GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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Burma's rising star

Tin-Tungsten mineralisation in Myanmar

BGS SCIENCE
Mike Stephenson on 'Instrumenting the Earth'

TRIPPIN' OUT
Why undergraduate geological fieldwork matters to all

YEAR OF MUD
Follow us, follow - Down to the hollow, and there...

The Geological Society
serving science & profession

Lyell Meeting 2015

Mud, glorious mud, and why it is important for the fossil record

The Geological Society — serving science & profession — 2015 YEAR OF MUD

11 March 2015

The Geological Society, Burlington House

Mudrocks provide an unrivalled medium for the preservation of fossils. This exceptional preservation has, in turn, enabled significant scientific advances in the functional morphology and evolution of biota throughout life history and, a high resolution record of the ways in which biota adapt and evolve during environmental change.

It has long been observed that mudrocks yield abundant, diverse and well-preserved micro- and macro-fossils. Almost all the strata yielding fossilised soft parts are also from mud-grade deposits. More recent studies have discovered that the seawater chemistry at the time of deposition remains largely unaltered in shells preserved in mudrocks. This enables these fossils to be used as proxies for important Earth surface parameters such as water temperature, salinity, ice volume, rate of chemical weathering and pH. The role of mudrocks in providing an ideal medium for understanding life throughout geological time also applies to lake deposits where terrestrial palynomorphs provide us with records of vegetation change in response to climatic fluctuations. The relative stratigraphical completeness of most mudrock successions makes them ideal for high-resolution studies and hence for understanding the rock record on biological timescales.

The meeting will be of relevance to those interested in marine and terrestrial Earth surface processes particularly periods of extreme environmental change as well as those interested in the exceptional preservation of fossils.

Registration is open

To register and for more information, visit: www.geolsoc.org.uk/lyell-2015

Speakers include:

Derek Briggs
(Yale University)

Paul Pearson
(University of Cardiff)

David Martill
(University of Portsmouth)

Hugh Torrens
(Keele University)

Volke Wilder
(Senckenberg Naturmuseum)

William Gosling (University of Amsterdam)

Nick McCave (University of Cambridge)

Convenors:

Angela Coe
(The Open University)

Alan Lord
(Senckenberg Naturmuseum)

Linked Public Lecture

There will be a linked public lecture on the evening of the 10 March by Euan Clarkson (University of Edinburgh) entitled 'The Cambrian Alum Shales of Scandinavia and their remarkable trilobites'.

Further information

For further information about the conference please contact:

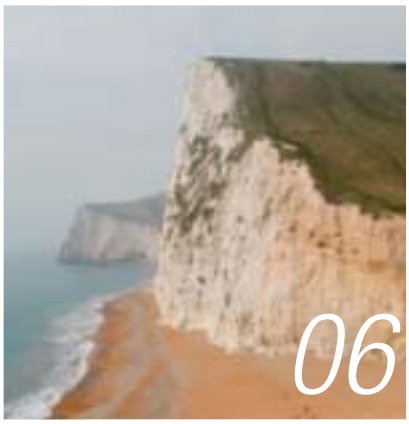
Jess Aries, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG

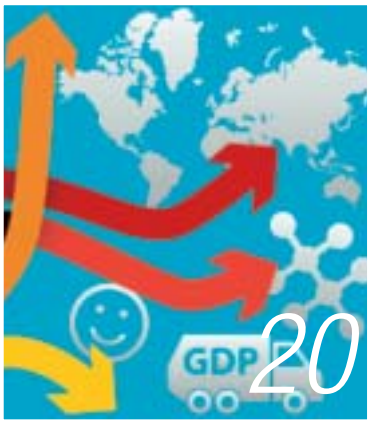
T: 0207 432 0983

E: jess.aries@geolsoc.org.uk

Web: www.geolsoc.org.uk/lyell-2015

Follow this event on Twitter: #lyell15





IN THIS ISSUE...

ON THE COVER:

FEATURES

REGULARS

William Smith Meeting 2015

Registration is now open
To register and for more information, visit: www.geolsoc.org.uk/wsmith15

The Geological Society
serving science & profession

History Of Geology Group

PART OF THE WILLIAM SMITH MAP BICENTENARY PROGRAMME OF EVENTS

200 Years of Smith's Map

Associated events

Preceding the conference, private viewings in small groups of Smith's fossils, rocks and minerals, and maps have been arranged at the Natural History Museum. Following the conference a field trip in Oxfordshire to visit Churchill and Stow-on-the Wold, where Smith grew up and was first apprenticed, and to Oxford University Museum of Natural History to see Smith's diaries and maps – published and manuscript. During the conference, maps and Smithiana from the Geological Society's archives will be displayed.

Further information

For further information about the conference please contact:
Jess Aries, Conference Office,
The Geological Society,
Burlington House,
Piccadilly, London W1J 0BG
T: 020 7432 0983
E: jess.aries@geolsoc.org.uk
W: www.geolsoc.org.uk/wsmith15

Follow this event on Twitter #wsmith15
W: www.historyofgeologygroup.co.uk

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

22 April 2015: Private Exhibition at Natural History Museum

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

25 April 2015: Field Excursion in Oxfordshire

Programme

Keynote Speakers

Professor Simon Knell and Professor Hugh Torrens.

Day 1: 23 April

Tom Sharpe – W. Smith's 1815 map: its production, distribution and survival
Karen Cook – Cartographic Innovation and Tradition in W. Smith's Geological Maps
John Henry – W. Smith, the maps supporting his published maps
Kate Santry – W. Smith Online: The impact of re-curating the W. Smith Archive
Peter Wigley – W. Smith, from Fuller's Earth to Google Earth
KEYNOTE LECTURE: Hugh Torrens – W. Smith's search for a money-earning career
Owen Green – W. Smith in E. Anglia: legacy of a sea defence and drainage engineer
Peter Riches – A breach too far? E. Norfolk's place in Smith's search for success
John Mather – W. Smith, principles of stratigraphy, & underground water supplies
Richard Irving – W. Smith & Combe Down: a Geologist and his 'Cherished' Home

Wine Reception, Conference Dinner

Day 2: 24 April

Pierre Savaton – First geological maps of France: between individual plans & national plan
Ezio Vaccari – 'Practical' roots of stratigraphy & geological mapping in Italy
Peter Schimkat – Geological mapping in Germany during early 19th century
Patrick Wyse Jackson – W. Smith & Ireland: sources of Irish geological Information
Martyn Pedley – New light on the 1824 W. Smith Northumberland County map
Duncan Hawley – W. Smith's error in South Wales
Nina Morgan – William Smith, family man
Alan Bowden – John Farey, pioneer geologist & advocate of Smithian methods
Cherry Lewis – David Mushet, John Farey & W. Smith, geologising in Forest of Dean
KEYNOTE LECTURE: Simon Knell – William Smith: the coming of the Father

The William Smith Map Bicentenary (1815-2015)

The Geological Society · University of Bristol · British Geological Survey · Natural History Museum · Museum of Natural History

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THE PLAIN OF BAGAN/ PAGAN, MANDALAY, MYANMAR
Cover: Ikunl / Shutterstock.com

FROM THE EDITOR'S DESK:

Glorious. Mud.

Hoping perhaps to tap into some hitherto unsuspected public appetite for the stuff, Council has decided to designate 2015 the 'Year of Mud'*. London Lectures, Flagship meetings, and other activities will be themed accordingly. And, to add our encouragement to this innovative – not to say courageous - initiative, Geoscientist may even run a feature in these pages.

Now – speaking as one who has actually lived the dream, and stared at mud down a microscope (for years) and got paid for it – I am reminded of something I had forgotten, or perhaps blotted out. For those years taught me something important; something no amount of time in the Academy could have done.

Students of rocks spend long hours staring down microscopes at thin sections. We work our way through drawer after drawer of glass slides, describing what we see, identifying minerals, textures, cements, crystal morphology, fossil fragments, strained detrital quartz, inclusions, blebs, schillerized feldspars, reaction rims, pleochroic haloes, and much more.

Such variety! And yet, there is one thing common to every single rock on every slide in every drawer of every cabinet in every lab. For all were chosen because they beautifully illustrate something important, rare, fine, significant. They are teaching specimens – either illustrative of some feature, or interestingly difficult to interpret, and therefore instructively mind-bending. They represent all that is most fascinating, alluring, and beautiful about the stuff of the Earth.

This has, however, an unfortunate side-effect. Just as addiction to pornography can result in unreal expectations in life, students emerge with the impression that all rocks are as interesting as the ones they have pored over in the teaching lab beauty pageant.

Once you employ your skills on rocks chosen for economic reasons – because they may contain oil, or because you wish to build a skyscraper on them for example - you get a rude awakening. Most rocks are not that interesting. Most limestones, for example, are not lovely grainstones with calcite pseudomorphing original acicular aragonite, from which one can construct fascinating diagenetic histories. No. In business what you spend your time looking at is thousands of feet of brown micrite - with a bit of neomorphic spar for variety and the odd agglutinated benthic foram. Because most sediments, clastic or carbonate, are - mud.

Mud may have been unjustly neglected and overlooked by the academy in the past; but its economic (and volumetric) importance cannot be overestimated, and arguably, people should be told. I suppose.

So, good news, you thwarted devotees of sediment's finest grade. Your Society is riding boldly to the rescue. Let the wallowing commence!

* Other years are available. 2015 also marks the Smith Map's 200th birthday, and the 25th anniversary of 'CGeol'.

DR TED NIELD, EDITOR - ted.nield@geolsoc.org.uk @TedNield @geoscientistmag

SOCIETY*NEWS*

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

Elections to Council 2015-16

The October issue of *Geoscientist* invited Fellows to nominate new members of Council including the President-designate. A preliminary ballot will be conducted, the results of which will determine the list for the formal vote at the Annual General Meeting to be held on 3 June 2015.

By the second week of February, full details of all the candidates should be available on the Society's website at **www.geolsoc.org.uk/biographies**, and you will also be able to vote online. The March issue of *Geoscientist* will include full details, including a postal ballot paper; but Fellows are encouraged to vote online by logging onto the Fellows-only part of the website **www.geolsoc.org.uk/vote15** to register their vote. Please follow the instructions.

The closing date for voting, both online and postal, is **31 March 2015**

Diversity monitoring

***Zachary Lamdin writes*:** As readers of the December/January Soapbox piece by Tricia Henton will know, as part of our commitment to supporting diversity, equality and inclusion in the geosciences, the Society has now started to monitor the diversity of its Fellowship. A diversity monitoring form will now be included with application forms for new joiners, and existing members can complete the form via their online MyGSL accounts by logging in at **www.geolsoc.org.uk**.

We already collect information about the age and the sex of our Fellows, and the new form requests information on ethnicity, disability, religion, sexual orientation and gender identity. We believe it is important to know more about the diverse make-up of the Fellowship so that we can identify barriers to inclusion and understand where we need to work harder to improve equality, and also so that we can measure our success over time.

