

**Cymdeithas Daeareg Gogledd Cymru**

**North Wales Geology Association**

**NEWSLETTER**

**Issue 95**

**March 2017**

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### Front Cover Image:

Close up image of the Sandbian graptolite *Dicellograptus cambriensis* from Llanfawr Quarry, Llandrindod Wells. The stipe of the graptolite is approximately 1mm across. Image copyright – KHN.

Articles correspondence etc to Newsletter Editor: Keith Nicholls 07442 495534 [keithnicholls@gmail.com](mailto:keithnicholls@gmail.com)

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## Chairman's Message

It's a funny thing, the way that interest can be sparked by an unexpected encounter or conversation; or even by the return of the sun after a winter of wet and dark months; but it can be so and I will talk a bit about some recent sparks.

Last year I was very disappointed to miss the field meeting that was led by Richard Birch to the Nantlle valley. Anybody who knows anything about this archetypal industrial area and its associated 'slate villages' will appreciate that it is a landscape like no other, and that the basis of that industry was a particular belt of Cambrian rocks which has produced what are arguably the best roofing slates in the world (N.B. Chinese slates may not be as bad as their image suggests, but the wooden crates they are shipped in have been infested with wood-boring beetles which seem to like our trees and are spreading fast in Europe, so that's another fine mess we got ourselves into).

Anyway, back to the Nantlle valley, which is an area little visited except by a particular breed of diehard thrill seeker diving in the flooded Dorothea pit, an incurably romantic industrial archaeologist, or the occasional geologist trying to make sense of papers written long ago about strata that may now have been quarried away completely and put on roofs or waste heaps. The only time I have turned the corner and headed eastwards from Pen-y-groes was the occasion when I was looking to find a suitably infinite and slightly conductive body of water for gathering key calibration data from an ELOG sonde when I was working for Robertson Geologging. The Electric Log measures the resistivity of the rocks surrounding a geological borehole, but since rocks are essentially perfect insulators unless they are porous and saturated with conductive water what they

actually measure is a proxy for porosity - valuable if you are looking for aquifers and water supply. I visited several quarries that day and found that water quality was a function of altitude - high on the hills the water flooding the quarries was clean rain, but at valley floor level it wasn't so clean because of the soils and mineral deposits that it had passed through and the ionic load (fairly slight) that it had accumulated.

Back at Christmas time there came on the television a programme that many of you may have already seen, about the industrial legacy of the Dorothea pit, its pumping engine now long dormant, and a descent into the curious depths of the pit itself, courtesy of underwater archaeologists looking at the variety of machinery and quarry activity that is now flooded, preserved, and otherwise inaccessible. I determined that the first decent day of the year would see me visit the area once more, and this time with more than water quality on my mind. I was instantly hooked, and courtesy of "A Gazetteer of the Welsh Slate Industry" I am now able to locate and discuss arcane locations such as Moel Tryfan, Pen yr Orsedd and even Cornwall. The biggest surprise was at the summit of Moel Tryfan where I encountered the Cilgwyn Conglomerate for the first time, though I suppose I should stick to the dry, homogenised terminology of the BGS and call it a member of the Fachwen Formation.

Despite then having read many of the books over and over it was going out in the field that brought the message indelibly home - a concept that I have tried so often to communicate. I am pleased to say that a second, more recent day has now been spent in the area, with slightly warmer and more consistent sunshine and this time in the company of Richard Birch, who tried to explain what he found interesting and challenging about the area and its strata. I can see a significant programme of exploration unfolding in the landscape that

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is host to the Llanberis Slates Formation (glad that one kept its traditional name). Although progress is slow, we hope to bring you at least one slate-themed meeting this year.

a good natter over a glass of wine at the end. I have since been enjoying reading for the first time the paper "Some Anglesey Dykes" read by Alfred Harker in 1887 and would love to share a short passage from it, since it is so well written:



The annual Herdman Symposium at Liverpool University proved to be the usual eclectic delight, but two talks stood out. Hugh Tuffen's work on rhyolite flows was not only fascinating but highly relevant to the rocks of Snowdonia, and food for thought regarding the mechanics of rhyolite magma emplacement and eruption. Marian Holness from Cambridge spoke on igneous petrology and petrography of mafic rocks (basalts etc), a topic that I thought had simply died out due to over-familiarity and a modern tendency for whizzy, computer-based virtual-reality methods to take over the task of looking at rocks critically and in thin section. Suffice to say, I was reminded of the fact that we have some good, mafic igneous rocks in North Wales, and we had

