

Cymdeithas Daeareg Gogledd Cymru ***North Wales Geology Association*** ***NEWSLETTER*** ***Issue 101 April 2020***

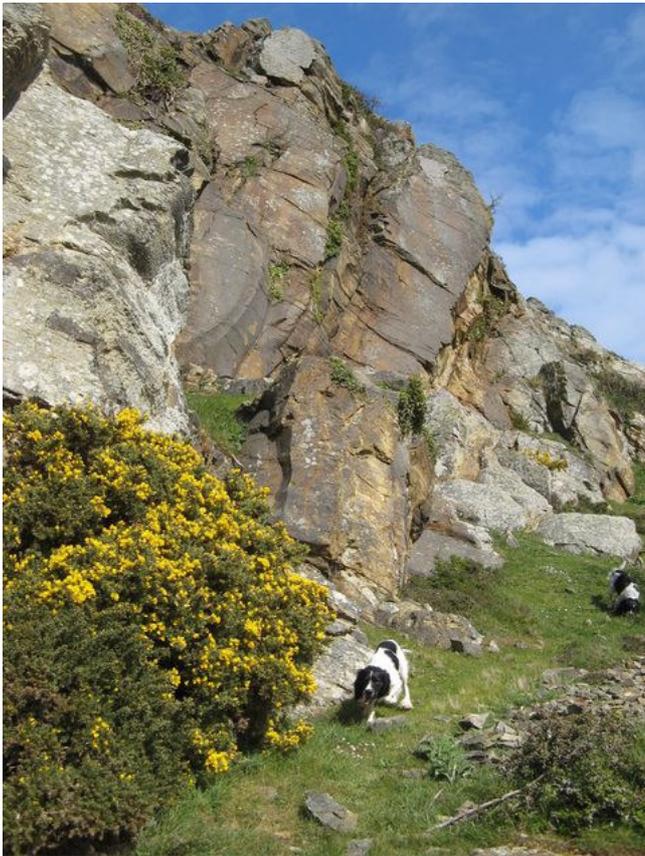


Chairman's remarks

By Jonathan Wilkins

When I started to write this we had not long since been entertained and enthralled by Dr. Sarah Davies from Aberystwyth at our regular meeting held at Pencychnant in February. I was reminded that the CHERISH project was funded through the INTERREG programme of the European Regional Development Fund, the current round V running from 2014-2020 and carrying a total worth of 10.1 billion Euro. I appreciate that other funding programmes do exist, but I thought it a great shame that we would be turning our back on an organisation whose principal objectives were to strengthen economic, social and

territorial cohesion throughout Europe and to diminish the influence of national borders in favour of equal economic, social and cultural development of the whole territory of the European Union. That's all the politics in this issue. At that point it appeared as if the separation of the UK from the European Union was going to the defining moment of 21st century history, but already a rather ugly plague was beginning to dominate life in far-off China. In the UK, however, it was flooding which filled the newsreels and it was not until the floodwaters receded that we woke up to what was heading our way. The rest is history, and on 16th March you will recall that I advised the indefinite postponement of our programme of meetings, which had begun to shape-up quite nicely. Since then we have been advised to limit severely all forms of social,

