

GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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Her dark materials

Kathryn Goodenough hunts for rare metals in Greenland

CRACKING UP

How adverse soil conditions affect the local roads of Britain

VOTE! VOTE! VOTE!

Time to make your choice in the Council elections

CLIMATE CHANGE

Society publishes addendum to 2010 report

New publications

to add to your bookshelf...



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Deer, Howie and Zussman

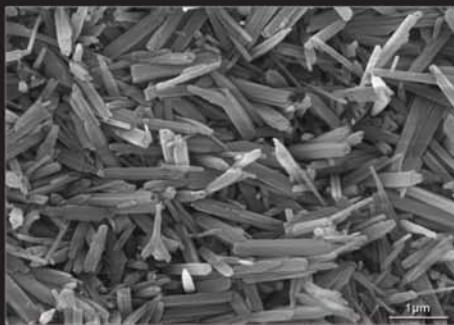
ROCK-FORMING MINERALS

Volume 3C

Sheet Silicates Clay Minerals

by M. J. Wilson

Second edition



Published by The Geological Society

Anatomy, Phylogeny and Palaeobiology of Early Archosaurs and their Kin

Edited by S. J.北斗, C. R. Desojo and R. B. Irmis



Advances in Carbonate Exploration and Reservoir Analysis

Edited by J. R. Buddle, J. E. Neftvein, S. E. Laudien and A. J. Whittle



Geological Society Engineering Geology Special Publication No. 26

Earthworks in Europe

Edited by T. A. Redford



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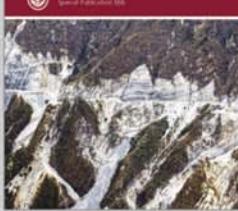
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Edited by A. M. Spencer, A. F. Embry, D. L. Gautier, A. V. Stoupakova and K. Soremek



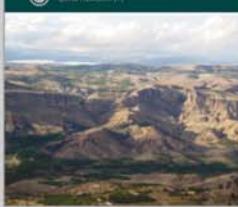
Geology and Hydrocarbon Potential of Neoproterozoic-Cambrian Basins in Asia

Edited by G. M. Blatt, J. Crisp, I. M. Thomas, R. Thaini and A. Coste



Geological Development of Anatolia and the Easternmost Mediterranean Region

Edited by A. H. F. Kuklmann, O. Pöhl and U. C. Ünalıoğlu



Remagnetization and Chemical Alteration of Sedimentary Rocks

Edited by R. D. Evans, A. R. Munsamy, M. M. Abdalla and M. Mora



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Register now!

The 'Brae Play', South Viking Graben; Jurassic coarse-grained clastic reservoirs, structural development and hydrocarbon systems

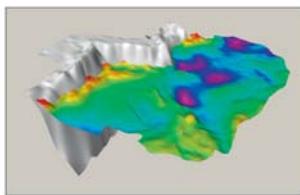
23rd-24th April, 2014

Aberdeen

This **2-day meeting** will bring together workers from industry and academia, from both the UK and Norway, resulting in a compilation of papers which will form a comprehensive account of the petroleum geology of the South Viking Graben. Themes will range from;

- mechanisms and geometries of deposition of conglomeratic, proximal submarine fan deposits and sand-rich basin floor fans
- sediment supply systems on the graben footwalls
- structural controls on deposition and the structural evolution of the graben
- development of the hydrocarbon systems within the graben

Although primarily focussed on the South Viking Graben, contributions on relevant processes or analogues from the North Sea or elsewhere will also be included. Hopefully the results may stimulate further exploration activity in this region and also provide analogues for the exploration and development of other rift systems.



Over 20 papers plus numerous posters will be presented from various industry and academic organisations.

In addition, a **Core Workshop** will be held on 22nd April 2014 and a **Field Trip** to the Helmsdale area, NE Scotland, to view Brae-like sequences for a limited number of participants on 25th-27th April 2014.

For further conference, core workshop or field trip enquiries contact the following

Colin Turner ccturner@marathonoil.com
+44 (0)1224 803880

Bryan Cronin bryan@deep-marine.com

For registration see:

www.braeplay.com

Twitter: @BraePlay

Petroleum Group Medal & Young Petroleum Geoscientist Award Nominations

Nominations for the Petroleum Group's annual awards are now open.

Petroleum Group Medal Award

The Petroleum Group Medal is a yearly award presented to individuals with a geoscience background who have made outstanding contributions to the petroleum industry. It can be awarded for excellence in petroleum geoscience and/or management of oil-finding activities. The winner will be presented with the medal at the Petroleum Group Annual Dinner on 26th of June 2014.

Young Petroleum Geoscientist Award

To recognise young talent, the future of our industry, the Petroleum Group will be awarding the medal at their 2014 Annual Dinner. Nominees should be under 35 and either have already made a significant contribution to the understanding of petroleum geoscience or be an emerging talent who is making a significant impact in the field. The winner will be presented with the medal at the Petroleum Group Annual Dinner on the 26th June 2014. Unsuccessful nominees will be mentioned in the Chair's speech at the Annual Dinner and will also be mentioned in the Petroleum Group E-Newsletter.

Submissions must be made by 31 March 2014

For further details please visit the Petroleum Group web pages:
www.geolsoc.org.uk/petroleum or contact Laura Griffiths by phone:
+44 (0)20 7432 0980, or email: laura.griffiths@geolsoc.org.uk



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www.geolsoc.org.uk/petroleum

Corporate Supporter:  

Call for Abstracts - 14 February 2014

Operations Geology Conference

"The Life-cycle of a well"

26-27 November, 2014

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Nick Pierpoint
BG Group - Chairman

Malcolm Brown
BG Group

Richard Smout
Eon - Secretary

Manoj Gaur
Cairn India

Gordon Holm
Tullow

Kirstin McBeath
BP North Sea

Joanna Kidd
BP North Sea

Pat Spicer
Dana Petroleum

Louise Young
BP Azerbaijan

CALL FOR ABSTRACTS

Following the highly successful Operations Geology Workshop held in Aberdeen in October 2012, the Petroleum Group of the Geological Society are pleased to announce the dates for the next event, which will be held over two days in 2014. This is also the first call for abstracts. Operations Geologists play key integrating roles at all stages of the life cycle of a well. This conference will look at the life cycle of a well and the contributions of Operations Geology at each stage. It is the intention of the convenors that both oral and poster presentations will eventually be prepared for release in a Special Publication of the Geological Society of London. To that end we invite contributions to the programme sufficiently early to make it possible for Authors to gain necessary permissions to present and publish what we trust will be cutting edge material.

- **Well Planning** - hazard identification (due to rocks, fabric, pressure, stress, geometry etc) and avoidance/mitigation, targeted data acquisition for all disciplines for life of field
- **Execution** - real-time techniques, managing the drilling window, the acquisition and use of Integrity test data, appropriate isolation of permeable zones in the overburden
- **After Action Review** - NPT analysis and the learning loop, continuous improvement
- **Emerging Technologies** - the next generation of needs and solutions - logging, formation and gas detection/analysis, real-time well bore stability analysis tools, PPG tools
- **Professional Competence** - the need to strengthen the available processes for training and the vetting of competence for OGs, particularly in safety critical areas

CALL FOR ORAL AND POSTER ABSTRACTS:

Abstracts of up to 300 words and up to three colour figures are requested.
Abstract Deadline 14 February 2014.

Abstracts should be submitted to Nick Pierpoint and Laura Griffiths.
For further information, please contact Laura Griffiths, Event Co-ordinator;
+44 (0)20 7432 0983 or E-mail : laura.griffiths@geolsoc.org.uk
Nick Pierpoint E-mail : Nicholas.Pierpoint@bg-group.com

At the forefront of petroleum geoscience
www.geolsoc.org.uk/petroleum

Corporate Supporter:  

Registration now open

Petroleum Geoscience of the West Africa Margin

31 March - 2 April, 2014

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Teresa Sabato Ceraldi
BP

Richard Hodgkinson
Dana Petroleum

Hannah Suttill
Genel Energy

Matt Warner
BP

Conference Sponsors:





Petroleum Exploration along the West African margin has a long history. Discovery of commercial oil in the Niger Delta in 1956 and offshore Angola in 1966 led to these two countries becoming the largest oil producers in the region today, accounting for 5% of global daily oil production. Even with this extensive history, however, new exploration plays continue to be found with imaginative ideas & innovative technology.

In the last decade, independent oil companies have aggressively pursued new concepts – from stratigraphic traps in Ghana to recent exploration success in Cameroon & Equatorial Guinea. Independents and Majors now compete head-to-head in the more “mature” areas such as Gabon & Angola, investing in new play concepts and exploring the pre-salt, prompted by successes on the conjugate Brazilian margin. To the south, Namibia is undergoing renewed exploration activity. In short - it's an exciting time to be exploring in West Africa.

This conference will showcase the regional geology, from Morocco to South Africa, sharing insights on recent exploration successes and emerging plays, & integrating inputs from academia, industry, and national oil companies.

Keynote Speakers:

Prof. Gerard Stampfli, University of Lausanne
Dr. Paul Dailly, Kosmos Energy
Dr. Mike Mayall, BP

For further information please visit www.geolsoc.org.uk/westafrica14 or contact:
Laura Griffiths, The Geological Society, Burlington House, Piccadilly, London W1 0BG.
T: 020 7434 9944 F: 020 7494 0579 E: laura.griffiths@geolsoc.org.uk

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The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T +44 (0)20 7434 9944
F +44 (0)20 7439 8975
E enquiries@geolsoc.org.uk
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The Geological Society Publishing House, Unit 7, Brassmill Enterprise Centre, Brassmill Lane, Bath BA1 3JN
T 01225 445046
F 01225 442836

Library

T +44 (0)20 7432 0999
F +44 (0)20 7439 3470
E library@geolsoc.org.uk

EDITOR-IN-CHIEF

Professor Peter Styles

EDITOR
Dr Ted Nield
[E ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk)

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 Alban Row, 27–31 Verulam Road, St Albans, Herts, AL3 4DG
T 01727 893 894
F 01727 893 895
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ADVERTISING EXECUTIVE
Jonathan Knight
T 01727 739 193
E jonathan@centuryonepublishing.ltd.uk

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Heena Gudka

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66 MOUNTAINS BEHIND NUUK, GREENLAND, CLOSE TO THE BOUNDARY OF THE GREENLAND ICE SHEET 99

Cover: Anders Peter Photography / Shutterstock.com

FROM THE EDITOR'S DESK:

Done proud

Back in 2006, when the five Courtyard Societies collectively fought the Government in the High Court of Chancery over their rights of occupancy at Burlington House, a debate opened up in *Geoscientist's* letters column over whether we should bother to keep our Mayfair palace at all. Wouldn't something functional, closer to the geographical heart of Britain be more appropriate 'in our modern age'?

This argument – dubbed the 'Arthur Scargill Gambit', in honour of the NUM leader who moved the Union's HQ away from London's fleshpots to wholesome oblivion in Barnsley – proved moot when the Trustees discovered that the cost of relocating anywhere would bankrupt us. So we fought on, and after mediation settled on an affordable rent. Years of planning blight were lifted and the Bicentenary refurbishments followed.

I harboured doubts of a different sort. As well as general neglect, I saw drawing pins being stuck in oak doorcases, maps fixed to oil paintings with Blu-tack, gnawed chicken bones dropped onto the Lower Library's grubby lino; and in my darker moments wondered whether these ragamuffins really deserved a building so evidently wasted on them.

But enhancing the environment really does improve people, and behaviour slowly improved. Yes, I did find chewing gum stuck to the backs

of the new seating on day one after the Lecture Theatre's first major (1999) refurb, but later, the Lower Library's new carpet imposed its gentle discipline on the bone-chuckers. Visitors realised that Burlington House was not to be treated as though it were some 1960s lavatory of learning.

Organisations wishing to be taken seriously in the wider world have to behave properly. This is a serious point. Maintaining the interiors of a Grade II* listed building, *to an appropriate standard* is an unequivocal stipulation of our lease. Yes, it's expensive; but over and above our need to generate income as a conference venue, it is worth it solely for the inestimable status-boost we get from occupying a nationally important home, on the 'world's most famous street'.

With the refitting of the Council Room (see review, p. 24) Phase Four of the refurbishments is finally complete. It is a tribute to the Trustees – and above all the Executive Secretary, who has brought continuity and personal commitment to this long-term project – that the Society has been prepared to budget for, and spend, the sums made available by our improved finances on maintaining the national heritage – despite other demands that might, superficially, seem closer to home.

Not so. Outsiders may finally conclude that geologists are not the oiks they might once have taken us for.

DR TED NIELD, EDITOR – ted.nield@geolsoc.org.uk

SOCIETY NEWS

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



Fellowship renewals, Council elections

Every year at this time we remind Fellows to renew or face being struck off – with the subsequent inconvenience of having to re-apply, writes **Edmund Nickless**.

For the Society, late payment results each year in additional costs and administration. In this economic climate we ensure that optimum use is made of Society resources and we rely on the support of Fellows to achieve this. Time is running out for you to renew your Fellowship. To ensure that you continue to support and belong to your professional body, please renew today, preferably online via the web site; or you

can call Burlington House and ask for the Fellowship Department.

Vote! Vote! Vote!

May I also encourage you to cast your votes for Council (see p.09). The total number of Fellows voting in 2013 was 1092, from an electorate of around 10,500. Candidates running for Council have committed to give considerable their time to serve the Society if elected – so please, give a very little of your time to vote. Unless there is a reasonable turnout, it will be difficult to encourage people to stand in future.

COUNCIL MEETINGS AND OGMS

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

◆ **2014:** 2 April (Council),

9 April (OGM),

18 June,

25 September,

26 November;

◆ **2015:**

4 February,

8 April.



Society Awards 2014

The Society is delighted to announce the names of the winners of its medals and funds and offers all its heartiest congratulations.

