

JOURNAL OF THE



2018



Hello Readers,

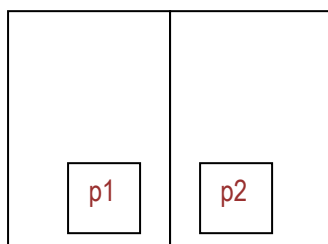
Welcome to the Great Orme Exploration Society Journal 2018. In this edition you will find numerous articles providing a fresh insight into the history of the Great Orme. There are remarkable images of a lost entrance, the story of a local rock collector and mineral specimens from the Orme kept at the National Museum of Wales in Cardiff, together with an engaging account of a secretive world, that of radar during World War Two. We evaluate the meeting of Welsh and Irish ice flows around the Great Orme, bring the Penmorfa Chronicles up to date and reveal a major new project for Romans. In addition to all this we take a look back at the 2017 Summer Walks and reveal the itinerary for 2018.

I hope everyone will enjoy reading it.

As always, a great deal of thanks to all contributors.

Regards

Dave Wrennall – GOES Journal Editor 2018



PRINTING the JOURNAL

With inkjet printers use at least 90gsm paper (200gsm for the front cover). In order to optimise page sequencing page 1 should be placed on the back of the front cover with page 2 opposite on the next sheet of paper.

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Front Cover: Llandudno Pier at low tide

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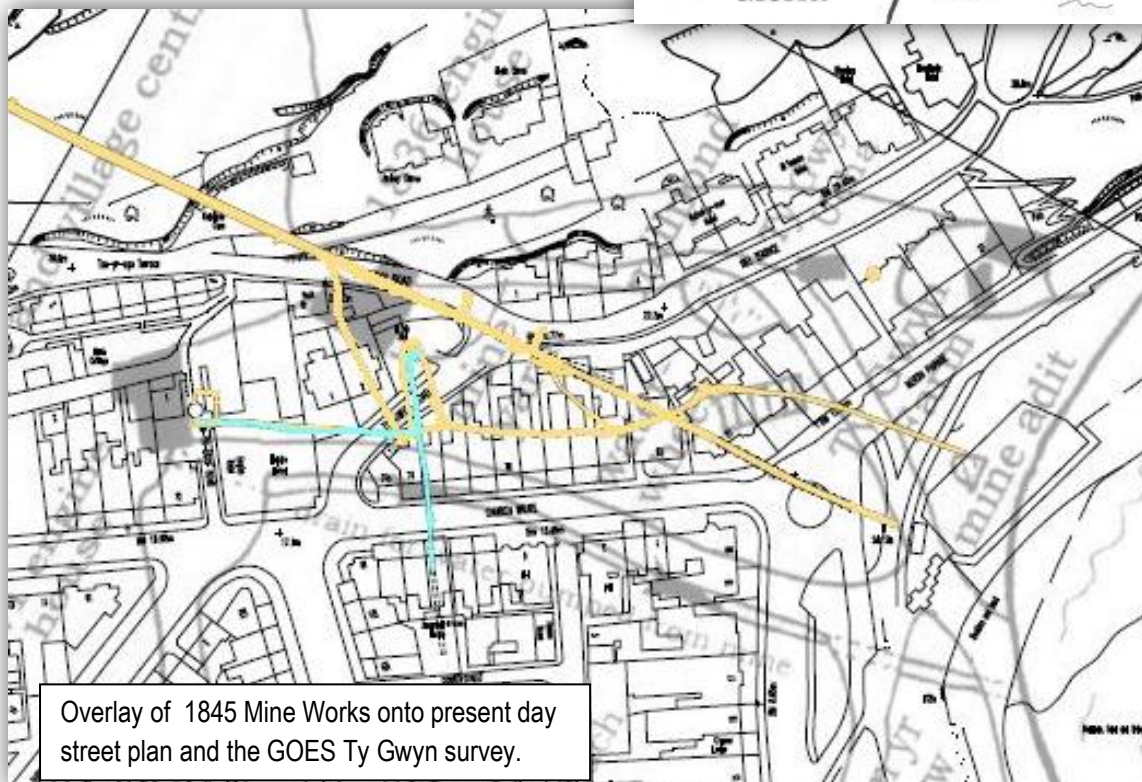
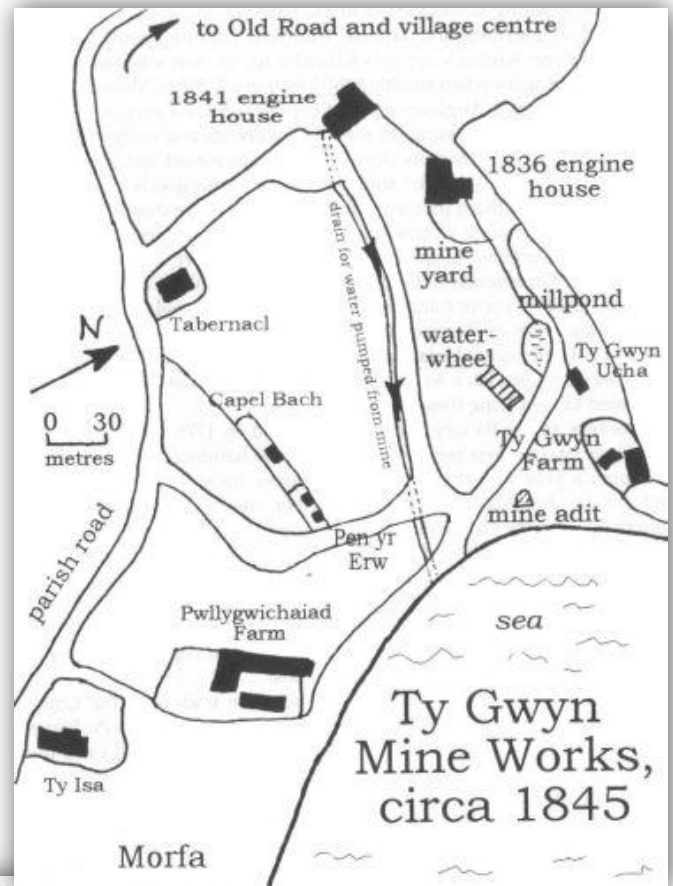
Ty Gwyn Mine

Stepping Back into the Past with some Old Images

There have been several interesting images recently found of the Ty Gwyn Mine which most of us has not seen before, the first has been unearthed by Dave Flowers. The sketch is a plan of the area around Ty Gwyn Mine in 1845. It has been scaled and rotated as an underlay to our survey plan by using some key points like Tabernacle Welsh Baptist Church on Tudno Street.

The mine adit shown appears to be the coffin level which we consider to be the original entrance. Note drainage from the Simms Engine pumping shaft flowing onto the beach.

The next picture is a water colour dated 1852 by R Green. The main Ty Gwyn adit was constructed in the mid 1840's so should be in the face of





1852 water colour by R Green with kind permission of Conwy Archive Service

the broken bank. The enlargement below highlights the central horseshoe shaped feature, a possible entrance. To the left could be some walling, and left again an incut into the banking, both potentially linked to the mine. There appears to be a watercourse flowing from the corner of Ty Gwyn Farm and pouring onto the beach in the foreground, just left of some figures. Next to the building the water might be flowing across the path in a launder (half pipe made of wood). Two more figures sit alongside it, behind them could be a series of buddles for washing ore. (or boat(s) and buddle(s)?).