*"Specimens of the principal dykes were submitted to the examination of Professor Cordier, and his remarks on them are quoted in Henslow's paper. As Cordier's determinations date from a time when thin slices of rocks were unknown, and but little attention has since been given to the dykes of Anglesey, it is believed that brief notices of some of the typical rocks from localities easily identified may have an interest for British geologists. As regards the mode of occurrence of the dykes and their effects upon the adjacent strata, little can be added to the accurate descriptions of Henslow, written at a time when the igneous origin of dykes was a proposition to be proved."*

And the relevance of all this? The interest of British geologists is still strong, and I hope that Professor Holness will be able to find exposures that she needs for her work on microstructural parameters of cooling mafic rocks on Anglesey. I reckon we should start planning for the bicentenary of Henslow's publication and hold a dyke-party in his honour!

At a time when the creative juices seemed to be running out, suddenly there is a new mantra: "The future is bright; the future is fieldwork" if I may paraphrase an old advertising slogan.

*Jonathan Wilkins*

**Editor's Note:** After having had a close look at the image I suspect that I can see bedding more or less at right angles to the prominent cleavage. It's dipping down from top right to bottom left and is best picked out by weathering near the top of the outcrop. It is parallel to (more or less) the prominent feature forming the sky line. But only field work will confirm!

With regards to JW's suggestion of an event to recognise the bicentennial of Henslow's work we have plenty of time to plan – as it was published in 1822. For those interested in seeing the original work a copy is available on-line here:

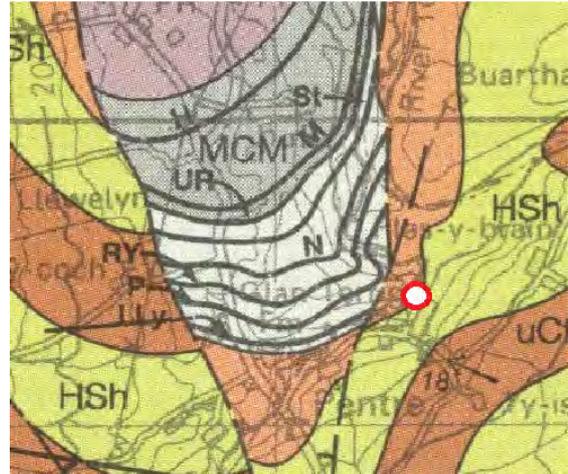
[http://www.tpwilliams.co.uk/henslow/henslow\\_2012\\_web.pdf](http://www.tpwilliams.co.uk/henslow/henslow_2012_web.pdf)

## Articles:

### Content of the Coal Measures – Treuddyn, Flintshire

I was recently invited to see a collection of fossils made by Michael Levi of Pen-y-Ffordd Farm near Mold during excavation work on his land. The farm sits in an interesting location alongside the Afon Terrig. The river has cut its way along one of two faults that define a small graben structure which creates an outlier of Westphalian Coal Measures strata, between two outcrops of Namurian Holywell Shales.

The approximate position of the farm is shown on the extract from the 1:50,000 scale geological map below:



**Figure 1: Extract from BGS Sheet 85 "Flint" Solid Edition, copyright NERC.**

The collection includes material recovered in-situ, and from both fluvial and glacial drift. Consequently it is extremely varied, although as with most Carboniferous collections, it is dominated by the plant material. Bedrock at the collection site consists of Coal Measures, immediately above the outcrop of the Premier Seam.

The following images show some of the material present.

### 1) Invertebrate Material



Figure 2: Erratic glacial boulder of bioclastic limestone with “horn coral” *Zaphrentis delanouei*?



Figure 3: The same erratic as Figure 2, but with a well preserved brachiopod valve



Figure 4: The same erratic with a well preserved bivalve amongst the assorted crinoid and lithic debris



Figure 5: The distinctive Carboniferous colonial coral *Lithostrotion*

### 2) Plant Material



Figure 6: *Triginocarpus*? Possible pteridosperm seed body preserved in-situ on the upper surface of a seat earth bedding plane



Figure 7: Collection of *stigmaria* (root) and *lepidodendron* (stem) fragments



Figure 8: Close up of water worn *Lepidodendron* fragment



**Figure 9: 30cm long fragment of *Stigmaria***

One or two further specimens are the subject of some further investigations at this time. I remain in touch with Michael, and in the event that anyone wishes to see these fossils then I can pass on contact details.

