the WMS web pages, but providing a printer friendly version can be sorted, it may also be issued in hard copy.

**16. The Mines and Quarries of North Wales**

WMS member Jeremy Wilkinson has compiled a gazetteer and bibliography of over four and a half thousand mines and quarries in the pre-1974 north Wales counties of Anglesey, Caernarvonshire, Denbighshire, Flintshire and Merioneth. Courtesy of Jeremy, listings of this information are now available on the Internet from Dave Linton's web site :

**<http://www.hendrecoed.org.uk/Wilkinson/>**

*[Link on WMS webpages, go to 'Links', 'Resources for Welsh Mining Research' – Ed.]*

The files available for download are:

1. An alphabetical list of the mines and quarries, which includes for each the product mined/quarried, parish and county details, map reference (where known), a list of bibliographical references and a list of persons and the roles they held.
2. A list of Crown Grants, in date order, giving details of the type of grant (take note, lease etc.), the mineral involved, parish(es) and county, co-grantee (if any), PRO reference and notes.
3. An alphabetical list of persons, companies and organisations which includes for each entry a list of the mines/quarries they were associated with and their role and also any Crown grants made to them.

Full details can be found at the above web address including example entries from the three files.

In addition to the above material, Jeremy has passed on to Dave his files of company details abstracted from the Public Record Office files and his card index files of mines. In both cases these contain records which are not (yet) in the computer files. Contact Dave, preferably by email, ([dave.linton@hendrecoed.org.uk](mailto:dave.linton@hendrecoed.org.uk)), if you are looking for information which is not in the computer files.

*Dave Linton*

**17. 'Slate Inclined'** – The latest slate quarry 'developments' ...

**Dorothea Slate Quarry** – The site is up for sale at £1.35 million. Latterly used as a diving centre. Earlier in the year the water filled pit had claimed its 21<sup>st</sup> death in ten years.

**Ty Mawr West Slate Quarry** – The owner has started slate crushing operations but has been having problems selling the material !

**Tyn y Weirglodd Slate Quarry** – McAlpines have put in a planning application to use the quarry for extractive operations for the green slate.

**Aberllefenni Slate Quarry** – It is understood that the application to 'transform' the site into a tourist attraction has been granted.

*John A. Knight*

**18. More discoveries at Erglodd.** Following some initial excavations in March, (see WMPT Newsletter, April 2004), Cambria Archaeology returned to the site in June which was, by then, identified as a Medieval wattled causeway of 970-1010 AD. They discovered

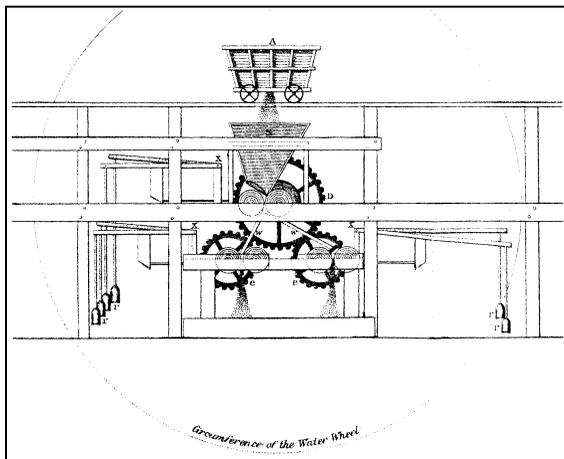
that its southern end had been built over a lead smelting site. In this there were copious quantities of charcoal and slag containing prills and spatters of metallic lead and litharge, with pieces of furnace lining encrusted with tell-tale vitreous yellow-green slag and a single example of a rather small bucking stone or quern incorporated into the causeway. Slag and cinders were spread over an area of about 30 metres in diameter. It would appear that the southern end of the causeway was partly built out of rocks and cinders robbed from these works.

As the smelting site only lies a matter of half a kilometre north of the Roman fort at Erglodd, occupied from 72-140 AD, it would be easy to assume an association. However, about fifty metres to the east of the smelting site a substantial wooden trough was discovered and dated to around 1250 BC. Llancynfelin lies half a kilometre to the north, at the other end of the causeway, and has a verified Bronze Age copper mine. Erglodd mine lies about a kilometre to the south east and is probably of a similar date whilst Allt y Crib lies about a kilometre to the southwest of the site and displays similar small quern stones in the older sections. An extensive suite of samples were taken and a magnetometry survey undertaken over a broader area. Once these are analysed, some likely dates and reasons will start to emerge. The archaeological findings are to be reported when the data has been processed and I will notify the Newsletter in due course. Provisionally, it is generally thought to be Roman or slightly later.

*Simon J.S. Hughes*

### 19. The Machinery at Lliwedd Copper Mine, Snowdonia. (Ref. last N/L, Item 24)

For those of us who are fit enough to get there next June, I have a few words to say about the surviving ironmongery. (By the way, its name is Lliwedd, not Cwm Erch, which some



**Three-pair set of crusher rolls**

*A similar set-up may have existed at Lliwedd Mine.*

people seem to favour, on what grounds has never been explained.) Due to its isolation, much of the original crushing machinery still survives, and quite possibly represents the remains of a three-pair set of rolls, (see left) which were common in the north but rare in Wales. (See my 'Old Copper Mines of Snowdonia', new edition, pages 94-97). To my regret, I have not been there for many years, and doubt I shall get there again, but as regards early mining machinery, a site more worthy of an in-depth study will not be found in Wales. Let us hope it will be done.

*David Bick*

**20. Tunnelling in Gibraltar** – In his comments on the use of quicklime [Ref Item 18. Spring 2004 N/L] Simon Hughes says he has heard one account of the Dolcaucothi miners who went to work on extending the tunnels through the Rock between 1939 and 1945, and asks if anyone can throw light on this.

In the booklet I mentioned in the previous Newsletter [Ref Item 29, Winter 2003 N/L] 'The Tunnels of Gibraltar', by M.S. Rosenbaum and E.P.F. Rose, the authors list all the named tunnels with their dates of construction. There were five main periods of tunnelling activity. Some 28 tunnels were driven in the first period, from 1782 to 1790, all of a defensive nature spurred on by the Great Siege. Then tunnelling ceased for 90 years. In the second period, from 1880 to 1915, 18 tunnels were driven, mainly to provide underground ammunition storage and water reservoirs. The third period of activity, from 1933 to 1938, involved the construction of seven tunnels, including hospitals, air-raid shelters and more water storage facilities. By the outbreak of war in 1939, there were seven miles of tunnels in Gibraltar (whose area is 2.25 square miles). The fourth and most active tunnelling period was during the Second World War, especially after Dunkirk. In the five years from 1940 to 1945 some 75 tunnelling projects were undertaken, two or three of which were suspended, incomplete, at the end of the war. Power stations, hospitals, REME workshops, accommodation blocks, fuel oil storage, ammunition stores, some main roads, etc., were all moved underground. By 1945 the length of tunnels in the Rock had risen to 25 miles, and during this period some 35 million cubic feet of rock had been removed. In the final, post-war, period 1953 to 1965, the outstanding war-time projects were completed (including the ones I worked on during my National Service) and 14 new projects undertaken, mainly road tunnels and more water reservoirs. There are now 30 miles of tunnels in Gibraltar. A comprehensive description of the WWII tunnelling was given in 1945 by Major W.H. Wilson in his paper 'Tunnelling in Gibraltar during the 1939-1945 War' which appeared in the Transactions of the Institution of Mining and Metallurgy, Vol. 55. pp. 193-269. The paper itself comprises 32 A5 pages, giving a wealth of detail with copious line drawings and photographs, and the ensuing discussion occupies a further 45 pages. There were up to five companies of Royal Engineers engaged in tunnelling activity, plus one company of Canadians, which included some experts in diamond drilling. The latter were employed in drilling blast holes to give a good arch profile to the roof of some of the chambers which are 50 feet wide, 23 feet high at the walls, and 34 feet high at the centre, some of these chambers being 130 feet long.

I guess the Dolaucothi miners, that Simon Hughes refers to, were enrolled in one of the Royal Engineer tunnelling companies – the whole wartime operation was a military exercise, although civilian contractors have been used at other times.

*A.A.C. Brewis*

**21. The Antiquity of Early Mining.** (Ref. last N/L, Item 24) I see that Stephen Briggs, the 'enfant terrible' of the prehistoric mine protagonists, is still refusing to lie down, and in one respect I believe he has a point. At least in mid-Wales, this is the entire absence of furnace slag or remnants of furnaces, without which the proof of bronze-age copper smelting can never be established beyond all doubt. It is an embarrassment to the copper lobby, but the fact remains and will not go away.

**22. Mines in the Elan Valley, near Rhayader** – Recently in the County Records Office in Llandrindod Wells, ref. R/D/WWA/1/48, I came across a great pile of papers ex-Birmingham City Council relating to buying up land for the waterworks and reservoirs in the 1890s. Amongst this is a lot on the local mines, including output figures and an **old photo** of *Dalrhiw* copper mine, also one of an unidentified level in work with a wheelbarrow outside. The material presents much scope for a serious study.

*David Bick – Above two items*

**23. Progress at Dolaucothi** – A brief visit made 30.12.04 to the Dolaucothi Gold Mines, showed that the work was indeed well in hand for the installation of the narrow gauge track, locomotives etc., removed from the now defunct Bettws Colliery in Ammanford. (Ref. Last N/L, Item 26). All existing track appears to have been stripped out of the ‘Long Adit’, and the replacement ‘track’ is stacked several feet high awaiting installation. This replacement ‘track’ may well upset some purists, being of the ‘captive’ type where by the wheels (smooth faced rollers) of the loco and rolling stock run within Rolled Steel Channel. It will be interesting to see how well the National Trust manage to smarten up a decidedly beat-up looking loco, which more closely resembles something out of a Sci-Fi novel than what the term ‘locomotive’ normally conjures up in ones mind.

