

# GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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## Crowd Sourcing

What does 'citizen science' have to offer the geological sciences?

### UNDER THE SUN GOD

Engineering geology of Lima's spectacular adobe pyramids

### SILENT SPRING

Society should condemn the use of synthetic chemicals

### NO PROSPECT OF A BEVVY

James Hutton's unsung contribution to home brewing

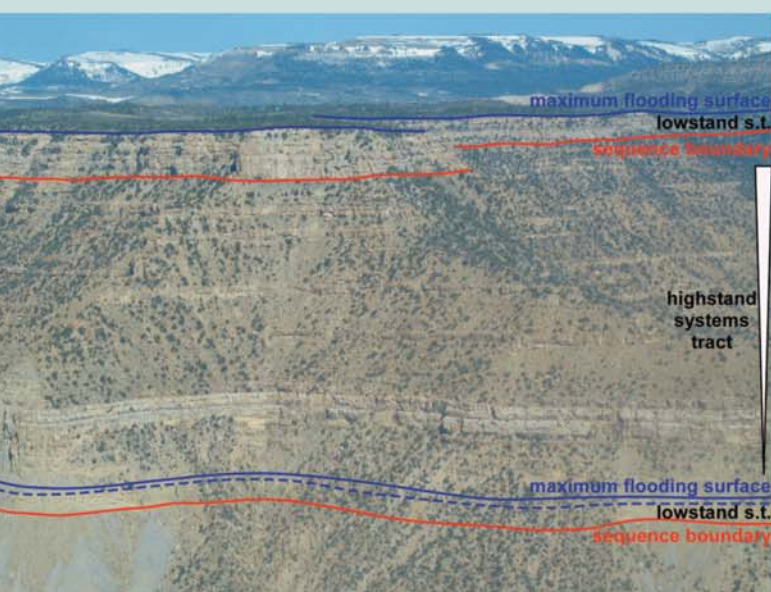


# William Smith Meeting 2014

## *The Future of Sequence Stratigraphy: Evolution or Revolution?*

22-23 September 2014

The Geological Society, Burlington House



This meeting is intended to bring together a diverse range of sedimentary geologists to foster a critical examination of the current state of the sequence stratigraphic model, and to highlight robust new methods, concepts and protocols that could evolve or maybe even potentially revolutionize stratigraphic understanding and prediction.

Developments in this area seem likely to come from a combination of outcrop, geostatistical/stochastic approaches, physical experiments including large flume tank studies, and numerical approaches to the modelling of erosion-transport-depositional systems, all under the umbrella of the Landscape Into Rock concept. However, we will also encourage presentation of brand-new innovative methods, including cross-disciplinary methods that bring in ideas from other branches of science.

The meeting will be organized into a series of themed sessions, with an emphasis on provocative but practical presentations. Presentations will be scheduled to ensure there is plenty of time to debate all the issues raised in the meeting. In a final session, the conveners will chair a discussion targeted at achieving a consensus view on how the subject should move forward.

### Conference Sessions:

- Does sequence stratigraphy provide testable predictions?
- Are the assumptions in the sequence stratigraphic model still valid?
- Varying Earth surface systems through time and the consequences for sequence stratigraphic prediction
- Sediment routing and variable sediment supply: do these fundamentally change the model?
- The consequences of non-uniqueness for interpretation and prediction
- What next for sequence stratigraphy? Evolution or revolution?

### Confirmed Keynote Speakers:

**Ron Steel** (University of Texas & University of Aberdeen) *William Smith lecture*

**Henry Posamentier** (Chevron) *Does sequence stratigraphy provide testable predictions?*

**Andrew Miall** (University of Toronto) *Are the sequence stratigraphic model assumptions still valid?*

**Mike Gurnis** (Caltech) *Is there a stable reference point for eustatic curve construction?*

**Tetsuji Muto** (University of Nagasaki) *The consequences of non-uniqueness for sequence stratigraphy*

### Convenors:

Professor Peter Burgess (Royal Holloway University London)  
Professor Philip Allen (Imperial College London)  
Professor Paul Wright (PWGC Ltd)

### Further information:

For further information about the conference please contact:

Naomi Newbold, Conference Office, The Geological Society,  
Burlington House, Piccadilly, London W1J 0BG

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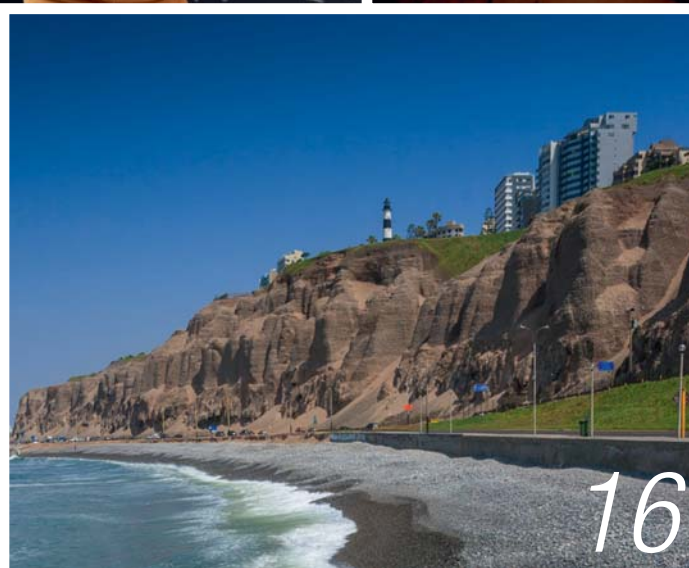
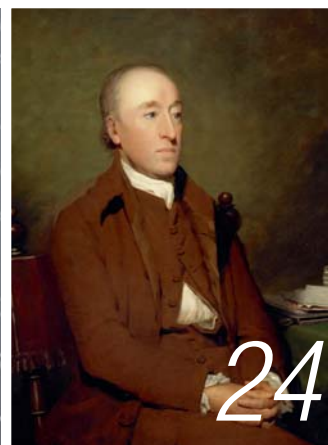
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Sourcing from the crowd - Helen Quinn asks what 'citizen science' has to offer Earth sciences and where its limitations lie

**ONLINE SPECIALS Carbon Capture & Storage** Bryan Lovell reports on the recent joint GSL/AAPG meeting on Carbon Capture & Storage

**CORRECTION:** The July Issue second feature, on the Carne Collection, written by author Douglas Palmer, wrongly described him as Director of the Sedgwick Museum – a post held (of course) by regular Geoscientist contributor Ken McNamara. Apologies to all concerned. **Editor**

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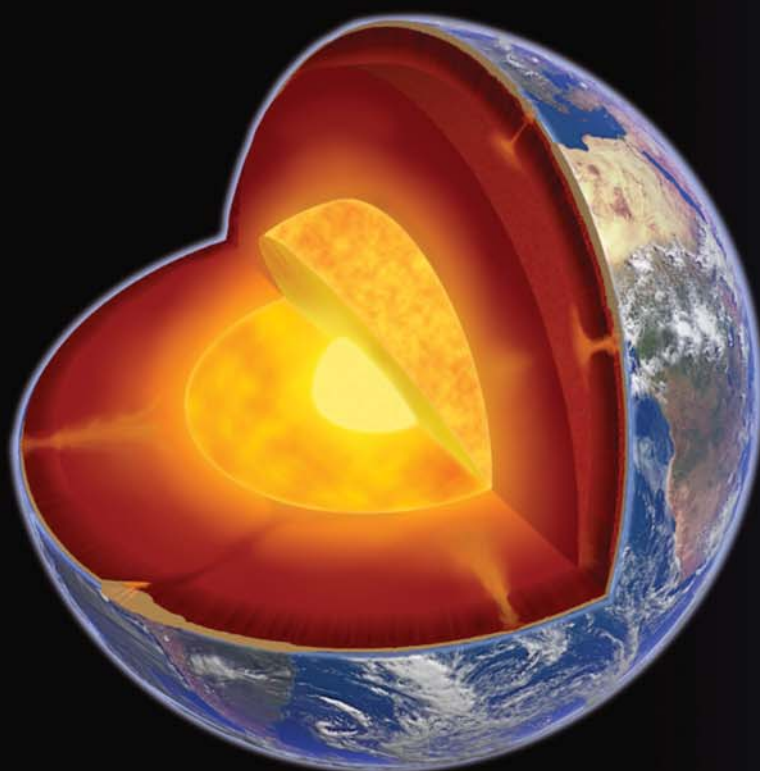
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# Deep Earth Processes

*windows on the workings of a planet*

15-16 September 2014



**The Geological Society, Burlington House,  
Piccadilly, London, UK**

The physical and chemical nature of Earth's deep interior is key in controlling many of the processes that shape our planet: from mantle convection to melting, from volcanism to plate tectonics. Rationalising the latest observations – be they clues revealed in the compositions of mantle melts, diamond formation, seismological nuances, or atomistic scale predictions – requires interaction across sub-disciplines. This international meeting seeks to draw together the latest ideas and results from geophysicists, geochemists, mineral physicists, geodynamicists and petrologists to identify the processes shaping the inaccessible depths of our planet.

#### Thematic sessions:

- Deep mantle structure
- Composition of the lower mantle
- Core formation, CMB & D"
- Surface expression of deep Earth processes

#### Convenors:

Sally Gibson, *University of Cambridge, UK*  
Saskia Goes, *Imperial College, UK*  
Simon Redfern, *University of Cambridge, UK*  
Mike Walter, *University of Bristol, UK*

#### Keynote Speakers:

John Hernlund, *Tokyo Institute of Technology, Japan*  
Bernie Wood, *University of Oxford, UK*

#### Invited Speakers:

Chris Ballentine, *University of Oxford, UK*  
John Brodholt, *University College London, UK*  
Arwen Deuss, *University of Cambridge, UK*  
Dan Frost, *Bayreuth, Germany*  
Matt Jackson, *UC Santa Barbara, USA*  
Peter van Keken, *University of Michigan, USA*  
Mike Kendall, *University of Bristol, UK*  
Graham Pearson, *University of Alberta, CA*  
Dan Shim, *Arizona State University, USA*

#### Further information

For further information about the conference please contact:

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“NEW TECHNOLOGY OPENS UP NEW WAYS FOR PUBLIC PARTICIPATION IN SCIENCE. HELEN QUINN EXPLORES THE PROGRESS AND LIMITATIONS OF ‘CITIZEN SCIENCE’”

Front cover image: karavai / Shutterstock.com

FROM THE EDITOR'S DESK:

# Deadlier than the male

It's official. Tropical cyclones of the North Atlantic – hurricanes, to you and me – are more deadly if they are more 'Victoria' than 'Victor'. A study by scientists at the Illinois and Arizona State universities, published in the Proceedings of the National Academy of Sciences, revealed in June that - even excluding outliers like Katrina and Audrey - of the 47 most damaging hurricanes since 1950, those with feminine names killed on average 45 people, compared to 23 deaths in 'masculine' storms.

For the mathematically challenged, that's almost double - a statistically significant result. Indeed, the authors state that "changing a severe hurricane's name from Charlie... to Eloise... could nearly treble its death toll". Why? Because people don't take storms with female names seriously, and so are less likely to take precautions.

As PR people are fond of reminding scientists, perception is reality. "When under the radar, that's when [sexism] has the potential to influence our judgments", Sharon Shavitt (University of Illinois) told reporters. Everyday sexism can, and does, kill.

Ironically this phenomenon has come about thanks to 1970s anti-sexism. The report states: "Although using human names ... has been thought by meteorologists to enhance the clarity

and recall of storm information, this practice also taps into well-developed and widely held gender stereotypes, with unanticipated and potentially deadly consequences".

True: but only since 1979. Storms have been 'named' since 1947, first using the phonetic alphabet. This was confusing, so in 1953 a new phonetic alphabet using female names was introduced. Naming storms in this way evoked wild, tempestuous, termagant females, emerging from the (feminine) ocean, to be eventually soothed into quiescence by contact with the (masculine) land. Women's libbers, as they were known, hated it, and rightly so. In 1979 the World Meteorological Organization introduced new lists with male names included. It was hailed as a triumph for equal rights.

It is easy to make fun, but the exclusive use of one gender's names was invidious and patronizing and had to stop. Unfortunately, gender stereotyping is too deeply rooted in the subconscious for this to be the end of the matter. We are all victims of it, no matter how right-thinking or politically correct we consider ourselves. Things done for the right reasons can, in this chaotic world, have unintended consequences.