Maureen **Raymo**, Wollaston Medal; Martin **Brasier**, Lyell Medal; Julian **Pearce**, Murchison Medal; Peter **Styles**, William Smith Medal; Jane **Francis**, Coke Medal; Christine **Peirce**, Coke Medal; John **MacLennan**, Bigsby Medal; Max **Coleman**, Prestwich Medal; Edward **Rose**, Sue Tyler Friedman Medal;

Robert **Chandler**, R H Worth Prize; Craig **Barrie**, Wollaston Fund; Claire **Corkhill**, William Smith Fund; Paul **Butler**, Lyell Fund; Katherine **Joy**, Murchison Fund; Maggie **Williams**, Distinguished Service Award; Michael **Babechuk**, President's Award; Hannah **Hughes**, President's Award; Oliver **Shorttle**, President's Award.

► The Awards will be presented at President's Day on **4 June 2014**



In image: Klar / Shutterstock.com

LONDON LECTURE SERIES



Nuclear waste

Speaker: Rebecca Lunn

(University of Strathclyde)

Date: 19 March

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/gslondonlectures14.

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.

Earth Science Week 2014

Following the success of 2013's Earth Science Week, the Society is keen to reach an even wider audience this year, writes **Sarah Day**.

UK Earth Science Week 2014 will take place on October 13-19, with a theme of 'Our Geo-Heritage.'

We are hoping that events during Earth Science Week will help to promote the UK's geological heritage sites, from famous landmarks like Giant's Causeway, to less well-known areas of geological significance - so do get in touch with ideas if you would like to take part.

As ever, we want to promote guided and self-guided geology walks, in towns and cities as well as the countryside, so please contact us if you are able to plan one during the week, and we will make sure it gets publicised.



► Earth Science Week's homepage www.geolsoc.org.uk/earthscienceweek will be continually updated through the year. Please email ESWUK@geolsoc.org.uk to propose an idea, or find out about getting involved.

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

FELLOWSHIP ELECTION

The following are put forward for election to fellowship at the OGM
2 April 2014:

ABDULLAYEV Elshan; ADAMSON Peter William; AGUILERA Roberto Carlos; AGUSTDOTTIR Thorbjorg; ALEVIZOS Georgios; ANDERSON Ryan; ANKETELL-JONES Samuel; ARCHER Michael; ARMSTRONG Alan; ARMSTRONG James; ASEKAUNO Oshioke S; ASKEW Rob; AU Wai Lun Warren; BAAH Kwaku; BABECHUK Michael Gordon; BAIN Katharine Georgina; BAKER Sarah; BALLARD Matthew; BARIBAULT Mathieu; BARNES Ryan David; BARRINGTON Charlotte; BASS Sarah Anne; BATES Neil; BEGG Joseph; BELLENGER Celine; BENGHAT Philip; BLACKLEY Simon Geoffrey; BLAND Lynsey; BOHLIN Madeleine Sassaya; BONNEY Roslyn; BOOTH Adam; BRADBURY Harold John; BREISLIN Catherine; BRITLAND David; BRONSTON Mark; BROWN Rowan Katie; BUCK Jake; BURTON Tina Elizabeth; CALLIOLI SANTI Andrea; CAMPLIN David; CANNEAUX Daniel; CARLILE Kenneth; CARLISLE Charlie; CHAN Jennifer Pui Ching; CHAPLIN Greg; CHEBBIHI Lynda; CHENDORAIN Michael; CHENG Ho Ming Edward; CLARKE Adam; CLARKE Amy Louise; CLEMSON Jon; COHU Laura; COLEBROOK Steven Gordon; COOKE Martin; COOMBES Henry; COWAN Robbie; COWTON Laurence; CURTIS Alexandra Lucy Adams; CUTTS Alexander; DA MATTA Rodrigo Antonio Melisan Amanci; DARLING Jamie; DAVID Martin; DAVIDSON Craig; DI CUIA Raffaele; DICKESEN Zachary; DIEU Nicolas; DIGNES Thomas William; DIXON Richard; DOLBY Matthew Robert; DOLSON John; DOMZIG Anne; DOUGLAS Chad; DONNIS George; DUFFY Louise Marie; ELDER Douglas; ELYV James; EMCI Mehmet Burak; ENDEBROCK Larry; FERRY John Martin; FINDLAY Dawn; FITZGERALD Ross; FITZROY Charles; FOLDER Matthew; FORD Christopher James; FOWLER Mark; FRANCE Emily Rose; FREESE Rachel; FUNG Yun Ting; GAMBLE Richard; GIFFORD Owen; GILDER Charlotte; GOMERSALL Patrick; GOODING Scott; GOUGH Peter Charles; GOZZARD Simon; GRACE John; GREED Catherine; GREEN Matthew Richard; GREEN Robert George; GREENFIELD Timothy Stephen; GREENWAY Simon Andrew; GREW Tony; GRIFFITH Lucy; GRIFFITHS Matthew; GRIMSHAW Matthew; GROSVENOR Daniel; GU Chunxiao; GUPTA Saibal; HADOUTU Suhail; HANDS Philip John; HARPER Matthew; HARRIS Emily; HARRISON Mark; HAYES Paul; HAYMAN Guy Andrew; HAYNES Ronald; HAZEL Alexander James; HEATHERINGTON Elliott; HEFFERNAN Christopher; HEPWORTH Luke; HILLS Nicholas; HO King Lam Taylor; HOCKER Christian; HODSON Paul; HOGGARD Mark James; HOLMES Kevin Bryan; HOUGHTON Matthew; HOWARD Trevor; HOWELL Andrew Roy; HUGHES Joshua; HUMPREYS-WILLIAMS Emma; HUNT Ryan; HUTSON Rachael; ILOAN Nnaemeke; IND Jonathan; INGLE David John; JACKSON John; JAMES Trystan; JANKOWSKI Robert Edward; JEACOCK Tim; JENKINS Jennifer; JENKINS Marcus; JOHNSON Olivia; JOLLEY Elizabeth Jane; JONES Ben; JONES Daniel; JONES Emily; JONES Richard; KAI Wing Wai Emily; KATHRINEER Luzia; KEHINDE Michael Olatunde; KENCHINGTON Charlotte Guenvere; KHAIRA Harrimder; KIBBEY TAYLOR Brian; KING Niall Thomas; KIRBY Matthew Edward; KLATT Stephanie; KLIMENTIDIS Robert; KLOCKING Martha Sophie; KORAI Despoina; KUUSANNIEMI-ABBOTS Henrik; LAGESSE Richard; LANCASTER Verone; LARTER Stephen Richard; LAU Chi-Hing; LAU Wesley; LAVERY Rachael; LAVIS Shaun; LAWTON Gareth; LAWTON Laura; LEPPARD Christopher William; LEVICK Thomas; LEWIS Daniel Mostyn; LEWIS Edward; LEWIS Sirrocco; Li Yuting; LINCOLN Paul; LLOYD Max; LODGE Mark David; LONGSTAFF Sarah Louise; LORD Andrew; LOWE Edward Thomas; LUKEK Richard; LYNCH Peter; LYTHGOE Karen Helen; MA Noah; MADER KAYSER Nadine Katja; MAILEY Emma; MANI Lara Lucy Jane; MANNING David; MARKS Fiona Dawn; MARSHALL Peter; MASON Ben; MASON Frances; McDONAGH Tom; MCELHINNEY Will; MCGILL Sean; MCLEAN Simon; MEDICI Giacomo; MESSENGER Jeffrey Charles; MICHE Emma; MILES Thomas; MILLER Robert; MILLER William; MINTON Paul Ralph; MOHR Peter; MORGAN Adam; MORRISON Alister; MORRISON Cassius Isa; MORTON George Leo; MUDE Omorere; MUÑOZ Josep Anton; NAMSRAI Munkhileg; NEWBERRY Richard; NORMAN Kate; O'DONOVAN John; O'LEARY John; O'REILLY Nick; OAK Justyna Paula; OSTCLIFFE Martyn; OWEN Fred; OWEN Matthew; OWENS Eleanor Ruth; PACK Stephen; PARSONS Barry Eaton; PARSONS Emily; PATEL Sameer; PATTINSON Zoe Jade; PEASE Andrew; PERRY Helen; PIEDADE Aldina; PIZZI Ulisse; POLLOCK Andrew;

Climate Change Statement – policy update

The Geological Society has published an addendum to *Climate Change: Evidence from the Geological Record* (November 2010) taking account of new research writes Nic Bilham.

The reconvened working group and Council concluded that the 2010 Statement remained valid, and did not need amending. The addendum sets out new research relevant to the questions addressed in the original statement.

Below follows the non-technical summary of key points from the addendum. The full technical version with references may be read online. It is intended to be read alongside the original 2010 Statement, and follows the same Q&A format.

Summary

"Since our original 2010 statement, new climate data from the geological record have arisen which strengthen the statement's original conclusion that CO₂ is a major modifier of the climate system, and that human activities are responsible for recent warming.

"Palaeoclimate records are now being used widely to test the validity of computer climate models used to predict climate change. Palaeoclimate models can simulate the large-scale gradients of past change, but tend not to accurately reproduce fine-scale spatial patterns. They also have a tendency to underestimate the magnitude of past changes. Nevertheless they are proving to be increasingly useful tools to aid thinking about the nature and extent of past change, by providing a global picture where palaeoclimate data are geographically limited.

"Geologists have recently contributed to improved estimates of climate sensitivity (defined as the increase in global mean temperature resulting from a doubling in atmospheric CO₂ levels). Studies of the Last Glacial Maximum (about 20,000 years ago) suggest that the climate sensitivity, based on rapidly acting factors like snow melt, ice melt and the behaviour of clouds and water vapour, lies in the range 1.5°C to 6.4°C. Recent research has given rise to the concept of 'Earth System sensitivity', which also takes account of slow acting factors like the decay of large ice sheets and the operation of the full carbon cycle, to estimate the full sensitivity of the Earth System to a doubling of CO₂. It is estimated that this could be double the climate sensitivity.

"When viewed in the context of geological time, today's conditions are atypical. We are living through an interglacial period, whose mean temperature is representative of only 10% of the last 800,000 years. The other 90% of that time, temperatures were lower, ice sheets larger and sea levels lower. This highlights how unusual



Image: iStockphoto.com

current temperatures, and estimated future warming, are.

"Before the current warming trend began, temperatures in the Holocene (the last 11,000 years) were declining. This was due largely to insolation – the solar radiation received by the Earth's surface – and dictated by the Earth's orbit and the tilt of the Earth's axis. Insolation declined throughout the Holocene. This cooling took Earth's climate into a Neoglacial period, culminating in the 'Little Ice Age' (1450 – 1850).

"Astronomical calculations indicate that this period of low insolation and associated cool conditions should continue for about another 1000 years. Nevertheless, after 1900 the overall decline in temperature sharply reversed. According to one recent study, it is likely that the area-weighted global average temperature for the 30 year period from 1970 to 2000 was higher than at any time in nearly 1400 years. Tree ring data confirm that recent warming is unprecedented in central Europe over the past 2500 years, and in eastern Europe over the past 1000 years. Palaeoclimate records from the Arctic show that the warmest 50-year interval of the past 2000 years occurred between 1950 and 2000 AD.

"Atmospheric CO₂ is currently just below 400 parts per million (ppm) on average. It last reached similar levels during the Pliocene (5.3-2.6 million years ago). At that time, temperatures rose to levels 2-3°C warmer than today, and sea level rose by up to 20m in places. Sea level takes a few hundred years to reach equilibrium in response to changes in atmospheric CO₂ and temperature, which may explain why sea level has not yet risen to the same levels seen in the Pliocene.

"Atmospheric CO₂ is increasing at around 2ppm per year (1995-2010 average). If this rate continues, it may reach 600ppm by the end of this century – a value that appears not ►

SOCIETY NEWS...

► to have been typical for at least 24 million years.

"Our 2010 statement suggested that the rise in Antarctic temperature at the end of the Last Glacial Maximum (approximately 20,000 years ago) began a few centuries before CO₂ showed any reaction. New data now indicate that CO₂ rose at the same time as Antarctic temperature, and ahead of the global rise in temperature. This strengthens the argument that rises in CO₂ levels triggered by regional factors were instrumental in triggering global temperature increases, with positive climate feedbacks magnifying this effect."

"There is now greater confidence that a relatively modest rise in atmospheric CO₂ levels and temperatures results in significant (though not globally uniform) sea level rise. Increased CO₂ in the atmosphere also increases CO₂ levels in the oceans, making sea water slightly more acidic and less oxygenated. In past warming events, such as at

the Paleocene-Eocene Thermal Maximum (PETM) 55 million years ago, this caused marine crises and extinctions. The Earth System usually takes around 100,000 years to recover from such events.

"Given the above, based on a growing abundance of palaeoclimate data, there is now greater confidence than in 2010 that the only plausible explanation for the rate and extent of temperature increase since 1900 is the exponential rise in CO₂ and other greenhouse gases in the atmosphere since the Industrial Revolution. This rate of increase of CO₂ is unprecedented, even in comparison with the massive injection of carbon into the atmosphere 55 million years ago that led to the major PETM warming event, and is likely to lead to a similar rise in both temperature and sea level."

► Read the full Addendum at www.geolsoc.org.uk/climatechange



CHARTERSHIP NEWS

Chartership Officer Bill Gaskarth reports on a projected new logo for use by CGeols, advice on applications and company training schemes.

The Professional and Chartership Committees are to produce a 'kitemark' for use by Chartered Geologists on their reports, letters and other communications, to indicate that they are written by a Chartered Geologist in good standing. The logo will identify the author by Chartership number.

SI applications

Geologists working in the SI industry have hitherto received no guidance with regard to demonstrating their competencies, particularly against Chartership criteria i and ii. David Norbury has now prepared one, which can be found on the website (go to 'Apply for CGeo' and scroll down).

A number of Scrutineers have expressed concern about many of the items submitted as Supporting Documents. Many appear not to be focused on specific criteria, nor to indicate clearly the relevant parts of these documents, causing scrutineers unnecessary work. A guidance note on this will appear on the website shortly (again, under 'Apply for CGeo'). All Sponsors should look at this guidance and advise their candidates accordingly if, when they read the Application, they find deficiencies.

