Cymdeithas Daeareg Gogledd Cymru

North Wales Geology Association

NEWSLETTER

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Front Cover Image: Rock outcrops on the eastern flank of Llwytmor, above Llyn Anafon, belong to the Foel Fras Volcanic Formation. The interest lies principally in the frost-shattering of the hard rocks and the formation of a scree of huge, angular boulders. This is a peri-glacial phenomenon dating to a time of intense cold without continuous ice cover.

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Chairman's Message

It seems that the conference season is upon us - and no, I do not mean that of the political parties. In the past week I have attended two meetings that highlight the endeavour by specialists in physics and chemistry to bring us comfort and convenience from a geological base. Every commodity that we take for granted is sourced from on or within this small blue planet, and until we commence harvesting asteroids that is how it will continue. Although, if you take commodity pundits seriously, we have not only passed 'Peak Oil' but 'Peak Coal' and 'Peak A Lot of Other Things', so from now on recycling will become much more important.

The Physicists got in first with a symposium to mark the forthcoming end of generation by the Magnox fleet of reactors, of which the nearest, most powerful and now unique survivor is still fizzing away at Wylfa on Anglesey. It was a fascinating meeting and drew young students for whom a career may be beckoning and the 'grey-haired' members of the teams who designed and implemented the post-war nuclear power revolution. Part of the reason for that revolution was the insatiable rise in demand for power as austerity after World War II was relaxed, and the perennial shortage of coal at that time. Now, of course, in our Greenhouse-aware times we are desperately cutting back on coal, which is pure carbon and replacing it with gas which is about 75% carbon. The search for uranium, coal and gas has taught us much about the Earth, and the search for a safe repository for spent nuclear materials and their daughter products will teach us a great deal more. Maybe, the ground-investigation for the development of a new generation of nuclear power stations at Wylfa will give us greater understanding of the subsurface of Anglesey before it is finished.

Yesterday, as I write, it was the turn of the Chemists, at a meeting convened by the award-winning restoration of the Lion Salt Works at Marston, near Northwich. Salt has always been an important mineral commodity, as the basis of food preservation, as a condiment and as the starting point of an enormous number of downstream chemical agents and products. Indeed, the availability of salt in western Cheshire made it the crucible of the chemicals industry, manufacturing everything from soap, bleach and glass to plastics. Unfortunately, since the beds of salt that were first exploited were at little over 40m in depth, the legacy of their removal was ground subsidence on a legendary scale, and those holes were quite capable of swallowing the works buildings which were set above them.

Northwich today bears a continuing legacy of ground movement that has meant innovative ground-engineering as well as a lot of

money spent in grouting up the holes that remained - even when they were supposedly designed to be secure. Salt is prone to creep, and the creep rate was underestimated despite the best intentions of the mine engineers. This tendency - or halokinesis - is responsible for the formation of some of the planet's largest oil reservoirs and has profoundly changed the configuration of the upper crust in many parts of the world, the North Sea and Gulf of Mexico to name a couple of important ones.

So finally, I have to remember the Civil Engineers who are brought in to build, to remedy and to remove the structures which are part of our complex lifestyle. Without reliable roads, railways, dams, waterways and shopping centres it would all grind to a halt (as the A55 near Penmaenmawr seems to do on a daily basis, and has done it seems almost permanently in memory while the lights, crash barriers and verges are endlessly primped and tweaked without a care for the millions of man-hours of dislocation caused). So, the task of reviewing for our illustrious Editor the latest volume by Doug Nichol of "Urban Geology in Wales"* has been a delight, renewing aquaintance with engineering projects that I have glimpsed in passing or followed from afar. One has been the site of a visit by our Association in the past, and I think we must try harder to get out more - though the teams responsible are on onerous contracts with their paymasters these days, and any excuse to keep visitors away may be seized upon as necessary.

I am pleased that relations with our neighbouring geology groups continue to flourish. I am already booked to lead a visit to the Conwy district by a party next year, and I am sure it will not be the only one. I am delighted that we are able to sustain interest in the geology of North Wales and help others to enjoy the rocks which we take for granted. I hope that you will continue your support of the Association over the forthcoming year, and that your committee are able to deliver a vibrant and stimulating programme of meetings.

Jonathan Wilkins

Editor's Note:

* Jonathan's review is not copy ready yet and will therefore appear in the next edition of the Newsletter in the New Year

Articles:

The Middle Cambrian St David's Exposure at Ganllwyd, Coed y Brenin

The Cambrian System is of particular relevance in Wales because it was defined here. Adam Sedgwick named it after classifying the Welsh rocks, John Salter found the best fossils, apparently when he got lost, and we have some extensive exposures here. The Cambrian ended 488 million years ago with the beginning of the Ordovician System (marked by the first appearance of graptolites), but the beginning of the Cambrian is more of a moveable feast. It is generally considered as being defined by the appearance of burrows in sediment at *circa* 540 million years old. The Middle Cambrian – wherein Salter found his fossils – occurs around 510 million years ago.

Undoubtedly the best exposures of Middle Cambrian rocks are to be found in the cliffs at St. David's in Pembrokeshire (Figure 1), and the series is known as St. David's.

