Geoscientist

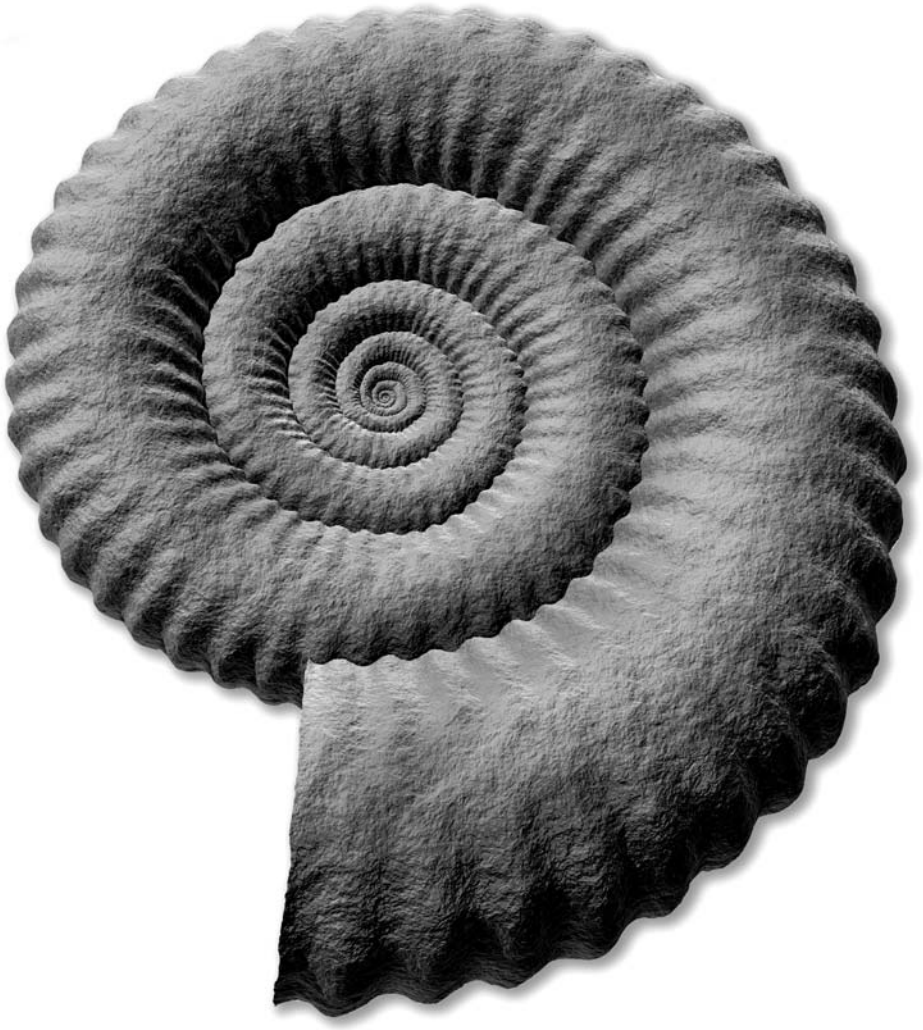
The Fellowship magazine of The Geological Society of London | www.geolsoc.org.uk | Volume 23 No 7 | August 2013

[BOOKS & ARTS SPECIAL REVIEWS BUMPER ISSUE]

QUESTION TIME
Answering politicians' climate change queries

CHARTERSHIP
Recognition grows within geoscience professions

POTASSIUM POTENTIAL
Getting excited about an essential resource



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AUGUST 2013

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FEATURES

REGULARS

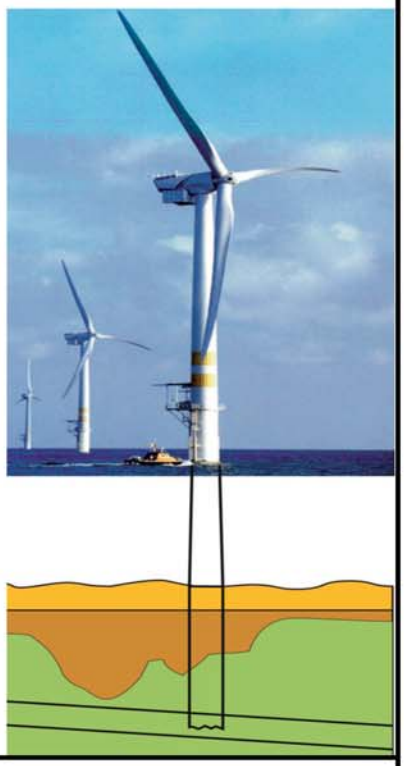
Geologists' Association

2013 Annual Meeting

Sponsored by Elsevier

Onshore and Offshore Geology

the vital link



Saturday 21st September 2013: conference

Sunday 22nd September 2013: field excursion

Appleby Lecture Theatre, University of Durham DH1 3LE

Further information contact:

conference@geologistsassociation.org.uk

Exploration offshore for wind farms, tunnelling, mining and hydrocarbons benefited initially from knowledge of adjacent onshore geology. Subsequently, the detail available from offshore methods of exploration has greatly enhanced our understanding of the onshore geology.

This conference illustrates the benefits of this interplay to UK Earth Science.

Programme:

Professor John Underhill	**Introductory keynote speech - Resolving Long-Standing Tectonic Enigmas in the UK - New insights from the integration of Field Observations with the Subsurface Database**
Peter McPhee	**Controls on Triassic subsidence in the Solway Basin, northern England**
Dr Rachel Jamieson	**Role of onshore-offshore, surface-subsurface mapping in unravelling the structural evolution of the Flamborough Head Disturbance**
Dr Haydon Bailey	**Micropalaeontology and Nannopalaeontology – how the offshore feeds back into the onshore**
Dr Stephen Stukins	**Using onshore palynology to inform offshore exploration**
Dr Bethan Davies	**The Quaternary Glaciations of the western North Sea Basin: implications for ice-sheet dynamics**
Professor Paul Younger	**Chloride waters of Great Britain revisited: what can offshore brines now tell us about onshore geothermal brines?**
Dr Rick Smith	**Polyhalite prospecting, deep below North Yorkshire**
Professor David Manning	**NE link to how will minerals feed the world in 2050**
Professor Cynthia Burek	**The importance of Marine Geoconservation for sustainable development**
Vicky Wanstall	**Geological Characterisation of onshore and offshore sites**
Professor Malcolm Hart	**The Holocene separation of Jersey from mainland Europe**
Professor Rory Mortimore	**Closing address**

Organisers:

Rory Mortimore, Lesley Dunlop, Jonathan Imber, Eric Johnson, Derek Teasdale, Brian Young

FURTHER CONTRIBUTIONS INVITED for poster presentations especially from young geoscientists.

Contact conference@geologistsassociation.org.uk

DALLOL GEOTHERMAL AREA, POTASSIUM SALT DEPOSITS FORMED BY BRINE HOT SPRINGS, DANAKIL DEPRESSION, ETHIOPIA

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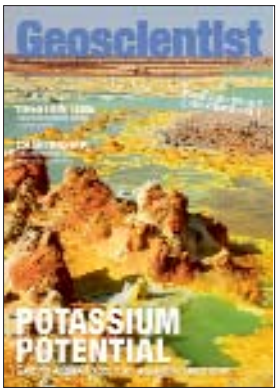

REVIEW TIME

Although the time may already be upon us when printed journals have become irrelevant, technology will have to become a lot more portable, cheap and convenient before it can finally be said to have replaced paper for the sort of information that people read - not because they have to, but for pleasure.

Assuming that, in the coming brave new world, anyone has time for 'reading for pleasure', or for pleasure at all, it will be found in the interstices of increasingly busy days. These nooks of time will probably remain much the same as now: on public transport, before putting the light out at night, or at those natural moments when even the least Garboesque of us wants to be alone. These last remaining crannies of contemplation are not yet safely or conveniently penetrated by costly, water-sensitive, desirable, nickable technology.

But the effects of digital media on what we still choose to read on paper can nevertheless be felt right now. A monthly magazine – indeed, even a weekly one – is no longer a reasonable place to put breaking news, when most readers enjoy instant access to the news output of scientific organisations directly, let alone online versions magazines and papers. For this reason, the print *Geoscientist* rarely carries a *Geonews* section any more.

Geoscientist is nobody's *required* reading – no shame in this… it is a badge of honour, worn with pride. Our audience is not captive. We may have assured circulation; but if we are boring, we are lost. We must entertain. 'Not being boring' is (sadly) not an imperative that the white literature has to face.

Against the changing background of news delivery, media with longer lead-times must rebalance their content. News, having moved to more immediate platforms, must be replaced by reflection, review, in-depth treatment, and opinion. This is why, this month, we are running another 'Books & Arts Special', and carrying more reviews than usual.

Reviews have another added advantage: they are a great way for you, the reader, to become involved with your Fellowship magazine. We are keen for more of you to review books for us. To see a full list of available titles, please go to **www.geolsoc.org.uk/reviews**.

This is not the only route to review-writing. Maybe you recently read a newly published book, not on our list, which deserves a review? Also, we don't only review books. Seen an exhibition? Been to a film or a show with scientific aspects? Please email me with a proposal: **ted.nield@geolsoc.org.uk**.

DR TED NIELD EDITOR

SOCIETYNEWS

Founders' Day

Date and speaker for the Society's Gala Event announced, reports *Naomi Newbould.*

The Society was inaugurated on Friday 13 November 1807 by thirteen gentlemen over dinner at the Freemasons' Tavern, Covent Garden.

To celebrate our 206th birthday, we will be holding our annual Founders' Day Lecture and Dinner on Wednesday 13 November.

Historian of geology and author of Arthur Holmes's biography *The Dating Game*, Dr Cherry Lewis (University of Bristol) will talk on James Parkinson and the Founding of the Geological Society. The occasion will be a Black Tie event, and the ticket price will be £80 per person. Lecture (at 1800) will be followed by a Champagne reception and dinner at Le Meridien from 1900.

Drawing by James Parkinson, the lily ecrinite

For tickets and further information please go to: **www.geolsoc.org.uk/founders13**

Society Awards 2014

Fellows of the Society are invited to submit nominations for the Society's Awards for 2014 to the Awards Committee. Full details about how to make nominations may be found at **www.geolsoc.org.uk/awards**.

Nominations must be received at the Society no later than Friday, 4 October 2013

LAMBECK'S RECALL

An unfortunate omission on President's Day will be rectified in September, reports *Dawne Riddle.*

Due to a most unfortunate diary malfunction, Prof Kurt Lambeck managed to miss President's Day and the Awards Ceremony, at which he was to receive the Wollaston Medal. We look forward to welcoming him back on Wednesday 25 September, when he will finally deliver his much-anticipated lecture, *Of Ice and Land, Sea and Strand: Sea Level During Glacial Cycles*.

Prof. Lambeck told *Geoscientist*: "One of the classic problems joining many of the geoscience disciplines is the relationship between ice sheets, sea level and the solid Earth during glacial cycles: Geophysical modelling defines the solid Earth's response to changes in surface loads and hence constrains estimates of mantle rheology; geological observations provides constraints on past ice movements and on the sea level response to the changes in the ice loads; geodetic data provides measures of the recent response to past and present ice changes; glaciology provides the observational evidence and theory for ice movements in a changing climate; and the dynamics of the solar system provides one of the driving forces for the growth and decay of ice sheets. It provides therefore not only a scientific challenge but also insights into the working of the climate system of the planet, and a framework for discussing human migrations and coastal archaeological settings.

"I will endeavour to give an overview of where this science is at: what have we learnt about past ice sheets from geophysical inversions of geological data; what have we learnt about the mantle's response to surface loading on time scales of thousands of years; are realistic palaeo-reconstructions possible of the coastal zones; and are there lessons that may be relevant to understanding present sea level change."