*Keith Nicholls*

## Job Opportunity: Urban Geoscientist/ Applied Environmental Geologist

The British Geological Survey (BGS) is one of the world's leading and forward thinking geological science institutes with a focus on both public good science for government and geoscientific research to understand earth and environmental processes. A vacancy has arisen for an Urban Geoscientist/ Applied Environmental Geologist based at our headquarters in Keyworth, Nottingham.

As a highly motivated and experienced scientist, you will play a key and proactive role in the development and delivery of urban geoscience in the BGS Engineering Geology Science Directorate, including our research platforms in developing countries. The Directorate incorporates a wide-range of projects that map, analyse, monitor and model the physical properties, hazards and processes of the subsurface environment in the UK and overseas. Our research enables society to respond to the challenges and opportunities of environmental change, population growth and economic regeneration. Based on this experience, the Programme is developing a growing portfolio of resilience focused projects in the international forum.

You will engage with government, regulators, research institutes and industry to develop partnerships and secure funding opportunities. Through these collaborations, you will help deliver a programme of national good geoscience in the area of regeneration and sustainable development of key city-regions in GB and overseas. You must therefore have a good understanding of the relevant issues and challenges faced globally and the role of applied geoscience in addressing these. You will be able to apply this scientific

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understanding to urban areas in the UK and developing countries.

You will already have experience of working on Applied Environmental Geology or Engineering projects in an urban setting and you are looking for the opportunity to develop and lead future research. You will have excellent skills in project management and be able to deliver outcomes effectively. You will be able to demonstrate how your science plays a vital role in the development of practical solutions. You will be able to communicate your ideas effectively in a variety of ways to scientists, decision makers and funding bodies.

You should be educated to 2:1-degree level in a relevant geoscience subject and have an MSc/PhD in Applied Environmental or Engineering Geology (or directly related applied geoscience discipline). In addition, you must possess excellent communication skills, both oral and written. The post involves team working; therefore you should be able to demonstrate that you can work effectively with others, and in a leadership role when necessary.

Although the post will be based in Keyworth, you should expect significant periods of time working away undertaking research in the UK or overseas, or working at other BGS sites.

Depending on qualifications and experience, full time starting salary will be £28,200 per annum to £30,600 per annum. Full time working hours are 37 per week excluding lunch breaks. A generous benefits package is also offered, including a company pension scheme, childcare voucher scheme, free on-site parking, 30 days annual leave plus 10.5 days public and privilege holidays.

The Natural Environment Research Council is an equal opportunities employer

and welcomes applications from all sections of the community. People with disabilities and those from ethnic minorities are currently under-represented and their applications are particularly welcome. The British Geological Survey is an Investors in People organization and has Athena SWAN bronze award. There is a guaranteed Interview Scheme for suitable candidates with disabilities.

Applications are handled by the RCUK Shared Services Centre; to apply please visit our job board at [http://www.topcareer.jobs/Vacancy/irc240354\\_7019.aspx](http://www.topcareer.jobs/Vacancy/irc240354_7019.aspx) and submit your up-to-date C.V. and covering letter, which clearly outlines why you are applying for this post and how you meet the criteria described in this advertisement. Applicants who would like to receive this advert in an alternative format (e.g. large print, Braille, audio or hard copy), or who are unable to apply online should contact us by telephone on 01793 867003, Please quote reference number IRC240335. Closing date for receipt of application forms is 2 April 2017.

*Helen Reeves*

## Abstracts:

*“A Tale of Two Quakes” – comparing the impacts of the 2010 Darfield 7.1 ( $M_w$ ) and the 2016 Kaikoura 7.8 ( $M_w$ ) earthquakes and associated aftershock sequences*

### **Mark Easton – Opus International Consultants**

Mark Easton is a Principal Geotechnical Engineer and has worked for Opus International Consultants (Opus) since 2005. Mark has spent the last 11 years with Opus, based in Christchurch, New Zealand and is currently seconded to Opus UK based in the Bristol office. Mark has spent much of his recent career involved in the Response and Recovery phases that follow natural hazard events / disasters. Notably, this has included the 2010 Darfield, 2011 Christchurch and most recently the 2016 Kaikoura earthquakes.