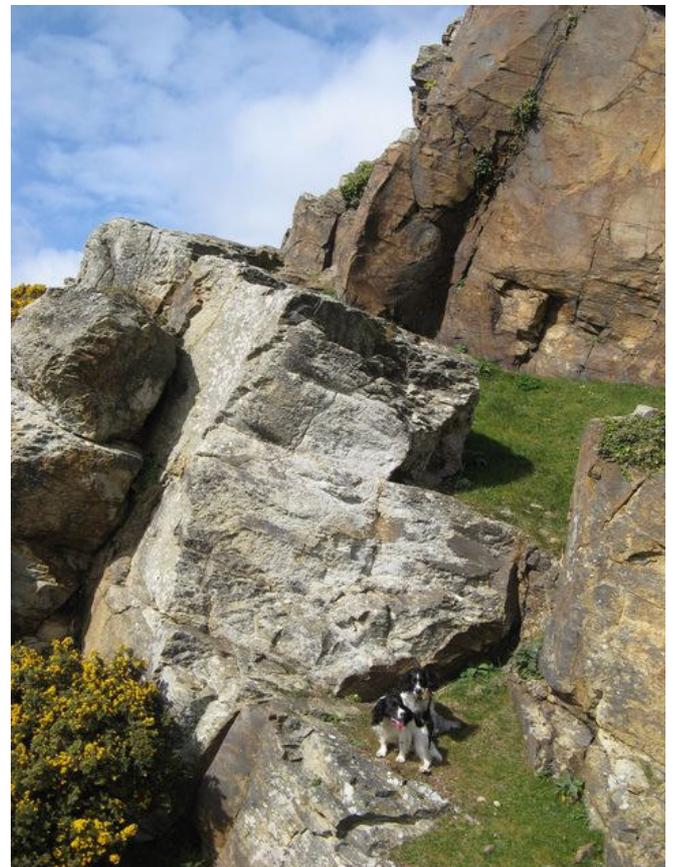


economic and educational congregation. I am working from home, and no longer able to handle or examine the geological materials which are analysed in the course of my work. It is a surprising handicap and a reminder that geological investigation is about observation. Now we cannot even go into the field to view the rocks, unless we are fortunate enough to live by outcrops within the compass of a moderate walk. Never have the rocks of the Vardre and Deganwy Castle been so visited and admired, especially by my two energetic Spaniel companions. It is particularly upsetting that I cannot undertake my usual peregrinations because they are what drive my personal field geology programme, and I have at least a couple of places I want to visit in case they are a good target for field meetings. Further, I have some field work to do on quaternary deposits with a view to publishing something on the red porphyry erratics of Arfon now that the lab work has come to a conclusion. And, piling on the insults, the weather has been good or superb for long spells after a simply terrible, wet start to the year. At least we can be certain that the rocks will not be affected by coronaviruses and will endure.

In my email message announcing the suspension of our meetings, I said that we would be working on alternative means of communication. This newsletter is the product of a determination to restart the publication under the editorship of Terry Williams, and we wish him well in his task. I am sure that he will be particularly well-disposed towards people who

send in editorial content, so please do not be shy. One sharp-eyed member spotted the error on the yellow membership form which you received in February. It seems that I cut-and-pasted a new 2021 date into one page of the original forms document and omitted the other. Thus 50% of what emerged had an end date of 31st January 2020, but it was not only your chairman who missed it. Whatever the date on your form you can be sure that you will be a member until next January, and if you have not yet returned your form and payment please do so soon. It is customary for me to examine renewals in detail at the point when I have to post the paper copies.

Finally, I have to say, quite simply, take care of yourselves, heed the warnings and we can with good fortune look forward to resuming our course through the geology of North Wales.



Illustrations

Images on this page are of Ordovician (Caradoc) rhyolitic tuff in a 19th century quarry site by Deganwy Castle. Lichen-covered outcrops of compact beds are overlain by more fractured and weathered material which has been worked for use locally as stone walling. The larger image is a wider view of the same quarry site, with a distant landscape view over the Conwy Morfa, Penmaenbach and Anglesey.

Kitchen table-top geology

By Keith Nicholls

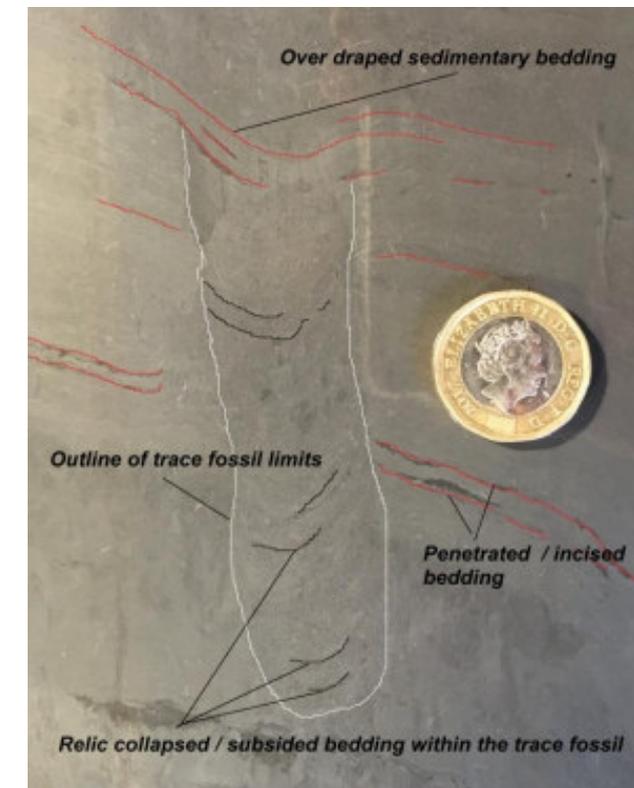


Fig.1 Image of trace fossil showing relic collapsed bedding within the trace fossil, bedding features penetrated by the trace fossil, and overdraped sedimentary bedding.

A few years ago I took the somewhat parochial, and perhaps a little self-serving, decision to pay the extra to make sure that our new kitchen top surfaces were to be sourced locally, as well as looking good. Consequently, the slate surfaces were procured from (I believe) Blaenau Ffestiniog, of which we have come to hear a lot in recent months.

Having lived with them for some time now, and despite noticing previously the presence of fairly widespread burrow mottling, I had not previously seen two occurrences, a few centimetres apart, of a

significant trace fossil. Figures 1 and 2, show these occurrences (apologies for the iphone reflection on both images). These show a thumb sized burrow-like feature within a near horizontally bedded sedimentary rock. The burrow appears to cross the bedding at right angles. Bedding within the “body” of the trace fossil can still be seen, but has suffered as a result of settlement. I believe that this trace fossil can be ascribed to the ichnogenus *Parahaentzschelinia* (Chamberlain, 1971).