Completion of the diversity monitoring form is optional: no one will be required to provide this information. But we hope many of you will want to help us find out more about the diversity of the Fellowship. All personal information is treated confidentially and stored securely and will only be used to provide anonymous statistical information.

Research funds

Applications are invited for the 2015 round of Society research funds, *writes Stephanie Jones*.

To apply for a fund, please complete the form downloadable from the Society Awards and Research Grants page at www.geolsoc.org.uk/grants. Here you will also find information about all the funds administered by the Society. The average award has been about £1000.

The Research Grants Committee meets once a year. Applications must reach the Society no later than 1 February 2015 and must be supported by two Fellows of the Society, who must each complete the supporting statement form. Only complete applications on the appropriate form will be considered. Please send to the Awards Secretary at the Geological Society.

Novas Consulting Ltd is again generously providing bursaries for undergraduate field mapping and supervisors are asked to encourage their students to submit applications.

Poas volcano, National Park of Costa Rica

Image: Ivalin / Shutterstock

LONDON LECTURE SERIES

When Continents Collide: Active Deformation and Seismic Hazard

Speaker: Tim Wright, University of Leeds
Date: 25 February

Programme

- Afternoon talk: 1430 Tea & Coffee: 1500 Lecture begins: 1600 Event ends.
- Evening talk: 1730 Tea & Coffee: 1800 Lecture begins: 1900 Reception.

Further Information

Please visit **www.geolsoc.org.uk/Events/London-Lectures-2015**. Entry to each lecture is by ticket only. To obtain a ticket please contact the Society around four weeks before the talk. Due to the popularity of this lecture series, tickets are allocated in a monthly ballot and cannot be guaranteed.

Contact: **Annie Sewell**, The Geological Society, Burlington House, Piccadilly, London W1J 0BG, **T:** +44 (0)20 7432 0981 **E: Annie.Sewell@geolsoc.org.uk**

FUTURE MEETINGS

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

- **OGMs:** 4 February 2015; 8 April; 17 June; 22 September; 25 November; 3 February 2016; 6 April
- **Council:** 4 February 2015; 8 April; 17 June; 22&23 September (residential); 25 November; 3 February 2016; 6 April
- **AGM:** 3 June 2015

Image: SJ Francis / Shutterstock

Bat's Head (left) and Swyre Head, Dorset

Steer the flagship!

The Society is calling for proposals for the 2016 Lyell Meeting, *writes Naomi Newbold*.

The Lyell meeting is an annual flagship event for UK Palaeontology. The meeting is co-ordinated by the Joint Committee for Palaeontology (JCP), which consists of representatives from The Geological Society (GSL), Palaeontological Association (PalAss), Palaeontographical Society (PalSoc) and Micropalaeontological Society (TMS). The co-ordination of the Lyell Meeting is open to any member of the four constituent societies.

The 2016 Lyell meeting is scheduled for Wednesday 9 March 2016 and a call for proposals is now open. Those wishing to propose a topic and convene this meeting are invited to submit developed proposals to the JCP (**E: jcp@geolsoc.org.uk**) by 28 February 2015. Submitted proposals will be reviewed by the JCP, and the successful proposal decided by mid- March 2015.

JCP welcomes submissions that are ambitious in scope and trans-disciplinary, and therefore more likely to attract a larger and potentially international audience. Proposed topics should appeal to a wide cross-section of the geological and palaeontological community. Proposals should have a lead convener and one or two co-conveners.

➤ For further information about submitting a meeting proposal, please visit **www.geolsoc.org.uk/Events/Meeting-Proposals/Meeting-Categories**

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.

◆ **2015:** 4 February (Burlington House - buffet); 4 March (Athenaeum); 8 April (Venue tbc); 6 May (Athenaeum)

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

NEWS IN BRIEF

Chartership elections

The following Fellows gained Chartered Geologist (CGeol) and Chartered Scientist (CSci) status in November 2014, writes Bill Gaskarth (Chartership Officer).

➤ CGeol: Gary Marshall; Richard Brandsma; Matthew Logan; Steven Best; Natasha Wilkinson; Alan Bell; Donald McPhie; Colin Miles ; David Brock; Julian Aldridge; Aleksandra Clark; Iain Mackenzie; Anna Goodwin; Chloe Chan; Egemen Oguz; Simon Auvergne; Simon Bottoms; David Craig; David Hope; Clive Mitchell; Elspeth Urquhart.

➤ CSci: Kevin Shepherd; Kerry Murray; Graeme Duff.

Fellowship rising

Mid-year Fellowship figures reveal that Society's membership continues to grow strongly. The Society's membership grew by 5.8% in 2013-14, to 11,606, mid-year figures reveal. Biggest growth was seen among Full Time Postgraduates (MSc – 71.2%, PhD - 23.8%), and Candidate Fellows (39.8%). The Society expects its membership to break through the 12,000 mark in the current year. *Dwain Eldred*

Borehole capped

Council has decided to wind up the former Borehole Research Group, writes Edmund Nickless. For a number of years the BRG has been inactive since 2001. Council therefore decided at its meeting on 25 September 2014 to close it. Much of the science that led to the formation of the Borehole Research Group is now covered by other Specialist Groups. If Fellows wish to amend their Fellowship record so they are kept up to date with the work of other Specialist Groups, please contact the Fellowship office on T: +44 (0)20 7434 9944 xtn 385.

SOCIETY*NEWS...*

Company training schemes

The WSP UK Ltd training scheme for Engineering Geologists has been Accredited by the Chartership and Professional Committees.

This scheme is now the twelfth to be Accredited and joins CEDD Hong Kong, Gammon Hong Kong, Atkins, CH2MHill, Arup, Jacobs Hong Kong, URS, RSK, RPS Energy, Fugro Hong Kong, Card Geotechnical, whose trainees follow programmes accredited by the Society as providing training leading to a Chartership application. Three more companies have indicated that they will be making an application shortly.

Information on the Society's scheme can be found on the website. Go to 'Chartership and Professional' and follow the link to 'Continuous Professional Development and Training'.

Register of Chartered Fellows

Our newly reorganised web pages now carry a list of Chartered Geologists and Chartered Scientists. These are not, however, complete for several reasons and I would be grateful if Chartered Fellows would check the list to ensure that their name is there! If it is missing please let me know by email (**E: Chartership@geolsoc.org.uk**).

Fellows were first Chartered in 1990, so 2015 - in addition to being the 200th anniversary of William Smith's great map and the Year of Mud - also marks the 25th Anniversary of Chartership by the Society. *Bill Gaskarth.*

Library newsletter

Subscribe to our bi-monthly newsletter to keep up-to-date with important Library news, electronic journal updates, online exhibitions, events and more: **www.geolsoc.org.uk/newslettersignup**.

New acquisitions

A month-by-month list of new books and serial special issues which have been added to the catalogue can be viewed on our website at **www.geolsoc.org.uk/library_collections**.

E-Journals

Fellows of the Society can access over 90 journals online using Athens authentication. There is no charge to Fellows for this service. Visit **www.geolsoc.org.uk/ejournals** to register.

Literature searching

Not enough time or struggling to find the information you need ? We can search a wide range of resources on your behalf and send you the results directly to your inbox. To find out more about this service, please email **library@geolsoc.org.uk**.

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Image: Anton Balazh / Shutterstock

PERC news

The Pan-European Reserves and Resources Reporting Committee (PERC) has been active, *writes Eddie Bailey*.

The PERC Training subcommittee, led by Ed Sides of AMEC, has produced a one-day Workshop on the reporting of exploration results, reserves and resources specially adapted for PERC Standard 2013. This was presented on 21 October 2014 in London preceding FINEX '14, and will also be presented on 19 November, in Brussels, ahead of MIN WIN WIN. Steve Henley led a half-day reporting standards masterclass for a group of Russian candidate members of IOM3 in London on 17 October.

Our PERC Standard 2013 sub-committee, led by former Chair Steve Henley, has drafted proposals for additional clauses on mining and demolition waste, as well as dimension stone. Work also continues on integrating the FRB reporting code into PERC. Some extension of the PERC standard will be needed for governmental use in the context of the INTRAW project, and initial consideration of the requirements has begun.

Regulators

In June 2014 Chair Eddie Bailey presented on the work and principles of PERC, and our relationship with European and international regulators and standards authorities, at the UK Extractive Industry Geologists Conference held in Scotland.

In September, Secretary Carlos Almeida, Treasurer Ruth Allington, together with Steve Henley, successfully established PERC as a core participant of the EU Horizon 2020 INTRAW Project. This is a large project aimed at developing international cooperation on raw materials with Australia, Canada, Japan, South Africa and the USA. Aligned to existing EU initiatives, MINVENTORY, and another small project MINATURA in which PERC is also a participant, INTRAW will create databases based on PERC Standard 2013 and establish a permanent European Raw Materials Observatory securing raw material strategy and development for decades to come.

➤ A longer version of this article may be read online. *Editor*

Trippin' out

Mike Streule and Lorraine Craig* explain why fieldwork is so important in academe and industry and well worth the cost in time and money

Much has been written in these pages (and elsewhere) questioning the value of fieldwork in undergraduate geoscience education – and justifiably so. The financial expense, burden on staff time and complex planning required for successful fieldtrips on undergraduate courses are considerable. Such burdens set geoscience courses apart from all other engineering and physical science courses, as university financial controllers well know.

So we need to be sure that if we are going to do it, we are doing it for the right reason, with an outcome for the students that is achievable and valuable to them. While the burdens of fieldwork set undergraduate geoscience courses apart, we would argue that graduates who complete geoscience courses with a rich fieldwork programme also are set apart from the crowd, and that therefore we must continue to overcome the burdens.

Integrative

The key reason lies at the very root of geoscience. Ours is an integrative subject. It draws together training and understanding from many different core scientific principles, applies them to the Earth and challenges us to yield solutions to scientific problems. As the questions we face in academia and industry become ever more complex, so too do the breadth and depth of scientific understanding required to come up with solutions.

Increasingly, no single individual will be capable of creating such solutions. Collaborative efforts among many co-workers will be needed. We need true experts in various fields to drill down to ever greater depth, while being able to communicate and integrate that knowledge with their co-workers. Fieldwork training provides a uniquely valuable environment in which to train future geoscientists to do just this.

Field trip participants develop a sense of collective purpose as they tackle challenging problems, requiring collaboration in groups. That sense of 'being a 'real' geologist' generates an effective working community of practice over the duration of an excursion. Successful participants will therefore find that they are more successful in tackling and solving problems, either in academia or industry, later on. It doesn't matter if many of those graduates never do fieldwork again; they will have had a hugely powerful and valuable opportunity to train themselves in the collaborative endeavour that will be required of them in the future. No other educational vehicle in the subject can achieve this so effectively and pervasively as fieldwork.