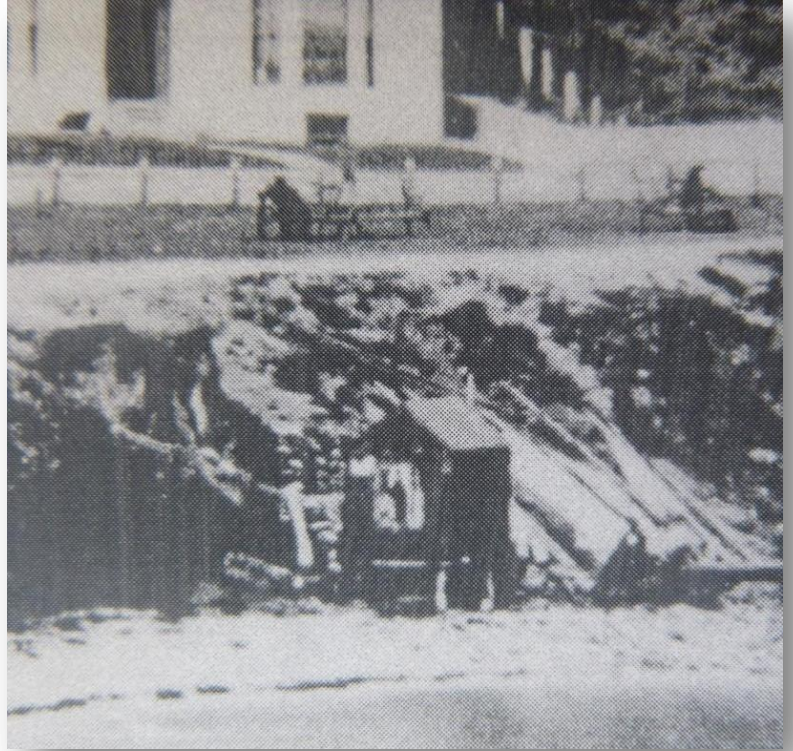


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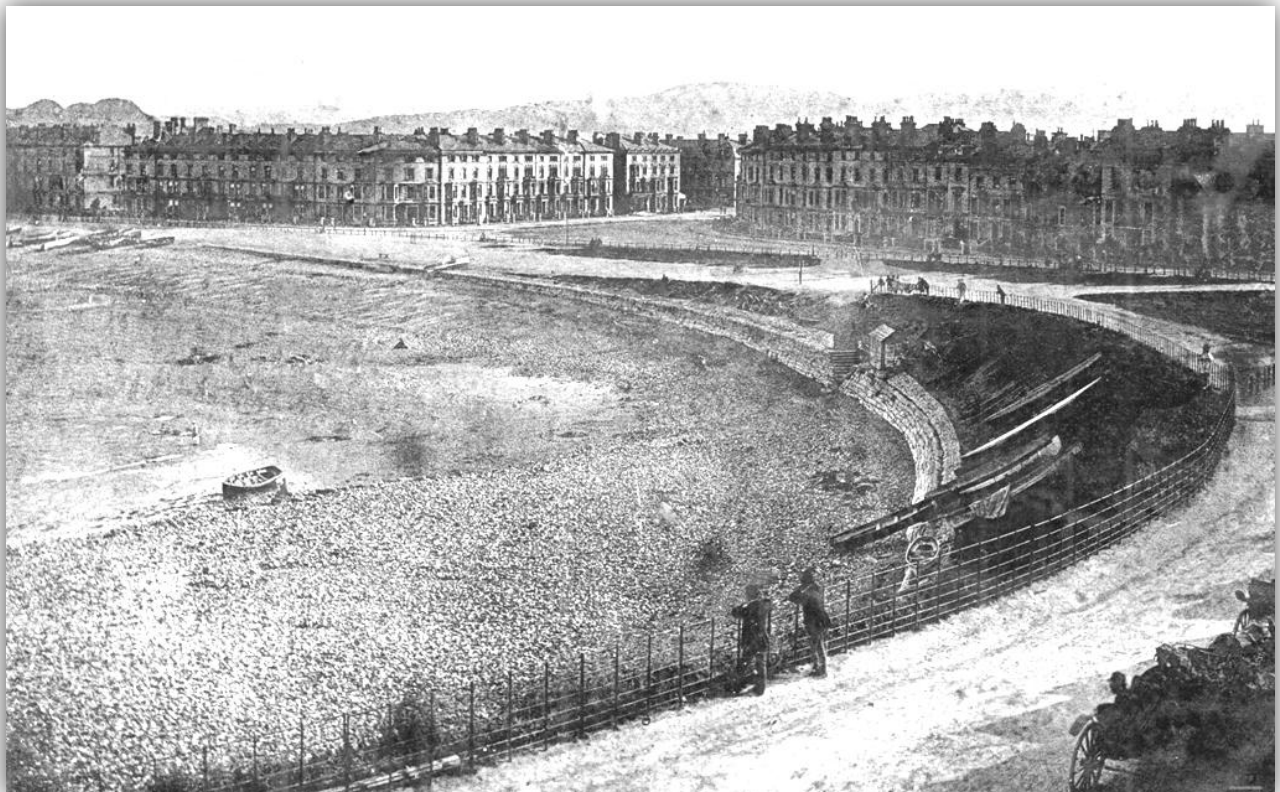
This next picture is an enlarged section from an 1857 Roger Fenton photograph. It was previously printed in the 2003 Journal Issue No2 by Phil Barratt who had obtained a copy of the entire photograph courtesy of the Conwy Archive Service.

The Ty Gwyn adit can be seen left of the building. In his article Phil wondered if this was the only picture of the adit.

We now know there are at least two others as a detailed look at the following two images will reveal. These are very early pictures of the promenade taken after the construction of Osborne House in 1851 and prior to the completion of the pier extension in front of the Grand Hotel in 1884. The first immediately below, from the Francis Frith Collection is labelled circa 1870, the second on the next page seems slightly later.



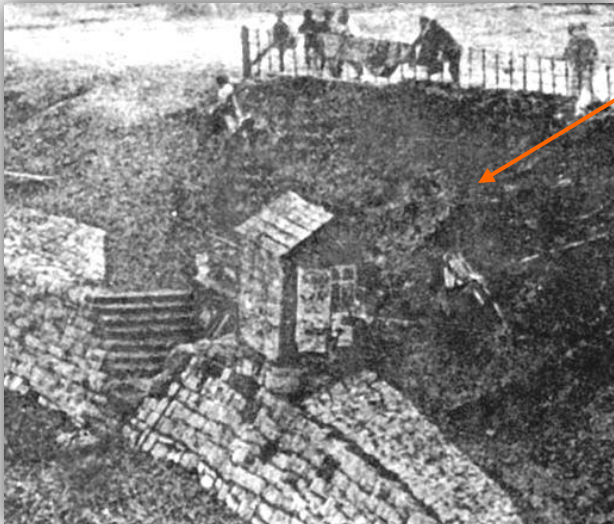
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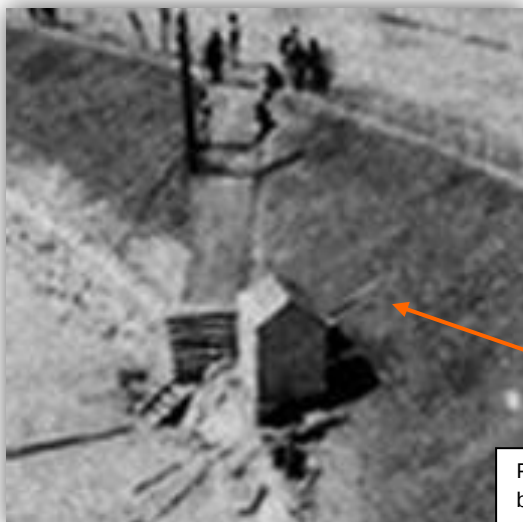
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An enlargement of the first picture shows steps down to a building which has a window facing the observer. Alongside a small fence protects the drop prior to a final set of steps onto the beach. Behind the building is classic ginged adit portal set back into the slope with plenty of headroom. All the banking up to the promenade fence appears quite rough and the area is clearly well used to store small boats.



Photograph may be under copyright

Enlarging a similar section from the second picture we find the adit entrance set into a regular landscaped slope. The opening looks neater perhaps less functional. Steps to the building have been replaced by an inclined path. There is no boat storage. It was clearly taken some time after the first photograph but still before 1884.



In the more recent second photograph a close look at the beach in front of the building reveals several figures sat on a linear feature. It is undoubtedly a wheeled jetty such as appear centre stage on the next photograph, a useful piece of equipment for loading and unloading boats on a gradually sloping beach subject to tidal variations. A bonus for both tourists and locals alike.



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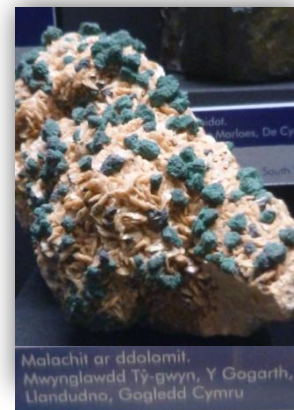
'Copyright The Francis Frith Collection – www.francisfrith.com'.

This final picture is dated 1895, after the construction of the pier walkway in 1884. By comparing it with earlier images the location of the now hidden Ty Gwyn adit to be deduced.

**Authors: Stephen J Lea
and Dave Wrennall**

Dr Harwood of Deganwy

Many years ago whilst visiting the National Museum of Wales in Cardiff I was surprised to see a mineral specimen labelled as coming from the Ty Gwyn in Llandudno. The productive life of the Ty Gwyn Mine was 1835 -53. The rock must have been collected at about this time, as subsequently, the mineralized workings became completely flooded. (The battle with sea water constantly entering the mine was the main reason for its closure). After making enquires it was discovered that many more Great Orme mineral specimens existed at NMW. The following is an account of one eminent collector who acquired many Orme rocks and in his later life lived in Deganwy.



Still on display in museum
cf Rocks in NMW article: No 18

Scientist....

Henry Francis Harwood was born in North Lancashire in 1886. He studied at the University of Manchester receiving a 1st class BSc Honours degree in Chemistry and a Masters in Geology, before obtaining a PhD in Mineralogy at Heidelberg in Germany.

In 1911 he was appointed as a demonstrator in chemistry at Imperial College London. His entire career would be spent there, apart from a period during World War One when he carried out work for the War Office (part of which involved providing estimates of the world wide occurrence and economic potential of the tin mineral cassiterite - tin oxide). He became a lecturer (1920) and a regular contributor to articles. As well as continuing the universities emphasis on analytical chemistry in the Undergraduate laboratory course (inorganic) he developed a post graduate course in Rock Analysis and lectured final year students in the History of Chemistry. By 1929 he was in charge of the Advanced Inorganic Laboratory and in 1933 was promoted to Assistant Professor and reader in Analytical Chemistry.

Dr Harwood was an 'Ordinary Member' of The Mineralogical Society (elected 1917) as well as a Fellow of The Royal Society of Chemistry and The Geological Society. In 1940 an early retirement aged 54 was been put down to 'health reasons'. He moved to his father's house Erlesdene in Gannock Park Deganwy, possibly as temporary measure before returning to his Lancastrian hills and dales, though he never did. He died 14th October 1974 aged 88.





Deganwy and Conwy Estuary from high on the Vadre

Much of what is known of Dr Harwood's life in Deganwy comes from the recollections of his friend and fellow collector the late Dr Robert (Bob) King. He describes Harwood's personality as reflecting his scientific mind, not too easy to get on with, having little sympathy for fools and being extremely punctual. His bachelor household had chiming clocks in every room. However he was also a very caring and modest man, He loved his ponies which he kept at a local farm and he would encourage his visitors to ride them.

Collector....

The exact period Dr Harwood started collecting rocks isn't known but it is likely to be the early 1900's. On his death there were 11,000 specimens. Dr King suggests his collecting was more incremental rather than purposeful. As well as finding his own specimens he would obtain them through exchange with other collectors or by donation. So far as Dr King was aware he never brought them. Forming friendships with various mine captains was also important, with specimens being set aside for him.

Dr Harwood was justifiably proud of his collection (particularly his sulphide and sulphosalt specimens) and was well aware of its significance, especially as many of the sites no longer existed. During his retirement his collection was kept both at Erlesdene and in storage with a company in Llandudno. Within the house mineral cabinets were positioned in prominent places with extra large specimens sitting on top of them. Outsize specimens were kept separately. Much of the collection was stored in wooden drawers and kept strictly in chemical groups. Although he would enjoy looking at aesthetically pleasing rocks their academic value was paramount. Nothing was ever taken out.



It might be assumed that the collection was well documented however this was not the case. Although specimens were all labelled, records regarding acquisition and analysis were not always kept and there was no overall register. In addition some meta-stability issues, when specimens might be unstable and start to decay in the wrong (or even the right) environmental conditions, were ignored, all to the frustration of Dr King. Dr Harwood seemed to consider such record keeping a waste of time, maintaining that if you couldn't

remember what had been said about individual specimens it clearly didn't mean that much to you. Besides, he always intended to bequeath his collection to a museum where a professional curator would take care of such details.

Every year Dr King spent a week at Erlesdene, talking mineralogy till midnight. He went with many questions and learnt a great deal. The fact that in 1974 Dr Harwood left half his collection to Dr King, who had first choice of the specimens, testifies to the value he placed on their friendship, the rest being divided between the Geology Department at the University of Manchester and Manchester Museum.

After his death a large collection of coins was found by Dr Harwood's executors, something which was a surprise to everyone, even Dr King.

In 1983 Dr King's mineral collection was acquired by the National Museum of Wales. It contained approximately 4,000 Harwood specimens.

Bibliography: A study of Dr. Henry Francis Harwood and the Harwood Mineral Collection (An unpublished essay by Hannah-Lee Chalk: submitted for distance learning module 2: MSc Museum Studies, University of Leicester) - which contains the recollections of the late Dr Robert King.