Parahaentzschelinia is a typically funnel shaped trace fossil thought to be associated with either polychaete worms or bivalves making an agrichnial living by cultivating micro-organisms for food in complex tiered burrow systems (Reynolds and McIlroy, 2017). These occurrences seem to be a section through the periphery of the main funnel structure, as indicated by the section line A-A' in Figure 3 (modified after Chamberlain 1971).

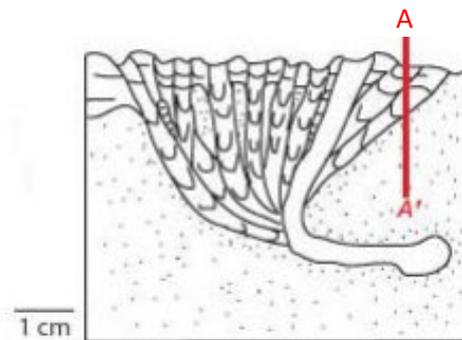
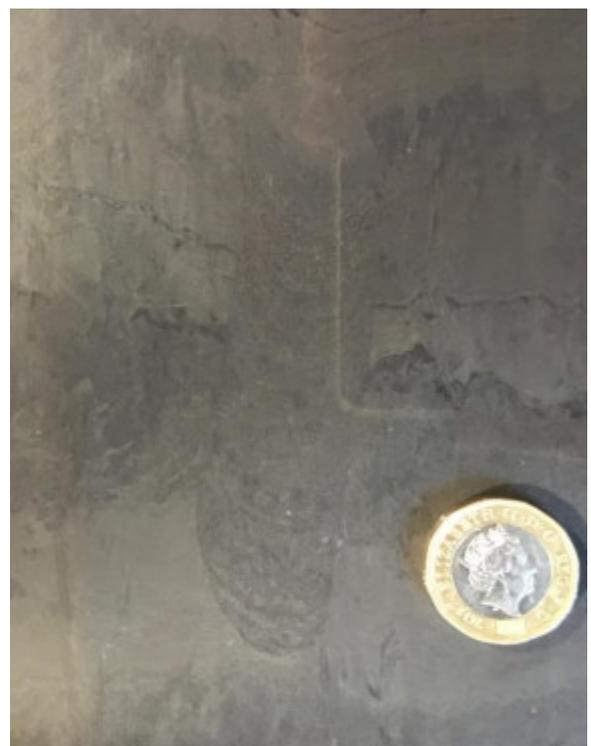
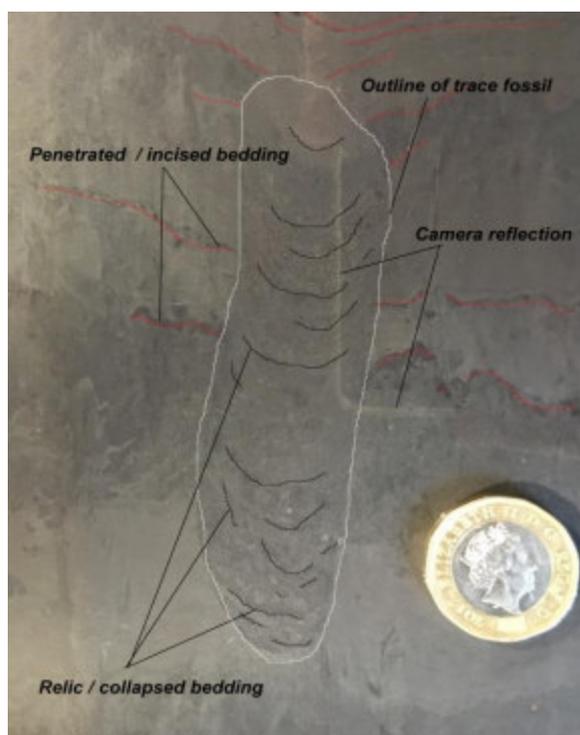


Fig.2 Morphology of the standard *Parahaentzschelinia* trace fossil with the section showing the location of the observed trace fossil A-A'





Figs.3,3a. A further example of the same trace fossil.

References

Chamberlain CK (1971) Morphology and ethology of trace fossils from the Ouachita Mountains, southeast Oklahoma. *J. Paleontol* 45: 212–246

Reynolds, R., McIlroy, D. (2017). Three-dimensional morphological analysis of a *Parahaentzschelina*-like trace fossil. *Papers in Palaeontology*, 3, 2, 241-258. DOI: 10.1002/spp2.1074

What is a Geopark?

By Dr Margaret Wood, Director and Principal Geoscientist, GeoMôn and Dr Stewart Campbell, Natural Resources Wales and GeoMôn Ambassador. Photos by Stewart Campbell.

UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.

See www.unesco.org/geoparks

How did Anglesey's UNESCO Global Geopark come about?