And if irrationality can control survival behaviour, how much more likely is it to affect our political, or for that matter, scientific judgement?

DR TED NIELD, EDITOR - [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk) @TedNield @geoscientistmag

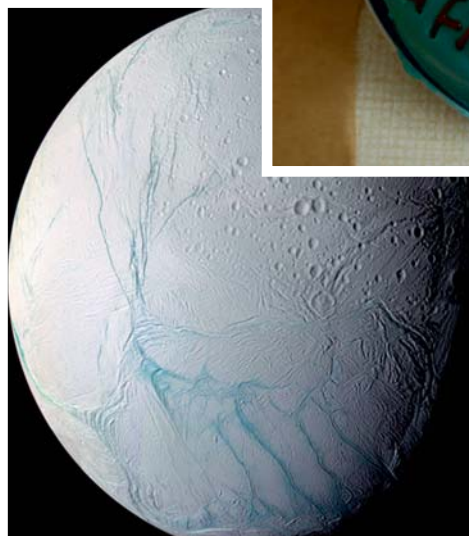


# SOCIETY NEWS

What your society is doing  
at home and abroad, in  
London and the regions



## The great geobakeoff



### Sarah Day reports on the most successful geology-based baking competition in the entire history of the world, like, ever.

Back in April, we set readers of the Geological Society's blog a challenge. With Easter around the corner, how many geologically themed cakes could they bake in a four-week period? Challenges ranged from a simple sandstone layer cake for 10 points, to classic formations such as Durdle Door and Giant's Causeway, to the 100-point challenge – to recreate the *Velociraptor*-hatching scene from *Jurassic Park* in edible form.

Thus the geobakeoff phenomenon was born, and almost 100 entries came pouring in via facebook, twitter and email (disappointingly, none by parcel post). Incredibly, every challenge was met – including the hatching *Velociraptor* – plus a few extra ones created along the way.

Thank you to everyone who baked, shared the #geobakeoff hashtag, and to those who send in pictures of their own geological cakes – we had no idea there were so many geobaking possibilities. Congratulations to our 10 winners, who are all the proud recipients of one of our coveted, near-mythical rock hammer USB sticks, and a lovingly designed wooden spoon trophy.

Geobakeoff returns with a Schools Special, for Earth Science Week (13-19 October). See our blog for details.

### Geobakeoff winners

And the 10 winners were, in reverse order:

- ◆ **100 points** Hannah Moss Davies (@hannah\_MD24), Rachel J (@rachisaurus)
- ◆ **130 points** Leanne Roden (@leanneroden90), Dheyne (@dheyne\_x), Catherine Kenny
- ◆ **140 points** Rehmat Bhatia (@livelovesurf24)
- ◆ **160 points** GeoBus (@Geobus\_StA)
- ◆ **310 points** Gwenno Talfryn
- ◆ **360 points** Carrie Soderman (@carriesoderman)
- ◆ **580 points** Liz Laycock (@longrat)

➤ All the entries are available to see on our Flickr page [www.flickr.com/photos/geolsoc](http://www.flickr.com/photos/geolsoc) Keep up to date with geology baking and other stories by reading our blog [geolsoc.wordpress.com](http://geolsoc.wordpress.com)



## August special offer

**Emily Milroy (GSL Publishing House) on a special cut-price subscription to the Full Book Collection, available this month!**

Fellows who have not previously taken advantage of the Full Book Collection in the Lyell Collection can become online subscribers for the remainder of the year for the reduced price of £37.50 (normally £75).

To sign up, please contact the Fellowship Department by 29 August 2014 (see right).

◆ Features more than 420 books, comprising all books included in the

Books Archive, plus all other titles published from 2010 to the present day

◆ You can read individual chapters from new books online soon after they are accepted for publication and before the volume is collated through our Online First publishing system.

➤ Find out more about the Full Book Collection at: [www.geolsoc.org.uk/fellowsaccess](http://www.geolsoc.org.uk/fellowsaccess). To take advantage of this offer, contact: [membership@geolsoc.org.uk](mailto:membership@geolsoc.org.uk).



## Geological Society Club

The Geological Society Club, successor to the body that gave birth to the Society in 1807, meets monthly (except over the field season!) at 18.30 for 19.00 in the Athenaeum Club, Pall Mall, or at another venue, to be confirmed nearer the date. Once a year there is also a buffet dinner at Burlington House. New diners are always welcome, especially from among younger Fellows. Dinner costs £57 for a four-course meal, including

coffee and port. (The Founders' Dinner, in November, has its own price structure.) There is a cash bar for the purchase of aperitifs and wine.

◆ **2014:** 24 September; 15 October.

➤ Fellows wishing to dine or requesting further information about the Geological Society Club, please email Cally Oldershaw (Hon Sec) at [cally.oldershaw@btopenworld.com](mailto:cally.oldershaw@btopenworld.com) or T: 07796 942361. DR

## Society Awards

Fellows of the Society are invited to submit nominations for the Society's Awards for 2015 to the Awards Committee. Full details of how to make nominations are on the website at: [www.geolsoc.org.uk/gsl/awards](http://www.geolsoc.org.uk/gsl/awards). Nominations must be received at the Society no later than 1 October 2014. *Stephanie Jones*



### FUTURE MEETINGS

The dates for meetings of Council and Ordinary General Meetings until June 2015 will be as follows:

- ◆ **OGMs:** 25 September, 26 November 2014; 4 February; 8 April 2015
- ◆ **Council:** 25 & 26 September (residential), 26 November 2014; 4 February; 8 April 2015



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### ◆ Inter-library loans

If the item you want is not in our collection, we may be able to obtain it from another library. To find out more about this service, please email [library@geolsoc.org.uk](mailto:library@geolsoc.org.uk) or call 020 7432 0999.

### ◆ Sponsor a Book

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➤ The library is open to visitors Monday-Friday 0930-1730. For a list of new acquisitions click the appropriate link from [www.geolsoc.org.uk/library](http://www.geolsoc.org.uk/library)

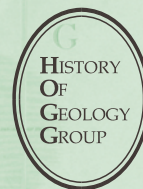


# William Smith Meeting 2015



The  
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PART OF THE WILLIAM SMITH MAP BICENTENARY PROGRAMME OF EVENTS

## *200 Years of Smith's Map*



William Smith was an English geologist who created the first nationwide geological map. In 1794, as a surveyor for the Somerset Coal Canal, Smith recognised that each stratigraphic horizon contained unique fossils. This enabled him to work out the order of strata. From his 1799 map of the strata around Bath, Smith progressed to the publication in 1815 of 'A Delineation of the Strata of England and Wales'. His ideas disseminated widely but took time to become accepted.

This bicentenary meeting aims to address:

- Smith's achievements and his impact on the state of geology in his time
- His fossil collection
- His contemporaries
- His relationship with the Geological Society of London
- His various careers including canal builder, land drainer, mineral surveyor and lecturer.
- Contemporary concepts of geological survey and map design
- Past and present research into surviving Smith maps, sections and documents.

**Private Exhibition at Natural History Museum:  
22 April 2015**

**Conference at the Geological Society, Burlington House: 23-24 April 2015**

**Field Excursion in Oxfordshire: 25 April 2015**

**The History of Geology Group (HOGG) is organising the first of 2 Geological Society William Smith Meetings in 2015.**

### Confirmed Keynote Speakers

Professor Simon Knell, Professor Hugh Torrens, Tom Sharpe.

### Convenors

David Williams, Cherry Lewis, John Henry.

### Call for Papers

We are pleased to invite all interested participants to submit abstracts for 25 minute oral presentations and posters on topics of relevance. International contributions are most welcome, although no financial assistance can be given. 500-word abstracts should be submitted by 31 August 2014 to John Henry: [wmsmith2015@gmail.com](mailto:wmsmith2015@gmail.com)

### Posters

Given the fundamentally graphic contribution of William Smith to geology, posters are also invited and it is intended that short presentations of selected posters will be addressed to the conference

audience prior to the poster sessions. 250-word abstracts should be submitted by 31 August 2014 to John Henry: [wmsmith2015@gmail.com](mailto:wmsmith2015@gmail.com)

### Publication

It is intended that the conference proceedings will be published as a Geological Society Special Publication. Please indicate your willingness to contribute a paper when submitting your abstract. Suggestions for written contributions to supplement the proceedings from the conference are also invited.

### Field and other visits

During the conference we aim to visit Smith's fossil and rock collections at the Natural History Museum. On Saturday 25 April we will visit the Smith Archive at the Oxford University Museum of Natural History, and Smith's birthplace and the Smith Heritage Centre in Churchill village.

### Further information

For further information about the conference please contact: Naomi Newbold, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG

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Follow this event on Twitter #wsmith15 W: [www.historyofgeologygroup.co.uk](http://www.historyofgeologygroup.co.uk)

The 2nd 2015 William Smith meeting will be in November. W: [www.geolsoc.org.uk/wsmithNov15](http://www.geolsoc.org.uk/wsmithNov15)

**The William Smith Map  
Bicentenary (1815-2015)**





# Plastic spring

May I respectfully ask the Society to think twice about its Amended Climate Change Statement? asks **Chris Mackenzie\***



Call me a 'denialist' if you have to, but please let's have a broader environmental debate. Carbon dioxide is fine, it occurs in nature, it has been around acting as an agent of evolution far longer than oxygen. Plants make themselves from it. Nature deals with it.

But the biosphere is suffering from a huge increase of man-made substances which nature cannot deal with. Should we not be more concerned about any chemicals that do not occur in nature, and hence have not been "evolved for" by anything in nature? CFCs (remember them?), PCBs, BPA and a whole host of other catchy acronyms are a case in point. All plastics and synthetic products, overwhelmingly produced by Big Oil, are a huge environmental catastrophe in the making. Non-natural radionuclides are another example. The clamour to demonise CO<sub>2</sub> does us a disservice by blinding us to other threats.

Nothing ever evolved to deal with 2,4,5-Trichlorophenoxyacetic acid. When mixed with 2,4-Dichlorophenoxyacetic acid and dioxins it made an effective herbicide. Today we know a lot more about 'Agent Orange'. The swathes of tropical rainforest against which it was used are still suffering, decades later. Humans died, nature died, and the poison persists - bio-accumulating, like all these poisons which cannot be metabolised by nature.

Nowadays, neonicotinoids are implicated in the loss of our bee colonies. While the scientific evidence may not yet be concrete,

do we really need more data to realise that the unintended consequences of synthetic chemical usage are huge?

We are all concerned about 'sustainable development' and other such Newspeak buzzwords. But looking back on billions of years of evolution, it is clear that the main issues facing this planet resulted from the transition of one primate from a hunter-gatherer lifestyle to that of farmer. As soon as human populations came to control their food supply, rather than the food supply controlling the size of human population, things began to go seriously awry.

We cannot turn the clocks back. We must minimise our impact, and massively reduce the amount of synthetic, non-natural chemicals in the biosphere. We must revert to the use of natural materials where possible, rather than plastics and synthetics. Even as an eternal optimist, I personally hold little hope of progress, given the quality of debate about CO<sub>2</sub>. Rachel Carson never saw even the tip of the iceberg. In one village in Tanzania where I work recent river sediments contain up to 5% plastic debris.

*Silent Spring* was written a long time ago; now synthetic chemicals are far more abundant, far more complex and long-lived, and appear to be making significant inroads into the natural environment at a cellular level. That is a clear and present danger, one about which I hear nothing about from my Society.

\* **Chris Mackenzie** works in mineral exploration and is based in Windhoek, Namibia

## SOAPBOX CALLING!

Soapbox is open to contributions from all Fellows. You can always write a letter to the Editor, of course: but perhaps you feel you need more space?

If you can write it entertainingly in **500 words**, the Editor would like to hear from you. Email your piece, and a self-portrait, to [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk).

Copy can only be accepted electronically. No diagrams, tables or other illustrations please.

Pictures should be of print quality – please take photographs on the largest setting on your camera, with a plain background.

Precedence will always be given to more topical contributions. Any one contributor may not appear more often than once per volume (once every 12 months).

