

Cymdeithas Daeareg Gogledd Cymru
North Wales Geology Association

NEWSLETTER



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Front Cover Image:

Crinoid death assemblage. Existing NEWRIGS Rigs site at Halkyn Mountain, Flintshire seen during our September Field Visit

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Chairman's Message

Swedish sand-woman

The presence of the North Wales Geology Association on the web ensures a steady trickle of the strangest enquiries you could wish for. Sometimes it is film companies angling for some free advice, and other times someone who has found crystals in their garden (but doesn't reply when you contact them as requested).

This summer's fun contact was a lady artist in Sweden collecting representative sand samples from each of the United Nations to create an artwork of some unspecified kind. Nationalist sympathies led her to solicit separate samples from Scotland, England and Wales, however. The work has proceeded for two years now, and a trawl through her Facebook page is an amusing and occasionally fascinating exercise (e.g. Goa). It turns out that there is quite a community behind this collection, spread as you would expect across the globe and taking in deserts, rivers, beaches and pits alike. It just goes to show that there is a lot more to 'sand' than you would guess.

West Shore jellyfish and fossils

The younger generations of the Chairman's clan continue to delight and amaze, and a trip to a local beach can yield not only sand but some interesting geological insights. Back in July when there was some hot sun about we were wandering the high tide mark at the West Shore of Llandudno, with the water almost at full tide again. A chance stranding on the previous high tide of large numbers of compass jellyfish (*Chrysaora hysoscella*) was drying-up rapidly and vanishing almost completely. Compass jellyfish take their name from the dark-brown, radial markings and 32 marginal spots on their umbrella. All that remained of many of

these unfortunate creatures were perfectly-formed, coloured imprints on the sand with no remnant of their body however. What an intriguing mode of preservation for fossils in the right context, I thought. We continued our walk to the nearby groyne and amused ourselves by looking at fossil coral, crinoids and brachiopods and some veins of sparry calcite. What a fine outing – we should count ourselves lucky with all this at our doorstep!

New recruit to the scale-bar team

Another milestone this summer has been the recruitment of the latest black & white photographic scale-bar to the team. He is now over 5 months old, growing fast and called Tegid. While still too young to be relied upon to stay still for as long as required, he is already taking in a keen interest in rock outcrops and erratic boulders so should appear in the appropriate publications before very long.

Coastal management forum

If you take an interest in these things you might be aware that a draft copy of the Llandudno Beach Management Plan has been published for consultation. Parts of it relating to sediment transport patterns and history were passed to me for comment, and I have to say that it made extremely interesting reading – particularly the bits about the way that the North Shore of Llandudno has responded to the various mitigation works and developments over the years. It is possibly well-known that Llandudno's original pier was destroyed by a storm within a year of its completion in 1858, and not replaced until 1875. Reports into the loss of beach material have cropped up at intervals since 1907, including 1937 when there was a report commissioned in the aftermath of significant damage due to a storm that February which had ripped up the stepped revetment constructed between 1895 and 1906. A major scheme of works begun in

1992 has been followed by intensive monitoring of beach-front and shore profiles to remedy the lack of long term data on the situation – leading to the perceived urgency of replenishment that has so enraged the local populace. It is a pity that ‘folk memory’ is long enough to remember the halcyon days of the resort, but not its longer term problems which include continual and serious loss of beach material. We will hear more, it is sure!

Rona Ridge palaeogeography

I recently had the pleasure of a field trip to the ancient basement rocks of Britain, aka the Lewisian Gneiss, located not where it should be off NW Scotland but near Guildford (famous as the birthplace of the Stranglers and the supposed Earthly residence of alien journalist Ford Prefect, according to the late Douglas Adams in a well-known radio drama). Well, the town had to be famous for something, but the real story goes like this.....

The oil and gas which the British economy has traditionally relied upon to supply revenues to the government in lieu of taxes on the populace has accumulated in sedimentary basins developed in response to the tension imposed upon the continental crust by the opening of the North Atlantic Ocean. It is also hypothesised that the Scottish Highlands have been significantly elevated as a consequence of hot, basaltic magma underplating during the Palaeogene period, some of which escaped and formed the Hebridean (or Thulean) Volcanic Province. Great volumes of elevated material were consequently eroded away and carried into the developing sedimentary basins in the North Sea and Atlantic Approaches. Rather later, oceanic crust began to form further to the west and the general sag continued apace. It seems likely, therefore (but there is disagreement) that highland Scotland was once host to significant accumulations of younger

sediments which were unconformable on the basement of Moine Schist and Lewisian Gneiss etc. that we take for granted today. It was this concept which so excited the Victorian geologists when they realised that the ancient Torridon Sandstone had buried an older landscape of eroded Lewisian Gneiss with considerable topography.