Figure 1: Porth-y-rhaw, St David's Peninsular, Pembrokeshire.

By the Middle Cambrian, the fauna of trilobites is amongst the most recognisable, and includes the characteristic *Paradoxides davidis*, a veritable giant, attaining a length in excess of 30cm. This is the 'National Fossil', and many museums boast impressive specimens as the prize of their collections. All of these come from South Wales, although the same rocks also crop out in North Wales.

At Pont Tafarn Helyg in Gellilydan (SH 687 398) – those dark mudstones in the riverbed are Middle Cambrian. Volume 18 of the GCR (Rushton 1999) identifies Afon Llafar (SH 735 364) as St. David's, and there are good outcrops above the waterfall at Ceunant Llennyrch (SH 668 388) and on the Lleyn. At Ganllwyd, dark Clogau shales rest on top of paler Gamlan mudstones and sandstones – The North Wales equivalent of St. David's series. The Geological Survey identifies a rich fauna from various locations along the Mawddach, but it is restricted to the Clogau shales, and being soft,

they have either eroded away or been colonised by vegetation.

In 2010, a mountain bike trail was cut through felled forestry above the old bridge at SH 737 276 (Figure 2).

Figure 2: Rapidly-vegetating Clogau Shales (St. Davids) at Ganllwyd, Merionnydd.

The trail winds up the slope, and exposes different levels through the Clogau shales. At the bottom of the slope, just north of the bridge, thinly-bedded soft shales exposed in the bank yield *Centropleura* (syn. *Anopolenus*) *henrici, Holocephalina incerta* and the agnostid trilobite *Ptychagnostus punctuosus*. The weathered nature of the shale suggests these have moved down the slope by mass flow. Follow the cycle route upwards (beware! Mountain bikers with no heed for life and limb hurtle down this route!) and there is a spring line cutting across the track. The banks of the spring expose a section of crumbly shale where *Parasolenopleura* cf. *applanata* (Figure 3) occurs, although trilobites are far from common. Continue up the track to where it joins the council road. You will now be at the top of the exposure and standing on dark mudstones with a varied lithology: some of the rock is very hard, but there are shale zones within it. There is an old exposure on this ridge, from where the trilobites *Eodiscus punctatus* (Figure 5) and *Meneviella venulosa* (Figure 4) occur.

