

Geoscientist

Volume 19 • No 7 • July 2009

Society gets younger
PGC7 - a tale of two meetings
TELLUS





Lithography rules

The reader survey reveals strong reader preference for print, says Ted Nield

It is six years since we last conducted a survey of our faithful readers, and much has changed at *Geoscientist* since then. The magazine has gone all-colour; we print on higher quality paper; we have put on pages and, most important of all, we have gone online. We think we have got better – but it was time to ask your opinion. We were so overwhelmed by your response that (for the purposes of this editorial only) I shall relax our rule about never beginning sentences with figures.

We received 234 responses, 96.6% from Fellows, and roughly two thirds were submitted online. 95.3% agreed (41% strongly) with the statement that you “look forward to receiving *Geoscientist*” – an increase of 20 percentage points on 2003. 82% agreed (24% strongly) that *Geoscientist* was “one of the main benefits of Fellowship”. So far, so good. Now for the *really* good news.

99.5% agreed (39% strongly) that *Geoscientist* copy was “well written” – an increase of just over 15 percentage points on 2003, and 92.3% agreed (35% strongly) that the copy was pitched at the right level. Moreover, in a pleasing tribute to the late Carol Liddle, whose design template this is, 92.7% agreed (32% strongly) that the magazine was attractive – up 20% over 2003.

You delivered a clear message that “online only” was not an option, with 88% of you agreeing (53% strongly) that you would “miss receiving a paper copy”. Although 34% of respondents admitted to looking at the online version, which was very pleasing, only 2.5% of respondents *only* looked at the online version, while 66% of respondents only read the print version.

An overwhelming 92% of you said you preferred to read *Geoscientist* in print, and 78% said they would not read *Geoscientist* (or would read it less often) if it were only online. Conversely, 8% of respondents said you would not read the magazine (or would read it less often) if it were only in print. As a broad-minded readership, 92.7% said that the magazine should, nevertheless, be available both in print and online. A larger than expected percentage – 46% – said they would sign up for email alerts, while 64% said that *Geoscientist* should be added to the Lyell Collection.

Of course, the survey consisted of more than bouquets – there was for example a strong view that there should be a presumption against text-over-images, especially reversed-out text, which many find hard to read. (I would however be failing in my duty as Editor if I did not point out that if you do experience difficulty in this area, you can now consult the online version – which is fully accessible to the visually impaired.) We shall of course take that on board along with many of your other detailed (and often trenchant and amusing) comments, which will be of great help in our drive to fit the magazine ever more closely to your needs. The prize draw winners are listed in this month's *People* section.

Finally, I and the Editorial Board thank you for your time and evident enthusiasm for *Geoscientist*. We shall, as many of you urged, “keep up the good work” – for which your positive feedback has only sharpened our appetite. ☘

Ted Nield



Front cover: Although she didn't respond to the survey, this younger reader (Miss Lili Reynolds) clearly enjoys her *Geoscientist*. If you would like to suggest a caption, please email the editor at ted.nield@geolsoc.org.uk. A selection of our favourite entries will be published in a future issue. Also, see *Society at Large* (p.9) to find out why the Society's membership is about to get a lot younger. Photo: Nik Reynolds.

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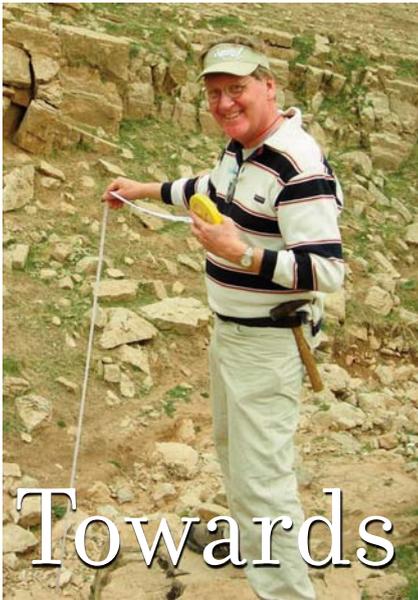
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Soapbox – is open to contributions from all Fellows. You can always write a letter to the Editor, of course; but perhaps you feel you need more space? If you can write it entertainingly in 500 words, the Editor would like to hear from you. Email your piece, and a self-portrait, to ted.nield@geolsoc.org.uk. Copy can only be accepted electronically. No diagrams, tables or other illustrations please.



Chris Garland sees a clear duty ahead for all Earth scientists.*

"The past is the key to the future". These words point to the revived importance of geology today, and invert the familiar cliché that summarises the principle of uniformitarianism. This axiom has underpinned the study of geology for almost two centuries and implies that, for example, we can go down to Worthing beach and see the same processes at work as those that formed the Piper sand. We can go snorkelling in the Maldives and see the same biological activity as that which built up massive carbonate sequences such as the Portland limestone.

The inverse warns, however, that we may be living in "special" times. The coal swamps of the Carboniferous, the festering anaerobic basins of the Jurassic, or the endless overheated seas of the Late Cretaceous have no counterpart today, but may point to uncomfortable possibilities for the future.

These interpretations are fundamental to our own discipline but they are not widely appreciated outside the Earth sciences, any more than the idea that oil occupies porosity in rocks rather than big caves under the sea. And we geologists, who in the past learned how to seek and produce energy from within the Earth's crust, are only now beginning to realise the future implications of this energy's use.

Towards the next revolution

At university in the 1970s, it was fashionable for our contemporaries to see oil companies as villains in the game of world development; but, such liberal sentiments were little or no match for the promised foreign travel and raw excitement of exploration that were offered by the "oil patch". In retrospect, we can look at the growth and development that has been fuelled by all this energy: cheap travel; warm homes; varied food; convenient power. We can be proud to have been able to help provide light and energy to a world that wanted and needed to grow. However, whereas hitherto society could carry on its development agenda in good faith, the all-bounteous Mother Earth providing everything, we can now see from space the edges of developed areas beginning to merge together as we expand to cover our planet's dear face ever more completely.

These are exciting times for Earth scientists. Since people are now being warned of future consequences on a geological scale with geological risks, we as geologists have a duty to educate people - starting with our friends - by pointing to the evidence of the past as it applies to the kind of change that future generations will have to face. Our clear duty lies in encouraging more of them, and especially more young people, to take up the study of one or other of the sciences of Gaia, to enhance knowledge of Earth resources, and improve the chances of the scientific revolution that we will need to ensure the survival of human society for the next millennium and beyond. ☞

* *Addax Petroleum, Geneva.*

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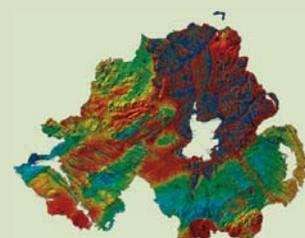
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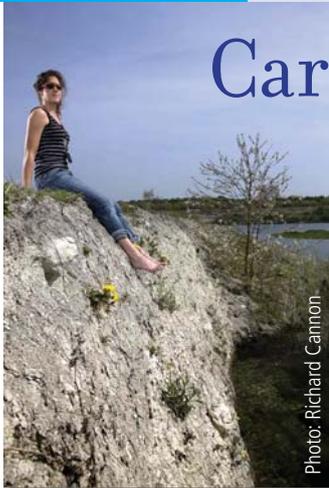


Photo: Richard Cannon

Kevin Eaton, Principal at ENVIRON, has been appointed as the new "SiLC Champion", with the task of "developing the scheme to the next level of growth and success". The Specialist in Land Condition (SiLC) scheme exists to establish, promote and maintain professional standards in brownfield land assessment. SiLC is an accreditation for experienced individuals who have demonstrated a high level of competence in land assessment during their career and gained through examination. Kevin says: "In promoting the SiLC scheme I would like to see more chartered geologists involved in the assessment of land condition and brownfield regeneration becoming involved with SiLC and applying for accreditation (see www.silc.org.uk)." The Geological Society is one of the supporting organisations of SiLC.

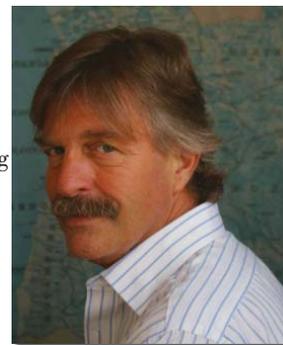


www.stemnet.org.uk/leadinglights



Wolfgang E Schollnberger, Independent Energy Adviser, has been honoured with the Heritage Award during the 2009 Offshore Technology Conference in Houston. The Award recognizes individuals who have provided distinguished service and significant contributions to the development of offshore resources.

Tako Koning received an Alumni Honor Award from the University of Alberta, Canada for his volunteer and humanitarian work during the past 17 years while living and working in Nigeria and Angola. Koning is adviser for Tullow Oil in Angola and is also residential representative for Yme Foundation, a Norwegian aid organisation drilling wells for clean drinking water in northern Angola.



Steve Larter, Society 1998 William Smith Medal winner and former member of Council, has been made a Fellow of the Royal Society in the recent crop announced on May 15. Steve holds the Canada Research Chair in Petroleum Geology, University of Calgary and the J B Simpson Chair of Geology, University of Newcastle Upon Tyne. His citation reads: "Using molecular and kinetic insights, he played a pivotal role in developing quantitative chemical typing of sedimentary organic matter, thereby improving understanding and modelling of petroleum generation. He has pioneered the use of molecular tracers in following secondary migration and the charging of reservoirs, the origin of gas condensates and tar mats, and the microbial degradation of oil." 

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

Lucky winners

The Society's Lyell Essay Prize for students, run for the first time this year, was won by Jonathan Paul (Imperial College, London). Peter Spooner and Becky Langham of Oxford University took second and third places respectively. The awards will be presented at President's Day on June 3. The Essays were judged by Prof. Ed Derbyshire (External Relations Secretary), Dr Stuart Monro OBE., (Chair, Education Committee), Sarah Day (Earth Science Communicator) and Ted Nield (Chair, Association of British Science Writers and Editor, *Geoscientist*).

The winners of the *Geoscientist* Reader Survey 2009 prize draw were Marie Jones, Louisa Pettit (pictured) and Aaron Wilkins. 



National treasures

On 28 May, a new article on the Founders of the Geological Society of London (1807) was added to the prestigious Oxford DNB, writes Dawne Riddle.