Yes, it is expensive, and yes, it takes dedicated staff to make it happen, but it makes geoscience graduates more truly valuable in the workplace than many others. Other scientific subjects, particularly those that have evolved more recently, are finding themselves slowing down at the forefronts of their disciplines – because while their graduates may possess individual expertise they don't have the co-working skills needed to bring together solutions effectively.

Geoscience has been a long-established integrative science. Let us not throw away our main method of achieving the very thing that other disciplines so desperately need.

Image: michaeljung / Shutterstock

* **Mike Streule and Lorraine Craig** Rio Tinto Senior Teaching Fellow & Director of Undergraduate Studies, Department of Earth Science and Engineering, Imperial College, London

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**. 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).

> YES, IT IS EXPENSIVE, AND YES, IT TAKES DEDICATED STAFF TO MAKE IT HAPPEN, BUT IT MAKES GEOSCIENCE GRADUATES MORE TRULY VALUABLE IN THE WORKPLACE THAN MANY OTHERS
>
> **Mike Streule and Lorraine Craig**

BURMA'S RISING STAR

Nick Gardiner*
on tin-tungsten mineralisation in Burma, where mining is all set to make a comeback

Above: ***Hermyingyi Mine, a tin mine operated by the British before World War 2***

Burma – Myanmar – is one of the largest countries in Southeast Asia. Lying at a historically key geographical juncture between India, China and South East Asia, it is slowly emerging from decades of oppressive military rule. It is extremely attractive to geologists for two principal reasons.

First, as a minerals jurisdiction, it is astonishingly rich in a variety of commodities and ore deposit types: tin-tungsten, copper, nickel, gold, silver, lead and zinc, as well as the famous Myanmar jade and the Mogok rubies and sapphires. It contains at least three world-class mineral deposits (Mawchi (tin-tungsten), Bawdwin (lead-zinc-silver) and Monywa (copper)). Second, it is sited at the eastern end of the Mesozoic-Cenozoic India-Asia collision zone, immediately south of the Namcha Barwa Eastern Syntaxis, providing a pivotal link between Tethys suture zones (to the north in Karakoram-Himalaya-Tibet), and those found further south and east (Thailand, Malaysia and Sumatra).

However, largely due to the recent political situation (and despite sterling work by indigenous geologists and a few notable UN and other Western-sponsored programmes) it remains geologically enigmatic. Political and economic changes over the last four years have, however, been profound and rapid. While democracy remains a 'work in progress', the country's slow opening up has allowed Oxford scientists to gain unprecedented access to areas that, in some cases, have not been visited by western geologists for 40 years or more.

Oxford Burma Project

The Oxford Burma Project has one simple but broad aim: to unravel the tectonic history of the country, and link it

> BURMA'S SLOW OPENING UP HAS ALLOWED OXFORD SCIENTISTS TO GAIN UNPRECEDENTED ACCESS TO AREAS THAT, IN SOME CASES, HAVE NOT BEEN VISITED BY WESTERN GEOLOGISTS FOR 40 YEARS OR MORE

Map of Burma (Republic of the Union of Myanmar) showing principal settlements

Tin Concentrate being panned at an alluvial deposit

Burma's many unpaved roads are slowly being metalled but are frequently rendered impassable by rains

to the metallogenesis of the ore deposits. We would like to answer some fundamental questions regarding the nature and evolution of Burma's geological history and of its mineral deposits, and to address these we use a variety of field, petrological, geochemical and geochronological techniques.

We have particular interest in the petrogenesis of the extensive tin-tungsten deposits. While significant recent research has focused on granitoid-related porphyry systems hosting copper-gold mineralisation (in part due to their immense economic significance) granite-related tin-tungsten and associated mineralisation has received less attention - especially since the tin crash of the mid-1980s. However interest in tin deposits has increased, driven by strong short- to medium-term price forecasts and by associated 'security of supply' concerns over co-genetic metals.

'Critical Metals' are elements deemed necessary for new and green technologies with a limited supply-base. Such metals include tungsten, the Rare Earth Elements (REEs), lithium, tantalum-niobium and indium - as highlighted on the British Geological Survey's 'Risk List'. Most of these are lithophile elements, and are spatially and genetically concentrated by the granite-related processes that give rise to the world's major tin deposits. Such deposits are markedly associated with crustal-melt granites associated with major subduction zones – of which the principal Mesozoic-Recent examples are the tin-tungsten provinces of the Andean Cordillera and the Southeast Asian tin granite belts. The opening up of a promising new jurisdiction hosting one of these major tin-bearing Southeast Asian granite belts is therefore of great interest both to academia and trade. Accordingly we have been generously funded both by the University and by a minerals investor.

Diminished

The Burmese mining industry has become much diminished in recent decades from peaks before WW2, in 2010 registering barely 0.1% on Burma's total GDP. But huge potential for careful redevelopment remains, which could be of significant benefit as the country strives to rebuild its economy.

In the 1930s the Mawchi Mine was perhaps the world's largest single tungsten producer, accounting for some 60% of Burma's total production - the country then being the world's biggest tungsten supplier. The Bawdwin Mine in the Northern Shan States was, in the early 20th Century, one of the world's largest ▶

Hermyingyi Mine – veining within the host rock

Sluice in a processing plant

Rice paddies around Dawei

lead mines (as well as a major silver, zinc and nickel producer), hosting a major mining and smelting operation (where Herbert Hoover, future US President, made one of his fortunes).

While both Mawchi and Bawdwin retain production potential, present mining operations are now largely artisanal. Despite the temporary lifting of western sanctions in 2011, in my travels around the country it is obvious that a chronic lack of investment, coupled with concerns over tenure, punitive production-sharing licences and a lack of modern mining skills and equipment all contribute to a challenging operating environment.

Within the last year, I have visited Burma five times, usually accompanied by one or other of my Oxford colleagues Mike Searle and Laurence Robb. We have also worked closely with Dr Andrew Mitchell, a geologist who has worked in Burma for over 40 years and who remains one of the few true experts on the region. I have built up a network of local geologists –practising consultants and from academia - and am pursuing joint research opportunities with domestic universities.

While simple to fly to, in many ways Burma still remains a tricky country to travel in - you cannot simply turn up in Yangon, hire a car and drive to an outcrop. Any proposal to visit much of the country beyond the central plains (roughly between Yangon-Mandalay-Bagan) generally requires a government permit issued through the Ministry of Mines. Hiring a guide is a necessity, for both translation and local logistics. Foreign mobile phone roaming does not work, and Wi-Fi is available but often patchy. The local currency is the Kyat, but for many things you need to pay in

pristine US$; while ATMs and credit card facilities are only starting to appear in major cities. Regardless, we have forged on and participated in field trips to various localities, including mine visits to tin, gold and lead-zinc deposits. Most recently I have made a couple of trips to southern Burma to study the extensive tin-tungsten deposits and observe present-day mining operations there.

Tanintharyi

Burma's main tin-tungsten district is located along its southern spine, an archipelago stretching down along the Andaman sea, sharing the border with Thailand. This is the Tanintharyi region, difficult of access and my favourite part of the country (albeit a bad malarial zone with a problem of increasing resistance to drugs). Largely jungle, its coastline comprises pristine beaches with a multitude of islands and inlets, while inland are lowland rice-paddies and slow-moving muddy rivers with a backdrop of extensive and vegetated mountain ranges. High precipitation means that during the rainy season from May to September the rivers swell and many dirt roads are rendered impassable - but on the other hand the verdant green of the palm-fringed paddies is stunning.

Dawei (Tavoy) is about an hour's flight from Yangon and best flown, courtesy of one of the new breed of privately-owned local operators, on modern ATP prop planes. You will probably be the only westerner on board. It is a pleasant, small, fairly undeveloped town, where I was met at the airstrip by my guide. After registering with the local authorities we jumped straight into a 4x4.

The recent geological history of SE Asia is dominated by Mesozoic-Cenozoic subduction, accretion and collision between a series of plates and island-arc terranes that rifted from Gondwana in the south, and sutured onto the South China terrane during the staged closing of Tethys. The history is similar to other terranes along the Tethyan margin (e.g. Tibet), with progressively younger continental collisions and associated suture zones running east to west.

Two principal collision events dominate the geological history of Burma. The Late Triassic Indosinian Orogeny (the closure of Palaeo-Tethys) describes the collision of Sibumasu with the Indochina terrane. The resulting Bentong-Raub Suture is thought to run through eastern Burma, western Thailand and south into peninsular Malaysia. Sibumasu (Siam-Burma-Malaysia-Sumatra) is the basement thought to underlie eastern Burma, and represents a contiguous terrane that rifted from Gondwana in the Early Permian.

The more recent closure of Neo-Tethys and the initiation of the Himalayan Orogeny, has been dated along the Indus-Yarlung-Tsangpo suture further north at c. 50Ma, and its suture is thought to crop out in western Burma, in the Mount Victoria Belt. This suture has, however, been cut by recent Neogene strike-slip faults; most notably the 1200km-long dextral Sagaing Fault, a major active north-south fault dividing eastern and western Burma, and which continues to accommodate most of the northward motion of the Indian Plate to this day.

Mineralisation

Tin-tungsten mineralisation in southern Burma is associated with the intrusion of a suite of largely Cretaceous-Eocene crustal-melt granites, part of the extensive tin granite belts of SE Asia. Collectively, these belts are thought to be the magmatic expression of the staged closing of Tethys. To the east, and running through peninsular Malaysia, through Thailand to the border with both Burma and Laos, two of these major granite belts are found, together representing the Indosinian Orogeny.

These are termed *'Main Range'* and *'Eastern Belt'*, and are delineated by the Bentong-Raub suture. This suture is accordingly thought to separate dominantly subduction-related 'I-type' granites to the east from continental collision 'S-types' in the west. Classically, tin mineralisation is linked with the latter; though recent work at Oxford has shown that these granite belts are more chemically and chronologically similar than previously thought, and that tin mineralisation is associated with both.

Together, these Southeast Asian granite belts produced some 54% of all the tin ever won worldwide. Most was found through the destructive dredging of river and coastal deposits in both Malaysia and Thailand. In Burma, however, many primary deposits remain; the Burmese tin granite belt is one of two magmatic belts found within the country. These two are thought to be ▶

Above: ***Maung Ma Kan Beach***

> TWO PRINCIPAL COLLISION EVENTS DOMINATE THE GEOLOGICAL HISTORY OF BURMA. THE LATE TRIASSIC INDOSINIAN OROGENY (THE CLOSURE OF PALAEO-TETHYS) DESCRIBES THE COLLISION OF SIBUMASU WITH THE INDOCHINA TERRANE

parallel, probably contemporaneous magmatic-metallogenic provinces related to the closure of Neo-Tethys. However they do exhibit completely distinct mineralisation. The Mogok-Mandalay-Mergui (MMM) belt (central and southern Burma – the site of our study) is rich in extensive tin-tungsten mineralisation; while the Wuntho-Popa Arc to the west is thought to be a magmatic arc with Cu-Au porphyry and Au-Ag epithermal mineralisation.