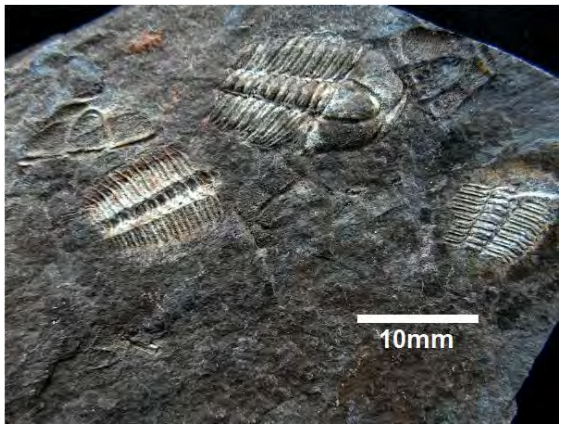

Figure 3: *Parasolenopleura cf.applanata*

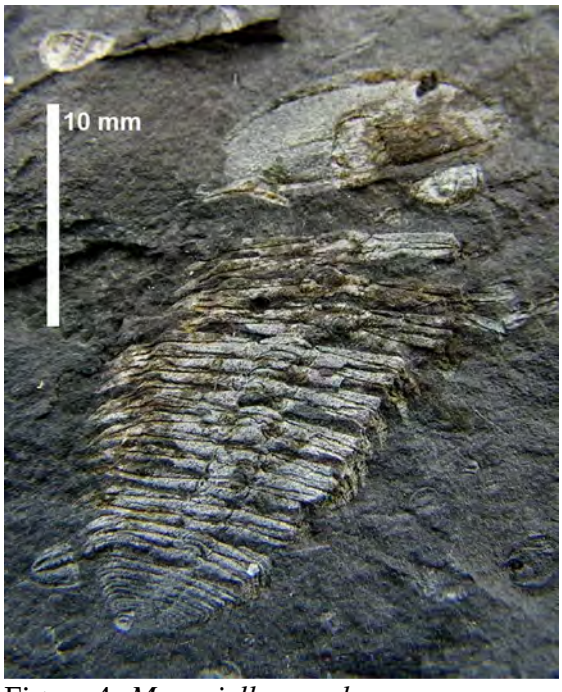

Figure 4: *Meneviella venulosa*

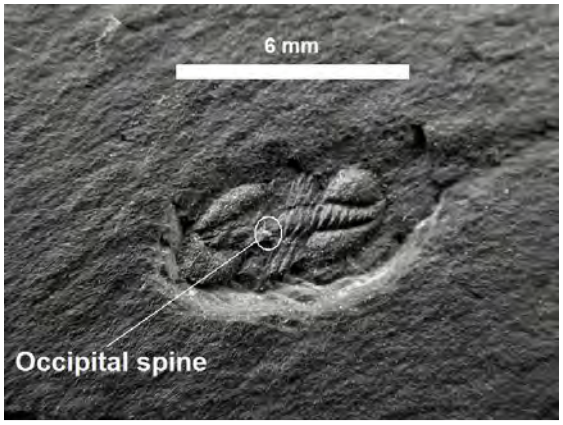

Figure 5: *Eodiscus punctatus*

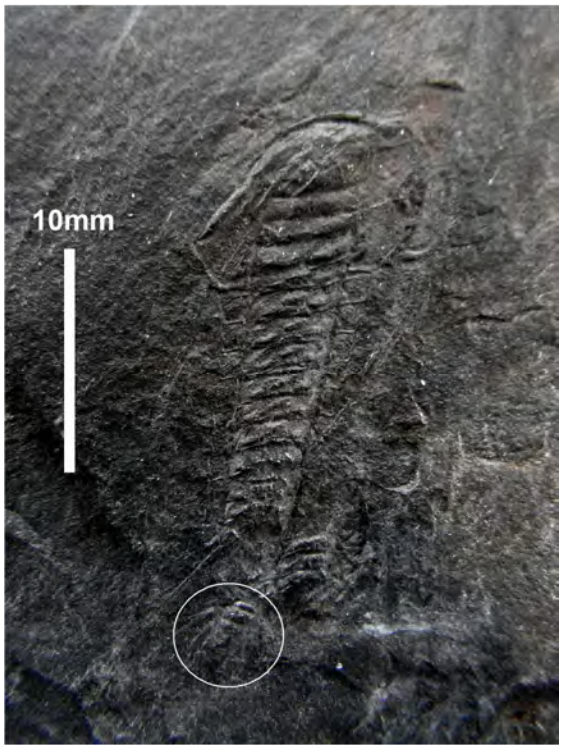

Figure 6: *Paradoxides*

Occasionally the former is abundant. These are all classic St David's series trilobites and each one characterises a particular zone, but of the giant *Paradoxides* there was no sign. It was recorded here by the Geological Survey (Allen 1985) but no material, collected over several years, could be attributed to it. Then in 2015 a single specimen was found at the top of the slope, in the *Eodiscus-Meneviella* zone (Figure 6). It is complete but a mere baby, measuring just 25mm in length. The distinctive pygidium (tail segment – circled in Figure 6) confirms the identification, but it has exceptionally long genal spines (either side of the head) and the way they fold back across the thorax indicates that this is a moult. The animal crawled forward out of its exuvia like a car driving out of a garage.

National Fossil it may be, but *Paradoxides* is not common in Wales. It is absent from the Middle Cambrian exposures at Porth Ceiriad on Lleyn, and although reputedly common at Ceunant Llennyrch, you would be unlikely to find anything there, and the designation as a Special area of Conservation, and a SSSI, prohibits any excavation. Ironically, giant Paradoxidid trilobites (including *P. davidis*) are best seen from St David's exposures in… Newfoundland! Many huge specimens have been recovered from Manuel's River, northwest of St. John's on the Avalon peninsular (Figure 7a or b). Doubly ironic, a good geological field guide to the Avalon peninsular (Boyce 2001) and the excellent geological report of the area (Fletcher 2006) are useful guides to the same Cambrian rocks and their fauna that you might find in the Middle Cambrian of Wales.

Richard Birch

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Boyce, W. D. (2001). Trip A3: *Classic Cambrian Trilobite Localities of the Conception Bay South Area, Avalon Peninsular, Eastern Newfoundland*. St Johns, Newfoundland, Geological Association of Canada / Mineralogical Association of Canada.

Fletcher, T. P. (2006). *Bedrock Geology of the Cape St Mary's Peninsula, South West Avalon Peninsula, Newfoundland*. St Johns.

Rushton, A. W. A., Owen, A.W., Owens, R.M., Prigmore, J.K. (1999). *British Cambrian to Ordovician Stratigraphy*, Joint Nature Conservation Committee.

The use of "open nomenclature" in the naming of fossils.

In a number of recent articles and site visit reports in this newsletter the use of "open nomenclature" has been apparent. Given that some of our readership may be unfamiliar with its use in the detailed description of fossils (and trace fossils) it is worthwhile presenting a brief summary of current usage.

Hopefully most of our readers will be familiar with standard "Linnaean" binomial nomenclature based on *Generic* (first letter always capitilised) and *specific* (first letter never capitilised) pairs of names (think of these respectively almost as surnames i.e. family (*s.l.*) names, and given i.e. individual names), so:

Nicholls keith

or, applied to the real context:

Homo sapiens
Gorilla gorilla
Tyrannosaurus rex
Paradoxides davidis

In the preceding article (Birch, R., 2015) reference is made to:

Parasolenopleura c.f. *applanata*

Parasolenopleura applanata is the generic and specific name for a particular species of Cambrian trilobite. What however is the meaning of the "c.f." designation?

The c.f. is a commonly used indicator which means "compare with" by which means Richard is stating:

"I'm able to assign this specimen to the genera *Parasolenopleura* – beyond that it appears to be the species *P. applanata* – but I'm uncertain of that assignment for the moment".