After working for nine years with the Countryside Council for Wales as the regional geologist for North Wales, Margaret Wood realised that the development of a geopark for Anglesey would be an ideal way of using much of the geoconservation information that had already assembled from previous projects in a sustainable way that would benefit the inhabitants of the island as well as visitors. These projects included documentation of all the nationally important

geological localities on Anglesey (Geological Conservation Review sites/Sites of Special Scientific Interest) as well as the more recently developed network of Regionally Important Geodiversity Sites (RIGS). What better way of protecting, using and publicising these magnificent scientific and educational resources could there be than to integrate them into a geopark - similar to the ones being set up in Europe.

Following in the footsteps of other important geological areas and territories that were applying to the European Geopark Network (EGN) to become geoparks, we decided in 2004 to try to get official geopark recognition for Anglesey. It took five years to fulfil all the conditions to join the EGN, and official geopark status for Anglesey was granted in 2009. In 2010, Anglesey's GeoMôn Geopark became affiliated with UNESCO. In 2015, EGN members were accepted as full members of UNESCO and we were bestowed formal recognition as GEOMÔN UNESCO GLOBAL GEOPARK. As such, we are formally part of this UNESCO program and under its jurisdiction. There are now 147 UNESCO Global Geoparks in 41 countries throughout the World.

GeoMôn today

GeoMôn is a registered charity and a social enterprise run entirely by volunteers. It makes important contributions to the international status of Ynys Môn and to the wellbeing of its people. Together with Fforest Fawr in the Brecon Beacons, we are the only two UNESCO geoparks in Wales; there are seven in the UK. Our geopark brings international recognition to the island and delivers unique information and activities that support tourism, education, and wellbeing in the region. We provide information to the public that explains how the geology of Ynys Môn underpins its rich natural and cultural heritage, as well as most of its historical and present socio-economic development including tourism, industry and agriculture. GeoMôn has designed and documented a series of trails that illustrates the geological highlights of the island. We offer talks and guided walks for school and university groups as well as specialist societies and groups like U3A. GeoMôn is run by 10 dedicated volunteer Directors, Chaired by Emeritus Professor Colin Jago of Bangor University. We maintain a Visitor Centre at the Watch House in Porth Amlwch that provides the public with information, literature, displays, and advice. You may have seen our Centre in the final program of BBC's "Hunted" when the hunted members escaped by jumping into the harbour and collecting their prize in the Rib Ride speed boat. When the Covid 19 emergency ceases, the Centre will reopen and display a new touch screen. We plan to re-develop our exhibits to be

themed on climate change through geological history. This should make the Geopark even more relevant to Anglesey's inhabitants and make us a greater draw to visitors.

Some current research

Margaret Wood is currently researching Anglesey's Precambrian stromatolites, which she was the first to describe in a short note in the journal *Nature* in 1973. The coordinator of the fossil group at UNESCO meetings has invited us to write a more detailed paper. This will include a more comprehensive description of the different types of fossil, possibly supplemented with age determinations using strontium isotope ratios. Stewart Campbell will provide photographic illustrations of salient areas and specimens *in situ*. We hope that Jonathan Wilkins will be able to facilitate analysis of rock samples for us.

Keeping our UNESCO accreditation

All Geoparks have stringent rules and are revalidated every four years. Revalidations are conducted by examiners from other UNESCO Geoparks. A colour-card-system is used. If all is well, and the geopark is operating sustainably and fulfilling the UNESCO rules, a green card is issued. A few small failings might warrant a yellow card, with two years given to put the house in order. A red card is given for breaking the rules or not showing sufficient improvement from the previous revalidation. Geoparks lose their UNESCO status and membership if a red card is given. So far, GeoMôn has received green cards. Next year we will be revalidated again, so we are working hard now to sort out the problems that were noted during our previous examination.



The GeoMôn Centre at the Watch House in Porth Amlwch

Get involved and help GeoMôn

We have a very good, hard-working Board and two Ambassadors. We have many wonderful volunteers who run operations at our Centre, the Watch House, in Porth Amlwch. We also have 16 qualified geoguides. We are always looking for more volunteers to help operate the Watch House. Anyone can

become a member of GeoMôn and attend our free annual members' walk. This year, 45 attended our trip to Newborough Forest and Llanddwyn Island with refreshments provided. We hope more members will join us this year when we visit the Porth Wen area on the island's north coast. The HOGG Group of the Geological Society of London is holding its annual trip this year on Anglesey and joining our excursions to Newborough, Ynys Llanddwyn and the Marquess of Anglesey's Column. Because this year marks the centenary of the publication of Edward Greenly's seminal geological map of Anglesey, Professor Cynthia Burek will celebrate this immense achievement at the grave of Edward and his wife Annie. Stewart Campbell and Margaret Wood will also showcase some of the classic sites where Edward Greenly was photographed in his memoir.