*M.P.M., K.S. & B.D.*

**24. Esgair Hir.** During April 2004, Dave Seabourne and I went to investigate a subsidence hole, reported by Roger Bird which had developed at SN 7288 9105 about thirty metres east of Nant Ddu brook and on the line of the old West Adit on the North Lode. Apparently this is an old adit which was ‘dressed up’ under Waller’s instruction. I suspect that the timber cladding carrying the level through the overburden had eventually failed after 300 years of service. The resulting subsidence being a shallow, bell shaped, hole onto pile of earth with narrow and totally flooded workings on either side. As the water level is only about 3.5 metres below the surface at this point, it would be a relatively easy job to pump most of the water out with an ordinary contractor’s centrifugal pump which will usually lift 6.0 metres without diminishing the flow too badly. I estimate that the floor of the adit lies at about 5.5 metres below the surface at this point. However, the roof is somewhat fragile and may fail without the extra support of the water. I certainly wouldn’t recommend entering such an unstable working.

On the western bank of the stream the lode has been stoped out in a narrow slot for a distance of about three metres, it struck both of us that sufficient material had run into the stope as to conceal any drift which might have been driven west along the North Lode.

Ten metres upstream of where the North Lode crosses the stream is another slot cut into the eastern bank of the stream. This appears to be where some poor and narrow, but easily gotten, ore was worked with a crowbar until it involved more effort than it was worth.

*Simon S.J. Hughes*

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### Query Corner

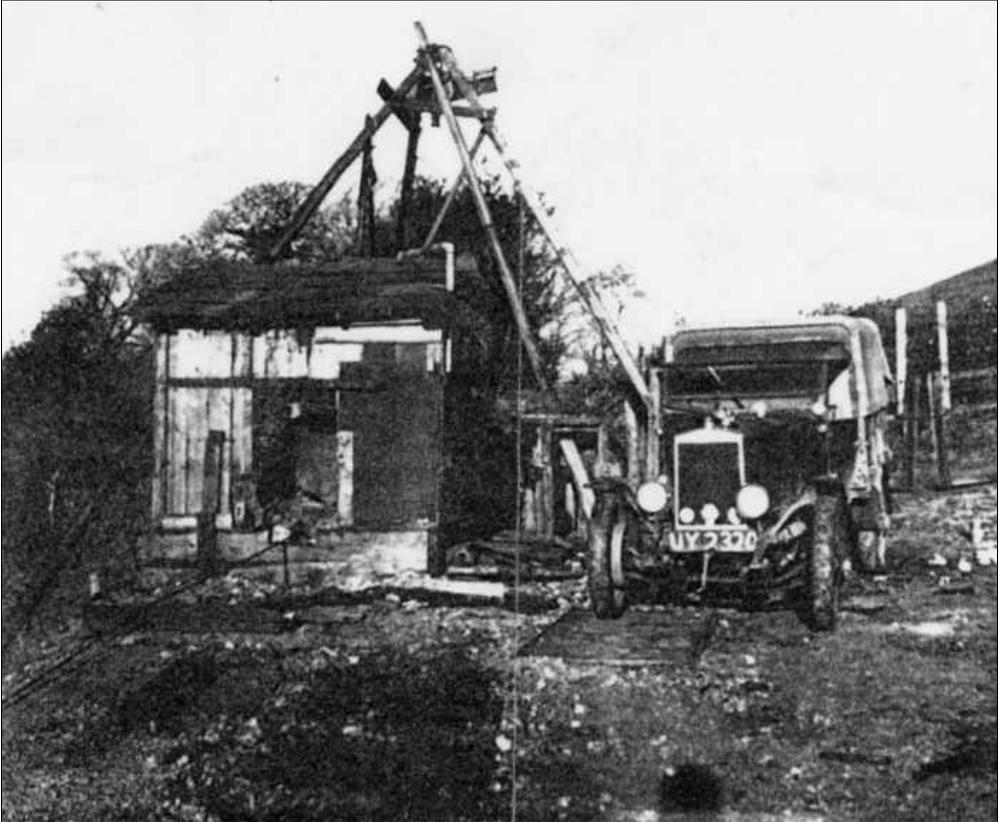
*Please reply direct to the correspondent. Any follow-up info will however be gratefully received by your editor to allow a suitable response to be placed in the next newsletter for the benefit of all.*

**25. Mineral Oddity** – It was noted by Alan Holmes on the excellent field trip to the Abergynolwyn slate quarry that there was a small trial for manganese below the main workings. Neil Weston and David Roe fought their way through some almost impenetrable brushwood to the small tip that is just visible below the main track. This tip certainly shows a quantity of very lustrous black mineralisation – which shows a great reluctance to dissolve in strong muratic acid. Was this in fact “Fools’ Manganese” – an example of highly metamorphosed slate ?

**26. Aerial Ropeways & Bucketways** – Having visited what I understand to be the very last operating aerial ropeway in the UK, at Cloughton Clayworks in Lancashire, and since found

scant info on the web, I decided to set up an on-line gazetteer. I would guess that there must have been upwards of a few hundred aerial ropeways installed in Wales during the past couple of centuries, but I've only reference to a few dozen. If you know of any, please do let your Editor know – [editor@welshmines.org](mailto:editor@welshmines.org)

### 27. 'Somewhere in Wales...'



*David Bick asks : 'where and when and what were they mining ?'  
(No prizes for guessing the owner of the truck !)*

**28. Longest Ladderways** – In a recent discussion on mining matters David Bick asked if anyone knew the greatest depth to which a mine had been worked, using only ladders for access. No one offered a confident answer, but I have since done some research into the question, and put forward as a candidate Great Laxey. Here Clement Le Neve Foster, the new Inspector of Mines for the Isle of Man, found in 1880 that the men had to climb from 259 fathoms below adit. He thereupon threatened the management with prosecution, and they reluctantly installed a man-engine.

*G.W. Hall*

**29. Website Queries** – As previously mentioned, the **WMS** web pages inevitably produce a regular stream of enquiries. A recent one from someone with a 'Welsh Dragon pin' with "WMS 1904" inscribed on the back, wondered if I knew what the WMS referred to –

knowing that our President wasn't even born then, I suggested the Wesleyan Missionary Society perhaps more likely !

I have however a couple of queries which I've not yet sorted so any help in locating the activities of the following would be appreciated by your Editor / Webmaster :

- i. North & South Wales Coal & Lime Co.
- ii. Fron-Vellan Lead Mining Co. – I'm sure I know this one, but just can't track it down !

## General Articles

### 30.

### EFFECTS OF MINING ON HEALTH

In Newsletter No. 49 I complained of the use of 'appalling' (on Le Neve Foster's memorial tablet) to describe the 'death rate' in metalliferous, as opposed to coal, mines (meaning in the past). This has produced three replies, which I think call for a response.

In Newsletter 50, (Item 34), David Bick quoted one particularly unfavourable sentence from the Kinnaird Report, which I refer to below. Peter Challis, (Item 19), makes a somewhat intemperate attack on me, though whether for my English usage, which he calls a 'semantic and pedantic outburst,' whether he considers 'appalling' to be incorrect, or whether he thinks my remark a personal attack on himself or a friend, to be repulsed by exaggerated rhetoric, isn't clear to me. Alan Williams also 'phoned, to draw my attention to his article, 'The High Mortality of British Metal and Slate Miners... (1556 to 1904),' which appeared in British Mining No. 34, 1987. I had to admit I was unaware of this, and Alan kindly sent me photocopy. It is essential reading for anyone who wants to know more about the subject. I have now studied it, together with other publications referred to below, and I have tried here (without examining all sources exhaustively) to make a fair analysis of the question.

I should perhaps start by reminding everyone that the detrimental effects of mining on miners may be divided into two categories. One, violent death, due to blasting or explosions, falls of ground, inundations, and so on, the other, factors that cause a gradual destruction of health and, ultimately, premature death. Alan discusses only the second category, not the incidence of violent death.

Alan claims that metalliferous mining has always had a significantly deleterious effect on the miner's health, and that this has always been almost entirely due to siliceous dust caused by boring, or other mining operations. He points out that this has varied greatly from area to area, chiefly owing to the rock types in which the mineral occurs. That rock dust has always been the main cause of the shortening of miners' lives, where these have been significantly less than the general population, I find difficult to believe.

It has long been known that certain types of dust are very damaging to health. For example, flint-knappers, stonemasons, and grinders. There is also no doubt, as Alan shows, that it was so in mining in areas where the rock is of a particularly harmful character. For example, Thackrah (1832), quoted by Alan, said that there were at that time 30 widows under 30 in the gritstone lead mining village of Arkendale. But I still think that in many mines dust was of small effect, and other conditions were more harmful.

I can see that before the introduction of gunpowder, when levels, slopes, and shafts could only be advanced by the infinitely laborious use of pick and wedge, it was inevitable that they should be kept to the smallest size through which a man could pass, and any work not in ore was avoided if possible. In time, as these workings got farther and farther from surface, it

seems to me that, if the vein continued rich, they must have been taken to the limits that men could endure, and that no doubt had a serious effect upon their health.

After gunpowder came into general use in the late 1600s it became practical, and common practice, to make levels much larger, which allowed better air circulation (see comments by Warington Smyth and others in the Kinnaird Report). Furthermore it was now feasible to drive shafts, levels, and winzes for the specific purpose of ventilation, as this could be accomplished much more easily, and in a practical space of time.

Driving rates were still, by modern standards, very slow. In the 19<sup>th</sup> century in mid-Wales four miners, the usual number, would, boring by hand, drive a level, on an average, three fathoms in a month, barely twenty feet. I have never seen a hole bored by hand, but I find it difficult to believe that harmful amounts of dust would be produced by this method. Not only is the rate of boring slow, but the rock chippings can't be ejected from the hole with the force that a machine drill would achieve, nor is the miner's face close to the hole. In support of this view I would like to point out that Mr. G.J. Williams, then Inspector of Mines for North Wales, when being examined by the 1914 Royal Commission, agreed 'most decidedly' that the dust from siliceous rocks was dangerous, but said that he only knew of one case of 'miners phthisis' [*consumption – Ed.*] in his district, and that man had worked in South Africa for some years. He said they had no problems, as the only such rock was in the gold mines 'and most of the work there is done by hand drilling.'