The *Oxford Dictionary of National Biography* is a vast collection of over 55,000 biographies of men and women who have shaped Britain – the good, the bad, the important, the curious and, yes, the downright ugly – in every field. As well as individual lives, the dictionary also contains “reference group” essays, as part of a continuing project to provide a history of significant networks, clubs and associations in which men and women came together to shape Britain’s past.

The new essay on the creators of the Geological Society of London (1807), written by Leucha Veneer, charts the role of its founding



Dr. Babington, founder of the Society

membership—of geologists, mineralogists, and chemists—in developing a nationwide organisation capable of withstanding a challenge from the mighty Royal Society. One of the striking characteristics of the new Geological Society was the diversity of religious affiliations among its early membership, with Quakers, Unitarians, independents, and Anglicans finding common cause in scientific investigation. 

Personals

Free journals to good home

Prof. Mike le Bas writes: “The following runs are available free to anyone who can collect from my home in me in Blandford, Dorset (or P&P arranged)”.

- Bulletin of Volcanology (*Bulletin Volcanologique*): 1940 to 1959 (20 odd copies), 1971 (v. 35) to 1991 (v. 53)
- Geological Magazine: 1948-1994
- Mineralogy & Petrology: v. 41 (1989), v. 43 (1990), v. 46 (1992) to v. 57 (1996).
- Journal of Petrology: v. 1 (1960) – v. 38 (1997) and v. 39 pts 1 and 5.
- Lithos: v. 1 (1968) – v. 28 (1992).
- Min Soc America, Reviews in Mineralogy: 2 (1975), 9A, 9B, 11, 12, 13, 16, 21, 24, 26, 30, 34.

Contact: T: 01258 454515, or
E: m.lebas@btinternet.com

Deaths

Read obituaries online at www.geolsoc.org.uk/obituaries.

The Society notes with sadness the passing of:

Baumer, A
Johnson, George A L
Mills, Anthony B
McKinlay, Alex C M
Truss, Stephen*

In the interests of recording its Fellows’ work for posterity, the Society publishes obituaries online, and collects them once a year in its *Annual Review*. The most recent additions to the list are in shown in bold. Fellows for whom no obituarist has yet been commissioned are marked with an asterisk (*).

If you would like to contribute an obituary, please email ted.nield@geolsoc.org.uk to be commissioned. You will receive a guide for authors and a deadline for submission. You can also read the guidelines 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 in the next available *Annual Review*.

Help your obituarist

The Society operates a scheme whereby Fellows may deposit biographical material for use by their obituarist. The object is to assist obituarists by providing useful contacts, dates and other factual information, and thus to ensure that Fellows’ lives are accorded appropriate and accurate commemoration. Please send your CV and a photograph to Ted Nield at the Society. *Editor* 



Geologist and science writer Nina Morgan* on a familiar affliction – the lost field notes...

I have a photograph of every rock hammer I've ever lost. Most geologists will know the feeling! But more distressing still is the loss of a field slip or notebook – as David Hiram Williams, a geologist in our fledgling Geological Survey, knew only too well.

Williams, who was employed in 1839 as a mapper for the Geological Survey of England and Wales by Sir Henry De la Beche (pictured) at a

DISTANT THUNDER

rate of seven shillings a day, soon gained a reputation for precision and hard work. If his 20 or so surviving letters are anything to go by, his two main objects in life seem to have been to achieve accuracy and save time by careful preparation – qualities that eventually found their reward in a substantial pay rise. By 1840, Williams' salary was increased to a princely ten shillings per day.

So imagine his distress when, in a letter sent from Carmarthen and dated 17 December 1840, he was obliged to inform De la Beche of a serious slip-up. "I have had a sad loss this morning" he wrote: "...while out on duty I lost 7 portfolio squares of the map of this part of the country. [...] I am sorry, very sorry to say I am in great trouble about the loss of those sketches, I hope and trust I shall have the good fortune to meet with them again."

Whether he did or not is not recorded. But his letter describes the lengths to which he went to try to recover them. "As soon as I discovered my loss I immediately returned to Caermarthen [sic] and had them cried by the town crier, and I again returned enquiring at all the houses along and back again to town without the slightest information as to their recovery. I am afraid they have been found by some country person who might fancy they are pictures as two of them are coloured. Should such be the case, I am fearful they will be stuck upon the wall of some cottage."

And very nice they must have looked, too! ☺

Acknowledgments

Thanks to Tom Sharpe of the National Museum of Wales for alerting me to this story. Sources for this vignette include *The papers of H.T. De la Beche (1796 – 1855) in the National Museum of Wales* by T. Sharpe and P.J. McCartney, National Museums and Galleries of Wales, Geological Series No. 17, 1998; and F.J. North, *Further chapters in the history of geology in South Wales; Sir H.T. De la Beche and the Geological Survey*, Transactions of the Cardiff Naturalists' Society, vol. 67 (1934), pp.31-103.

* Nina Morgan lives in Oxfordshire.

If the past is a key to your present interests, why not join the History of Geology Group (HOGG).
For more information visit the HOGG website at: www.geolsoc.org.uk/HOGG

A major Lyell Collection benefit for Geological Society Fellows

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A pleasing bouquet?

Diana Garnham, Chief Executive of the Science Council, is also a keen gardener. But is there more to her day job than letting a thousand flowers bloom? Ted Nield interviews.



Diana Garnham has what many would regard as an unenviable – indeed un-doable job. She oversees an umbrella body comprising the CEOs of scientific and technological institutes – including the Geological Society. The rest of the membership consists of similar organisations – but their connection with science and technology, and in some cases their former membership of the Science Council’s predecessor the “Council of Science & Technology Institutes” (CSTI) is usually where their similarity ends.

Yet somehow this naturally factitious bunch of prima donnas has to be made, coerced or cajoled into behaving themselves, and reaching some sort of consensus – which is Diana Garnham’s role in life – at least for now. Formerly Chief Executive of the Association of Medical Charities, Diana joined the Council in January 2006. She admits to not being too hung up on history. “I don’t know a great deal about the old CSTI though I did recently find some rather dusty files when we moved office” she quips.

Her appointment owed much to the Council’s former President, the late Sir Gareth Roberts, former Vice Chancellor of Sheffield University, Chairman of the Committee of Vice Chancellors and Principals, and author of numerous Government reports now named after him. “I had known Gareth for many years and worked with him on many different issues at AMRC – including university overheads and the RAE. I also served on the HEFCE research strategy committee, which he chaired” she says. “Gareth persuaded me that my skills were what the Science Council needed if it was to develop a culture of collaboration and a true community.

“Once communities work together they can have enormous impact, reducing the discord and noise levels

that are so confusing for government, and looking towards tackling the big issues facing society. But I had also worked for many years on public engagement in science, and wanted to explore the difference between trust in science and trust in scientists. We have to raise the visibility of the *people* who do science – and Chartered Scientist, the new post-nominal designation that we brought in, is a great way of doing that.

“The problems facing society are hugely complex and require the skills of a wide range of professionals, including scientists. But there isn’t going to be a single approach or answer.”

Diana sees Chartered Scientist as *the* platform for raising the profile of scientists. “I think the focus of media, and government and indeed everyone is most often on ‘academic’ scientists; but there are so many other types out there, and from the public’s point of view, they are probably even “closer” to them. It’s just that no one knows they are there! I want to change that.”

“So we are now trying to share the individual stories, the inspiration and energy we see every day. For example, Edmund Nickless did a podcast interview for us a while ago – about how he “thinks” when he sees a mountain – what’s it made of, how long it has been there and so on. Another Science Council Board member talked lyrically about the mathematics of a rainbow. When journalists heard these they were bowled over – the stories had texture, were approachable and were fun. Non-scientists could relate to them too. It wasn’t about “breakthroughs” and Nobel prizes; it was about what goes on every day in a scientist’s head.

“I am really passionate about making this work. If we don’t enable the wider public, and particularly young people and their parents, to get a better idea of what scientists are doing in their community every day, we won’t encourage more young people into science. Raising the profile of the hidden working scientist is very high on our agenda.”



To this end, and to encourage the young, the Council has run a number of initiatives like *Future Morph* (www.futuremorph.org) and *Big Bang* (www.thebigbangfair.co.uk/home.cfm - picture). I asked Diana how they fitted in with this policy of bringing people closer to working scientists. “*Future Morph* is all the above and more. With 65 partners providing funding and content for the website, it has a guiding, sharing and enabling role – which I think are the key behind the scenes skills for any CEO of an umbrella group!”

“It is important to remember that in an umbrella body, each member is different; and part of what we need to do is celebrate those differences – the “specialness” – at the same time as remembering that we become stronger and more effective by working together. It isn’t just CEOs of course – in this sector the influence of the ever-changing Presidents needs to be taken into account too – so, first rule is to find space and a voice for every individual.

“I suspect some of the CEOs see me a ‘voluntary sector type’ who doesn’t understand the science world very well; but I believe it was important for the Science Council to have an early discussion about its *values*. We did that, and central to this is that each organisation in membership is valued and respected within the collective. One of our aims is to showcase the great things our members are doing. The Geological Society, for example, is doing some innovative projects with young people, and it is great for us to be part of these events and then report on aspects of it. I don’t think we can really find an activity and say “this is the

right way” – because every organisation is different, has differing resources available and faces a different set of issues. Take gender and diversity. GSL has some good projects that we can showcase, but we would encourage our member bodies to look at this for ideas, rather than “blueprints”. Sharing ideas and good practice within the community is something we want to encourage.

“The next task for Science Council is to get a success under our belt; and I think we have that with *Future Morph*. Our member bodies need to feel good – proud even – of what they achieve by working together. Being able to identify something that they think is different, and down to their commitment is a good step forward.

“The Science Council’s “Unique Selling Proposition” (as the jargon has it) is its ability to look at issues right across science and mathematics. The problems facing society are hugely complex and require the skills of a wide range of professionals, *including* scientists and mathematicians. But we need to accept there isn’t going to be a single approach or answer.

“It annoys me when I see institutions going beyond their own field. They should be working across the discipline barriers. Take water as an issue. Almost all STEM subjects have a role to play in addressing it, so it cannot be down to one subject discipline or professional body to put forward the only single solution. Geologists know about one part of it but meteorologists know another, and so on. Our future is about getting our organisations to go beyond where they are now. Of course, some will need to be coaxed, but I hope we have at least reached the stage where they all prefer to be at the table, rather than left out. Of course some organisations and groups will be less engaged than others; but we will get there.