Mark’s specialisation is landslide hazard management, typically where this is rockfall and infrastructure related. Mark’s commissions have involved him with projects informing and advising the NZ Transport Agency (NZTA), Christchurch City Council (CCC), Environment Canterbury (ECan), GNS Science (GNS), the Canterbury Earthquake Recovery Authority (CERA) and the Ministry of Business, Innovation and Employment (MBIE).

Within the last 7 years, the Canterbury and Marlborough regions of New Zealand’s South Island have been significantly impacted by a series of damaging earthquakes. Following a period of relative quiet, the increased rate of seismic activity has created a groundswell in knowledge and corresponding techniques to better understand and mitigate the impacts on civil engineering projects.

This presentation, whilst primarily focused upon geological effects and natural

hazards (such as liquefaction and co-seismic landsliding), will also cover the wider implications of living and developing in actively seismic countries such as New Zealand, which is currently well deserving of its nickname as ‘The Shaky Isles’.



## Reports:

### **NWGA Evening Meeting**

*“Gold Rushes – Past and Present - Prospecting and Small Scale Mining for Gold and Diamonds to the Present Day”*

*Jim Richards*

We were treated to a romp through Jim Richards experiences in life from the inception of his interest in the mining of gold, beginning with a summer job at Dolaucothi Gold Mines as a tour guide, through a career in the Parachute Regiment, to experiences in gold rushes in Brazil, Guyana and Australia. At the beginning of his talk he passed around a

lump of gold ore with visible flakes of gold within a quartz matrix similar to the ore mined at Dolaucothi. Jim gave a history of the mining methods used in historic gold rushes, such as fire setting to cause fracturing of the rock, the breaking up of the rocks using stamps and the means of separating the gold from the other minerals and rocks after they had been ground up, by the use of water from a dammed stream higher up the slope and sheep fleeces covering the slope to catch the gold as it sinks within the flowing water. Then the consequences of trying to bring the gold back from the California gold rush when the ship you are travelling on, the Royal Charter, sunk off the Anglesey coast where if you still were carrying your gold in your pocket you sank with the ship, such is the effect of gold fever.

We had an explanation of the technology used to separate gold from sediments in rivers starting with panning, through the use of rocker boxes to sluices as the technology improved over time, and many of these techniques are still used today. In the Parachute Regiment he learnt the skills needed to manage men in adverse circumstances which were of advantage when working in the primitive mining areas in Guyana. So he left the Parachute Regiment and went in search of gold in south America, starting in Belize where he was able to get a flight courtesy of the UK army, then travelling overland to Guyana where he got a job with a mining company in Omai drilling to prove the deposit, alluvial deposits had been worked in the area in the past and much of the old equipment was still visible in the jungle. Informal gold mining was also going on in the jungle where the government of the country struggled to keep control. There were problems with artisanal miners who would cause violence, damage and disruption in the area. Other hazards of prospecting in that area were vampires and piranhas.

The next area where he worked in Guyana was “Pothole Falls” where he set up a project exploiting deposits in potholes within the river bed in that area. Here the density of gold leads to it accumulating in potholes in the river bed, the same process also applies to diamonds, quite large nuggets can be found in this type of deposit, to illustrate this he took a large nugget about fist size out of his pocket and showed it to us. Jim also showed a sample of the diamonds he has found, at the end of the presentation we were able to hold these but he did not pass them round, too valuable to be out of his sight! The extraction of gold and diamonds from this type of river bed in the Ekereku River means getting wet and working with a pump on a homemade floating barge, but there are dangers from wildlife here too, with tarantulas, very poisonous snakes, mosquitos and water fleas that burrow into your flesh.

Other interesting areas he has worked in were Zimbabwe in search of diamonds coated in laterite, and Peru where he worked in an area 17,000 feet high seeking gold deposits in areas where the glaciers were retreating. Jim then moved into a mining operation in Meekatharra, Western Australia where he was involved in exploration and actually found a large deposit of gold adjacent to the area which was already being worked. He has also worked in the Ellendale diamond project in Western Australia. In Australia, the mining companies fund conservation work such as removing non-indigenous mammals, such as feral cats, from Islands off the coast to allow indigenous species to recover.