Mineral provinces

Burma can be divided into three major mineral provinces; the aforementioned Wuntho-Popa Arc, the MMM, and the Shan Plateau in the far east of the country.

The Wuntho-Popa Arc is underlain by the *Burma Seismic Zone*, an eastern-dipping subduction zone with earthquakes recorded down to 230km. Sited above this are several large Pliocene calc-alkaline stratovolcanoes (Popa, Taungthaulon and Loimeye). The Arc hosts the major copper deposit at Monywa.

The Shan Plateau largely comprises a series of Ordovician-Triassic carbonates overlying PreCambrian-Cambrian sediments and volcanics, the latter hosting the major lead-nickel-silver Bawdwin Mine, a VMS-type deposit.

The MMM can be subdivided into the Mogok Metamorphic Belt and the Slate Belt. The former is a high-temperature kyanite-sillimanite grade metamorphic terrane dominated by ruby-hosting phlogopite and diopside-bearing marbles, with occasional pelites.

The Slate Belt runs broadly north-south from Mandalay to Mergui and Phuket, and is a Late Palaeozoic succession of meta-mudstones and sandstones. It is within this we find our tin granites. Both hornblende and biotite 'I-type', and two-mica occasional toumaline-bearing 'S-type' crustal-melt granites punctuate the Slate Belt. Tin-tungsten mineralisation is strongly associated with the intrusion of the crustal-melt granites, and is found both as Cornish-type greisen-bordered veins within the granite cupolas themselves, and as quartz-hosted veins in the country rock.

Unlike the Variscan tin deposits of SW England, no significant copper mineralisation is associated with the tin granites - they are distinctly tin-tungsten producers. In a typical deposit, tin and tungsten are found as varying proportions of cassiterite and wolframite-rich pegmatites, and greisen-bordered quartz veins. There is marked regional zonation; tungsten becomes progressively dominant over tin towards the north. Indeed, from its general predominance, some workers have asserted that collectively the mineralised granites of Burma should be called a "tungsten province" with subsidiary tin. The granites extend as far south as Phuket in Thailand, where mica-tourmaline pegmatites have recorded significant amounts of monazite and other REE- and yttrium-bearing minerals.

The Dawei region is home to over 50 historical tin and tungsten mines - although tin production stretches both further north and south, following the granite belt. Many worked deposits are a mixture of primary with elluvial and alluvial association, but quite a few are solely alluvial, often following river and stream gravels, or as palao-terraces. Working alluvium is favoured by locals who run small-scale artisanal operations, usually with rudimentary processing plants (predominantly sluices) to produce tin concentrate. As cassiterite is largely resistant to the intense lateritic-type weathering, much tin is found as SnO_2 dispersed in the alluvium. Thus, a simple gravity separation process is all that is required to produce a concentrate grade suitable for sale to

Artisinal miners following primary outcrop

Backroads in the Dawei area

local wholesalers. There is no local smelter, so most tin concentrate is exported either to Thailand or Malaysia.

Historic mining

Many of the major mines in the area have a long history. We visited the Hermyingyi mine, a primary deposit which was, pre WW2, a significant British-operated tin mine, and one whose redevelopment is already afoot. Here, greisen-hosted quartz veins of cassiterite and wolframite are found within the host granite, and underground mining has been operating since the 1930s. The mine is accessed via a small rail bridge, and although the railway engines have long rusted solid, wagons still run on man-power, transporting hand-excavated ore to a basic processing plant a few hundred metres along the valley.

The Bogyoke Mine is another colonial-era working. Its main underground shaft is now flooded, but a Chinese-sourced processing plant has recently been installed, aiming to produce tin concentrate from the dredgings of nearby rivers. The Mawchi Mine, once the world's pre-eminent tungsten producer, exemplifies a typical primary deposit. The Mawchi granite is a relatively small intrusion of porphyritic biotite granite, intruding metasediments of the Slate Belt. Mineralised veins up to 2.5m wide are present mainly within the upper part of the granite, and economic tungsten-tin grades are focused within this cupola, decreasing rapidly with depth. These veins show an earlier generation of wolframite and cassiterite, with paragenetically later molybdenite, chalcopyrite and magnetite, gangue minerals such as fluorite.

Up-sides

There are huge up-sides to travelling and working in Burma. Despite having been ruled by one of the world's more unpleasant regimes, the Burmese people remain among the kindest and friendliest on the planet. While travelling around to more rural areas, children and adults alike will come up to say hello ("Mingalaba"), give you a toothy grin (the degree of toothiness contingent on whether they chew betel nut or not) and shake your hand. This is a profoundly Buddhist country, and wherever you travel you are greeted by the sight of a dozen golden pagodas rising above the trees, or monks in red robes zooming about on the back of motorbikes. You also enjoy the sight of bullock carts travelling the wrong way down the only dual-carriageway (one which uses the furlong as a measure of distance).

The country itself contains a variety of landscapes: hot central plains, a patchwork of rice paddies, is usually baked to dust by late May waiting for the monsoon; those idyllic, pristine beaches and a thousand waving palm trees greet you in the deep south. In the north, the Himalayan foothills grade from teak forests to rise to Hikabo Razi; and you can get seriously lost in the intractable malarial jungle of the east, host to tiger, elephant - and several armed separatist groups.

We have more trips to Burma planned in the next year - hopefully going further north. It will be a pleasure to return. ◆

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FURTHER READING

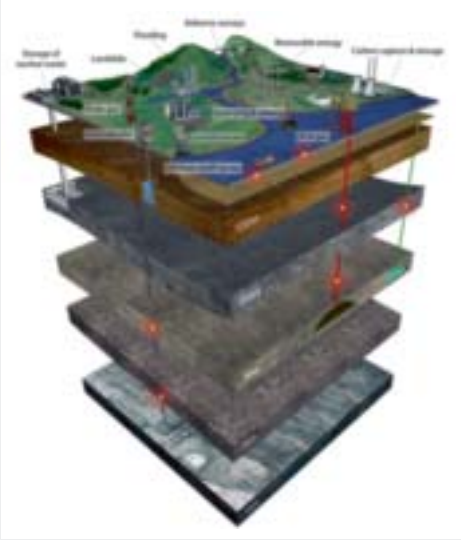
Further details regarding Economic and Tectonic Geology at Oxford can be found on the group's home page at **hardrock.earth.ox.ac.uk**. For a metallogenic summary of the country see Gardiner *et al.* (2014): The Metallogenic Provinces of Myanmar. *Applied Earth Sciences*, 123.1 doi:10.1179/1743275814Y.0000000049

Many religions are practised in Burma, but a large majority (80-89%) are Buddhist

INSTRUMENTING THE EARTH

Image: M Stephenson

Mike Stephenson* outlines a new part of British Geological Survey strategy to study geological processes 'in real time'



Above top: *The GB3d model, published in late 2012, provides a national resolution model of the stratigraphy and structure of UK bedrock geology*
Above lower: *Britain has large untapped potential for greater subsurface usage; but our densely packed population requires high levels of subsurface management and environmental security assurance to realise this potential. Monitoring and measurement will be a large part of this*

Left: *BGS mapping of the cover rocks in Malaysia that are being used by Singapore to develop underground facilities*

You might remember the TV coverage of last winter's floods, reporters standing in waders in the suburban streets of west London, talking about the mysterious phenomenon of 'groundwater flooding'. Occasionally they might bring in a BGS (British Geological Survey) expert to explain the process. The whole thing was replayed for 'sinkholes'. Why do they happen and where would they happen next? Shale gas started to worry people too. Where is the shale gas, and what are the consequences of drilling for it - for the landscape... and house prices? Rarely have geological processes been so close to people's lives.

But this trend will continue. Our changing climate and new developments in energy mean that geologists need to understand the changing processes that affect lives and livelihoods. Luckily there's a technological revolution going on around us that will enable us to do just that, and to study geological processes as they happen.

Real time

Meteorologists have long been able to assimilate data in near real-time; but now, environmental scientists and ecologists are getting in on the act. Every new study, whether remotely-sensed or from sensors in rivers or soil, reveals something new about the environment that surrounds us. One startling new development is 'satellite CCTV' which allows us to see road-traffic moving in real time, from space.

But large scale monitoring and measuring in real time has not been a feature of Earth science and geologists have largely missed out. The geological community needs to harness the power of sensor technology to be able to answer people's questions about the changing Earth at timescales that matter to them – whether it be groundwater flooding, or changes brought about by nearby drilling.

The need for better monitoring and measuring - and therefore better models and predictive capability, as well as the new sensor technology that might enable this – is not lost on BGS. The new BGS strategy 'Gateway to the Earth'[1] outlines some of the challenges that Britain and the world faces - climate change, geological hazards and competing demands for resources - but also shows how sensor deployment will help us answer questions that matter to people. 'Instrumenting the earth' will enable better 3D models for predicting such events as groundwater flooding in the southeast, or cliff falls and erosion around our coasts, as well as the effects that climate change might have on built infrastructure, such as railway embankments. It will help us build better models for subsurface developments in cities for example, geothermal for heating and air-conditioning.

But the deeper subsurface of Britain has large untapped potential too: for energy, storage and disposal. Apart from shale gas, there's coal-bed methane, underground coal gasification, geothermal, nuclear waste disposal and carbon capture and storage (CCS). Our dense population and already heavily-used underground require that we manage the subsurface much better than we have so far - not just for understanding the processes, but also to assure the public that we are competent. Part of BGS's job is to inform Government regulators and we will work with them to make real-time data available to the public to encourage transparency and to improve public 'buy-in' and trust. A combination of good regulation and public buy-in could be a powerful enabler for home-grown and secure, low-carbon energy, for example.

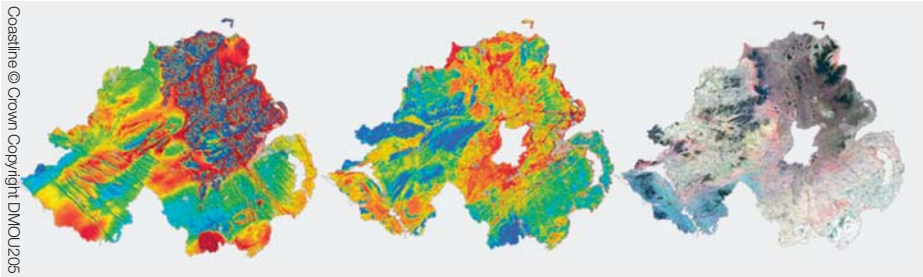
Sensors

BGS has already started to deploy sensors and is investing in equipment to measure conditions in groundwater to ground-truth our models, as well as in more seismometers to improve our national network so that we can measure induced seismic activity connected with past, present and future energy activity.