The event will follow the AGM and begin with tea at 1730. The medal presentation talk will follow at 1800 and culminate in a wine reception, finishing around 2000. Entry is free but by ticket only. Please register with **naomi.newbould@geolsoc.org.uk**

FUTURE MEETINGS

Dates for meetings of Council and Ordinary General Meetings until April 2014 shall be as follows:

- **2013:** 24 & 25 September (Council residential) – OGM at 1630, 25 September; 27 November
- **2014:** 5 February; 9 April

[LECTURES]

Shell London Lecture Series


By Giovanni Dall'Orto via Wikimedia Commons

Dwarfism in animals on islands

Victoria Herridge (Natural History Museum)

11 September 2013

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In Robert's memory, his family are donating an annual undergraduate prize, The Robert Andrew Scott Prize for overall excellence in geology fieldwork at the School of Earth Sciences, University of Bristol. This Summer, in Robert's memory, Mary Scott and her two children Louisa and Alexander will walk 175 miles along the West Highland Way and the Great Glen Way in Scotland, to raise funds for 'SOS Children's Villages' programme in Chipata, Zambia, and for Addenbrooke's Charitable Trust (Intensive Care Unit) in Cambridge. Any of Robert's friends in the geological community who wish to sponsor them can do so at **http://uk.virginmoneygiving.com/WalkforRobert**.

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International military matters


Ted Rose

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***Ted Rose* writes:** The 10th International Conference on Military Geosciences was held at Aviemore in Scotland from 16 to 21 June, convened by Hugh Hamilton of Nottingham Trent University (E: **hugh.hamilton@ntu.ac.uk**).

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The Chartership Officer has some big news for professional geoscientists

More information can be found online www.geolsoc.org.uk or email chartership@geolsoc.org.uk

Company Training Schemes

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Information on the procedures for MSc course Accreditation can be found on the Society's web site or from the Accreditation Officer **Colin Scrutton** (**colin.scrutton@dunelm.org.uk**)

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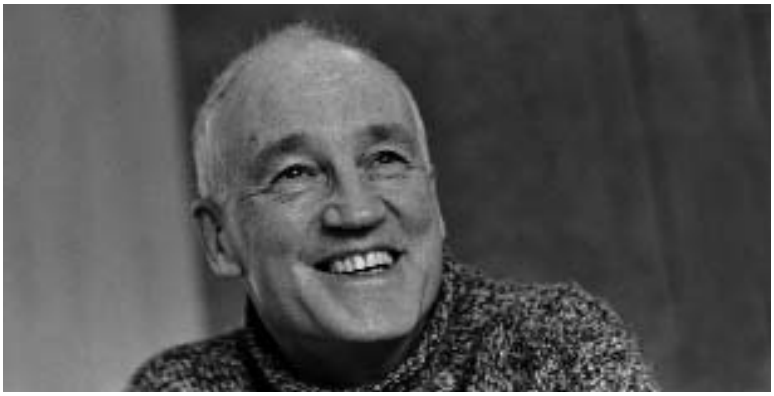
[CHARTERSHIP GAINS INFLUENCE]

Latest high-profile CGeol recruits!







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Holding a title such as CGeol indicates to the outside world that you are a professional whose competence is recognised by your peers and whose work can be trusted. It provides assurance to your clients and the general public, and marks you as a professional practitioner. Similar status is afforded to Fellows holding the CSci title.

Previously CGeol was valued most by engineering geologists and others who work alongside Chartered Engineers and where a professional qualification was necessary in order to sign off reports, etc. Today, its use is spreading to fields such as oil and gas, mineral exploration and academia.

Above (clockwise from top left): Among those chartered recently were Malcolm Brown, Graham Brown, Jonathan Turner, Mike Daly and Mike Harris

Developing interest in these sectors has led the Society to introduce an additional application route for Fellows with 20+ years' professional experience. We are pleased to announce that Mike Daly (Executive Vice President Exploration BP), Malcolm Brown (Executive Vice President Exploration British Gas), Jonathan Turner (Deputy Chief Geologist British Gas), Graham Brown (Chief Geoscientist Anglo American), Mike Harris (Technical Director Business Development Rio Tinto), David Giles (Principal Lecturer Engineering Geology MSc, Portsmouth University), Tim Jones (Director of the Taught Masters Programme, Cardiff University) have all become Chartered recently. A considerable number of other senior geologists have expressed intent to apply and we expect their applications shortly.

Applications for Chartership remain buoyant with over 100 applications each year including ones from Hong Kong, New Zealand, Australia and the USA. In order to service this demand we are still looking for experienced CGeols to act as Scrutineers. If anyone has five or more years' post-Chartership (or extensive experience pre-Chartership) we would ask you to apply to be a Scrutineer.

If you are interested in becoming a Scrutineer, please download the job description and application form from the website **www.geolsoc.org.uk/scrutineers** or contact **Bill Gaskarth** for further details **chartership@geolsoc.org.uk**

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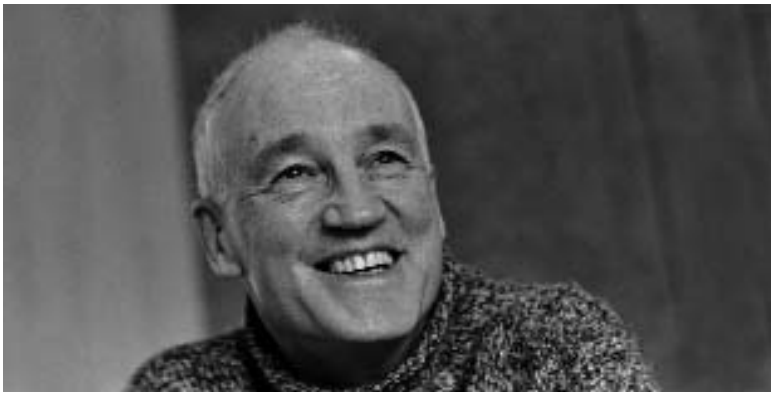

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Holding a title such as CGeol indicates to the outside world that you are a professional whose competence is recognised by your peers and whose work can be trusted. It provides assurance to your clients and the general public, and marks you as a professional practitioner. Similar status is afforded to Fellows holding the CSci title.

Previously CGeol was valued most by engineering geologists and others who work alongside Chartered Engineers and where a professional qualification was necessary in order to sign off reports, etc. Today, its use is spreading to fields such as oil and gas, mineral exploration and academia.

Above (clockwise from top left): Among those chartered recently were Malcolm Brown, Graham Brown, Jonathan Turner, Mike Daly and Mike Harris

Developing interest in these sectors has led the Society to introduce an additional application route for Fellows with 20+ years' professional experience. We are pleased to announce that Mike Daly (Executive Vice President Exploration BP), Malcolm Brown (Executive Vice President Exploration British Gas), Jonathan Turner (Deputy Chief Geologist British Gas), Graham Brown (Chief Geoscientist Anglo American), Mike Harris (Technical Director Business Development Rio Tinto), David Giles (Principal Lecturer Engineering Geology MSc, Portsmouth University), Tim Jones (Director of the Taught Masters Programme, Cardiff University) have all become Chartered recently. A considerable number of other senior geologists have expressed intent to apply and we expect their applications shortly.

Applications for Chartership remain buoyant with over 100 applications each year including ones from Hong Kong, New Zealand, Australia and the USA. In order to service this demand we are still looking for experienced CGeols to act as Scrutineers. If anyone has five or more years' post-Chartership (or extensive experience pre-Chartership) we would ask you to apply to be a Scrutineer.

If you are interested in becoming a Scrutineer, please download the job description and application form from the website **www.geolsoc.org.uk/scrutineers** or contact **Bill Gaskarth** for further details **chartership@geolsoc.org.uk**

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Masters of mapping?

WRITTEN BY MARK BRODIE

Mark Brodie* wonders whether the time has come to map out a new future for the undergraduate geologist's skill-set

Ask any geology student about their dissertation, and you will almost always hear a story of 'mapping'. This skill is marketed by fledgling geologists; carbon copied onto every socially networked CV, and plastered across their A4, double-sided paper counterpart. But who cares?

How many geologists start or even end their career mapping? I, like many of my peers, started my geological career on a rig. I remember my first day well – bewildering! Not only was the mechanics and the process of drilling completely alien to me, but my primary role as a 'geo' was indeed far from familiar. I had never seen a rig before, nor did I know much of the skill of logging; yet I was a master of mapping. Sure, I had logged vertical sections before, on an outcrop on a windswept Dorset beach; and I had read of geotechnical logging techniques. I had even logged a section from an old, battered core box. My job in industry was however quite different.

DATED

While I have no doubt that my traditional geological education was of the highest calibre and has furnished me with the firmest of foundations, I wonder if it was outdated. Do we need to replace this approach based on ancient crafts with an insight into more relevant job-skills? And if we did, what would be the alternative?

First, the skill of mapping could be given a diet, as far as the curriculum is concerned. Should a geologist not have the option for mapping to be one of several skills available to them as they finalise their education, and not be apparently the sole goal in their technical education? While field work is a critical and defining feature of our subject, what proportion of geologists actually work 'in the field'? Many never have. Some never will.

WIRELINES

Rarely do universities teach in any depth the subject of wireline geophysics, for example - a fundamental skill to those in almost all in mineral, hydrocarbon, and even some environmental and hydro geologist roles. Perhaps we might consider also teaching undergraduates something of drilling engineering? Should we not also offer some guidance on project management? The basics of investment finance? Or is it is as simple as making a clear connection in our teachings between what we are teaching and its relevance?

I am not suggesting simply a more vocational approach to geology. I recognise that some of my suggestions may sound woolly. What I am suggesting is greater insight into how education relates to a geological career, and the skills in use day-to-day, as a geologist in today's world. This seems quite far removed from those of our tweed-clad forbears, whose work, at times, our education system strongly recalls.

***Mark Brodie** is currently studying for a PhD. He was formerly a wellsite geologist

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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 – as a rule of thumb, anything over a few hundred kilobytes should do.

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).

> I RECOGNISE THAT SOME OF MY SUGGESTIONS MAY SOUND WOOLLY. WHAT I AM SUGGESTING IS GREATER INSIGHT INTO HOW EDUCATION RELATES TO A GEOLOGICAL CAREER, AND THE SKILLS IN USE DAY-TO-DAY, AS A GEOLOGIST IN TODAY'S WORLD
> **Mark Brodie**

EXCITED ABOUT POTASSIUM

Linda Campbell, Mark Tyrer and **Alan Dyer*** explore some emerging new insights into the geological and planetary occurrences of this common element

Any attempt to inspire geologists with enthusiasm for a common and almost ubiquitous element in the Earth's crust has to be slightly audacious! Nevertheless, as world population is predicted to hit nine billion by 2050, there is an imperative to better understand natural K-cycling as demand for fertilizers from mined K-resources increases[1]. While potash resources, evaporites and authigenic mineral reactions have largely (and appropriately) been the domain of sedimentologists, it is now time for the wider mysteries of K concentration and cycling to be revisited across disciplines