Acknowledgements: I am indebted to Dr Hannah-Lee Chalk Learning Manager at Manchester Museum the University of Manchester for the use and adaption of her work. I am also grateful to the National Museum of Wales Cardiff for the use of several photographs and to Tom Cotterell Senior Curator of Mineralogy for his assistance.

Addendum:

Most of Harwood's specimens are labelled no more specifically than Great Orme, or Great Orme's Head.

The majority of the specimens labelled as from Ty Gwyn Mine seem to have been collected personally by Bob King who probably used it as a generic term for a Great Orme mine. They may have been collected from spoil tips further up the hill?

Of interest is rock specimen No 25 (NMW 83.41G.M.4846) labelled 'New Mine' and 'Lorreto'. Possibly some connection with the Loreto Convent / Centre and Penmorfa?

It is possible that additional research, looking through Dr King's notebooks kept by the British Geological Survey at Keyworth, Nottingham, might shed further light on where certain rock specimens were actually collected.



Some Harwood labels held at NMW
©NMW

Author: Dave Wrennall

GREAT ORME MINERAL SPECIMENS IN THE NATIONAL MUSEUM OF WALES, CARDIFF

The museum has quite a large number of mineral specimens from the Great Orme acquired from various sources although the most aesthetic specimens came via Dr King and Dr Harwood. Some of the earliest specimens are from the G.J. Williams collection. Griffith John Williams was originally a teacher in Blaenau Ffestiniog (c1880's) later moving to Bangor. He became assistant Mine Inspector for North Wales and Ireland in the early 20th century. His mineral and fossil collections were purchased by NMW in 1927 although some of his specimens found their way into other collections in North Wales.

As a general rule the malachite specimens in the NMW collection will have come from the very upper (near surface workings) which relate to the Bronze Age mines rather than the lower, flooded, levels.

The museum's numbering system might look quite complicated, but it provides key information pertinent to each specimen and crucially provides a unique code number for every specimen. The prefix of NMW (for National Museum of Wales) is always present and if we take the example of NMW 27.111.GR.116 : 27 = the year (in this case 1927) with those specimens acquired during the 21st century having a full four digit year number.; the second number, in this case 111, represents the 111th accession (group) during that year; G = Geology; R = Rocks, or after the 1970s there was the introduction of M for Minerals; the final number, 116 = the number of that specimen within that particular 111th group of objects.

An asterisk in the 'locality list' usually just means that NMW has no confirmed grid reference for the locality. The use of 'C' in the context of the G.J. Williams collection refers to 'Caernarvonshire'. Williams' own label and numbering system.
(Abridged from correspondence with Tom Cotterell: NMW)

1 NMW 27.111.GR.116

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C92** calcite

Notes : Very irregular aggregate of obtuse rhombohedra.

Great Ormes Head , Llandudno , Caernarvonshire

2 NMW 27.111.GR.125

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C133** calcite

Notes : with inclusions of malachite. ; malachite

Great Ormes Head , Llandudno , Caernarvonshire

3 NMW 27.111.GR.275

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C174** asphaltum

Notes : noted by G.J. Williams as 'bitumen' ; malachite ; calcite

Great Ormes Head , Llandudno , Caernarvonshire

4 NMW 27.111.GR.304

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C158** aragonite

Notes : NMW X50 (XRD identification No re: analysis of the specimen)

Great Ormes Head , Llandudno , Caernarvonshire

NB: The Editor has added the initial numbers 1 to 46 to simplify identification.



5 NMW 27.111.GR.441

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C93** quartz var. chalcedony sub var. beekite

Great Ormes Head , Llandudno , Caernarvonshire

6 NMW 27.111.GR.453

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C164** malachite ; limonite ; chalcopryite ;
dolomite ; limestone

Old Great Orme Mine Heap , Great Ormes Head , Llandudno

Geological dating : Geological dating :

CARBONIFEROUS

Carboniferous Limestone Supergroup

7 NMW 27.111.GR.454

Other number :

Previous Collection (name): **G.J. Williams**

Previous Collection No. **C46** malachite

Notes : mamillated ; dolomite ; limestone, Carboniferous

Great Ormes Head , Llandudno , Caernarvonshire

Geological dating : Geological dating :

CARBONIFEROUS

Carboniferous Limestone Supergroup

8 NMW 27.111.GR.523

Other number :

Previous Collection (name): **G.J. Williams** malachite ; calcite ;
limestone

Great Ormes Head , Llandudno , Caernarvonshire

Geological dating : Geological dating :

CARBONIFEROUS

Carboniferous Limestone Supergroup

9 NMW 77.35G.M.47 (*On display in Museum: cf end of article Ed*)

Other number :

Exhibition No. Diversity 1646 chalcopryite

Notes : Isotopic analysis: 208Pb/206Pb 1.90346, 207Pb/206Pb

0.77129, 06Pb/04Pb20.325. Rohl (1995) ; calcite ; limestone,

dolomitic

Great Ormes Head (Copper) Mine*, Great Ormes Head , Llandudno

10 NMW 77.36G.M.16 azurite ; dolomite

Great Ormes Head , Llandudno , Caernarvonshire

11 NMW 78.33G.M.112

Other number :

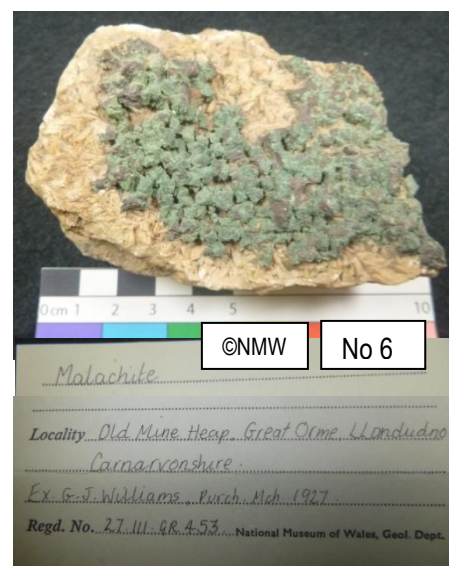
Previous Collection No. 210 azurite

Notes : Small bladed azurite crystals in clusters with malachite on
goethite (altered chalcopryite) on dolomite - TFC 02/03/2005. ;

malachite ; dolomite ; goethite

Notes : Dark brown alteration product of chalcopryite

Great Ormes Head , Llandudno , Caernarvonshire



Notes : Great Orme, Llandudno, Denbyshire, (sic) N. Wales.

12 NMW 78.33G.M.113 azurite

Notes : and malachite coating altered chalcopryite crystals in dolomite with calcite crystals also present. ; malachite ; dolomite ; calcite

Notes : Large crystals

Great Ormes Head , Llandudno , Caernarvonshire

Coordinates :

Grid Reference [NGR] 770 831 (Possibly GOCM? Ed)

13 NMW 83.41G.M.429

Other number :

Previous Collection No. **R.J.King** 994/1952 chalcopryite

Notes : on dolomite ; dolomite

Ty-Gwyn Mine , Great Ormes Head , Llandudno

14 NMW 83.41G.M.442

Other number :

Previous Collection No. **R.J.King** 1823

Exhibition No. EOW no. 644 chalcopryite ;

limestone, dolomitic ; anthracite

Great Ormes Head , Llandudno,

Caernarvonshire

15 NMW 83.41G.M.1489

Other number :

Previous Collection No. **R.J.King** 4554

Previous Collection No. **H.F.Harwood**

2881 siegenite

Notes : Octahedral crystals to 4 mm on edge in massive sulphide matrix.

previously I.D. as linnaeite. Analysed by microprobe by Dr R. Ixer

[Univeristy of Birmingham], Sept.'1994. ; linnaeite

Great Ormes Head , Llandudno ,

Caernarvonshire

Notes : found on the burrows

16 NMW 83.41G.M.3939

Other number :

Previous Collection No. **R.J.King** 5062

Previous Collection No. **H.F.Harwood** 3435 goethite

Notes : pseudomorphous after cuprite ; cuprite

Great Ormes Head , Llandudno , Caernarvonshire

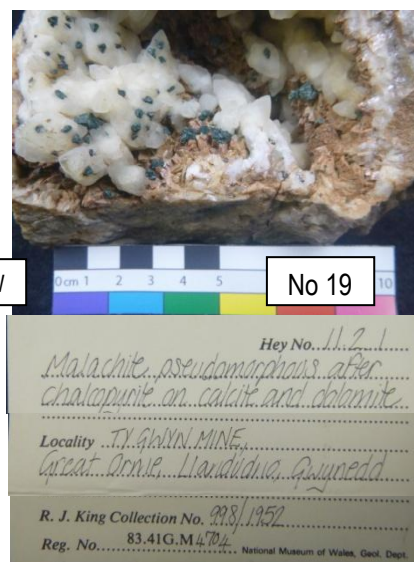
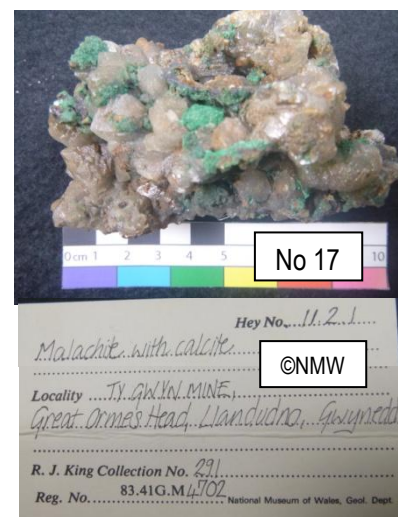
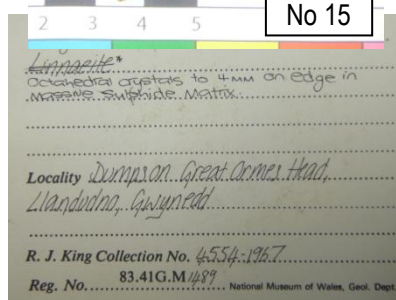
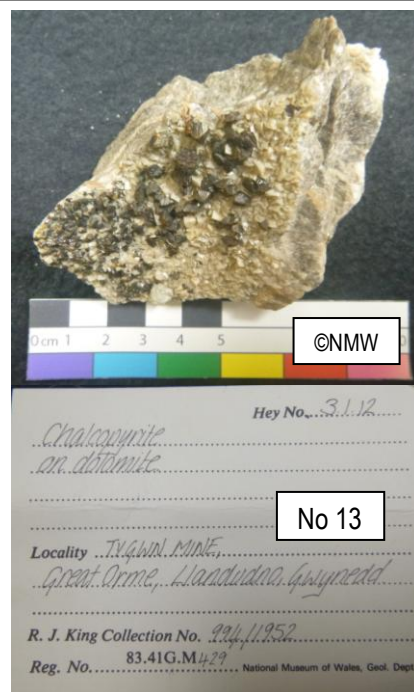
Notes : Dumps on Great Ormes Head