The advent of compressed-air driven rock-drills changed the situation completely. They were first successfully employed to drive the Mont Cenis tunnel through the Alps in 1860s, not to reduce cost, but in order that the bore could be completed in a reasonable period of time. They were, however, slow to develop, owing to difficulties both in finding the best design, and in overcoming metallurgical problems, and did not start to become common in mines until the late 1870s, or attain anything like their modern efficiency until after Leyner's introduction of the hammer (as opposed to piston) principle at end of the 1890s.

As a result of a series of head-line making disasters, Government regulation of coal mines began with the Mines and Collieries Act of 1842, under which the first Inspectors were appointed. Metalliferous mines, which were not subject to huge gas explosions, and seemed safer, were not included in its jurisdiction. Nevertheless there was continuing disquiet about the health of metal miners, which culminated in the 'Kinnaird Report' of 1864, and then the 1872 Metalliferous Mines Regulation Act, which appointed Inspectors of Metal Mines.

I have three volumes of this Report: Minutes of Evidence, Epitome of Evidence, and Appendix B. These contain 23,556 questions and answers, as well as several special reports, some medical, others on air quality, and so on. I have not, and am not going to, study every page of it, but I have read several sections with some care, and looked through others. It is not entirely what we would now call a scientific study, although there is an important body of accurate and detailed statistics. Much of it is a collection of opinions. These can, of course, be accepted or dismissed according to the prejudices of the reader.

It is clear that most, though not all, of the witnesses believed that working underground shortened a man's life, though to what extent was not agreed. For instance Robert Hunt thought a miner (in Cornwall) finished at 40, while Warington Smyth knew many still in good health at 50 or 60. In Cornwall, from the age of about forty on, there was an exceptionally heavy death rate from 'consumption,' which we may call lung diseases, but it was generally agreed that copper mines were much less healthy than tin mines.

More precise data came from William Farr, Chief of the Statistical Department in the General Register Office. Using the 1851 census, he stated that up to the age of 35 the mortality of Cornish miners was no different from the general population, but from 35 to 45 the ratio was 14 to 10 ; from 45 to 55, 34 to 15 ; and from 55 to 65, 63 to 24.

He remarked that in manufacturing districts the mortality among children and women was much higher, while in the mining districts of Staffordshire it was about the same as Cornwall, and in Merthyr Tydfil a good deal worse. At this time about eight miners per thousand per annum in Britain met a violent death. Owing to the lack of sanitation in towns, the toll by cholera, smallpox, typhoid, and other diseases was from time to time enormous.

Most interviewees agreed that dust from drilling was harmful, but no one seems to have thought it as detrimental as poor ventilation in development ends, climbing ladders from deep mines, poor housing, bad diet, negligible sanitation, and so on, and the general conclusion of the Report was that dust was not the main cause of premature death.

I noticed some answers suggesting that it was common practice to fill holes with water in rocks regarded as producing a harmful dust.

Alan, I hope I represent him fairly, considers that these various interviewees were mistaken, in that they failed to recognise that rock dust was everywhere the pre-eminent danger to health, far more so than the other causes discussed. I think he goes too far, principally because I feel sure that the amount of dust produced by drilling was then insignificant, compared with that generated by the advance of machine rock drills in the 1880s and 90s, and would, in most mines, have been less harmful than other noxious circumstances. I think that today we tend to underestimate the bad effects of climbing such lengths of ladders, poor diet, abysmal housing, and so on, which, while commonplace in the 19<sup>th</sup> century, are now completely outside our personal experience.

I should add that doctors quoted by the 1914 Commission said that the danger was not just the dust lodged in the lung, but that the damaged lung was more susceptible to tuberculosis, and that in many cases that was the cause of death.

Following the Mines Act of 1872 Dr. Clement Le Neve Foster was appointed Inspector of Mines for Cornwall, Devon, &c., and Thomas Fanning Evans Inspector for North Wales. I presume that, together with the other Inspectors, they were intelligent and well-educated men, fully conversant with mining, diligent in their efforts to improve the health of miners, and, while conditioned by experience, were not rooted in prejudice. Their Annual Reports, and those of their successors, provide interesting comments on miners' health problems, as well as death rates (see below), and show a change in opinion over time.

The first significant notice of lung disease by the new Inspectors appears to be in Mr. Evans' report for 1875. The slate mine owners had contended that they were not bound by the Act of 1872, but on the Court of Queen's Bench deciding that they were, he began his examinations. These included obtaining from the Registrar for Ffestiniog a list of the males who died during 1875. This gave 61 names, and showed that the average age at death of slate workers was 37.78 years, and of others 67.12 years. This startling and alarming discrepancy Evans attributed to poor and overcrowded housing, bad diet, negligible sanitation, and polluted drinking water. Of the 35 'slate' deaths, 9 were 'accidents', and 14 were due to lung diseases.

In the following year he arranged for Joseph Dickinson, Inspector of Mines for the Manchester Area, an expert on ventilation, to visit the slate mines. Dickinson agreed that

ventilation there was gravely inadequate, with an air current 'so sluggish and laden with powder smoke that it cannot be healthy to breathe.'

Evans attributed the high incidence of pthisis among slate miners to two main causes. One, to 'working in the clothes they habitually wear,' in spite of often getting soaking wet when walking to and from work. 'The other is the practice of boring holes for blasting without putting in water. This produces a quantity of dust of highly deleterious character...' and, 'I suggested that it would be well to ascertain whether the diagnosis of miners who die prematurely does not indicate miner's, or grinder's asthma...'

Here it is interesting to note that the Second Report of the Royal Commission on Metalliferous Mines and Quarries, 1914, found much less lung disease in miners than surface workers at the Festiniog slate mines.

Machine rock drills were first successfully used in a British metal mine at Dolcoath in 1876. [*I believe they were used earlier than this in the iron mines of N. Yorks. – Ed.*] George Seymour, quoted by Le Neve Foster, stated that with the aid of Barrow drills the 314 fm. level was then extended 5 fms. a month against 9 feet by hand labour, at a cost of £20.18.0 per fm. by machine against £28.5.3 per fm. by hand. The expelled air also greatly improved the ventilation.

From then on machine drills gradually came into common use, and became more effective, and there's surely no doubt that, between the late 1870s and 1900, there was an enormous increase in the amount of dust produced by drilling, particularly, in this country, in Cornwall. When drilling dry in raises and overhand slopes this would cover the men. Le Neve Foster noted, in his report for 1898, that 29 drilling machines were in use in North Wales, of which 15 were at Minera. There were no doubt many more in Cornwall.

It was quickly recognised that the extra dust produced was undesirable, although it was not at once realised how undesirable. Attempts were often made to kill the dust by directing a spray of water at the hole. These were not effective, partly because most miners preferred to put with up the dust, with perhaps some improvised covering over their mouth and nose, rather than spend the shift soaking wet. But in any case the very fine particles, the most dangerous, can get through ordinary cloth and escape the wetting effects of a spray.

During 1884 Le Neve Foster, now Inspector for North Wales, concerned at the prevalence of lung disease and the evident poor ventilation in slate mines, made 170 determinations of 'carbonic acid gas' therein. He 'frequently found 0.5 to 0.8% by volume' when '0.1% is considered to indicate bad ventilation...' In the following year he found 1.2% in a roof at Llechwedd, together with a 1% deficiency of oxygen, but failed to secure a conviction at the Petty Sessions for insufficient ventilation, in spite of being supported by a Dr. Nichol, who testified that such an atmosphere would be 'very prejudicial to the health of the workmen.'

It will be seen that at this date, which is before the use of machine drills had become extensive, Le Neve Foster was convinced that the atmosphere in some mines was bad enough to cause lung disease, but that he did not attribute this particularly to dust. He goes into the matter quite fully in his report for 1885, not only the effects of an excess of 'carbonic acid gas', but of oxygen deficiency. This is a most interesting contribution, but is too long to reproduce here.

Also in 1884 Mr. Frecheville, reporting on Cornwall and Devon, refers to the 'appalling' mortality, meaning the early death of Cornish miners due to pthisis and diseases of the respiratory organs. He attributed it to, 'no doubt,' insufficient ventilation and climbing ladders [from great depths].

In 1892, however, machine drills were becoming more powerful, and were in more general use, and Le Neve Foster prosecuted the owners of Laxey Mine for allowing men to work in a cloud of dust produced by a rock drill, 'competent medical authorities' having concluded that 'inhaling stone-dust is very injurious to health.' But a conviction was quashed on appeal on grounds of incorrect wording.

Where the deadly effects of certain types of dust first forced themselves into the forefront of the attention of the industry, however was on the Witwatersrand goldfield in South Africa. Here the vast expansion of gold mining in the 1890s, in particularly bad rock types, caused the worst incidence of silicosis ever known. This was so severe that in the first few years of the new century the active life of a white miner was from three to five years. The natives were much less effected, as they did not operate the machines. This was truly appalling. But these were huge mines, where a thousand tons of quartzite a day might be broken, transported, and crushed.

Although he then wrote that 'the serious effect of dust in these [metal] mines has long been realised...' the problem of dust does not seem to have got the full attention of Joseph Martin, then Inspector of Mines for the Southern District, until 1903. This was a result of the early deaths of many rock drill men from the Rand, who returned to Cornwall because of the interruption to mining there caused by the Boer War.

I do not doubt that from the 1890s, if not somewhat earlier, the incidence of silicosis caused by rock drilling and blasting was a most serious matter, and what is more it took many years to get it under control. This was partly because it was so difficult to make a hollow drill steel, down the centre of which water could be forced, and that would stand up to the work, partly because, if air was allowed to enter the hole with the water, dust was still disseminated into the atmosphere.