MYSTERIES

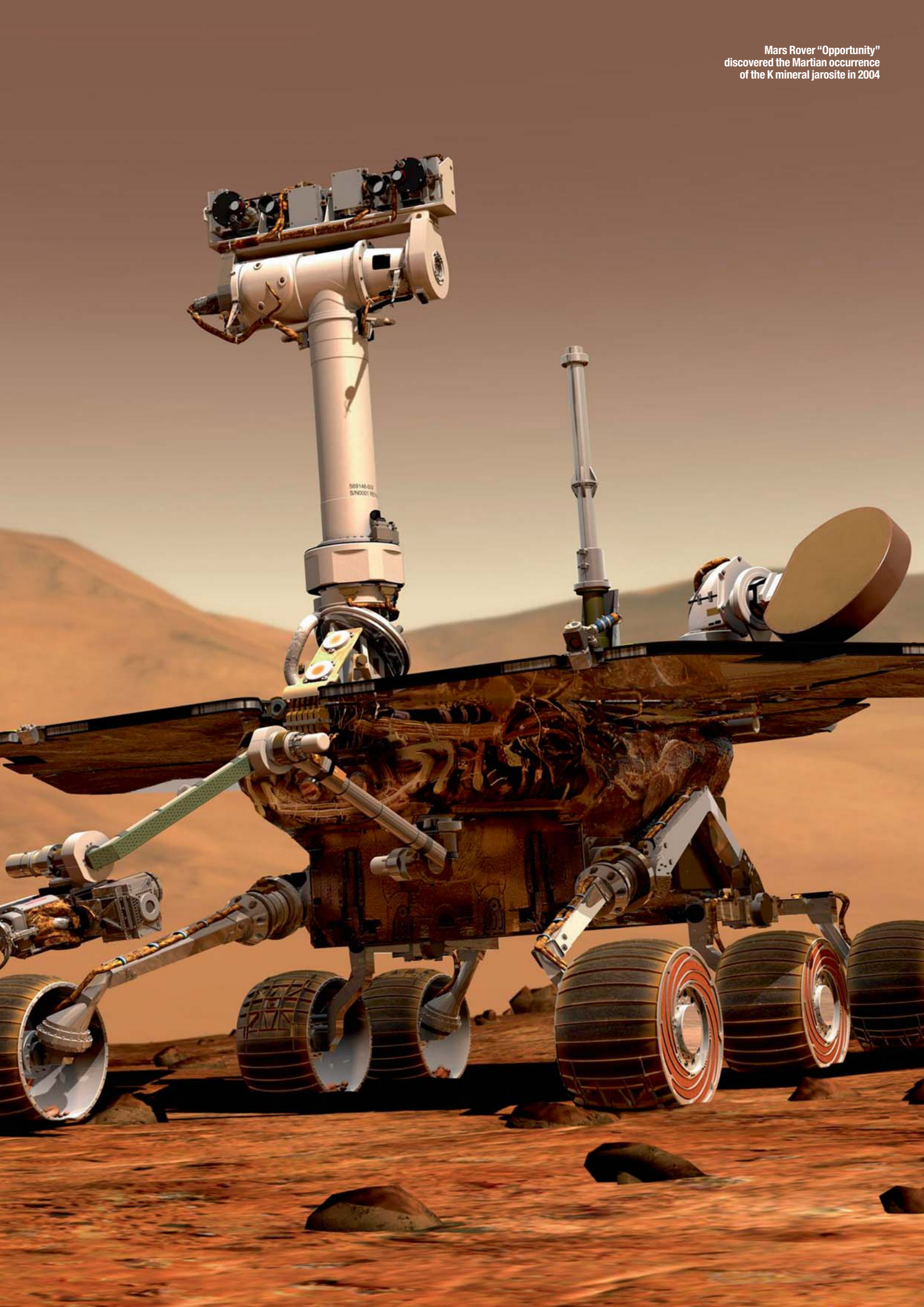
Within the last decade, an esteemed sedimentologist allegedly commented "…but we still don't know where the potassium comes from", in relation to brine sources and authigenic K-feldspar replacement, in a cross-continent study. This is an intriguing and compelling comment about a common element which follows the fundamental rules of chemical behaviour in geology, and which is so familiar to us all in the chief rock forming minerals. The comment is mirrored by news of the abundant occurrence of ultramafic-associated jarosite, $KFe_3(SO_4)_2(OH)_6$, on Mars.

Jarosite usually forms in acidic environments from the microbially-mediated oxidation of pyrite, but it is now heading for spotlight attention, not least because of its Martian occurrence and relationship to water, but also because of reports of an uncharacteristic occurrence in a high-pH saline lake environment on Earth[2]. It is thought that the saline lake occurrence is also the result of pyrite breakdown, where acidic conditions prevail just at the mineral surfaces. Continental lake evaporites, supplying K resources mainly from the mineral sylvite, have compositions distinctively different from seawater-derived evaporites. They are discussed in a detailed review[3], in which some, but not all of the mysteries of potash deposits are explained in relation to patterns of ages and tectonic settings.

These seemingly diverse topics all drive research questions towards the concentration and cycling of K in magma-mineral-fluid systems. It is here, and especially in East African studies, that we find a focus of expertise on rift-associated alkaline environments[4,5,6], and where perhaps some clearer understanding might be found.

CROSS-DISCIPLINARY

A new hypothesis and conceptual model has been introduced[7] on the shared links between alkaline rocks, zeolite minerals and carbonatites (igneous rocks with >50% carbonate minerals - see also Obituary, p28). Presented as a potential *resource pathfinder* innovation (especially for rare earth elements (REE) from carbonatite suites), and noting the implications for estimating volcanic contributions of carbon to the atmosphere (see **https://dco.gl.ciw.edu/news**), the globally applicable hypothesis outlines a natural 'masquerade' scenario. Essentially, it is proposed that the continental, bedded zeolites represent 'hidden' alkaline pyroclastic deposits, most probably originally accompanied by magmatic carbonate. If the model is examined in the context of the hot spring saline lakes of East Africa, the brines can be shown to be related to the fluid plumbing system of the magmatism (K-rich in places) in this region. ▶



Mars Rover "Opportunity" discovered the Martian occurrence of the K mineral jarosite in 2004

▶ So, to better understand evaporitic potash, we can look to investigations of the mineral reactions occurring in these dynamic surface environments, where contact with the atmosphere changes lava crusts within hours of eruption[8] (pictures, right). The interplay between Na and K during these processes helps to explain how K is concentrated in evaporite deposits, as chlorides (e.g. sylvite and carnallite) and in some K-rich zeolites such as phillipsite, clinoptilolite and merlinoite, derived from bedded tuffs.

PRESERVATION

Nowhere else is the preservation issue of these silica-undersaturated igneous rocks so strikingly demonstrated as in the present day East African volcanics. For carbonatite science however, the preservation-pattern of extrusive products in the geological record is problematic because carbonate might have other, non-magmatic sources, and the alkali elements Li, Na, K, Rb and Cs are highly mobile. Add to this, the huge diversity of alkaline rock types plus the subsequent domination of Si-buffered alteration fluids in continental settings, and it is plain to see that the waters become muddied (literally – with clay minerals!). Perhaps the masquerade hypothesis[7] could prove to be helpful, highlighting the contribution of natural zeolites as transient 'staging posts' *en route* to more stable, preserved assemblages (e.g. with K-feldspar) in longer geological histories?

Natural processes therefore demonstrate that alkaline alteration is critical to the staged release of K from an aluminosilicate environment to a hydrated one, where it readily becomes exchangeable in a diverse suite of zeolite minerals. The known value of zeolites in agricultural applications also becomes evident[9], and it comes as no surprise that alkaline rocks are being trialled as fertilizers due to their high reactive susceptibility, releasing their K relatively easily from feldspathoid minerals[1]. For micas, K is readily released by ion-exchange.

VALUE OF ZEOLITE

Generally, the major element compositions of zeolites provide a clue as to the compositions of the precursor components. Classic examples are the K-rich zeolites montesommaite, merlinoite, phillipsite, chabazite and erionite from the ultrapotassic region of central Italy, and Ba-rich edingtonite in zeolite assemblages from carbonatite localities in the Kola Peninsula, Russia, Mont St. Hilaire and Ice River in Canada, and Jacupiranga in Brazil. Zeolite formation is favoured by high pH, low-Si conditions, and for the abundant, economic, continental-bedded types, alkaline volcanic glass compositions are ideal precursor materials[4]. Where zeolites have not been subject to progressive reaction processes, their trace element compositions also appear to preserve alkaline and peralkaline REE signatures too[7].

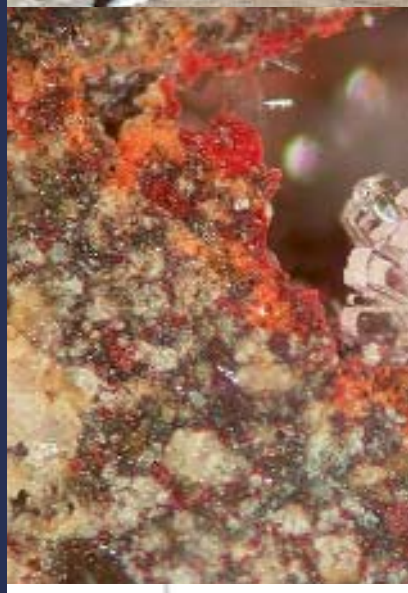
Using the revelatory evidence from the carbonatite community of spatially-consistent repetition of alkaline-carbonatite magmatism over vast perisods of geological time (billions of years[5]), a superb opportunity for resource exploration beyond evaporitic potash deposits exists. Young zeolites associated with continental extensional tectonic regimes, especially where continental saline lake environments are identified, are suggested as obvious prime target regions for mineral exploration, because ancient systems that have concentrated the ores could have occurred in the same places. The Mountain Pass REE deposit, lying under a large province of young bedded zeolites is a case in point, but in isolation, is merely interesting rather than serving as convincing evidence. With global applicability, the zeolitic masquerade model therefore provides considerable scope for locality-specific testing where known deposits occur, including deposits of non-marine potash.

FUTURE

The scientific value of K in understanding Earth system science is considerable. So to what extent can we work backwards along zeolitic and evaporite-mineral reaction paths to reach alkaline-carbonatitic rock compositions in bedded successions that are difficult to explain with conventional models? The abundance and widespread occurrence of zeolite minerals (particularly K-rich varieties and their potential contributions to geological problem-solving and to resource needs) therefore demand renewed attention. More background data are needed to create 21st Century impacts from the *zeolitic pathfinder* hypothesis, and these are achievable with wider-academic and industrial engagement.

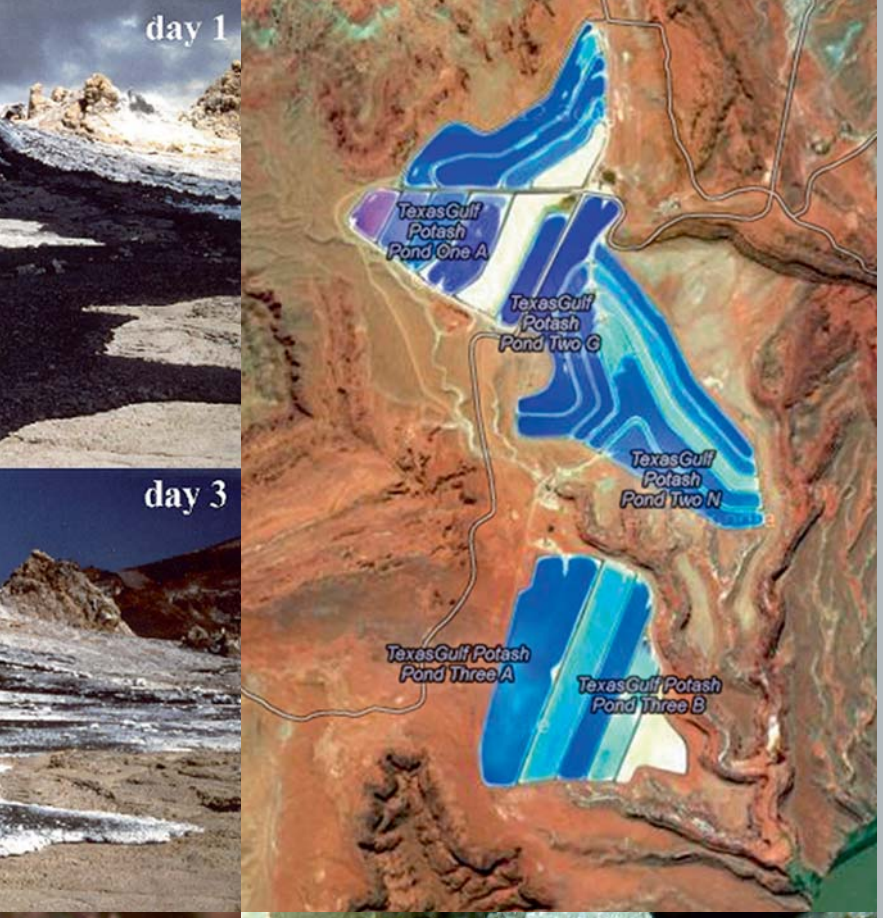
Recent rejuvenation of interest in NE England *marine* potash resources[10] is undoubtedly symptomatic of the global revitalization of fertilizer demand. With fundamental scientific research potential and the driving force of increasing global resource needs, getting excited about potassium is timely. ■

Ol Doinyo Lengai hornitos of natrocarbonatite lava (East Africa), studied by Anatoly Zaitsev