There are a number of other such qualifiers used by palaeontologists and the more commonly used are as follow:

aff. – this indicates that a new i.e. previously undescribed taxon appears to be related to an existing named taxon.

? - indicates that any identification is far from certain, typically as a result of poor preservational detail.

n.sp. - indicates that the fossil cannot be ascribed to any existing species, and we are therefore dealing with a new species.

Occasionally readers may come across generic or specific names written between a single pair of inverted commas thus:

'*Brontosaurus*'

This indicates that the name is now deemed to be obsolete (taken over in this case by *Apatosaurus* of course). In my work on the Hirnantian rocks of the Bala district I frequently come across references in early twentieth century literature to the brachiopod *'Orthis' hirnantensis* (M'Coy) which is now more correctly, and pretty much ubiquitously, referred to as *Eostropheodonta hirnantensis.* In referring to this brachiopod as quoted by for example Elles (1926) I would be expected to write, on first occurrence:

"Elles records the presence of the distinctive brachiopod *'Orthis' (Eostrophedonta) hirnantensis* M'Coy" in the Hirnant area of the Bala District."

Subsequent use would revert to the simpler *E. hirnantensis.*

The final comment worth stating is the use of *s.l.* and *s.s.* which are used to signify something applied in the "loose sense" or the "strict sense", following respectively the Latin *"sensu lato"* and *"sensu stricto".*

This brief explanation is a rather over simplistic summary of a paper published in 1988 by Peter Bengston. The interested reader is directed at the full article (referenced below) for a more thorough, but brief and easily readable, review.

Keith Nicholls

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Bengtson, P. (1988). "*Open nomenclature."* Palaeontology. Volume 31, Part 1, pp 223-227.

Birch, R. (2015). *The Middle Cambrian St David's Exposure at Ganllwyd, Coed y Brenin.* Newsletter of the North Wales Geology Association, **90**, September 2015.

What's this then?

It was found by an eight year old girl from Port Dinorwic sailing club who has developed an interest in rocks from listening to me tell her about some rocks that she brought back from Cornwall this summer. Her name is Leah and she went sailing in her small Optimist class boat from Port Dinorwic to Abermenai with her family in an accompanying small cruiser for a weekend camping adventure, the journey itself being quite a big effort for a small child in a small boat a journey of some 6 nautical miles in each direction. On her own initiative Leah brought back five pebbles that she thought would be interesting.

I could readily identify four out of the five pebbles and tell their stories for her, but this one has me absolutely confounded. I brought it to the last meeting of NWGA in Pensyschnant and various suggestions were made, but these were based on the possibility that the round sections might be crinoid ossicles.

However, testing with dilute acid indicates no calcite present, the whole thing appears to be formed from very fine grained siliceous material, and the circular features do not carry through the specimen from one side to the other. Photographs A and B show the two larger sides of the pebble.

Photograph A

Photograph B

There is no radial structure within the circular features but there are concentric colour changes from the external black to internal white and pinkish material. A close up photo shows the intersection of some of the black outer edges of the circular features where they appear to have grown into each other (photograph C).

Photograph C

Photograph D

In the centre of one of the whitish circles there appears to be a hole where there appear to be small crystals of quartz. (Photos D and E).

Photograph E

The fact that this rock was found on a beach at the western end of the Menai Straits means that its origin could be from anywhere in the UK or further afield. It seems likely from its very polished surface that it may have been transported to this area by ice, but, as this is within an area of confluence of the north Wales ice sheet and the Irish Sea ice sheet, its origin could possibly still be geographically within anywhere in the northern half of the UK or even possibly Scandinavia. The other less problematic pebbles from the same location were Carboniferous black limestone with *Syringopora* coral, probably from the Benllech area of Ynys Mon, a striped mudstone possibly from southern Snowdonia, a dark grey phyllite with a rose quartz vein possibly Dalradian from Scotland, and a piece of purplish material with blobs of jasper within it, which looks like volcanic ash material from within the local Gwna Group pillow lavas and associated sediments which crop out at Llandwyn and Porth Dinllaen.

I have not seen a rock similar to this pebble anywhere in the UK but my knowledge of the geology of the UK is not as complete as it could be which is why I ask the question. Has anyone seen anything like this and can help with the mystery of what this pebble might be? I would be grateful for any suggestions that might help with answering this question because little Leah is very desperate to know what this specimen is especially as we have

told her that it is an important and interesting rock and that the clever people of NWGA might be able to identify it.

Cathy O'Brien

The geologist in modern popular culture

What to make of the opinion of us of those around us? - *"O would some power the giftie gie us to see ourselves as others see us"* as Burns put it.

I am often intrigued by comments from close friends and family along the lines of "How can you be interested in slopes?" to which I usually answer "How can you not be/" before suggesting we have to agree to disagree. But how is my profession thought of by wider society?