17 NMW 83.41G.M.4702

Other number :

Previous Collection No. **R.J.King** 291 malachite ; calcite

Ty-Gwyn Mine , Great Ormes Head , Llandudno



18 NMW 83.41G.M.4703 (On display in Museum of Dr Harwood Article Ed)

Other number :

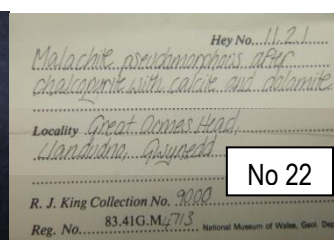
Previous Collection No. **R.J.King** 319

Exhibition No. Diversity 275 malachite ; chalcopryite ; limestone, dolomitic

Ty-Gwyn Mine , Great Ormes Head , Llandudno



©NMW



No 22

19 NMW 83.41G.M.4704

Other number :

Previous Collection No. **R.J.King** 998/1952 malachite

Notes : pseudomorphs after chalcopryite ; calcite ; dolomite

Ty-Gwyn Mine , Great Ormes Head , Llandudno

20 NMW 83.41G.M.4709

Other number :

Previous Collection No. **R.J.King** 1001/1952 malachite

Great Ormes Head , Llandudno , Caernarvonshire

21 NMW 83.41G.M.4711

Other number :

Previous Collection No. **R.J.King** 5155

Previous Collection No. **H.F.Harwood** 3537

malachite

Great Ormes Head , Llandudno , Caernarvonshire

22 NMW 83.41G.M.4713

Other number :

Previous Collection No. **R.J.King** 9000

Previous Collection No. **H.F.Harwood** 3538 malachite ; dolomite

Great Ormes Head (Copper) Mine*, Great Ormes Head , Llandudno

23 NMW 83.41G.M.4773

Other number :

Previous Collection No. **R.J.King** 895/1936

azurite ; malachite

Ty-Gwyn Mine , Great Ormes Head , Llandudno

24 NMW 83.41G.M.4775

Other number :

Previous Collection No. **R.J.King** 1080/1952

azurite

Ty-Gwyn Mine , Great Ormes Head , Llandudno

25 NMW 83.41G.M.4846

Other number :

Previous Collection No. **R.J.King** 996 calcite

New Mine *, Llorreto*, Great Ormes Head

26 NMW 83.41G.M.4871

Other number :

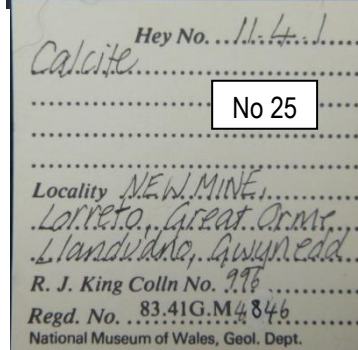
Previous Collection No. **R.J.King** 5787

Previous Collection No. **H.F.Harwood** 4229 calcite

Great Ormes Head , Llandudno , Caernarvonshire



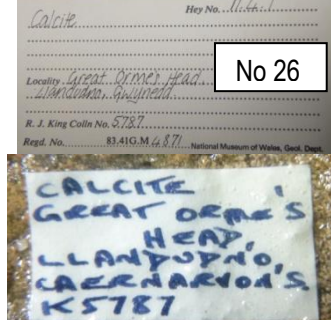
©NMW



No 25



©NMW



No 26

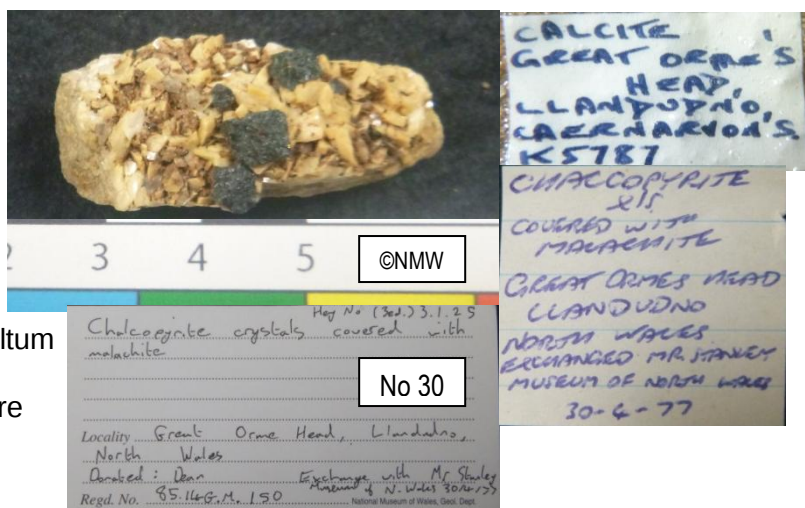
27 NMW 83.41G.M.5300

Other number :

Previous Collection No. **R.J.King** 3062

aragonite ; malachite ; dolomite

Ty-Gwyn Mine , Great Ormes Head ,
Llandudno



28 NMW 83.41G.M.9319

Other number :

Previous Collection No. **R.J.King** 997 asphaltum

Notes : uraniferous ; dolomite

Great Ormes Head , Llandudno , Caernarvonshire

29 NMW 83.41G.M.9441

Other number :

Previous Collection No. **R.J.King** X3513

asphaltum Notes : uraniferous ; dolomite

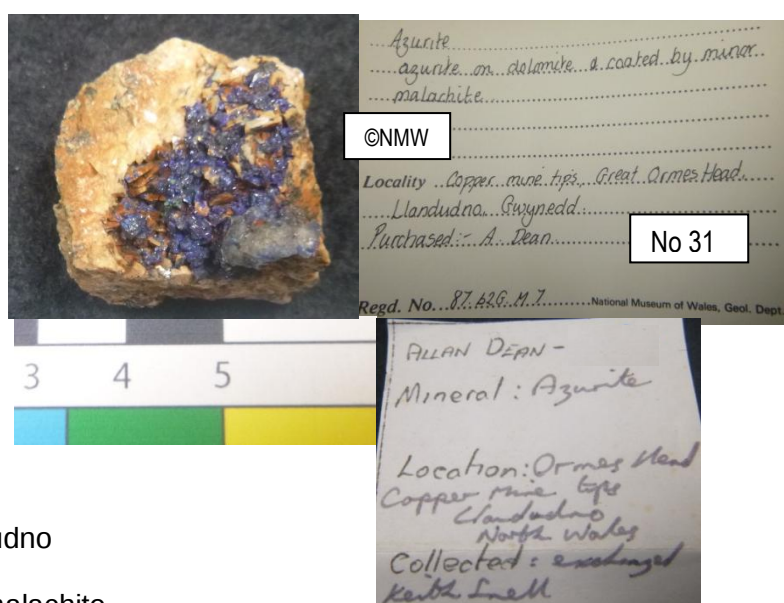
Great Ormes Head (Copper) Mine* , Great Ormes Head , Llandudno. Notes: Dumps of

30 NMW 85.14G.M.150 chalcopryite

Notes : crystals, covered with malachite ; malachite

Great Ormes Head , Llandudno ,
Caernarvonshire

Notes : exchanged with **Mr Stanley - Museum of North Wales** 30/04/77



31 NMW 87.62G.M.7 azurite ; dolomite ;

malachite

Notes : minor

Copper Mine Tips* , Great Ormes Head , Llandudno

32 NMW 87.62G.M.8 azurite ; dolomite ; malachite

Notes : minor

Copper Mine Tips* , Great Ormes Head , Llandudno

33 NMW 90.49G.M.2 malachite ; dolomite

Great Ormes Head , Llandudno , Caernarvonshire

34 NMW 90.49G.M.6 chalcocite ; malachite

Great Ormes Head , Llandudno , Caernarvonshire

35 NMW 94.42G.M.1 malachite

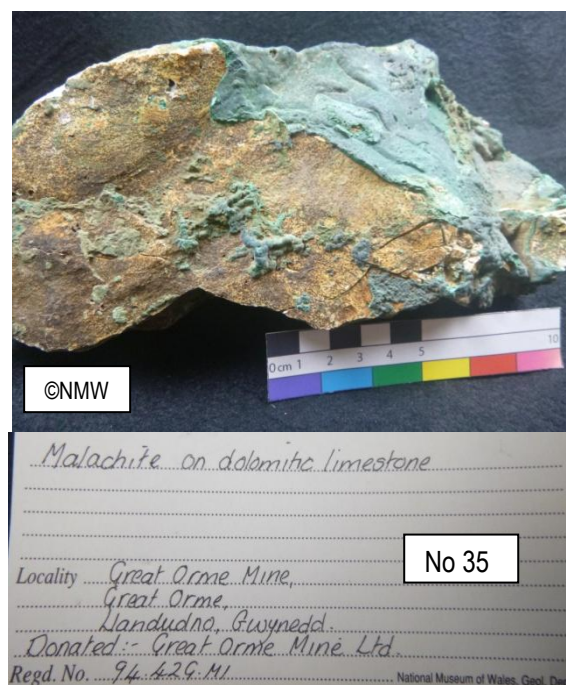
Notes : On dolomitic limestone. ; limestone, dolomitic

Great Ormes Head (Copper) Mine* , Great Ormes Head ,
Llandudno

36 NMW 94.42G.M.2 malachite

Notes : Lining fractures in dolomitic limestone. ; limestone,
dolomitic

Great Ormes Head (Copper) Mine* , Great Ormes Head ,
Llandudno



37 NMW 94.70G.M.1 chalcopryite

Notes : on dolomite ; dolomite
Great Ormes Head , Llandudno , Caernarvonshire
Coordinates :
Grid Reference [NGR] SH 7683
(Possibly Owens/Treweeks? Ed)

38 NMW 94.70G.M.2 calcite ; malachite ; dolomite

Great Ormes Head (Copper) Mine*, Great Ormes Head , Llandudno
Coordinates :
Grid Reference [NGR] SH 768
(Possibly Owens/Treweeks? Ed)

39 NMW 94.70G.M.3 calcite ; malachite

Great Ormes Head (Copper) Mine*, Great Ormes Head , Llandudno
Coordinates :
Grid Reference [NGR] SH 7683
(Possibly Owens/Treweeks? Ed)