Company Training Schemes

The Professional Committee has accredited three new Training Schemes - RPS Energy, CH2MHill and URS, bringing the total number of accredited schemes to eight. RPS Energy's course is the first to be received from the Hydrocarbons sector. The others mainly cover training of Engineering and Environmental Geologists. Other companies have expressed intent to apply, including AECOM, Fugro and BG Group.

► For further information go online www.geolsoc.org.uk or email chartership@geolsoc.org.uk

Geological Society Club

The Geological Society Club, successor to the body that gave birth to the Society in 1807, meets monthly (except over the field season!) at 18.30 for 19.00 in the Athenaeum Club, Pall Mall, or at another venue, to be confirmed nearer the date. Once a year there is also a buffet dinner at Burlington House.

New diners are always welcome, especially from among younger Fellows. Dinner costs £55 for a four-course meal, including coffee and

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

◆ **2014:** 5 March (Ath); 2 April; 14 May; 24 September; 15 October.

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

FELLOWSHIP ELECTION

Continued from previous page:

POPE-CARTER Finnegan; **POWELL** William; **PRICE** Rebecca; **PRIOR** Jennifer; **PRYOR** Robert; **PUGH** David James; **PUTIRKA** Keith; **PYLNOV** Sergiy; **RABAYROL** Fabien; **RACEY** Andrew; **RAITHATHA** Bansri Gitesh; **RAJI** Munira; **RANKEN** Christian Judith Elizabeth; **REDFEARN** Stuart Norman; **REECE** Lewis; **RHODES** Christopher; **RITZMANN** Nicklas; **ROBERTS** Jenny; **ROBERTS** Mark; **ROBERTSON** Donald Allan Thomas; **RODRIGUEZ TRIBALDOS** Veronica; **ROSE**

Michael John; **RUDD** Michael; **RYAN** Francesca Antonia Gabriele; **RYAN** John; **SADLER** Matthew; **SALEM** Lois Claire; **SALTER** Timothy Mark; **SANDBACH** Harry; **SARGENT** Sabine Wilhelmine; **SAVAGE** Bethany; **SCHOONMAN** Charlotte Maria; **SEITKAN** Ainur; **SENIOR** Mark; **SHAW** Charlotte; **SHAW-SMITH** Edmund John; **SHELTON** Robert George; **SIEMERS** Frederick William; **SIKDR** Elena; **SIMISTER** Nick; **SIMMONDS** Vartan; **SKIGGS** Keith; **SLOAN** Mark Livingstone; **SMETHURST** Nicholas; **SMITH** Joanne; **SMITH** Robert Paul; **SPENCE-JONES** Carl; **SPENCER** Scott

Nathaniel; **SPILSBURY** Richard; **STELTER** Sebastian; **STEPHENSON** Charlotte April; **STEWART** Matthew; **STONE** Ralph Arthur; **STONE** Thomas; **TALLETT-WILLIAMS** Sarah; **TAYLOR** Benjamin; **TAYLOR** John; **THOMAS** Deborah Leigh; **THOMAS** Neil; **THOMPSON** Mark; **THOMPSON** Matthew John; **THOMPSON** Maxwell; **TORR** Stephen Dominic Edward; **TSAMAKI** Maria; **TSIKRAS** Leandros; **TSITSANIS** Pavlos; **TSO** Mandy Tsz Ying; **TURLEY** Aled John; **UMOREN** Nyaknno Anthony; **URIEN** Miren Edurne; **VAN DER WAL** Jorien; **VICKERS** Madeleine; **WALKER** Faye; **WALKER** Ricki; **WALKER** Stephanie;

WALKER-VERKUIL Kyle; **WALSH** Tanya Klaaszien; **WALVIN** Rachel; **WARD** Kelsey; **WARDMAN** John Blackburn; **WESTOBY** Laura; **WESTON** James; **WIGGAN** Nickolas James; **WILD** Thomas; **WILKINS** Timothy Conor; **WILKINSON** Darren; **WILLEMSE** Willem; **WILLIAMS** Thomas John; **WILSON** Beth; **WOJTUN** Ewelina; **WONG** Hoi Kistine; **WOODIER** James Peter; **WRIGHT** Kirstie; **YARR** Katherine; **YATES** Andrew; **YATES** Meryl; **YEOMANS** Chris; **YU** Long; **YUNG** Mo Choi; **YUSIFOV** Mehdi; **ZAPICO** Pablo; **ZHANG** Jing; **ZHAO** Pu; **ZIABEK** Rachel; **ZUEHLKE** Rainer.

Elections to Council 2014-2015

Image: Andrey Burmakin / Shutterstock.com



The time has come for you to do your bit, read through the candidates' statements and vote – online!

The October issue of *Geoscientist* invited Fellows to nominate new members of Council. Eight nominations have been received for the five vacancies on Council. The results of this preliminary ballot will determine the list for the formal vote at the Annual General Meeting to be held on 4 June 2014.

Jonathan Turner (*Secretary, Publications*) is retiring from Council and Colin North, if elected, has agreed to serve in his place. Recognising the importance of this role and the time commitment that it

requires, Council endorses* his candidature.

Tricia Henton, *Secretary, Professional Matters*, is retiring from Council. Council proposes that Natalyn Ala, a current member of Council, should succeed Tricia in that role.

Council proposes that Alan Lord, *Secretary, Foreign & External Matters*, remain on Council for a further year, to smooth the rotation of Officers.

Below are the supporting statements of the candidates standing for election, together with a table showing the expertise of the present Council (biographies of continuing members of Council are at www.geolsoc.org.uk/biographies).

VOTING ONLINE

Fellows are strongly encouraged to vote online, by logging on to the Fellows-only part of the website www.geolsoc.org.uk/vote14. Please follow the instructions.

POSTAL VOTING

Enclosed with this *Geoscientist* are a ballot paper and an envelope for its return by those unable to vote online. Fellows should make their mark against the names of up to five candidates. Papers with marks against more than five names will be invalid.

The ballot paper should be placed in the envelope provided, which should be sealed and returned to reach the Society not later than 31 March 2014. Unless we are able to determine your eligibility to vote the envelope will not be opened and your vote will be invalid. Consequently, you are asked to include your full name on the back of the envelope. No other communication of any kind should be included.

NOTE: Fellows may only vote once, either online or by postal ballot.

SUPPORTING STATEMENTS FOR COUNCIL NOMINEES

► Nigel Cassidy



I am currently Reader in Applied Geophysics at Keele University, having completed a BSc in Geophysics in 1997 (University of Liverpool) and

a PhD in Geophysics at Keele (2001). Originally an industrial electrical engineer, I have been a Fellow of the Geological Society for over 10 years, a Royal Society Industrial Fellow, Chair of the Near-Surface Geophysics Group (NSGG) (2003–07) and currently sit on the Society's Degree Accreditation Panel. As a practical geophysicist, I have always had a passion for the technical and field-related aspects of the subject and have been involved in undergraduate, postgraduate and professional training for most of my career.

To me, nurturing newly-qualified geoscientists and developing their careers are important aspects of the Society's role, particularly as a highly respected international organisation. With my cross-disciplinary experience (industrial and academic), background in education/training and broad-based understanding of the geosciences sector, I feel that I can significantly contribute to the Society's professional development strategy and knowledge exchange activities. By being elected to Council, I aim to play an active role in the formulation, defence and

COUNCIL MEMBERS

	Present Council (2013-2014)	Nominees for new Council (2014-2015)
PRESIDENT	Mr David Shilston	Professor David Manning
VICE PRESIDENTS	Dr Mike Armitage Mr David Cragg Mr David Jones	Dr Mike Armitage Mr David Cragg Mr David Jones
SECRETARIES	Professor Al Fraser (Science) Mrs Tricia Henton (Professional) Professor Alan Lord (Foreign & External Affairs) Dr Jonathan Turner (Publications)	Mrs Natalyn Ala (Professional) Professor Al Fraser (Science) Professor Alan Lord (Foreign & External Affairs) Dr Colin North* (Publications)
TREASURER	Dr Adam Law	Dr Adam Law
OTHER MEMBERS OF COUNCIL	Mrs Natalyn Ala Professor Rob Butler Professor Neil Chapman Dr Angela Coe Mr Jim Coppard Mrs Jane Dotridge Mr Chris Eccles Dr Maria Edmonds Professor Richard Lisle Professor David Manning Dr Brian Marker Dr Gary Nichols Dr Lucy Slater Mr Michael Young	Professor Neil Chapman Dr Angela Coe Mr Jim Coppard Mrs Jane Dotridge Mr Chris Eccles Dr Maria Edmonds Dr Brian Marker Dr Gary Nichols Dr Lucy Slater Mr Michael Young
	Retiring members of Council Professor Rob Butler Mrs Tricia Henton Professor Richard Lisle Mr David Shilston Dr Jonathan Turner	Nominations for Council Dr Nigel Cassidy Dr Anthony Cohen Mr James Dodds Mr Graham Goffey Mr David Hopkins Professor David Norbury Dr Colin North* Mr Keith Seymour

► delivery of these practices and hope to facilitate greater CPD-related collaboration across all areas of the geosciences community.

Proposer: **Peter Styles**

Supporters: **Sheila Peacock, Jamie Pringle**

► Anthony Cohen



Humankind depends increasingly on the Earth Sciences for the responsible delivery of crucial resources – energy, minerals, water – and

for an understanding of how the Earth System will respond to the demands of an ever growing population. I have been captivated by the Earth Sciences ever since my schooldays, when an enthusiastic teacher introduced me to the rocks and fossils of Derbyshire and the Lake District. I gained my first degree and a PhD in Geochemistry from Cambridge University, and an MSc from Leeds. I have worked as an Earth Scientist for over 30 years in academia (Cambridge and The Open University) and industry (Johnson Matthey).

Currently a Senior Lecturer at The Open University, I recently served as Head of Earth Sciences. I have contributed to many GS activities - as a JGS subject editor, as convener of two conferences, giving two

public lectures at Burlington House, and serving on the committee producing the Society's statement on Climate Change – and have been a Fellow for five years. If elected to Council, I would enthusiastically promote the Earth sciences and the unique contributions that Society geologists, both in industry and academia, can jointly make in dealing with the 21st Century's key challenges.

Proposer: **Alexander Finlay**

Supporters: **Hugh Jenkyns, Peter Sheldon**

► James Dodds



I started my career in 1988 as a hydrogeological consultant and continue in this role, owning and managing my own company.

I joined the Institution of Geologists in 1988 and the Society in 1992, gaining Chartership in the same year. I helped create the Southern Wales Regional Group and served as Secretary for a period of years. Since that time I have supported the Hydrogeological Group and been a member of the Chartership Committee and the Panel of Scrutineers.

I have played an active role within the Society for many years and through my career have developed a strong interest in the communication of geology, and hydrogeology

in particular. This extends from my own consultancy, to outreach with my children's primary school (including collaboration with the University of Leicester). Through this experience, involvement and interest I would look to help with the development and extension of the Society's outreach program and link this through the Regional and Specialist groups as well as Chartership and CPD. Getting the geological and hydrogeological message out to the general population is critical in giving people a better appreciation of the world in which we live, and how that may change in the future.

Proposer: **Paul Maliphant**

Supporters: **Stephen Bennett, Bill Gaskarth**

► Graham Goffey



Having spent 27 years in the petroleum industry in geosciences and exploration management roles, I am currently MD North Sea & West Africa/Senior

VP Exploration for PA Resources in London. My qualifications are BSc Geological Sciences (Birmingham), MSc Petroleum Geology (Imperial College) and MBA (Warwick).

I have been a Society Fellow for most of my career. From 2004 – 2010 I served on the committee of the Petroleum Group, including three years as Chair. During this period I convened many Petroleum Group workshops and conferences. I led the NW Europe section of the PGC VII conference in 2009, and co-edited GS Special Publications 254 (The Deliberate Search for the Stratigraphic Trap) and 348 (Hydrocarbons in Contrritional Belts).

Its history, reputation and scientific *modus operandi* are the Society's strength, the basis of its authority and of the respect which it commands. Through leading one of its most active Specialist Groups I have an insight into how the Society can play an important role in both the advancement of our science and in guiding policy makers and society on matters of public concern. If elected to Council, I would be keen to play a role in progressing the Society's mandate in these key areas.

Proposer: **Malcolm Brown**

Supporters: **Jonathan Craig, Mike Bowman**

BACKGROUND OF CONTINUING MEMBERS OF COUNCIL

Name	Expertise	Sector
Natalyn Ala	Expertise	Sector
Mike Armitage	Hydrogeology	Industry
Neil Chapman	Mining	Industry
Angela Coe	Radioactive Waste Management	Industry
Jim Coppard	Sedimentology & Stratigraphy	Academie
David Cragg	Mineral Exploration	Industry
Jane Dottridge	Engineering Geology	Industry
Chris Eccles	Hydrogeology	Industry
Marie Edmonds	Engineering Geology	Industry
Al Fraser	Igneous Petrology, Volcanology, Geochemistry	Academie
David Jones	Petroleum Geology	Academie/Industry
Adam Law	Hydrogeology	Government
Alan Lord	Petroleum Geology	Industry
David Manning	Micropalaeontology	Museum
Brian Marker	Mineralogy	Academie
Gary Nichols	Environmental Geology	Retired
Lucy Slater	Sedimentology	Academie
Michael Young	Petroleum Geology/Geophysics	Industry
	Geophysics	Government/Industry

► David Hopkins



I have been a Fellow of the Society since 1979 and a Chartered Geologist since 1990. I was a Council member for six years (1987-93) with the Institution of

Geologists and subsequently the Geological Society. I served on several Society committees and was Chairman of the Regional Groups Committee during the 1980s. Employed in the quarrying industry for 34 years before my retirement from full-time employment in 2012, I was Director of Geological Services for Aggregate Industries with responsibility for geological teams in both the UK and USA. We developed strong links with Leicester University Geology Department at both a professional level and with ongoing student training.