There is a lot of geology in the news these days – volcanoes, earthquakes, fracking, sink holes etc., and we are of course contributing to the wider debates on energy supply, waste disposal and climate change. This has led to me wondering why there appears to be so little cultural reference to us in popular culture. Plenty of protest songs about politicians, soap operas about the police and hospital staff, comedies about student life and so on and so forth. Yes, we do occasionally get to see Iain Stewart presenting, and David Attenborough was something of a pathfinder for the likes of Alice Roberts, Alan Titchmarsh and Julia Bradbury who have all presented programmes of broad geological interest in recent years. However, if we ask the general public who is the most well-known geologist in the UK at the moment, after Ian Stewart I think most would not be able to add to this list of one.

So searching around modern popular culture, where do we find references to our profession? There is one particularly rich mother lode to mine; step forward Sheldon Cooper of the Big Bang Theory whose antipathy to the "rock monkeys" he is forced to share his department with is legendary:

"Did you throw a children's party while I was away"?

"Oh no – what have I done?"

"Geology is not a real science"

A much more positive image perhaps is portrayed in the American cartoon series "American Dad"

"It's true what they say about geologists; they are the coolest and sexiest men alive."

Check this out at : https://www.youtube.com/watch?v=DWiIIhAh2-U

Can't really add much to that…apart perhaps a note of apology for the sexist stereotype to our lady members.

Keith Nicholls

GB3D from the BGS

Members of the North Wales Geology Association (NWGA) maybe interested to know about the National Geological Model (NGM) released by the British Geological Survey (BGS).

The NGM (named GB3D) was first released in 2009-2010 and, at that time, only covered Wales and England. In December 2012 an update was released that took into account the Isle of Man and Scotland and it has undergone several new developments up to the present day. The model is based on 121 geological cross sections with a linear length in excess of 20,000km. GB3D forms part of BGS's work on better communicating the geology of the UK and is accompanied by brief accounts of the regional geology of England,Wales and Northern Ireland published in 2014.

GB3D has been part-funded by Radioactive Waste Management who use it to support their work on national geological screening following some initial funding by the Environment Agency. The

information behind the model is based on corporate databases and dictionaries including subsurface, offshore survey memoirs and atlases together with contour and isopach maps, existing models and geophysical data.

Geological maps have typically been limited to two dimensions with many only having a single cross-section representing a slice through the earth's crust. The NGM takes individual cross-sections generated using modelling software (GSI3D) and correlates them to create a nationwide fence diagram.

The NGM extends the 2D geological map of Great Britain into the third dimension with the current version including the extension of selected cross-sections into the nearshore zone around England and Wales. GB3D shows the sub-surface structure of geological formations including important aquifers. By improving the understanding of 3D geometry at depth it will help identify and therefore protect significant natural features such as nationally important water resources.

The tool is a way of visualising national-scale geology that can benefit those wanting to understand its relationship with landscape and resources (such as water, oil, minerals, coal and gas) and for educators and the public.

GB3Dis available for free download in a number of formats including 3D PDF, 3D Shape files, KMZ (for Google Earth) and in the bespoke BGS Viewer from the BGS website:

http://www.bgs.ac.uk/research/ukgeology/nationalGeologicalModel/GB3D.html.

The terms of use are straight forward and the GB3D downloads are delivered under the Open Government Licence, subject to the following acknowledgement accompanying the reproduced BGS materials: "*Contains British Geological Survey materials © NERC [year]*".

The fence diagram can be opened in Google Earth where you are able to rotate, tilt and zoom into areas of interest. The user can also interrogate each individual geological layer and find out more about its relationship with surrounding formations at depth. The information held in each layer includes the Rock Classification Scheme (RCS) lexicon, RCS descriptions, hydrogeological descriptions and aquifer designations. GB3D enables users to easily visualise the subsurface at county, regional and national scales and also understand the complexity of the geology in the context of aquifer vulnerability.

Note: Wales comes under UK Region 18 when selecting layers to import into Google Earth.

Another useful tool for viewing the GB3D model is the BGS' Lithoframe Viewer. This can also be downloaded from the BGS Website at:

http://www.bgs.ac.uk/downloads/start.cfm?id=2091

and it allows you to construct digital cross sections along coordinates of your choice. The outputs can then be viewed in the 3D viewer where it allows you to rotate the section to observe its spatial relationship with other formations.

It can be very easy, when working in shallow geological environments, to disregard the importance of the deeper geology and the role it had to play in forming landscapes and regions, the GB3D tool puts it on the map, quite literally!

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Hydrogeology & Environmental Consultancy

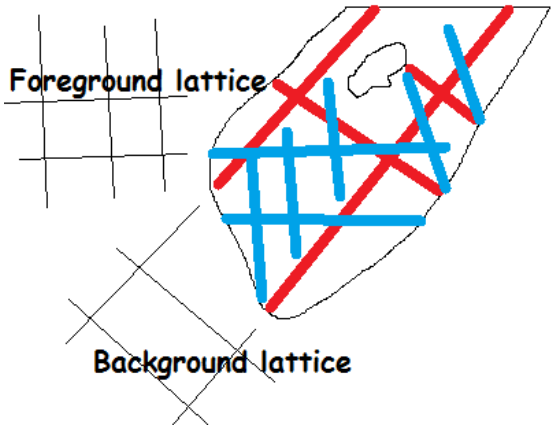
Discussion on "What's this then?" – by Jan Heiland

The question that occurs here is really simple – man made or natural? If we go for a natural origin then we need to offer up some form of mode of origin with some form of trace fossil suggested. *Cruziana* has been suggested, but these do not have the typical bilobed appearance of these trilobite locomotion traces (remember the *Cruziana* from our field trip to the Llyn a couple of years ago?)