40 NMW 2002.15G.M.7

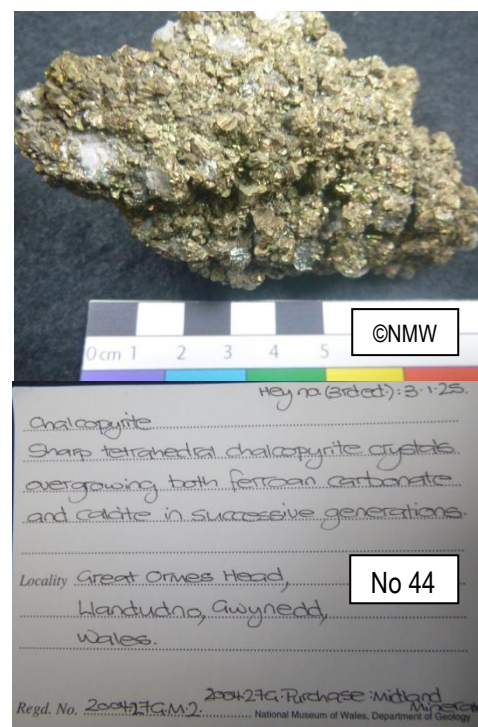
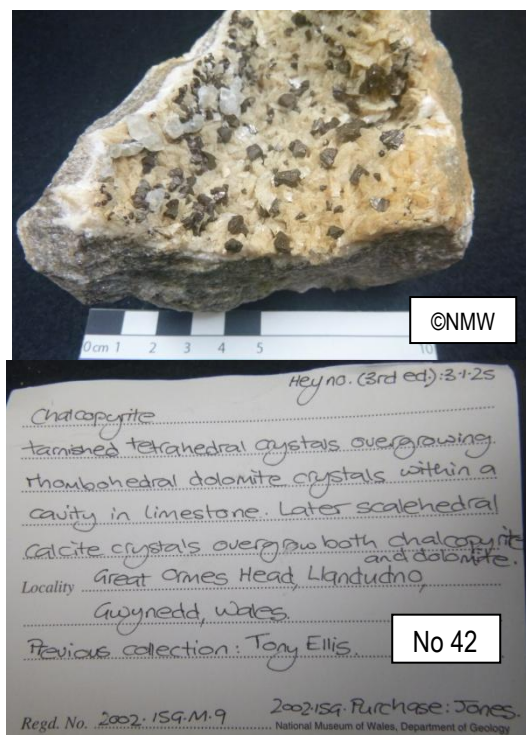
Other number :
Previous Collection (name): **Tony Ellis**
Previous Collection No. **C91** chalcopryite
Notes : tarnished tetrahedral-shaped crystals overgrowing
rhombohedral dolomite crystals in dolomitic limestone ; dolomite
Notes : creamy rhombohedral crystals ; limestone, dolomitic
Great Ormes Head , Llandudno , Caernarvonshire
Notes : Great Orme

41 NMW 2002.15G.M.8

Other number :
Previous Collection (name): **Tony Ellis**
Previous Collection No. **286** malachite
Notes : deep emerald-green acicular microcrystals of malachite
overgrowing goethite pseudomorphs after chalcopryite within dolomite
lined cavities in dolomitic limestone ; goethite
Notes : pseudomorphs after chalcopryite (both tetrahedral and platy
crystals) ; dolomite
Notes : buff coloured rhombohedral crystals within cavities ;
limestone, dolomitic
Great Ormes Head , Llandudno , Caernarvonshire
Notes : Great Orme

42 NMW 2002.15G.M.9

Other number :
Previous Collection (name): **Tony Ellis**
Previous Collection No. **519** chalcopryite
Notes : tarnished tetrahedral crystals overgrowing rhombohedral dolomite crystals within a cavity in
limestone. Later scalehedral calcite crystals overgrow both chalcopryite and dolomite ; calcite
Notes : colourless? scalehedron crystals overgrowing chalcopryite and dolomite within cavity ; dolomite
Notes : rhombohedral crystals lining cavity ; limestone
Great Ormes Head , Llandudno , Caernarvonshire
Notes : Great Orme



43 NMW 2003.1G.M.539

Other number :

Previous Collection (name): **John Mason**

Previous Collection No. **JM 2143** malachite

Notes : and calcite: vuggy dolomite contains calcite crystals with malachite inclusions. ; calcite

Notes : Crystals. ; dolomite

Notes : Vuggy.

Great Ormes Head , Llandudno , Caernarvonshire



44 NMW 2004.27G.M.2

Other number :

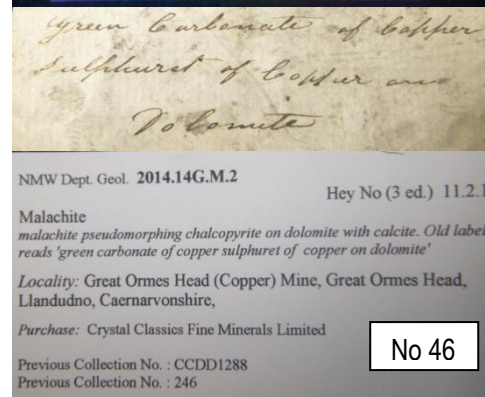
Previous Collection (name): **Neil Hubbard** chalcopryite

Notes : Sharp tetrahedral chalcopryite crystals overgrowing both ferroan carbonate and calcite in successive generations. ; calcite

Notes : white, overgrown by chalcopryite. ; ferroan carbonate

Notes : orange-brown weathered curved rhombic crystals overgrown by chalcopryite then calcite. ; limestone

Great Ormes Head , Llandudno , Caernarvonshire



45 NMW 2012.6G.M.93

Other number :

Previous Collection (name): Ex **Gregory, Bottley & Lloyd**

Previous Collection (name): **Frank Ince Collection**

Previous Collection No. 1950 calcite

Notes : calcite, malachite, goethite pseudomorphing chalcopryite and dolomite ; malachite ; goethite ; chalcopryite

Notes : goethite psudomorph ; dolomite

Great Ormes Head , Llandudno , Caernarvonshire

Notes : Bought from: Gregory, Bottley and Lloyd

46 NMW 2014.14G.M.2

Other number :

Previous Collection No. **CCDD1288**

Previous Collection No. 246 malachite

Notes : malachite pseudomorphing chalcopryite on dolomite with calcite. Old label reads 'green carbonate of copper sulphuret of copper on dolomite' ; chalcopryite ; dolomite ; calcite

Great Ormes Head (Copper) Mine*, Great Ormes Head , Llandudno

Notes : ?



Acknowledgements:

- National Museum of Wales Cardiff for the use of their records and permission to take photographs of their mineral specimens.
- Tom Cotterell, Senior Curator of Mineralogy for his written contributions, time and assistance.

A list of the Great Orme mineral specimens kept at Manchester Museum / University of Manchester will be published at a later date, hopefully with some pictures to accompany the text.

Author: Dave Wrennall

Hatter's Castle And Radar On The Great Orme

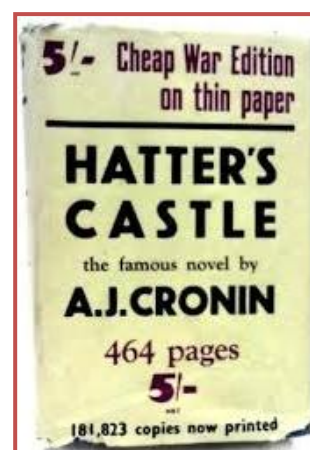
Hatter's Castle was a secret installation in World War Two on the Great Orme. Near the Rest and be Thankful Café, a narrow concrete road snakes upwards and at the top was a hush-hush military building. In the summer of 2017, a GOES Summer Walk visited the Hatter's Castle site, and there was some speculation then about the operations there. Another of Nick Challinor's Summer Walks took us to the remains of the artillery school. Both walks were fascinating and together they sparked off the research for this article.

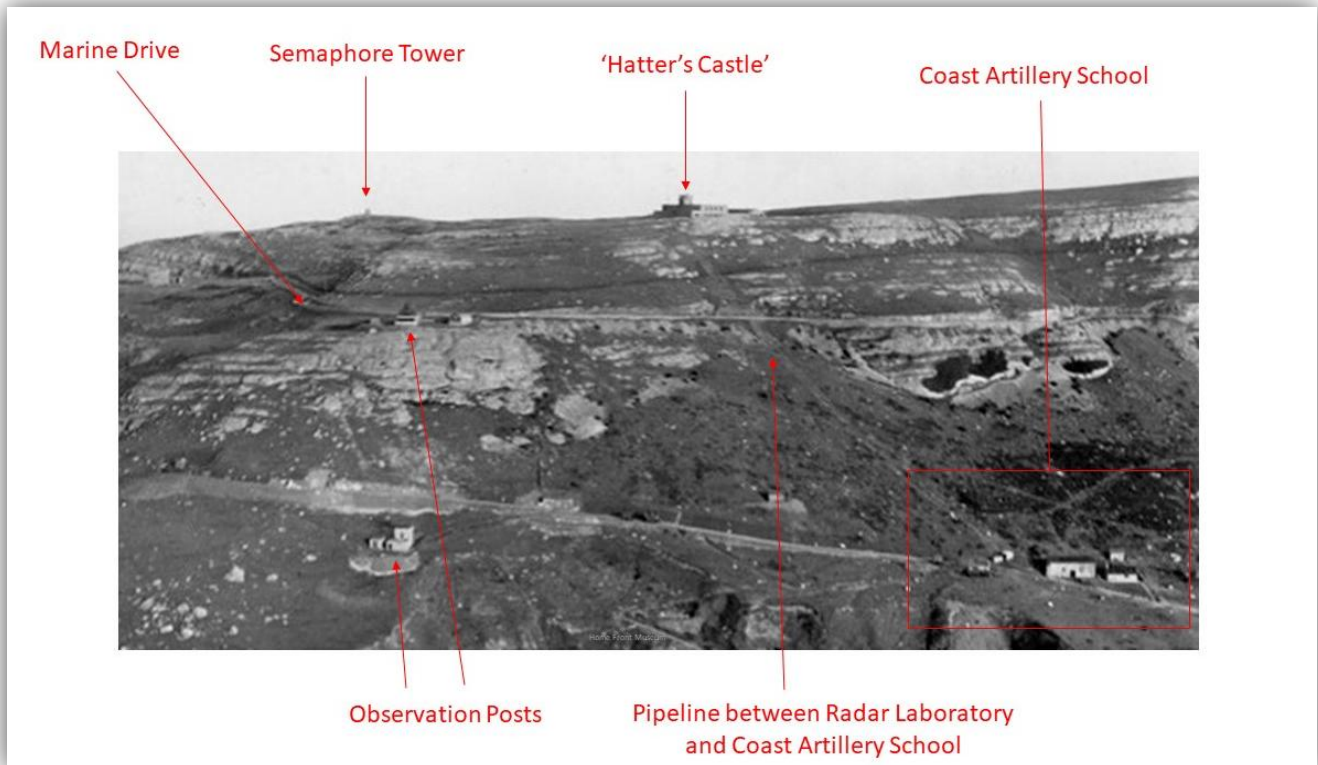
Adrian Hughes, who was on both walks, is a knowledgeable sort of bloke (he set up the Home Front Museum on New St). He explained that the Hatter's Castle nickname came from the 1942 film called Hatter's Castle which was based on A. J. Cronin's book of the same name. Adrian added that the building had been a 3 storey construction of about 50 rooms with a rotating aerial on top; the aerial indicating that radar was the reason for the building. Hatter's Castle was demolished in 1956.