But not everywhere. I wish to point out that in the deep mines of the Kolar goldfield in India, where, because of the high humidity, water was not introduced into the boreholes, even as late as the 1940s, yet silicosis was not regarded as a significant health risk. The reason for this was that the needle-like silica crystals which were the main source of damage on the Rand are not present in the Kolar rocks.

It should be remembered that coal miners have also suffered from lung disease caused by dust, particularly in the western part of the South Wales Coalfield.

I have relied for most of the above on, besides the Kinnaird Report and the Inspectors of Mines' Reports, the Second Report of the Royal Commission on Metalliferous Mines and Quarries, 1914, Treve Holman's 'Historical Relationship of Mining, Silicosis, and Rock Removal,' which was published in the 'British Journal of Industrial Medicine,' Volume 4, Number 1, 1947, and Alan himself.

Turning to violent death by some mishap in the mine, I have gone through the Inspectors of Mines Reports for the South-West from 1873 to 1914, and for North Wales from 1873 to 1901. They make interesting reading.

In the mid-1870s the annual death rate in mining in Cornwall and Devon from 'Accidents' amounted to about 2 per thousand. This was worse than some of the coal districts. It surprised Le Neve Foster, the first Inspector for the South-West, who had expected a significant difference in favour of metal mines. He accordingly checked the records of the Prussian mines from 1863 to 1872, and found their annual rate to be 1.38 per thousand, while in Saxony from 1862 to 1871 it had been only 0.86 per thousand.

Le Neve Foster had expected that the Metalliferous Mines Regulation Act of 1872, and the appointment of Inspectors, would have a favourable effect. In the event it proved less so than anticipated. There was, on the whole, a steady improvement (in Cornwall) until the first years immediately after 1900, when the figure seemed likely to have settled at less than one per thousand. But then from 1904 things went wrong again, and the annual rate stayed between 1.31 and 2.26 until 1913. This latter figure was significantly worse than in the coal mining areas. These were, however, usually single deaths. Catastrophes involving a large number of men were rare in metal mines.

This dismayed the then Inspector, Joseph Martin, and his successor Hugh Johnstone. But the general opinion of the various Inspectors seems to have been that the inherently safer nature of metal mines, with their freedom from the risk of gas and dust explosion, and generally stronger ground, generated a more reckless attitude among the men, and allowed weaker discipline than in collieries, and that at least half the fatal accidents might have been avoided had greater care been taken.

I have made an attempt to work out the annual death rates from accidents in ore mines in Mid and North Wales and Shropshire and, according to my calculations, they were generally significantly lower than in Cornwall, varying between 1873 and 1895 from a minimum of 0.29 to a maximum of 2.7, most years lying between 0.4 and 1.6. I also see (1914 Commission) that in the period 1906 to 1910 (about 2,000 persons employed) the average number of deaths by accident per 1,000 employed in the ore mines in the North Wales and Manchester District was only 0.38. The figures for coal and slate mines were 1.43 and 1.21 respectively. I have not made an exhaustive study of the large numbers of statistics available, but I have tried not to pick figures that support my case, and to provide an unbiased selection.

Welsh slate mines and quarries, from what I have seen of their statistics, appear to have been somewhat more dangerous than collieries. But I'll leave serious comment on them to our slate experts.

It is therefore clear that, like Le Neve Foster, my experience of mining, a good deal less than his, has deceived me. I now consider that, through most of the 19<sup>th</sup> century, and the early part of the 20<sup>th</sup>, as the mines got deeper, ventilation worse, and ladder climbing more exhausting, the effects of mining on health in Cornwall (taking lung disease as well as violent death) became more and more serious. Once coal mining practice had been improved as a result of the Coal Mines Act, and the work of the Mines Inspectors, I am ready to agree that their record was no better, and may have been worse, than that of collieries. From the 1880s on the previous causes of ill health became of much less importance than the enormous increase in dust produced by the rise in machine drilling (and by then most men travelled through the shafts in gigs).

These effects were compounded by poor housing and inadequate sanitation, which, of course, was in those days common to most of our urban and industrial areas.

I am, however, still inclined to think that metal mining in other areas except for those, such as Arkendale, where the rock types were particularly vicious, was significantly safer, both in long and short term, than in coal mines.

Finally, returning to the word which caused the fuss, 'appalling,' I wonder whether we would all agree as to what makes an 'appalling death rate' ? Deaths due to work occur in just about every occupation, and actuaries can tell us the normal rate thereof. In mining it appears, from what I have gleaned from the sources mentioned above, that an annual death rate of not more than one per thousand might be considered good. Two might be bad, but

would it be appalling ? Obviously a life expectancy of three to five years for a working miner is appalling, as is the sudden loss of hundreds of lives in an explosion in a colliery. But where do we reach that definition ?

We need, I think, when considering these matters, to be careful not to condemn the past because it does not come up to what we regard today as acceptable standards. We might also bear in mind that there have been less healthy places to be than in a mine. I read recently that the average life expectancy in Manchester in 1841 was 26 years ! A dusty mine might well be better than that.

*G.W. Hall, August 2004.*

**31. More on Miners Health** – Peter Donovan adds the following : ‘In the mid-1850s a family by the name of Free came from just north of High Wycombe in Buckinghamshire, to work the sarsen stone on the downs above Fyfield, west of Marlborough, Wiltshire. The stone in Bucks had become too difficult to obtain, whilst in Wiltshire it lay on the surface. The Free and Cartwright families had a virtual monopoly of the business, breaking the stone for stone setts. These men and their workers did their work in the open. Their average age of death was 44. They died from lung disease caused by inhaling the fine particles in the stone they were working. You did not have to be a miner, metal or coal, to die from the dust.’

**32. Working Conditions, Death Rate & Health of Miners.** There were, and always will be, good mines and bad mines. I was told by the late Mrs Davies of Fagwr, Ponterwyd, that her brother wanted to go and work at in a mine to raise money for the farm just before the Great War. After much discussion it was decided that he could go and work at Castell but not at Ystumtuen or Cwm Rheidol. Those who worked at Cwm Rheidol spoke of the mine in kindly terms but the graveyard at Ystumtuen does appear to have many young men interred there. At Cwmystwyth, some of the old miners gave me the distinct impression that they disliked parts of Pugh’s workings, and Taylor’s adit had particularly foul air. Most of the Cwmystwyth men who went to work in the collieries of the Ogwr valley would have been delighted to return to lead mining but the opportunity never arose. In Aberllefenni, the worst place to work in the 1950s was a chamber grimly dubbed ‘Belsen’ but most of the men, with whom I worked in the early 1980s, were all delighted that Braichgoch had closed down. Locally, it had a very poor reputation, as did Bryneglwys. After Aberllefenni, I went to the El Limon gold mines in Nicaragua, which claimed to be the hottest mines in the world (90°C) and had a death rate of one man per week out of a workforce of about 250. The mine water was so acid that the pumps required a total replacement every six weeks and the water was so hot that you could boil an egg in the mine gutters in five minutes. Quite regularly, the rock was so hot that it would fire the detonator whilst the round was charged.

The lure of above average wages has always been the greatest influence and drawn lads away from the farms. Captain Ridge told the Kinnaird Commission in the July of 1863 that ‘*the smell of the mine would almost knock you back*’ and that ‘*by the time a miner was 40 years of age, he was not worth the snap of a finger*’ but also recall that when Doctor Rowlands was examined regarding the health differential between the miners and farmers, he told Lord Kinnaird that he ‘could not tell the difference, as the agriculturalists do not appear to be healthy’.

An indication of the status that can be rapidly acquired through compromising ones health in the mines is well illustrated in Cardiganshire by citing that the first man to own a motor car was Dr. Bonsall of Aberystwyth, whilst the second was a Frongoch miner who bought

himself a new motorcycle in 1900. I had as much work as I wanted, as a prospector, in 1970 and as a direct consequence was the first lad in my year to buy a motor vehicle a few months after I was 17.

My family owned a woollen mill and of recent years have become involved in fishing and forestry. Personally, I have always preferred narrow vein mining but have a soft spot for slate mining after the year that I spent at Aberllefenni. A career in coal mining was once considered and quickly dismissed. Sewers, conduits and pipelines are also fairly vile places to work and I was glad to see the back of most of these jobs. It appears that the greatest permanent damage has been done to me by pneumatic drills and lightweight picks which have wrecked my joints. Maybe I have escaped lightly as most of the men with whom I worked at Aberllefenni have now died, none made their allotted three score and ten.

Health versus money, would I do it all again ? Need you ask !

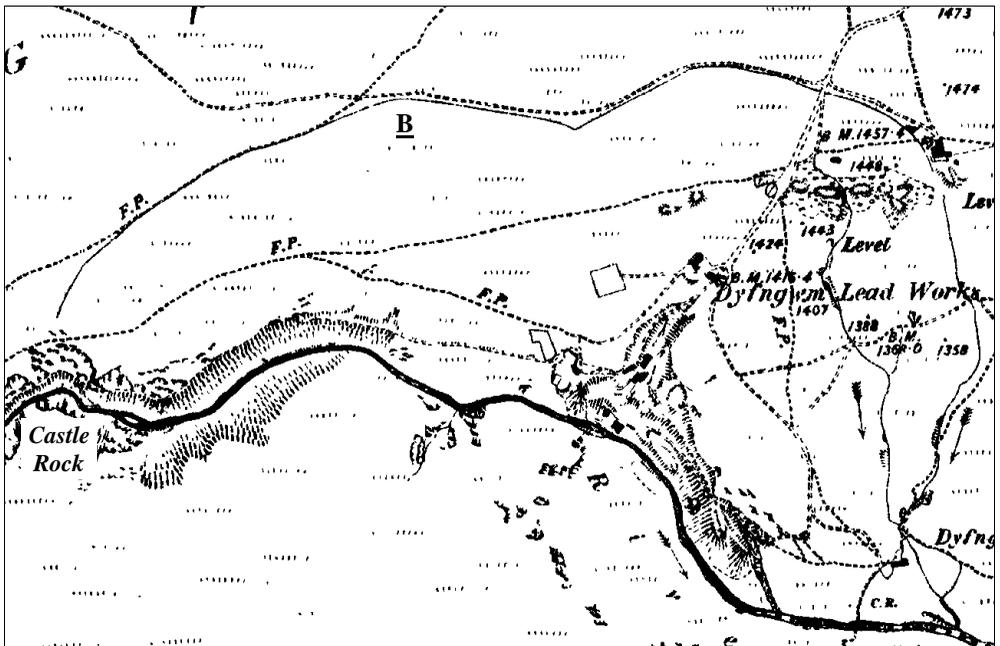
Simon J.S. Hughes

### 33. DYFNGWM – A GOOD MINE RUINED

In my account ‘Early Days at Dylife’ in the last WMS N/L (Item 35), I hinted at a contribution on Dyfngwm, (NGR SN 849 931) and here it is...