Major basins off the NW coast have existed since the Devonian, and as the sag continued they have been buried by much younger sediments, while the mountains of the day have been lost to sight beneath the newer cover rocks. That those mountains were real and had a long history of weathering has become obvious now that they have been reached by the probing of wells seeking petroleum beneath the waves. And not only are the rocks fissured and porous, they are filled in places by oil that has leaked out of the younger rocks in the adjacent basins, so a series of promising wells have been drilled along the ‘inside’ of the buried Lewisian Gneiss mountains close to their unconformable contact with the overlying sediments. That is as far as the process has reached today, and it was my privilege to visit the rocks sampled by the drilling programme and currently residing just off the M3 in Surrey, rather than 2000 metres beneath the North Atlantic and half way to Iceland or at outcrop in Ross-shire and the Outer Hebrides. All in all a most interesting scenario, and well outside the comfort

zone of most petroleum geologists! If you want to read more, start searching the web for publications on the Rona Ridge and the exploration wells of Hurricane Oil. It's not a secret!

Read on for more on the summer programme of field meetings and the forward programme of events. We look forward to your company.

Jonathan Wilkins

Editor's Note: Mention of Swedish ladies and jellyfish in the same article reminds me of a very interesting Saturday afternoon from my youth at Caswell Bay on the Gower Peninsula, near Swansea. Remind me to tell that story sometime!

Articles:

Rhydymywn Valley Historical Society

The dates of the 2018 open days at the Rhydymywn Valley tunnel site near Mold have been announced (see Dates for Your Diary).

The available spaces are strictly limited, and anyone wishing to attend must book in advance. Information packs are available at:

<https://rhydymwynvalleyhistory.co.uk/events/events-2018-tunneltours.htm>

Please note that a contribution of £5 per person to cover costs of insurance and kit is requested, and that visitors must be 16 years old.

KHN

What's this then?

The latest in our occasional series of perplexing oddities from the smorgasbord of the North Wales rock record is from the Cambrian Ffestiniog Flag Formation, part of the Merioneth Series Mawddach Group, in its magnificent coastal exposure (defined reference section) at Portmeirion, Gwynedd.

This feature occurs on the upper surface of a bedding plane. The BGS Lexicon description of these rocks states:

“Regular alternatives of quartzose siltstone and sandstone in beds up to 2m thick, interbedded with silty mudstone; abundant sedimentary structures”.

Nothing obvious on which to hang a hat

in that description, other than the “abundant sedimentary structures”. During previous visits I have seen many trace fossils (mostly *Planolites* and *Arenicolites*) and frequent broken up shell fragments, tentatively ascribed to *Lingula*.



Frankly I couldn't make my mind up...natural? anthropomorphic? biological origin? physical feature? It looked mostly like a trail of something that you might find on Bangor High Street during Fresher's Week, but is quite literally “rock hard”.

Answers on a postcard please!

KHN

Job Opportunities

Until recently Geotechnics Ltd. In Chester were the NWGA's hard copy sponsors. With the principle of quid pro quo in mind I have noticed they are currently in search of graduates with an earth or environmental science background, and a more experienced individual with a background in Site Investigation Estimating.

Advertisements for current available posts can be viewed on line here:

<https://www.geotechnics.co.uk/careers>

For individuals with significant post graduate experience there are a number of jobs currently advertised with the Coal Authority:

https://ce0108li.webitrent.com/ce0108li_w ebrecruitment/wrd/run/ETREC106GF.display_srch_all?WVID=90092702ct&LANG=USA

The Programme Manager for their metal mines project looks to be particularly interesting role for the individual with the right experience, although quite how that fits within the remit of the Coal Authority is causing me some confusion (there's a clue in the name folks!)

KHN

Reports:

NWGA Field Meetings

Penrhyn Quarry. Saturday 15th July,

Production of Slates in North Wales is divided into two principal regions according to the age of the formation which is host to this very special development of lithology and cleavage. In the Ffestiniog district the strata are Ordovician in age, while the more northerly belt of outcrop running from Nantlle through Llanberis to Dinorwic is of Cambrian. Production from Silurian strata and in other areas such as Corris was never so extensive, or successful as that from the younger strata.

Another difference is that the Ordovician slates are mined from beds separated by barren sandstones (termed granite by the quarrymen, sadly) in underground workings reaching significant depths, while the Cambrian strata are much thicker and are typically won from open quarries operated upon many levels. The archetype of these is the Penrhyn Quarry near Bethesda, which has seen continuous production since the 16th century, and in the late 19th century dominated production at levels regularly exceeding 100,000 tons of finished goods annually and earning the title of the world's greatest slate quarry.