I have been a strong advocate of the importance of the Society to our profession since graduation and was a Council member at the important time of the formation of our Chartered Geologist status in the late 1980s. Personal family reasons have meant that I have been unable to commit seriously to the Society in recent years but with retirement I feel that I can now give the time necessary for such a commitment. If elected, I feel that I can add valuable and extensive industry experience to Council membership.

Proposer: **Bill Gaskarth**

Supporters: **Edward Bailey, Rick Brassington**

► David Norbury



In my nearly 40 years' experience as an engineering geologist I have led industry in deployment of systematic soil and rock description

and professional practice. I have also served for 30 years on committees of the Society, including 10 years representing the profession in Europe. I now want to bring this combined experience to bear in helping to

strengthen the national and international position of the Society as a learned and professional body.

I am currently Director of David Norbury Limited after working for Soil Mechanics for over 30 years. I am Professor of Engineering Geology at Sussex University reflecting my teaching duties there and at other universities.

I have been a Fellow of the Society since graduation in 1974. I have served on Council (1993-96) and Professional and Fellowship Committees (1993-03 including as Chair of the latter). I was Secretary General of the European Federation of Geologists and then Chair of the Registration Authority (2002-13). I am the GSL nominee on the British Standards committee looking after site investigation and testing. I am a member of the Engineering Group and served on the committee from 1985-92, including as Treasurer.

I am Chartered as a Geologist, Civil Engineer and Scientist and a European Geologist and Engineer.

Proposer: **Martin Culshaw**

Supporters: **Ivan Hodgson, David Giles**

► Colin North*



Through its publications, the Geological Society has long led the world in communicating, and thus stimulating, the science of Geology. The world of publishing is changing rapidly, driven by innovative technology and new ways of sharing and evaluating our science, meaning we must not become complacent. Change needs to be assessed carefully yet embraced positively; the message remains more important than the delivery mechanism.

As a Fellow of the Society for 33 years, Chartered for 20, working in the petroleum industry with BP and in university teaching and research, currently at University of Aberdeen, I have admired the successful way this activity has been managed sustainably thus far. If I were the Publications Secretary, I would be able to help our Society navigate the new challenges by applying my wide-ranging publishing knowledge and experience



built up with other international organisations. This includes: Chair of the GeoScienceWorld electronic publishing aggregate board of directors; Journal of Sedimentary Research editor and SEPM Council member; AAPG publications

committee Chair and Elected Editor candidate; book editor; and article author and reviewer. Above all is the need to protect the high standard of our Society's science while fostering collaboration: quantity should never trump quality.

Proposer: **John Underhill**

Supporters: **Jonathan Redfern, Stuart Archer**

* Council-endorsed candidate

► Keith Seymour



Having started out as an engineering geologist before moving into hydrogeology, I currently work in a national technical leadership

role in the Environment Agency, supporting and developing geoscience colleagues to manage and protect our groundwater resources. Throughout my 37-year career, starting in the old 'Water Authority' days, it has been the application of my geological and geoscience skills to understanding and solving environmental issues that has been so rewarding.

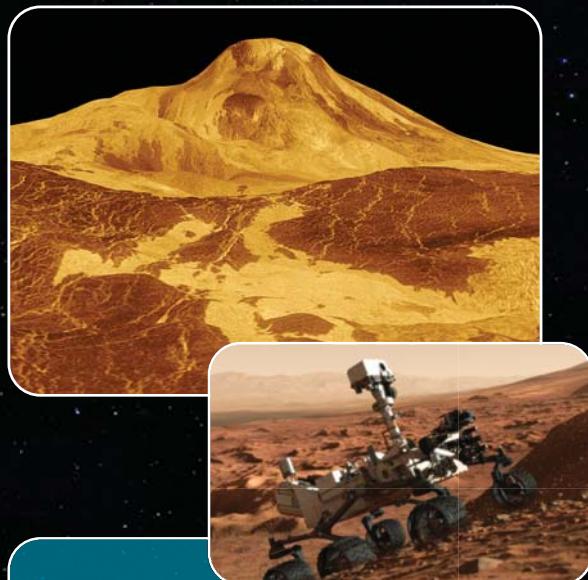
Underpinning this has been being recognised as a professional geoscientist. I have been a Fellow of the Society since graduating from Newcastle University in 1976 with a degree in Applied (Engineering) Geology. I was a member of the former Institution of Geologists and sat on the Committee of the North West Regional Group for a number of years. I was proud to become a Chartered Geologist back in 1990.

So why do I want to sit on Council? What could I contribute? It would be a great opportunity to 'give something back' to the institution and profession I have been a proud member of all this time. My particular interest is in promoting chartership and professionalism among our practising geoscience community.

Proposer: **Matt Whitehead**

Supporters: **Anthony Peacock, Rick Brassington**

Fermor Meeting 2014: *Comparative Planetology*



19-20 May 2014

The Geological Society, Burlington House

A great deal of new data on the terrestrial planets and moons has been produced recently from numerous planetary orbiters, together with rovers. This meeting is planned to bring together scientists who are studying aspects of planetary science on terrestrial planets in the inner solar system. Presentations will fall under three broad themes: Planetary crusts and interiors, planetary surfaces and surface processes (including volcanism, tectonic activity, sedimentation, and impact cratering), and planetary climates and atmospheres. Links between the three themes will be investigated, to develop ideas of exchange between the interior, exterior and atmosphere of planetary-scale bodies.

Topics for discussion:

- Internal structures
- Volcanism
- Sedimentation
- Cratering
- Samples
- Rovers
- Tectonics
- Analogues
- Remote sensing

Conveners:

Professor Hilary Downes FGS

Professor Ian Crawford FRAS

Dr Peter Grindrod FGS, FRAS

Speakers include:

Dr Ellen Stofan (NASA Chief Scientist) *Venus-Earth-Mars-Titan: Comparing Surfaces, Comparing Climates*

Dr David Catling (University of Washington, Seattle USA)
Atmospheric evolution on Rocky Planets

Dr Mary Bourke (Trinity College Dublin, Ireland)
Blows and flows on Martian dunes

Professor Sanjeev Gupta (Imperial, London, UK)
Recent explorations of the Curiosity rover

Dr Nick Tosca (St Andrews, UK)
Alien surfaces: interpreting the mineralogical record of early Earth and Mars

Dr David W Mittlefehldt (JSC Houston)
Dawn at Vesta

Further information:

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

T: 0207 434 9944
E: naomi.newbold@geolsoc.org.uk
W: www.geolsoc.org.uk/fermor14

Follow this event on Twitter #fermor14



Geology – poor relation?



Ben Topley* wishes university Earth science departments would shed their outdated obsession with maths, physics and chemistry and show a little more support for Geology A-Level...



The idea, put forward by Gordon Neighbour in a *Soapbox* piece in last year's March issue (*Geoscientist* 23.02), that the Geological Society should have greater input into A-Level and GCSE geology courses, is a good one. However I believe the geological community's overall aim should also be to improve the subject's value as a science. In this, the community is currently doing itself no favours.

Soft option

I am a student doing Geology A-Level, with the intention of studying the subject at university (my subjects are Biology, Geography, Geology and Chemistry). Yet I find many university departments of Earth science do not seem to regard A-Level Geology as a useful requirement at all. For example, departments in Russell Group universities tend to ask for one or two science subjects from a list including biology, chemistry, physics and maths. Subjects such as geography, geology and environmental science seem to be sneered at as 'soft options'.

Why do we voluntarily insult our own subject in this way? I believe the current Geology A-Level (from the Welsh Joint Education Committee (WJEC)) can hold its own, any day, with a chemistry or physics A-Level, which in fact cover very little if any maths, or confine themselves to basics. The idea - or prejudice - that students *must* do chemistry, physics and maths at all costs in order to be deemed worthy of studying geology in Higher Education is a piece of inverse academic snobbery that is frankly no longer tenable. The status of geology as a subject would be greatly enhanced,

were geology included among its own *prime* requirements, especially if this fact were communicated to students at an early stage, while they are still making decisions that will ultimately lead to their choice of A-Level.

Recognition

Indeed, in common with many students in my position, I believe that taking a route embracing geography and biology will, if anything, *better* prepare us for tackling a geology degree. Maths, chemistry and physics should not be prioritised, in the way they currently are, as 'must have' qualifications. Only a basic knowledge of these subjects is actually *required* to understand geology, and most universities nowadays routinely offer top-up / refresher courses across the board for any students who need remedial work. Providing a student has good-enough grades in other science subjects, especially geology, I feel confident - such is my own experience to date at least - that they will be perfectly able to deal with whatever maths, physics and chemistry that geology is ever likely to throw at them.

Why do ourselves down? Students studying geology are quite the equal of those with maths, physics and chemistry, and will be even better placed, surely, to do well in their first year in Higher Education. Until we recognise the value of our own subject, how can we - indeed, why should we - expect others to?

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).

“ UNIVERSITY DEPARTMENTS OF EARTH SCIENCE DO NOT SEEM TO REGARD A-LEVEL GEOLOGY AS A USEFUL REQUIREMENT AT ALL... WHY DO WE VOLUNTARILY INSULT OUR OWN SUBJECT IN THIS WAY? ”

Ben Topley

* Ben Topley is an A-level student and a Junior Candidate Fellow of the Society

CRACKING UP IN LINCOLNSHIRE



**Oliver Pritchard,
Stephen Hallett
and Timothy
Farewell*** consider
a case of 'the wrong
kind of soil'

All the UK's local roads are deteriorating, as most readers will no doubt be able to confirm by personal experience. Currently the UK ranks 24th in the world for the quality of its road infrastructure¹. Councils are facing increasingly tight budget constraints, and are finding their ability to provide proactive (rather than reactive) road maintenance severely reduced.

Ninety-eight percent of the UK's roads are 'local'. The remaining 2%, including the Highways Agency-controlled strategic motorways and 'A' trunk roads, carry the largest volume of traffic. So for most, if not all of us, journeys start and end predominantly on the local road network.

In this article we take the county of Lincolnshire as a case study. Lincolnshire's remote and agricultural setting underlines the importance of the local network, both economically and

socially, especially given the county's poor railway infrastructure. Road defects therefore create strong public reaction – especially when left untended.

A number of factors can lead to road deterioration, from traffic volume, road works (Excavations for infrastructure services), poor construction or reinstatement, cold weather and tarmacadam oxidation to local environmental conditions like soil-type, and proximity to trees and other large vegetation. Lincolnshire's road condition appears to be among the worst in the UK. The reason for this highlights the role played by the geoscientist.

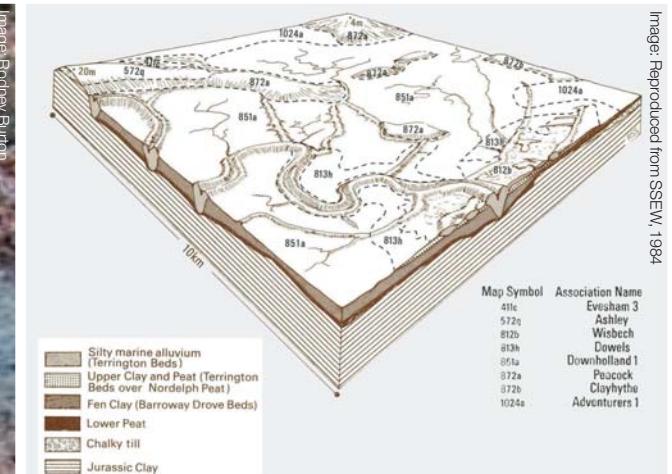
Soils

The soils of Lincolnshire and East Anglia are particularly prone to moisture-related soil-shrinkage. During the droughts of 2003 Lincolnshire County Council recorded damage estimated at

Above: Longitudinal cracking on Cowbridge Road, near Bicker

“ LINCOLNSHIRE’S ROAD CONDITION APPEARS TO BE AMONG THE WORST IN THE UK. THE REASON FOR THIS HIGHLIGHTS THE ROLE PLAYED BY THE GEOSCIENTIST ”

Image: Lincolnshire County Council



Soil associations of the Fenland area



£7 million affecting over 200 road sections. More recently in 2010-11, more drought conditions caused damage to 154 sites, predominantly in the south-east of the county. Newspapers carried headlines that ran: ‘Is the drought wrecking our roads? As we bask in unseasonably high temperatures, how cracks are appearing on surfaces as soil shrinks’².

A consortium of East Anglian county councils including Lincolnshire, Norfolk, Cambridgeshire, Suffolk and Peterborough City applied for additional emergency funding after both 2003 and 2010 drought events. The latter bid, totaling £26 million in emergency funding, was unsuccessful. This spurred the Institution of Civil Engineers to regard improving the condition of UK roads as a top priority³, along with damage due to recent cold weather and floods.

Highways engineers, asset managers and engineering geologists have

predominantly used geological maps to interpret areas of subsidence risk to road networks in the UK. In this article we suggest and describe practical uses for soil survey data and associated mapping, as an aid to asset-managing the Lincolnshire local road network. We also consider the integration of projected climate change data to aid in modelling soil-related subsidence.

Evolved network

Road construction is nothing new, as our Roman roads attest. The inspiration for this feature originated during Oliver Pritchard’s MSc research, which considered the environmental context of historic trackway construction across Irish peat bogs. These trackways, of which many similar examples have been found across Britain, are evidence of man’s early attempts at overcoming the engineering implications of problematic soils.

Many modern roads still follow the course of historic and ancient roadways – known in the trade as ‘evolved’ roads, and this term applies to much of Lincolnshire (and indeed most of the UK). Evolved roads include rural roads, estate roads and distributor roads⁴. Some will have originated as, and developed from, historic tracks originally constructed during the Roman and Bronze Age periods.

Little, if any, engineering foundation underlies evolved roads. The relatively thin road surface is therefore often placed in direct contact with, and is so directly influenced by, the underlying soil conditions.

Soil survey mapping

Many people still associate the Soil Survey of England and Wales (SSEW) with agricultural research, which provided the impetus for its earliest ►



**Smartphone
scale of
differential
settlement, Iron
Bar Drove, near
Spalding**



*Soil Associations
of Lincolnshire*



*Embankment
collapse B1165,
Ravens Bank*

- ▶ activities. SSEW joined Cranfield University in 1987, forming first the Soil Survey and Land Research Centre (SSLRC), and then subsequently the National Soil Resources Institute (NSRI). From this time, efforts were made to diversify the uses to which soils information could be applied. The engineering characteristics of soil provided one such avenue.