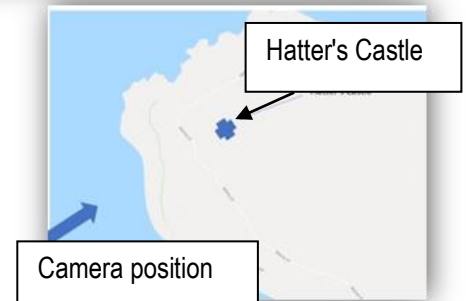
A screenshot from the film 'Hatter's Castle'

Radar was a great invention for detecting enemy planes and lots of effort went into gaining an edge on the enemy: radar's range was rapidly extended & its accuracy was constantly improved. But radar wasn't just for spotting hostile aircraft: it was also used for search light control and for improving the accuracy of coastal guns; matters of great interest to the artillery school. A huge recruiting operation took place nationally to train people in this exciting new field. George Robson, a former colleague, told of RAF radar courses running 24 hours a day, seven days a week. Once trained, George installed early radar sets in aircraft – only to be told by the pilots: "You're wasting your time, mate. That stuff's no bloody use: we don't bother with it." A couple of months later, he would be removing the sets and replacing them with updated models. Such was the rapid development of radar.





Hatter's Castle was built in 1942, though construction actually started in 1941. What could it be that prompted the government to spend lots of money on this substantial building? It had to be something pretty important. In a book by Brigadier Sayers (cf Sources), the new facility on the Orme was described as "a radar laboratory."



There was an amazing amount of radar activity going on in Llandudno at this time. The Coast Artillery School (CAS) had moved to Llandudno in 1940 and was experimenting with radar at its site near Millionaires' Row. In addition, there were other organisations attracted by CAS and all were collaborating closely on the development of radar. So we need to take a look at them and their work.

The Telecommunications Research Establishment (TRE)

Sometime after September 1940, TRE moved a research detachment to Llandudno alongside the CAS. TRE was set up to carry out research for all three services, but sending a research detachment to Llandudno was a significant development for the CAS & its work. There was to be close co-operation between TRE and ADRDE (see below).

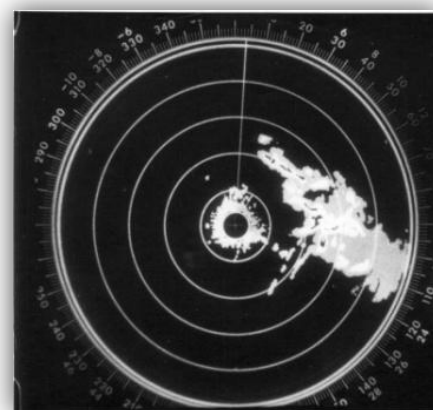
In 1940 TRE produced the first practical magnetron and by 1941 was experimenting with shortwave radar; this soon led to the outstanding NT 271 radar set. Centimetric radar sets had the considerable advantages of being smaller and more accurate which meant they could be fitted to ships and aircraft.

TRE was also instrumental in the development of window (the American term “chaff” is more familiar). Adrian Hughes suspects that Hatter's Castle was used to research window as he had many reports of window being found on the Orme and on the West Shore during the war. Window was a short, narrow strip of metallised material which was dropped in packets from aircraft in order to confuse radar signals. Adrian's theory may well be correct, but the timing does not look quite right for Hatter's Castle. Window originated in 1936/7, but no trials took place until 1942 when research on window was carried out at TRE by the Welsh scientist Joan Curran. The authorities, fearful of the concept being “acquired” by the enemy, then left window alone until 1943 when it was first put into use. As the go-ahead for building Hatter's Castle was received the year before Joan Curran started her research on windows, it looks as though Hatter's Castle was intended for something else.

The Air Defence Research & Development Establishment (ADRDE)

According to Brigadier Sayers (cf Sources), ADRDE was the sole authority for radar equipment design and they carried out initial trials of experimental types of radar set. They were assisted by TRE and CAEE (see below). An experimental section of ADRDE moved to Llandudno sometime after 1940.

In 1939/40 ADRDE was running courses on coastal defence radar and on Chain Home Low (CHL) radar stations. There was a CHL station on the Orme: this was at the Summit Complex and was known as RAF Great Orme. CHL radar was designed to track low flying aircraft and ships out at sea. (An earlier network was called Chain Home radar stations; these were good only for detecting high flying planes, so they had to be supplemented by the CHL stations. There were no CH radar stations on the Orme, though there were two on Anglesey and one near Bodelwyddan).



In June 1941, ADRDE began experimental trials of the NT 271 radar sets. Operational trials were then carried out at Dover and at Great Ormes Head for both CAS and CAEE. In the same year, ADRDE at Christchurch produced two pilot models of radar sets for coastal artillery. These were designated CA No1 sets. One of the pilot sets was tested by CAEE which then transferred the set to the CAS at Llandudno for its use.

The Coast Anti-Aircraft Experimental Establishment (CAEE)

According to the book by Wilcox (cf Sources) the HQ of CAEE was moved to Deganwy in July 1940 alongside the CAS at Llandudno, although Wilcox also says the HQ was established alongside

the CAS at Great Ormes head near Llandudno (cf addendum)

CAEE was an army establishment largely working for ADRDE and did lots of work on centimetric radars to aid coastal gunnery. And, as we have already seen, CAEE did operational trials in 1941 at Great Ormes Head with NT 271 and CA No1 radar sets.

In 1943, CAEE and CAS were carrying out trials at Llandudno using 3cm wavelengths for fall of shot observations with CA No3 radar sets. Demos were given to the War Office and to the Yanks: all were very impressed.

According to Mike Dean of Purbeck Radar: "CAEE was based in Llandudno and had sites all over the Great Orme. In late 1944 and into 1945 the Great Orme site was used for trials in K, X and S-band radar trials."

The Coast Artillery School (CAS)

This moved to Llandudno in September 1940, where it was joined by the Coast Artillery Radar Wing. CAS ran its first courses at Llandudno in October 1940 to train operators in coastal defence radar sets.

In March 1941, the latest coastal defence radar sets were moved from Watchet to Llandudno and established there in conjunction with the new radar laboratory (Hatters Castle) then under construction (Sayers p 216). The following month "the CAS Radar Wing started their first War Special Wireless Course, but the incomplete laboratory and a shortage of equipment & components meant that the course dragged on to August 1941. The trainees gained practical experience of radar equipment and took part in the erection and installation of radar sets" (Sayers).

The CAS Radar Wing developed a coast defence radar set for the direction of coastal guns. This was the CA No1 set mentioned previously. In August 1941 the CAS was devising drills for the use of this set, was studying its performance and looking at tactics for its use.

In March 1943 the CAS were busy at Llandudno with trials of the 3cm wavelength radar for fall of shot observation with a range of 25,000 yards. This was in collaboration with CAEE as we have already seen. These trials led to the CA No3 radar set.

Hatter's Castle

Hatter's Castle was situated at Great Ormes Head where much of the research on the use of radar appears to have been centred. The most likely scenario is that Hatter's Castle was a radar



laboratory for developing advanced radar systems and for training operators in the use of these radar sets. This does not rule out the use of the Orme for counter measures against radar – such as jamming and window – being researched at Hatter's Castle. After all, once radar had proved its importance, the next step would be to work on counter measures, but radar had to come first! As we have seen several times, 1941 was a crucial year for advances in radar which was probably the reason for the existence of Hatter's Castle.

As there was a war on and as the work of the radar laboratory was cutting edge, everyone kept very, very quiet about their work: this makes the conclusion about Hatter's Castle somewhat tentative.

Sources – websites

Malvern Radar & Technology History Society <https://mraths.org.uk>

Purbeck Radar Museum www.purbeckradar.org.uk

RAF Air Defence Museum www.radarmuseum.co.uk

Sources – books

“Army Radar” by David Wilcox, Menin House 2014. A readable account of army radar largely based on Sayers book. Conwy County Library has a copy of the Wilcox book.

“Army Radar” by Brigadier A. P. Sayers, War Office 1950. A very comprehensive account which is not easily come by. The book was classified until 1977

Author: Keith Morris

Addendum

The Deganwy connection is still a mystery. I have asked a few members of Deganwy History Society who were children in the village during the war and none can recall anything that might have resembled CAEE. Although, saying that, it looks as there may be a slight contradiction as to exactly where was meant by ‘Deganwy’ - according to Wilcox.

Hatter's Castle was demolished in the Spring of 1956 by an engineering and public works contractor from Mochdre, near Colwyn Bay, called A E Hannen. Local residents had been complaining to Llandudno Urban District Council that the building was an eyesore and needed pulling down. In turn the council contacted the Ministry of Works who authorised its demolition. Hannen estimated that there were over 2500 tons of bricks and over 2400 pieces of piping to remove from the site. As well as the removal of the building itself, the contractors also had to fill in a gun-pit and a reservoir. I'm wondering now if the gun pit is what we can see in this photograph.