One of Greenly's pillow lava sites in Newborough Forest

Remarkable Creatures: a glimpse into Wales' most ancient seas

By Dr. Richard Birch

Now that a preliminary paper has been successfully peer-reviewed and accepted for publication in the 'Proceedings of the Geologist's Association' (February 2020),¹ a detailed inventory of the palaeoecology of the Upper Green Slate Member of the Llanberis Slate can be undertaken, opening up this remarkable pageant of earliest life for general scrutiny.

Anyone with a mild interest in palaeontology will be familiar with the Upper Cambrian Burgess Shale of British Columbia and the extraordinary community of soft-bodied animals that was first discovered in 1909 by Charles Doolittle Walcott of the US Geological Survey. Sir David Attenborough has dealt with the events leading up to this discovery, first in the BBC TV series 'Lost Worlds, Vanished Lives' in 1989, and again in 2010 with the series 'First Life'. Anything that exercises Sir David enough to revisit must be important, and anyone who has seen a Burgess Shale specimen cannot help but marvel at the

quality of preservation of something so insubstantial from such a long time ago. The Royal Ontario Museum has created a website inventory of these fossils, which can be found at:

<https://burgess-shale.rom.on.ca/en/fossil-gallery/list-species.php>

Since then, other such aggregations of soft-bodied organisms from the Cambrian – correctly referred to as a *lagerstätte* - have been discovered, notably in China (The Maotianshan shales), Greenland (The Sirius Passet Formation) and Australia (The Emu Bay shale). Scientifically thrilling though all these discoveries are, they haven't done us any favours in Wales, distracting from our pioneering ownership of the Cambrian (and also the Ordovician & Silurian) which were named by Sedgwick & Murchison (1835 - with a little help from Charles Lapworth) after their pioneering work in Wales.

In order to reclaim the Cambrian, we need something equivalent. So rare are these *lagerstätten* it's a big ask to expect one to turn up here. Think of it: the conditions needed to preserve a soft-bodied creature like a worm are phenomenally unlikely. And yet in the last decade, they are turning up here in Wales and the border counties where these Palaeozoic rocks occur. A Tremadoc-age (early Ordovician) *lagerstätte* was described by Botting *et al*² from Bala, and a prominent International research group are banging out papers on arthropods from a Silurian location in Herefordshire like there was no tomorrow. But from the Cambrian, there has been nothing ... until very recently, anyway. Of all places to look, the Llanberis Slate seemed the most unlikely. The qualities that make Llanberis Slate so important commercially, have been bestowed on it by tectonic deformation on a scale that would normally destroy fossils. It has been quarried on the western flanks of Snowdonia since Roman times and has recently been considered worthy as a UNESCO World Heritage Site³ because of its Industrial and Cultural heritage, endorsed by none other than Boris Johnson, (who of course visits Wales regularly and knows the area well ...). Fossils were discovered in 1888: a few trilobites that served to provide a Lower Cambrian designation, but they were considered so rare, no-one ever went back for another look. In fact, fossils are not so rare in the upper part of the Llanberis Slate, but it must be admitted that they are not quite as amazing to look at as those from the Burgess Shale, which is probably why they were overlooked for so long. They are, however, indicative of an entire ecosystem, not just the hard parts of a few shelly species that are the components of most fossil faunas.

Those sexy arthropods, like the giant predatory *Anomalocaris*, or the beautiful lace crab,

Marrella splendens which form a major component of other *lagerstätten*, don't occur, or haven't yet turned up in the Green Slate.⁴ We're left with sponges and worms, which lack the same pulling power on the public imagination. Perhaps that's why the excitement that should be generated by a soft-bodied fauna from the historic heartland of the Cambrian, a fauna that is ten million years older than the Burgess Shale and the oldest Cambrian fossil fauna in Wales, has been such a damp squib so far?

Even when the issue was raised for inclusion in the UNESCO bid package, it was ignored. Timing is everything. The first paper came out in February, a few weeks before the Corona virus absorbed everybody's attention. There was hardly any money for non-dinosaur palaeontology before Covid-19; nobody is expecting that to improve in a shell-shocked economy afterwards. So perhaps it shall remain our little secret, confined to the hallowed pages of the North Wales Geological Association newsletter.