In mining ventures, as in all commerce, much depends on the competence and integrity of the management, and no better illustration may be found than the contrast between Dylife and Dyfngwm during the mid-19<sup>th</sup> century. One, a great success and the other, its neighbour, ruined by disgraceful practices from beginning to end.

Before 1776 the Dyfngwm sett was defined as shown on the plan in N/L 50, and in places



The Dyfngwm sett on the 6 inch O.S. map, 1891

B = Dyfngwm boundary bank/ditch

the boundary banks are still plainly visible. Eastwards from Castle Rock the hillside and gorge are pock-marked with old shafts and adits, but the main operations were on the high ground towards the old Dylife mine. We have seen a few mentions in the last N/L, but the first real details date from about 1800 – “Dymfngwm belonging to Mr. Griffith Jones is nearly worked out... Nine shafts about 14 yards deep have been sunk, and a level drove 500 yards from the river... Besides lead, ore of zinc are found, denominated Black Jack, which is not as formerly, thrown away or used for repairing roads; but carried to Machynlleth and sold for thirty shillings per ton”.<sup>1</sup> Thus we learn that the deep adit around which most of the later workings centred, was driven before the 19<sup>th</sup> century; it also seems that the mine was already more or less exhausted down to adit level, in spite of the apparent shallowness of the shafts.

According to Matthew Francis the Cardiganshire mining engineer, in 1837 ‘Tyfryn Gwm’ was 15 fathoms under adit with a 45 ft diameter waterwheel, presumably for pumping. A little later, the mine was active with Cafartha, in wild and dreary moorland a mile to the west, from which ore was being carted over mountain tracks to Dyfngwm for dressing; it was then carted back again towards the coast for shipment to the smelters – hardly an economic proposition.<sup>2,3</sup> By 1840 a Flintshire man, Edward Davies aged only nineteen, was in charge for a while, and in 1842 a crushing mill was being erected under John Reynolds. He remained involved for some years, afterwards going to Nant Melin.

For the rest of the century, practically our sole source of information is the Mining Journal, with no less than 285 separate references between 1845 and 1867, plus a few more up to 1886. Although invaluable, the reports are generally aimed more at bolstering shares and shareholders than presenting the truth; but between the lines the pattern of events can be pretty clearly made out.

### **The Dyfngwm Lead Mine Co. 1847-1867**

The chief actors in the story were George Hadley of Chelsea, later Westbourne Park, and Edward Davies, whose stock in trade was mine promotion and what could be made out of it, rather than the welfare of mining itself. Also involved was William Prosser, inventor of Prosser’s patent guide-wheels to keep railway wagons from leaving the track, a useless device which soon disappeared into oblivion.

In 1845 the trio launched a company to re-open the Rhoswydol mine (NGR SN 838 975) near the road to Machynlleth. But they also had other designs, which took shape in March 1847 with the promotion of Dyfngwm Lead Mines. The capital was £30,000 in shares of £10 each, on the cost-book principle where cash was raised by a series of ‘calls’ as required. Davies held a 50 year lease dating from September 1845, whilst Hadley acted as purser (*treasurer*) and later the secretary. The mine was now drained by a 40 ft waterwheel, described as ‘quite new’ and it was proposed to sink 50 fathoms deeper, with a cross-cut to the Esgairgaled lode to the north. On site were a house, crushing mill, smithies and carpenter’s shops, rails and trams.

But according to a report by Matthew Francis, problems had already arisen: “no great skill has hitherto been shown in the arrangements... The wheel is in a ravine... (*with*) a line of rods taken along the adit under an iron railroad. A small drawing machine is attached to the rods for drawing (*winding*) the ore... The wheel would have been much better on the dip of the hill where the same stream might have been conveyed, a much more convenient site”. (How the drawing machine was operated from the rods, which reciprocated in order to work the pumps, was not explained – perhaps using a ratchet-wheel device). Finally, he

recommended a new engine (pumping) shaft should be sunk from surface to 100 fathoms below adit. This sound advice was never followed, and instead, investors were told of “a mine of unusual and extraordinary resources... The Esgairgaled lode is a mineral wonder”. They were also informed of a lode found towards Castle Rock in the Clywedog Gorge, where two poor men had raised about 400 tons of ore in only two months before losing the lode in a fault.

At a meeting of the parties held in London early in 1848, the true character of the venture became apparent when of the 3,000 shares, no less than 2,500 fully paid at £10 each were handed over to Davies and friends for the lease, plant and machinery. And having ‘puffed up’ the prospects, shares were now advertised for disposal; to be sold of course, by the promoters. It was the standard trick, with the mine itself little more than the means to an end.

In reality Dyfnngwm appeared to be failing, and attention turned to Castle Rock on the western boundary of the sett where an old adit and shaft with a wheel, pumps and a tramway had been abandoned for years. A disused level on the way to Castle Rock, confusingly called Carvartha Level, was also opened up. Then, in 1850, two powerful waterwheels, a drawing machine and a six-head stamp battery for ore-crushing were installed below the main adit, but by now shareholders were £3,000 out of pocket due to a series of calls. Underground, the ventilation was so bad in places that men could scarcely work.<sup>§</sup> As for the new stamps wheel, it had scarcely turned a revolution before being moved by Captain Hoskins, the manager, to Castle Shaft for pumping. No accounts were presented at the next general meeting in London, where the real picture was being quietly concealed until a Mr. English (no doubt Henry English, founder and editor of *The Mining Journal*), reported upon a recent visit. The shaft was badly situated, being only nine feet from the boundary, no ore was raising, and although the waste-heaps were full of ore it could not be treated because the stamps wheel had been taken away. But by now the management had other irons in the fire, promoting in 1851 with the usual rhetoric two copper mines near Rhayader, Dalrhiw and Nant y Car, both of which turned out a costly failure.<sup>4</sup>

Inexplicably, the company now took an option on ‘East Dyfnngwm Brynmoel’, in a dingle east of Dylife, where for a year or two an adit was driven abortively westwards before being abandoned. (The sett was again taken up in the 1860s as Dylife Consols). Then, in 1852, a reservoir was built above Cafartha to augment the water supply for the wheels, and in the following year a road was made partly through rock over 500 yards long, down to the ore-house near the main adit. Very steep though it was, it enabled the ore to go directly by waggons to Derwenlas instead of being lugged up the mountainside on men’s backs. That such a practice had been tolerated for so long, illustrates once more the quality of management.

But by this time the prospects had brightened. The 42 fathom level had proved so wide and rich that two levels were needed side-by-side for sloping, and the mine’s potential was no longer in question. Captain James Paull, of the very profitable Goginan Mine some seven miles east of Aberystwyth, submitted a lengthy report, and in addition to the main lode, he referred to a south lode which had to some extent been worked, but which hardly showed at surface; the two were expected to unite in depth. He suggested a new shaft, confirming Francis’s advice of years before, but it was never done, and the old system of an underground shaft sunk from the adit, with sundry attendant problems, endured to the end. The mine was

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<sup>§</sup> Collieries were better ventilated, to reduce the risk of explosions.

now down to the 50 fathom level, but in parts of the workings both ore and waste were being raised by merely a hand winch. There was plenty of ore, but the primitive methods strangled production and greatly added to costs. It is clear that Paull realised that only drastic action could put both mine and plant in proper order, for which £3,000 would be needed – a considerable further sum for the hapless investors to find. But such reforms, like the proposed shaft, were never forthcoming.

Troubles arose endlessly. In the adit, the pump-rods dragged slowly to and fro in a slough of rubbish beneath the tramway, and only when the friction became intolerable was the level widened to set them alongside. And in spite of the new reservoir, droughts in summer and frost in winter still rendered water a fickle power at best. In 1856 Davies therefore acquired a steam engine, ‘a novel feature in mining in the district’. This was a twin cylinder horizontal, and drove the pumps through a huge cog-wheel 12 feet diameter. But it was still half-measures, with the winding department able to raise barely five kibbles an hour until a new drawing machine arrived. And the engine, supposed to banish the power problem for good, was very often idle due to the cost or shortage of coal, with the inevitable outcome as to flooding. Over 900 tons of ore had been sold, but there were still no signs of a dividend, although other mines in the district were doing well, at least as regards output. Here are the figures for the second quarter of 1858 :

<b>Mine</b>	<b>Lead ore (tons)</b>	<b>Copper ore (tons)</b>
Llanerchyrour	189	–
Rhoswydol & Bacheiddon	129	–
Dylife	89	44
Dyfngwm	66	6
<b>Value</b>	<b>£ 6,546</b>	<b>£ 435</b>

The glowing reports by Davies continued, with mention in 1861 of a stope displaying large vughs lined with quartz crystals set in solid lead ore. The spectacle was magnificent, but it hardly contributed to profit. As a further encouragement the Esgairgaled lode was again resurrected as a saviour even though it had never been properly tried, but ‘where large quantities of ore are next to a certainty’. The mine was now down to 70 fathoms with a new 55ft waterwheel from John Taylor’s foundry at Mold, and early dividends were once more predicted. However, the crushing mill was repeatedly failing and instead of attending to so vital a matter, efforts again turned to Cafartha but to little or no avail.