“The hardest area is undoubtedly science policy development. Some think of science policy as only being about research funding. Science policy for me governs the landscape in which we have to work – which includes research funding in HE but it does not end there. We need to get the overall temperature of the water right for science and innovation to thrive. There are several strands to this. Capacity, both in terms of research strengths and investment, and the numbers of professional scientists in the economy outside academia, is one strand. Another might be improving the teaching of science in schools; ensuring that degree courses provide the right depth of subject and skills, and achieving broad-based public support for science and scientists so that we get the regulatory and social environment right for science and innovation to thrive.

“As the Science Council we need to be involved in public affairs, but we also need to improve our accountability and openness with the public. In many ways Geol Soc is a microcosm of this. It represents scientists with a broad range of STEM skills and draws members from across academia, big business, public sector, SMEs and consultancies, education and also committed individuals. The science community embraces all these groups. So my job is much like any CEO of a learned society - trying to please everybody!”

- For further information: www.sciencecouncil.org

Society Business

Steady as she goes

Dues to remain fixed at current levels, votes AGM

Fellowship dues will be held steady, following a resolution at the Annual General Meeting, President's Day (June 3). In view of the current financial downturn and low inflation, Fellows voted to keep most dues where they are for the time being.

A new category, Junior Candidate Fellow, was also approved. Due to increasing demand from younger geoscientists, it had become apparent that the GSL needed to introduce a 'Junior Candidate Fellowship' to its list of categories of membership. This will be open to all those from 16 years up who are not yet at university and have an interest in Earth sciences. They will enjoy similar entitlements to Candidate Fellows, including *Geoscientist* magazine, use of the library, and allocated membership of a regional group. In addition, where relevant and appropriate, JCFs will be able to attend meetings at a discounted rates.

A week later, at the June Shell London Lecture (Speaker – Rachel Wood) the Society launched another new membership category – "Friend". A Friend of the Geological Society will be someone who, while not qualifying for any existing category of membership, supports the work of the Society and wishes to be associated with it. The clear market for this new category has become evident as a result of the amazing success of the Shell London Lecture Series. These are regularly sold out and many are now presented in matinée performances to cope with the demand. Among other privileges, Friends will receive a monthly copy of *Geoscientist*.

Edmund Nickless told *Geoscientist*: "This new category shows the Society is reaching out to a whole new community, which we have been able to do thanks to the vision and generosity of our sponsors, Shell, who have supported our public outreach programme since Bicentenary Year. We look forward to building links with many more interested lay people as we develop this exciting new scheme".

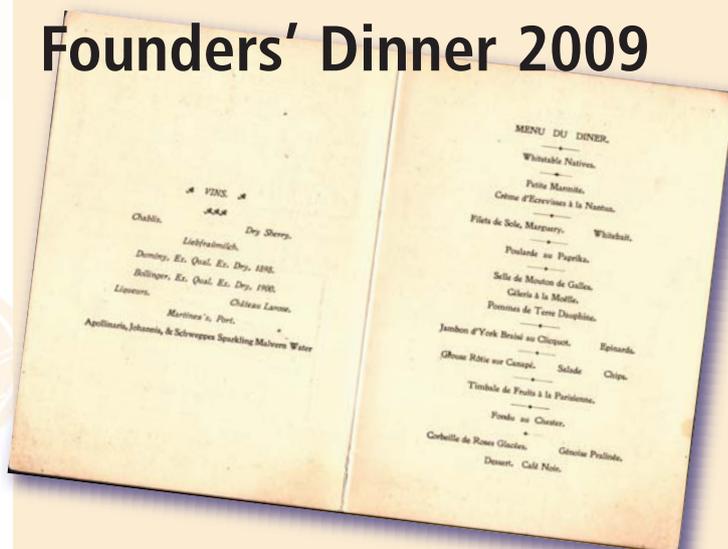
A similar scheme will also be created for schools, who will be able to affiliate with the Society, in a similar way to the Society's existing Corporate Affiliates. The full package of educational benefits is yet to be worked out in detail, but it will include – you guessed it – copies of *Geoscientist*! TN

FUTURE MEETING DATES

OGMs: 23 September 2009; 25 November 2009; 28 January 2010; 21 April 2010

Council: 23 September 2009; 25 November 2009; 27/28 January 2010; (residential); 21 April 2010

Founders' Dinner 2009



On 12 November, the eve of Founders' Day, the Society will celebrate Darwin's Wollaston Medal with a black tie dinner and pre-dinner talk, writes Dawne Riddle.

Eleven good men and true, and two absent friends, signed the founding document of the Society at the Freemason's Tavern, Great Queen Street, London on 13 November 1807. To mark the event, the Society instituted a Founders' Day dinner in 2008, to build upon the great success of the Bicentenary dinners held on the 12th and 13th of November 2007. This year the new tradition continues.

Advertisements for the dinner will appear in due course, but the evening will follow a similar plan to 2008, with a lecture beforehand in Burlington House, followed by dinner at the nearby Méridien Hotel, Piccadilly (Chef de cuisine – Marco Pierre White). This year the sense of occasion will be heightened by black tie.

The Society is fortunate in having attracted a topical speaker of the highest calibre – previous winner of the Sue Tyler Friedman Medal, historian of science Prof. Jim Secord, Director of the Darwin Correspondence Project at the University of Cambridge. His talk will be titled *Charles Darwin and the World of Geology*.

It is a little known fact that, as well as being the 150th anniversary of the publication of *On the Origin of Species* and the 200th birthday of its author, 2009 is also the 150th anniversary of Charles Darwin's Wollaston Medal – the highest honour conferred by the Geological Society, and first awarded to William Smith in 1831. Darwin won the medal for pioneering work on the structural uplift of the Andes and his theory of the origin of coral reefs. Over 75% of Darwin's notes from the *Beagle* voyage consist of geological observations, and after the voyage his primary reputation was as a geologist. His books were widely discussed and his spectacular vertebrate fossils were on public show in London. He wrote on petrology, invertebrate palaeontology, and the action of worms in transforming the earth. In his most celebrated work, Darwin used a geological approach to solve that 'mystery of mysteries', the origin of new species.

So – put November 12 in your diaries now, and watch future *Geoscientists* for the advertisement. 



Shell London Lecture Series 2009

The Shell London Lecture Series comprises public talks that aim to introduce modern Earth science and its relevance to society to the attention of a wide audience, many of whom will have an interest in science, but who are not necessarily trained in the Earth sciences. Below is the remainder of our 2009 programme.

September 9	Richard Fortey	NHM, London	<i>The fossil record since Darwin</i>
October 7	Rosalind Rickaby	Oxford	<i>Perturbing plankton in the sea: past and future</i>
November 11	Tony Watts	Oxford	<i>Mountains in the Sea</i>
December 9	Bruce Levell	SHELL	<i>The sameness of rocks, the uniqueness of Earth history, and what all that means for hydrocarbon exploration</i>

We hope to be able to run matinees of these talks alongside the evening lectures, although some are yet to be confirmed. Please see our website or contact us for up-to-date information.

Planned timings are:

- Matinees: Tea and coffee 14.30;
- Lecture 15.00 – 16.00.
- Evenings: Tea and coffee 17.30;
- Lecture 18.00 – 19.00.

Each talk will appear online shortly after the talk has been given. To view the presentations please visit the event page www.geolsoc.org.uk/shellondonlectures09

Please let us know now if you are interested in any of the above lectures by contacting Alys Hilbourne. Your name will then be entered in the draw for tickets two weeks in advance of each talk. Entry to these lectures is by ticket only. Please note that due to the popularity of this lecture series, we cannot always allocate tickets to all who wish to attend and places are only confirmed two weeks in advance of each talk.

For further information on the Shell London Lecture series including abstracts and biographies for all of the above talks, please visit our website.

The Geological Society, Burlington House, Piccadilly, London W1J 0BG
Tel: +44 (0) 20 7432 0981; Email: alys.hilbourne@geolsoc.org.uk

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All past lectures can be viewed online at www.geolsoc.org.uk/londonlectures



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New portrait of Janet Watson by Alice Hesketh.

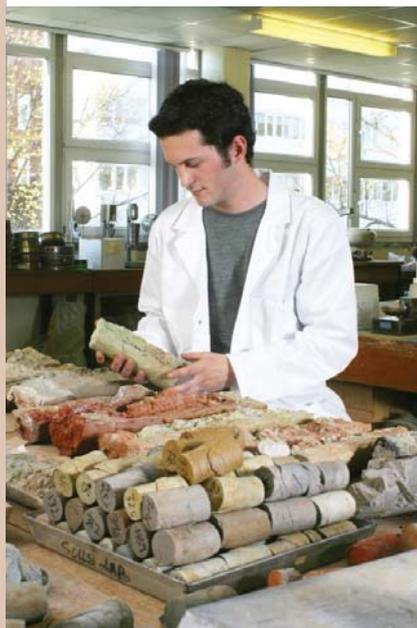
Watson portrait

A portrait of Janet Watson was unveiled in the newly renamed Janet Watson Lecture Theatre, Burlington House, at a meeting to celebrate the work of the Society's first woman President on May 28. The portrait, in acrylics, is by renowned portrait artist Alice Hesketh. A brief report of the meeting will appear in a future issue. 

Industrial bursary scheme

The Society is supporting an Industrial Bursary scheme at Portsmouth University to assist the training of engineering geologists, reports Dawne Riddle.

Eight bursaries in total are on offer, one from GSL and seven from industry. The Industrial Alliance Bursary Scheme (ABS) for the



Portsmouth BEng (Hons) Engineering Geology & Geotechnics (Sandwich) is aimed at boosting recruitment to at least 25 graduating students per year, and to halt a recent downward trend against the background of the falling demographic.

Led by Nick Koor, the staff involved are Dr Malcolm Whitworth, David Giles, Andrew Poulson, Nick Walton and Dr Andrew Gibson. Students will follow a four-year course including an industrial

placement in year three, and field mapping (including hazard mapping) in the French Alps.