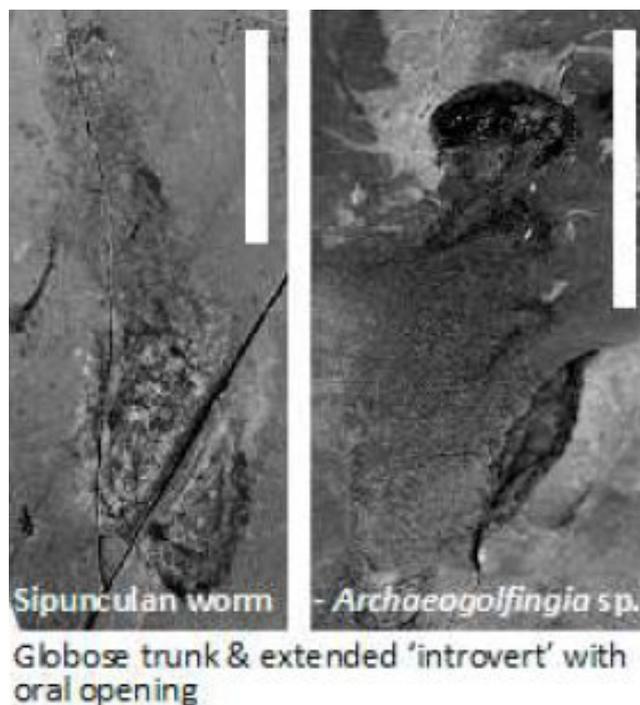


Fig 1a. Worms (and trilobite) from the Upper Green Slate

References

- <https://www.sciencedirect.com/science/article/abs/pii/S0016787820300109?via%3Dihub>
- Botting, J.P., Muir, L.A., Jordan, N. and Upton, C., 2015. An Ordovician variation on Burgess Shale-type biotas. *Scientific reports*, 5, p.9947.
- <https://www.gwynedd.llyw.cymru/en/Council/Documents--Council/Have-your-say/Slates/Slate-Landscapes-ENG-190809.pdf>
- There have been a few arthropods and some of these are illustrated in an article in the Special Cambrian Edition (issue 100, December 2018) of the NWGA newsletter.

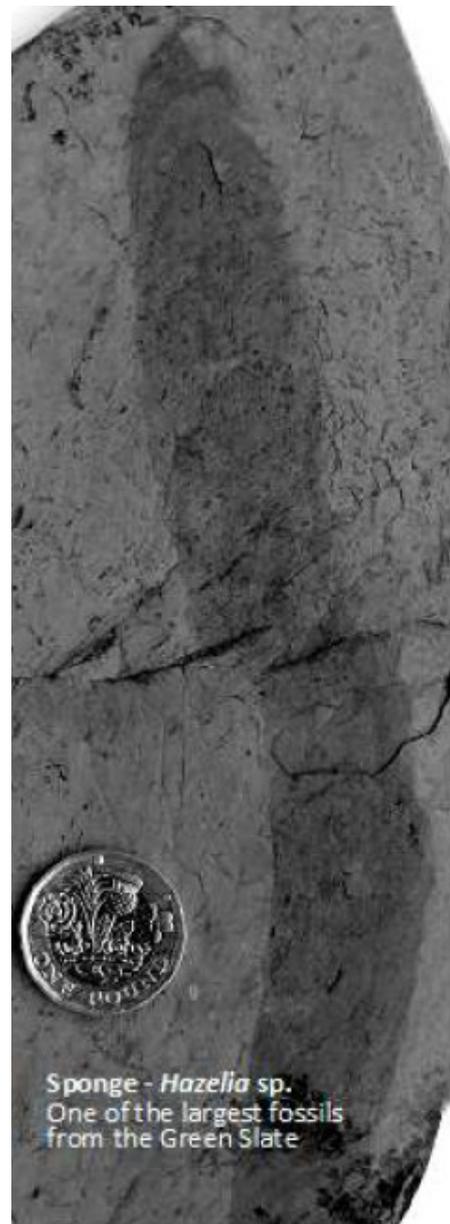
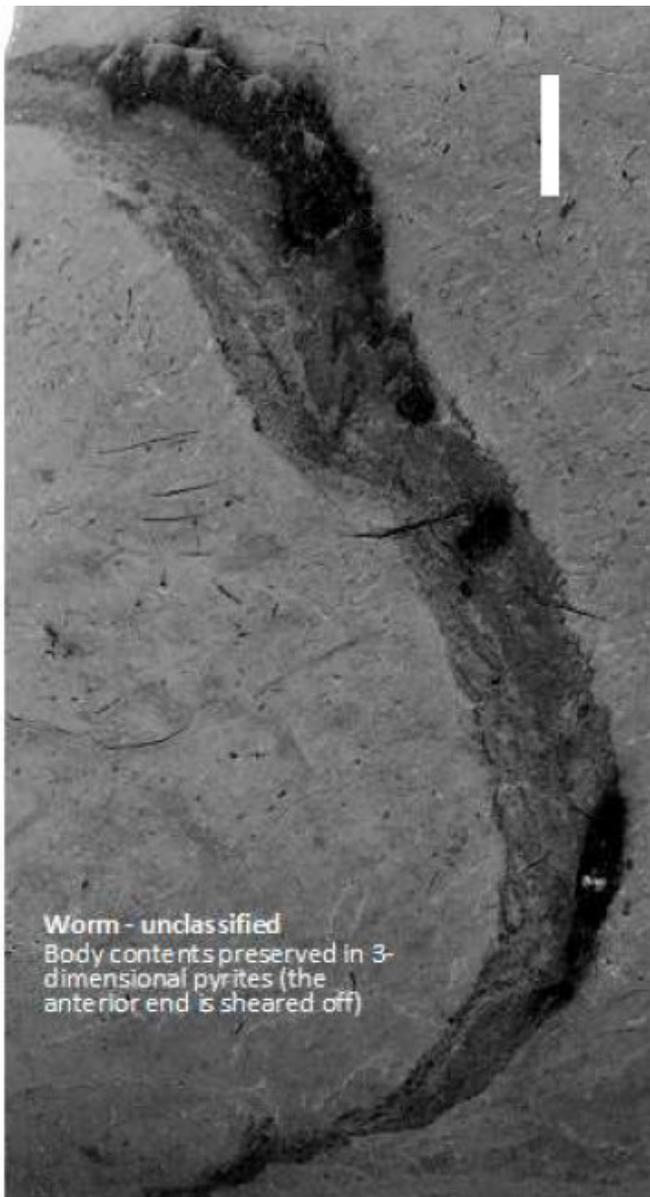
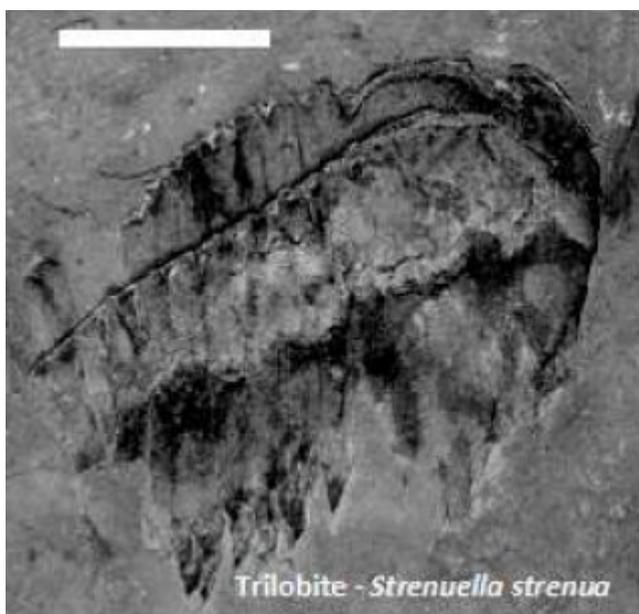