“ALL PLASTICS AND SYNTHETIC PRODUCTS, ARE A HUGE ENVIRONMENTAL CATASTROPHE IN THE MAKING. THE CLAMOUR TO DEMONISE CO<sub>2</sub> DOES US A DISSERVICE BY BLINDING US TO OTHER THREATS”  
**Chris Mackenzie**



Perfidious plastic



Chris Mackenzie



# CROWDSOURCING SCIENCE



**Helen Quinn\***  
investigates the  
potential of 'citizen  
science' for geology

*Above: Hands up – who wants to be a citizen scientist*

*Right: Gold from the Goldcorp Red Lake Mine, Ontario, Canada*

**E**arly in the new millennium, the Chief Executive of Goldcorp, a Canadian gold producer, took the unusual step of making a large amount of private commercial data public. His employees thought he was mad, but Goldcorp was in trouble and facing the very real prospect of going under.

The company posted all of its data for the Red Lake mine in Ontario online – staking \$575,000 in prize money to anyone who could identify the best target for the next six million ounces of gold. This early example of crowd-sourcing was a last-ditch effort to find the gold that had been eluding

Goldcorp for so long. More than 1400 scientists, engineers, and geologists from 50 countries around the world accepted the virtual exploration challenge and for Goldcorp the gamble paid off. The value of the gold discovered in the Red Lake district has so far exceeded \$6 billion, helping make Goldcorp one of the fastest growing gold producers in the world.

Today, reaching out to a virtual crowd is becoming more common within the scientific community. By outsourcing tasks to an unknown, widely distributed group, crowd-sourcing can enable researchers to gain a large amount of data, often exploiting the fact that the



“CROWD-SOURCING CAN ENABLE RESEARCHERS TO GAIN A LARGE AMOUNT OF DATA, OFTEN EXPLOITING THE FACT THAT THE CROWD CAN CONTAIN MORE KNOWLEDGE THAN INDIVIDUALS”



Red Lake mine, Ontario, Canada



Image: With thanks to Goldcorp [www.goldcorp.com](http://www.goldcorp.com)

Gold pour at Goldcorp's Red Lake Mine



Image: via Wikimedia Commons

Gregor Mendel, father of genetics: once upon a time, all scientists were citizen scientists

crowd can contain more knowledge than individuals. Goldcorp's early example of geological crowd-sourcing was a huge success but is it something that could be more widely applied in Earth sciences, and how useful are 'citizen scientists' in the world of geological research?

## Nothing new

Citizen science is nothing new according to Dr Chris Lowry of Buffalo University, New York, who has pioneered a citizen science project, measuring water levels across different drainage basins throughout America. "Originally everyone was a citizen scientist" say Chris, "You had a job and science was

on the side, at some point in history we decided to professionalise science."

The gentlemen who found themselves dabbling in the scientific world a couple of centuries ago may have been surprised to hear themselves described as 'citizen scientists', but the active involvement of amateurs in science, and specifically geological sciences, is something Chris is keen to exploit. "It is the

connectedness of our world that has increased these opportunities for scientists to seek help from non-specialists, and also thrown up greater opportunities. There has been a convergence between professional and citizen science, it is becoming blurred again, because citizen scientists can process and correct data."

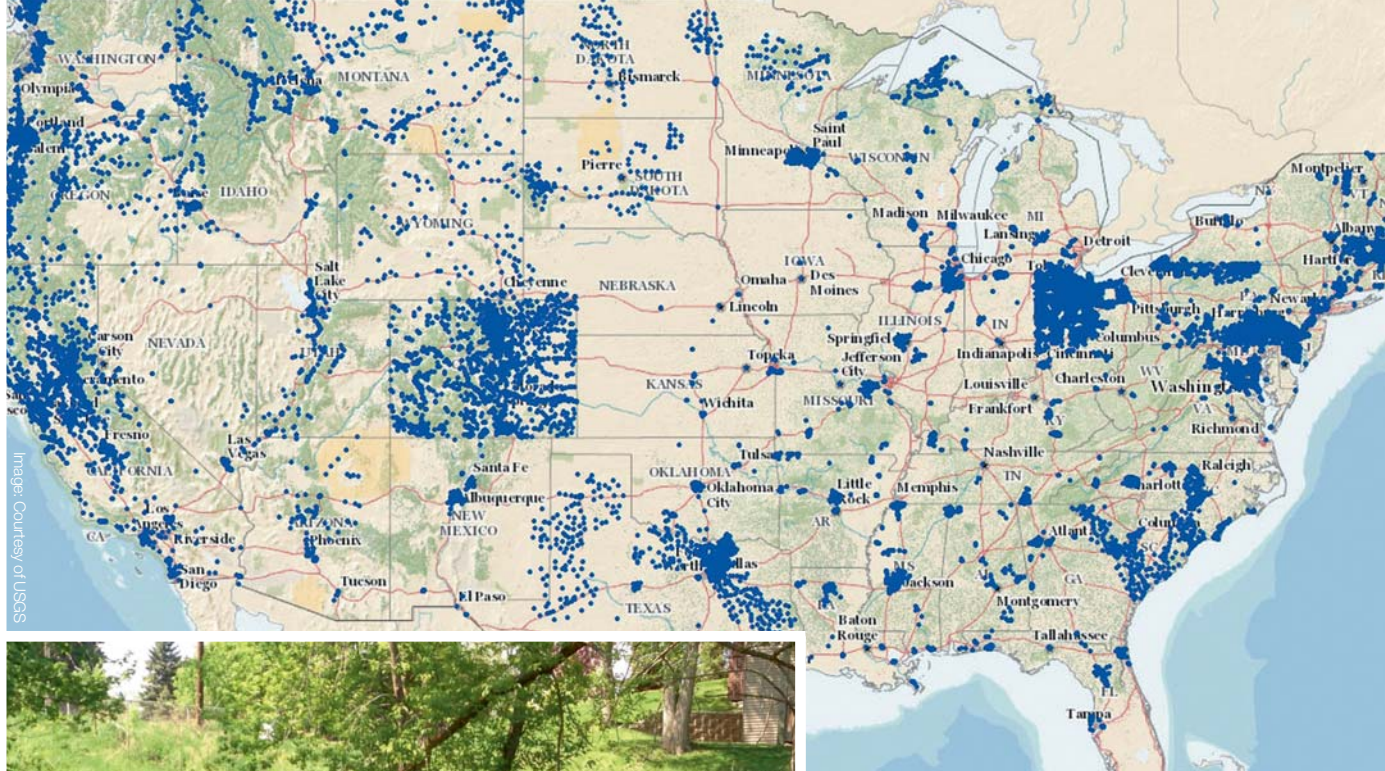
## Data collection

The USGS has been actively encouraging ordinary citizens to get involved in their projects for over a century. ▶





The National Map volunteer contributions April 2013 to April 2014



A simple river gauge

► The organisation, one of the most renowned mapping institutions in the world, began mapping the American continent 135 years ago. What started as mineral exploration, very quickly turned into the creation of a topographic map covering the whole of the United States of America. Today this map is known as 'The National Map' and although built on the mapping expertise of the USGS, the map has greatly benefited from the contributions of volunteers throughout its existence.

When the USGS began work on the National Map, it quickly realised that vast areas had to be covered and USGS employees alone could not complete the work. "We have been collecting forms for over 100 years. In the past half century we would post questionnaires and the postmaster would fill it out and return it here" says Dr David Wald, a citizen science project leader at USGS.

The postal surveys were designed to provide topographic information in areas that USGS surveyors could not practically reach, and although the best option at the time, they were for obvious reasons limited. Postmasters could not always be relied on to fill them in and the areas covered were perforce confined those connected by the postal system. Usually about a hundred surveys would come back and processing took between six months and a year. "It was a huge amount of work," says David.

What has changed is the advent of the Internet, and mobile phones. Today we are connected like never before, so the possibility of reaching the 'crowd' has never been so high. For the last five years, the National Map Corps at USGS has collected all its citizen updates online. 12,000 volunteers across the country have submitted more than

'Crowdsourced hydrology' in action in the UK





25,000 data points, allowing USGS to acquire and check data from citizens with local knowledge.

For citizen science to be successful the trick is creating the right conditions to enable researchers to tap into and harness the collective knowledge out there. The USGS, with decades of mapping expertise behind it, has been able to incorporate the work of volunteers into an existing project to supplement and update its vast foundations of knowledge. The public has a very simple role - no expert knowledge is required.

## Simple ideas

Having a very simple premise certainly helps when setting up this type of project. Dr Chris Lowry, in partnership with Dr Mike Fienen at USGS, is using the crowd to collect water-level data. "I like to think every American can read a ruler" Chris says, and with this in mind he realised that crowd-sourcing for extra hydrological data on his projects could become a reality. "We can't afford to collect all this data ourselves - I needed higher resolution and lower costs; and so we realised we could put giant rulers into streams with signs saying 'please text me the water level'."

Chris and Mike set up a series of such rulers in streams and lakes around their study basins. "We definitely could not do this much data on this many sites using more traditional methods; we just couldn't afford it. Economically it doesn't make sense" says Chris.

For a project to be successful it must have a low barrier to entry. This is not because the crowd is uninterested but because people are generally busy, and if it is too much hassle people simply won't bother. But a well thought-out simple premise can throw up surprising revelations. For Chris and Mike, the location of their 'giant rulers' was the key to the project's success. Initially they went for sites with a high footfall, but surprisingly these often turned out to be sites where the lowest number of people got involved.

"We learned good lessons," says Mike. "We thought boat landings would be a good place but the sites were horrible traffic jams, not relaxing places". In this frame of mind people were disinclined to participate. Popular fishing spots also turned out to be unpopular for texting in data. It seems that if you are out for a relaxing day fishing, you are more likely to keep your phone off!

Chris and Mike are very keen to understand what motivates people to become involved in a scientific project. Often, mutual benefit is enough to guarantee a crowd. They have discovered that canoeists in some of their study basins actively participate, frequently texting data because canoeists themselves have found the information useful - water levels being crucial to their activities on the river. Next summer Chris and Mike hope to target such groups rather than relying on chance participation, moving from passive crowd-sourcing to actively targeting willing volunteers.

## Natural crowd

In other areas of geoscience, finding a crowd is not so hard. Natural disasters automatically bring people together and regular earthquakes across the United States have provided the USGS with an already-assembled, active and connected crowd.

Last year, after a successful pilot project, USGS launched a nationwide project known as "Did you feel it?" which asks citizens to detail their experiences of any earthquakes in their area. "I call it citizen-based science: the person filling out the form just has to be an observer. Anyone who feels an earthquake can be a valid contributor" says Dr David Wald, project leader of *Did you feel it?*. "Mother nature shocks you into it, it's an experience you can't get away from. People are often truly scared, providing what you feel is a kind of catharsis, people want to share their experience and we are tapping into that."

The USGS has always been a source of earthquake information for citizens of the United States. Members of the public come to their website for advice about earthquake activity in their area and while online often discover *Did you feel it?*. Next time there is an earthquake they are invited to submit information about their experiences. By answering questions such as: If you were sleeping, did it wake you? Was there any damage to your building? and: Did pictures on the wall move or get moved askew?

Citizens are thus able to contribute actively to USGS's knowledge of earthquakes around the United States. The questions are designed to be diagnostic of ►



**Above:** People gathering outside in Washington, D.C. in the wake of the 2011 earthquake which registered M5.9. There were around 150,000 'Did you feel it?' responses to the Virginia earthquake, 80-90% of these were in the first hour

“FOR A PROJECT TO BE SUCCESSFUL IT MUST HAVE A LOW BARRIER TO ENTRY. THIS IS NOT BECAUSE THE CROWD IS UNINTERESTED BUT BECAUSE PEOPLE ARE GENERALLY BUSY, AND IF IT IS TOO MUCH HASSLE PEOPLE SIMPLY WON'T BOTHER”





► earthquake intensity and the citizen response, through the application of a simple algorithm, can be translated into a quantitative intensity as measured on the Modified Mercalli Intensity Scale. The translation of citizen observations to quantitative data is an important step forward in citizen science, which has mostly relied on simple qualitative observations in the past.

One of the quirks of *Did you feel it?* is that citizen information, via text and the Internet, often get to the USGS faster than the seismic measurements. "It is a unique form of traffic, everyone feels it at the same time and people feel connected and get online. Now we have a much better sampling reach, a better volume; we had around 150,000 responses to the Virginia earthquake [in 2011] and 80-90% of these were in the first hour" says David.

Because large magnitude earthquakes are fairly rare along the East Coast, there were only a small number of seismometers installed nearby to record the Virginia earthquake event; citizen scientists therefore provided much of

the preliminary data for this earthquake. "It's almost more than we can do to keep up with this growth; now it's orders of magnitude higher, we have higher population and huge Internet growth. It's a game-changer. We just can't collect that amount of data. We scratch the surface with our own resources."