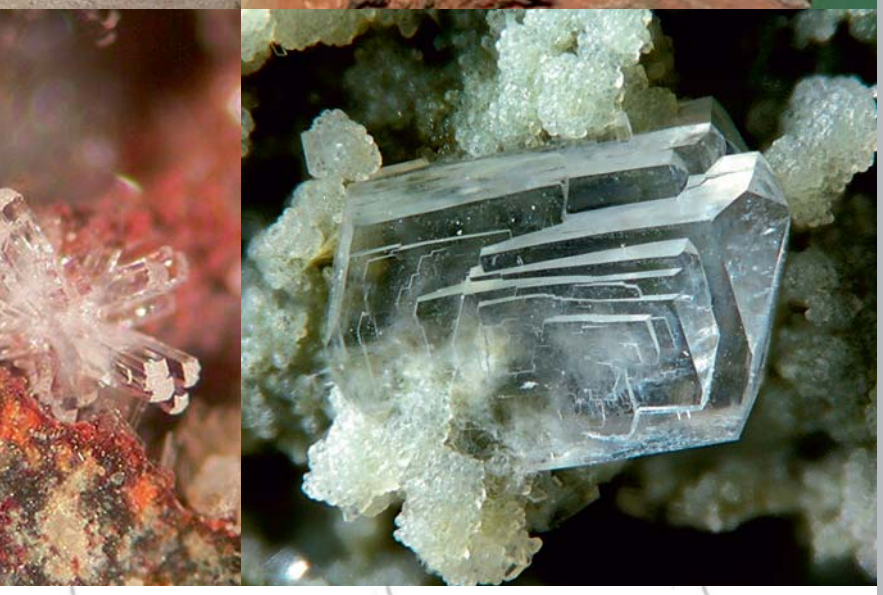


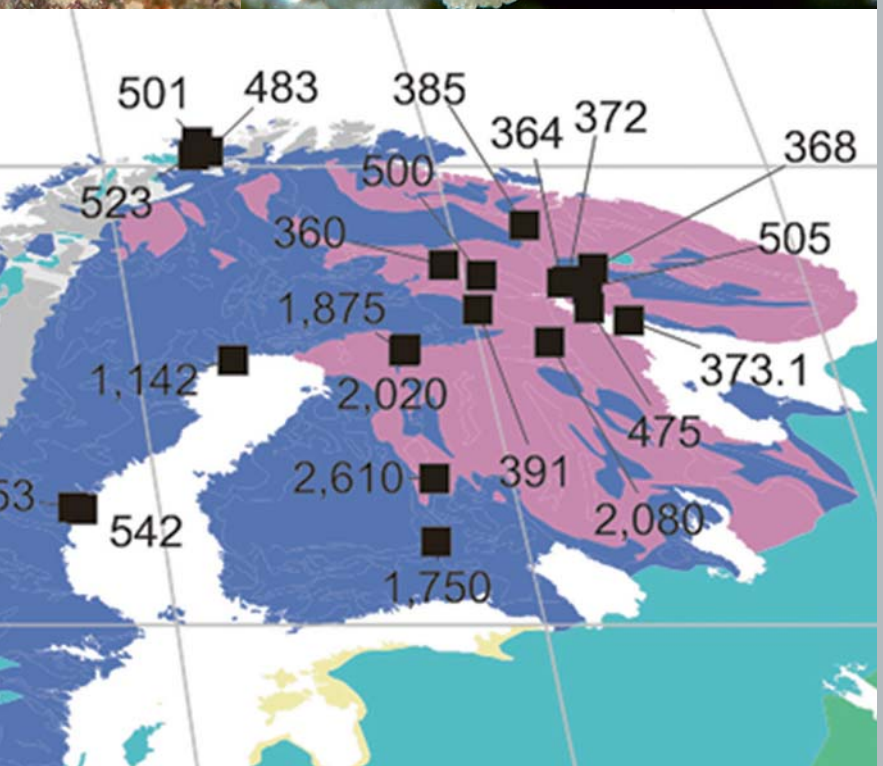
Merlinoite - a K-rich zeolite mineral, derived from bedded tuffs. Far right – Clinoptilolite

Scandinavia map. Extract from Woolley and Kjarsgaard (2008a) showing repetition of carbonatite occurrence with time. Ages in Ma



Moab potash evaporation ponds near the Colorado River in Utah





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ACKNOWLEDGEMENTS

Anatoly Zaitsev for Oldoinyo Lengai hornitos - with permission license from Elsevier. Mars landscapes, courtesy NASA/JPL-Caltech. Scandinavian carbonatites' map - open access, Geological Survey of Canada. Other figures from Wikipedia Commons and **Linda Campbell**.

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QUESTION TIME

Adler deWind * reports on a recent Society submission to the House of Commons Science & Technology Committee on public understanding of climate change

Questions, questions. These days it is not unusual for Parliamentary committees or Departments of State, when calling for evidence, to issue a set of more or less specific questions to which respondents are requested to reply. Answering them is not compulsory, of course; and if they are smart, learned societies will leave many of them unanswered because they lie outside the remit of those organisations. Individuals can afford to be less constrained about offering their opinions, and there is nothing to stop anyone making statements if they feel that they have something to say that is not addressed by the questions. However there are those who feel that this tendency to ask specific questions might be a thinly disguised effort by those in power to 'tramrail' discussion.

Above: How does the Society interact with the Mother of Parliaments?

So, when the Society made its submission (*Geoscientist June 2013 p.6*)[1] it chose not to answer all the questions raised by the Inquiry for the very reason that any answers would lie outwith the Society's remit. However, that judgement is often a fine one. The question it chose to focus on, *'How could public understanding of what is meant by climate change be improved? What are the main barriers to this?'* might not on the face of it look very geological. Yet for the Society it had clear Earth science implications because it went to the root of one major source of public mistrust (and denialist misinformation), namely climate modelling.

PUBLIC DEBATE

Anyone following the public debate on climate change will have noticed that the science most often quoted is dominated by atmospheric science, oceanography and predictive climate modelling - much reliance therefore being placed on 'present day' observations and data from what to geologists constitutes the recent past. This was evident in the Royal Society's (September 2010) report *'Climate Change: a summary of the science'*, which


Image: Claudio Divizia / Shutterstock.com

referred to the historical past and to data from air bubbles trapped in ice cores up to 800,000 years old, but to no older data. As the Society pointed out to the Committee, 'This is very recent in geological terms' – a fact that might come as a surprise to many non-geologists.

Thus, the climate change narrative communicated to the public (by governments and others), shaped as it is by this rather limited science base, is vulnerable to attack. We saw the result when email records at the University of East Anglia's Climatic Research Unit were made public.

The Society pointed out that the geological record contains abundant evidence of how the Earth's climate has changed over *hundreds of millions of years*. This evidence includes direct and proxy data for ocean and atmosphere, including temperature, ocean acidity and oxygen levels, oceanic productivity, sea-level change and atmospheric composition, including CO_2 concentrations. This broader evidence base, showing that the climate has undergone many fluctuations over this extended time, is entirely independent of both atmospheric modelling and data from the recent past, so making it invulnerable to attacks on those procedures.

PAST CLIMATE CHANGE

On several previous occasions, including 55, 120 and 183 million years ago, carbon has been rapidly injected into the atmosphere, triggering significant changes in climate. These included temperature increases of at least 5-6ºC globally (more near the poles) in the 55 Ma event, increased acidity and decreased oxygen levels in the oceans, increases in sea-level, and widespread extinctions. The submission pointed out that the source of this carbon was undoubtedly 'fossil', probably methane from collapsing hydrate deposits on the seabed; though CO_2 from massive emissions of lava in plateau basalts is another possible scenario in this and other past carbon release events.

The important thing for politicians to grasp is that although ▶

Image: UK Parliament via Flickr.com

Full house? The number of MPs with science qualifications remains vanishingly small

Image: Mike Dunn NOAA Climate Program Office, NABOS 2006 Expedition

Image: Slim Sepp / Shutterstock.com

Climate change rates high on the public and political agenda, along with natural hazards of all kinds, from earthquakes and eruptions to flooding and subsidence

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Far left: Coal-fired power station – sustainable energy?

Left: Rebmann Glacier, Kilimanjaro

these major environmental changes happened rapidly (not by Parliamentary standards, but over perhaps hundreds or a few thousands of years), the climate then took 100,000 or more years to recover. Emissions of CO_2 from human activity since 1750 amount to perhaps a quarter to a third of the amount of carbon released during the 55 Ma event, and are happening at least 10 times faster. Moreover, irrespective of the success of global efforts to curb anthropogenic emissions, this release of carbon into our atmosphere will continue for several decades at least.

The Society highlighted recent research into ice cores containing bubbles of trapped air, which date back as far as 800,000 years, updating the evidence cited in the Royal Society's 2010 report. As of early 2013, this research debunks the theory that the rise in global temperatures during the Ice Age preceded the increase of atmospheric CO_2 levels. Refinements to the technique used to date air bubbles in the ice cores have revealed that, rather than being sequential, these increases were simultaneous – CO_2 levels in the air increased whenever temperatures rose, though over this period rates of increase of CO_2 were 10 to 100 times slower than in the past 100 years.

COUPLED

It is therefore clear that on no matter what scale - millions of years, or tens of thousands of years - CO_2 and temperature have always changed together. Indeed, basic physics suggests that there is good reason to think that the two are causally linked. The Society pointed out that these various pieces of geological data allow us to calculate the sensitivity of the atmosphere to a doubling of CO_2, *independently of climate models*. The fact that climate sensitivity, as calculated from observed geological data, matches climate models quite well, lends the latter great credibility.

The Society published a public statement about the climate change evidence contained in the deep geological record in November 2010[2], prepared by a working group with a wide variety of relevant expertise. This submission urged that paying greater attention to this (independent) disciplinary approach to climate change science can deepen public understanding and add resilience to efforts to build public trust and engage the populace in efforts to reduce carbon emissions.

Right: Climate debate cannot profitably be carried on in a vacuum of Earth science knowledge

Image: paintings / Shutterstock.com

EXPERIMENT

It is often said, for example, that in continuing to emit carbon at current levels, we are running an 'unprecedented' or 'uncontrolled' experiment on the Earth system. This seems like an attempt to invoke a 'precautionary principle' approach; but while many may find it persuasive, many more do not. It might be more fruitful instead to highlight the natural analogues for this so-called 'experiment', citing events that have actually occurred in the geological past, such as the 55 Ma event (the Paleocene-Eocene Thermal Maximum, or 'PETM'). The key question then becomes – are we now recreating the conditions that led to the PETM? The answer to that is surely clear.

The Society also said it believed there was scope to improve engagement between different scientific 'tribes'. On the one hand, we have climate modellers and atmospheric and ocean scientists with knowledge of evidence from the recent past. On the other stand geoscientists whose expertise relates to the deep geological record. The design and parameters of the predictive models used in forecasting, based as they are largely on current observations and data from the recent past, need to draw more heavily on research into rapid climate change events in the deeper geological past. Such collaboration would test and improve the performance of predictive models and should be encouraged.

Finally, in a plea for more (or no reduction in) relevant research, the Society concluded by pointing out that better understanding of past climate change will result from greater investment in sampling the geological record. This is, mostly, hidden - either in ice cores, or in deep ocean sediments requiring deep ocean drilling or piston coring for collection.

***Adler deWind** writes exclusively for *Geoscientist* on science policy, mining and metals. He may be contacted via the Editor.

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1 www.geolsoc.org.uk/pu-climate-change

2 www.geolsoc.org.uk/climatechange

South of Scotland - Fourth Edition

Applied geologists in the UK are lucky that we have BGS to provide good and generally reliable background information on the geology across the whole country. From time to time people may moan about how long it takes for a map to be revised or a new edition of a book to be produced – my personal grumble is the Pateley Bridge sheet, still the 1889 Old Series edition – but when the product is out the quality is obvious and has improved over the years.

The new series of regional guides is a case in point. Starting with *Pennines and adjacent areas* in 2002 and culminating in *South of Scotland* in late 2012 seven new guides have been produced. The improvements over the earlier ones are obvious at a glance. The use of full colour throughout hugely improves the clarity of photographs, maps and diagrams and greatly enhances the value of the book to its readers. An extract of the 1: 625 000 bedrock map extending to the area surrounding the region is also provided in a pocket inside the back cover.

To my mind however, the most significant improvement is that each book puts the regional geology into a wider context - not just the surrounding area but also the global palaeogeographical history, thereby giving the reader a far better explanation of how the various rock-types relate to each other and making the books valuable teaching aids and sources of information at all levels. Each edition addresses applied geology in a chapter on *Geology and Man* covering the geological resources in the region, man's activities that are causing impacts such as mineral exploitation and waste disposal and geology-based threats such as earthquakes.

The new *South of Scotland* edition replaces the 1971 version and incorporates much of the research completed during the intervening four decades. A quick examination of the reference lists for each chapter shows significant numbers were published after 1990 with many since the millennium building on the knowledge from earlier work. As with the others in the series I am pleased to own a copy and know that I will get valuable information from it as well as the enjoyment of learning more of the geology of this area.