Jim has published a book on his life which is available from his website [jimrichards.com.au](http://jimrichards.com.au) and copies of this were available at the end of his talk.

*Cathy O'Brien*

## NWGA AGM Meeting

*“The belly of the beast – exploring the history of super-eruptions from the Yellowstone hot spot track, USA”.*

*Dr Tom Knott, University of Leicester*

As is usual following the AGM we had the opportunity to listen to an excellent talk on a significant subject.

In a typical human life time the prospect of us seeing a “proper” super-eruption seem remote. Consequently the sheer scale of these events, which dwarf Tambora, Mount St Helens, and such trivial events as Vesuvius in AD79, beggars belief.....

*“There, but for the grace of contingent good fortune....!”*

Super-eruptions of the scale Tom is concerned with are some of the largest catastrophic events affecting the earth’s surface. Magnitude 8+ events are apparently associated with eruptions of the order of  $10^{15}$ kg of material. There have been at least 47 such Super-eruptions between the Ordovician and the Pleistocene, with 42 of these 47 events having occurred in the last 36 million years (hopefully a reflection of the preservation record, rather than a harbinger of the approach of Dante’s Inferno?). There are apparently typically 1.1 eruptions of this scale every million years.

The Yellowstone / Snake River volcanic province records the presence of at least two such events, the Huckleberry Ridge Tuff and the Lava Creek Tuff. These events which are associated with  $2,200\text{km}^3$  and  $1000\text{km}^3$  of ejecta respectively, span a history of between 16.5 and only 0.6 million years ago.



**Successive tuff / ignimbrite horizons can be seen in this image of the Snake River Canyon**

Tom’s talk was very well illustrated, showing evidence of curious rheomorphic welded ignimbrites, and fascinating relationships between palaeosols and the ignimbritic ash falls.

There was a perhaps surprisingly mercifully small, number of graphs to consider, for a talk which was fundamentally about geochemistry, and the evolution of deep magma by mixing and/or contamination.

Tom explained his work clearly, and showed how it feeds into the overall regional volcanic stratigraphy. Cycles evident in the field relations are being successfully linked to the chemical signatures of the rocks.

On closure of his talk Tom was good enough to answer questions and respond to the usual range of comments from the NWGA audience of 20 members and a few further friends.



The walk after the talk was blessed with glorious January weather

We have had a number of short walks around Conwy Mountain following the AGM in recent years, but none quite so lucky with respect to the weather, and certainly none quite so relevant to the speaker's field of interest. I'm not quite sure whether the Snowdon caldera collapse is listed as one of the 47, but interesting tuffs we have in abundance.

*KHN*

## Publications related to the Geology of Wales:

A.J. Miles, N.H. Woodcock, C.J. Hawkesworth

*"Tectonic controls on post-subduction granite genesis and emplacement: The late Caledonian suite of Britain and Ireland"*, Gondwana Research, **39**, November 2016, Pages 250-260, ISSN 1342-937X, (<http://www.sciencedirect.com/science/article/pii/S1342937X16300090>)

## Dates for Your Diary:

### NWGA:

### Spring Evening Meeting

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

Wednesday 26<sup>th</sup> April – Mark Easton

**"A tale of two quakies"**

See Abstract elsewhere in this newsletter for details of the talk

## Other Groups Events:

### Saltscape / Cheshire RIGS

**23<sup>rd</sup> June 2017:**

*"Geodiversity and geoconservation"*

See details at rear of this newsletter.

### Geo-Science Wales

**16th March 2017**

Richard Morgan: *"Petroleum geoscience in 2017: A contrarian's view"* in the RCA, Conwy

### Liverpool Geological Society

Saturday 20th May - Geoff Gilchrist

**"Hilbre Island geomorphological contrasts – structure, process and form"**

**Date TBC – led by our own Ray Humphreys**  
**"Halkyn Mountain"**

Further details from the LGS Web-site

## Mid Wales Geology Club

**14<sup>th</sup> May 2017**

*Field Visit - "Llangranog"*

Led by Keith Nicholls – NWGA members are very welcome to attend – contact Keith for joining instructions.