Data acquired from citizens is regularly tested against data from the USGS seismic stations to ensure errors are minimal. These types of checks are being repeated in other studies such as Chris Lowry and Mike Fienen's hydrological project, where checks using pressure transducers and USGS borehole data provide error measurements of less than 200th of a foot (an increment of their giant rulers) for every measurement. This gives researchers confidence that this type of controlled volunteer participation can add scientifically valid data to existing projects.

## Global engagement

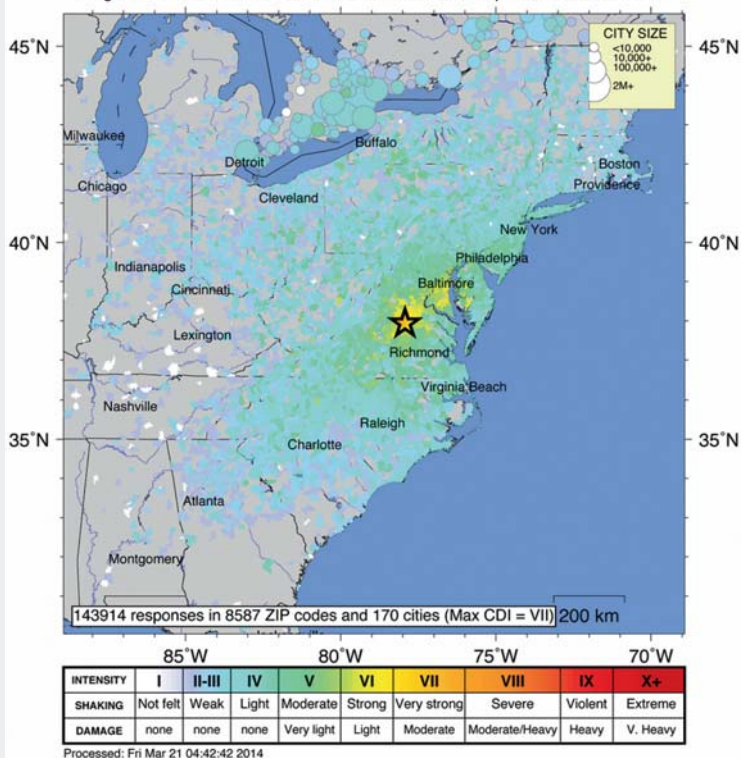
Closer to home the British Geological Survey have at least seven scientific

projects in which they work with citizen scientists. From soil studies, to flooding and earthquakes to landslides, the BGS is actively engaging with the British public. "I am really enthused," says Professor Mike Stephenson, Director of Science and Technology at BGS. "For us it would be madness not to take into account what people observe. There are lots of feet on the ground and lots of eyes out there - it would be just nuts not to use it. We have very much bought into the idea of citizen science and crowd-sourcing, I don't think we could operate without it."

Interestingly the BGS has actively encouraged citizens to go beyond simple observations and to collect samples. Keen amateur volcanologists can send in ash samples to help scientists understand the distribution of ash-fall after major volcanic events such as the Eyjafjallajökull in 2010 and Grímsvötn in 2011. All of this can be done via a smartphone app known as *myVolcano*, which guides volunteers through the process of collecting images, samples and data, while also

USGS Community Internet Intensity Map  
VIRGINIA

Aug 23 2011 01:51:04 PM local 37.9360 77.9330 M5.8 Depth: 6 km ID:se082311a



A USGS Community Internet Intensity Map of the 23 August 2011 Virginia earthquake



Natural events like the eruption of Eyjafjallajökull (Iceland) trigger the need for 'cathartic' contributions, say crowd-sourcers



providing the user with information and education about volcanoes around the world.

The volcano project is being undertaken on a worldwide basis, in conjunction with the Smithsonian Institute in Washington, and like many of the BGS's citizen science projects there is a real feeling of global reach. Mike is keen that BGS projects continue to go beyond the shores of the UK and is excited about the collaboration with aid agencies around the world, potentially making disaster relief increasingly accessible and more quickly available.

Worldwide projects come with their own problems, not least border and language issues; but by bringing crowds together on a worldwide stage there is even more potential to gain from the crowd's collective knowledge. "It's the size of the information out there. It's wonderful to develop relations with citizen scientists out there and use these things. Astronomy has been doing it for a while, why is geology any different? It's a very

exciting time," says Mike.

Not all of BGS's public participation projects have so far met with unqualified success however. Its *GeoExposures* website, which aims to allow citizens to record temporary exposures, has logged only 13 such exposures in the five years since its inception. These entries are of high quality, but it appears that the level of specialist technical knowledge required is simply too high for it to qualify as a true 'crowd source' project. While the community appears keen in theory, reactions seem to bear this out: "The activation energy required is simply too high" one amateur field geologist confided. The USGS's view about 'low barriers to entry' seems to be right on the money.

### Awareness

Undertaking citizen science can be quite unlike traditional methods of research and as a result it has sometimes jarred with the scientific community. But, with high levels of accuracy being recorded and awareness growing, the possibilities

for supplementing core research are huge. At the heart of all citizen science projects lies the active involvement of amateurs in the work of the scientific community. Technology has made some of these connections feasible, but it is the human behaviour that technology enables that makes crowd-sourcing such an exciting option. Scientific projects are capitalising on a much more connected world and our deeply ingrained social nature, offering exciting possibilities for the geological sciences.

As Mike Fienen reflects: "I really love the idea of people engaging in science even if they are not 'experts'. Whenever the general public and scientists come together strongly it's a way to engage and interact with the environment. I love the idea that people feel engaged with the environment around them and it's a clever way to get more data, but more important it is that engagement." ♦



\* **Helen Quinn**, who studied geology at Edinburgh University, works in the science department at the BBC.



Image: Johann Helgason / Shutterstock.com



Image: Infico / Shutterstock.com

*The engagement aspects of citizen science are at least as important as their scientific contribution*



# NOTHING NEW

## UNDER THE SUN GOD





## John Dixon\* explores earthquake damping technology in the Pre-Columbian pyramid structures of Peru

**A**s I sat in my office in one of the high rise buildings in San Isidro feeling the effect of a relatively minor (M5.5) earthquake (the fifth of 2013, which shook my surroundings like distant thunder) I was reminded that in this plate-edge environment where earthquakes are far from infrequent the peoples of Peru must have been coping with such instability since they first appeared in the land.

The geological setting of Lima would not perhaps be considered conducive to construction. The city is built upon two great alluvial fans of the rivers Rimac and Chillón. These fans, of late Pliocene or early Pleistocene age, derived from the igneous rocks of the Andes, comprise a thick sequence of sands, gravels, cobbles and boulder beds sometimes showing good gradation and localized stratification. As may be expected, the clasts are largely igneous with cobbles and pebbles of Andean rock-types such as granites, diorites and gabbros. They are weakly cemented and their erosion into gullies is well developed along the cliffs of Miraflores.

They do not strike the eyes of this hard-rock geologist as good foundation material; though clearly, over some 2000 years or more they have been just that - and these days high-rise buildings abound within the modern city limits. It is worth noting that erosion of the cliffs has occurred over a long time period since water is a rare commodity in Lima, most being drawn from the Río Rimac, with an annual rainfall of about 25mm mostly occurring as *garúa* (or, very fine drizzle).

### Lima quakes

Lima is no stranger to earthquakes and there are certainly many records dating back to the first arrival of the Spanish. Throughout the years since then there are significant earthquakes every few decades or so as the Nazca plate slowly grinds its way under the South American plate. For instance in 1940 there was a M7.3 which devastated the town and this was followed by a smaller one (M6.4) in 1966 and another of M7.2 in 1974.

Modern construction and engineering techniques and codes are in place to help mitigate the effects of such events, but in much of Lima these codes simply cannot be applied because of the rapid growth of the city and largely uncontrolled building. It is for this reason that seismologists are warning of significant loss of life should Lima be struck by large quake, as is widely anticipated.

In the modern world we are, as geologists and engineers, familiar with such things as Maximum Design Earthquake criteria and associated peak ground accelerations and risk assessments based on these factors. It is easy to forget that for most of human existence on the planet there were no such tools by which we could feel some comfort or level of control when building town and cities.

No clear picture exists of the events witnessed by early settlers. Little by way of records were kept in a society where verbal tradition was more important. But it is clear that there was a keen interest in cyclical events, if only because they needed to understand such things as the effect of *el Niño*, and seasonal variations, to be able to produce sufficient food for a growing population. It is probably within this context that the people of, for instance the Lima or Huari cultures, first became aware of both the effect of earthquakes and the fact that, while they were not necessarily cyclical, they certainly occurred frequently enough to warrant attention and concern.

None of this means that people did not try to understand what was going on, or try to mitigate the effects of the Earth's power upon their built environment. So what sorts of techniques were available to the pre-Columbian peoples of the area we now call Lima? Examination of the structures' construction reveal that they employed two effective methods of seismic damping.

Within Lima there are at least two sites - in San Isidro and Miraflores - that provide evidence of a level of evolving understanding about the behaviour of earthquakes, demonstrating that these ►



**Above:** Delta fan material forming the cliffs in the Miraflores district of Lima, Peru

**Left:** The modern city of Lima, Peru, a site where earthquake-proofing may have a lengthy history

“THERE ARE SIGNIFICANT EARTHQUAKES EVERY FEW DECADES OR SO AS THE NAZCA PLATE SLOWLY GRINDS ITS WAY UNDER THE SOUTH AMERICAN PLATE”





By no means all of Lima's modern buildings incorporate Maximum Design Earthquake criteria



► cultures were both aware of their effects and able to deal with them – at least to a certain degree.

## Huaca Huallamarca

The earliest of these structures is the Huaca Huallamarca in San Isidro. This is believed to have been constructed about 1800 - 2000 years ago in the form of a stepped pyramid rising in three platforms to a height of about 19 metres. Each platform is formed from roughly rounded adobe, laid in rough stretcher courses, with a clay layer of about 25mm separating each course. The mud bricks, all 3.5 million of them, are of a varied composition is so far as many are quite pebbly or contain shell material, indicating the source material came from local rivers.

It has been much restored since the 1950s but the method of construction indicates that it was a solid structure; its use as a cemetery, some hundreds of years after abandonment by its original builders, is purely coincidental. Rounded mud bricks have by their very nature

significant spaces between them and between each layer, and it is believed that this behaved as damping system against earthquakes. The effectiveness of this system is difficult to judge because of alteration and restoration since its abandonment, c.700 AD. However, significant areas of original adobe indicate the construction approach, and suffice to say the structure remains - a monument to the appropriate building skill of the Lima Culture at even this early stage in development.

## Huaca Pucllana

The second, slightly later structure is the Huaca Pucllana, in Miraflores. The site is considered to have held religious significance for several hundred years about 1600 years ago. It is a construction of mud brick and, tiered in a number of platforms, it forms a substantial pyramid structure within a complex covering some 15 acres. The construction is entirely from adobe, much as the Huaca Huallamarca; but in this case there has been an evolutionary change in design.

The bricks at the Huaca Pucllana are all rectangular prism-shaped, each formed by hand. Although they are all nearly the same size and generally 'brick shaped', the lack of any sort of mould means there is inevitably some shape and size variation. In total some 9,000,000 mud bricks were made to produce this edifice, also thought to be solid – that is, containing no burial chambers. The change in the shape of the adobe may be a conscious development of older building techniques in the light of experience gained at the earlier sites such as Huaca Huallamarca. This is clear from the method of construction, which involved stacking the bricks in 'soldier courses' as they are known in the trade, like books on a shelf, but all with small gaps between each brick.

These gaps were not filled at all, with no effort to use any form of mortar or cement. Between each course the builders placed a binding layer of clay about 25 - 50mm thick, as at the older site, before starting their next course. This means that the pyramid, reaching a total





*Clockwise from lower left (this page): The restored Huaca Huallamarca in San Isidro, Lima*

*Rounded adobe exposed at the edge of second platform. Note what appears to be an internal buttress and the restored level above*



*Rounded adobe fill to the interior of platform 1. Note the irregular surface formed by the roughly formed adobe*

*Huaca Pucllana rising to a height of over 22m*

*The stacks of adobe making the Huaca Pucllana*



of 22m in height, was entirely a 'dry brick' structure. This may not appear at first to be inherently stable, but nevertheless it has stood with little damage for nearly 2000 years and in that time has withstood some large scale earthquakes.