Sadly, the great improvement in the new series of regional guides underscores the paucity of those that are yet to be revised, particularly *East Anglia and adjoining areas* and the *Wealden district*. Seven new editions in a decade is a praiseworthy achievement but with another 16 to go (depending how they are counted) we can only hope that BGS are able to increase the rate at which these revisions take place.

Reviewed by ***Rick Brassington***

SOUTH OF SCOTLAND – 4TH ED.
STONE P *et al.* Published by: British Geological Survey
2012 ISBN: 978 085272 694 5 Pbk 247pp
List price: £18.00 http://shop.bgs.ac.uk/Bookshop/

Novel Science

The way in which we imaginatively re-create the past is - like all minefields – a dangerous landscape, greatly in need of a philosophical map. Adelene Buckland, lecturer in 19th Century Literature at King's College London, has made that journey, and attempts – triumphantly – to get inside the heads of those generations who wrote into existence a properly scientific geology and simultaneously made their greatest contribution to literary form - the 19th Century novel.

Early geologists were deeply concerned with finding appropriate literary (as well as visual) forms that would convey their discoveries without traducing them. The act of writing was for them as essential a part of scientific practice as any other, and they looked to contemporary writers for models. Meanwhile, novelists like Scott, Eliot, Kingsley and even Dickens drew from the new science (and the awareness of deep time that it brought to popular consciousness), and found a new profundity with which to disturb, interrupt and enrich their narratives.

Historians may find it amusing that uniformitarianism – or 'measuring the past by the ruler of the present' – is a sin they would call whiggishness: one which Buckland studiously avoids. Yet as constraint on imagination it proved the salvation of historical geology. The other turning point was the foundation of this Society in 1807, which eschewed theorizing in favour of information-gathering. Together, uniformitarianism and theory-free observation laid geology's claim to realism, rigour and respectability.

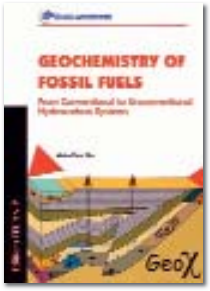
Geologists fretted about embodying their science in literary forms that might do violence to their quest for academic dignity, and this anxiety predisposed them against plot. Geologists worried deeply about being coerced by the dictates of motive (i.e., theory), and reviled those popularisers who sought to make their work palatable by succumbing to it. They wished to purge romance - and yet, even as they espoused more classical models, they kept the public's attention by becoming the romantic heroes of their own personal dramas.

Nineteenth Century novelists, meanwhile, were also laying claim to intellectual high ground, by dissociating themselves from the low-status romancers of previous eras. As both groups strove to attain realism, geologists discovered Scott - and he them. The story of how they, and successive generations of geologists and novelists, helped one another to write the past into existence, is Buckland's material.

Since 1983, when Gillian Beer produced her seminal *Darwin's Plots*, the relationship between science and literature has proved a rich seam of inquiry. Buckland shows herself equal to this multidisciplinary challenge, and demonstrates comprehensively how wrong scientists might be, should they wonder if anything new remains to be said about the 19th Century novel.

Reviewed by ***Ted Nield***

NOVEL SCIENCE – FICTION AND THE INVENTION OF NINETEENTH CENTURY GEOLOGY
ADELENE BUCKLAND, Published by: Chicago UP 2013.
ISBN 978-0-226-07968-4 Cloth. 364pp
List price: £29.00 www.press.uchicago.edu



Geochemistry of Fossil Fuels

This book is an excellent and informative introduction to the major aspects of the geochemistry of fossil fuels, in particular of petroleum systems. Alain-Yves Huc is a world-renowned specialist in the field, with an extensive publication history in the subject and is well placed to provide, as intended, a general summary of the topic. The book is well written for the technical specialist, yet easy to read and hence will appeal to a wider audience including both non-specialists and undergraduate students interested in the field (perhaps even, as suggested by the author, serving as course material for teaching purposes).

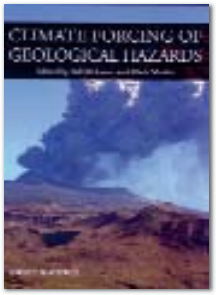
The book is well structured, beginning with an introduction into the basics of oil and gas composition which lays excellent foundations of understanding for the more junior reader. The main focus of this volume is the functioning of a petroleum system, which is covered by an extensive second chapter. This progresses logically through source-rock formation, oil and gas generation to migration. Of particular interest is the insight into basic methods of source-rock assessment. Here the author covers the key elements of source rock analysis both routine and alternative in sufficient detail to allow understanding without overloading the reader.

Reservoir geochemistry and the effects of biological, physical and chemical processes, including biodegradation and thermal cracking within the reservoir and its influence on the hydrocarbon end product, are covered briefly. A short chapter exploring production geochemistry, reservoir fluid composition and production monitoring, is also included. The book concludes with an informative chapter devoted to hydrocarbons in 'unconventional' settings - particularly of interest as these fuel sources are becoming an increasingly significant part of our energy supply. The settings are explored as part of the 'extended petroleum system' and include oil shales, gas hydrates, geological biogas, coal and coal-bed methane.

Diagrams and figures are ample and informative. Plentiful annotated colour photographs and diagrams accompany the text. The author has provided a comprehensive index as well as plentiful useful references throughout, which along with the selected additional readings makes this a good reference volume (though one might complain that some of the references are quite old). An interesting read, both for those in the field and others with a general interest in the subject.

Reviewed by ***Laura McParland***

GEOCHEMISTRY OF FOSSIL FUELS: FROM CONVENTIONAL TO UNCONVENTIONAL HYDROCARBON SYSTEMS
HUC H Y, Published by: Editions TECHNIP (2013) ISBN: 978-2-7108-0990-6 (pbk) 254pp.
List price: £50.00, www.editionstechnip.com



Climate Forcing of Geological Hazards

In the preface to this volume, the editors state their intention that it should reinforce the notion that anthropogenic climate change will directly impact upon the geosphere. In this excellently illustrated and well communicated text, and they certainly achieve this. Bringing together an impressive range of expertise, this collection of papers outlines numerous ways by which changes in climate force a dynamic response in the form of multiple natural hazards.

The first two chapters present an overview of key relationships, establishing the big picture, and describe the relationship between climate and the geosphere response. These two chapters alone are a rich source of information and inspiration for further reading. They also benefit greatly from a number of helpful summary tables. For practitioners, policy-makers and others interested in global environmental change, they offer an informative and convincing overview.

For academics, students and professionals, chapters three through 12 give the detail, case studies and 'further reading' lists that they will expect. Each chapter examines in detail a particular climate-geosphere relationship and its impacts. Chapters three to five examine the impact of climate change on various volcanic processes and hazards. Chapters six to seven explore how faults and earthquake activity may be influenced by climate. Chapters eight to nine examine the relationship between climate and mass movements (including tsunamigenic submarine mass failures). Chapter 10 gives a regional overview of the impacts of climate change on natural hazards in the European Alps. Finally, chapters 11 to 12 assess the stability of gas hydrates.

While each of these chapters offers a valuable insight, one personal 'highlight' that demonstrates the approach and utility of this book is chapter four, which gives a thorough overview of the interaction between climate, ice and volcanic hazards (including eruptions, mass movements and flooding). In a truly multi-hazard way, this chapter highlights the significant interactions between climate, ice formation and volcanic processes and hazards. It contains generous illustrations, well organised ideas, good detail and an outline of further work required to refine our understanding.

Through the relationships between climate and geological/geomorphological processes, the authors reaffirm the importance of a holistic approach to the study and management of natural and anthropogenic hazards. This excellently illustrated book offers readers from a variety of backgrounds something of interest, in a highly stimulating read.

Reviewed by ***Joel C Gill***

CLIMATE FORCING OF GEOLOGICAL HAZARDS
BILL MCGUIRE AND MARK MASLIN (eds), Published by: The Royal Society/John Wiley & Sons, Ltd 2013 xiii+311pp ISBN 978-0-470-65865-9 (Hbk)
List price: £75.00 http://eu.wiley.com/ ▶

Da Vinci's Water Theory

During a recent family visit to Milan, we found Leonardo Da Vinci's *Last Supper* needed weeks pre-booking to see. Instead, we visited the Science Museum displaying Da Vinci's scientific work alongside models of his inventions. When my 11-year old son asked what Da Vinci did, I replied 'many things, but I think not hydrogeology' (my own profession). Moments later I was in front of a display titled 'The Stratification of Rocks' describing Da Vinci's studies of rivers, erosion and sedimentation. Intrigued, subsequent Googling led me to this publication.

It presents a human and fallible side of Da Vinci, supported by quotes from his own writings. It includes an overview of prior hydrological knowledge, explaining that some philosophers developed a good understanding of the water cycle from as early as 500 BC. Good work, however, was often separated by centuries and an absence of scientific journals meant no universal understanding of hydrology was established before the 18th Century.

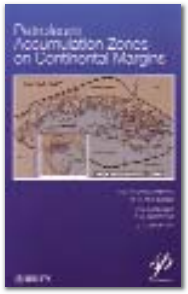
The book demonstrates nicely how science progresses through a combination of need and curiosity. Da Vinci's life-long interest in water was triggered by knowledge of devastating floods, and a need to better protect cities and populations, leading to work on flood-control projects. But as an observer and artist, he was also fascinated with water and its power for its own sake, as in the book's cover illustration of a storm.

Da Vinci was perhaps the first empirical hydrologist committed to a logical process as in this note to himself: "Remember, when you speak about water, to show first the experience and then the interpretation". He is a little unfairly accused of being incorrect about some things – for example, that rainfall is insufficient to fully explain all river flow. More fairly, he was a pioneer of scientific method, which means first working through some 'wrong' theories before finding righter ones. Notably, he was prepared to modify his views according to evidence, and was remarkably accurate in many things, including: cloud formation and rain; river meandering, and how water takes on a character representative of all it has passed through. He also designed instruments to measure such things as wind-speed, humidity and water flow.

Of 13,000 pages of notes at his death, only half remain, and in dispersed collections. The authors must therefore be commended for their detective work in piecing together Da Vinci's water theories in an informative and entertaining read.

Reviewed by ***Peter Easton***

LEONARDO DA VINCI'S WATER THEORY: ON THE ORIGIN AND FATE OF WATER
PFISTER L, SAVENIJE H H G & FENICIA F, Published by: the International Association of Hydrological Sciences 2009 IAHS Special Publication 9. ISBN 978-1-901502-34-3 92 p **List price: £25.00** **www.iahs.info**



Petroleum Accumulation Zones on Continental Margins

This is an extremely wide-ranging review of petroleum systems along continental margins, both present day and in the geological record. Although there is a reference to the substantial oil and gas in the Russian margins in the very first paragraph, this book is mainly, but not exclusively, a treatise on exporting the Russian methodology outside Russia.

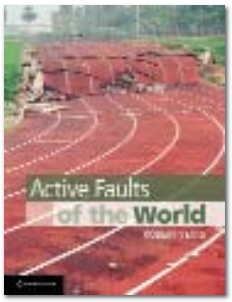
The book has two main sections, 'topped and tailed' by an introduction on methodology and a concluding section highlighting the potential use of the methods set out in the book. These two main sections highlight examples of petroleum provinces in the two main genetic continental margins – Atlantic (extensional) and Pacific (compressional). A wealth of technical information is presented on each example in this whirlwind tour. It is not clear why the North African Basins such as Sirte are classed as 'continental margin' settings, but they could qualify in that these basins 'attempted to form' continental margins.

The methodology is, in effect, to describe petroleum plays as having certain potential in terms of barrels/km^2. Although very broad brush, it is very useful in frontier areas and I have found myself looking at field analogues in terms of barrels/km^2 as a 'sense check'. Certainly one can argue the USGS approach to its Worldwide Resource Assessments is in essence the same strategy, with analogues used to guide the boundaries of the parameter distributions in the software model.

The one criticism I have is that the translation from Russian is laboured and makes for a difficult read, especially in the introductory sections. The use of obscure terms such as 'naphtide' and 'domanikite' could have been better thought through. However, there are gems - such as the statistic that there is as much Jurassic-Pliocene sediment preserved in continental margins as on the continents themselves. I found the basin reviews – four to five pages on each basin – extremely well done, making this book a useful addition to reference when charged with that elusive task of replacing reserves from more and more distant and lesser known basins.