Of course, we need more than just ▶

> "GEOLOGISTS NEED TO UNDERSTAND THE CHANGING PROCESSES THAT AFFECT LIVES AND LIVELIHOODS. LUCKILY THERE'S A TECHNOLOGICAL REVOLUTION GOING ON AROUND US THAT WILL ENABLE US TO DO JUST THAT, AND TO STUDY GEOLOGICAL PROCESSES AS THEY HAPPEN"

Image: Ryan Simpson / Shutterstock.com



Coastline © Crown Copyright DMOU205

Above: ***New energy developments like shale gas will need better regional monitoring***

Left: ***Northern Ireland with Aeromagnetic (left), Electromagnetic (centre) and Gamma Ray Radiometric (right) Tellus airborne survey data***

sensors. Where they should be placed, what they measure and how often they measure - and a whole host of the other questions - need to be answered. These are partly informed by having some understanding of Earth processes in the first place; but also a deep understanding of the solid geology. Solid geology – the rocks – is what the fluids that we're interested in flow through. It is the solid framework in which we will hang our sensors.

BGS has over a hundred solid geology 3D models of various kinds. One part of BGS strategy is to meld these into the National Geological Model – a seamless model representing the whole of onshore and part of nearshore UK. In December 2012, BGS released the first downloadable versions of GB3D -the National Bedrock Fence Diagram[2] - and the National Geological Model will essentially fill in the gaps. The Netherlands already has a complete 3-D lithostratigraphic framework model[3] for the onshore, and the benefits are huge – for government, for industry and for the public.

BGS models are also lithostratigraphic – in other words divided into units based on traditional stratigraphy - and for many of the uses to which we will put these models, this division will be fine. But some fundamental properties of rocks do not always correlate with lithostratigraphy and in the gap between the upper boundary of a lithostratigraphic unit and the lower boundary a lot can happen - there can be a lot of heterogeneity, as well as faults and fractures.

Focused

So much of the work we'll be doing in the next few years will be about adding this new knowledge about properties to our National Geological Model. Beyond the focused studies already going on, for example for nuclear new-build and the high-speed rail link HS2, we'll be out collecting new data. These will integrate with geological mapping, geophysical, geochemical and remote sensing methods, building on the success of projects such as Tellus[4] and Maremap[5]. We will be up-front about the uncertainties in our interpretations, models and forecasts, not only to inform better risk management but also to build public confidence in the transparency and objectivity of our science.

Not that we shall confine ourselves to Britain! One of the most exciting current scientific projects in Southeast Asia is helping to build models of the Permo-Triassic sedimentary rock cover in Singapore. On a crowded island, space is at a premium and so Singaporeans are going underground, hollowing out caverns for oil and gas storage, and ultimately for car parks, utilities and many other uses. BGS is mapping the cover rocks there and in nearby Malaysia to understand their properties.

Arrays

Instrumenting the Earth is not all just about applied science. Having sensors where we have never had them before will give rise to all kinds of new science. New, denser seismological networks will act like distributed radio-telescope arrays that survey the sky; only these will pick up seismic activity on the far side of the Earth, revealing deep structure better. Other sensors may pick up subsurface biological activity, or unforeseen hidden biogeochemical linkages between surface processes and the subsurface.

This is an exciting time for the British Geological Survey. Our high profile has handed us some very public challenges, but the technology is now available to rise to them. We have a long history of collecting and analysing. We made maps, then 3D models; now we will make those models work for the public, industry and government by 'instrumenting the Earth' so that we can solve geological problems and make a difference to people's lives and livelihoods. ◆

***Mike Stephenson** is BGS Director of Science and Technology and the author of *Shale Gas and Fracking – the science of the controversy* (Elsevier 2014)

REFERENCES

1 www.bgs.ac.uk/ebooks/gateway_to_the_earth/index.html
2 www.bgs.ac.uk/research/ukgeology/nationalGeologicalModel/GB3D.html
3 www.academia.edu/3169883/TNO_-_Geological_Survey_of_the_Netherlands_3-D_Geological_Modeling_of_the_Upper_500_to_1_000_Meters_of_the_Dutch_Subsurface
4 www.tellusgb.ac.uk/
5 www.maremap.ac.uk/index.html

READERS' LETTERS

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What is the true relationship between geology and economics?

End of an era – and a new dawn?

Sir, Kristin Vala Ragnarsdottir and her ASAP colleagues take a strangely superficial approach to the relationship between geology and economics (*Beyond GDP, Geoscientist 24.9, October 2014*). Having conceived the idea of Gross Domestic Product in 1934, Simon Kuznets (see reference) went on to question its role when it came to unpaid labour and international development. Furthermore, his 1971 Nobel Prize speech throws up some fundamental questions about growth and unforeseen technological developments - including surprises, which may be positive or negative, such as the onset of anthropogenic global warming.

Simplistic graphs add little to this debate when logarithmic plots would have made it easier to comprehend levels of historic mineral production. Given the biggest economic collapse since the great depression, 'peak oil' is a total irrelevance, when without carbon capture and storage even a slump in using hydrocarbons will prove highly dangerous. With the advent of digital technology and labour intensive services, GDP does not have to be linked to hydrocarbon intensity and depletion of natural resources. Though the authors are right to question growth that only results in growing inequality and dissatisfaction, this is not inevitable. Also it is clear from international marketing that 'life satisfaction' depends partly on temperament. Following quantitative easing and unprecedented falls in oil prices during a period of international turmoil, we may be on the brink of another economic epoch.

The Spirit Level is a deeply flawed book: none of the graphs has any population weighting, for plotting arbitrary straight line least squares fits. Nor did Wilkinson and Pickett state their exchange rates, when in any case many international comparisons should have been kept in terms of distribution of national income and wealth. Correlation does not necessarily prove causation, even if I have no doubt growing inequality is socially corrosive.

DAVID NOWELL

Reference - W: www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1971/kuznets-or.html

Publish or perish

Sir, Many Fellows will agree with Don Hallett's criticism (*Soapbox, Geoscientist 24.10 November 2015*) of the system of learned journals that has grown up – I won't say 'evolved', for evolution surely implies, at least in most cases, some kind of improvement in function. Hallett does not mention the further blight that many journals are produced by international publishing firms whose aim is to make money. Try to find a short cut to a paper on the web and you find that to access the full text you must pay a fee. OK, most of us subscribe to libraries which allow access to many journals, but it's a pain all the same.

I am encouraged by the fact that most 'reprints' that I now receive from friends and colleagues are pdf files. They have probably been published on paper but that doesn't concern me - I have instant access. Now at least one journal, *Palaeoelectronica*, is published only online. There are others. My suggestion is that some of the major societies – GSL, GSA, European societies and a few others – get together to organise electronic publishing centrally. This would be supported by a paid, professional staff who would perhaps be gradually transferred from print journals.

There have been predictions for decades that electronic publishing will supersede paper, but it hasn't happened. Perhaps the time has come at last. And if commercial publishers lose out, well, my heart bleeds for them.

DESMOND DONOVAN

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Correlation does not necessarily prove causation, even if I have no doubt growing inequality is socially corrosive
DAVID NOWELL

Portland substitutes

Sir, I have been reading the November edition of *Geoscientist* and was interested by the article on the headstones of the Commonwealth War Graves Commission by Nina Morgan (*Geoscientist 24.10 p 25*).

Over the years I have spent a lot of time looking at CWGC cemeteries all over the world and it is as Nina Morgan points out – Portland Stone headstones are usually used to mark the final resting place of the war dead of the Commonwealth. It is also true that there have been attempts to move away from this stone on occasion, and there are examples of several different types of stone in use.

In Scotland, as Morgan states, granite has been used in some places and some of these are in isolated communities in the highlands and islands. In Wales there are examples of slate headstones, for example in the main cemetery in Abergavenny. However, it is perhaps unusual to find battlefield cemeteries where significant departure from the Portland Stone headstones occurs.

The Marinsart British Cemetery (picture) has 333 burials from the fighting on the Somme in both 1916 and 1918. All the headstones are either Corsehill or Lochabriggs red sandstone, marking a contrast to the other cemeteries of the area. There does not seem to be any significant reason, but when I spoke to people who worked with the CWGC I learnt that they consider it simply a trial that had not progressed beyond this one cemetery. Some years ago, when I was involved in the building of the Mametz Wood Memorial, we were talking to the CWGC about the possibility of using the normal Portland Stone for the memorial. We were told at that time that Portland Stone was becoming so expensive that the CWGC was sourcing some of its stone for the headstones in France from similar but cheaper material within the Paris Basin. I do not know if this is still the case.


Image: www.cwgc.org

JOHN DIXON

[CAN'T FIND YOUR MEETING? FIND FULL, ACCURATE, UP-TO-DATE DETAILS ON THE WEBSITE: WWW.GEOLSOC.ORG.UK/LISTINGS]

ENDORSED TRAINING/CPD

COURSE	DATE	VENUE AND DETAILS
Forcing & Predictive Models of Change	16-20 February	**Venue:** University of Sussex. Consideration of future forcing of geomorphological processes and landform change are essential for modelling and quantifying hazard and risk. **Contact and registration:** www.sussex.ac.uk/geomorphology/ E: Dr John Barlow
Lapworth's Logs	n/a	'Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. **Contact:** info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

DIARY OF MEETINGS FEBRUARY 2015

MEETING	DATE	VENUE AND DETAILS
New Advances in Geophysics 2015: The Lithosphere-Asthenosphere Boundary. BGA	5-6 February	Conference & AGM. **Venue:** Burlington House. Fees apply. For registration and details see website
Forensic geology. Southern Wales Regional ICE Ground Engineering	5 February	Evening Lecture 1730 for 1800. **Venue:** Trevithick Building, Cardiff University, The Parade, Cardiff, CF243AA. **Speaker:** Dr Laurance Donnelly. **E:** swales.rg@geolsoc.org.uk
William Smith and his geological advances as expressed through his work in Yorkshire East Midlands Regional	14 February	Lecture, Social Event. **Venue:** Lecture Theatre B3, The Biology Building, University of Nottingham. **Time:** 1800 followed by Annual Dinner. **Speaker:** Dr Hugh Torrens. **E:** lectures@emgs.org.uk
Karst from the Inside; a Caver's Perspective South West Regional	19 February	Lecture. **Venue:** Pengelly Centre, Russets Lane, Buckfastleigh, Devon. TQ11 0DY. **Speaker:** Paula Grgich-Warke (Red Rock Geoscience). **Time:** 1900. **E:** office@redrockgeo.co.uk
Forensic Geoscience Group's 'Whodunit' Forensic Geoscience Group	19 February – 1 March	**Venue:** Ulster Museum. A 'Year of Mud' event, forming part of the NI Science Festival. See website for details.
Non-Seismic Geophysics. Finding Petroleum	19 February	Conference. **Venue:** Burlington House. **Time:** 0900. Free. **E:** natalie@findingpetroleum.com
An introduction to quarry design – skills, experience and approaches needed for success. Home Counties North RG	24 February	Lecture. **Venue:** TBC at time of writing. See Website. **Speaker:** Dr Ruth Allington. **Time:** 1800 for 1830. **E:** homecountiesnorthregionalgroup@gmail.com
When Continents Collide: Active Deformation and Seismic Hazard. Geological Society	25 February	**Speaker:** Tim Wright, University of Leeds. **Times:** 1500 & 1800. A Society London Lecture. See p. 6 for details
Schools Geology Challenge Home Counties North RG	25 February	Workshop. **Venue:** Sharnbrook Sixth Form, Odell Road, Sharnbrook. **Time:** 1200 – 1500. **E:** homecountiesnorthregionalgroup@gmail.com

Advances in Ar/Ar Dating

This Geological Society Special Publication is a long-anticipated contribution to the literature documenting recent advances in the science of $^{40}Ar/^{39}Ar$ dating.