It appears that the reason for the pyramid's seismic resistance lies not only in the fact that the building is essentially solid but in the deliberate gaps between all 9,000,000 bricks. Though there are some areas which may represent failure and repair, the greater use of deliberate inter-brick voids is believed to have further acted to dampen seismic effects.

While the homes of the people who invested so much time and effort in the construction of the Huaca Pucllana may have been destroyed, their great edifice remains to this day a symbol of their god's power and the ingenuity of engineering brains all those years ago. ♦

**\*John Dixon** is a consulting Engineering Geologist, currently based in Lima, Peru

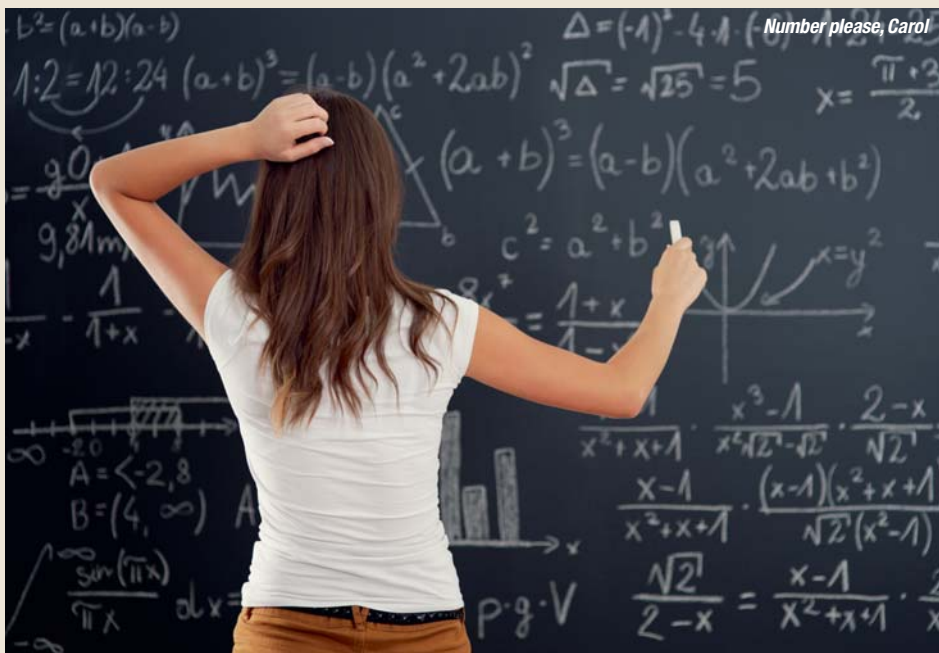
## SIGNIFICANT EARTHQUAKES IN LIMAS RECENT PAST

Date	Location	Strength
28 October 1746	Callao Region, Lima	8.7
13 August 1868	Arica, Lima	9.0
24 May 1940	Callao Region, Lima	7.3
17th October 1966	Liam Region	6.4
3 October 1974	Liam Region	7.2
18 April 1993	Liam Region	6.0
15 August 2007	South Southeast of Lima	8.0
25 September 2013	South southeast of Lima	6.8
25 November 2013	South east of Lima	5.5



# READERS' LETTERS

**Geoscientist** welcomes readers' letters. These are published as promptly as possible in *Geoscientist Online* and a selection printed each month. Please submit your letter (300 words or fewer, by email only please) to [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk). Letters will be edited. For references cited in these letters, please see the full versions at [www.geolsoc.org.uk/letters](http://www.geolsoc.org.uk/letters)



## Still room for the innumerate geologist

Sir, Ken Vines is quite off the mark when it comes to his "and maths is always going to be the most important". I have always considered geology to be as much art as science. As a retired senior geologist with Anglo American my working career was on several important Copperbelt mines and prospects. We had the geophys and geostat fellers when we needed them but there was one amazing occasion when a quite senior chap, who had come up the 'geo-maths' ladder, looked at the specimen I had picked up and said "what's that?". I said it was the local tillite. He said "don't be ridiculous we are in the middle of Africa, it's hot around here!".

I achieved a maths 'O' level but went on to "A" level with biology, chemistry and physics. I entered university quite late, having been through Teacher Training, qualifying in biology and rural science, and then teaching general science. My intended university course was to be biology with chemistry. I missed the first chemistry lecture and was told to read chapter one of a physical chemistry book. It was quite unintelligible - mainly because of all the maths. My personal tutor said: "I think there are still places on the geology course". I never looked back. To those without maths I say - do not despair!

JOHN WATERS

## Ground-breaking?

Sir, I find the tacit acceptance of my article (*Geoscientist* 23.10 November 2013) about the unusually high incidence of riots in the 14 days before earthquakes in England and Wales between 1980 and 2012, highly encouraging.

I thank Richard Batchelor for his supportive letter and naturally, any further comments or suggestions from Fellows would be welcome.

The Hypotheses I tested were: 'There is a significantly higher incidence of riots and disorder in the 14 days immediately before earthquakes of 2.5ML or greater [in England and Wales 1980 to 2012] than would be expected by chance.' and...

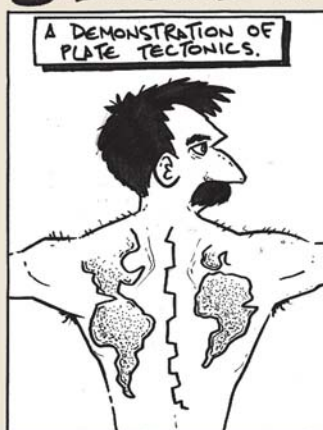
'There is a significantly lower incidence of riots and disorder after more than 140 days has passed since the last most recent earthquake and when more than 14 days remain before the following earthquake of 2.5ML or greater [in England and Wales 1980 to 2012], than would be expected by chance.'

Apparently, your readership does not object to my conclusion that the probability of the stated hypotheses being wrong is substantially less than 1%. I am delighted that the geological community is at least not dismissing the results of my research into this little-known phenomenon.

ALAN WATSON

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## STICKS AND STONES

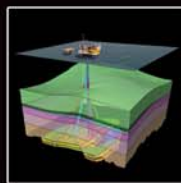
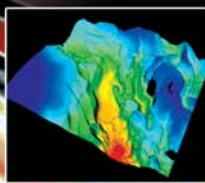


## GEO TATTOOS



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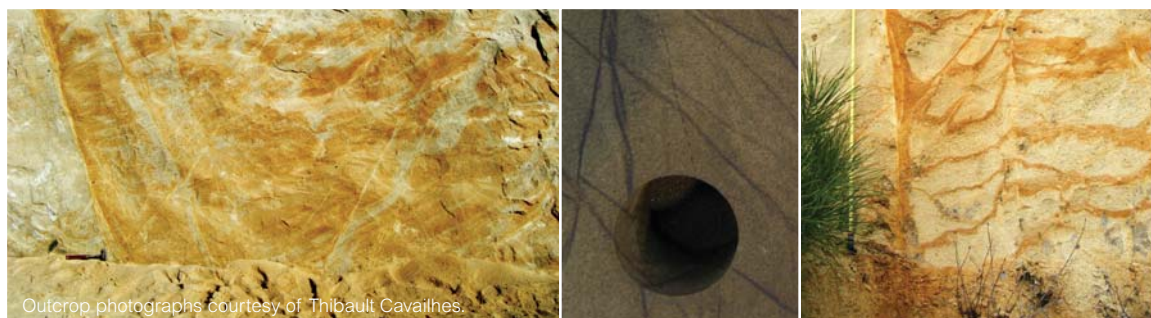


**REGISTRATION NOW OPEN**

# Small to Subseismic Scale Reservoir Deformation

## 29-30 October 2014

The Geological Society, Burlington House, Piccadilly, London



Outcrop photographs courtesy of Thibault Cavailhes.

Small to subseismic deformation features can negatively impact reservoir performance and/or be stimulated to enhance field recovery. In many cases such features are controlled by, or interact with, similarly scaled sedimentological features, complicating conventional views of intra-reservoir connectivity and flow unit definition. Whilst the intra-reservoir distribution of these small-scale features has traditionally been 'modelled' in the subsurface by applying data from analogue outcrop studies, the recent advances in the acquisition and processing of both seismic and imaging techniques, such as helical CTscans, have provided greater resolution of the 'subsurface' than ever before.

This 2-day international conference will bring academic and industry geoscientists and engineers together, to examine: (i) how much extra geological detail modern seismic and imaging techniques are now able to provide; (ii) how that expansion of detailed information is being approached and captured by interpreters - and tied back to real reservoir geology; (iii) what 'new questions' are now being asked of outcrop and well based studies in order to address the 'unseen challenges' of subseismic deformation; (iv) how this is influencing the level of detail that should be captured to define better subsurface flow characteristics within flow simulation models; and (v) how depletion and injection impact upon formation and reactivation of reservoir scale deformation features.

### Confirmed Speakers:

- Haakon Fossen, University of Bergen
- Paul Gillespie, Statoil
- Graham Yielding, Badley Geoscience
- Dave Sanderson, University of Southampton

For further information please contact:

Laura Griffiths, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.

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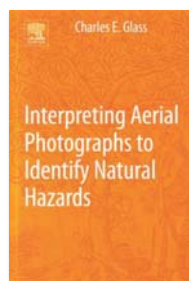


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## Interpreting Aerial Photographs to Identify Natural Hazards



This small softback is written in a rather informal style and contains many diagrams, references and colour photographs. It examines the fundamental principles of aerial

photography such as measurements in the Ultraviolet, Near Infrared, Thermal Infrared, and Microwave Regions. The author also discusses details of how aerial photographs are collected.

First there is a brief discussion of the theory of light with just enough maths to explain absorption, reflectance etc. It explores the problems that may occur with aerial photographs compared with maps and how these can be counteracted (e.g. issues with optics and elevation). It considers the best sort of film or other sensor to use.

On the hazards front, the book concentrates on natural (e.g. earthquakes, faults, landslides, floods and ground subsidence) rather than man-made ones. The author gives examples of how to interpret aerial photographs for these hazards and how not to miss potentially dangerous aspects that the untrained eye might overlook. He considers the best representational formats for recognising natural hazards, concluding that stereoscopic images are generally better.

The author makes the important point that aerial photographs can save a lot of expensive fieldwork. He considers factors such as developing drainage patterns which are useful in interpreting the photograph, and despite the emphasis on natural hazards that landscape traces of human activities such as mining, roads, railways and excavations are briefly mentioned. The book is suitable for use by students, professional scientists, engineers, estate managers, developers, construction personnel, land use planners, lawyers, archaeologists, national, county, and local policy makers and regulators.

Whether they are indicated by natural terrain, geology, vegetation, hydrology or land use patterns – it is important to recognise dangerous conditions when and where they occur. While the book offers instruction in recognising dangers it also gives examples of items which

can prove problematic and argues strongly against making snap judgements. Things are not always as they at first seem!

Failure to recognise and characterise geomorphic, geologic and hydrologic dangers on the ground from aerial photography can contribute materially to the seriousness of natural disasters, damage to architectural structures, and the subsequent loss of human life. Aerial photographs provide one of the most wide-scale, inexpensive and valuable tools to those with the knowledge and experience to use them.

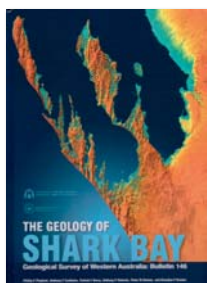
In summary, this book is well-written and colloquial. It is suitable for many and good value.

Reviewed by **Steve Rowlett**

### INTERPRETING AERIAL PHOTOGRAPHS TO IDENTIFY NATURAL HAZARDS

CHARLES E GLASS 2013, Published by Elsevier.  
Softback. ISBN 978-0-12-420018-0 164pp  
List price: £30.99 [www.elsevier.com](http://www.elsevier.com)

## The Geology of Shark Bay



This book is another beautiful contribution from the Geological Survey of Western Australia on one of the extra special places in Western Australia, indeed the whole world. Shark Bay, a UNESCO World Heritage Site, has contributed so much to our knowledge and understanding of stromatolites and featured in many television natural history programmes that almost everyone will have heard of the place, not just Earth scientists.