Since to chronicle all such events would take more than space allows, we will ignore the next few years, except to mention a novel, unexpected and misguided innovation – the purchase in 1864 of an Aveling & Porter steam traction engine, driven all the way by road from Rochester. At so early a period this caused a great stir in the district, and I may relate its story another day. Interestingly enough, an ancient boiler survives in a North Wales slate quarry, (if it has not been lately removed)<sup>5</sup>, which may well be the remains of this engine.

As for Dyfngwm, matters went from bad to worse. In 1866 it was revealed that the committee held most of the shares, rendering the other investors virtually powerless to intervene. But the carrot of dividends constantly dangled before them could no longer keep a lid on the cauldron of disenchantment. John Young, late of Lloyd’s and once the chairman of the company’s finance committee, publicly challenged Davies under the pen-name ‘Ex-

officio'. "Ignorance, incompetence and wilfulness reign supreme at Dyfngwm", and among his further assertions were:

1. The reservoir, upon which large sums were spent, had been built on Sir W. W. Wynn's land without permission, and was no longer serving its purpose.
2. The steam engine was in a deplorable state, and according to a visiting engineer, the worst he had ever seen.
3. Davies, the manager, lived five miles away on his farm and was frequently absent although a house for his use remained empty on the site, whilst the clerk had to walk from Machynlleth.
4. The ore-dressing was very inefficient and the river dreadfully polluted.
5. The shaft, pumping and winding arrangements were very defective.
6. No plans or sections of the extensive workings existed, an incredible omission which Young had tried hard to rectify, for as he remarked "a ship might as well go to sea without a chart as a mine should be worked without a plan".

In reply, Davies resorted to endless bluster and bombast, during which he admitted to making between £8,000 and £10,000 a year in mining transactions – a very large sum in those days. But the main charges stuck, and early in 1867 he resigned. One of Young's charges was soon confirmed when the Crown Inspector of Fisheries reported that the slime pits were quite inadequate and constantly overflowing, with not a trace of vegetation in the river or upon its banks for four or five miles downstream. Some £110,000 had been spent, much of it derived from ore sales, and Young's assertions were further confirmed after an inspection by John Davis of the Llywernog mine near Ponterwyd when he commented "I really never saw a mine in so bad a plight, disorder remains supreme everywhere..." He mentioned that in spite of various intimations to the contrary, only one lode had ever been worked, although another, cut in a wheelpit and showing ore, had never been tried. He added that the mine had been worked out right up to the boundary with Dylife, but that the potential was still very great, especially towards the west, where the levels had been driven up to some disordered ground but never through it. Further, the bottom or 82 fathom level showed rich ore but the pumps comprising no less than eight separate lifts were so inefficient it could rarely be kept dry. The ladders were dangerous with broken rungs and liable to collapse, and as for the miners, they must have been exhausted after gaining the surface and trudging miles in all weathers after work. Nothing but a complete overhaul could save the venture, the same conclusion as reached by Captain Paull 15 years before; but it was now too late. Following a stormy meeting with no hope of raising funds it was agreed to wind up although ironically, only a few weeks earlier, John Taylor had been anxious to buy a half-share in Dyfngwm for £5,000. John Bright, then the major shareholder in Dylife, had wanted it outright – no doubt with the eminently sensible prospect of working the two together.

In the autumn of 1867 Dyfngwm was advertised for sale, but as there were no takers it then came up for auction. Davies and Hadley had exploited the mine for their own ends from the beginning, and in a final letter, Young stated that the mineral owner had told him that no good would ever come of it whilst remaining in their control. It also became clear that for years Davies had built up a lucrative trade in mining machinery, some acquired at knock-down prices when his various promotions closed. A few years later he emigrated to America to manage a mine in Nevada, though whether with Mrs Davies and their eight little Davieses I

am unable to say. So ended this 20 year tragedy of comic opera, but Dyfngwm still had much potential which had not remained un-noticed.

### **The Stronsberg Interlude 1868-1881**

The next chapter in the story of Dyfngwm is equally intriguing although in a very different way. It is rendered tantalising by the dearth of sources, and because the outcome could have proved a great success. The owners were quoted as George Hadley & Co. until 1873, and then Colonel F.P. Stronsberg of Machynlleth until 1877.<sup>6</sup>

However, it was stated in 1874 that a German (no doubt Stronsberg) who had taken over six years before, had sunk the mine to 110 fathoms and in a very methodical fashion quite at variance to previous methods, had laid out a great deal of ground ready for sloping. But before production began, 'urgent foreign engagements' had suspended the operations. Later, a more sober report by two old miners claimed that only the 90 and 100 fathoms had been driven, and for no great distances although in good ore. The engine shaft had been re-timbered with new winding gear installed, but it was never used.<sup>7</sup> The only known plan of Dyfngwm, dated April 1868, was probably commissioned by Stronsberg,<sup>8</sup> but the apparent overlap when both parties were involved is hard to explain; perhaps merely reflecting an error in the records. The last ore was sold in 1870 and in 1873 all work had ceased; it was said that Stronsberg at one time had refused an offer of £10,000 for the mine. It is a period we should like to know very much more about.

After 1877 the rapid and lasting fall in the price of lead destroyed any real prospects for many years. Edward Davies later returned from America to Dolcaradog, where he now devoted himself to farming and public affairs becoming, *inter alia*, an ardent temperance reformer, a J.P., and a governor of the University College of Wales. His obituary gave glowing testimonials, his past having long been forgotten, or perhaps indeed, excused as merely the actions of a young man on the make.<sup>9</sup> Yet the old rascal was still at heart a rogue, having with undiminished rhetoric attempted to re-start Dyfngwm in 1887. As my father used to say, 'Leopards never change their spots'.

### **Hirnant Minerals 1926-1935**

The final re-opening had its origins not at Dyfngwm, but Dylife, where the enormous waste heaps attracted the attention of a Mr G.F. Wallace. Dumps of this kind have ever presented a strong attraction to those hoping to profit from their mineral residues, but the results are nearly always disappointing due to over-optimistic estimates of recovery and the cost involved.

The venture followed the usual pattern and by 1929 sales of concentrate could not even pay the wages. The crushing and ore-dressing plant were then re-sited at Dyfngwm, (a move which according to Will Richards, took two years), with a view to re-opening the workings. The initiative never quite succeeded; the compressed air pumps were unequal to the task, and only the 42 fathom level was attained – far short of the old bottoms. Even so, Richards has recalled the fatigue in climbing no less than twenty-two ladders to the adit at the end of each shift. Wallace left in 1933, being replaced by a Scotsman named John Mitchell, who however, spoke perfect Welsh. At surface, the plant comprised a 90 hp Petter Diesel driving two air compressors, and at the mill a Blackstone oil engine worked a stone-breaker, crushing rolls, jiggers and shaking tables.<sup>10</sup> From 1931 a handful of men were employed both above ground and below, but it appears that the only ore sold was 74 tons of galena and 8 tons of blende in 1934.<sup>11</sup> Once again the enterprise was under-capitalised, and all work ceased in

May 1935 following the death of the proprietor, John Stevens. Attempts by Mitchell to raise new interest came to nothing and the plant was sold to Thomas Ward the scrap merchants in the following year. So ended the last attempt to conquer Dyfngwm. It failed, but at least it was an honest endeavour.

So much for a brief history of Dyfngwm, a mine with huge potential ruined until too late by inept, greedy and unscrupulous management. How different might the story have been !

*David Bick – 26.06.2004*

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- 1 Rev. J. Evans, *‘Beauties of England and Wales: Vol.XVII Pt.I’*, 1812, pp. 848-849.
  - 2 Ed.Williams papers, D.I. papers, NLW.
  - 3 D.Bick, *‘The Old Metal Mines of Mid-Wales: Pt.4’*.
  - 4 G.W. Hall, *‘Metal Mines of Southern Wales’*, pp. 84-85.
  - 5 [Ref. last N/L, Item 51 – Ed.]
  - 6 Hunts list, Inspectors Reports.
  - 7 Report dated 1908, in possession of G.W. Hall.
  - 8 G.W. Hall
  - 9 *‘Byegones’*, 1908, p. 246.
  - 10 G.W. Hall papers.
  - 11 Mineral Statistics, List of Mines.

**34. The Banc Tynddol gold disc** – Subsequent to the last Newsletter, (Ref. Item 39), it was pointed out, by a keen eyed member Peter Donovan, that the composition of the gold/silver alloy from which the disc was formed did not in fact add up to 100% ! Simon Timberlake explains the missing 1% and much more besides...

‘The actual figures quoted were 93-94% gold, 6-7% silver, and less than 0.1% copper (below minimum detection limits) using a CamScan SEM (Scanning Electron Microscope) plus a Link Isis energy dispersive X-ray spectrometer (EDX). The analysis was carried out at Cardiff by Mary Davis. My references to ‘electrum’ (naturally occurring alloy of gold with very small % silver) are my own interpretation of conclusions we drew that it could have been from a single source, perhaps even cold-worked/annealed from a single piece, i.e. a nugget.

‘Whatever the case, the composition fits with the range for most Beaker/very Early Bronze Age gold from Britain. Interestingly, the disc composition is somewhere in the middle of the typical Au/Ag/Cu range for gold specimens for various mines in Wales, as confirmed by Northover (1995) for the Dolgellau gold belt, the Mawddach, and Dolaucothi area, and by Hartmann (1980) of between 3-15% silver, very low copper (0.01-0.14%), and 85-97% gold. However, this doesn’t at all exclude an Irish source (which typologically the disc ornamentation would favour), or for that matter a Scottish or Cornubian one. The speculation on this will no doubt continue ! There will come the day when we will be able to provenance gold better.’