The main parts of the volume are introduced with a thorough summary and review of the principles and applications of the ^{40}Ar / ^{39}Ar dating technique. The research paper contributions are then presented, broadly organised into two complementary thematic sections addressing advances in methodological development and in the applications of the technique.

Advances in methodological development (12 papers) cover aspects of argon diffusion, sample quality, age standards, neutron irradiation, analytical instruments and software, decay constants and other argon isotopes (such as ^{37}Ar and ^{38}Ar). The second part of the volume presents recent research efforts in the applications of the technique to the planetary sciences (four papers), terrestrial tectonics (four papers), detrital material provenance (one paper), volcanism (two papers) and archaeology & climate.

I have one minor criticism, acknowledged by the volume editors, is that no recent research contributions have been included for the fields of archaeology and climate (i.e. application of the technique to the Quaternary). Further reading in recent advances in these fields is indicated; but it might have been appropriate to consider amending the title of the volume to reflect this omission.

All sections of the volume are well written and edited, concisely laid out with clear and appropriate figures, photographs and data-tables - features that one has come to expect from the Geological Society Special Publication series.

In summary, the volume is a comprehensive and significant contribution to the field, and the editors are to be congratulated. I expect this will become a valuable complementary volume to the established principal reference work for the technique[1]. The primary readership is expected to be practising geoscience professionals and graduate students within the ^{40}Ar / ^{39}Ar and geochronology research communities. A recommended read and essential reference work.

Reviewed by ***Mark Griffin***

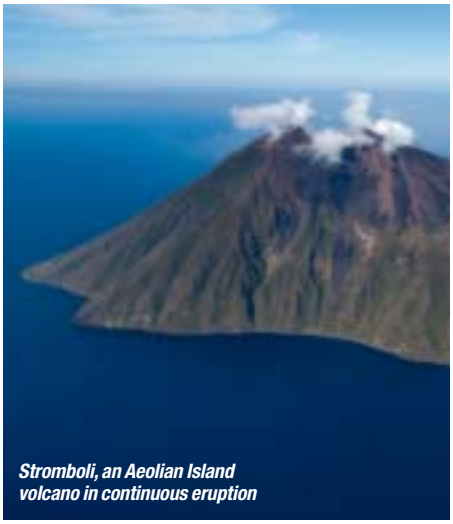
References - 1) McDougall, I. & Harrison, T.M. 1999. Geochronology and Thermochronology by the ^{40}Ar / ^{39}Ar Method. Oxford University Press. Oxford. 282pp.

ADVANCES IN ^{40}AR / ^{39}AR DATING: FROM ARCHAEOLOGY TO PLANETARY SCIENCES
F. JOURDAN, D.F. MARK AND C. VERATI (eds).
Geological Society Special Publication No 378. 2014.
Geological Society of London. ISBN 978-1-86239-360-8. hbk 378pp. ISSN 0305-8719
List price: £125.00 www.geolsoc.org.uk

The Aeolian Islands Volcanoes

This large format memoir provides an encyclopaedic account of these scattered islands just to the north of Sicily. Coupled with a wider series of seamounts, the Aeolian Arc curves around the southern margin of the Tyrrhenian Sea for over 200km off Sicily and Calabria. Continuing volcanism is related to extension above the Ionian slab as it sinks below the Calabrian Arc, and since the Pliocene it has migrated south-eastwards under what is now the toe of Italy. Though the oldest rocks dredged from the Sisfo seamount have been dated at 1300ka, none of the subaerial eruptions is older than 270ka.

Introductory chapters about the islands' tectonic setting and submarine portions could have been extended, though they contain invaluable background information. While chapter two includes an innovative 3D map of Moho depth, some of the figures could have been enhanced with schematic cross-sections and better captioning. Two chapters on the submarine portions of the Aeolian volcanoes, coupled with a set of contoured bathymetric morphological maps on disk and other superb images including 3D views, are too narrowly focused to gain an idea of the nature of the seamounts forming the rest of the Arc, let alone the Marsili and Palinuro seamounts to the northwest and north of the Marsili Basin. It would be useful to know their minimum depths and sea-floor elevation in relation to the islands. However, it is clearly explained how changes in global sea-level, driven by glacial cycles, have carved distinct benches around these islands with a shelf break at around 90 to 130m.



Stromboli, an Aeolian Island volcano in continuous eruption

A brief chapter explains the methodology underpinning the incredibly detailed geological mapping, reproduced on the disk (including additional data) as a wonderful series of downloadable colour pdf 1:10,000 maps, complete with numerous beautifully drafted inserts and annotations. This is followed by the detailed regional correlations across the archipelago supported by radiometric dating tied into the sea level curve. Then naturally the main chapters focus on the seven main islands and their satellites in exquisite detail, with superbly drafted figures and annotated black and white photographs coupled with geochemical plots and detailed clearly set out tables.

The penultimate chapter dwells on the ongoing activity on Stromboli and related volcanic hazards, including localised tsunamis. Finally a chapter brings together how compositional magma variations are related to their petrogenesis and geodynamic setting. Sadly, whoever drafted the truly superb graphics does not appear to be acknowledged, as this excellent volume can be thoroughly recommended for anybody with a serious interest in volcanism.

Reviewed by ***David Nowell***

THE AEOLIAN ISLANDS VOLCANOES (GEOLOGICAL SOCIETY MEMOIR NO. 37)
EDITED BY F. LUCCHI, A. PECCERILLO, J. KELLER, C.A. TRANNE AND P.L. ROSSI. Published by: Geological Society of London. Publication date: 2013
520pp with DVD. ISBN: 978-1-86239-365-3
List price: £130.00, GSL members £65.00, other societies £78.00 www.geolsoc.org.uk

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Contact the editor for further information **TED.NIELD@GEOLSOC.ORG.UK**

New Perspectives on the Caledonides of Scandinavia and Related Areas

The Caledonian Orogen has been the subject of intensive geological investigation for over two centuries, with these studies contributing to the development of fundamental geoscientific concepts such as regional metamorphism, the origin and emplacement of granitic magmas, nappe and thrust tectonics.

Based upon the outcomes from the European Geoscience Union General Assembly session entitled *'Rifting, assembly and collisional processes in the Caledonides: the first step on the way to Pangea'* (Vienna, April 2012), this Geological Society Special Publication documents the advances made in the analytical techniques of structural geology, petrology, geochemistry and geochronology that have been applied to understanding the various aspects of the evolution of the Caledonides over the past three decades.

The volume is divided into seven thematic sections (comprising 29 papers) covering a diverse range of topics that summarise the current understanding (and the remaining contentious areas) and interpretation of the orogen. As the volume title suggests, the majority of the papers cover themes within the Scandanavian Caledonides, but also include contributions on key topics within the geology of the British Caledonides, Greenland, Svalbard and the East European foreland, presented as overviews.

The main thematic sections are: Introduction and Geological Overview (four papers), Provenance of Sedimentary Units along the Baltoscandian Margin (three papers), Architecture of Allochthons of Baltic Affinity (four papers), Development of the Seve Nappe Complex and its position within the Orogeny (four papers), New results on other Caledonian high-pressure rocks (four papers), Evolution of Terranes from the Iapetus Realm (nine papers), and Exhumation, Extension and Mesozoic Reactivation (one paper).

The volume provides an excellent synthesis of the current research efforts within the Caledonides, successfully combining both contributions from field studies and modern analytical techniques. All sections are well written and edited, concisely laid out with clear and appropriate figures, photographs and datatables. The inclusion of numerous colour figures and photographs is a welcome addition and should be applauded. The volume is a recommended read for all Caledonide researchers and should prove to be an essential reference source for many years to come.

Reviewed by ***Mark Griffin***

NEW PERSPECTIVES ON THE CALEDONIDES OF SCANDINAVIA AND RELATED AREAS
F. CORFU, D. GASSER AND D.M. CHEW (eds). Geological Society Special Publication No 390. 2014. Published by: Geological Society of London. ISBN 978-1-86239-377-6. Hbk. 718pp. ISSN 0305-8719
List price: £100.00 (Fellows £50)
www.geolsoc.org.uk

A History of Geology and Medicine

Rocks, minerals and fossils have been used by man therapeutically since ancient times. The Greek physician Pedanius Dioscorides who was the imperial surgeon to Nero and the legions of the Roman army 'published' his five-volume *magnum opus The Materia Medica* around AD 64, although largely a medical herbal work his last volume contains a section called 'Metallic Stones'. He advocated the use of rocks, limestone, pumice and serpentine; minerals, cinnabar, calcite, pyrite, realgar, asbestos and corundum (one shudders to think how these might have been administered) and fossils such as echinoid spines and oysters. This became a standard work of reference for the next 1400 years.

At the beginning of the 19th Century when the science of geology was still in its infancy, progress and scientific advancement were the preserve of men who were quite naturally from other disciplines and names such as William Buckland, who became Dean of Westmintser, Charles Lyell, a lawyer by profession and George Bellas Greenough who was involved with the legal profession, come to mind. These were the men who would further the science of geology, along with a number from the medical profession such as James Parkinson, a founder member of the Society, John Jeremiah Bigsby, who founded the Bigsby Medal awarded by the Society, Edward Jenner, and William Hunter - all of whom made significant contributions to the understanding of geology as an emerging science.

The links between geology and medicine are explored in this volume as a series of 29 papers from an international array of authors covering subjects as diverse as 'the influence of geology in the development of public health' and 'the health properties of groundwater' to 'Dr Arthur Conan Doyle's contribution to the popularity of pterodactyls' and 'the pharmaceutical use of pumice'... a truly diverse collection that makes this eclectic series of papers fascinating reading.

The papers in the publication are varied in scope and give a broad history of the interrelationship between geology and medicine. The book is well illustrated, including some in colour and the 15+ pages of references are a very useful addition to what will certainly be seen as a definitive work of reference. This is the first ever volume dedicated to this subject - an enjoyable read that can be recommended to all who have an interest in the history of geology and the history of medicine. It will certainly be recognised in future as a seminal work.