Although remote and sparsely populated, if you like sediments, Shark Bay is stunningly attractive – a true 'bucket-list' place. The GSWA has been mapping and studying the area for nearly 50 years and its results are wonderfully illustrated here, with over 430 colour photos and figures. The stromatolites themselves are given nearly 100 photos and are well described, along with an account of their discovery and significance with regard to Precambrian microbialites. The various macro-morphologies of the structures are related to local energy regime, and the



internal structures to the nature of the microbial community.

There are many other features of general interest in the region apart from stromatolites. Most of the land surface is covered by sand dunes in a variety of types, well defined in digital elevation maps (DEMs). One of these is used as the front cover – really eye-catching. One section describes the remarkable tsunami deposits that occur along the coast, facing the open Indian Ocean. Boulders of limestone (calcrete) torn up from shoreline cliffs were carried up to 400 metres inland and now rest on a flat karstified surface up to 15m above present sea level.

One of the largest is 10 x 7 x 4 metres and is estimated to weigh 700 tons, demonstrating the awesome power of the waves. Another feature of sedimentological interest is the extensive Holocene Hamelin Coquina composed almost entirely of the shells of the bivalve *Frugum*. The coquina is disposed in a series of beach ridges, which developed over the last few 1000 years in response to intense tropical cyclones with an average frequency of around 100 years.

This book is a delight to read and delve into – lavishly produced, with easy-to-read text, and much to be gleaned from the wonderful pictures. It is also available free online as a pdf. Now everybody can see the beauty of limestones!

Reviewed by **Maurice Tucker**

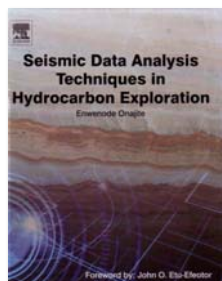
### THE GEOLOGY OF SHARK BAY

PHILLIP E PLAYFORD, ANTHONY E COCKBAIN, PATRICK F BERRY, ANTHONY P ROBERTS, PETER W HAINES AND BRENDAN P BROOKE, 2013. Published by Geological Survey of Western Australia: Bulletin 146 ISSN 0508-4741, 281p List price: A\$70 plus postage ([www.dmp.wa.gov.au](http://www.dmp.wa.gov.au)), limited edition, (300). Free online: <http://geodocs.dmp.wa.gov.au>





## Seismic Data Analysis Techniques in Hydrocarbon Exploration



What on earth has happened to Elsevier? Can one of the largest scientific publishers on the planet no longer afford to employ copy editors?

This book could have been a useful, though rather pricy, purchase for anyone wanting to make a start on understanding how the seismic method is used in today's oil industry. It aims to cover not merely the seismic method, but also sedimentology and oil/gas formation principles. The chapter that introduces these subjects is followed by chapters on seismic wave propagation, seismic exploration and noise in seismic data. A second section aims to deal with the sequence of seismic processing, CMP binning and sorting, deconvolution, NMO velocity analysis, DMO and stacking, residual statics and seismic migration. Finally, there is a section covering seismic interpretation methodology and (oddly late) reflection coefficients. Sadly, the text is marred throughout by misprints, curious grammatical expressions and typographic errors. It should never have been published in its present form.

Seismic processing is, of course, the art of making elegant pictures that, we hope, will provide some approximation to geological reality, and no book on the subject could succeed without plentiful illustrations. This book amply satisfies that requirement, but the author has believed too strongly that a picture can speak for itself. In many cases, only readers who already know quite a lot about the subject will understand the point that an illustration is supposed to be making. In some cases, also, the captions are simply wrong. The supposed minimum-phase wavelet shown is not minimum-phase, and the supposed zero-phase wavelet is not zero-phase, and these errors occur not just once but twice. The illustration provided of a '2D seismic configuration' shows only basic single-fold coverage, and the following picture, of a '3D seismic configuration', merely shows a 2D line with multi-fold CMP cover.

There are also curious omissions, of which perhaps the most important is the absence of any discussion of the use of

vibration sources. Ignoring this topic gives a totally false impression of current onshore practice. It is also a missed opportunity, because the importance of information on source signature, and the uses of correlation techniques and deconvolution, can be explained with much greater ease when it is surveys made with controlled sources that are being discussed.

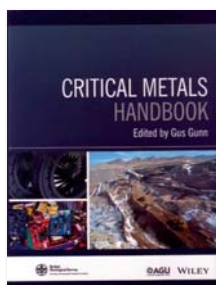
I cannot recommend this book as it stands. I look forward to a much revised second edition.

Reviewed by **John Milsom**

### SEISMIC DATA ANALYSIS TECHNIQUES IN HYDROCARBON EXPLORATION

ENWENODE ONAJITE, 2014. Published by Elsevier Inc. ISBN 978-0-12-420023-4 237pp List price: ££59.25 [www.store.elsevier.com](http://www.store.elsevier.com)

## Critical Metals handbook



Our dependence on new technologies places increasing demands on the supply of certain elements and this has become newsworthy, making publication of this volume both

timely and very welcome.

The book opens (Graedel, Gunn & Tercero Espinoza) with an informed discussion of both metal resources and the concept of criticality, reviewing American studies from the 1970s and 80s and following the debate through recent work in both Europe and the US. The authors show that criticality is very much a sliding-scale and that it is at times, highly non-linear, as shifts in favoured technologies impose rapid changes on the supply and especially, demand of the metals required to implement these technologies.

Chapter 2 (Humphreys) concerns the mining industry and the supply of critical minerals, discussing the major producers and their operations across the globe. He discusses the supply in terms of natural, economic and institutional constraints, showing the complexity of their interrelationships with a detailed discussion of the role of China as a major supplier of these resources. Chapter 3 (Hagelüken) discusses the role of recycling in the supply chain, as it stands

now and how it is likely to evolve in the future.

A good overview of metal recovery is presented alongside life cycle analysis, which is illustrated with three case studies and concludes with the need for innovation; in education (concerning sustainability) and legislative support, in addition to technological advances. Chapters 4 to 16 focus on one or more specific metal (Sb, Be, Co, Ga, Ge, In, Li, Mg, Rh, Ta, Nb, W, the lanthanides and platinum group metals) but space precludes a detailed description of each here. All chapters are highly informative, succinct and very readable and any one would stand as an authoritative review article in its own right. Together, they represent a substantial body of work.

The editor, Gus Gunn, (also a contributing author) has led his 23 co-authors from North America and Europe in producing a commendable and most enjoyable book.

Overall, the text is very accessible and requires no specialist knowledge of the field; explaining the significance of its arguments and observations with great clarity. The diagrams (many in colour) are well-reproduced and highly relevant; conveying important information with a strong impact. It is a great credit to the authors, editors and publishers in these respects. It should be compulsory reading for politicians and financiers alike.

Reviewed by **Mark Tyrer**

### CRITICAL METALS HANDBOOK

GUS GUNN (Ed.) 2014. Published by: American Geophysical Union/John Wiley, in collaboration with British Geological Survey. 439pp. ISBN 978-0-470-67171-9 List price: £90.00 <http://eu.wiley.com/>

## BOOKS Available for review

Please contact [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk) if you would like to supply a review. You will be invited to keep the review copy. See a full up-to-date list at [www.geolsoc.org.uk/reviews](http://www.geolsoc.org.uk/reviews)

- ◆ **NEW! Coastal Wetlands of the World: Geology, Ecology Distribution and Applications** David Scott Jennifer Frail-Gauthier & Petre Mudie 2014 Cambridge UP. 349pp sbk
- ◆ **NEW! Formation, Detection & Characterization of Extrasolar Habitable Planets** 2014 Nader Haghighipour (ed) IAU (CUP) 463pp hbk
- ◆ **NEW! An introduction to Ocean Remote Sensing (2nd Ed)** by Seelye Martin 2014 Cambridge University Press 496pp hbk.
- ◆ **NEW! The Finite-Difference Modelling of Earthquake Motions - Waves and Ruptures** 2014 by Peter Moczo et al., Cambridge University Press 365pp hbk



# PEOPLE NEWS

## CAROUSEL

All Fellows of the Society are entitled to entries in this column. Please email [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk), quoting your Fellowship number.

### ◆ Richard Boak



Richard Boak has taken up the position of Water Resources Manager for Kenya for Tullow Oil, based in Nairobi, responsible for planning, organising, and overseeing the company's water resources management plan covering operations in Kenya. Richard is a Chartered Geologist and Chartered Engineer, previously working as an independent hydrogeologist based in Shrewsbury.

### ◆ Edward Derbyshire



Edward Derbyshire has been elected to one of several Inaugural Fellowships of The British Society for Geomorphology (FBSG) with effect from November 2013 "in recognition of significant contributions to the advancement of geomorphological research".

## IN MEMORIAM [WWW.GEOLSOC.ORG.UK/OBITUARIES](http://WWW.GEOLSOC.ORG.UK/OBITUARIES)

### THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Baker, John Macrae Christian Wellstood\*  
Crook, John P\*

Francis, E Howel  
Hull, John Hewitt\*

In the interests of recording its Fellows' work for posterity, the Society publishes obituaries online, and in *Geoscientist*. The most recent additions to the list are shown in bold. Fellows for whom no obituarist has yet been commissioned are marked with an asterisk (\*). The symbol § indicates that biographical material has been lodged with the Society.

If you would like to contribute an obituary, please email [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk) to be commissioned. You can read the guidance for authors at [www.geolsoc.org.uk/obituaries](http://www.geolsoc.org.uk/obituaries). To save yourself unnecessary work, please do not write anything until you have received a commissioning letter.

Deceased Fellows for whom no obituary is forthcoming have their names and dates recorded in a Roll of Honour at [www.geolsoc.org.uk/obituaries](http://www.geolsoc.org.uk/obituaries).



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As a Fellow of the Society you can take advantage of a wide range of benefits that support learning and career development while enjoying the opportunity to meet other Earth scientists.

### Discover

- Online access to a free journal of your choice including all content from the earliest volume, and the option to purchase a discounted print version.
- Online access to the Society's oldest published material – Transactions of the Geological Society.
- Additional GSL journals subscriptions at a greatly reduced rate.
- Options for discounted subscriptions to *Geology Today* and *Geology*.
- Free subscription to our Fellowship magazine, *Geoscientist*, containing news, views and features.
- Free online access to the Books Archive which provides access to all book titles published prior to the current or previous three years.
- Access to all recent books is available via an optional subscription to the Full Book Collection.
- Deep discounts on the Society's highly acclaimed Special Publications and other books (usually 50%).

### Develop

- The Society offers two pathways to charterhip: Chartered Geologist and Chartered Scientist. Equivalent in status, each requires high standards of knowledge, competence and professionalism.
- Training courses and CPD events endorsed by the Society are available free or at discounted rates to Fellows.
- Upload your CV online for free and let employers find you.
- Be informed about the progress of cutting edge science. Engage in the development and debate of GSL policy and position papers.

### Explore

- The Geological Society houses one of the most important libraries in the world, with over 300,000 volumes of books and serials, remote online access to over 60 subscribed journals and a collection of over 40,000 maps. The library's collection can be searched from anywhere in the world through the online catalogue. Items can be posted anywhere in the UK and photocopies can be sent to Fellows overseas.
- Reduced registration rates to conferences and meetings.
- As a Fellow you will be assigned to one of our Regional Groups and have the opportunity to sign up to a Specialist Group.

There is an appropriate grade of membership for each career stage, from student to retirement. Fees are graduated according to age, so that membership is made accessible to younger and older geoscientists. For further information [www.geolsoc.org.uk/apply](http://www.geolsoc.org.uk/apply)

For more information or to download an application form visit [www.geolsoc.org.uk/join](http://www.geolsoc.org.uk/join)





## DISTANT THUNDER

## An old stick and his carrots

### **Geologist and science writer Nina Morgan\* discovers what James Hutton got up to in his spare time**

As the geologist and polymath, James Hutton (1726-1797) might have put it, when it comes to home brewing – there really is no vestige of a beginning, and no prospect of an end to the ingredients that can be used. It is possible to ferment almost any vegetable or fruit – though whether you'd actually want to drink the resulting product is another matter. The same might be said about Hutton's own written output.