Nick Koor says: "The scheme aims to increase the pool of talented, employable engineering geologists and geotechnical engineers in the UK, and forge stronger links between the department and the ground engineering industry." Sponsors gain access to the best students and have an input into curriculum development. 

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WiFi (wireless fidelity) access to the Internet is now available to all readers. If you are visiting the Library and have a WiFi-enabled laptop you can ask the staff for a password to give you free Internet access.

Pick of the crop

To see what other books, maps & serials the Library has acquired, why not register to receive a copy of *Recent additions to the Geological Society Library*, either by post or email? Contact Wendy Cawthorne on wendy.cawthorne@geolsoc.org.uk. 



Life in Hell?

*How old is life? New models suggest that it may have survived the Late Heavy Bombardment, making us all a lot older...
Ted Nield reports*

The timing of the origin of life has always been thought to depend on the timing of various inimical events in the history of the early Earth. One was the giant impact that created the Moon (at perhaps 4.5 Ga) and the end of the Late Heavy Bombardment - a period between 4.1 and 3.9 Ga when our planet was pounded by asteroidal bodies, and whose scars still pockmark the face of our satellite. Surely, the thinking went, no living thing could possibly have survived either event.

This idea fitted the earliest isotope-derived evidence for living processes; but these now come in at 3.8Ga, perilously close to the date for the end of the LHB. How quickly could life have arisen, and could it have done so more than once? Or could it even have been seeded here from its original home on Mars?

Geochemical evidence from detrital zircons dating from the Hadean began to suggest that the era (4.38-3.85Ga) had not been quite as infernal as it had been painted. Evidence began to emerge of liquid water at surface, as well as geochemical cycling rather similar to the sort we see around us today. Hadean life forms were no longer unthinkable. But any such hopeful monsters would still have had to get over the apparently impenetrable barrier of the LHB if they were to become our ancestors. And that was impossible. Or was it?

Well, apparently not. New research based on impact modelling and published in *Nature* in May suggests that the LHB was not unsurvivable after all. Authors Oleg Abramov and Stephen Mojzsis (University of Colorado) make a few assumptions of their own in framing their impact model, but all seem to be in line with what we know today about biological distribution on Earth. They assume that one of the effects of bombardment was to spread living spores over the whole surface of the planet. We cannot know whether this is true, but we do know that organisms under about two millimetres in diameter are indeed dispersed globally, both by winds and groundwater.

They also assume that the deep biosphere at that time extended to about four kilometres down. This too is perfectly reasonable given that we have records of microbes today from boreholes as deep as 3.5km. They also assume that Hadean life could live at temperatures as high as 110 degrees, which is well within the tolerances shown by modern thermophiles. They also assume that areas sterilised by impacts will then be re-colonised.

Given these assumptions, their model shows that the idea of an impassable barrier is no longer tenable. At its worst, they say, only 37% of the Earth's surface would have been sterilised, and under 10% would have felt temperatures over 500 degrees Celsius.

Although it is unclear how much photosynthesis could have been carried on during the LHB, this too is less of a problem than previously thought since genetic evidence suggests that the last universal common ancestor of living things was indeed a thermophile. Thermophiles specialise in other biochemical pathways that do not rely on sunlight to perform the necessary reduction. [CR](#)

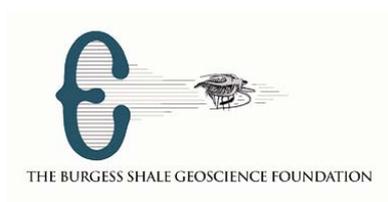
Reference:

Abramov, O & Mojzsis S J., *Microbial habitability of the Hadean Earth during the late heavy bombardment*. *Nature* 459, 419-422 (21 May 2009).

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Shale of the century

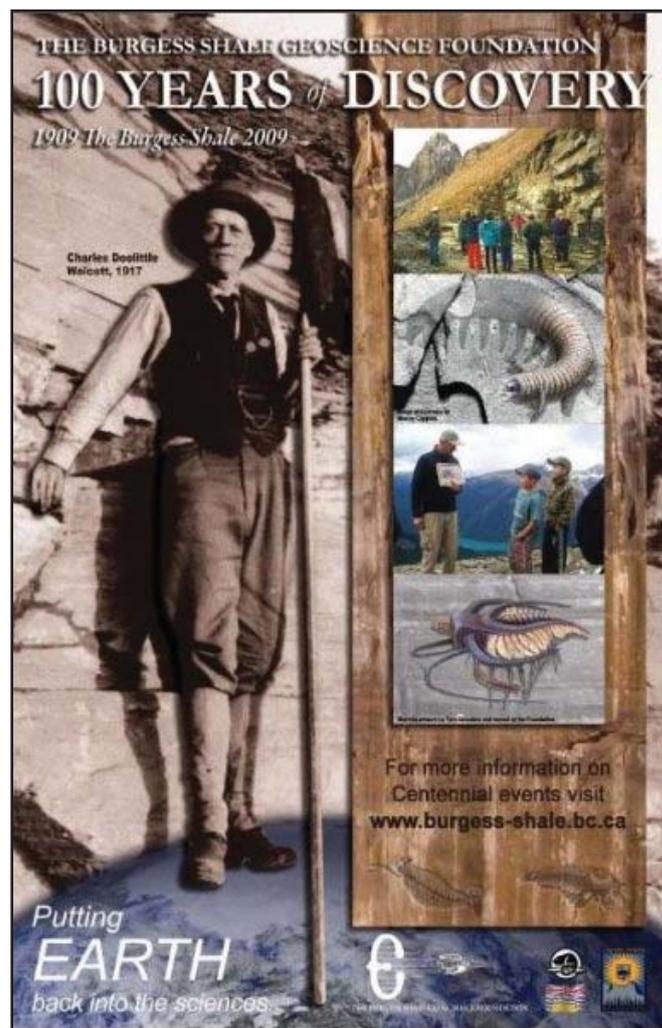
The summer of 2009 marks an important anniversary for the Earth sciences. And this time, it has nothing to do with Darwin, writes Sarah Day



In late August 1909, Charles Doolittle Walcott discovered the first fossils from the Burgess Shale site in Yoho National Park, Canada. During subsequent field seasons, Walcott continued his excavations with his family, collecting more than 65,000 specimens from what is now known as the Walcott Quarry. These record life on the Cambrian sea floor, demonstrating various modes of feeding and movement. The most abundant specimen, *Marella splendens*, was instrumental in demonstrating that soft-bodied organisms in the Cambrian were more complex and diverse than previously thought.

Named after nearby Mt. Burgess, the site has become one of the world's most celebrated fossil localities. The fossils date back to the Middle Cambrian, 505 million years ago, and are renowned for their exceptional preservation of soft parts. The Burgess Shale was designated a UNESCO World Heritage Site in 1981, and is within a specially protected area within the Yoho National Park.

To celebrate the Centennial, the Burgess Shale Geoscience Foundation will be holding a series of celebrations, under the theme of 'Putting the Earth back into the Sciences'. The events



are designed to appeal to both geologists and members of the public, and include guided hikes to the fossil sites, a series of public lectures, art activities for children and even a historical re-enactment (on horseback, and in period costume). The celebrations will begin with a keynote speech from Canadian astronaut Dr Roberta Bondar, who will give a talk entitled *The Fossil and the Astronaut – Exploring Earth from Inner and Outer Space*.

Through these events, the Foundation hopes to inspire appreciation for the Earth and life sciences, and highlight the importance of the fossil record in understanding how life has evolved. 

For more information about the celebrations, including a complete listing of activities and dates, visit the Foundation's website at www.burgess-shale.bc.ca

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Funny old world

Unconsidered trifles, by 'Snapper'

Brush with science



Devilish hot



Exciting times in Ben Rhydding, Yorkshire. A new vicarage for St John's Church is being equipped with geothermal heating from a 2900km-deep borehole. And they say the Church of England is broke. We shall bring you more on this story as the exciting new drilling plumbs new depths, as soon as it is reported in the *Ilkley Gazette*.

Monitors: Gerald Lucy, Tim Needham. All contributions gratefully received. Please write to the Editor at Burlington House, or email ted.nield@geolsoc.org.uk marking your submission "Snapper".



IN *Brief*

Joe McCall follows in some very ancient footsteps indeed ...

First steps

Bipedality is a key human adaptation that first appeared in the fossil record about six million years ago. Preservation of our ancestors' footprints in the East African Rift Valley is unfortunately fragmentary, and there has been much disagreement about its interpretation; although everyone accepts that modern *Homo sapiens* footprints contrast strongly with those of African apes during quadrupedal and bipedal locomotion.

In 1978, Mary Leakey¹ found 3.7 million year-old (Pliocene) footprints at Laetolil in the Tanzanian extension of the Rift valley south from Kenya. These primitive prints are thought to have been made by *Australopithecus afarensis*. Though a few other footprints dated about 1.5 million years old were reported from Kenya on the east shore of Lake Turkana about this time², only recently has a set of prints of this age (1.53-1.51 million years), well-enough preserved to make significant comparisons with the Laetolil and modern human prints, been discovered³ at Ileret, north of Koobi Fora.

The prints occur in the Okote member of the Koobi Fora Formation. There are sets of prints on a 9m-thick sequence of thin, graded silt and sand units, and the prints are sandwiched between two layers of fluviually reworked volcanic ash, firmly dated at 1.51 and 1.52 Ma. The prints lie at two stratigraphic levels, the upper with three hominin trails (two of two prints and one of seven), and the lower, 5m below, with one trail of two prints and a single print. (There are actually three volcanic ash horizons and the upper, Noth Ileret Tuff, also shows evidence of hominin activity.)

The prints are similar to those discovered in 1981 in the Akait Tuff, 45km to the south², dated at 1.435Ma. They show a deeply depressed and adducted (clenched) big toe, typical of modern human footprints. They were made by an organism with longer lower limbs than the Laetolil footprints, attributed to *Australopithecus australensis*.

Differing from modern human footprints, their size is consistent with *Homo ergaster/Homo erectus*, who had shorter arms and legs, and a more "modern" foot and gait than *A. afarensis*. Increased mobility opened up a wider range of potential habitats. (Laetolil prints are radically different, since the australopithecines could not balance the upright body and lacked the postural adjustments effected by humans.)