NSRI is the custodian of the national soil data archive, and holds many national and regional, as well as localised soil maps, associated data and soil samples. The collection and collation of datasets representing the spatial distribution of soils and their properties, formed the basis for 'LandIS', the computerised Land Information System (www.landis.org.uk)⁵. Commencing in the early 1990s, LandIS data have been applied to geohazard application modelling, leading to the development of the thematic 'Natural Perils Directory' (NPD)⁶.

NPD provides continuous geographical assessment of a range of geohazard assessments across England and Wales (and by incorporating similar data from the James Hutton Institute in Aberdeen, Scotland also). Assessments are provided for a range of soil perils: clay-shrink swell; silt-frost heave; sand-erosion; and peat-shrinkage. Further assessments of flood-extent alluvial plains, as well as summary wind exposure data, are also included.

The British Standards Institution⁷ highlights the usefulness of soil maps for depicting the occurrence of compressible materials, shrinkable clays, and unconsolidated sands. However, engineers in the UK have generally neglected the data produced by the soil survey as it only usually incorporates

soil data to maximum depths of approximately 1.5-2m below ground level. The pedological description of soils is also at variance with accepted civil engineering approaches, although attempts have been made to harmonise the respective classifications.

Drift

Soil maps also have advantages over geological mapping for representing surface geohazards, portraying certain stratigraphic features not present on geological maps, such as thin superficial drift, or peat layers, sulphate or acid-rich soils and highly expandable subsoils to name a few⁸. Approximately 50% of Fenland peat is now less than one metre thick. Geological mapping often does not recognise these deposits; consequently, soil maps can provide a more detailed assessment.

Internationally, in many countries (e.g. USA, Australia and the Netherlands) the use of soil survey data for highways design and management is commonplace. US highway departments frequently have their own soil survey teams who produce hazard maps prior to highway construction.

Lincolnshire can boast a wide range of soils. Much of East Anglia is underlain by geologically youthful peat, silt and clay soils, derived from previous marine inundations and regressions since the Pleistocene ice ages⁹. Chalk outcrops and extensive till deposits are found in the north and east of the county in the Lincolnshire Wolds, and limestone occurs to the county's north and west.

The peat deposits have now wasted to such an extent that underlying silts and clays have become exposed. This can be seen clearly in the creek patterns observed in aerial photographs. These fossilised tidal creek and historic river courses are known as 'roddons', whose formation and distribution have been recorded extensively¹⁰. Roddons are predominantly silt rich, being generally less susceptible to ground movement processes. For this reason road courses have historically followed them, avoiding surrounding clay and peat soils.

Many drivers desire flawless road surfaces, as evidence of their road-fund taxes being well spent; though in 2010-11 only £9.2bn of the £33bn road tax collected was actually spent on the UK's highways¹². Because it is a subjective assessment, it is not always clear exactly *when* a road has 'failed'¹¹. With the exception of landslides, 'failure'

does not often occur instantaneously, but as a chronic process occurring over a period of time.

Shrink-swell clays

Despite extensive research regarding expansive clays, these soils remain one of the most persistent threats to the UK built environment, causing some £300 million damage every year. The term 'clay' refers to naturally occurring particles that are < 2µm in size. Clays are 'colloidal' substances – that is to say they have enormous surface-to-surface contact characteristics that make them act as sticky glue. The characteristics of clays susceptible to shrink-swell can be influenced strongly by the mineralogical response to seasonal moisture fluxes. Clay soils with high vermiculite and smectite content are moderately and highly expansive, respectively.

Clay soils vulnerable to shrinkage in Lincolnshire include the Adventurers 2, Downholland, Wallasea 2 and Wisbech associations (detailed information about these can be found at www.landis.org.uk/services/soilsguide). These associations derive from superficial marine alluvium, and are all, to some extent subject to anthropic drainage practices.

In such expansive clays, soil moisture results in expansion (swell) as water is absorbed between the mineral particles, which have a microscopic 'dinner plate' appearance. The very minute size of these stacked, plate-like structures permits huge volumes to be retained per unit volume of mineral. Smectite crystals, for example, can have an astonishing surface area of 150 -175 square metres per gram, depending on their state!

Decreasing soil moisture causes clay particles to lose adsorbed water and move closer together, resulting in shrinkage. The lateral effects of clay-related soil shrinkage show up as shrinkage cracks in the ground. This, together with less evident vertical shrinkage, can prove particularly damaging to roads; however it is the differential settlement of the substrate that causes most damage.

Roads are designed to be impermeable, because water migrating into road foundations can lead to softening and pumping of the substrate, causing structural failure. During prolonged dryness, moisture within the soil is more readily retained underneath roads, whereas evaporation proceeds unimpeded in the verges, which dry more quickly. Vegetation, especially high

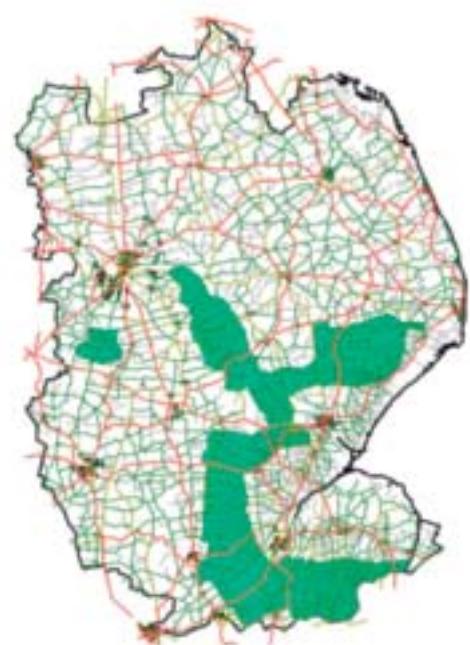


Image: O. Pritchard

Above: Holme Fen Post showing peat shrinkage, Holme Fen, Cambridgeshire

Below: Drought susceptible roads in Lincolnshire

**66 HIGHWAYS
ENGINEERS, ASSET
MANAGERS AND
ENGINEERING GEOLOGISTS
HAVE PREDOMINANTLY
USED GEOLOGICAL MAPS
TO INTERPRET AREAS OF
SUBSIDENCE RISK TO
ROAD NETWORKS 99**



► water-demand trees, exacerbate this.

Greater shrinkage therefore occurs towards the edge of the road than in the centre, resulting in damaging differential settlement. Roads passing over roddons also suffer differential shrinkage as a result of the silt in the roddon not being affected by moisture change, whereas flanking peats and clays are.

Longitudinal cracking of road surfaces can cause a road to 'break its back'. Roads are predominantly designed and built to be partially flexible, allowing them to absorb traffic stresses and subtle ground movement. In agricultural areas, the increasing size and weight of agricultural machinery is also putting increased pressures (literally) on the network.

Peat shrinkage

Peat is known for its poor bearing capacity, a result of large pore spaces and high water content (up to ten times its own mass). When water is lost, significant consolidation may result, especially when overburden is applied (i.e. road structure or traffic loading).

Water loss from peats has been increased by industrial agricultural drainage of the Fenlands since the 1600s. This has resulted in oxidation and mineralisation of peats, leading to untold and irreversible shrinkage. Holme Fen,

Cambridgeshire, is a good example of the substantial peat shrinkage loss in the Fenlands.

The resultant lowering of ground level due to soil wastage has, in some areas, left the highways high above the rest of the landscape - particularly those sections that are built on roddons. Such raised sections often have steep banks, with drainage dykes at their base. These factors, together with the presence of shrinkable clays, give rise to slope stability issues, resulting not only in road closures and high remediation costs, but potentially in a threat to human life.

Remediation

Many approaches have been adopted to the remediation of roads suffering soil-related problems. One particularly effective treatment has been applied to the A1073 near Crowland, Lincolnshire. Here, the installation of steel reinforcing 'geogrids' below the road surface has prevented the damaging effects of ground movement. Before this trial was undertaken, extensive cracks were encountered, thought to be the result of cyclic shrink-swell processes in the underlying soils. This drainage ditches along the sides of the road were also infilled, so reducing slope stability issues.

Soil hazard mapping

UK climate projections¹³ indicate that the UK is likely to encounter hotter, drier summers and wetter, warmer winters in future. For clay soils, this will result in greater soil moisture deficits, promoting more serious shrink-swell. Peat soils will continue to be subject to irreversible shrinkage and oxidation as the water table draws ever lower, exacerbated by farmers needing more irrigation. Lincolnshire's roads in future will probably be even more at the mercy of soil-related geohazards.

The Natural Perils Directory (NPD) does not currently permit the probabilistic modelling of soil subsidence hazards. We aim in our future research to integrate probabilistic climate data with the NPD subsidence perils model, and so allow us to forecast future likely areas of subsidence risk. Incorporating this approach with local road network data will enable us to identify priority areas at risk, aiding asset management strategies for the future. The All Parliamentary Group on Highway Maintenance¹⁴ is calling for asset management planning to become mandatory, in return for central government funds for road maintenance. Geoscientists will play a key role in formulating these plans.

In preparation for this, the combining



Thickness of tarmacadam in-situ prior to re-surfacing treatment, unclassified road Nr Grantham



Subsidence at Childers Lane near Spalding

soil-related subsidence knowledge with maps of baseline soil-subsidence risk has allowed Lincolnshire County Council to further develop and re-assess their current asset management and maintenance practices, identifying areas at highest risk of soil-related subsidence and so aiding the selection of appropriate cost-effective treatments.

New methods

Approaches like that seen near Crowland are relatively expensive and their use site-specific. Although the evolved road network is important, it is predominantly rural with low traffic volumes, and new methods might offer a more general solution. One such method involves *in-situ* recycling, whereby the existing road is planed, scarified, rolled and a new binding agent applied along with imported surface chippings to provide a new road surface.

As part of a 'soil-informed' maintenance strategy, such planed tarmacadam can be used to reinforce road foundations in areas affected by soil shrinkage. Creation of a deeper foundations in problematic areas results in evolved roads that are less likely to interact with soils affected by damaging seasonal or extreme moisture change, so prolonging their life. The added benefit of reduced waste disposal costs, combined

with longer road life, should enable the Authority to undertake more proactive road maintenance in future.

Few would envy the role of the many highway asset managers, at the mercy of diverse and problematic ground conditions, and who, under ever tighter budgets, often find their ability to remediate and innovate restricted by fiscal constraints. Prioritisation of highly limited funding is therefore paramount in maintaining road networks, and will remain so for the foreseeable future. Soil map-based evidence, together with future probabilistic climatic scenario projections, can assist this difficult decision-making process. ◆

ACKNOWLEDGEMENTS

The research associated described in this feature was funded by the UK Engineering and Physical Sciences Research Council (EPSRC) under programme grant EP/I01344X/1 to the UK Infrastructure Transitions Research Consortium (ITRC). **Mike Coates, Mark Heaton** and their colleagues at Lincolnshire County Council for introducing us to the soil-related problems faced on Lincolnshire roads and allowing Oliver to visit affected sites, as well as providing many of the illustrations presented.

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- ◆ Further references can be found online www.geolsoc.org.uk/geoscientist

* **Oliver Pritchard, Stephen Hallett and Timothy Farewell** National Soil Resources Institute, School of Applied Sciences, Cranfield University, Cranfield, Bedfordshire, MK43 0AL.



Image: Lincolnshire County Council



Image: Lincolnshire County Council

Varying depths of tarmacadam after coring investigation at Mole Drove

CRITICAL METALS



Kathryn Goodenough* goes to Greenland on a Society-sponsored hunt for the rare metals that underpin new technologies

Take a look at your mobile phone. Do you know just how many different elements are used to make it? Our modern lives rely on technological innovations that have developed over the last few decades - and those new technologies need a range of elements from the periodic table. Demand for some of these essential elements is increasing rapidly; yet in some cases the world's main supply comes from just one single country, or even a single mine.

In 2010, the European Union recognised a list of 14 elements (or groups of elements) for which demand is rapidly increasing, but supply is in some way restricted. These elements are termed 'critical raw materials'. A number of recent UK and international studies have used a wide range of metrics to measure this criticality. They have delivered varying results, but the Rare Earth Elements (REE) feature towards the top of most lists. Rare earths are vital to a wide range of modern technologies; yet currently, almost all the world's supply comes from a single mine in China.

Demand & security

Increased demand, rising prices and security of supply concerns have resulted in a surge in global exploration for REE and other critical metals. Within Europe, Greenland is a key country in the hunt for these mineral deposits. Greenland is rich in a wide range of mineral resources and importantly, it has major areas of alkaline igneous rocks - the main hosts for a range of critical metals. These include the (Mesoproterozoic) Gardar Province in South Greenland, and the (Neoproterozoic to Mesozoic) West Greenland Carbonatite province.

The West Greenland Carbonatite province lies at the northern margin of Greenland's Archaean Craton, which has seen repeated rifting events from Archaean through to Jurassic time, leading to the episodic generation of carbonatite magmas. Carbonatites are some of the Earth's most unusual magmas, being dominated by carbonate minerals rather than silicates. They are also commonly enriched in a wide range

of 'incompatible' elements, and host some of the largest known resources of critical metals such as REE and niobium (Nb).

However, developing a general genetic model that can be applied to carbonatite complexes has proved difficult. Their relationship to silicate magmas, the role of fractional crystallisation versus liquid immiscibility, the controls on metal mobility in carbonatitic magmas and fluids, and the sources of magmas, all remain relatively poorly understood, and widely variable between complexes. We know we need these elements and where they might be discovered; but how those resources come into being remains mysterious, and a challenge for Earth science.

Qeqertaasaq

A Greenlandic company, Nuna Minerals A/S (www.nunaminerals.com), which owns exploration licences in Greenland, is exploring for critical metals in the West Greenland Carbonatite province. In July 2013, Adrian Finch (St Andrews University) and I were invited to join Josh Hughes, Chief Geologist of Nuna Minerals, to do fieldwork at the Jurassische Qeqertaasaq Phoscorite Carbonatite Complex (QPCC).