Reviewed by ***Richard Porter***

A HISTORY OF GEOLOGY AND MEDICINE
C.J. DUFFIN, R.T.J. MOODY, AND C. GARDNER-THORPE, (Editors) 2013 Published by GSL. Special Publication 375. 512 pp Hardback ISBN: 978-1-86239-356-1
List price: £125.00 Fellows: £62.50 Other Societies: £75.00 www.geolsoc.org.uk

BOOKS Available for review

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- **NEW! Arsenic - Environmental Geochemistry, Mineralogy and Microbiology** by Bowell R J et al., (eds), Reviews in Mineralogy & Geochemistry v. 79. Mineralogical Society of America/Geochemical Society. pbk 635pp.
- **NEW! The Anthropocene - the Human Era and How it Shapes our Planet**, by Christian Schwagerl. Synergetic Press 235pp, sbk.
- **NEW! Aquatic Organic Matter Fluorescence**, Ed by Paula Coble et al., 2014 Cambridge UP

PEOPLE *NEWS*

CAROUSEL

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

◆David Coney

David Coney, formerly of Esso, set himself the challenge of walking over 1300 miles to raise money for the Princess Alice Hospice in Esher, Surrey, which cared for his wife Kari Olafson at the end of her life. At time of writing , 72-year-old David has just reached his goal - including five UK National Trails, part of the Camino de Santiago in northern Spain, and three charity walks. His webpage is still open for late contributions. **www.justgiving.com/David-Coney-WALK-2014**.

◆ Richard Fortey

Richard Fortey, former President of the Society, was awarded the Palaeontological Association's Lapworth Medal in December last year. The Lapworth is the Association's highest honour, given by Council to 'a palaeontologist who has made a significant contribution to the science by means of a substantial body of research'.

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Adatia, Ruth Horman*
Borg-Costanzi, Joseph A*
Brasier, Martin *
Cater, Maxwell Clinton *
Evans, J Russ*
Fortier, Yves O *
Foster, Michael *
Fothergill, T *
Heeley, Martyn *
Hooper, P L*
King, Roy
Kosler, Jan *
Lane, Alan*
Mills, J A*
McSweeney, LJM*
O'Hara, Mike
Oldroyd, David
Scott, Barry*
Sokolov, Boris* (2013)
Wright, Martin*
Williams, John B E*

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** to be commissioned. You can read the guidance for authors at **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**.

Image: Kunertus / Shutterstock.com

Geoscientists in the news and on the move in the UK, Europe and worldwide

DISTANT THUNDER *Enduring love*

Geologist and science writer Nina Morgan* recalls a tale of love, tragedy and trilobites

In 1991 Reinhard Kaiser bought a mixed lot at a stamp auction in Frankfurt– and stumbled upon an extraordinary love story. Among the items was a packet of 30 letters written by the German geologist and palaeontologist Rudolf Kaufmann to a young Swedish woman, Ingeborn Magnusson.

> ALL LOOKED SET FOR A SATISFYING ACADEMIC CAREER IN GEOLOGY – BUT THEN CAME THE NAZIS

Kaufmann, son of a physics professor at Königsberg University in Germany, was born in 1909. Fascinated by the boulders found in the Pleistocene drift of northern Germany as a child, he went on to study geology at universities in Königsberg, Munich and Griefswald.

In 1933, aged just 24, he published a PhD dissertation on variation in the Upper Cambrian trilobite genus *Olenus*, and was offered a position at Greifswald University. All looked set for a satisfying academic career in geology – but then came the Nazis. Although he was a second generation Christian, Kaufmann's family was of Jewish decent. As a result, he was branded as 'non-Aryan', and dismissed from his position. Unable to find work in Germany as a scientist, he sought whatever employment he could get.

A time of trouble

In the summer of 1935, while working as a photographer in Italy, Kaufmann met the 28-year-old Ingeborg when she was enjoying a holiday in Bologna. The pair fell deeply in love. But theirs turned out to be a tragic tale.

In 1936 Kaufmann was arrested and imprisoned for three years for 'offences against the race laws'. He carried on writing to Ingeborg while in prison, and managed to continue his work on trilobite evolution by corresponding with scientific contacts abroad. When war broke out in 1939 he escaped to Lithuania. There, after months of uncertainty and suspense, he was given a job in the Geological Survey in Kaunas – only to be murdered by Nazi soldiers while doing fieldwork on a country road, sometime after 1941.

The German-born geologist and palaeontologist Curt Teichert (1905-96), who married Kaufmann's sister Gertrud in 1928 and eventually settled in the United States, remembered his brother-in-law as a "cheerful companion, an indefatigable worker, and a sincere and mature scientist. He shared the fate of millions and his senseless death stands as a monument to human wickedness and ignorance alike". Although in all the couple were able to spend just 13 days in each other's company, Ingeborn, too, never forgot him. She remained unmarried and kept his letters. After her death in 1972 they were passed to her sister Greta, then stolen from a basement in Sweden before finally ending up in the Frankfurt auction house.

No ordinary tale

For palaeontologists Rudolf Kaufmann's story is no ordinary tale of enduring love and a life lost. Kaufmann's careful studies documenting the evolution of the primitive trilobite *Olenus*, a common fossil in the Cambrian alum shales in Sweden, led to the idea of 'punctuated equilibrium', a theory made famous in 1972 by American palaeontologists and biologists, Niles Eldridge (b. 1943) and Stephen Jay Gould (1941-2002).

***Nina Morgan** is a geologist and science writer based near Oxford and working on a book about the Geology of Gravestones

Acknowledgement
Sources for this vignette include: *Paper Kisses: A True Love Story* by Reinhard Kaiser, translated by Anthea Bell (ISBN 978-1590511817); The obituary of Rudolf Kaufmann by Curt Teichert, *Am Jour Sci*, vol 244, No 11, November 1946, pp. 808-809; *Trilobites* by John H Lienhard, available at: http://www.uh.edu/engines/epi2496.htm ; The blog *Trilobites and Tragedy in the third Reich* by Dan Chure of the Dinosaur National Monument available at: http://qvcproject.blogspot.co.uk/2012/11/trilobites-and-tragedy-in-third-reich.html; and the Wikipedia entry for Rudolf Kaufmann. Kaufmann's story also features in *Trilobite! Eyewitness to Evolution* by Richard Fortey; ISBN 978-0006551386.

OBITUARY JOHN BAKER 1927-2014

Much-loved Cardiff University academic, petrologist, extra-mural lecturer, chief examiner and pianist

John Macrae Christian Wellstood Baker, or simply 'John' as he preferred to be called, was born in Essex and schooled in Birmingham and graduated in Birmingham University in Geology in 1947 under Prof. Wills, whom he greatly respected. He was then appointed at University College Cardiff to an Assistant lectureship under Prof. Cox. He joined a very small department with only two other lecturers as an additional post to cope with the postwar bulge of student numbers, just before Cox retired in 1949, to be replaced by Professor J G C Anderson. He was a Fellow of the Society for 66 years, elected in 1948.

Teaching

John concentrated on teaching including mineralogy and petrology, but also making contributions to introductory geology, stratigraphy and, of course, to field classes. He had a diffident, retiring character but was very popular with undergraduates as he was always approachable over problems. He also taught extra-murally, including schoolteachers of geology.

John undertook research in petrology on the poorly exposed Precambrian rocks of SE County Wexford in Ireland, including the Carnsore Granite, and obtained a University of Wales PhD in 1965 for this work, which he published but did not continue. In later years apart from teaching, he spent much time setting and marking external examinations, including practicals, in Geology for Welsh schools, which taught the subject much more widely than schools elsewhere in the UK. These exams were organised by the Welsh Joint Education Committee (WJEC) and for some years John was their Chief Examiner in Geology. Finding exactly comparable samples to go out to numerous schools at the same time was no trivial task!

He was a long-time member of the South Wales Geologists' Association Group from its formation and Chairman (1968–70). As a Senior Lecturer he went part-time in 1987, retiring fully in 1990 thereafter spending much time nursing his wife Elizabeth (née Richards), a 1948 Cardiff Geology graduate, who died in 1993.

Alumni

John then turned his attention to Cardiff University geological alumni matters. He compiled a list of former geology students totalling about 1600, corresponded with a surprising number of them, organised news circulars (1997-2004) and reunion dinners, before stepping aside when central administration, finally waking to the importance of alumni matters, took over. His last years were occupied with compiling information and writing about the 123-year history of the Cardiff Geology Department (now the School of Earth and Ocean Sciences). This, on his death, was nowhere near completion.

> JOHN WAS VERY POPULAR WITH UNDERGRADUATES AS HE WAS ALWAYS APPROACHABLE OVER PROBLEMS

John was interested in local history and vernacular architecture. He loved travelling and used to caravan with the family around southern Europe, driving through central London in the early hours of the morning to shorten the time to reach Dover (before the M25 existed). After his wife's death, he and his companion went much further afield to China, Thailand, Sri Lanka, Egypt, Turkey, Canada, the USA and other places. He was a pianist and a transport enthusiast - especially railways.

John Baker leaves a son, David, a daughter Lynette, whose help is acknowledged, and grand-daughter Rhian.

By **Bernard Elgey Leake**

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.

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Over the last few decades Tony Robinson has emerged as Britain's foremost face of popular history, the creator of a worldwide comedy icon, and an award winning writer of children's books and television.

Tony presented twenty seasons of Channel 4's archaeology series "Time Team", and played Baldrick in "Blackadder". He devised and wrote four series of the BBC's "Maid Marian and Her Merry Men" in which he played the Sheriff of Nottingham, made two series of "The Worst Jobs In History" and an acclaimed documentary about the elderly entitled "Me and My Mum".

He has made TV documentaries on a host of different subjects including The Da Vinci Code, The British legal system, The Peasants Revolt, the Roman Emperors, Macbeth, Robin Hood, the geology of the U.K, the Blitz, the London Olympics, right-wing Christian fundamentalism, the paranormal and the impact of climate change on ancient civilisations. He has extensively toured his one-man stage show "Tony Robinson's Cunning Night Out", including a series of sell-out performances at the Edinburgh Festival. In Australia his series "Tony Robinson's Australia" and the award-winning "Tony Robinson's Time Walks" are the all-time top-rated factual shows on Foxtel. A second series of "Time Walks" was transmitted in 2014. He recently returned to Australia to make Tony Robinson's Tour of Duty, a ten-part series about World War One.

Sponsorship opportunities are available. Please contact Rosy Chirayath rosy@pesgb.org.uk for further information.

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f in

OBITUARY SIMON TOBY COCHRANE 1951-2014

NCB geologist remembered for his involvement with Pontefract, Castleford and Wakefield collieries

Simon 'Sam' Cochrane, who has died aged 63, joined the National Coal Board (Deep Mines) in 1974. He monitored, and recorded the geology in underground coal mine developments and logged surface boreholes, in West Yorkshire.