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Some on the Web have questioned the conclusions, including a suggestion that the prints belonged to gorillas. But the circumstantial evidence of their close geographic and geological association with the famous hominin site east of Lake Turkana seems strong, and the evidence of hominin activity nearby would seem to support the conclusions of this excellent addition to the literature on the Rift Valley - which continues to reveal new discoveries since I mapped there more than 50 years ago.

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Visitors from Mercury?

There has been speculation from time to time whether certain meteorites emanate from the planet Mercury. There has been very little publication on whether large scale impacts onto Mercury could reach our planet. Gladman and Coffey¹ have recently covered this topic admirably. A small minority of the total meteorite population is reliably attributed to impact ejection from Mars: there is no proof of this but gaseous inclusions within them match the Martian atmosphere in composition and it is a case of applying 'Occam's razor'; they must emanate from a planet and Venus's atmosphere would prevent ejection from there. True, there remains the small, innermost planet, Mercury, with a surface revealed by Mariner 10 to be pitted with impact craters; but recent imagery has also revealed many volcanic features (*Geoscientists passim*).

The launch speed needed to escape the gravity of Mercury is intermediate between that of the Moon and of Mars, so escape is feasible. This is the only planet where impact speeds routinely exceed the escape speed by 5 to 20 times, so many impacting objects will escape its gravitational pull, a large fraction achieving heliocentric orbit. These authors conclude that the time taken for delivery on Earth would be ~30 Myr, and several percent of the material ejected from Mercury would reach Earth (slightly less than from Mars, and the same amount would reach Venus).

Since all the material ejected is Mercury-crossing in its orbit, much of it would be re-accreted. This is of little significance to the feasibility of Earth delivery, but is of interest when considering the possibility of impact-stripping of the mantle of the proto-Mercurian planet by a giant collision, recently reviewed⁴. This suggestion has been advanced to explain the high density of Mercury, and its postulated large core. Gladman and Coffey conclude that this stripping could only operate if the ejected mantle fragments were small enough to be dragged into the Sun on the timescale of a few million years, otherwise they would be re-accreted.

As to Earth delivery of Mercury-source meteorites, this is clearly a reality, although we do not know anything of their composition and petrology, and at present suggestions as to this remain in the realm of speculation. Somewhere among the vast accumulation of more than 30,000 meteorites known to science, there are hidden Mercury-sourced objects. Detecting them will be a challenge for the future!



• *Most GeoNews appears first in Geoscientist Online* •

Sarah Day fought through the banner-waving hordes on the outside to attend the 7th Petroleum Geology Conference on the inside.

The last six months have been a reality check. On April Fools' day, slap bang in the middle of the 7th Petroleum Geology Conference (31 March – 2 April), thousands marched through London demanding to know why realities had not been faced sooner, and what will be done about it all. So was it the best of timings, or the worst of timings for PGC VII?

Some would say it was actually *perfect*. The oil industry remains central to many of the issues on the protestors' lips – the environment, future energy supplies, the economy. Petroleum Geologists, as well as politicians, have had to face up to reality.

Over 700 attended the Conference in Westminster, where as well as the usual poster programme and talks, a series of debates tackled some of the most topical issues facing the industry. Throughout, I caught a sense that a period of uncertainty and change had begun – Richard Hardman, arguing that North Sea exploration is finished, and warning that explorers are like artists, who risk allowing their natural

optimism to blind them to reality. Marlan Downey, meanwhile, suggested that his argument for the future of national oil companies felt like a eulogy.

For many, the change is natural, as the oil business adapts itself to the future. One of the most tangible signs was the inclusion for the first time of virtual field trips. Using only a projector screen, speakers spirited attendees as far away as France, Portugal, Egypt and Utah. The field trips used LiDAR – Light Detection and Ranging – to obtain highly accurate data on ground elevation. (A laser is used to measure the distance between an aircraft and the ground, often with a digital photograph added, for greater realism.)

Speakers were keen to address the main issue that these field trips brought up – were they designed to *replace* real trips? The message from all was that they were a useful tool but that “getting your hands on the rocks” remained as important as ever. Virtual field trips were a great way to access places that would otherwise be difficult, and for remotely sensing data; but ultimately the models they generate could only be tested by drilling. And as one speaker demonstrated, the inclusion of a “virtual beer” at the end of a virtual trip could never quite match the real thing.

Through technologies such as this the oil industry is moving rapidly towards the future. It remains divided, however, as to what that future might be – as the “geocontroversies” debates showed. Sessions devoted to carbon capture and storage (CCS), and its potential for helping meet emissions reduction targets which the UK has committed itself to, also brought up

A tale of two **meo**

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the question. CCS, as keynote speaker Raymond Levey (University of Utah) pointed out, may well become the biggest industry in the world one day, and is inextricably linked to the oil business itself. What other industry, he asked, has the opportunity to make such an important difference to the world? What other industry has found itself in a position where, simply by applying its own principles in reverse, it can play a vital role in developing a sustainable future?

So yes, the timing of the event might after all have been just right. While outside the protestors were calling on governments to address the problem of climate change, reduce emissions, face reality, inside those with the knowledge and expertise to make it happen were discussing practicalities. Yet despite this, the CCS sessions were not well attended. One speaker pointed out wryly that, in a few years' time, when it has all become unavoidable, his audience might be rather larger.

Petroleum geology has already embraced the virtual realities of the future. Now is a good time to embrace the true realities.

The debates

Tuesday: This house believes Peak Oil is no longer a concern

The inevitable "Peak Oil" debate was fronted by John Underhill of the University of Edinburgh, who spoke for the motion, and sun-king Jerry Leggett, who in the past has campaigned for *Greenpeace* as well as working in the oil industry. Leggett's main criticism of the proposal was that, while the concept of 'peak oil' may have changed since it was first introduced, to claim that it is no longer a concern is a

step too far towards complacency. Despite Underhill's attempts to relieve anxiety by pointing out how quickly we have been able to cope with energy shortages in the past, the majority of the audience agreed that the issue remains a concern, and voted against the motion.

Wednesday: Are National Oil Companies (NOC) the future of the petroleum industry?

Marlan Downey, after 50 years' experience in multinational oil companies, opened the debate by stating that his speech felt like giving the eulogy. He mourned the passing of a century of international oil companies, likening this to "the wisdom of recognising life as it is, not as we once had it". Peter Gaffney argued that the real power lies not with the oil companies, national or multinational, but with geologists. The sourcing and extraction of oil will always be an international geological project, he suggested. The audience disagreed, and voted for the motion.

Thursday: Is exploration in the North Sea finished?

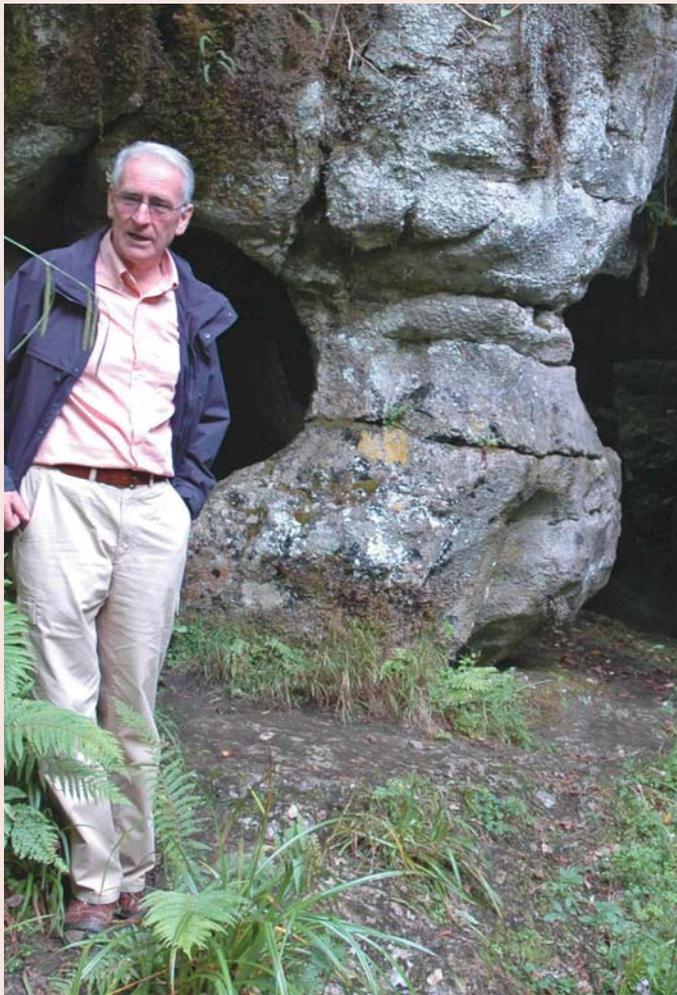
In perhaps the biggest reality check of the lot, Richard Hardman argued that the possibilities for new companies to explore the North Sea are over, and that the oil industry must face up to the fact that it can no longer hope to profit from North Sea exploration. Jim Hannon opposed the argument, suggesting that while politics and investment may be problems in the short term, the reserves that remain are timeless, and should not be walked abandoned. Despite Hardman's likening of those who opposed the motion to "turkeys voting for Christmas to be postponed", the audience did not agree, and voted against.

Red cards - delegates vote at one of the topical debates at PGC 7.

etings



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Tony Bazley explains the origin, evolution and future of Northern Ireland's very own geological survey

TELLUS

What is GSNI?

The Geological Survey of Northern Ireland (**GSNI**) was established in 1947. It is an integral part of the Northern Ireland Department of Enterprise, Trade & Investment (**DETI**).

DETI does what it says on the label: it brings inward investment by encouraging enterprise and trade. It is within this remit, to make a positive contribution to the economy, that the GSNI strategy is developed.

The new Northern Ireland system of “joined-up” government, created by devolution, has had the desired effect of bringing all government departments closer together. This means the Geological Survey of Northern Ireland (GSNI) serves any department where its expertise is needed. Accordingly it finds itself dealing today with a wide range of matters, from minerals, agriculture, education and tourism to the environment – as well as all planning, water and heritage issues.

Staffing and mineral licensing

The office, sited in the university district of Belfast, has around 20 staff. Six are employed directly by DETI to operate the Minerals Branch, which administers mineral and petroleum licensing. The remainder of the (mostly scientific) staff are members of the British Geological Survey (**BGS**). This direct link with the BGS is a huge advantage to the GSNI. It means that local staff can avail themselves of its training and quality assessment, as well as call quickly on a wide range of specialist advice.