This work had two objectives - to understand the evolution of the complex itself, and to collect samples that would help us build a bigger picture of the magma sources and tectonic setting for the West Greenland Carbonatite province as a whole. The QPCC covers an area of around 15km², to the north-east of Nuuk, Greenland's capital. Our team of five was landed in this remote area by helicopter. The flight had taken us across spectacular rock platforms formed of Archaean gneiss, and in comparison with that one's first view of the QPCC is not quite as impressive - low, rolling hills, well vegetated because of the phosphorus-rich soils that form above the Complex. Rock exposure is therefore limited, and as a result the Complex takes time to yield up its secrets.

Our camp was set up in the central 'core' of the QPCC. The camp consisted of one tent per team member, plus a Weatherhaven portable shelter for



Above top: Kathryn Goodenough in the field at Qeqertaasaq – with modern mapping technology, a Panasonic Toughbook running the BGS SIGMAmobile digital data capture system

Above middle: Studying the outcrops at 'Banana Lake'.

A pair of major faults run along the lake and out through the twin valleys in the middle ground of the photo

Above lower: Working on the fault scarp, on typical vegetated slopes

Left: Mountains in Dronning Marie Dal, Greenland – more dramatic than the typical scenery of the QPCC!

WITHIN EUROPE,
GREENLAND IS A KEY
COUNTRY IN THE HUNT
FOR THESE MINERAL
DEPOSITS. GREENLAND IS
RICH IN A WIDE RANGE OF
MINERAL RESOURCES



The QPCC is bounded by fast flowing rivers



Top right: Outcrop of strongly foliated brown carbonatite dykes separated by screens of basement, near the margins of the QPCC. An undeformed, grey lamprophyre dyke cuts through from top left to lower right of the outcrop



While the UK was basking in a heatwave, temperatures dropped to freezing on some days in the field

Bottom left: A typical outcrop of the marginal part of the carbonatite complex, with brown carbonatite sheets anastomosing through basement gneisses. The mosquito net was an essential piece of field gear!

cooking, eating and drying clothes - invaluable during the first week's wet weather. We were surprised on our arrival to find the campsite infested by a plague of small, black caterpillars. It will be a long time before I forget the image of waking up to the sight of caterpillars crawling all over the tent fabric above my head - thankfully on the outside! It has been suggested that caterpillars similar to these might have contributed to the demise of the original Norse settlements in Greenland - and having seen for myself how they destroyed the vegetation at Qeqertaasaq, this seems only too feasible.

Ring dykes

The complex had previously been mapped (Knudsen 1991) as a series of concentric carbonatite ring-dykes intruding, and metasomatising, Archaean basement gneisses. Nuna Minerals have already carried out significant drilling work in the core of the QPCC, and as a result have identified a suite of carbonatite veins enriched in REE (up to 13.2% Total Rare Earth Oxides). These veins are of particular economic interest because the REE are hosted in carbonate minerals, from which they can be easily separated in mineral processing.

A key aim for us was to improve our understanding of the context of this mineralisation, through studying the controls on magma emplacement, and collecting a series of samples that would provide information about magma and fluid sources and element mobility. To this

end, we walked across the whole of the Complex, in the process encountering several reindeer and a stunning white-tailed eagle. We amassed a vast sample suite, a substantial cairn of rocks slowly growing back at camp.

As we worked, we developed a revised map of the Complex, during which process it became increasingly clear that syn-emplacement deformation had played a large role in the QPCC's intrusion. The area is characterised by a suite of ENE-WSW-trending shear zones and faults that have been reactivated many times, and it is evident that these faults were important during the development of the QPCC. Most importantly from the point of view of mineralisation, we recognised that a major fault system in the south of the complex had controlled the emplacement of the carbonatite sheets associated with Nb-rich fluids. Nb mineralisation appears to extend along the length of the fault, while the REE mineralisation is focused in the area just to the north.

Mosquitoes

The famous Greenland storms failed to materialise, and after some initial rain, much of the trip was characterised by sunshine, blue skies and, of course, the inevitable mosquitoes. Departure from the campsite rather rushed, packing up the samples and equipment into large bags that were slung beneath a helicopter

for transfer to a boat waiting on the fjord. Detailed mineralogical and geochemical investigation is now being carried out in the labs back in St Andrews, to elucidate the history of this exciting Complex and its critical metal mineralisation.

Carbonatites the world over are not well understood, and yet they contain some of our most significant resources of critical metals. The British Geological Survey, St Andrews University and Camborne School of Mines are working together with a number of other collaborators to develop research into how the critical metals are concentrated by geological processes, in carbonatites and in other settings. Work at Qeqertaasaq is an important part of this, and I'd like to thank the Geological Society very much for its support for this fieldwork. ♦

* Dr Kathryn Goodenough is Senior Geologist at NERC British Geological Survey, based in Edinburgh.

ACKNOWLEDGEMENTS

I would like to thank Nuna Minerals for providing extensive support and logistics for our fieldwork, and the Geological Society's Gloyne Outdoor Research Fund for additional funding. To find out more about Society fieldwork grants and how to apply, visit www.geolsoc.org.uk and look for 'Research Grants' in 'About Us'.

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COURSE	DATE	VENUE AND DETAILS
Groundwater Contamination and Remediation	03 - 07 March	Newcastle University School of Engineering and Geosciences. Fee: £1125.00 Fellows' discount £1012.50. See website for details and contact.
Geohazard Risk Analysis & Communication	10 - 13 March	University of Sussex. Cost: £1229 Fellows 10% discount. See website to enrol. E: r.moore@sussex.ac.uk
Groundwater Modelling	17 - 21 March	Newcastle University School of Engineering and Geosciences. Fee: £1125.00 Fellows' discount £1012.50. See website for details and contact.
Risk Mitigation, Planning and Engineering	31 Mar - 04 Apr	University of Sussex. Cost £1229 Fellows 10% discount. See website to enrol. E: D.A.Robinson@sussex.ac.uk

DIARY OF MEETINGS MARCH 2014

MEETING	DATE	VENUE AND DETAILS
Reducing Subsurface Uncertainty & Risk through Field-based Studies. Petroleum Group	04 - 06 March	Venue: Geological Society, Burlington House. Please register for this event online. Fees apply. Fellow: £200. No contact given at time of writing.
Shale UK Conference. Shale UK, The Geological Society, Global Event Partners	04 - 05 March	Venue: Millennium Gloucester Hotel, London. E: policy@geolsoc.org.uk. Please visit website for further information, or directly at www.shaleuk.com .
Careers Afternoon. North West Regional	5 March	Venue: Schuster Lecture Theatre, Schuster Building, Brunswick Street, Manchester University M13 9PL. Time: 1200. Careers talks from 1300. Contact: Nik Reynolds E: geologicalsociety.northwest@gmail.com
Research in Progress meeting 2014 Geochemistry Group	5 March	Venue: Open University, Milton Keynes. See website for details. Cost £30, payable on the door. E: c.manning@es.rhul.ac.uk
London Crossrail. Home Counties North Regional	6 March	All TBC at time of writing. Contact: E: homecountiesnorth@geolsoc.org.uk
Forensic Geology: The Applications of Geology to Policing and Law Enforcement. Geologists' Association	7 March	Venue: Burlington House. Tea from 1730. Speaker: Lawrence Donnelly. Contact: Sarah Stafford E: geol.assoc@btinternet.com
Lyell Meeting 2014: Deep sea chemosynthetic ecosystems. Geological Society	12 March	Venue: Burlington House. Convenors: Silvia Danise (Plymouth University) and Crispin Little (University of Leeds). Free to Fellows, students and Corporate Affiliates. Contact: 020 7432 0981 F: 020 7494 0579 E: Naomi.newbold@geolsoc.org.uk
MSG Research Meeting. Metamorphic Studies Group	12 March	Venue: Gass Building, Open University, Milton Keynes. No registration, but contact k.brodie@manchester.ac.uk if you intend to come.
SVOC and DNAPL - Challenges for Contamination in Bedrock. North West Regional	14 March	Speaker: Hazel Davidson. Venue: University of Manchester. See website for time, details etc. Contact: Nik Reynolds E: geologicalsociety.northwest@gmail.com
Ash Clouds and Aeroplanes: Managing the Risk posed from Iceland's volcanoes. Southern Wales Regional	25 March	Venue: Main Building, Cardiff University, Park Place, Cardiff. Speaker: Dr Matt Watson, University of Bristol. Time: 1730 for 1800.
London Underground: The new Northern Line Extension and the upgrade of Bond Street Station Hong Kong Regional	25 March	Venue: Room HJ302, The Hong Kong Polytechnic University. Speaker: Jonathan Gammon. Time: 1830 – 1930. Contact: Kitty Chan E: kitty.chan@arup.com
Petroleum Geoscience of the West Africa Margin Petroleum Group	31 March - 02 April	Venue: Burlington House. Fees apply. Fellows discount: £200. See online for details and registration. Contact: Laura Griffiths T: 020 7432 0980 E: laura.griffiths@geolsoc.org.uk

STICKS AND STONES

ROCKNEY RHYMING SLANG





The refurbished Council Room, with new tables and bespoke handmade chairs



One of the new ventilation grilles set into the floor



The remodeled ceiling follows the original, but unrealized design of Barry & Banks

Power, splendour and high camp

The 2013 Council Room makeover, phase four of the refurbishment of the Society's apartments, succeeds brilliantly, says **Ted Nield**

The Council Room of the Society, its seat of power, was until recently greatly in need of a makeover far more radical than the one it received in 2006, when it became the home for much of the Society's portraiture and was given a lick of paint. The colours chosen then mirrored the colour scheme it received during its last major refurb, in the 1970s when money was distinctly tight.

That palette of anaemic 'Jane Austen' pastels, together with a disproportionate 1950s-Georgian ceiling rose (and housing-estate-Georgian sideboards, tables and chairs in saggy, sweaty leatherette), embodied the architectural misconceptions under which that makeover was carried out. Over the

years, the room's remaining integrity (such as it was) was further eroded by the addition of noisy, intrusive and rather ineffective aircon units and ugly coffee-making facilities; as well as by a persistent crack running centrally up the south wall and across the ceiling.

As Bob Sandford, architect superintending the current redesign, put it: "The decor fell well short of the quality expected of an important room in a Grade II* listed building".

Re-imagining

Burlington House, completed in 1874 to the designs of the noted architectural practice of Barry & Banks, is emphatically not a Georgian building.

It is a resolutely Victorian re-imagining of Palladian style, exhibited by 'Old' Burlington House. Its profuse grotesqueries and over-ripe ornamentation make it quite clear that, for all its pastiche Classicism, it is no less Victorian than St Pancras Station – a brash, confident, gloriously vulgar product of London's greatest building boom, and in its enthusiastic exaggeration of another age's forms and habits, architectural high camp.

But when the contract for the redesign came to be drawn up, the demands it made were not only aesthetic. As with the Janet Watson Lecture Theatre, the roles that the Council Room must now fulfil have long exceeded its inherited capacity. A well as AV presentations, it needed to be more versatile: for hire as a banqueting suite, or an overflow to the Janet Watson Theatre, or a seminar room. The air conditioning had to be made both more effective and less physically and



COUNCIL ROOM PROJECT DETAILS

Client: The Geological Society of London
Project cost: c. £250,000*

Architect: Robert Sandford
 (Julian Harrap Architects LLP)

Main Contractor: NDB Construction Ltd.

Quantity Surveyor: D R Nolans & Co.

Air Conditioning Subcontractor:
 SUGOI Solutions Ltd.

Data & AV Subcontractor: Whitwam Ltd.

Structural Engineers: Hockley and Dawson –
 Doug Murray

Bespoke furnishing: Period Design Furniture
 Company Ltd.

Electrical subcontractor: Allen Electrical Ltd.

Chandelier light fittings: Great British Lighting Ltd.

Picture lights: Aktiva Systems Ltd.

*Indicative cost only

aurally intrusive. Finally, these demands had to be satisfied without ‘undermining the room’s historic character’.

Bob Sandford told *Geoscientist*: “Research into the original construction drawings [of the apartments] indicated that the room was originally to have had a highly decorative plaster ceiling similar to that in the Lyell Room. This scheme was never actually carried out; but we felt that a more decorative ceiling would enhance the room’s character and at the same time provide an opportunity to address the crack, a disfiguring presence.

“The decorative scheme that we proposed, of deep red and grey with an off-white ceiling, was influenced by the Dulwich Picture Gallery and Sir John Soane’s Museum. These illustrated how a similar scheme could be an authentic background for the 19th Century portraits, which form such an important element of the room. To give added richness, the paint finish to the main wall face was rag rolled and given a protective varnish.

“The doors and windows were stripped back to their natural colour and French polished, while the secondary glazing (discovered to be softwood rather than oak!) was grained to match the real oak of the doors and windows. These colours were reflected in the purpose-made Wilton Carpet, with its red and grey border and stone-coloured infill.”

Aircon

The new air conditioning, whose installation was the most expensive single element of the work and occasioned the relocation of many staff for several months over the summer, provides treated fresh air and 80% recycled air. The ductwork and air conditioning units have been fully concealed behind the walls and within the floor void. Purpose-made cast iron floor grilles have been

introduced for extract ventilation, with the Society Roundel sensitively incorporated into the design.

A retractable projection screen has been built into the ceiling void above the fireplace, and the projector housed within the wall-thickness opposite, behind the existing doors to the (new) kitchenette. Electrics and data sockets are mostly concealed in floor boxes set into the bespoke carpet.

The lighting incorporates bespoke LED picture lights, together with two specially designed, bronze and opal glass chandeliers. The lights are controlled by a scene-setting control adjacent to the entrance doors, providing a number of possible lighting effects, linked to the audio visual system.