Fig 2a,b,c. Further images of worms (and trilobite) from the Upper Green Slate



The Bryn Maethlu limestone, Llanfaethlu, Anglesey - an anomalous footnote to Horak and Evans 2010

By T.P.T. Williams and Margaret Wood

In 2010 Horak and Evans¹ published their ground-breaking account of the dating of the large Proterozoic limestone olistoclast in and adjacent to the Gadlys quarry, Trwyn y Parc, Cemaes Bay in N. Anglesey. This lies in green micaschist and melange of the Gwna formation (Greenly 1919).² They concluded from a very comprehensive geochemical analysis including Strontium isotope ratios (⁸⁷Sr/⁸⁶Sr) that the limestone was dated to between 800 and 860 Myr (Early to mid-Proterozoic Tonian to Cryogenian) and was thus possibly the oldest rock in the southern British Isles.

It was noted that these authors had not extended their analyses to any of the other smaller

exposures of presumed similar Gwna limestone occurring throughout that formation. In particular it was thought worthwhile to extend their analysis to exposures south of the Carmel Head thrust plane (Greenly 1919). The present writers therefore decided to investigate the possibility of applying the techniques described by Horak and Evans to the next largest such exposure, the well-known Bryn Maethlu limestone at Llanfaethlu. This was first described by Henslow (1822).³ It was then being actively quarried and burned for agricultural lime. Greenly gave a megascopic account of the rock, considering it closely similar to that at Cemaes. He also noted a substantial adjacent graphite schist.

Sample ID	$\delta^{13}\text{C}$ V-pdb	$\delta^{18}\text{O}$ V-pdb	$^{87}\text{Sr}/^{86}\text{Sr}$
BM/LS/01	0.44	-16.95	0.714863
BM/LS/02	1.50	-17.74	0.711882
BM/LS/03	1.31	-17.35	0.713497
BM/LS/04	-0.07	-15.00	0.712545
BM/LS/05	1.43	-17.31	0.712097
BM/LS/06	0.94	-17.18	0.712227
BM/LS/07	1.70	-17.45	0.712872
BM/LS/08	1.25	-17.38	0.711987
BM/LS/09	1.48	-14.74	0.710560
BM/LS/10	1.95	-15.88	0.711438

Table 1. Oxygen, Carbon and Strontium stable isotope ratios measured for Bryn Maethlu limestone.