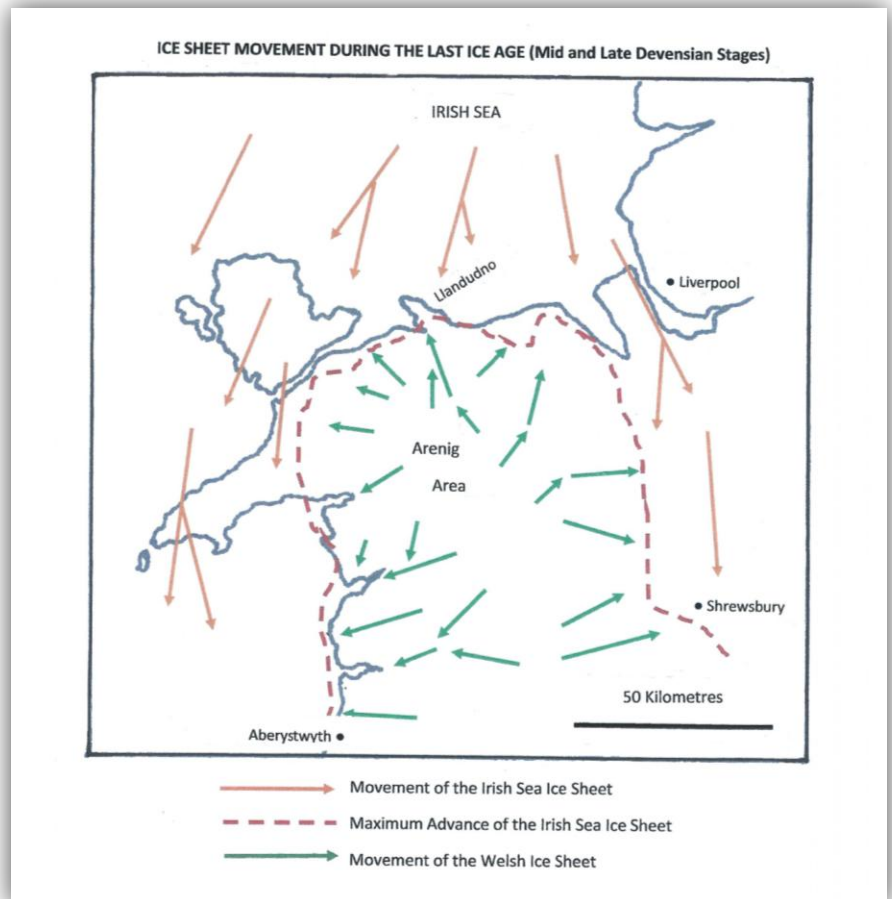
Possible gun pit

Author: Adrian Hughes

A Note on the Final Retreat of the Welsh - Irish Sea Quaternary Ice Sheets from the North Wales Coastal Region

There is little published research into the timing of the retreat of the Welsh and Irish Sea ice sheets from the North Wales coastal area, in particular the area of Llandudno and the Great Orme. The dating of the retreat of the ice is complicated by the fact that there are two source directions. From the south the North Wales ice sheet, which is thought to have been up to 1,400 metres thick, was centred on the Migneint – Arenig area south-east of the Snowdon Massif. The Irish Sea ice sheet advanced over the area from the north.

Llandudno and the Great Orme were on the northern extremities of the North Wales ice sheet at the junction with the Irish Sea ice sheet. This is confirmed in the Ty Gwyn Mine where sharp brecciated moraine of the North Wales sheet is in juxtaposition with the rounded pebbles and cobbles of the Irish Sea ice sheet moraine. Rocks from the latter can be directly sourced to the Lake District and other areas to the north.



The most recent glacial maximum was approximately 22,000 years BP (Before Present) but by 19 - 21,000 years BP Britain and Ireland were beginning to experience a gradual rise in temperatures, resulting in the first indications of retreat of the covering ice sheets. There is evidence that by 19,000 BP the summits of the highest peaks of North Wales were nunataks projecting through the surrounding ice. However, the rate of subsequent retreat of the ice varied considerably from place to place and in

particular on how far different localities were from the centre of the various ice sheets.

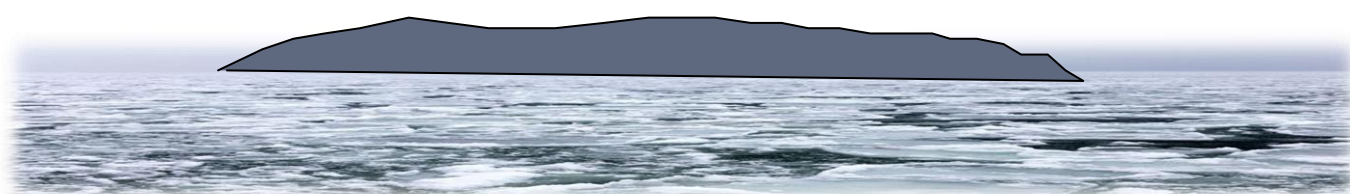
In North Wales some of the first definitive dates available for the retreat are from the Nant Ffrancon valley and Cwm Idwal. Pollen from trees and arctic-alpine flora in the Nant Ffrancon has been dated to 11,500 years BP and it has been estimated that the area, with the exception of some of the higher slopes, was largely ice-free by 12,500 – 12,700 years BP. Ice was present for longer in Cwm Idwal where there is evidence for a minor drop in temperature and re-advance of the ice, but even this area was ice-free by 10,000 years BP. Both these locations were considerably nearer to the centre of the North Wales ice sheet than was the coastal area. Situated on the northern extremities of the North Wales ice sheet it can safely be assumed that retreat of ice from the Llandudno area must have taken place at a time considerably prior to its retreat from the more central region of Nant Ffrancon at about 12,000 years BP.

There has been no published date for moraine or glacial deposits found on the Great Orme or those visible in the Ty Gwyn Mine. However, a paper on detailed research into the retreat of ice from Britain was published in 2010 (*Clark, C.D., et al., Pattern and timing of retreat of the last British-Irish Ice Sheet. Quaternary Science Reviews (2010)*). This paper dates the initial decoupling of the Irish and Welsh Ice Sheets to 20,000 years BP with subsequent relatively rapid deglaciation. It indicates initial withdrawal of ice from the area near the current North Wales coast by 18,000 years BP with the area in the region of Llandudno becoming completely ice-free by 17,000 years BP.

This date of 17,000 years BP seems to be the best estimation for the time at which the Llandudno and Great Orme became ice-free at the end of the last Quaternary glaciation and there is no evidence of any glacial deposits after this period. It would be interesting to see if there are any preserved pollens present in deposits associated with, or immediately, above the moraines, and if there are to see if they can be dated.

Author: Martin Trevelyan-Jones

April 2018

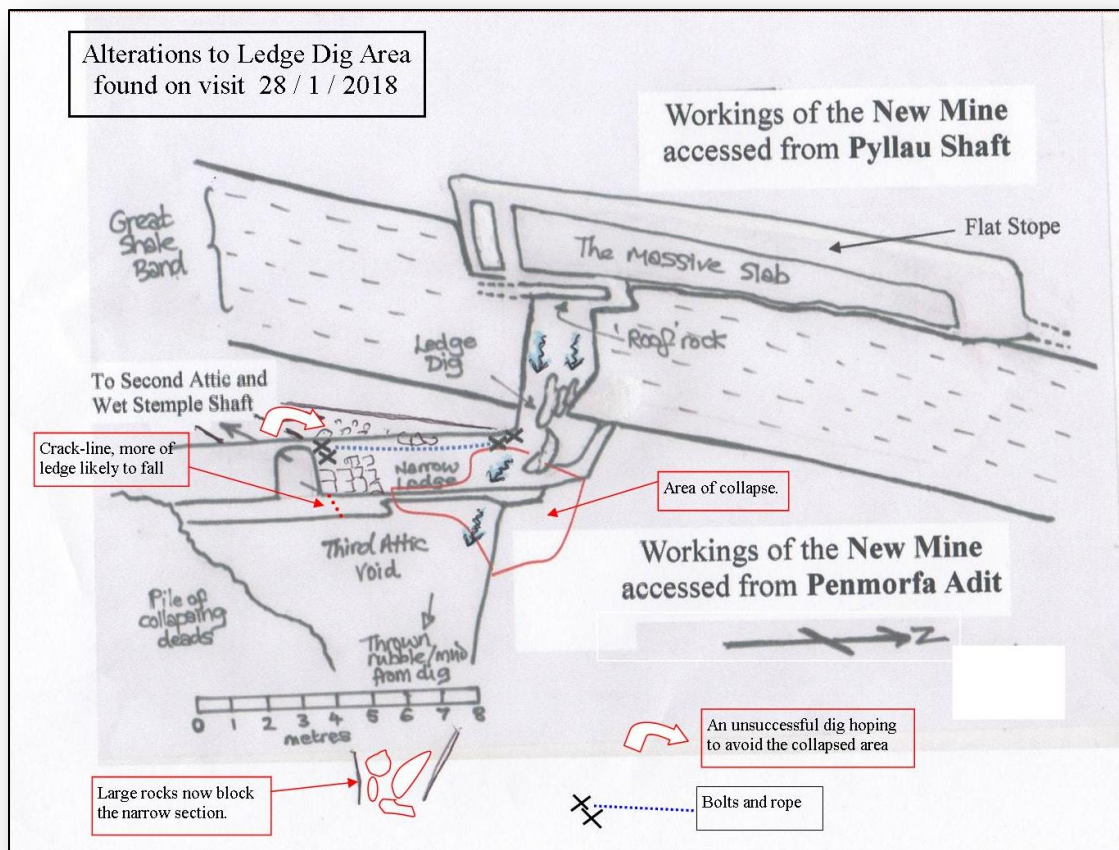


The Penmorfa Chronicles

Connection into Pyllau update

On a Penmorfa trip in January 2018 a large collapse was discovered in the Third Attic which has affected the easy access route through into Pyllau. Not only had most of the narrow ledge used to reach Ledge Dig and so Pyllau, fallen away, but also the entire large platform on the far side which had been used as the base from which to do the digging.

No doubt the steady dribble of water emanating from the Great Shale Band which had contributed to the mud encountered by the diggers had, over a period, led to the failure of the solid looking ledges. A crackline close to the adit indicates even more material is likely to fall away.



The affect on the route has been exacerbated in that the collapse of the narrow ledge has led to the demise of the neatly built up pack wall alongside it, leaving behind a loose face of rubble and large boulders. The rope which was used to safeguard passage on this section is still there but now you need to hang from it to get across whilst trying not to disturb any rocks. It was eventually crossed with much trepidation. At the far side the mud was found to be as copious as ever. The connection through into Pyllau above the mudflow was open and unchanged.

An alternative approach to the far side was examined, starting within the side adit. Digging through loose rubble was looking optimistic until very large rocks probably from the roof were

encountered. The situation seemed far too unstable to continue. There's a strong possibility that the triangle of material we were digging in, on the edge of the Third Attic between the side adit and Ledge Dig was actually walled up to safeguard the chamber from roof fall.



Dave Flowers lights up Dave Wrennall fighting the mud at the collapsed area

Hopefully in future visits a safe way can be engineered possibly with a realignment of the rope or with the use of scaffold / laddering to restore easy access to and from Pyllau.

In 2016 all the mud and rock removed from Ledge Dig was thrown down into the void below to fall through a narrow section to Llyn Penmorfa Chamber where some of it stuck, the rest continuing down to Surprise Chamber on the Wet Way.

Whilst returning down the system a quick slither down Llyn Penmorfa Chamber's mud-bank allowed a visit to be made to the base of the narrows, it was found to be totally blocked by very large jammed boulders displaced in the recent collapse. (cf diagram).



On 22nd April 2018 GOES hosted a group of explorers from CATMHS (Cumbria Amenity Trust Mining History Society) Dave Wrennall took 10 through Penmorfa whilst Steve Lea guided one individual around Ty Gwyn. Both trips were very well received and we are invited to visit them in Cumbria sometime in the future.