*Simon Timberlake*

*[Simon is currently preparing a paper with Adam Gwilt and Mary Davis (National Museum of Wales) on the disc and its find context.]*

**35. Flotation** – Further consideration does not incline me [*George Hall*] to alter one word of what I wrote in Newsletter 49, (Item 12), but the comments thereon by Peter Cloughton prompt me to offer another contribution.

My Chambers Dictionary defines 'invent' as 'to devise or contrive; to design for the first time, originate.' Adhering to that, then William Haynes, of Holywell, who patented an extraction process based on the affinity of oil for metal sulphides in 1860, might have claimed to be the inventor of flotation, although he did not develop his idea into a practical process.

Following Haynes, John Tunbridge, of New Jersey, filed two patents, in 1877 and 1879, aimed to save precious metals from jewellers' hands when washing, in which the word 'float' is used. Carrie Everson's patent was granted in 1886. The process described was similar to Haynes', but oil was to be used.

Further patents for the recovery of metallic particles using oil were issued to J.W. Sutton in 1892, and to George Robson and Samuel Crowder in 1894. These two gentlemen were experimenting at Glasdir Mine. The original Elmore patent dates from 1898, and their second from 1901.

The next patent is that of Alcide Froment, of Traversella, Italy, in 1902. This is the first to refer to the use of gas bubbles to lift the mineral particles.

However, what I wish to emphasise is that the Elmore family, faced by the extraction problems at Glasdir, conceived an entirely new mineral extraction process, originally called simply the 'Elmore Process,' or 'Oil Concentration'. They were aware of Robson and Crowder's experiments, but they seem to have made a completely fresh start, inspired by Frank Elmore noticing pyrite adhering to grease marks in the dressing plant.

Having realised the affinity of oil and grease for metal sulphides, but not for rock, and the tendency of oil to float on water, they devised an operating plant to turn these phenomena to account, built it, and got it running satisfactorily. Put simply what they did was to design suitable rotating drums, in which the crushed ore was mixed with water and oil. Water and tailings were then drained off in a 'subsidence vessel,' and the oil, remaining water, and sulphides separated by a type of centrifuge. This sounds fairly straightforward, but it was in fact a very difficult thing to do. None of the previous inventors had been able to turn their ideas into a workable process. The plant was described in detail in the *Transactions of the Institution of Mining and Metallurgy*, Vol. 8, (1900), pp. 379 to 395.

I therefore consider that Peter is wrong to say 'Certainly the Elmores made significant developments at Glasdir, but...' If they did not 'invent' flotation they 'created' it. The original Glasdir plant was a complete, and practical, innovation. It produced a saleable concentrate, with a good recovery, at a reasonable cost. What more could they possibly have done to get full credit? Since then various people, including Americans and Germans, who had nothing whatever to do with the early days of flotation, have claimed to have invented it! I think we should give due honour to our own prophets.

It's true the mine was too small and poor for the Glasdir plant to be a success on site, but that's not relevant. It's also true that in a few years oil flotation was superseded by froth flotation, which the Elmores did not invent. But froth flotation was developed out of the inspiration of oil flotation, and depends, if I understand the physics correctly, on the same principles. It was stumbled upon by chance during the rush of experiments that were carried out at Broken Hill in the early 1900s, when it was realised that a form of oil flotation might be the answer to the extraction problems there, partly to try to improve on it, partly to find a variation that would avoid the Elmores' patents.

In those days no one really knew how flotation worked, experiments were 'trial and error,' and when in 1902 C.V. Potter found that, under the right conditions, sulphide particles would

be carried to the surface of a pulp by bubbles, it was a chance discovery. This, as I understand it, was the first real example of froth flotation, the process that has now been so successfully used for a hundred years. However the Minerals Separation Company, the great promoter of froth flotation in the early days, was founded on the Sulman-Picard-Ballot patents.

Peter also remarks that marginal copper deposits in North Wales would never have provided the incentive to develop the process fully. No doubt, but this was never going to be a limitation. As soon as the Elmore had their novel plant successfully at work they were spreading the news of it, and mines in many parts of the world were sending samples of ore they could not treat to Glasdir for testing. The first three plants commissioned after Glasdir were at Tywarnhaile in Cornwall, Clogau (St. David's Co.), and Sygun, while according to The Mineral Industry (1901 & 02), by the latter date, Elmore plants had been ordered by the Mammoth Mine in Utah, Lake View in Australia, and Le Roi No. 2 in British Columbia, besides a mine in Norway, probably Sulitelma.

Anyone who doubts my views should study not only the description of the original plant in the I.M.M. Transactions of 1900, but the early years of the Mining Magazine. I have drawn heavily on these for my comments, and note especially 'The Debt We Owe to Elmore's' in the November 1916 issue. I have no doubt that Edward Walker knew what he was writing about.

I should add that the Elmore's 'Vacuum' process, a great improvement on their original design, was successfully used at Broken Hill, and elsewhere, for several years.

*G.W. Hall, August 2004.*

**36. 'The Origins of Flotation'** – A final summary to the discussion ? (Ref. N/L 50, Items 40 & 41, N/L 49, Item 12 and N/L 48 Item 16) Chris Stone backs up George Halls' stance with reference to previously published material...

'In his book "The Rush That Never Ended, the History of Australian Mining", Dr. Geoffrey Blainey, one time lecturer at the University of Melbourne, states that the principle of flotation was discovered by Richard Watson, a Welsh bishop and Fellow of the Royal Society, in 1789. He was in the habit of demonstrating this by putting powdered ore into an ale glass, adding water and then nitric acid. The acid caused the pulp to froth, taking the ore particles to the brim in the process. However, he made no efforts to develop any commercial process from his observations.

'In the 1890's, a Melbourne brewer named Charles Vincent Potter experimented on similar lines and on 5th January 1901 took out a patent on his process which was similar to Watson's but he preferred sulphuric acid instead. Shortly afterwards he took out a further three patents on his process and in 1903 erected a plant at Broken Hill Block 14 mine. The mill worked until 1905 and it is said that it recovered 60% of the zinc content but proved too costly to run and was shut down.

'At around the same time, Guillaume Delprat, the General Manager at Broken Hill Proprietary mine was experimenting with differing chemicals for a different process. Purely by accident, he found that if he mixed ore, water, common salt and sodium nitrate together and then boiled the mixture, the gases given off lifted a scum to the top which he found contained the ore particles. He erected a plant and in early 1904 managed to produce concentrates on a large scale.

‘Potter then sued BHP on the grounds of infringement of his patents but lost the case in 1907 when the Supreme Court of Victoria ruled that Potter’s patent was invalid for want of utility. After this, the process became known as the Potter-Delprat Process.

‘In July 1904, yet another brewer, Auguste DeBavay patented a flotation process. This time, oiled particles of ore were dropped straight onto the surface of the water/chemical mixture where they formed a skin, only one particle deep. Naturally, this became known as the Skin or Film Flotation Process. The drawback was that the process required an enormous surface area of water to work efficiently but despite this the DeBavay Treatment Company put in a plant at Broken Hill. It was only partially successful.

‘In 1908, E. J. Horwood, Resident Manager at BHP, experimented with ways to separate the different metal particles by flotation methods. He took the resultant froth from one of the flotation cells and roasted it until the galena content was partially oxidised. He then returned the mixture to a flotation tank and found that this time the galena stayed on the bottom of the tank, whilst the zinc content floated. He had invented a selective flotation process.

‘Dr. Blainey does give the Elmores some credit. However, he states that the Elmore Bulk-Oil Process was not a true flotation process, which, I suppose, is correct ! *[I assume Dr. Blainey was referring to the use of bubbles/froth ? – Ed.]*

‘Peter R Jenkins, in his extremely detailed book ‘The Elmore Mystery’ gives details of the Elmores’ discovery of oil flotation along with what must be the entire history of the Elmores and the companies they controlled. In fact, it was not Elmore that first noticed the affinity of certain sulphide ores for oil but the manager at Glasdir, one George Robson and the discovery took place in 1893 before the Elmores became involved with that mine. Robson developed his process somewhat and patented a machine in 1894 but found that the running costs exceeded the value of the concentrate and with the Mawddach Copper Company’s finances in a parlous state, his experiments were stopped and the mine sold up.

‘However, Elmore later further refined Robson’s ideas after they took an interest at Glasdir in 1896. In 1897 they began tests on Glasdir ore and in October 1898 took out a patent on their process which they admitted at a meeting of the Institution of Mining and Metallurgy in 1901, involved a process discovered by George Robson and further said that they accepted that the use of oil in concentrating ores was not novel. It was their machinery and associated process that was novel.

‘The rest of the oil flotation process is well known, suffice to say that the Elmores ‘perfected’ their oil flotation processes over the next few years by certain additional processes including heating, the addition of certain acids, agitation and operating the system under vacuum conditions.

‘So, from the above we can see that the discovery of the ‘Flotation Process’ took place virtually simultaneously in Australia and in Wales, but the processes were dissimilar. The Elmore process was undoubtedly the first on the scene but they used oil and water to concentrate the ores whereas the Australians used acids and water from the outset. Elmore’s early experiments used agitation to mix the oil, water and ore whereas the Australians bubbled gases in from the start.

‘To give credit to all those concerned in these early experiments, I would say that the OIL Flotation process was first invented in Wales whilst the FROTH flotation process was invented in Australia but, to be absolutely pedantic, the first patent for a flotation machine of any type was taken out by George Robson in 1894, so, if you just want to call it the FLOTATION process without qualifying the type of flotation, then Wales has it !

'Does that answer the question ? Or does that just confuse things further ?'

*Chris Stone*

**37. Expensive Driving** – We are all accustomed to the system of tutwork, driving levels at so much per fm. In mid-Wales this would usually be £4 or £5, occasionally less, in some areas a good deal more. The other day I came across what must surely be the highest price ever. Robert Hunt, in giving evidence to the 'Kinnaird Commission' in 1862, said he understood that three guineas (£3.15) an inch had been paid in driving a level to ventilate the Hot Lode in the United Mines. This was 230 fms. below adit, in extremely humid conditions, with a temperature of about 115°F [46°C], where the men were only able to work four 20 minute stretches in an eight-hour shift.