In the beginning, it was minerals - both industrial and precious - that were the *raison d'être* of the Belfast office. The initial deep drilling of potential coal basins brought disappointing results - although in the 1980s about one billion tonnes of brown coal were proved around Ballymoney, Co Antrim. Those early deep boreholes of the 1950-60s, however, have proved to be lynchpins around which modern 3D models are built. Also important in the earlier days was the role the Survey played in developing legislation leading to the 1969 Mineral Development Act. This vested mineral interests in DETI, with just three exceptions: gold and silver (the Crown), mineral deposits being worked in 1969, and common substances (sand & gravel and aggregate).

TELLUS

During the last 15 years, the emphasis of the GSNI's work has been changing and projects have been growing in size. The changes began with a cross-border initiative to produce resource maps and geological tourism products for counties Fermanagh and Cavan - in close cooperation with the Geological Survey of Ireland (GSI). Currently, the nationwide Tellus Project holds centre stage.

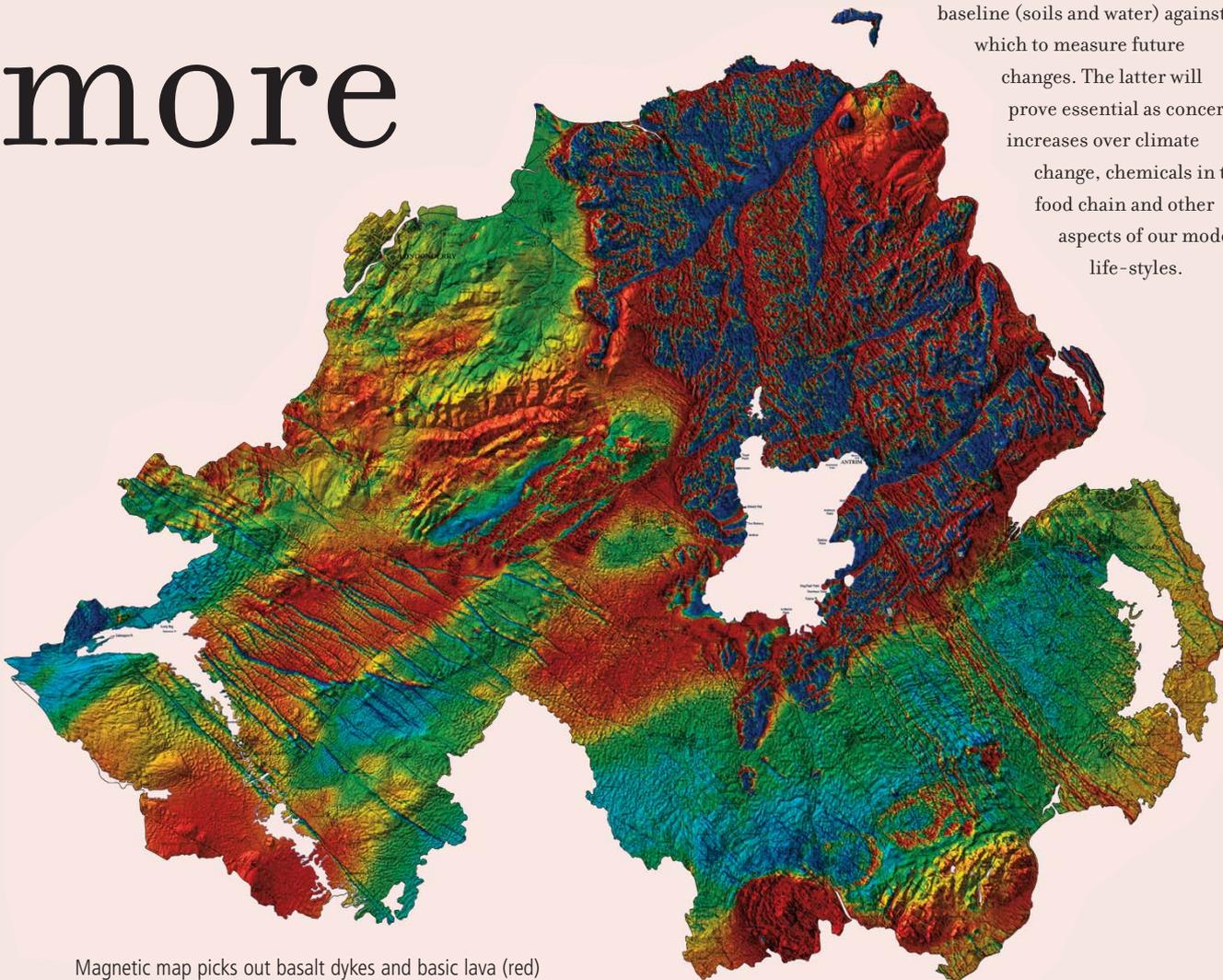


'TELLUS' Aircraft, ready to go

Tellus is the biggest investigation ever carried out by the GSNI. It has given Northern Ireland complete high-resolution geophysical (low-level airborne sensing) and geochemical survey cover (30,000 samples tested for 60 elements and compounds). Added to detailed modern geological maps, it puts Northern Ireland in an enviable position, with very few nations being able to boast equivalent levels of data. We now have the means to solve some of the many structural and economic geology conundrums that remain (such as the 'Dromore gravity high' and the enigmatic 'red bed' sequences). It opens up the prospects for more exploration and currently a record 70% of the ground is held under licence. It has given a

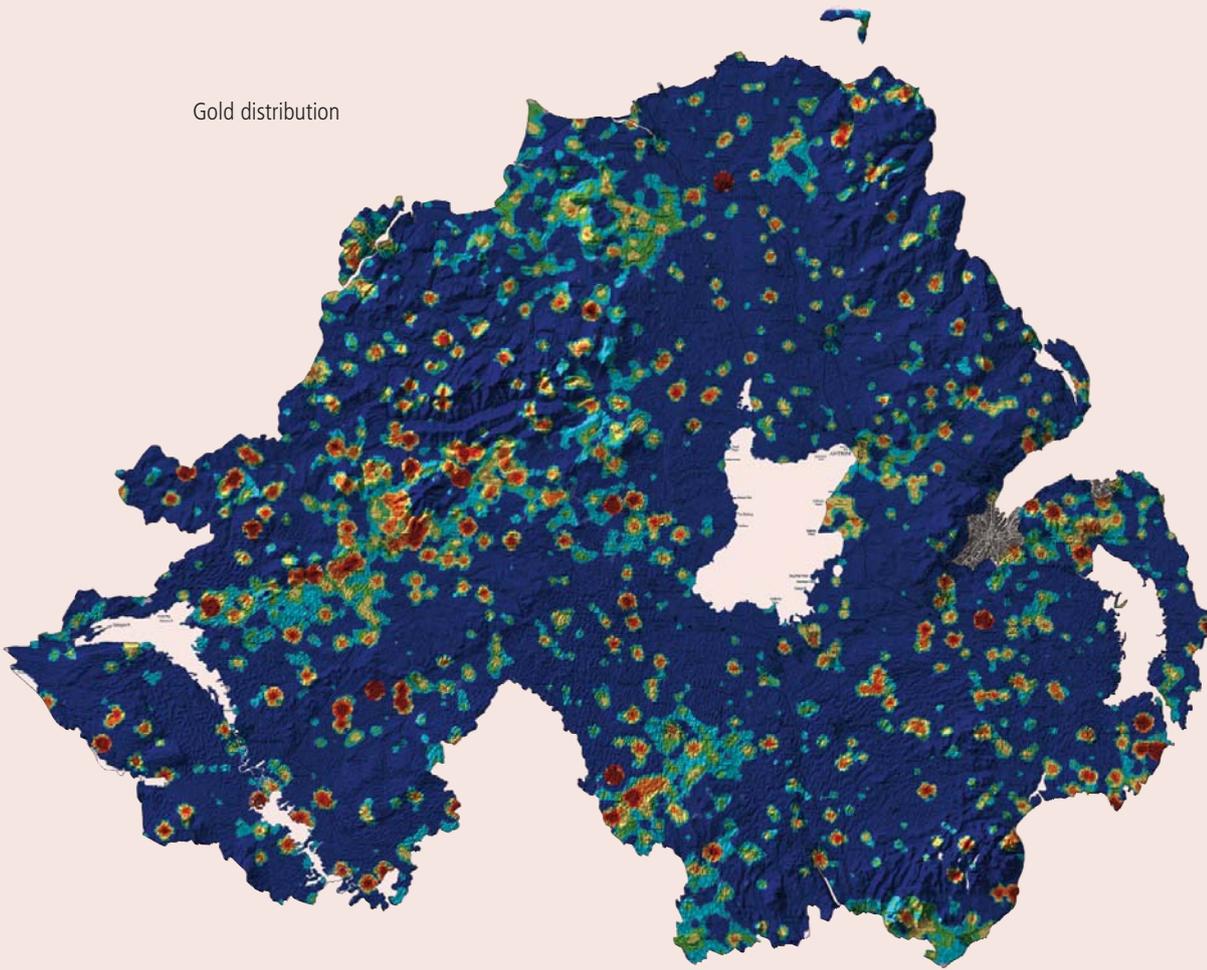
countrywide environmental chemical baseline (soils and water) against which to measure future changes. The latter will prove essential as concern increases over climate change, chemicals in the food chain and other aspects of our modern life-styles.

more



Magnetic map picks out basalt dykes and basic lava (red)

Gold distribution



The Tellus Project was far from simple to arrange and carry out. It involved flying along a countrywide grid at heights of less than 100m. The geochemical survey required widespread access to land and involved laboratories in the UK, Netherlands, Finland and Canada. That it was completed on schedule and with a minuscule number of public complaints was no less than a triumph of management. This was recognised in 2006 by numerous awards for public relations work (*Geoscientists passim*).

TELLUS results

Pure, blue-skies research is a luxury hardly possible in a small office such as the GSNI. Only in collaboration with others can such ideas be developed. Now, however, mineral exploration companies and university researchers are already taking up the challenge presented by the new Tellus data. Although the project is a multi-million pound venture the economic return to Northern Ireland has already many times exceeded the expenditure. Indeed, the only sad note is that there is no longer a local mainstream geology department in Northern Ireland to help decipher the 'new geology'. The department at Queen's University Belfast was (wrongly, in the author's opinion) closed down in 2001.