## 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/cdgc/index.html>

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/>

## Committee Contacts:

### **Chair and Website:**

Jonathan Wilkins

Tel: 01492 583052

[wilkins@ampyx.org.uk](mailto:wilkins@ampyx.org.uk)

### **Meetings Secretary:**

Gary Eisenhauer

Tel: 01492 596255 or 07732 745945

[g.eisenhauer@btinternet.com](mailto:g.eisenhauer@btinternet.com)

### **Secretary:**

Lyn Relph

[hazlyn.relph@yahoo.co.uk](mailto:hazlyn.relph@yahoo.co.uk)

### **Treasurer:**

Cathy O'Brien

[cathy@obrien6236.freemove.co.uk](mailto:cathy@obrien6236.freemove.co.uk)

### **Newsletter Editor:**

Keith Nicholls

Tel: 01352 750925 or

07442 495534

[keithnicholls@gmail.com](mailto:keithnicholls@gmail.com)

or [keith.nicholls@opusinternational.co.uk](mailto:keith.nicholls@opusinternational.co.uk)

Cheshire RIGS presents a  
Geological Society of London  
Endorsed CPD Course on:

FREE

## Geodiversity & Geoconservation Conference: An introduction for professional Audiences

Conference Date: 23/06/2017

Start Time: 9:30am

At: Lion Salt Works, Ollershaw  
Lane, Marston, Northwich,  
CW9 6ES

### LUNCH / COFFEE INCLUDED

This course is aimed at Planners, Local Authority officers, Environmental and Geoscientists, Environmental Consultants, Nature Conservation Personnel, EIA Consultants, Ecologists, Engineers, Environmental Lawyers and Conservation Professionals.

Contact Cheshire RIGS  
Grosvenor Museum  
27, Grosvenor Street  
Chester  
Cheshire  
CH1 2DD

To Book:  
Ring: 07743 285466  
or Saltscape Tel: 01606  
723160  
Fax: 01606 7231170

or complete the booking form  
attached and fax or email to  
veronicacubitt@hotmail.com  
or info@saltscape.co.uk

This one-day conference, endorsed by the Geological Society and presented by highly knowledgeable and regarded specialists from across the country, will provide its attendees with all the key terms and topics in Geodiversity and Geoconservation by exploring the approaches and important issues associated with Geodiversity and Geoconservation and introducing methods of communication them through GeoHeritage and Geotourism.

09:30 *Registration, tea and coffee*

10:00 **Introduction to the day** – Veronica Holmes/Steve Woolfall

10:10 **Introduction to Geodiversity:** Dr Ian Drew/ Prof Cynthia Burek

An interactive lecture covering an introduction to geological concepts and followed by a short introduction to the history and definitions of geodiversity.

11:05 **Introduction to Geoconservation:** Prof Cynthia Burek

An interactive lecture covering an introduction to the term, background and history of Geoconservation. This will also include the drivers for this type of conservation in Cheshire within the wider national and international scene. The difference between biodiversity and geodiversity conservation measures will also be discussed.

12:00 **Introduction to GeoHeritage:** Dr Kevin Crawford

A fascinating look at GeoHeritage focusing on 'Cultural GeoHeritage', covering an introduction to terms and the background and history of GeoHeritage.

12:45 *Lunch* – A lovely buffet lunch will be provided—please inform Veronica of any dietary requirements.

13:15 **Geotourism:** Dr Kevin Crawford

Kevin will take you on a journey through Geotourism, including some workshop sessions looking at journal articles and literature. The lecture will also cover an introduction to terms, the background and history of Geotourism

14:10 **The Natural Resources of the Saltscape:** Dr Ros Todhunter

Ros will analyse the Geodiversity and GeoHeritage of the salt landscape of Mid Cheshire. She will look at how the location and depth of the salt-bearing strata, plus 2000 years of exploitation of this natural resource are a consequence of it's the roots of Saltscape's heritage. From brine springs to controlled brine pumping, salt mining to underground gas storage poses and the challenges to faced by development and infrastructure in areas of past, present and future rock salt extraction and exploitation.

15:05 **Legislative Issues:** Dr Kevin Crawford

15:30 a) **Short local walk** to see impact of salt mining and brine pumping: Dr Ros Todhunter

or b) **Tour of Lion Salt Work Museum:** Salt Museum Member of Staff

PLEASE INFORM VERONICA OF YOUR CHOICE OF ACTIVITY WHEN MAKING A BOOKING.

16:00 *Tea & coffee*

16:15 **Question and answer session**