*G.W. Hall*

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## Book Reviews & Bibliographical References to Welsh Mines & Mining

### Due for Publication

**38. 'Rhiwbach Slate Quarry'**, by Griff R. Jones. This book is expected early 2005 but no further details at present. Griff has been working on this for sometime and it will be a most welcome addition to the bookshelves. Expected to be of similar size to his much acclaimed 'Hafodlas Slate Quarry' book.

### Currently Available

**39. 'The North Wales Quarry Hospitals and the Health Welfare of Quarrymen'**, by Edward Davies (Gwynedd Archive Service) ISBN 0-901337-83-8. This book, written by a medical doctor who grew up in Blaenau, redresses the balance. Mervyn Jones book, 'The North Wales Quarrymen 1874-1922' and others have generally given the doctors of the quarry hospitals a bad press. I have not seen the book at the time of writing but I have read a very complimentary review by Dr. David Gwyn.

**40. 'Quarries of the Gwyrfai Valley'**, by Alun John Richards and Gwynfor Pierce Jones (Gwasg Carreg Gwalch) over 300 pages in A5 size Price £9.95. The book covers the Welsh Highland Railway and the quarries along the route including Glanrafon, Rhos, Clogwyn and Ffridd. The book has only just been released as I write but Gwynfor tells me it is excellent !

### Book Reviews

**41. 'Aberllefenni Slate Quarry – The end of an Era'**, by Ray Gunn (An Efel Production) A4 with many monochrome photographs, computer printed (on good quality paper) & comb bound with 38pp. Available direct from Efel Publications, Yr Efail, Ceinws, Machynlleth, Powys, SY20 9EX. Please make cheques payable to Ray Gunn for £8.00 including post and packing.

Hearing that the quarry was due to cease production, Ray decided to make a record of the last days, featuring the workforce, the surface remains and the underground workings – including one of the last pieces of slate extracted. The book provides an invaluable record of the last days of the last working quarry in the Dulas Valley.

*John A. Knight – Above four items*

**42. 'Waller's Description of the Mines in Cardiganshire'**, by David Bick. Published by Black Dwarf Lightmoor, ISBN 1 903599 11 3. A4, landscape format, 64 pages including an

introduction, references, bibliography with 46 additional plates and figures in colour, sepia or monochrome. £10.00 post free from the Pound House.

With over 50 years of research under his helmet, David has once again done sterling work in preparing this facsimile and analytical commentary which collates the life and times of William Waller with his best known work, reprinted on its tercentenary. The volume was still at the discussion stage during the spring and to have carried the project through to fruition in a matter of eight months is quite a remarkable achievement.

The debacle of the Company of Mine Adventurers was a huge fraud with Sir Humphrey Mackworth of Neath at its helm, for him to later pretend that he was taken in by Waller is an absolute nonsense. Mackworth was a very sharp lawyer and I have long suspected that he was a particularly nasty piece of work and a maestro at cooking the books. His pedigree further elevated him to a very superior, almost untouchable position.

It is therefore most gratifying to see that many of the allegations laid against Waller are demonstrated to have originated from Sir Humphrey Mackworth as a smokescreen to cover his own personal failings. Further armed with the knowledge that Waller and Mackworth were distant cousins, their chance meeting at Llanbadarn now seems to be another concoction. I have long sympathised with Waller's dilemma of having an aggressive master and very little ore in sight, this account does much to redeem him.

Having studied this period of industrial development in Cardiganshire for many years, this volume sifts through the many contemporary accounts and presents the clearest and most concise description, beautifully written in David's inimitable style.

The landscape format is ideal and allows the commentary to be placed alongside the facsimile. The typeface is particularly clear but rather small for my poor old eyes, this does not detract from the overall presentation as, on balance, it allows a lengthier text and I am quite happy to use a lens.

Black Dwarf Lightmoor are also to be congratulated on the excellent print quality and full colour presentation of what is essentially difficult and aged material. A most professional job with no errors or transposed captions. The thermographic binding is adequate and shows no early signs of shedding pages.

For nearly 40 years I have used a bound photocopy of the original 'Description', during that time I have been offered two copies of original volumes but with a price tag of £1,000 I simply could not justify this expense for such a thin volume. I am certain that this new offering will do nothing to dent the second hand book trade but gives us all the opportunity to acquire a good facsimile at a realistic price.

**43. 'Aspects of Welsh Slate',** by "Pip" (Phyllis) Knight-Jones. Published in Llanrwst by Gwasg Carreg Gwalch, July 2004. ISBN 0 86381 882 X. 80 pages, A5 landscape format. £6.95. A delightful little volume of her own images interwoven with authoritative text contributed by numerous authorities on the Welsh Slate Industry. I found it very difficult to find any faults with this compact volume and suspect that I will be enticed to view and/or purchase some of these stunning landscapes/quarryscapes at her next exhibition. Everyone, who has seen the book has commented most favourably upon it and it will undoubtedly sell well, not only to the mining history enthusiast but also to the tourist and casual browser simply because it is a nice book at a nice price. I can only dream that she might consider a volume on the metal mines in due course.

*Simon J.S.Hughes – above two reviews*

**Bibliographical References to Mining in Wales**

44. **‘Below’** – Quarterly Journal of the Shropshire Caving & Mining Club, No. 2004.1  
 p.3-4 ‘Cwmystwyth Christmas Trip Report’, Ian Cooper.  
 p.13 ‘Boxing Day at Glyn Ceriog’, Ian Cooper. Visit to Cambrian Quarry, SJ 189 378.
45. **‘Below’** – No. 2004.2  
 p.10 ‘Roof Collapse in Level Fawr, Cwmystwyth’, Kelvin Lake.  
 p.17 ‘Dorothea Death toll rises, 20<sup>th</sup>-21<sup>st</sup> March 2004’ The flooded quarry claimed its 21<sup>st</sup> life in ten years. [*It was likely safer to work in it ! – Ed.*] ‘Dorothea Quarry Up for Sale’ – A cool £1.35 million.
46. **‘Below’** – No. 2004.3  
 p.1 ‘RoofFall (*sic.*) – Level Fawr’  
 p.3-4 ‘West Brecon Cave Rescue Practice, 19<sup>th</sup> June 2004’, Ian Cooper. Carried out in underground at Cwmystwyth.
47. **‘Below’** – No. 2004.4  
 p.1 ‘Quicker by Tube’, visit to Cwmystwyth to ‘check out’ work completed by members of the WMS & WMPT to ensure access through Level Fawr remains following the collapse during 2004.
48. **‘Journal No. 9’**, Shropshire Caving & Mining Club, 2004  
 p.47-52 ‘Some Artefacts in Level Fawr, Cwmystwyth Lead Mine’, Kelvin Lake. Includes photographs and dimensioned drawings of the Haulage Skip Wagon & End Tipping truck.
49. **Info ‘On-Line’** – An ever-increasing amount of ‘quality’ information can be found on-line, particularly as the institutions make not only the indexes to their archives available, but also some of their material too.  
 Check out the following : (*Dozens & dozens more on the WMS ‘Links’ pages !*)  
 ‘COFLEIN’ – The on-line database for the National Monuments Record of Wales.  
**[www.rcahmw.gov.uk/coflein.shtml](http://www.rcahmw.gov.uk/coflein.shtml)**  
 The Welsh Mines Preservation Trust now have their very own web-site, (*created by yours truly of course !*) – go to **[www.Welshmines.org](http://www.Welshmines.org)** and click on the link.  
 GENUKI – Huge source of info and links, including articles transcribed from NLW Journals, e.g. *The Mines of Llywernog & The Old Slate Industry of Pembrokeshire...*  
 Go to **[www.geniuk.org.uk/big/wal/NLWjournals.html](http://www.geniuk.org.uk/big/wal/NLWjournals.html)**

**Miscellaneous****50. For Sale : Old Mining Journals & Colliery Guardian** – David Bick says :

‘I offered six Mining Journals of 1870 for sale [*at the September 2004 meet – Ed.*] at a price of £30 each as suggested by members – 2/3rds of receipts to be donated between the Welsh Mining Society and the Welsh Mines Preservation Trust, 1/3rd to myself. Copies, now rare collectors’ items, were quickly snapped up. NOTE: A few more remain if anyone is interested.

‘Copies of the Colliery Guardian are rarer than hen’s teeth, but I have a bound volume for July-December 1896 to sell for £80. It runs to over 1,200 pages and is in pristine condition apart from a detached front board. Full of illustrations and enough reading to keep you busy for years.’

**‘Tailings’**

**WMS e-mail Discussion Group** – This is for the *exclusive* use of **WMS** members, mainly for the communication of WMS matters outside of the Newsletter. Visit **www.welshmines.org** for details on how to join.

**Acknowledgements** – Many thanks to all those who have provided me with contributions and feedback for the newsletter. Note that all items are credited to the contributor, unless submitted by your editor or his dog !

All contributions welcome – see note (below) about format. Absolutely ‘any’ field reports/notes, or news item from the local paper, T.V., radio or ‘heard down the pub’ are sought. Without these the Newsletter would cease to exist, so please don’t stop sending them in !

*Mike Munro & Bronwen Dog* 🐾

**Welsh Mines Society Membership :**

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**[www.british-caving.org.uk/bca/insurance/insurance.htm](http://www.british-caving.org.uk/bca/insurance/insurance.htm)**

**Copydate** for the *Spring 2005 Newsletter* : **15<sup>th</sup> March 2005**, publication due April-May. (Please be prompt – the sooner I get the material, the sooner I can ‘go to press’ !) Articles, preferably typewritten, and ideally in electronic form, (MS Word 97 or Plain Text format) should be sent (on a 3.5" disk) to Mike Munro (address on front page) or by e-mail to **editor@welshmines.org**

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