Reviewed by ***Paul Barrett***

PETROLEUM ACCUMULATION ZONES ON CONTINENTAL MARGINS
GRIGORENKO Y N et al,2012. Published by : John Wiley & Sons. ISBN: 978-1118385074 448pp
List Price £130.00 **http://eu.wiley.com/**



Active Faults of the World

This is a high quality book, well-written with many informative diagrams, useful maps and geological sections. There are many references and a comprehensive index. It is suitable for both academics and students and is particularly good for

engineering geologists, civil engineers and planners. It is also useful reference for analysts and consulting firms.

The author notes that the study of faults requires the understanding of several areas of geology, including tectonics, plate tectonics, structural geology, geodesy etc.

He considers regional seismic hazards and active earthquake faults worldwide and then puts them into a regional seismic and plate tectonic context.

Many faults and types of fault from around the world are discussed as are their associated volcanoes and microplates. All the usual suspects turn up: San Andreas, East African Rift, Indonesian thrust, Red River etc. Followed by a discussion on how the earthquakes can be dated; e.g. from historical records to ^{14}C dating to correlation with dated tephra. Histories of some plate movements are given (e.g. the Caribbean, N and S American plates) together with their associated faults.

The book treats South America and the Andes at some length, but does not neglect the other remnants of Pangea, including Europe. The Dead Sea Fault is discussed in considerable detail. The author focuses on the effects of earthquakes (including tsunamis) and on faults with the potential to destroy large cities both in the developed and developing world.

He then moves on to the value of planning for large-scale projects such as nuclear power plants, hydroelectric dams and oil pipelines. The book provides an important basis for upgrading building standards and other laws in developing nations.

It looks at the impact of major quakes on social development through history. Two examples are the 1505 earthquake in Kabul, which killed hundreds of people, and the quake which probably caused the destruction of the biblical cities of the plain, Sodom and Gomorrah.

This fascinating and comprehensive survey provides interest for the general geological reader, the planner and the engineer facing the daunting challenge of construction in unstable regions. Highly recommended.

Reviewed by ***Steve Rowlatt***

ACTIVE FAULTS OF THE WORLD
ROBERT YEATS, Published by: Cambridge University Press 2012 Hbk ISBN: 978-0-521-19085-5 621pp
List price: £50.00 www.cambridge.org

Under the Surface

High volume hydraulic fracturing and horizontal drilling techniques have allowed natural gas and oil in Devonian shales to be exploited across the United States of America, and will likely be coming to a basin near you, soon. The growth and impact of this controversial industry has polarised opinion and finding an impartial source of information is difficult, especially when some leading academic geologists have been funded by the industry.

As a welcome antidote to the bias in so much coverage, this is a scrupulously balanced journalistic account of events during the shale-gas boom in Pennsylvania from 2007 to 2012. Sadly for some of those involved, it is like a story of a 'speed-dating' night leading to an inevitable divorce five years later. The author uses official documents, eyewitness testimony and transcripts of meetings to set the various scenes, from the geology and fracture sets of the Marcellus Shale, through the nefarious activities of the gas companies' land-men buying up leases, to the high hopes of landowners and leaseholders, and their eventual disappointment.

The story takes a turn for the worse, for some, when 'incidents' occur in the vicinity of drill rigs - methane explosions at domestic wells, diesel and wastewater spills, and private water supplies turning brown and frothy. Lawyers and lawsuits soon follow, and New York State bans 'fracking' while it learns from the problems encountered in Pennsylvania.

This is a faultlessly edited book, scholarly in its attention to detail and to its sources, but still manages to enthrall like a page-turning thriller. The author makes sure the facts are presented accurately and fairly, but also manages to slip in colourful details like the pattern on a lawyer's tie and a leaseholder's hairstyle. It would have benefited from a map of the locations discussed, specifically in New York and Pennsylvania. It will make interesting reading for energy company executives, activists on both sides of the debate, geologists interested in the personal impact of their science, and anyone who may one day be living in the vicinity of a gas pad or thinking of signing a lease with a shale-gas company.

Reviewed by ***Lewis McCaffrey***

UNDER THE SURFACE: FRACKING, FORTUNES, AND THE FATE OF THE MARCELLUS SHALE
TOM WILBER, Published by Cornell University Press, 2012, ISBN: 978 0 8014 5016 7 hbk 272pp
List price: US$27.95

REVIEWS: COPIES AVAILABLE

Please contact **ted.nield@geolsoc.org.uk** if you would like to supply a review. For a full list go to **www.geolsoc.org.uk/reviews**

- **NEW! The Rocks of Anglesey's Coast** by Jack and Susan Treagus 2013 191pp Gwasg Garreg Gwalch sbk.
- **NEW! GEOLOGY OF IRELAND - a field guide** by Pat Meere et al., 2013 The Collins Press sbk 372pp
- **NEW! OXFORD DICTIONARY OF GEOLOGY & EARTH SCIENCES** Michael Allaby (Ed) 4th Edn sbk 660pp Environmental Debt - the hidden costs of a changing global economy. By Amy Larkin Palgrave Macmillan 245pp hbk
- **World Mineral Production** 2007-2011 BGS NERC 76pp sbk
- **Atlas of Benthic Foraminifera** by Ann Holbourne, Andrew Henderson and Norman MacLeod. 2013 Wiley-Blackwell 642pp hbk
- **The Coast of the Bristol Region: Quaternary Geology and Geomorphology** Compiled by David Case. Geologists' Association Guide No 71. 152pp pbk
- **Forensic Seismology and Nuclear Test Bans** by Alan Douglas. Cambridge University Press 2013 514pp hbk
- **Radioactive Waste Management** 2012 by Nick Evans (ed) Mineralogical Magazine #501 December 2012. Mineralogical Society. pp 2865-3507 sbk
- **Earth Dynamics - deformations and oscillations of the rotating Earth** by D E Smylie. Cambridge University Press 2013 hbk 543pp.
- **Global Optimization Methods in Geophysical Inversion** (2nd Ed) by Mrinal K Sen and Paul L Stoffa. Cambridge University Press 2013 289pp hbk
- **Disaster Deferred - a new view of Earthquake Hazards** in the New Madrid Seismic Zone. (2012) by Seth Stein. Columbia University Press pbk, 282pp
- **Continuum Mechanics in the Earth Sciences** by William I Newman Cambridge University Press
- **Theory of Reflectance and Emittance Spectroscopy** (2nd Edn) by Bruce Hapke. Cambridge University Press.

PEOPLE

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

CAROUSEL

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

DAVE JONES

Dave Jones of Natural Resources Wales has been granted an award under the Society's Distinguished Geologists' Memorial Trust to allow him to attend the 40th Annual Congress of the IAH in Perth Western Australia. The theme of the meeting is 'Solving the Groundwater Challenges of the 21st Century'. Dave is a hydrogeologist, a member of Council, and has recently (June 2013) become a CGeol.

IAIN STEWART

Iain Stewart, Honorary Fellow of the Society and well known broadcaster, has been awarded an MBE in The Queen's Birthday Honours List 2013 in recognition of his services to Geology and Science Communication.

PAUL MALIPHANT

Paul Maliphant has been appointed Development Director with Mott MacDonald Ltd, based in Cardiff. Paul, a former VP of the Society and a UK Registered Ground Engineering Adviser, has nearly 30 years' experience in mining and civil engineering. He recently authored *Integration of Geotechnical Risk Management in Project Risk Management* linked to his initiative to enhance delivered value through effective geotechnical risk management in construction.

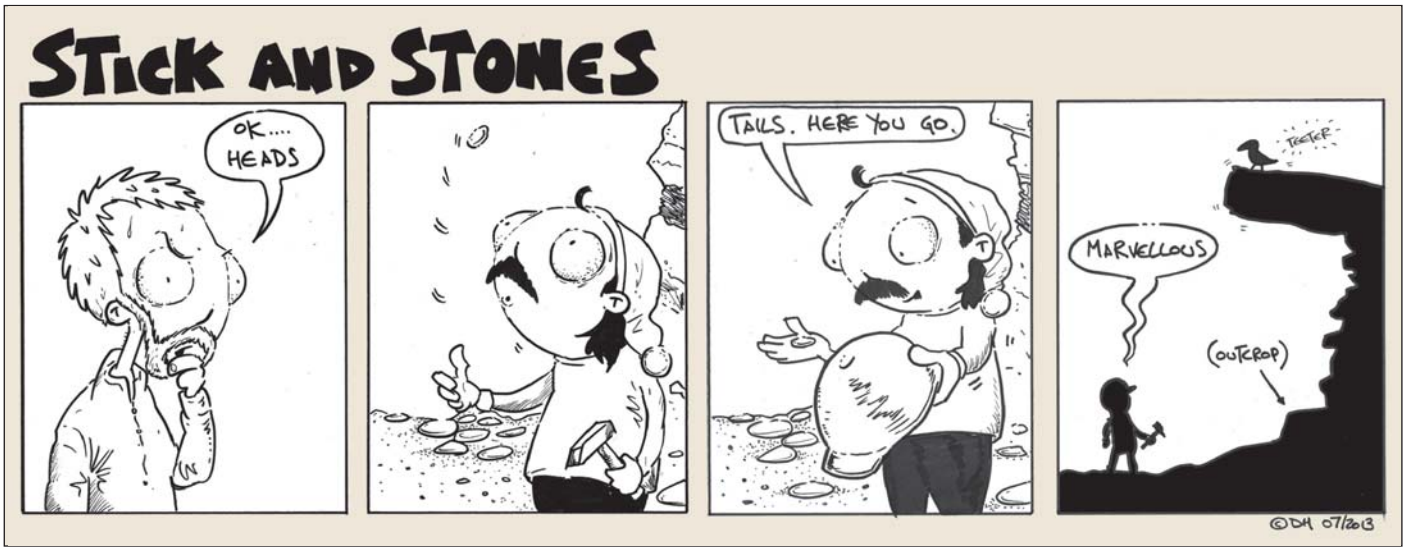
KEN MCCLAY

Ken McClay (together with John Shaw and J Suppe) has been awarded the Robert H. Dott Sr. Memorial Award for "AAPG Memoir 94: Thrust Fault-Related Folding." The Award is made to honour and reward the author/editor of the best special publication dealing with geology published by the Association.

JOHN UNDERHILL

John Underhill has been awarded the Grover E. Murray Memorial Distinguished Educator Award of the AAPG for distinguished and outstanding contributions to geological education, both at the university level and toward education of the general public.

Prof. Underhill has also been appointed Chair of Exploration Geoscience in the Institute of Petroleum Engineering (IPE, Herot Watt University). He takes up the new post this month, moving from his previous role in the Grant Institute of Geology (University of Edinburgh) where he has been Professor of Seismic and Sequence Stratigraphy since 1998.



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.

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

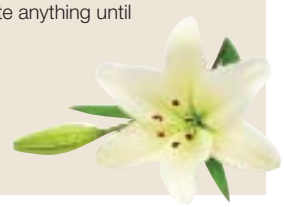
THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Bestow, Trevor *
Blackburn, James Kirk *
Bowen, Myles *
Bowler, Christopher Michael Lance *
Chapman, W T *
Holroyd, J D *
Hudson, Neal F C *
Jacqué, Maurice *
Jones, Brian Lloyd *
Middleton, John *
Miller, James *
Million, Ronald *
Moffatt, William
Stewart *
Rose, Howard *
Vincent, E A ('David')*
Whyte, Martin A
Williams, Colin L *
Willis, John Humfrey A

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

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

Deceased Fellows for whom no obituary is forthcoming have their names and dates recorded in a Roll of Honour at **www.geolsoc.org.uk/obituaries**.



DISTANT THUNDER

A word to the wise

As geologist and science writer Nina Morgan discovers, bricks and mortar are not always the best investment

'Naming opportunities' are all the rage. Soliciting a substantial donation in exchange for the privilege of having one's name attached to a handsome new or refurbished building is a popular way for institutions to raise much needed funds and for donors to ensure immortality. But buildings alone do not a museum or university make – a sentiment strongly felt by the geologist Charles Lyell (1797 – 1875).

In a letter written in February 1836, Lyell warns his friend, Gideon Mantell (1790 – 1852) about the evils of architects. Mantell, who in 1885 discovered *Iguanodon*, the second type of dinosaur formally recognised, was raising funds to establish a museum in Brighton to display his collection.

"… I had not time to tell you when you were here, how much I apprehend that the architect will run away with whatever money a zeal for science or friendship and regard for you may raise by subscription at Brighton," Lyell writes.