Cruziana from Porth Ceriad, Lleyn (copyright KHN)

If these are trace fossils then they must surely fall into ichnogenera other than *Cruziana*.

However there appears to be a distinct regularity to the pattern, with a lattice work effect with what seems to be three or four preferred orientations, a background of right angled lattice work (in red below), and a foreground (blue) of interwoven trellis work.



I believe this is of man-made origin, and must represent some form of art work. Over to those with an archaeological background for further explanation I hope.

Keith Nicholls

Abstracts: NWGA Members' Evening Presentations

Cathy O'Brien
Lava Tubes in Tenerife.

There are a lot of lava tubes/caves in Tenerife, many are short and easily accessed with little heed to Health and Safety. Tenerife also has a very long lava cave complex at Cueva del Viento which has been developed by the local university as a place where students can learn about lava cave development. We visited this facility in spring 2015 and will share the story of lava caves in Tenerife and pictures of the cave complex.

Keith Nicholls
The Ordovician / Silurian Boundary – but in Oslofjord rather than the Welsh Basin

Most members will be bored rigid by my one-track research interests in the O/S boundary in the Welsh Basin. In this brief talk I will attempt to flesh things out a bit – by reviewing a recent highly productive weekend visit to Oslo.

Jonathan Wilkins
"Snowdonia Glacial Geomorphology – off the beaten track"

The upland areas of Snowdonia are rich with the legacy of glacial erosion during the last glacial maximum. Visitor pressure on Cwm Idwal is now so high that parking vehicles can be a limiting factor at

popular times. However, there are a number of rewarding and fascinating glacial and post-glacial features close at hand within the rather less-visited areas around Llanfairfechan and Abergwyngregyn. This talk will take in some of the geological and geomorphological gems of the district.

Gary Eisenhauer
Volcan Villarica
Gary will regale us with his memories of a trip to the summit of the active Volcan Villarica in Chile. It's the same volcano that erupted in about Feb 2015.

Talk to follow Annual General Meeting

"The tectonic history of the early Cenozoic period in the British Isles"

Philip Firth

The tectonic history of the early Cenozoic period in the British Isles was largely defined by the opening of the North Atlantic, Alpine collision and the formation of the Icelandic mantle plume. This resulted in significant volcanism, referred to collectively as the British Palaeogene Igneous Province (BPIP) including the creation of giant dyke swarms that can be traced across Northern Ireland, the Irish Sea and into North Wales.

Flow processes and emplacement timing of Palaeogene dykes in North Wales were investigated using anisotropy of magnetic susceptibility (AMS) measurements, geochemical analysis and field observations. Two sets of dykes were identified for this analysis, the Holy Island Dyke near Trearddur Bay and the Llanbadrig Dyke near Cemaes Bay.

Given the broadly similar age range, NW-SE trend and geochemistry of Palaeogene dykes in North Wales and Northern Ireland, the original hypothesis of my Masters dissertation was that these intrusions may have been emplaced via the lateral transport of magma from a source in the Northern Ireland sector of the BPIP. This original assumption was based on extensive studies into the origin of giant dyke swarms related to Large Igneous Provinces. In many cases, these features have been interpreted as being fed horizontally across great distances from a common magma source (Ernst and Buchan, 1997). The Holy Island Dyke was dated by Evans et al. (1973) at 63.5-58.7Ma, making it contemporaneous with the the Carlingford Complex phase of igneous activity and during early Palaeogene, 61.5-59.5Ma (Mussett et al., 1988).

AMS measurements and field work observations revealed a range of emplacement processes and flow patterns in the dykes investigated. The clustering of AMS principal susceptibility axes was good, indicative of a normal magnetic

fabric, and magnetic lineation and foliation data pointed to a complex pattern of magma flow during dyke emplacement, with predominantly oblique to sub vertical movement of magma.

Field observations suggest that the 23m wide Holy Island dyke was created via multiple phases of magma injection. Field observations also revealed that these dykes had strikingly variable morphologies, including steeply dipping walls, non-linear pathways through the landscape and very bumpy dyke margins, features that significantly influenced magma emplacement and the creation of the rock fabric.

Geochemistry results revealed that the Holy Island Dyke is composed of tholeiitic basalt. A comparison of geochemical data, in particular levels of MgO and the Cr, Ni and Zr trace elements, suggests that the Holy Island Dyke may have shared a common magma source with the Donegal-Kingscourt dyke swarm in Northern Ireland. In both cases this source may have been fed directly from the mantle where partial melting created tholeiites with the high chromium and nickel values observed. The Llanbadrig Dyke is composed of basalt andesite, an indication that it may have been fed from a proximal source where magma resided for a period of time sufficient for it to become more evolved before intrusion.