A frequent contributor to the *Transactions of the Royal Society of Edinburgh*, Hutton wrote - at length - on topics ranging from philosophy to rain, language and speech, and much else in between, and earned a reputation for producing dense, dull prose at inordinate length. His *Theory of the Earth*, first published in four lengthy parts in 1785 in the *Transactions*, is a case in point. Although it contains many important

insights about unconformities and deep time – ideas that revolutionised geological thinking and formed the basis of the concept of uniformitarianism discussed in such influential books such as Lyell's *Principles of Geology*, (published in 3 volumes between 1830 and 1833)- Hutton's ground-breaking concepts may never have come to light had not his colleague, John Playfair (1748-1819), Professor of Natural History at the University of Edinburgh, recognised their importance and taken the trouble to present them in a more readable and understandable form.

### **Playfair**

In 1822, in Volume IV of his own collected works, Playfair also provided an 88-page *Biographical Account of the Late James Hutton, MD*. In this he not only waxed lyrical about Hutton's work. He also revealed a bit

about Hutton's passion for natural history in general, and geology in particular, and provided insights into Hutton's private life: "...Though he [Hutton] used to rise late, he began immediately to study, and generally continued busy till dinner. He dined early, almost always at home, and passed very little time at table; for he ate sparingly and drank no wine."

But Hutton apparently was not adverse to dabbling in spirits. In 1788, he teamed up with his close friend, physician and chemist Joseph Black (1728-1799), and with James Russell (1754-1836, a Fellow of the Royal College of Surgeons in Edinburgh) to report on a process for producing 'an ardent spirit from carrots'.

Presumably a lot of tasting of the product was required to ensure quality control.

But for Hutton, it must have been only in the name of scientific enquiry, of course!

### ➤ **Acknowledgement**

The starting point for this vignette was the article *James Hutton Meteorologist, Geologist, Phonetician and Carrot Brandy Expert* by G Y Craig, published in issue 8 July 1997 issue of *Earth Heritage*. Other sources include Volume 1 of the *Transactions of the Royal Society of Edinburgh*, available on-line at <http://biodiversitylibrary.org/>, which includes an account of the carrot brandy experiments (pp.28-29); as well as all four parts of Hutton's *Theory of the Earth*. Further biographical information was taken from entries in Wikipedia, *Dictionary of National Biography* and [www.electricscotland.com](http://www.electricscotland.com).

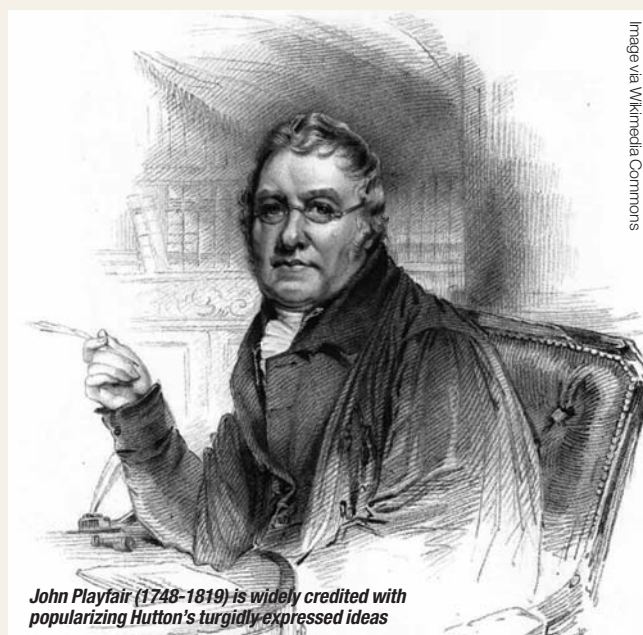
➤ If the past is the key to your present interests, why not join the History of Geology Group (HOGG). For more information and to read the latest HOGG Newsletter, visit [www.historyofgeologygroup.co.uk](http://www.historyofgeologygroup.co.uk)



**\*Nina Morgan** geologist and writer based in Oxford



James Hutton as painted by Sir Henry Raeburn in 1776



John Playfair (1748-1819) is widely credited with popularizing Hutton's turgidly expressed ideas

Image via Wikimedia Commons



# OBITUARY JOHN MYLES BOWEN 1928-2013

**J**ohn Myles Bowen died at his home near Newton Abbot, Devon, England. Myles, as he was universally known, was born on a farm in Kent in 1928, called up in 1946, commissioned into the Royal Artillery in 1947 and then studied forestry at Oxford, quickly switching to Geology, graduating with First Class honours in 1951. A PhD at Edinburgh followed in 1954.

## Borneo

Myles then joined Royal Dutch Shell and was sent first to Borneo and then to Venezuela. In 1960 he was then assigned to "well sit" Slochteren-2 in the Netherlands, the giant Groningen gas field discovery well. After marrying Margaret Guthrie he was posted to Nigeria before returning to Venezuela as Exploration Manager.

In 1969 he was moved to the UK as the Exploration Manager of Shell Expro. The southern North Sea gas basin fields had been discovered and the prevailing view was that there was no oil in the northern part of the North Sea. Myles was not so sure. His staff identified a vast tilted fault block on poor quality seismic in Block 211/29 far north of any previous activity. They applied for and were awarded the block in the 3rd UK licensing round. It was drilled in June 1971 and made the giant Brent oilfield

**Pioneer of North Sea Oil who, against the prevailing view, discovered the Brent and Nelson oilfields**



discovery. The subsequent 4th round of licensing involved cash bids for blocks for the first and, in public, last time. Shell kept the Brent oil discovery a secret so it caused quite a sensation when they bid £21 million for an adjacent block, especially as the next highest bid was £8 million. The first well on this "Golden Block" was dry, and it required a second well to prove that the bid had been justified.

After eight successful years in the UK Myles was assigned to Billiton, a Shell metals subsidiary, as an Exploration Vice President and expanded

metal exploration from six to 22 countries.

## Enterprise

He retired from Shell in 1982 after 30 years' service. Myles was immediately appointed Exploration Director of the newly formed Enterprise Oil Company. In the first five years a series of acquisitions increased the company's acreage, reserves, production, exploration activity and its market capitalisation by approximately five times. His best deal was acquiring a 100% interest in a block in which a dry hole had already been drilled by Shell and Gulf Oil. Re-examination of

the data revealed that the first well discovered what became known as the Nelson field.

Myles finally retired in 1992 to live in South Devon where he pursued his hobbies of ocean sailing, motorcycling, tractor driving and local community matters.

**“JOHN WILL BE REMEMBERED FOR HIS GENEROSITY AND GUIDANCE AND INSTINCT FOR FINDING PETROLEUM. HE HAD FINE JUDGEMENT, PERSEVERANCE, HUMILITY, AND HUMOUR”**

Myles will be remembered for his generosity and guidance and instinct for finding petroleum. He had fine judgement, perseverance, humility, and humour. He was a great communicator, teacher and counsellor. He was awarded the Geological Society Petroleum Group Silver Medal, the American Association of Petroleum Geologists' Pioneer Award. He was even awarded the OBE.

He is survived by Margaret, his wife of 52 years, and their three daughters.

By **Dick Selley** and **Andrew Armour**. A longer version of this obituary is available online.

**HELP YOUR OBITUARIST** The Society operates a scheme for Fellows to deposit biographical material. The object is to assist obituarists by providing contacts, dates and other information, and thus ensure that Fellows' lives are accorded appropriate and accurate commemoration. Please send your CV and a photograph to Ted Nield at the Society.





## ENDORSED TRAINING/CPD

COURSE	DATE	VENUE AND DETAILS
Lapworth's Logs	n/a	Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. Contact: <a href="mailto:info@lapworthslogs.com">info@lapworthslogs.com</a> . Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

## DIARY OF MEETINGS AUGUST 2014

MEETING	DATE	VENUE AND DETAILS
Field Meeting, Great Tew Geologists' Ass.	2 August	<b>Leader:</b> Andy Swift. For details see GA website <a href="http://www.geologistsassociation.org.uk">www.geologistsassociation.org.uk</a> . <b>Contact:</b> Sarah Stafford T: 020 7434 9298 E: <a href="mailto:geol.assoc@btinternet.com">geol.assoc@btinternet.com</a>
The 25th Colloquium of African Geology & 3rd Young Earth Scientists Congress GS Africa	11-16 August	<b>Venue:</b> Mwalimu Julius Nyerere International Convention Centre, Dar es Salaam, Tanzania. See website for details, registration and contacts. E: <a href="mailto:yescag2014@gmail.com">yescag2014@gmail.com</a>
AusIMM New Leaders Conference 2014 AusIMM	12-13 August	<b>Venue:</b> Perth, Australia. This conference aims to provide current students and recent graduates with skills and knowledge that may not be addressed during university studies. See website for registration, contacts and venue details.
Ninth International Mining Geology Conference 2014 AusIMM	18-20 August	<b>Venue:</b> Hilton, Adelaide, South Australia. <b>Conference Chair:</b> John Vann, AngloGold Ashanti, FAusIMM, FAIG. For all details about registration please see website. E: <a href="mailto:Siena.Deano@sdeano.com.au">Siena Deano sdeano@ausimm.com.au</a>



### Election of New Petroleum Group Committee Members

The Petroleum Group Committee of the Geological Society sets itself a number of key objectives:

- o To promote the worldwide sharing and dissemination of leading edge petroleum science amongst academics and practitioners primarily through convening and facilitating regular world-class petroleum-related conferences and related publications;
- o To foster a knowledge and understanding of petroleum geoscience;
- o To guide, support and shape the agenda of the Council of the Geological Society as it applies to petroleum related issues;
- o To support and promote the capabilities of the UK petroleum science community.

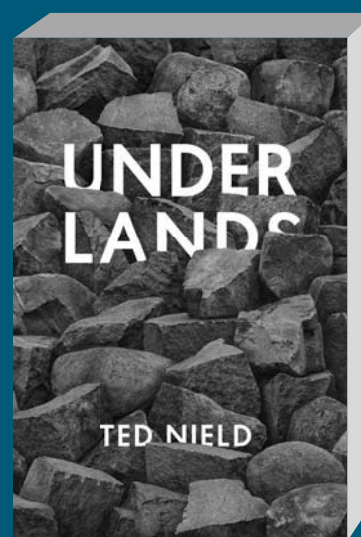
The Petroleum Group Committee comprises of up to 20 elected and 3 co-opted members based in the UK and overseas. Committee members are expected to actively participate in the Group's activities through the convening of conferences, participation in regular bi-monthly meetings and through other ad hoc activities related to the Group's broad agenda.

Nominations are requested for membership of the Petroleum Group Committee. Each nominee must write their own statement to support their nomination of up to 100 words (position, honours, degrees, other professional qualifications and what they feel they could bring to the committee). This must be supported by a PROPOSER and SECONDER (both of whom must sign the proposal). Should the number of nominations received be greater than the number of vacancies on the Committee, then the nomination forms will be uploaded to the Society's website and Petroleum Group members will be invited to vote for their 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> choice candidates.

Laura Griffiths  
The Petroleum Group  
The Geological Society  
Burlington House  
Piccadilly  
London W1J 0BG  
[laura.griffiths@geolsoc.org.uk](mailto:laura.griffiths@geolsoc.org.uk)

Nominations must be received by 12 September 2014

## The new book from Ted Nield



Out now  
**GRANTA**



# OBITUARY ADOLF SEILACHER 1925-2014

**A**dolph Seilacher was one of the most distinguished palaeontologists of his generation, and an Honorary Fellow of the Geological Society. He served as a soldier briefly in World War Two before work at the University of Tübingen led to a PhD under Otto Schindewolf on trace fossils. After short spells at the universities of Frankfurt and Baghdad he took a junior chair at Göttingen before returning to Tübingen in 1964 to succeed Schindewolf as Professor of Palaeontology. After 1987 he held an adjunct Professorship at Yale University and subsequently divided his time between the two institutions, before retiring to Tübingen in his early 80s.

## Trace fossils

Seilacher's numerous publications cover a range of topics of which those on trace fossils are probably the best known, especially, for geologists their bathymetric significance, and the concept of ichnofacies. This was later expanded to include the influence of substrate, oxygen, salinity and so on. In addition he analysed many trace fossils in terms of behaviour they represent, leading to such work as a computer simulation of trace fossil morphology with David Raup in 1969. Much of this work is summarised, together with new material, in his late book *Trace Fossil Analysis* published by Springer in 2007.

In 1970 he announced his

**Distinguished palaeontologist, pioneer of ichnology and philosopher of form and function**



Image taken by Anthony Martin, July 2003

programme of Constructional Morphology in which he stressed the importance of three factors determining the form of organisms: ecologic-adaptive aspects history and constructional aspects. The latter two factors are important sources of biological constraints. They acknowledge that both history and constructional principles place limits on what can be achieved in evolution, in at least the short term. Such a view was influential on later workers including Stephen Jay Gould and Richard Lewontin, in their well known paper on "spandrels" that criticised 'panadaptationist' concepts of

evolution and form.