" I remember that when some £8000 had by great effort been got together at Bristol, for lectures, and for a collection of books and other useful aliment for the mind, as the misguided projectors thought; in came the architect, gave them a handsome building, pocketed the cash, and left them with a room for the newspaper readers, and scarce a farthing to pay their invaluable curator, Millar…

"…the planners of the London University followed the same track, and spent several hundred thousand pounds in erecting a huge and never-to-be-finished edifice … and leaving nothing for professors but debt. Then came the King's College, and another splendid subscription, for the is no end to the gullibility of John Bull …

Had they hired a set of the ugliest houses in the Strand, and bribed, with their two or three hundred thousand pounds, the first teachers in Great Britain, they would have carried everything before them. But what did they do? Reared a huge wing of a building that swallowed up all the money … There is no hope for natural history or science or literature, until they precede, instead of following, the architect.

"Having spent all the money and mortgaged the handsome edifice, there will be nothing left for the Mantellian collection. Still left for the lectures. Try and preach against this, though I have but faint hope." A sentiment to which many of today's collection managers, curators, educators and university lecturers can only add Amen!

ACKNOWLEDGEMENT
Sources for this vignette include: Life Letters and Journals of Sir Charles Lyell, Bart. Author of Principles of Geology &c, Edited by his sister-in-law, Mrs Lyell, In 2 volumes – Vol 1 With Portraits, London, John Murray, Albemarle Street, 1881; the Wikipedia entry for Gideon Mantel;

Gideon Mantell

The entry for Gideon Mantell by Dennis R. Dean, in the *Oxford Dictionary of National Biography*.

If the past is the key to your present interests, why not join the History of Geology Group (HOGG). For more information and to read the latest HOGG Newsletter visit the new HOGG website at: **www.historyofgeologygroup.co.uk** where you'll also find abstracts for the talks and posters.

* **Nina Morgan** is a geologist and science writer based near Oxford

OBITUARY

ROBERT ANDREW SCOTT 1960 – 2012

Highly regarded geologist who devoted more than twenty years to Arctic research

Robert Scott, 51, died on 26 September 2012 following a sudden diagnosis two weeks earlier of acute myeloid leukaemia. He had recently returned from fieldwork in Taimyr, Arctic Russia.

Robert was born on 19 October 1960 in Goole, East Yorkshire, to Charles and Kathleen. He gained his BSc in Geology from the University of Bristol in 1982, where he had already met his future wife, Mary, on the same course. Robert completed his PhD at the University of Manchester, on the structure, stratigraphy and origin of metamorphosed stratabound mineralisation within the Argyll Group of Dalradian rocks near Tyndrum, in Perthshire, Scotland. Robert also worked briefly for scientific publishers Elsevier in Oxford, where his skill with the editorial 'red pen' was firmly established: numerous CASP geologists recall Robert's tireless pursuit of succinct and grammatically perfect scientific writing.

SVALBARD

In 1989, Robert joined the Cambridge Arctic Shelf Programme (CASP) at the University of Cambridge. Over 23 years he contributed formidable effort to unravelling the mysteries of the Arctic geodynamic jigsaw, undertaking ten field seasons to Svalbard, Canadian Arctic Islands, Polar Urals, Novaya Zemlya and Taimyr Peninsula.

Robert's knowledge of the Arctic was encyclopaedic. His collaborations included one with the United States Geological Survey to produce an acclaimed GIS-based tectonic map of circum-Arctic petroleum potential, and Arctic sediment provenance studies with the Universities of Uppsala and Stockholm. He participated in the 2004 'Bedrock' expedition, a collaboration with Swedish and Russian research groups, and the first western geological expedition to Novaya Zemlya since the 1930s.

Robert returned to northern Novaya Zemlya in 2005, identifying bitumen occurrences and hydrocarbon seeps, as well as sampling for apatite fission track studies. In 2007, Robert turned his attention to the Canadian Arctic islands, focusing on Axel Heiberg Island, and returned in 2009 to Ellesmere Island. In 2010 and 2012, his focus was Taimyr in Siberia, in collaboration with the Swedish Polar Research Secretariat.

Robert was always great company on tough field expeditions, where, day after day, he loved to hike miles across the tundra; he is remembered for his team spirit and quick humour. He regularly chaired sessions and presented at international conferences, and served on the Geological Society's Petroleum Group Committee from 2008 to 2011, contributing to the organisation of Petroleum Geology Conferences. He edited conference reports, most recently *'Sediment Provenance Studies in Hydrocarbon Exploration and Production'* (Special Publication 368 of the Geological Society of London, to be published 2014). He also made a key contribution to the Geological Association's *'Geological Conservation Review Series – the Dalradian rocks of Scotland'* (2013).

PASSION

Robert read widely, especially on travel and exploration, and was an 'armchair' economist, historian and politician. He was a keen wildlife photographer and helped instil in his children a shared passion for Alpine hiking. Robert was an expert organic gardener, vegetarian cook and bread baker. He loved classical music and jazz, and encouraged his children greatly in all things musical.

Robert is mourned by Mary, his wife of almost 25 years, daughter Louisa (b. 1995), son Alexander (b. 1998), mother Kathleen, brother Peter, and by many friends and colleagues at CASP and across the Arctic geological community.

By **Mary Scott** and **Christine Brouet-Menzies** (Managing Director, CASP), with contributions from **Li Guo** (CASP) and **Vicky Pease** (Stockholm University)

CAN'T FIND YOUR MEETING? VISIT WWW.GEOLSOC.ORG.UK/LISTINGS FULL, ACCURATE, UP-TO-DATE

ENDORSED TRAINING/CPD

Course	Date	Venue and details
Lapworth's Logs	n/a	'Lapworth's Logs' are a series of e-courses involving practical exercises of increasing complexity. **Contact:** info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

DIARY OF MEETINGS AUGUST 2013

Meeting	Date	Venue and details
ISARC 2013 and 23rd World Mining Congress and Expo 2013 Canadian Institute of Mining, Metallurgy and Petroleum	11-15 August	**Venue:** Palais des Congrès de Montreal. **Convener:** Chantal Murphy, Canadian Institute of Mining Suite 1250 3500 de Maisonneuve Blvd.W., Westmount, Canada QC. H3Z 3C1 **E:** cmurphy@cim.org **W:** www.cim.org
Impacts and their role in the evolution of life Nordic Network of Astrobiology	16-25 August	**Venue:** Georg Ots Spa Hotel in Kuressaare, Estonia and the Kaali impact crater site on the island of Saaremaa, Estonia. Course aimed at masters and PhD students. Contact Wolf Geppert **E:** wgeppert@fysik.su.se **W:** www.nordicastrobiology.net/Impacts2013.
2013 China International Offshore Oil and Gas Exhibition Beijing Zhenwei Exhibition Co. Ltd., China Petroleum and Petro-chemical Equipment Industry Association	20-22 August	**Venue:** Shanghai New International Expo Center, China. Fpr information see website. **Contact:** Norla Rong, 801, Building E, Kaixuancheng, 170 Beiuyan Road, Chaoyang District, Beijing China. **T:** +86 10 5823 6560. **E:** norlarong@zhenweiexpo.com **W:** sh.ciooe.com.cn/2013/en/

OBITUARY

JOHN BARRY DAWSON 1932-2013

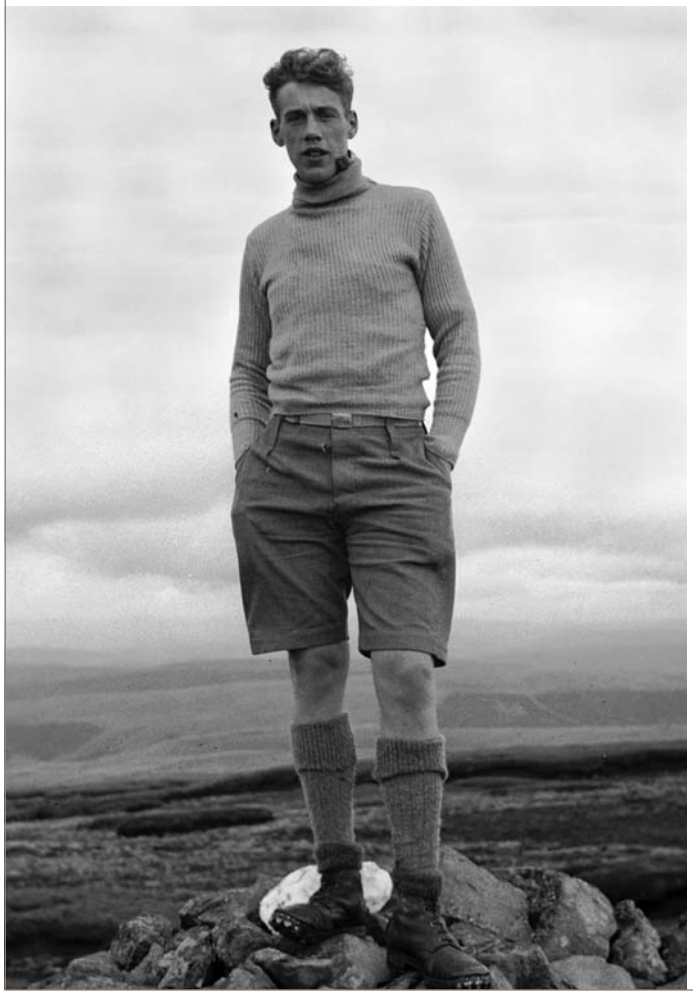
Outstanding expert on kimberlites, carbonatites, rift magmatism and mantle melting

It is with a mixture of sadness at his passing and joy at his memory that we pay tribute to an outstanding geoscientist and great man, Barry Dawson.

'INDIANA JONES'

Barry was an outstanding igneous geologist whose world-class research on kimberlites and their xenoliths, carbonatites and rift-related magmatism significantly improved our understanding of the mantle and its melting. Moreover, his collection of xenoliths and East African Rift volcanics will remain an outstanding resource for decades to come. He was the 'Indiana Jones' of igneous petrology – returning from remote regions with exceptional geological specimens, and many an amazing tale to recount.

Barry began his studies at Leeds University in 1953, graduating with First Class Honours in 1957 and subsequently a PhD on the kimberlites of Basutoland (Lesotho). He later gained international recognition in kimberlite research for his discovery of diamond in garnet lherzolite, his documentation of the MARID suite of mantle xenoliths, and his studies of mantle metasomatism. Barry joined the Tanganyika Geological Survey and was despatched to examine the 1960 eruption of Ol Doinyo Lengai. He found that many of the fresh lava flows were solidified from molten sodium carbonate, and so resolved the controversy over the origin of carbonatites in the most dramatic way possible - by discovering them erupted from a volcano.



He went on to determine the physical and chemical properties of natrocarbonatite lavas, re-visiting Ol Doinyo Lengai in 1988 to witness this extraordinary volcano in eruption (see p12). On leaving Tanganyika in 1962, Barry took up a Postdoctoral Fellowship in Dalhousie University, Nova Scotia. He was appointed to a lectureship at the University of St Andrews in 1964, and promoted to Professor in 1975. In 1978 he became the Sorby Professor of Geology in the University of Sheffield, moving to Edinburgh in 1989 as Professor of Geology until his retirement in 1997. He did not 'retire', but became a very active Emeritus Professor - his latest paper being published in January 2013.