To recreate the originally-intended ceiling design, as befits any fine room on the *piano nobile*, decorative plaster mouldings were taken from casts of the Lyell Room ceiling. The ceiling crack has been cunningly concealed within this, and flexible filler used to control future movement. Doors and windows have been overhauled and French polished. The windows and secondary glazing have been draught-stripped to reduce traffic noise – which was their original purpose, of course, in an age when iron tyres on cobbles made Piccadilly a lot noisier than it is today.

Power

The Victorians knew a thing or two about showing off paintings, and the ‘art-gallery’ red enhances the portraiture immeasurably. The ‘flying saucer’ chandeliers, which, perhaps as a result of being modelled on originals in the Berlin Library, have a certain Teutonic quality, are both effective and suitably monumental in scale.

Edmund Nickless, Executive Secretary, who oversaw the design of the scheme, told *Geoscientist* that he believes the new colour scheme is ‘unequivocally boardroom’ and ‘bespeaks power’ – which it does.

By the same token, it might also foster the delusion of power, something against which I hope the Trustees will be on their guard as they sit on the bespoke hand-made chairs, 32 of which now line the new (and more flexible) boardroom tables. These chairs, based on an original design by Charles Rennie Mackintosh, went through several prototype iterations before reaching their final form, and now provide the final grace-notes to this striking

remodelling of a truly prestige room.

For me the design succeeds because, over and above its beauty, and its enhanced technical and practical capabilities as a space, its spirit matches that of Burlington House itself. Yes, it does look a little as though it has been conceived by Decimus Burton, Fritz Lang and Albert Speer over lunch in a Nicholson’s Ale and Pie House, but the way it combines eclectic influences perfectly complements the flouncy, posturing mannerisms of the building whose interior it now enhances.

BOOKS Available for review

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

- ◆ **NEW! Geodiversity - valuing and conserving abiotic nature** by Murray Gray (2nd Edn., 2013). 495pp (sbk)
- ◆ **NEW! Fire on Earth - an introduction** by Andrew C Scott *et al.*, 2014 Wiley-Blackwell 413pp (sbk)
- ◆ **NEW! A History of Geology & Medicine** by Duffin, C J *et al.* (eds.), 2013 Geological Society Special Publication 375 490pp (hbk)
- ◆ **NEW! Foraminifera and their Applications** by Robert Wynn Jones. Cambridge University Press 2014 319pp hbk
- ◆ **NEW! Geochemical Rate Models - an introduction to chemical kinetics** by J Donald Rimstidt. Cambridge University Press 2013 232pp hbk
- ◆ **NEW! Sorby's Legacy: Geology at the University of Sheffield** by R Alison Hunter. Published by R Alison Hunter, 2013 201pp sbk
- ◆ **The Seismic Analysis Code - a primer and user's guide** by George Helffrich *et al.* Cambridge University Press 2013 173pp sbk.
- ◆ **Life Beyond Earth: the search for habitable worlds in the universe** by Athena Coustenis and Therese Encrenaz. Cambridge University Press 2013 287pp hbk
- ◆ **Upstream petroleum – Fiscal and Valuation Modelling in Excel** by Ken Kasriel and David Wood. Wiley Finance 2013 253pp hbk
- ◆ **Atlas of Benthic Foraminifera** by Ann Holbourne, Andrew Henderson and Norman MacLeod. 2013 Wiley-Blackwell 642pp hbk
- ◆ **Forensic Seismology and Nuclear Test Bans** by Alan Douglas. Cambridge University Press 2013 514pp hbk
- ◆ **Global Optimization Methods in Geophysical Inversion (2nd Ed)** by Mrinal K Sen and Paul L Stoffa. Cambridge University Press 2013 289pp hbk
- ◆ **Continuum Mechanics in the Earth Sciences** by William I Newman Cambridge University Press
- ◆ **Theory of Reflectance and Emissittance Spectroscopy (2nd Edn)** by Bruce Hapke. Cambridge University Press

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.

◆ Myra Keep



Myra Keep, Professor, of Structural Geology and Tectonics, UWA, has been named 'Science Ambassador of the Year' by the Western Australian Government's Office of Science. Over the last 11 years Professor Keep has developed a range of geological research, teaching and outreach activities in East Timor through collaboration with all levels of government, schools and the local community.

◆ Steve Matthews

Steve Matthews has joined Hanson UK as Senior Engineering Geologist

◆ Mark Pritchard and Rachel McAllister



Mark Pritchard and Rachel McAllister have both joined GWP Consultants LLP. Mark joins GWP as a Partner having previously been a Partner with PGW&A. Mark has a BSc in Engineering Geology and Geotechnics and an MSc in Mining Engineering. Rachel has a BSc in Geology and Petroleum Geology and an MSc in Applied Geotechnics and has extensive experience in geotechnical site investigations and studies, mineral resource evaluation and environmental permitting issues relevant to the UK quarrying industry.

◆ Willie Whitesmith



Willie Whitesmith has joined the marketing team at Gas Data Ltd in Coventry to assist in the launch of a new range of gas meters for use in the Site Investigation, Waste to Energy and Biogas fields. Willie was formerly head of Kenilworth-based Integrated Geotechnical & Environmental Services (IGES) Ltd and has many years' of Gas Data's instruments www.gasdata.co.uk.

◆ Bruce Yardley



Bruce Yardley has been appointed to the new role of Chief Geologist by The Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA). He will advise RWMD and its stakeholders on all Earth-science aspects of geological disposal. The appointment is part-time, and will run concurrently with his work as professor in the School of Earth and Environment, University of Leeds.

RWMD Managing Director Bruce McKirdy told *Geoscientist*: "Professor Yardley has a long standing interest in issues associated with the disposal of radioactive waste. He is recognised internationally for his work in geology and geochemistry and his experience will help us to further develop and explain our plans."

Bruce Yardley said: "Geological disposal is the only internationally recognised permanent solution for dealing with higher activity radioactive waste safely and securely. It is vital that as a country we take responsibility for this legacy waste and focus on finding suitable sites for its long term disposal. I am confident that we have sites in the UK where our geology will effectively isolate our waste, to help safeguard the future for countless generations to come."

◆ Staff promotions

Nic Bilham, member of the recently formed 'Senior Leadership Team' (Edmund Nickless, Neal Marriott and the (newly appointed) Director of Finance & Operations **Jonathan Silk**, a former Senior Assistant Registrar at Oxford University) has been awarded the new title of **Director of Policy and Communications**. **Michael McKimm** now goes by the title **User Services Librarian**.

Fookes celebrated

Professor Peter Fookes (Imperial College, London) honoured



A celebration of Professor Peter Fookes, and the work of the Engineering Group's Working Parties, was held at Burlington House on 17 December 2013.

Peter received a bound copy of the Hot Deserts Working Party report in the presence of the President Mr David Shilston, and many Working Party members past and present. John Charman delivered a tribute to Peter Fookes, followed by addresses

from Helen Scholes (Chair, EGGS), and David Shilston. Ted Nield gave an illustrated talk about the importance of regional activities and engineering geology in the early history of the Society, and conducted the party on a tour of the Apartments and their treasures, including the newly refurbished Council Room, completed on that day with the delivery of its 32 handmade chairs (see p. 24).

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Aldridge, Richard	Jacqué, Maurice*	Moffatt, William Stewart*
Blackburn, James Kirk*	Jones, Brian Lloyd*	Robson, Geoffrey Robert*
Bowler, Christopher	Leckie, George Gallie*	Spencer, Peter Murray*
Michael Lance*	Little, Betsy A*	Spurr, Arthur M M*
Chapman, W T*	Middleton, John*	
Holroyd, J D*	Miller, James*	
Hudson, Neal F C*	Million, Ronald*	

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](http://WWW.GEOLSOC.ORG.UK/OBITUARIES). To save yourself unnecessary work, please do not write anything until you have received a commissioning letter.

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

Top bananas

The Science Council has succumbed to the latest Internet meme and published a list of Britain's 'top 100 scientists', notes Dwain Eldred...

On 14 January, as part of its tenth birthday celebrations, the Science Council announced a list of the 'top 100 UK Practising Scientists'. You can see it for yourself at www.sciencecouncil.org/content/100-leading-uk-practising-scientists. The Council canvassed its members to create this list, and seven of the nine nominations made by the Geological Society made the final cut, which aims to 'highlight the different types of skills and challenges a career in science involves.'

The Science Council's competition was arranged around 10 categories, each to contain 10 members, in order 'to give a broad



picture of the many different ways people work with science, making valuable contributions across UK society and the economy.'

GSL Fellows on the list are: Jane Francis (Explorer category); James Jackson (Explorer category); Trisha Henton (Monitor/regulator category); Sir Mark Moody-Stuart (Business category); Andrew Mackenzie (Business category); Alan Gibbs (Entrepreneur category); Lord Ron Oxburgh (Policy category).

Nancy Tupholme

Nancy Tupholme (née Morris, 1912-2014)

Nancy Tupholme died 3 January 2014, aged 101. Nancy came to work in the Society in November 1940 and helped it through the difficult wartime years. She stayed until 1962, when she moved next door to the Royal Society (then in the Royal Society of Chemistry's apartments) and stayed until retirement. Nancy became Secretary of the European Association of Science Editors and maintained her attachment to the Geological Society. Until the 1990s she would be seen frequently in Burlington House undertaking various voluntary duties. She indexed the Council Minutes for the Hon Archivist and, until Richard Bateman's appointment as Executive



Secretary, continued to organise President's Day (then a 'black tie' event). She remained active until recently, remaining at 'Bruins' near Farnham, which she had built, looked after by cousins and carers. Her friends and associates will remember her poems and her personal Christmas cards each year. The Library has copies of her memoir 'Titanic' to the Millennium (2000 & 2001). *Wendy Cawthorne*

DISTANT THUNDER

Deja vu all over again

As the debate over the proposed HS2 high speed railway hots up, Nina Morgan discovers that some things never change...

William Buckland (1784-1856) first Reader in Geology at Oxford University is perhaps best remembered - in the geological sense - for his work on fossils. But like many of the early geologists, engineering was also apparently well within his remit. As a letter to Buckland from the famous railway engineer, George 'Rocket' Stevenson, preserved in the archives in the Hope Library at the Oxford University Museum of Natural History, illustrates, Buckland was willing and able to lay aside his usual studies to take on a bit of outside consultancy work.

No 35 ½ Great George Street Westminster, August 1st 1842
My Dear Sir, I have examined the

Line of Railway laid down by you from Oxford to join the Great Western near South Stoke & I have no hesitation whatever in giving my opinion as to its being the best line which could be suggested for connecting Oxford with the above Railway, but also looking to the very small amount of excavation required in its construction, the few roads interfered with, and the inexpensive character of the property intersected. I believe it will be found to apply as many facilities in its construction as any Railway heretofore projected in this country.

In order to forward the proceedings for carrying into effect the proposed Railway, it is most requisite that a powerful & respectable party should be got together to represent the project at Oxford, and thus obviate landed opposition & secure the Bill authorising the completion of the proposed Railway being obtained without the necessity of

making any ruinous agreements with Land Owners. – If this be accomplished, I myself and friends are so satisfied of the moderate outlays required for this undertaking, as well as of the Traffic it must command, that we would undertake to lease it for any term of years to be agreed on at 5 per Cent per Annum.

With such prospect, I need only observe that it rests entirely with the inhabitants of Oxford & the Land Owners to come forward to support the scheme with their influence and active co-operation to enable myself and connections to raise any deficiency in the Capital that may be required.

As soon as the views of the principal Land Owners are ascertained and you inform me of the result, I will send an Engineer to level the line previous to the field survey.

I herewith beg to return you the Ordnance sheet with the line laid on.
And remain –My dear Sir

Very Faithfully Yours,
Geo Stephenson
To Professor Buckland
P.S. I hope you will permit yourself to be nominated Chairman of this Company

Definitive evidence as to whether or not Buckland accepted the nomination for the chairmanship of the Great Western Railway is not preserved in the Oxford archives. But the fact that Buckland apparently recycled Stephenson's letter to use as a folder for some notes about glaciation suggests that Buckland - who met his wife-to-be on a train - felt his real interests lay elsewhere.

► Acknowledgement

Other sources for this vignette include *The Life and Correspondence of William Buckland, D.D., F.R.S.*, by his daughter, Mrs Gordon, John Murray, 1894 and the DNB entry for George Stephenson. More sources given online.

OBITUARY**RICHARD DOWNING 1928-2013**

Dr Richard Allen Downing, known universally as Dick, collapsed and died in Oxford on 28 June 2013. One of Britain's leading hydrogeologists, he was born on 18 March 1928 in Newcastle-upon-Tyne and educated at Gateshead Grammar School and Durham University, where he read Geology as a Shell Scholar. After graduating in 1949 with 1st Class Honours he joined the Geological Survey as a field geologist but his career was soon interrupted by National Service, where he was commissioned in the Royal Engineers. His National Service, followed by Reserve service in charge of a well-drilling unit, provided him with a fund of anecdotes that could still amuse listeners more than 50 years later.

Ineson

Back at the Survey, Dick was initially posted to the South Wales Coalfield, mapping parts of the Swansea and Newport sheets and publishing original findings, but in 1954 he joined the Water Department and began his career in hydrogeology. Working with Jack Ineson he was soon publishing on groundwater chemistry and explaining the analysis of the groundwater component of river flows.

In 1965 Dick moved with Ineson to the Water Resources Board (WRB) on its formation and was soon

Leading British hydrogeologist who developed a national water plan for England and Wales



supervising multidisciplinary projects involved with developing a national water plan for England and Wales – an excellent document that was ignored by politicians and then reinvented by the National Rivers Authority in the 1990s. With the reorganisation of the water industry in 1974 and closure of WRB he moved to similar work in the Central Water Planning Unit, on whose behalf he also did a short spell in Saudi Arabia.

In 1979 Dick returned to the Survey, by then BGS, as Manager of the programme to investigate the geothermal potential of the UK, supervising hydrogeologists, geophysicists, geochemists and structural geologists. He retired from BGS in 1988, having served twice as Acting Chief Hydrogeologist; it was a loss to both him and the country that he did not

achieve that substantive role for a long period. Everything he did was meticulously planned and executed. He was always at pains to encourage and acknowledge his junior colleagues and often gave them credit for work he had largely done himself.