Advances in mechanisation of production, however, has resulted in the older workings being obliterated, and a major slope failure has resulted in cessation of extraction from the northern, galleried pit which is so often shown as a book illustration. Production has been moved to the southern pit, and tipping has resulted in huge changes to the landscape, while part of the derelict site has been occupied by the ZipWorld adventure attraction. In contrast, the abandoned quarries of Dinorwic were never mechanised to the

same extent, and following the total and rapid shutdown of production have been preserved as a monument within the context of the Padarn Country Park and the associated museum.

Since the Penrhyn Quarry is in continued commercial operation, access is not straightforward, not least because the site has never encouraged or developed any profile as a visitor attraction, although the Zip World complex now occupies the north-western area of the quarry where extraction ceased many years ago. Another problem is caused by the almost continuous operation of removing overburden from areas newly opened to extraction, since it is expected that plant operation and haulage create constant traffic on the roadways. Therefore, a walking itinerary was ruled out and it was necessary to hire a minibus to accommodate our party, augmented by the leader's company vehicle.

An initial briefing and familiarisation took place within the canteen building, and we were treated to refreshments by our hosts Welsh Slate, to whom we extend our thanks. David had prepared a presentation on the history of the workings as well as its geology and an introduction to the geotechnical problems that have always dogged the operation of the site. Suitably refreshed and informed, we commenced the tour.



The first part of the visit was spent at the level of the main office where we were able to examine the Sebastopol water balance (see above) which was used to raise product from the lower parts of the northern pit to reach the railway network of the workshop level which is where all the production of finished slates and graded aggregates has always taken place. The use of the weight of water to move material is intuitively simple, but relies upon the water being able to escape when the job is done, rather than flooding the pit! Moving on, we came to a viewpoint above the now water-filled northern pit and were able to appreciate the changes to the geography of the area today compared with the historical and much published view of the great amphitheatre with its multitude of horizontal galleries and ‘*blondin*’ hoists for raising waste.

The structure of the subsurface is in the form of a major syncline whose limbs are not symmetrical. The axial plane runs in a north-easterly direction and defines the orientation of the cleavage, so production is jeopardised on the south-eastern limb of the syncline where the plane of the cleavage effectively ‘leans out’ of the quarry profile and creates a toppling hazard. Failure on this trend has occurred continuously during the life of the quarry and ultimately caused the abandonment of the lower pit in the late 1980s, following a sidewall collapse of around 3 million tons on the south-eastern face. The SE side of the modern pit is therefore buttressed by tipping of the overburden, which comprises some glacial deposits and around 65m depth of weathered and shattered rock that has no value for production. I found this disorientating, since my first view of the quarry was of the great amphitheatre in 1975, having climbed from Ogwen Bank to peep over the rim during a geology field excursion from Leeds University. Andy Siddans, who was leading us, made much of the green, elliptical spots in the

otherwise purplish-coloured slate and talked about strain and deformation, which went rather over my nascent geological head but certainly stuck in the memory. The other huge change is that trees are taking over the once barren slopes of waste, which is regrettable, I think. At least we didn’t see any rhododendrons! We were able to see in the distance the outcrops of a couple of dykes which were always troublesome during extraction because they were hard, useless and messed-up the cleavage in the slate. The encroachment of huge volumes of waste which has arisen from the northern pit is particularly notable.

The party then embarked in vehicles to ascend to the Holywell level some couple of hundred metres vertically and around 3km horizontally, which was a relief and meant that the party arrived fresh and fully able to enjoy the walk along the level, which curved around the eastern end of the southern pit and intersected the axial plane of the syncline. In this way we were able to explore the three main productive divisions of the slate beds which comprise the Red (Plum), Blue and Purple strata. It is very striking in views of the quarry just how pervasive is the purplish hue of the rock outcrop, after a while you cease to notice until your colour vision is recalibrated.

As we proceeded along the bench we encountered fascinating, clean out crop with faces rising around 10m to the next bench above. The purplish rock (Plum) was interrupted from time to time by green layers which were remnants of the bedding (top image, this page), while at the top of the face the dolomitic sandstones were clearly visible, distinguished by their different texture and the absence of cleavage.



deformation, which had produced the folding and cleavage in the slates. It also had a profound effect on the adjacent slates, and had created a selvage of green, massive slate nearly 0.5m in width. The picture hardly does credit to the feature, as the weather, whilst not unkind, did not give good light for photography. We were also treated to outcrop of some fantastic fault structures and stupendous views of the deeper benches of the quarry.

As we rounded the SW end of the pit we started to cross the successive beds and the faults which dissect the rock mass. It was here that we found one of the more beguiling features, another dyke that had rotted away almost completely, unlike the earlier example. Since we were unable to look at its deformation in the same way, there was much debate about establishing its age. However, close examination showed that it was porphyritic in a way that the Palaeogene dykes do not demonstrate, had the wrong orientation for the Anglesey Swarm and occupied a spotted hornfels selvage which had been deformed so that the spots had become long and thin. Some observers considered that this was the clinching evidence for intrusion before the generation of cleavage.