YORKSHIREMAN

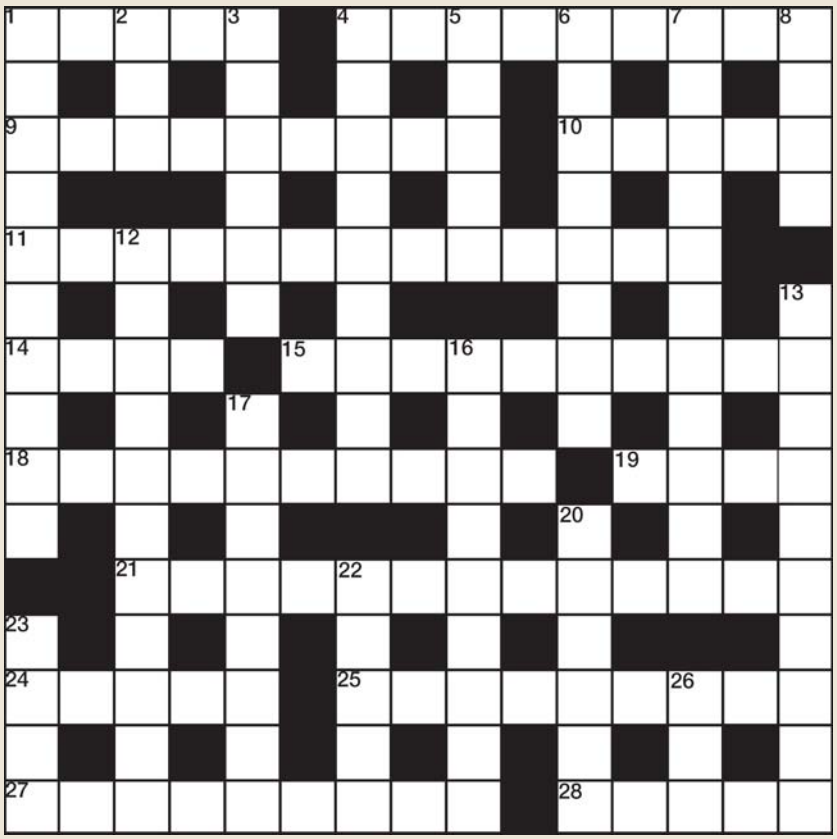
Despite his many years in, and love of, Scotland, Barry remained a proud Yorkshireman. He was excellent company and a great raconteur, always ready with a tale to tell. He was exceptionally generous with his time, wisdom and advice, both to colleagues and postgraduates. He was greatly appreciated for this – in Edinburgh the postgraduates attending our petrology seminar spontaneously raised glasses of fine malt to toast his memory.

Barry lives on through his scientific legacy. He published numerous papers, a seminal textbook, *Kimberlites and their Xenoliths*, and collaborated widely. He gained many awards, including election to the Royal Society of Edinburgh in 1972, the Norman L Bowen Award of the American Geophysical Union in 1987, election to the Fellowship of the German Academy of Sciences in 1994, the Clough Medal of the Edinburgh Geological Society in 1999, and the Mineralogical Society's Collins Medal in 2012.

We will all miss Barry, but he hasn't gone completely. Like the Cheshire Cat in *Alice's Adventures in Wonderland*, he has faded but his grin will remain with us for a long time to come.

By **Simon L Harley** and **J Godfrey Fitton**

CROSSWORD NO. 171 SET BY PLATYPUS



ACROSS

1 Tectonic crock (5)
4 Clickable links (9)
9 Short-lived, like mayflies, magazines and desert torrents (9)
10 Ecuadorian capital (5)
11 Break in a sequence (14)
14 Wise brush (4)
15 Falling outside the usual range (10)
18 Wind speed measuring device (10)
19 Seismic reflection (4)
21 Done according to the rules governing non-numerical mathematical objects (13)
24 Herbivorous odd-toed ungulate (5)
25 Four folds, 12 leaves, 24 pages (9)
27 Kentish headland, a cuspate foreland protecting Romney Marsh (9)
28 Vertical or subvertical sheet-like intrusions (5)

DOWN

1 Mosaics of calcite crystals, formed by neomorphic aggregation of aragonite mud (10)
2 Burned residue (3)
3 Devonian moorland bordering the Bristol Channel (6)
4 Capable of being passed down through generations (9)
5 A monumental gateway in the form of a pair of truncated pyramids (5)
6 Masses for the dead (8)
7 Relating to a gearing system involving one or more outer gears revolving about a central, or 'sun' gear (11)
8 Two-beat diagonal gait of the horse (4)
12 Division into classes (11)
13 Having identical meaning (10)
16 +, -, or x for example (9)
17 Eurasian carnivorans noted for 'giggling' during intercourse (8)
20 Concrete-layer or plasterer's smoothing/levelling tool (6)
22 Amateurish or incompetent building work (5)
23 Dry (4)
26 Kind (3)

WIN A SPECIAL PUBLICATION

The winner of the June Crossword puzzle prize draw was Dr Graham West of Wokingham.

All correct solutions will be placed in the draw, and the winner's name printed in the October issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - 20 August**.

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

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

Name .....

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Membership number .....

Address for correspondence .....

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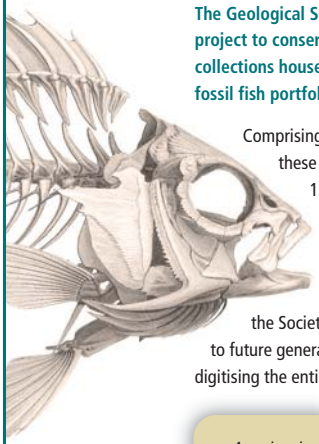
Postcode .....

SOLUTIONS JUNE

ACROSS:
1 Phyla **4** Tasmanian **9** Rankinite **10** River
11 Heterogeneous **14** Troy **15** Cryogenics
18 Troglodyte **19** Salt **21** Polypropylene
24 Cleft **25** Isomerism **27** Theosophy **28** Equal

DOWN:
1 Pyrrhotite **2** Yon **3** Apiary **4** Triggered
5 Stein **6** Aureoles **7** Investigate **8** Nora
12 Troposphere **13** Isothermal **16** Orthodoxy
17 Ululates **20** Xylene **22** Primp **23** Scat **26** IOU

Sponsor-a-Fish!



The Geological Society's Library needs your help with a new project to conserve and digitise one of the most important collections housed in the Geological Society's Archive: the fossil fish portfolio of Louis Agassiz (1807-1873).

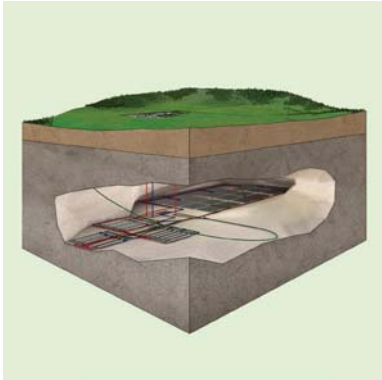
Comprising nearly 2,000 watercolours and drawings, these images of fossil fish, dating from the 1830s-1860s, were copied from private and public collections around Europe, principally by the German artist Joseph Dinkel. For many years the drawings were kept in a trunk in the Museum and later in different places around the Society. We would now like to make them accessible to future generations of researchers by conserving and digitising the entire collection.

Agassiz gained international recognition as the leading figure on fossil ichthyology after the publication of the five volume Recherches sur les Poissons Fossiles, lavishly illustrated with 400 lithographic plates of fish (1833-1843). In 1836 he was awarded the Geological Society's Wollaston Medal.

How you can help

If you would like to help the Library and Archive in this project, a small contribution of £20 will allow us to carefully clean, conserve and digitise one fish. The names of all sponsors will be included in a roll of honour in the Archive and on our website. If you would like to make a more substantial contribution please contact us to discuss the options.

To make a donation or for more information:
www.geolsoc.org.uk/sponsorafish



Chief Geologist and Senior Research Managers (x2) – Geosciences

A unique opportunity to join the team developing a major, high profile, complex project. Utilise your specific understanding of geosciences as part of the team preparing for and investigating potential sites for the geological disposal of radioactive waste.

About us

Dealing with the past. Protecting the future.

The Nuclear Decommissioning Authority (NDA) has been appointed by the Government to implement geological disposal for higher activity radioactive waste. Our Radioactive Waste Management Directorate (RWMD) is being developed into a wholly owned subsidiary and a nuclear Site Licence Company (SLC), which will progress this vital work. RWMD will develop a Geological Disposal Facility (GDF) and associated transport system based upon a robust geoscientific understanding of a candidate site(s).

Chief Geologist

Harwell, Oxfordshire
Attractive salary

3 year fixed term appointment (negotiable)
Approximately 3 days per week

About the role

We are looking for a Chief Geologist to join us to provide an authoritative position on Earth sciences and all aspects of geological disposal at this critical stage in our GDF programme.

Specifically, you will develop and communicate strategic approaches to generic and site specific Earth science issues relating to deep geological disposal and provide advice on geological aspects of RWMD's technical programme. As a senior representative of RWMD, you will interact with a wide range of external contacts including potential volunteer communities, the Geological Society, British Geological Survey, academia, expert advisory panels and international sister organisations. The role will require extensive travel within the UK and some international travel.

About You

A Professor in Earth sciences, you will have proven conceptual thinking skills and a demonstrable independent outlook to provide technically excellent and critical inputs to NDA RWMD geological strategy. Your outstanding interpersonal and communication skills will have been used to communicate complex messages to a wide range of audiences. You can demonstrate strong engagement and influencing skills. You will be seeking an opportunity which enables you to broaden your experience whilst maintaining some of your current research interests.

Senior Research Managers – Hydrogeochemist and Structural Geologist/Geophysicist

Harwell, Oxfordshire preferred, other UK NDA offices considered

Circa £50,000 pa plus bonus and relocation assistance

About the roles

We are looking for two new members to join us at a critical stage in our GDF programme. These are influential roles which provide an excellent opportunity to help shape our ways of working.

Apply

To apply please forward your CV and a covering letter identifying which role you are applying for to rwm.recruitment@nda.gov.uk by the closing date of 2 September 2013.

To find out more about the work of the NDA and RWMD visit www.nda.gov.uk

Senior Research Managers – Hydrogeochemist

You will be responsible for the specification, acquisition, processing, interpretation and modelling of hydrochemical data from geological investigations as appropriate. You will liaise extensively with specialist suppliers to provide information needed to undertake hydrogeochemical work in support of the Government's siting programme for a geological disposal facility. Other external contacts include the Geological Society, British Geological Survey, academia, expert advisory panels and international sister organisations. Your work will include the development of the hydrogeochemical aspects of needs-driven plans for surface-based and underground investigations and inputs to site identification and selection processes.

Senior Research Manager – Structural Geologist/ Geophysicist

You will be responsible for the specification, acquisition, processing, interpretation and modelling of structural geological and geophysical data from geological investigations as appropriate. You will liaise extensively with specialist suppliers to provide information needed to undertake structural geological and geophysical work in support of the Government's siting programme for a geological disposal facility. Other external contacts include the Geological Society, British Geological Survey, academia, expert advisory panels and international sister organisations. Your work will include the development of the structural geological and geophysical aspects of needs-driven plans for surface-based and underground investigations and inputs to site identification and selection processes.

About you

Your keen understanding of the relevant aspects of geoscientific investigations and site characterisation will be underpinned by a good first degree and PhD in science or engineering. You will hold, or be working towards, chartered membership status in a relevant professional institute. You will have significant experience and knowledge of the range of data acquisition and interpretation techniques available to characterise the geoscientific aspects of sites and the deep geosphere in particular. Excellent interpersonal and communication skills are vital to success.

NDA
Nuclear Decommissioning Authority

The Geological Society

serving science & profession

Founders' Day

LECTURE & DINNER 2013

THE GEOLOGICAL SOCIETY WAS INAUGURATED ON FRIDAY 13 NOVEMBER 1807 BY THIRTEEN GENTLEMEN OVER DINNER AT THE FREEMASONS' TAVERN, COVENT GARDEN.

TO CELEBRATE THE SOCIETY'S INAUGURATION, WE WILL BE HOLDING OUR ANNUAL FOUNDERS' DAY LECTURE AND DINNER ON WEDNESDAY 13TH NOVEMBER 2013.

Founders' Day Lecture

James Parkinson and the Founding of the Geological Society

Speaker: Dr Cherry Lewis, *University of Bristol*

At the age of 16, James Parkinson (1755-1824) was apprenticed to his father to learn the 'art and mystery' of being an apothecary. Living all his life in Hoxton, then a village on the outskirts of London, his pioneering work in medicine led to him identifying the Shaking Palsy as a distinct medical condition, which eventually became known as Parkinson's disease. His favourite past time, however, was collecting fossils. This talk will review Parkinson's remarkable life, including his involvement in a plot to kill King George III, how he put the study of fossils on the scientific map of Britain through his three volume work Organic Remains of a Former World, and how his expertise as the country's only 'fossilist' led to him becoming one of the 13 founders of the Geological Society.

Founders' Day Dinner

Venue: Le Meridien, Piccadilly · **Dress:** Black Tie · **Ticket price:** £80

After dinner speaker: TBC

Timings:

17.30	Tea & coffee served, Burlington House
18.00	Lecture by Dr Cherry Lewis
19.00	Drinks reception at Le Meridien
19.45	Presentation of The Neftex Earth Model Award
20.00	Dinner served
21.30	After dinner speaker
24.00	Carriages

Contact details:

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