Seilacher's interest in pattern formation led him to espouse self-organisation models for the origin of form, the most famous of which are "pneu" structures. These are fluid – filled structures under tension whose form is broadly determined by the need to distribute tension across the surface. He may thus be considered a structuralist.

## Lagerstätten

Much of Seilacher's other concerned preservation and taphonomy in general. His most controversial contributions arise from his research on Ediacaran assemblages, which he

suggested, based on their constructional morphology, were 'pneu' structures unrelated to modern metazoans, and termed 'Vendobionts'.

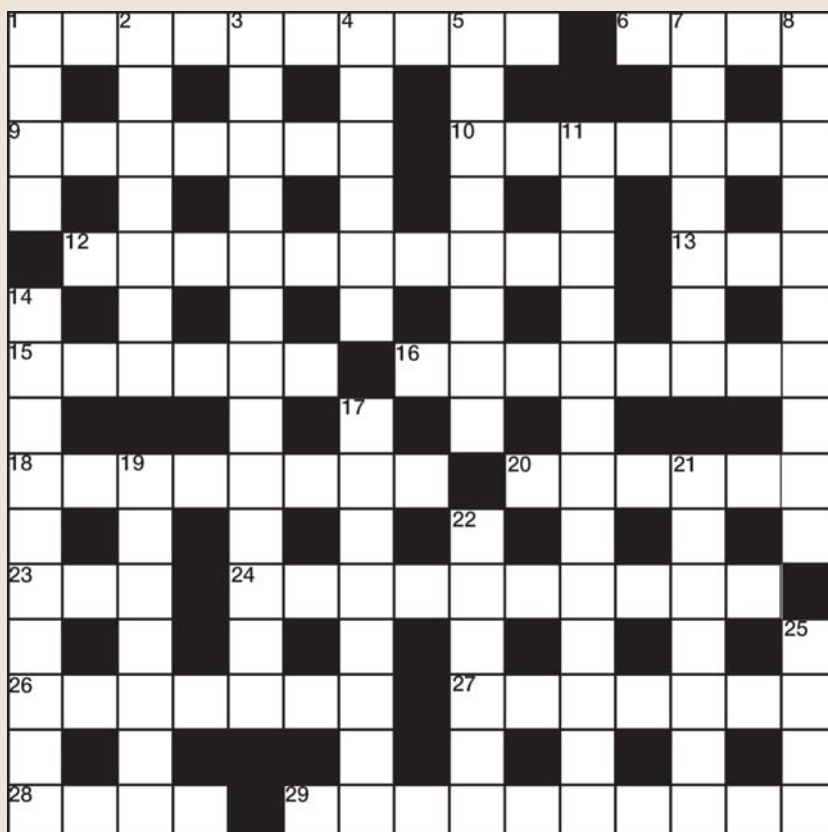
**“ANYONE PRIVILEGED TO HAVE KNOWN HIM WELL WOULD HAVE RECOGNISED A STRIKING COMBINATION OF SHARP OBSERVATION AND KEEN INSIGHT COMBINED WITH RICH IMAGINATION”**

Among his many honours he received the top medals of the Palaeontological Association and Paleontological Society and the Crafoord Prize (1992) - the only palaeontologist to have been awarded this. Anyone privileged to have known him well would have recognised a striking combination of sharp observation and keen insight combined with rich imagination and excellent draughtsmanship. Seilacher retained a keen intellectual curiosity and despite his advanced age at death there is bound to be a feeling of especial loss that someone of such formidable talents has finally left us.

► By **Tony Hallam**. A longer version of this obituary is available online.

**HELP YOUR OBITUARIST** The Society operates a scheme for Fellows to deposit biographical material. The object is to assist obituarists by providing contacts, dates and other information, and thus ensure that Fellows' lives are accorded appropriate and accurate commemoration. Please send your CV and a photograph to Ted Nield at the Society.



**CROSSWORD NO.182** SET BY PLATYPUS**ACROSS**

- 1 Permanently stratified lake (10)  
 6 Part of a fault that cuts across datum surfaces in thrust/extensional systems (4)  
 9 Desert landscape consisting of high, largely barren, hard, rocky plateaux (7)  
 10 Series of waterfalls in NE USA mountain range? (7)  
 12 Process of converting organic matter into oil and gas (10)  
 13 Hoppy light beer originally brewed for colonial export (1,1,1)  
 15 Starry (6)  
 16 Wood spirit with blinding side-effect (8)  
 18 Crystal molecular arrangements (8)  
 20 Liquid because the Gibbs free energy has become lower than for the solid (6)  
 23 Fourth order geological time unit (3)  
 24 Ferruginous rocks (10)  
 26 Genetically distinct geographic variety, population or race within species (7)  
 27 'One damned thing after another' (7)  
 28 Elongated, continuously growing front tooth (4)  
 29 Millions of Hertz (10)

**DOWN**

- 1 Crust/Mantle seismic discontinuity (4)  
 2 Part remaining (7)  
 3 Capable of being rendered in numerical terms (13)  
 4 Loose necktie, originally of Croatian soldiers, hence the name (6)  
 5 Dipping (8)  
 7 Large Middle Eastern desert shield (7)  
 8 Dominant (10)  
 11 At the same time (13)  
 14 Literally, and often figuratively, a talking shop. (10)  
 17 Thin, clear hydrocarbon liquid with a density of 0.78–0.81 g/cm<sup>3</sup> (8)  
 19 Seisms (7)  
 21 Cloverleaf (7)  
 22 Chronic inflammatory condition of the airways (6)  
 25 Visual organs (4)

**WIN A SPECIAL PUBLICATION!**

The winner of the June Crossword puzzle prize draw was **Fred Locke of Wareham**.

All correct solutions will be placed in the draw, and the winner's name printed in the October 2014 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - 22 August.**

The competition is open to all Fellows, Candidate Fellows and Friends of the Geological Society who are not current Society employees, officers or trustees. This exclusion does not apply to officers of joint associations, specialist or regional groups.

Please return your completed crossword to Burlington House, marking your envelope "Crossword". Do not enclose any other matter with your solution. Overseas Fellows are encouraged to scan the signed form and email it as a PDF to [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk)

Name .....

Membership number .....

Address for correspondence .....

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**SOLUTIONS JUNE****ACROSS:**

1 Discordant 6 Asia 9 Chilean 10 Cadmium  
 12 Slipstream 13 Ult 15 Pusher 16 Mudslide  
 18 Ribosome 20 Pineal 23 CIA 24 Regionally  
 26 Echidna 27 Aviator 28 Esau 29 Mechanised

**DOWN:**

1 Duct 2 Shields 3 Overpressured 4 Donate  
 5 Nacreous 7 Stimuli 8 Admittedly  
 11 Domestication 14 Spirochete 17 Amygdale  
 19 Brachia 21 Eoliths 22 Potash 25 Arid



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## HISTORY OF GEOLOGY GROUP

"Geology and Medicine: Exploring the Historical Links and the Development of Public Health and Forensic Medicine"

Celebrating the Tercentenary of Sir John Hill

**November 3-4 2014**

Geological Society, Burlington House, Piccadilly, London



### Organisers

Professor Richard T. J. Moody, Dr Chris Duffin and Dr Christopher Gardner Thorpe

### Call for Papers:

The History of Geology Group calls for oral and poster contributions from historians, medical professionals and geoscientists on the following topic(s).

- **Founding Fathers of Geomedicine**, recording the historical links established by individual scientists such as Darwin, Astley Cooper, Charles Daubeny and Gideon Mantell etc.
- **Geological Therapies**, dealing with the evolution of treatments from primitive lithotherapies to the therapeutic use of geological materials in medicines and the advent of hydrotherapy.
- **The Origins of Public Health**, including Soil Chemistry, Water Quality, Health and Safety and the provision of the necessary infrastructure during the Victorian Era.
- **The Evolution of Forensic Medicine.**

Those wishing to contribute should contact [rtj.moody@virgin.net](mailto:rtj.moody@virgin.net).  
Visit: [www.historyofgeologygroup.co.uk](http://www.historyofgeologygroup.co.uk) <<http://www.historyofgeologygroup.co.uk>>

Extended abstracts of 500 words and a maximum of 3 figures should be submitted by the 31st August 2014.

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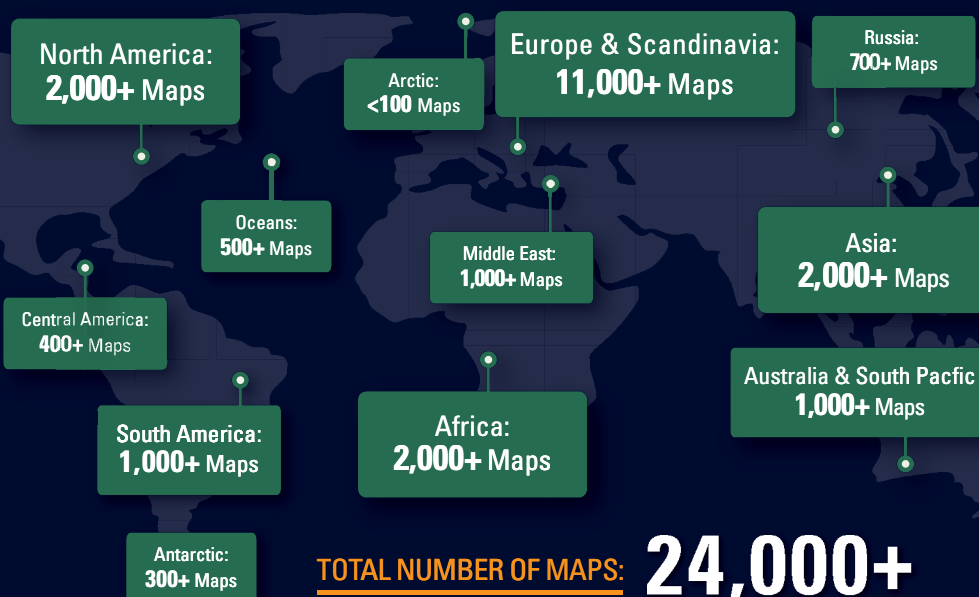
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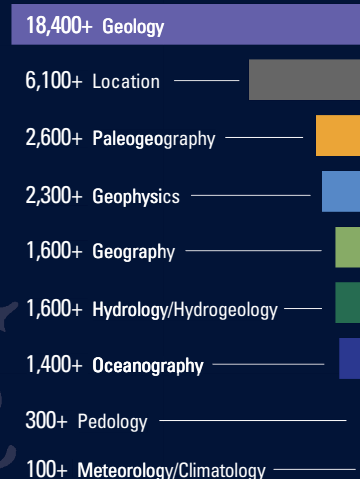


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# The Geological Society

## Careers Day 2014

Wednesday 5 November 2014

### Keyworth, Nottingham

The Geological Society's Careers Day is the essential meeting place for geoscience students and the geoscience industry. The day will include presentations on careers and an exhibition fair. University undergraduates and postgraduates will have the chance to find out about the latest career options, and talk to industry leaders about how they may gain entry into that sector. There will also be some University representatives available to discuss MSc and PhD programmes.

### Registration

This event is free to attend but there are limited numbers so you will need to pre-register by sending an email to [naomi.newbold@geolsoc.org.uk](mailto:naomi.newbold@geolsoc.org.uk). A student manual, lunch and a drink at the reception are included.

[www.geolsoc.org.uk/careersday14](http://www.geolsoc.org.uk/careersday14)

## Careers in Earth Science 2014

Wednesday 26 November 2014

### Edinburgh

The Careers in Earth Science event is being run by the Earth Science Scotland community, and is co-badged by the Geological Society and the Petroleum Exploration Society of Great Britain. The day will include presentations from early career earth scientists from the oil and gas, mining, geotechnical, environmental and research sectors. There will also be a panel Q&A on careers. The exhibition will include employers and professional bodies, and a higher education fair, promoting MSc and PhD programmes.

### Registration

This event is free to attend but there are limited numbers so you will need to pre-register by sending an email to [registrations@geolsoc.org.uk](mailto:registrations@geolsoc.org.uk). A student manual, lunch and drink at the reception are included.

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