Author: Dave Wrennall

Miscellany: Yes, No, Maybe.**Yes: Ladders in Roman Shaft**

At this year's April AGM it was decided to look into the possibility of laddering Romans Shaft and various options were discussed. Since then Gareth Davies has investigated the availability and cost of ladders and Stephen Lea has drawn up a provisional plan. A site visit is to be organised to look at the situation within the shaft to revise plans accordingly.

With the ladders in position Romans will become an easier trip option, abseils / SRT can still be done down Treweeks or via its 135m Level linking to the Ali Series.

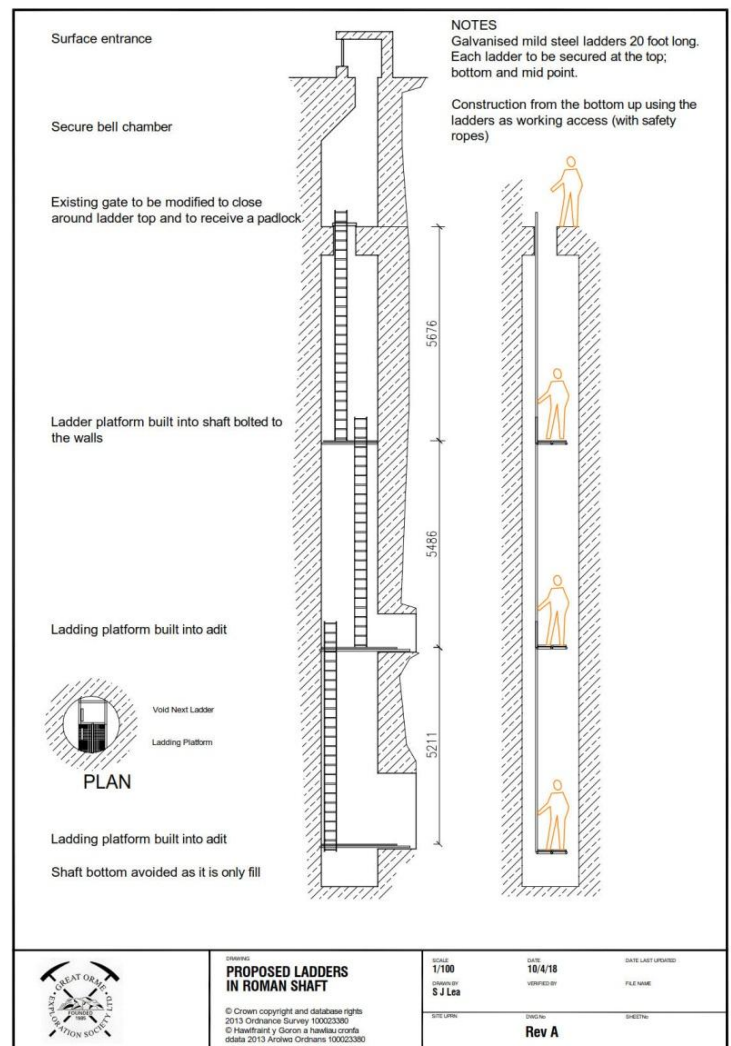
The greater variety of route options and relatively straightforward access to projects in Romans can only be beneficial to the clubs underground activity.

No: Pyllau Lease

The possible lease for Pyllau Shaft as considered by the 2017 AGM has not been progressed. Fewer underground trips were held last year than ever before in the history of the Society. In the 2018 AGM all agreed that considering the substantial financial cost involved and the current low level of underground activity that our proposed acquisition of the Pyllau lease should be shelved.

Maybe: NAHMO 2018

You may wish to attend this year's NAMHO Conference which is to be held in The Forest of Dean on the 1st – 3rd June 2018 further details are available at <https://www.namho2018.info/> The conference theme is Mines, Mining and Miners of the Forest of Dean – “A law unto themselves”.



Author: Stephen J Lea

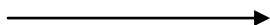
GOES Summer Walks 2017



First Summer Walk (18th May) - Medieval Settlement and Ski Slope Area.



25th May - Wendy's Botany Walk.



1st June - Inferno Quarry Mystery.



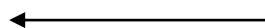
8th June - Happy Valley via the steep route.



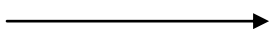
15th June - The Brammock
Rods and Bishops Quarry.



22nd June -
Deganwy Castle Walk.



29th June - Parc Farm Wall
Walk (looking down the Sink
Hole).





6th June - Haulfre Gardens Walk (and Steve with a couple of his mates).



13th July - Nant y Gamma Walk



27th July - Little Orme Walk.

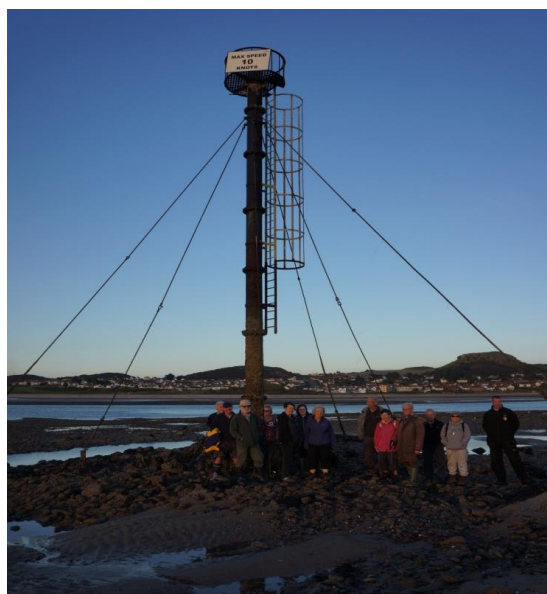
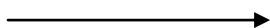




20th July - Concrete Road Loop.



3rd August - Maes y Facrell and the NNR Area Walk.



↑ 10th August - Last Summer Walk 2017
Conwy Morfa.

Author: Nick Challinor

GOES Summer Walks 2018

All walks start at 7pm and are usually gentle strolls, which last approximately 2 hours. Sturdy footwear and waterproofs are advised. Below is a list of the proposed walks, but all are subject to confirmation. Please check the community news section in the North Wales Weekly News and the GOES Calendar (on Website), which will provide full details of the walk taking place and recommend the arranged meeting place. If however, the weather is poor, then the walk is very likely to be cancelled or postponed until a later date.

24th May. Summit Area Walk. Meet at the Great Orme Visitors Centre Car Park - GR SH 766833

31st May. RA Gun Site Walk. Meet at the 'Rest and be Thankful' Cafe on Marine Drive. GR - SH 756843.

7th June. Little Orme Quarry Area. Meet at the Co-op Car Park Penrhyn Bay. GR SH 818816.

14th June. Pink Farm Walk and Powell's Well Walk. Meet at the Marine Drive North Shore Toll House. GR SH 782832.

21st June. Bodysgallen Obelisk. Meet at Bodysgallen Hall Car Park. GR SH 799792.

28th June. Wendy's Flower Walk (with walk guide Wendy McCarthy). Meet at the Half Way Tram Station by the Water Pump House. GR SH 772833.

5th July. Walk with a Warden (TBC). Meet at the Great Orme Visitors Centre Car Park - GR SH 766833.

12th July. Lovers / Invalids Walk plus Donkey Path. Meet at the Marine Drive West Shore Toll House. GR SH 768823.

19th July. Kendrick's Cave Area. Meet by the Empire Hotel at the top of Mostyn Street. GR SH 780827.

26th July. Zigzag Route and Caves (Good footwear needed). Meet at the Marine Drive West Shore Toll House. GR SH 768823.

2nd August. Little Orme Memorial Monument Walk (Low Tide 21:24 may need wellingtons). Meet at the end of the Beach North Shore. GR SH 804822.

9th August. Great Orme Cemetery Walk (with walk guide Adrian Hughes). Meet at the Cemetery Chapel. GR SH 768838.

16th August. Under the Pier (Low Tide 21:42 may need Wellingtons). Meet at the Pier entrance North Parade. GR SH 781827.

Walk Coordinator: Nick Challinor

GOES Committee and Contact Details:

Chairman: David Wrennall	email: dave.wrennall@gmail.com
Vice Chairman: David Broomhead	Mob: 07555 371509
Secretary: Gareth Davies	email: penrhynsideheating@hotmail.co.uk
Treasurer: Stephen Lea	email: Steve.lea005@gmail.com
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Summer Walks Coordinator: Nicholas Challinor	email: nicholas_challinor@sky.com

GOES meets informally every Thursday evening in The Snowdon, 11 Tudno Street, Llandudno from 9.30pm. <http://www.the-snowdonhotel.co.uk/> All are welcome.

The Great Orme Exploration Society (GOES) was formed in 1985 and became a Company Limited by Guarantee and not having a share capital on 7th April 1999. It is a member of the National Association of Mining History Organisation (NAMHO), British Caving Association (BCA), and works in association with the Gwynedd Archaeological Trust (GAT), the Early Mines Research Group (EMRG) and the Gwynedd Bat Group (GBG). Views and opinions expressed are those of the author(s) and not necessarily those of the Society.

The Caving Code:

1. Get the basic gear: Helmet, lamp, warm clothing, spare lighting, insurance.
 2. Always get permission from the owner: If in doubt, ask the local group; always leave the site secure and follow the 'country code', close the gates.
 3. Tell someone where you are going. How many, which mine and where, time in, out and home-contact; if overdue contact **CAVE RESCUE 999**.
 4. Never go underground alone or intoxicated: The minimum number is four, one to stay with the casualty and two to go for help. Alcohol or drugs in you, or one of the group, compromises the safety of the entire group.
 5. Do not exceed your capability: Do not over estimate your skills and endurance; and remember it is always more difficult coming out against gravity.
 6. Do not get lost: Take a reliable plan or guide from the local group.
 7. Never climb on mine ladders or machinery: If it is rotten you will not defy gravity for long, but you will accelerate at 32ft/sec/sec.
 8. Never climb on stacked or dead walls: They may collapse around you like a house of cards; take care.
 9. Never fool around underground. It might be the last thing you do for yourself or your mate(s), or they do for you.
 10. Do not spoil the mine environment: Take your rubbish home, leave artefacts in situ, leave bats and other flora/fauna alone. Do not smoke.
 11. Know your emergency self-help drills: Don't panic; apply first aid to save life (bleeding, breathing, consciousness) prevent deterioration (shock, hypothermia) and promote recovery (reassurance, and go easy on the gallows humour); stay with the casualty while two of you go for help.
 12. Access to the mines on the Great Orme is controlled, but is available to caving groups or individuals via the **Great Orme Exploration Society Ltd**. Arrangements for guided access can be made with the Society Secretary.
- **TAKE** only photographs, **LEAVE** only footprints, **KILL** only time.