Smith Medal

Dick Downing was head and shoulders above most of his contemporaries both physically (at well over six feet) and intellectually. He had an enormous breadth of knowledge in geology and science generally, was very widely read and had a prodigious output in papers and books, recognised by the award of a DSc from Durham in 1977. Although the submission was nominally in Geology, in practice it was the first UK DSc predominantly in Hydrogeology.

His contribution was further recognised by the award of the William Smith Medal in 1989.

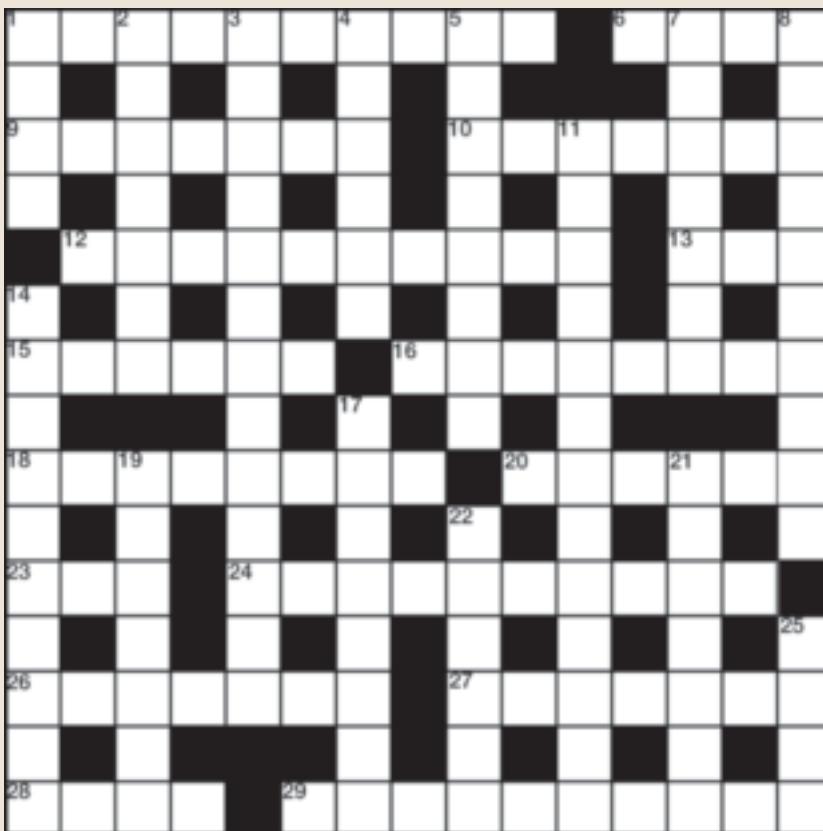
With John Rodda and Frank Law he wrote *Systematic Hydrology* (1976), one of the best summaries of the hydrology of the UK ever produced; only its inappropriate title prevented it becoming more widely appreciated. After retirement in 1988 he was the instigator, lead editor and a major contributor of two Clarendon Press (OUP) monographs, *Applied Groundwater Hydrology* (1991) and *The Hydrogeology of the Chalk of North-West Europe* (1993). He was chosen to give the inaugural Ineson Lecture of the British chapter of the International Association of Hydrogeologists and the Society's Hydrogeological Group in 1992. With David Gray he co-edited the BGS/HMSO publication on *Geothermal Energy: The potential in the United Kingdom* (1986). From 1993-99 he was an Honorary Research Associate of BGS, for whom he also wrote a popular account of hydrogeology: *Groundwater: Our hidden asset* (1998).

He remained active up to his death, latterly helping to write a history of Twyford, his home since 1960. Much of his later life was devoted to caring for his wife, Dulcie, who died in 2012. He is survived by their daughters Helen and Julia and two grandchildren.

➤ Written by Michael Price

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

CROSSWORD NO.177 SET BY PLATYPUS



ACROSS

- 1** Cryptocrystalline silica (10)
- 6** Leans closely against (4)
- 9** Tester of ores and minerals (7)
- 10** C₆H₁₂O₆ (7)
- 12** Not subject to external mechanical force (10)
- 13** Epochal subdivision (3)
- 15** History as preserved in rocks (6)
- 16** Animal hard parts (8)
- 18** Mineral containing water, for example (8)
- 20** To cut off a meander (6)
- 23** Greek letter denoting shear stress in continuum mechanics (3)
- 24** Relating to extraction of resources or manufacturing of commodities (10)
- 26** Essential component of deep driven foundations (7)
- 27** Inhabitants of The Shire (curly hair between the toes) (7)
- 28** One up from silt (4)
- 29** Eight-faced polyhedron (10)

DOWN

- 1** Lithified plant remains (4)
- 2** Toxic element found in many ores, including realgar (7)
- 3** Disturbance due to freezing (13)
- 4** County home of the Portland Stone (6)
- 5** Second city destroyed by A bomb, in this case 'Fat Man', the first plutonium weapon (8)
- 7** Floating (7)
- 8** Beneath the object in question (10)
- 11** The parcel that arrives when you are out (13)
- 14** Platonic pure form embodying the essential characteristics of a thing (10)
- 17** Buckminster-Fuller sphere, for example (8)
- 19** Element of 'Basket of eggs' topography (7)
- 21** More liable to sink, or betray secrets to the media, perhaps (7)
- 22** Common chronic inflammatory disease of the airways leading to breathing difficulties (6)
- 25** Every book must have one (1,1,1,1)

WIN A SPECIAL PUBLICATION!

The winner of the December/January Crossword puzzle prize draw was Iain Weir-Jones of Vancouver, BC.

All correct solutions will be placed in the draw, and the winner's name printed in the May 2014 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - 24 March.**

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

.....

Address for correspondence

.....

.....

.....

Postcode

SOLUTIONS DEC/JAN

ACROSS:

- 1 Chromosome
- 6 NERC
- 9 Desists
- 10 Teheran
- 12 Prospector
- 13 Ski
- 15 Steady
- 16 Conflate
- 18 Usurp
- 20 Proust
- 23 Ore
- 24 Thermostat
- 26 Prussian
- 27 Aniline
- 28 Rile
- 29 Isothermal

DOWN:

- 1 Coda
- 2 Reserve
- 3 Mesosiderites
- 4 System
- 5 Mutation
- 7 Eurasia
- 8 Continents
- 11 Hertfordshire
- 14 Pseudospar
- 17 Sciences
- 19 Unequal
- 21 Uranium
- 22 Impact
- 25 Keel

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CL:AIRE Networking Series

Hosted by The Geological Society & The Royal Society of Chemistry

In association with (sponsor from CL:AIRE Members tbc)

"The Importance of Toxicology in Managing Contaminated Land"

The CL:AIRE Networking Series is a programme of events aimed at bringing together the CL:AIRE Membership companies with the aim of creating new company connections, to discuss common industry problems, potential solutions and to highlight the latest developments in the industry.

Following the success of last year's events we are delighted to announce the first of these events for 2014, which will be held on Monday the 24th of March 2014 at the Royal Society of Chemistry and the Geological Society, Burlington House, Piccadilly, London. The session will run from 17:30 to 20:00.

Attendance is free to all CL:AIRE Members, Qualified Persons, Geological Society Fellows and Royal Society of Chemistry members. Non-members of these organisations will be charged £xx for entry. (TBC)

Evening agenda

17:30 Doors open: Tea & coffee in the RSC Library.

In the Geological Society Lecture Theatre:

18:00 Welcome address: CL:AIRE / RSC Toxicology / Geological Society.

18:15 Presentation: The Importance of Toxicology in Managing Contaminated Land
Camilla Pease (Environ)

18:45 Q&A

19:00 General networking / research poster displays and discussion (RSC Library)

19:50 Closing remarks and thanks.

For more information or to book a place please email enquiries@claire.co.uk with "24th March Networking Event" as the subject.



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www.geolsoc.org.uk/gsllondonlectures14

The Geological Society London Lectures

2014 Programme



22 January	LUSI: the Geology and Engineering of a Mud Volcano disaster in Java	David Shilston, <i>GSL President & Atkins UK</i>
19 February	Oil & Gas in the Arctic	Alastair Fraser, <i>Imperial College</i>
19 March	Meeting the Challenge: Geological disposal of UK higher activity Radioactive Waste	Rebecca Lunn, <i>University of Strathclyde</i>
16 April	Fracking (Title TBC)	Richard Davies, <i>University of Durham</i>
21 May	Managing Nuclear Power on a Dynamic Earth	Neil Chapman, <i>MCM International</i>
18 June	Geology in Space: Meteorites and Cosmic Dust	Matthew Genge, <i>Imperial College</i>
10 September	Industrial Projects (Title TBC)	Natalyn Ala, <i>Atkins UK</i>
15 October	Geoheritage related talk TBC (Part of Earth Science Week)	Kathryn Goodenough, <i>British Geological Survey</i>
19 November	Contaminated Land - What is it good for?	Paul Nathanail, <i>Land Quality Management Ltd & University of Nottingham</i>
10 December	Terra Infirma: What has Salt Tectonics ever done for us?	Chris Jackson, <i>Imperial College</i>

Timings: These lectures will be given at 3pm and 6pm on these days (with tea/coffee served for half an hour before each), so please let us know, when requesting a place, which talk you would like to attend. *Venue:* The Geological Society of London, Burlington House

Entry to this lecture is free to all, but places are allocated on a ballot basis. The doors to Burlington House will close at 6.15pm and you will not be able to enter the building after this time.
Please call at reception (to your right) or contact the Society by post, phone, fax or email (see below).

For further information, please contact: The Conference Office
The Geological Society, Burlington House, Piccadilly, London W1J 0BG

T: 020 7434 9944
F: 0207 439 8975
W: www.geolsoc.org.uk/gsllondonlectures14

E: registrations@geolsoc.org.uk
Follow us on [@gsllecture](https://twitter.com/gsllecture)

Geologists' Association Lectures 2014

3 January	Virtual fieldwork using Google Earth: exploring global tectonics from your armchair	Ian Watkinson
7 February	Japan: volcanic soils and agriculture from prehistory to present	Gina Barnes
7 March	Forensic Geology: The Applications of Geology to Policing and Law Enforcement	Lawrance Donnelly
4 April	Zeolites - Just boiling stones?	Vladimir Zhlobenko
9 May	AGM and Presidential Address A walk on the Chalk Side Part 2: Flint, basins and the end of the Chalk in the British area	Rory Mortimore
6 June	Big, bad and bizarre, the devil frog from the Late Cretaceous of Madagascar	Susan Evans
4 July	Late Mesozoic Insects in Search of the Fossil Silk Road	Dr Ed Jarzembowksi
3 October	The Incredible Story of the Stone Pipe Company 1805–1815, London, Manchester and Dublin	Hugh Torrens
5 December	The rise, fall and resurgence of UK domestic mineral supply	Andrew Bloodworth

For further information, please contact: Sarah Stafford, Executive Secretary, The Geologists' Association,
Burlington House, Piccadilly, London, W1J 0DU T: 020 7434 9298 E: geol.assoc@btinternet.com



Lyell Meeting 2014

Deep sea chemosynthetic ecosystems: where they are found, how they work and what they looked like in the geological past

Conveners:

Silvia Danise (Plymouth University),
Crispin Little (University of Leeds)

Speakers include:

Jonathan Copley (University of Southampton) *Orbis non sufficit: going beyond biogeography in understanding the ecology of deep-sea hydrothermal vents*

Nadine Le Bris (Université Pierre et Marie Curie-Paris, France) *Intimate links between chemosynthetic fauna and their chemical environment: a microhabitat perspective*

Richard Herrington (Natural History Museum) *The economic importance of modern seafloor massive sulphide deposits and their ancient analogues*

Marina Cunha (Universidade de Aveiro, Portugal) *Ecology and biogeography of cold seep fauna, with insights from the Northeast Atlantic*

Jörn Peckmann (Universität Wien, Austria) *Biogeochemical processes at ancient and modern methane seeps*

Jillian Petersen (Max Planck Institute for Marine Microbiology, Germany) *Chemosynthetic symbioses at vents and seeps: Tapping dark energy in the deep sea*

John Taylor (Natural History Museum) *Chemosymbiotic bivalves from the intertidal to deep sea – multiple origins, diversity and evolution*

Adrian Glover (Natural History Museum) *Chemosynthesis at whale-falls and their role in driving the speciation and evolution of annelids in the deep sea*

Steffen Kiel (Universität Göttingen, Germany) *Chemosynthetic ecosystems through Earth history*

Monica Grady (The Open University) *Astrobiological implications of chemosynthesis and the possibility of life beyond the Earth*

12 March 2014

The Geological Society, Burlington House

The ocean exploration in the past 40 years has revolutionised our knowledge of ecological adaptations of life in the deep sea and associated mineralogical resources. In the cold and dark ocean depths abundant animal communities flourish where fluids rich in methane, hydrogen sulphide, hydrogen and other chemically reduced compounds are released from the sea floor at hydrothermal vents and cold seeps. Similar communities occur where large pieces of organic matter, such as whales and wood, have sunk to the bottom of the sea. Life teems at these so-called chemosynthetic sites because of the huge amount of chemical energy available, and numerous symbiotic relationships of animals with chemoautotrophic bacteria. The same chemosynthesis-based communities are being increasingly recognised in the geological record, giving important new insights about the evolution of these communities through time. Part of this record comes from massive sulphide deposits, which are a significant economic resource.

This meeting will bring together geologists, marine biologists and ecologists, palaeontologists and geomicrobiologists to highlight recent achievements in our understanding of chemosynthetic ecosystems, past and present. We will explore the complex relationships between geology and life at these sites; details of chemosymbiotic animal-microbial interactions; and how and when animals adapted to life in these extreme environments. Finally, recent hypotheses about the existence of similar ecosystems on other Solar System planets will be presented.

Further information

For further information about the conference please contact:

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

Tel: 0207 434 9944

Email: naomi.newbold@geolsoc.org.uk

Web: www.geolsoc.org.uk/lyell14

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