In summary, although these dykes share many similarities in their geochemistry, AMS results do not support the idea of lateral magma transport from the Carlingford Complex in Northern Ireland into the Palaeogene dykes of NW Wales. An alternative source of magma for BPIP dyke swarms was proposed by Speight et al. (1982) based on intrusions being vertically fed from ridge like basaltic magma chambers at depths of 20 to 25 km.

Certainly in the case of the Holy Island Dyke, upwards propagation of basalt magma formed in the mantle from an elongated magma source deep in the lower crust, aligned with the regional stress field, is a better fit than the lateral flow model.

Palaeogene dyke: Treaddur Bay, Ynys Mon, Copyright - Jonathan Wilkins

References:

Cooper, M.R., Anderson, H., Walsh, J.J., van Dam, C.L., Young, M.E., Earls, G., Walker, A. (2012) '*Palaeogene Alpine tectonics and Icelandic plume-related magmatism and deformation in Northern Ireland*' Journal

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Speight, J.M., Skelhorn, R.R., Sloan, T. (1982) '*The dyke swarms of Scotland*". In Igneous Rocks of the British Isles (ed. D.S. Sutherland)' Wiley, Chichester, pp. 449–59.

Reports:

NWGA / GSOL Joint meeting 22nd October, 2015

Dr. Ian Stimpson of Keele University held at the University of Chester.

"Tales of Middle Earth"

This was the fourth annual joint meeting of the NWGA, and North West group of the Geological Society of London. As usual, the talk was very well attended, and pleasingly had a much younger audience than we are used to.

Ian gave a thorough review of crust, deep crust and mantle structure in an enjoyable and superbly illustrated (Ian is a Mac user) talk. The key take home for me was the need to be clear that variation in crust and mantle is more about phase / physical characteristics, than it is about compositional variability.

Following a lively Q and A session at the end (with the NWGA membership front and centre) we were left with a hangover from the Lisbon Earthquake – are we soon (in geological timescales) to see the establishment of an Eastern Atlantic Seaboard subduction zone off Portugal?

KHN

British Geotechnical Association XVI European Conference on Soil Mechanics and Geotechnical Engineering 13th – 17th September 2015

"Geotechnical Engineering for Infrastructure and Development"

With over 1000 delegates, and a prodigious proceedings volume that has become the largest book ever published by the Institution of Civil Engineers this was by any measure a major international conference.

What was surprising however was the lack of published information directly relevant to North Wales. Only four papers related to work in the Principality, two on the A465 Heads of the Valleys dualling scheme, one of the Swansea Bay Barrage, and one (Graham, Solera and Sanchez, 2015) relating to our patch, reporting on the Glyn Bends remediation scheme on the A5 near Corwen.

Over the years developments associated with the A55, in particular the Conwy Immersed Tube Tunnel and at for example Dinorwic have made North Wales something of a geotechnical hotspot. In South Wales work associated with tip stability (post Aberfan), rock slope stability, landslides and soft ground engineering has frequently been at the forefront of the geotechnical literature. It may be the case that given the easy access to

the published record afforded by the National Museums in Wales "Urban Geology in Wales" series; that our authors have written up all that is new, and of significance already? Hopefully it isn't the case that the innovative and interesting work is all being carried out elsewhere.

I enjoyed offering an oral presentation which grew out of the NWGA Members' Evening presentation on old mining photographs given to the NWGA two winters ago.

I was also involved in a poster presentation, co-authored with Cynthia Burek, which drew on finds made by Jan Heiland from Porthmadog and Joe Botting / Lucy Muir at Builth (see below) which was an appeal to the geotechnical community in general to pay a bit more attention to the rocks and soils that they are dealing with on a day to day basis:

KHN

Institution of Civil Engineers) Wales - Cymru 15th October 2015

Daryl Smith (JMC Engineering) held at Kinmel Manor, Abergele.

"Fire in the hole"

This paper described the remedial scheme put in place at Daw Mill Colliery, Warwickshire, following the 2013 fire which led to the closure of Daw Mill Colliery, and

the winding-up of UK Coal. Ownership of the below ground infrastructure reverted to the Coal Authority, who appointed JMC to undertake a safe method of putting out the fire and closing down the pit.

The fire is believed to have broken out at two locations below ground – at the working faces (some 12km distant from the shaft), and in coal storage bunkers near shaft bottom (some 500m below surface). With fires in both the workings and the shafts there was no means of safe man entry for the works.

The shafts were eventually sealed by tipping stone and a clay seal (at top and bottom of the Etruria Marl). The main incline / haul road was sealed by placing a grouted stone dam / stopping from a series of surface drilled boreholes which intersected the incline.

The works were undertaken in such a way that the Coal Authority and Environment Agency were satisfied with the outcome, and the surface site is now considered as suitable for potential redevelopment.