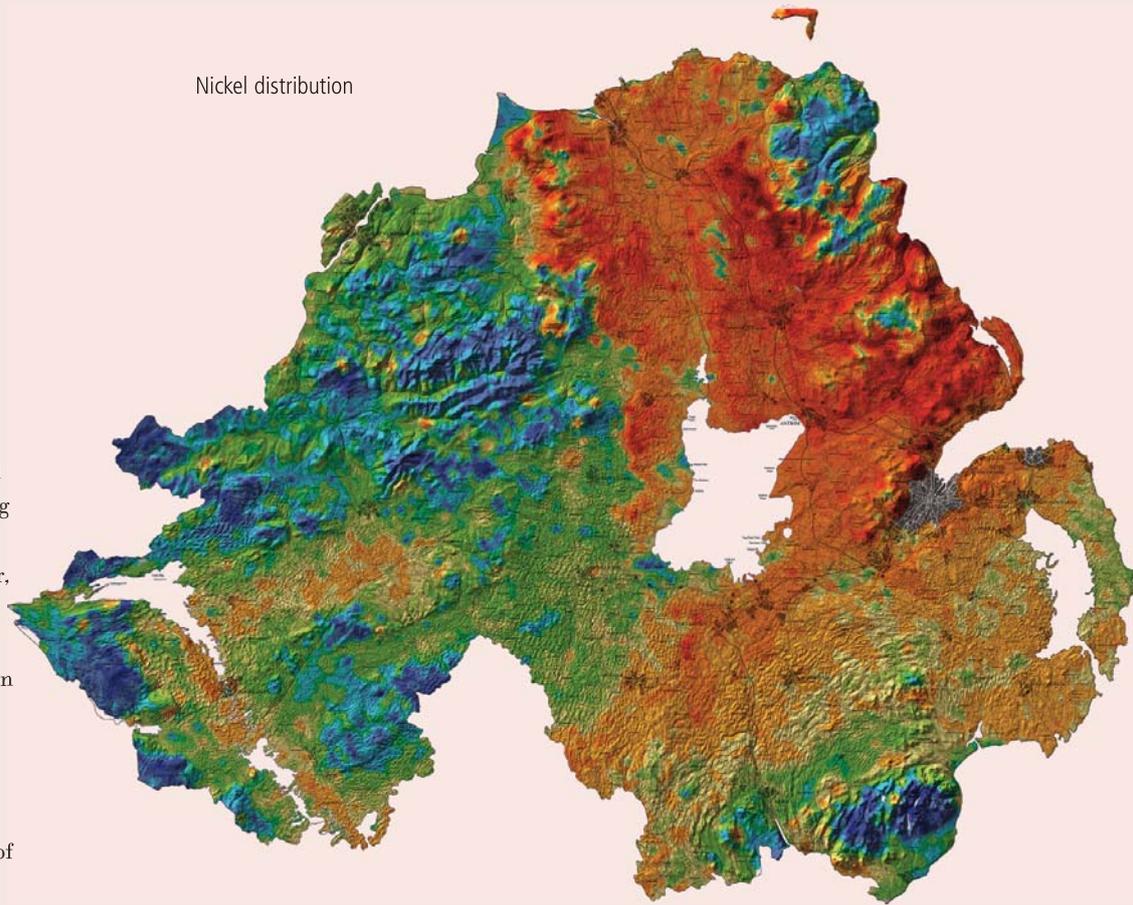
Others however, from Ireland and the rest of the UK, are not slow in coming forward. As an indication, about 30 PhDs, MScs and other university research projects have already been spawned by these new data. An example of the sort of fruitful collaboration is provided by the assessment of soil organic carbon, which has been carried out by scientists from Rothamsted Research and BGS in England with the GSNI and the Belfast Agri-Food and Biosciences Institute. The cost-effectiveness of airborne radiometric sensing of organic carbon is being tested. If it proves its worth, repeating the process at intervals could provide insight into how soil carbon contents are changing over time as climate change takes effect.

Take a look at some of the maps derived from the Tellus Project and you cannot fail to be amazed at the volume of new and relevant data. Hundreds of dykes have been revealed beneath thick Quaternary debris, telling of extensional tectonics as the Atlantic Ocean came into being, splitting us from North America. Platinum Group metals, nickel and copper, all show highs in soils over the Antrim Plateau. Look at the maps for gold, and see how the currently-worked deposits in Co. Tyrone can be traced into adjacent areas. Then there are other areas, like the Mournes in Co. Down, where gold concentrate has been panned. When Irish songwriter Percy French wrote of the Irish emigrant in London pining for home:

*.. there're gangs of them digging for gold in
the streets
(At least when I asked them that's what I
was told)...
But for all that I found there I might as well
be
Where the Mountains of Mourne sweep
down to the sea.*

...he spoke more truly than he knew!

Nickel distribution



Pure water vital

The economic importance of groundwater resources was recognised in the early days of the GSNI. Aquifers in counties Armagh, Antrim and Londonderry were tested and put into the supply chain, proving invaluable during drought years such as the mid-1970s. Today groundwater, and the protection of surface water supplies, is no less significant. Satisfying European quality legislation and the advent of water charges has also increased the need for hydrogeological advice. Dedicated officers of the GSNI support the vital work of the Water Management Unit of the Environment Agency.

All the above goes on alongside the digitising of map data to provide a geological Geographic Information System (DigMapNI), field surveying, monitoring quarrying activities, the management of all old mine workings (c. 2100), maintaining a comprehensive borehole database and dealing with enquiries from both private and public sectors.

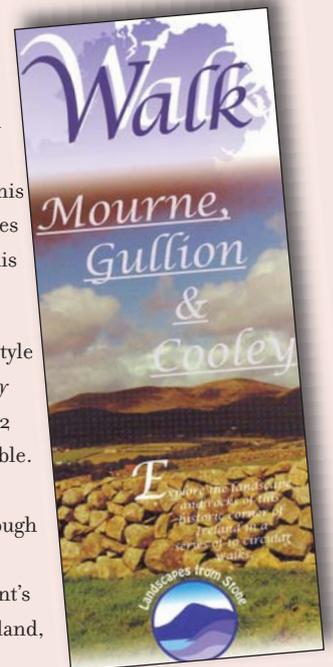
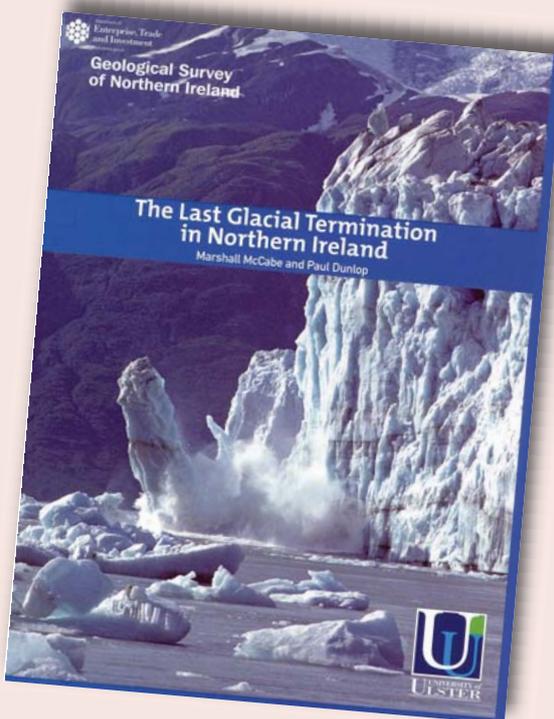
Anything but superficial

Another interesting change is the publication of University of Ulster research by DETI and the GSNI. A book *The Last Glacial Termination in Northern Ireland* sets a new scene for the last part of the Quaternary. Knowing how the glacial deposits of till, sand etc. were formed is critical in understanding the engineering characteristics of the superficial deposits on which our infrastructure is built. As the *Engineering Geology Map of Belfast* (1971) was the first of its type in Ireland and the UK, so GSNI plans to remain at the forefront in presenting superficial deposit data of clear practical utility. After all, this is what many of our houses is built on.

Landscape tourism

A most important initiative marked a new level of collaboration with the GSI in the field of landscape tourism and educational outreach. The two surveys played pivotal roles in developing the first trans-national geopark of counties Fermanagh and Cavan – *Marble Arch Caves Global Geopark*. Indeed, the GSNI geologist most closely involved with this project is now one of UNESCO's principal advisers on Geoparks all over the world – a topic that will form the basis of this year's meeting of the Association of European Geological Societies Meeting in Cluj, Romania (<http://bioge.ubbcluj.ro/maegs16/>) this month (9-13 July).

The surveys are also publishing Earth science data in a popular style under the general banner *Landscapes from Stone*. The book *A Story through Time*, 11 *Explore* guides and eight *Walks* guides cover the 12 northernmost counties of the island. All are colourful and readable. Relevant county councils and local district councils have been involved in their production, through advice and funding - although the lion's share of funding has come from European sources. Landscape tourism in a country with a World Heritage Site – Giant's Causeway – as well as geology that is as varied as the north of Ireland, just has to grow and be important for the future of its economy.





Education

GSNI is also actively involved in outreach work to schools, organising workshops for both teachers and pupils. This work is extending to taking a general role in raising the awareness of the importance of geology by organising public lectures and conferences. Iain Stewart, the Scottish geologist known for his frequent appearances as a television presenter, gave a public lecture *The Power of the Planet* in Belfast this January. It was followed the next day by a conference on *Climate Change*, and then visits to schools. About 1400 people attended the meetings. The GSNI is now often a partner in making such events happen.

Future

Further research into geothermal energy and gas storage, including sequestration of carbon dioxide, is on the cards for GSNI. A major new publication is being prepared to give new explanations of what the great poet

Seamus Heaney called 'the vastness and pastness of geology'. The GSNI has an important and continuing role to play in the economy of Northern Ireland - a survey changing to meet the challenges of the modern community it serves.

All pictures © GSNI

Tony Bazley is Editor of Earth Science Ireland magazine (formerly "ES2K"), and winner of the 2009 R H Worth prize of The Geological Society of London.