Co ppm	Cu ppm	Zn ppm	Ga Ppm	As ppm	Rb ppm	Sr ppm	Y ppm	Zr ppm
<10	11	11	6	<5	28	459	11	40
<10	13	22	6	5	30	387	12	49
15	13	19	6	<5	23	413	13	42
<10	<10	16	10	8	86	307	14	131
<10	13	152	6	<5	23	448	14	41

Mn ppm	Fe wt%	Ba ppm	La Ppm	Ce ppm	Nd ppm	Hf ppm	Pb ppm	Th ppm
418	1.45	144	8	19	<2	5	13	4
487	2.54	131	8	16	<2	5	14	5
974	2.21	117	11	23	<2	7	17	4
418	2.67	366	24	54	26	6	11	6
905	2.16	117	11	22	<2	6	10	3

Table 2a,b. Whole element abundances Bryn Maethlu limestone

Horak and Evans record values of $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ varying from -3.6 to +2.1 and from -18.9 to -4.9, with average values 0.738 and -15.01, respectively. The corresponding ranges and averages measured for the Bryn Maethlu limestone were -0.07 to 1.95 and -17.74 to -14.74 with means of 1.19 and -16.70 respectively. These two sets of results are clearly very similar.

Horak and Evans record values of $^{87}\text{Sr}/^{86}\text{Sr}$ for Trwyn y Parc ranging from 0.706198 to 0.710484 as

the exposure is traversed north-south from edge to edge. They consider that values around 0.706 consistently measured in the core of the megaclast reflect the original seawater strontium isotope ratio, and use the calibration curve published by Melezhik et al. (2001), Halverson et al. (2010) and Kuznetsov et al (2013) to infer an age of 800-860 Myr (Fig.1).

It is clear that the corresponding results obtained for Bryn Maethlu show a large degree of radiogenic alteration and do not reflect the original seawater value. This may be related to an anomalously high abundance of Rubidium in the Bryn Maethlu samples, Rb measurements ranging from 23 to 86 ppm with average of 38.0, whereas Horak and Evans report values in the range 0.02 to 4.64 ppm with average of 1.30 for their samples. The decay of

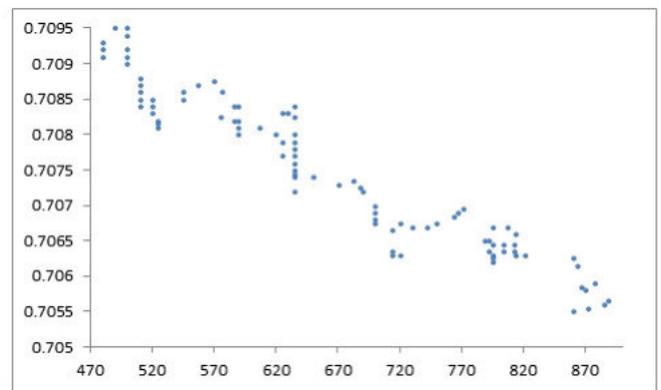


Fig 1. Relationship between Sr-ratio and age in Myr

^{87}Rb to ^{87}Sr by beta-decay may be a factor in distorting the Bryn Maethlu values. It is thus impossible to derive a date for this limestone, but it might be speculated that in view of the difference between the largest value 0.7105 recorded by Horak and Evans and their original seawater values of circa 0.7062, an idea of the likely original seawater values at our site might be glimpsed by subtracting a similar offset from the lowest of our values, viz 0.710560. This would give a value of circa 0.706 in broad agreement with their values. This is, of course, mere speculation, as is the idea that the enhanced Rb values might be connected with the adjacent substantial graphite schist, which is largely absent in the core of Trwyn y Parc. If this schist was originally biogenic, derived from algal reef fauna of species such as exist today and are known to selectively concentrate Rubidium, it might go some way to accounting for this curious anomaly. Who can say?

Acknowledgments

Strontium isotope ratios courtesy Dr Jason Harvey, Institute of Geophysics and Tectonics, School of Earth and Environment, University of Leeds

Oxygen and Carbon isotope ratios courtesy Dr S.Brookes and Messrs Iso-Analytical Ltd, Crewe

Whole element abundances courtesy Jonathan Wilkins and Messrs X-ray Mineral Services, Colwyn Bay

References

- 1 *Geol. Mag.* **148** (1), 2011, pp. 78–88. Cambridge University Press 2010
- 2 E.Greenly The Geology of Anglesey 2 vols *Geological Survey Memoir* 1919
- 3 J.S.Henslow Geological Description of Anglesea *Cambridge Philosophical Society* 1822

Dates for Your Diary

Due to restrictions upon movements and meetings outside of the immediate requirements of life, health and key businesses, we are unable to commit to any dates at this point. Even if strict movement restrictions are removed in the next couple of weeks, we cannot assume that it will be business as usual for our Association. We look forward to bringing you an actual programme which we can deliver when the time is right.

Committee Contacts

Chair and Website

Jonathan Wilkins
Tel: 01492 583052
wilkins@ampyx.org.uk

Meetings Secretary

Gary Eisenhauer
Tel: 01492 596255 or 07732 745945
g.eisenhauer@btinternet.com

Secretary

Lyn Relph
hazlyn.relph@yahoo.co.uk

Treasurer

Cathy O'Brien
cathy@obrien6236.freemove.co.uk

Newsletter Editor

Terry Williams
tptwilliams0@btinternet.com