Life in geology

Simon was born in London on the 9th May 1951. However, the family soon moved to Sheffield, and ultimately to Kendal, Cumbria, where Simon attended the Grammar School. The proximity of the Lake District would have an enduring influence on Simon. It was an area for leisure pursuits that instilled in him a lasting love for the countryside, and geology.

> THE LAKE DISTRICT WAS AN AREA FOR LEISURE PURSUITS THAT INSTILLED IN HIM A LASTING LOVE FOR THE COUNTRYSIDE, AND GEOLOGY

In 1969, he attended Leeds University to read geology, but a serious car accident deprived him of a year's study. He graduated in 1974, and joined the Yorkshire Regional Geological Services, NCB (Deep Mines), Doncaster.

Simon was assigned to the North Yorkshire Area, where he had responsibility for the older collieries around Wakefield (i.e., Lofthouse, Manor, Park Hill, Rothwell, Walton). Together with surveyors and mining engineers, Simon was involved with a drilling programme to determine the depths of old shafts, and the examination of early geological records. The information was used to assess the likely risks presented by old un-charted coal workings. His other duties included logging exploratory boreholes, and monitoring the underground geological environment.

Later, he was involved with a variety of new projects to increase production at existing collieries. For example, the construction of surface drifts at Allerton Bywater and Nostell Collieries, developments to new reserves at Prince of Wales and Ackton Hall Collieries, and the proving of the deeper un-worked strata sequence at Sharlston Colliery.

Simon developed his own unique style to explain Coal Measure geology to his non-geological colleagues. His communication skills were an asset to the geology department, and he was liked by all.

He was also an active member of the Geological Society Yorkshire group, and was a strong supporter of Chartership for Geologists, a status he ultimately achieved with much pride.

New career

The demise of the coal industry in the 1990s meant a career change, and so in 1994 Simon embarked on a career in teaching. He taught science at Lawnswood High School and Cockburn School in Leeds. His greatest personal satisfaction was gained working for the Hospital and Home Teaching Service, Leeds, which brought him into daily contact with children from a variety of backgrounds, and with physical or behavioural difficulties.

In 1974, Simon had married Carol. Their two daughters are Claire and Amanda, and he was proud of their many achievements as he watched them growing up. Claire's marriage this Summer undoubtedly gave him much happiness.

Simon's popularity is reflected by the many who attended a service to celebrate his life on 3 September 2014. His sudden untimely death from a heart attack on 21 August 2014 was a shock, and a great loss, to all who knew him.

By **Robert Vernon** and **Carol Cochrane**

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.

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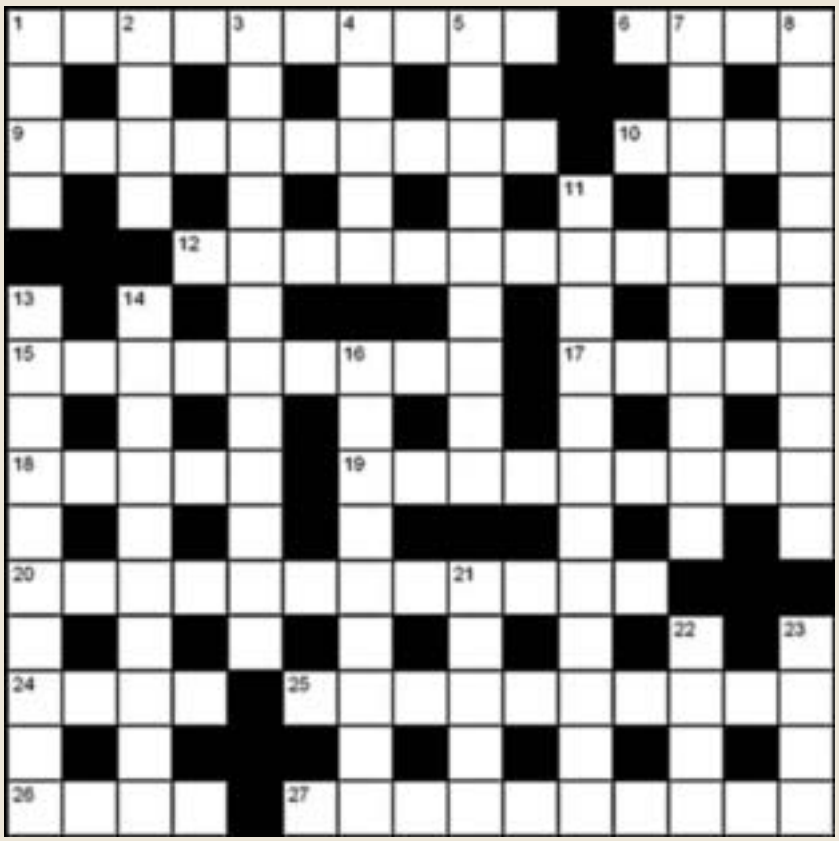

ACROSS

1 Impure polycrystalline diamonds (10)

6 Tucked up cosily in a stratum? (4)

9 Denunciations of previously held conviction (10)

10 Orbiting satellite (4)

12 The property of existing in more than one crystal structure (12)

15 Pogostemon, used to scent snuff (as served at Geological Society Dining Club dinners) (9)

17 Metal cast in a form suitable for further processing (5)

18 Kingdom, or biogeographical domain (5)

19 Deformed (9)

20 Behaving in a passive, deferential manner (12)

24 Notes of credit (1,1,1,1)

25 Rooms set aside for washing activity (10)

26 European engineering geological association, co-publisher with the Society of the journal Petroleum Geoscience (1,1,1,1)

27 Commonplace, meaningless or prosaic sentiments masquerading as wisdom (10)

DOWN

1 Finest grade of sediment (4)

2 Violent public disturbance (4)

3 Matchbox-shaped crystal system (12)

4 Quantitative assessment of, for example, a five down (5)

5 Rock masses containing potentially a commercially viable source of, typically, metal (3,6)

7 Interruptions, for example, in an otherwise steady ecological succession (6,4)

8 Blowing up a rock mass by the use of nitroglycerin explosive mixed with the diatomeceous earth kieselguhr (10)

11 The most animated and vivacious spirit (12)

13 Heavy, overbearing and repressive (10)

14 Capital of Alsace, France. Formerly home to a major annual geological conference (10)

16 Lacking appreciation of or ability in the art embodied by the muse Euterpe (9)

21 Gentleman's gentleman (5)

22 Class Aves (4)

23 Goddess of the Shining Nile. Or possibly the Thames. (4)

WIN A SPECIAL PUBLICATION!

The winner of the November Crossword puzzle prize draw was Richard O'Brien of Morpeth.

All correct solutions will be placed in the draw, and the winner's name printed in the April 2014 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - March 6**.

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**

Name .....

.....

Membership number .....

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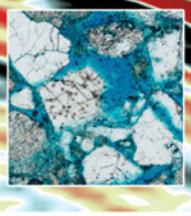
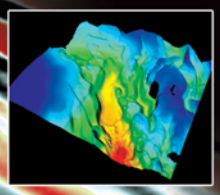
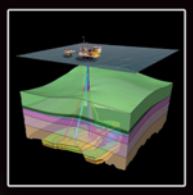
SOLUTIONS NOVEMBER

ACROSS:
1 Gastropoda **6** Marl **9** Excavation **10** Stud
12 Archipelagos **15** Porcelain **17** Alamo
18 Extra **19** Fossilise **20** Decalomania
24 Glow **25** Stratified **26** Sash **27** Transgress

DOWN:
1 Gael **2** Sick **3** Reverse Fault **4** Patch
5 Droppings **7** Astigmatic **8** Lodestones
11 Alkalinising **13** Appendages **14** Cretaceous
16 Affronter **21** Again **22** Mine **23** Odes

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Recognising the Limits of Reservoir Modelling - and how to overcome them

4-5 March 2015

Elphinstone Hall, University of Aberdeen

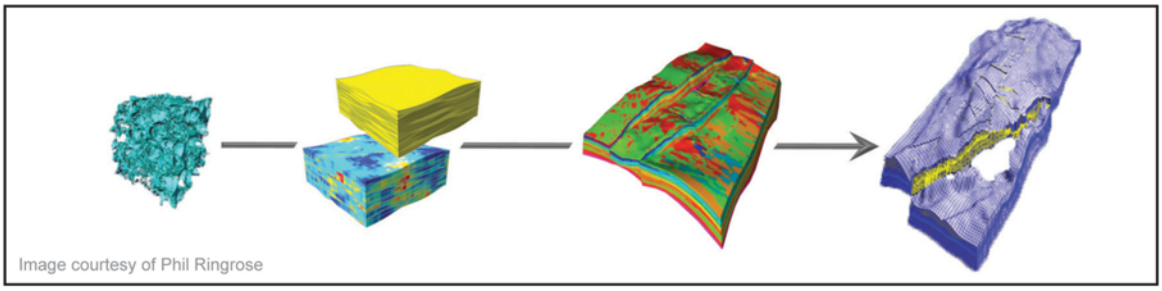

Image courtesy of Phil Ringrose

Nearly 20 years ago a paper describing some then best-practice reservoir modelling included this statement in the concluding section: "The parameters that we used to fine-tune this match were the well connection factors, the well skin factors and the relative permeability curves".

Can we honestly claim to have made progress from that situation?

Geoscientists and petrophysicists labour hard at reservoir characterisation. We are seduced by precision and enticed by the sophistication now offered by software. Meanwhile, we have become habituated to permeability multipliers, pore-volume multipliers, adjustments to the relative permeability curves and to modifying fault properties (up to and including their existence), and use the resulting models to support major capital investment decisions.

So what have we actually learned in the 20 years since geocellular modelling arrived on our desktops? Can we turn all that hindsight around into useful foresight? In situations where we cannot learn from the history-match, what can we learn from history? What are the most frequent failings of our geomodels?

Now that geomodelling is a mainstream activity, our attention moves to finding effective approaches to support investment decisions; multi-scenario, multi-scale modelling with multi-phase upscaling represents an ideal but requires smart and nimble application to be practical and efficient.

This conference seeks warts-and-all tales of reservoir models that eventually became accurate; descriptions of iteration between reservoir characterisation and reservoir performance; stories of managing small-scale heterogeneity in large scale models. The conference seeks to recognise the limits of our current workflows and chart a way forward to more accurate, useful and efficient reservoir modelling practices.

Themes:

- Handling incomplete or imperfect data – *modelling data or concepts?*
- Reconciling and integrating multi-scale data in models – *dealing with gaps*
- Multi-scale modelling – *rather than single detailed models*
- Impact of heterogeneity on fluid flow behaviour – *what matters to flow?*
- Conditioning to production data in mature fields – *how to iterate effectively*
- Advanced gridding and simulation techniques – *breakthrough technologies*
- Linking reservoir models to commercial decisions – *adding value through modelling*

For further information and registration please contact:

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Email: laura.griffiths@geolsoc.org.uk Website: www.geolsoc.org.uk/Recognising-the-Limits-of-Reservoir-Modelling

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