The intense weathering, we considered may result simply from the pervasive alteration and weathering in proximity to large faults parallel to the syncline which had created pathways for fluid transport. We were also able to see large and small-scale fold structures which were parasitic upon the larger structure of the syncline (see below), and excellent drag folding by the fault movements.

Sticking out from the face we found one of the dykes (above), which was clearly of Palaeozoic origin, because it had suffered brecciation and mineralisation because of its lack of ductility during the Caledonian



Finally, upon our return to base level we were able to examine the overlying Bronllwyd Grit Formation in the form of a number of glacial erratic boulders which had been transported down from the top of the workings with a view to sale as rock armour (below). The large scale of the conglomeratic facies and ripped-up clasts of slate, showed that the sedimentary environment had changed from the quiescence of the muddy deposition to one where presumably tectonic forces had come into play in a shallowing regime^[1].



The perfect exposure over long distances of the rocks in the quarry meant that tiny details could be examined which would not be visible in weathered, surface outcrop. Samples were taken for analysis of chemical and mineralogical content in order to inform on the basis of the colouring of the different slate facies, and

the results have been very illuminating. It has also been the basis of new work being done on the supposed ‘reduction’ spots and their nucleii which has excited and amazed seasoned researchers, and will we hope lead to new publication shedding light on a very old subject.

The NWGA wishes to thank Welsh Slate for their hospitality and David Jameson of GWP Consulting LLP who was our most informative and patient leader on the day.

Jonathan Wilkins

[1] Editor’s Question: Why shallowing? What depth evidence is there from the slates?

NWGA Evening Meeting

“Fossil plants, the evolution of a garden and it’s plants”

The first of this season’s autumn talks was an absolute gem. Following on from the earlier summer visit to his garden in Llanberis, Robbie Blackhall-Miles (<http://www.fossilplants.co.uk/>) gave us some real insight into the trials and tribulations of his palaeo-gardening enterprise. With stock picked almost exclusively from plants with close phylogenetic linkages to pre-Cretaceous terrestrial flora this work is clearly a devotion rather than a past-time.

The use of a 4.5m tape to represent the 450m million year (give or take) history of land plants, with potted representatives at the key branching points (sorry!) along the time line was a most effective teaching device, and one a few of us present will probably plagiarise in similar talks in future.

It became clear from Robbie's passion for the subject that this has been no ordinary hobby, and is developing into a significant piece of research in both plant conservation and palaeobotany. No wonder that the garden, despite its relatively small size was accepted with open arms by the Botanic Gardens Conservation International.

We closed with a rather thoughtful response to the question of what is Robbie's greatest worry? and we are back with that 4.5m long tape – and the observation that the ongoing trashing of our environment by mankind has been achieved in the equivalent of a mere 1.5mm at the end of that timeline.

KHN

Abstracts:

Member's Evening 6th December

Talks offered to date:

Keith Nicholls:

"The geology of Deeside, with particular reference to the Shotton Steel Works Site"

Jonathan Wilkins:

"Slates and their quarrying"

Please contact Gary Eisenhauer to register your interest in presenting.

Dates for Your Diary:

NWGA:

Autumn Evening Meetings

"Members' Open Evening" Wednesday 6th December, 2017.

All meetings 7:00PM for 7:30PM start, at Pensychnant, Conwy, unless otherwise noted.

NWGA:

Annual General Meeting

Saturday 27th January, 2018. 10:00AM, at Pensychnant, Conwy.

Please see formal notice at the rear of this Newsletter.

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Annual General Meeting

Saturday 27th January 2017 at 10:00AM

Pensychnant, Conwy

Agenda:

Apologies for Absence

Minutes of the previous AGM (January 2016)

Chairman's Report (& Membership)

Treasurer's Report

Elections for the posts of:

Chairman: (incumbent Jonathan Wilkins)

Treasurer: (incumbent Cathy O'Brien)

Secretary: (incumbent Lyn Relph)

Meetings Secretary: (incumbent Gary Eisenhauer)

Newsletter Editor: (incumbent Keith Nicholls)

Ordinary Committee Members: (All Positions vacant)

All current members have indicated their willingness to serve for at least one more year.

Any Other Business

Tea / coffee refreshments at 11:00AM

Following the AGM there will be a talk on a geological topic (starts at 11:30AM), speaker and subject to be confirmed

Weather permitting it is intended to have a short geological walk to a site of interest to the speaker – so please bring appropriate footwear for a yomp up, presumably, Conwy Mountain