KHN

Publications relevant to North Wales:

Graham, J.R., Solera S.A. and Sanchez C. (2015) *"Investigation of rock anchorage failures and cutting remediation at Glyn Bends, North Wales,* UK", Proceedings of the XVI ECSMGE, Geotechnical Engineering for Infrastructure and Development.ISBN 978-0-7277-6067-8

Edwards P. and Murphy F. (2015), *"Managing the environmental legacies of Fron Goch Lead and Zinc Mine."* Proc. NAMHO Conf, Aberystwyth (July 2013), Editor: Shaw, R., Mining History – Mining Legacies: history, archaeology and environmental impact: Volume 19, No 3, (Summer) 2015. Peak District Mines Historical Society, Matlock Bath, ISSN1366-2511.

Sables. D. (2015), *"The Monks who mined."*. Proc. NAMHO Conf, Aberystwyth (July 2013), Editor: Shaw, R., Mining History – Mining Legacies: history, archaeology and environmental impact: Volume 19, No 3, (Summer) 2015. Peak District Mines Historical Society, Matlock Bath, ISSN1366-2511.

Timberlake S. (2015), *"New investigations and new ideas on Pre-historic - Roman metal mining and smelting in Wales."* Proc. NAMHO Conf, Aberystwyth (July 2013), Editor: Shaw, R., Mining History – Mining Legacies: history, archaeology and environmental impact: Volume 19, No 3, (Summer) 2015. Peak District Mines Historical Society, Matlock Bath, ISSN1366-2511.

Brewis, T. (2015),*"Penmaenmawr Quarries."* Proc. NAMHO Conf, Aberystwyth (July 2013), Editor Shaw, R., Mining History – Mining Legacies: history, archaeology and environmental impact: Volume 19, No 3, (Summer) 2015. Peak District Mines Historical Society, Matlock Bath, ISSN1366-2511.

Nicholls, K. and Hutchinson J.*"Lead and Zinc Mining in Flintshire – the engineering legacy of new development."* Proc. NAMHO Conf, Aberystwyth (July 2013), Editor: Shaw, R., Mining History – Mining Legacies: history, archaeology and environmental impact: Volume 19, No 3, (Summer) 2015. Peak District Mines Historical Society, Matlock Bath, ISSN1366-2511.

Jenkins D. *"Management of the Mining Heritage on Mynydd Parys."* Proc. NAMHO Conf, Aberystwyth (July 2013), Editor: Shaw, R., Mining History – Mining Legacies: history, archaeology and environmental impact: Volume 19, No 3, (Summer) 2015. Peak District Mines Historical Society, Matlock Bath, ISSN1366-2511.

If anyone wishes to review this special edition of the PDMHS Journal (Volume 19) for the Newsletter please let the Editor know.

Please aslo note that until the end of November all Royal Society Publications are free to access on line at:
https://royalsociety.org/journals/

Dates for Your Diary:

NWGA:
2015/2016 Programme

Wednesday December 9th, 2015
"Members' Evening"
Pensychnant, Conwy, 7:00PM for convivial drinks and nibbles with talks to start at 7:30PM.

Saturday January 23rd 2016
Annual General Meeting (see notice at rear of this Newsletter – followed by *"The tectonic history of the early Cenozoic period in the British Isles"* **by Philip Firth**

The Palaeontological Association

14-17th December, 2015

"59th Palaeontological Association Annual Meeting"
Cardiff University and Amgueddfa Cymru – National Museum of Wales
Further details on the Association Website at:
http://www.palass.org/index.php

GeoScience Wales

Thursday 12th November 2015; 6:00 for 6:30 pm
"Attributes for Success or Failure in Exploration Portfolios"
Matthew Taylor: Chariot Oil and Gas
Royal Cambrian Academy, Conwy

Geological Society of London (North West Group?

Thursday 26th November 2015; 6:30 PM
"Gas from Shale"
Williamson Building, Oxford Road, Manchester

Oreil y Parc Gallery, St Davids,

Daily until 25th November, 2015
"Alfred Russell Wallace – The forgotten evolutionist"
National Museum Wales Gallery, Oriel y Parc, St Davids, Pembrokeshire.
Gallery opens 10AM to 4PM
www.orielyparc.co.uk

Web Site and Social Media:

Up to date information on our activities is posted regularly on the Association web site at:

http://www.ampyx.org.uk/

A much more informal way of keeping in touch with an eclectic mix of NWGA events, and other geological News items is available on the NWGA Facebook page at:

https://www.facebook.com/groups/northwalesga/

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Formal Notice of 2016 Annual General Meeting

Saturday 23rd January 2016, Pensychnant, Conwy

10:00AM

Agenda:

Apologies for Absence

Minutes of the previous AGM (January 2015)

Chairman's Report (& Membership)

Treasurer's Report

Elections for the posts of:

Chairman: (incumbent Jonathan Wilkins)

Treasurer: (incumbent Cathy O'Brien)

Secretary: (incumbent Judith Jenkins)

Meetings Secretary: (Gary Eisenhauer)

Newsletter Editor: (incumbent Keith Nicholls)

Ordinary Committee Members: (All Positions vacant)

All current committee members have indicated their willingness to remain in post in the forthcoming year

Any Other Business

Tea / coffee refreshments at 11:00AM

Following the AGM there will be a talk by Philip Firth (see abstract elsewhere)

Weather permitting it is intended to have a short geological walk to a site of local geological interest in the early afternoon