Further reading

- Rawlins, BG, et al., 2009: European Journal of Science, Vol. 60, Issue 1, 44-54.
- McCabe, M. and Dunlop, P. 2006: *The Last Glacial Termination in Northern Ireland*. GSNI, Belfast. 93pp.
- Mitchell, WI (ed). 2004: *The Geology of Northern Ireland – Our Natural Foundation*. GSNI, Belfast. 318pp.

STICKS AND STONES



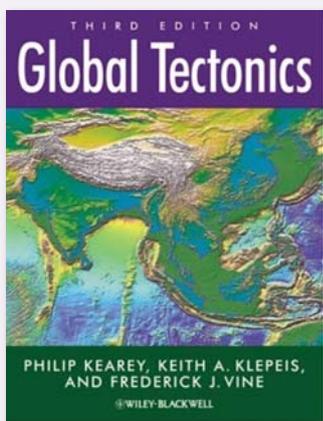
Reviews

Books available for review:

- Boyden, A. and Boyden, G. (eds) (2009), *Exploring Indonesia 1902-1911: Adventures of geologist Johannes Wanner*, Pen Press.
- Fortey, R. (2009), *Fossils: The key to the past*, NHM.
- Janson-Smith, D., Cressey, G. & Fleet, A. (2008), *Earth's Restless Surface*, NHM.
- Schuster, G. T. (2009), *Seismic Interferometry*, Cambridge.
- Schulson, E. M. & Duval, P. (2009), *Creep and Fracture of Ice*, Cambridge.

Interested parties should contact the **Reviews Editor, Dr. Martin Degg 01244 392749; m.degg@chester.ac.uk**, only. Reviewers are invited to keep texts.

Review titles are not available to order from the Geological Society Publishing House unless otherwise stated.



Global Tectonics (3rd Edition)

Philip Kearey, Keith A Klepeis & Frederick J Vine

Published by: Wiley-Blackwell

Publication date: 2009

ISBN: 978-1-4051-0777-8

List price: £34.99

482 pp

www.wiley.com/wiley-blackwell

It's worth pointing out occasionally that earthquakes have their positive side as well. Our planet needs tectonic activity to balance erosion, to stop the world becoming one vast shallow sea. Tectonics has made our planet what it is today, but it's fascinating how much we don't actually know. Does the Adriatic plate go under the Eurasian or *vice versa*? Which plate is Tokyo on? One would expect these to be simple questions, and it can be a surprise to find how much disagreement there is in the literature.

Global Tectonics, now in its third edition, won't answer these questions. Despite its title, it doesn't offer a global survey of what's going on where. What it does provide is an excellent synopsis of the processes themselves, aimed at senior undergraduate and postgraduate levels, but which should appeal to a much broader audience within the Earth sciences. For the non-specialist in tectonics, it would be hard to imagine a more comprehensive, yet readable, guide to the entire field.

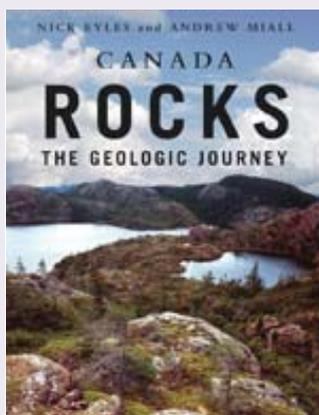
One of the great strengths of this volume is the way that it has been written with a sense of the history of the subject. Thus in addition to presenting what is the best understanding today, the authors guide us through the development of modern thinking,

taking in discarded ideas along the way. Knowing how current theory was arrived at, and what it superseded, gives one a much more secure understanding of the subject than would otherwise be the case and this approach is greatly to be welcomed. It also provides a good perspective on topics that are controversial today, since these can be seen in the context of an evolving science.

Indeed, the authors do not shy away from controversies, and make it clear, for instance, the extent of the current disagreement on such things as the existence of mantle plumes. I was interested to see not just a mention of the expanding Earth hypothesis, but an actual section on it, in which the authors demonstrate that evidence does not support this idea.

The first author, sadly, died in 2003 just after starting work on the preparation of this third edition. Fortunately his work was completed by the other two - this is a valuable text: comprehensive, clear, reasonably-priced and physically very well produced. Strongly recommended.

Roger Musson
BGS, Edinburgh



Canada Rocks: The Geological Journey

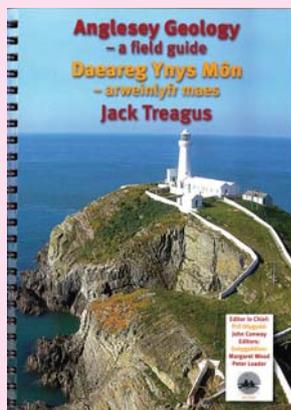
Nick Eyles and Andrew Miall
Published by: Fitzhenry & Whiteside
(Markham, Ontario)
Publication date: 2008
ISBN-13: 978-1-55041-860-6
ISBN-10: 1-55041-860-2
List price: Can \$60:00
498 pp

www.fitzhenry.ca/education.aspx

Big country, big book, and one of more significance than the sum of its parts; a book that I found hard to put down. Subtitled *The Geological Journey*, it is not just about the geology of half a continent, it includes many judicious titbits on the history, exploration and development of Canadian research. The systematic study of Canada's geology can be said to have begun in the eastern provinces with amateur and academic endeavours and mapping by the newly founded Geological Survey of Canada (1842). It still progresses with startling results year by year, ranging from the Precambrian to the Permo-Triassic and Pleistocene. Western Canada has seen a relatively late deciphering of its turbulent evolution, with the Geological Survey of Canada and petroleum and other prospecting parties playing key roles in this task.

This is an arresting and pictorially magnificent account of Canada's long geological story and of the importance of its rocks in a modern, increasingly industrial country. It also covers the national concern for its resources, climate and identity. *Canada Rocks* is also a new high point in presentation. Ron Redfern's *The Making of a Continent* (BBC, 1983) set a high standard for books on the geological evolution of North America, which is followed and exceeded here. The geological journey itself is neatly summarised in an early figure which has a time-stratigraphic column, table of major crustal events following the formation of the Canadian Shield, and a sequence of thumbnail maps highlighting the North American craton's hemispheric migration. 'Boxed' topics added on the way include relevant petrography and processes, tectonics and structural geology. Canada's spectacular palaeobiological record also gets plenty of welcome attention. All this is presented with the minimum of jargon and with a wealth of illustrations, making for a book of interest to a wide range of Earth scientists and not just those in North America.

Beginning the journey at the dusty origin of the Earth, the reader passes through theory and conjecture and arrives at the Canadian Heartland, the Shield, and for the non-specialist this is "where the story really begins". From here on the evidence is before us in half a continent. This



Anglesey Geology - A Field Guide

Jack Treagus
Published by: Seabury Salmon
& Associates
Publication date: 2008
ISBN: 0 95469 662 X (pbk)
List price: £9.95 (£11.00 inc. p&p)
168 pp

www.geomon.org.uk

How refreshing to have a beautifully presented guide to the geology of a classic British region that does not shy away from describing the geology in depth or drawing attention to the uncertainties that remain. Although an excellent adjunct for the armchair geologist, hopefully most readers will be inspired to visit the localities for themselves.

This is the first substantive account to be prepared for the recently established GeoMôn (Anglesey's GeoPark). It is an educational book, aimed at colleges and universities; it is also suitable for interested amateurs. Jack Treagus knows Anglesey extremely well, and is familiar with many of the geological controversies. He succeeds in presenting a balanced view and, where appropriate, makes clear where other opinions might prevail. His book presents a total of 14 itineraries, each of which would take at least half a day. Many are coastal exposures, some of which are tide-dependant. With a paucity of good exposures inland, this means that it is unlikely that the whole set of itineraries could be fully studied within a week. Nevertheless, a little careful planning should enable the majority to be covered. Furthermore, the GeoMôn web site (www.geomon.org.uk/geosites) helpfully includes details of many additional sites, arranged according to geological age, as well as sources of information aimed at different educational levels.

The guide needs reading twice before use, first to get an overview of the breadth of coverage and second to appreciate the various nuances of detail for which each location is known. The stratigraphy provides an introductory framework but it is the structural deformation that makes Anglesey so special for a field study, together with its plate tectonic setting. The excellent images within the text help the reader identify key exposures. The colour photographs are very clear and well focused. Furthermore, they are reproduced in clear detail, and so effectively enhance an understanding of the rock. In the field it would also be useful to have a text such as Ken McClay's *The Mapping of Geological Structures* (last published in 1991 as part of the Geological Society's Handbook Series), and a compass/clinometer (but not a hammer!).

account of the Canadian Shield is the best your reviewer has seen. Written by “soft rock” geologists, it smoothes the rough edges of igneous and metamorphic geology for the general reader and the illustrations are excellent. It conveys just how enormously varied and complex the Shield and its history are.

Thereafter comes the geological evolution of the conspicuously distinct natural regions of Canada – the interior platform, Appalachian or Atlantic Canada, the Cordilleran Rockies and seaboard of the west, and the arctic lowlands and islands. Sloss’s concept of sequences is used to explain the great spread of relatively thin sediments over the Shield, with marine giving way locally to continental environments. The vast organic activity throughout Phanerozoic time is graphically shown; a photo amusingly compares the bioturbated Tyndall Stone in polished section with H.M. the Queen’s patterned dress in Winnipeg.

In summary this very well written and produced book is less of a textbook and more of a good read and browse. Physically it is a heavyweight, though a paperback: how long will it survive usage in students’ hands? At the price it is a bargain and should command a market beyond Canada’s bounds. The authors hold British and Canadian qualifications to which they might well add a palm or two for the present contribution, which they clearly enjoyed writing.

David Dineley, Bristol

Sufficient information is included to guide the visitor with respect to parking and access, but large scale topographic maps will also be essential. A number of localities are included for each itinerary, helping broaden one’s appreciation of the local geology and reduce concentration on the better known exposures. Printed on clay-rich paper to maximise the clarity of the photographic images, the book is perhaps a little heavy. However, the printers have sensibly selected a spring-type wire ring binding which can easily release those pages needed for a day’s excursion. For those less familiar with the scientific terminology, there is a useful seven-page glossary. The font is a little small but is clear, helped by the extensive use of colour, reduction of text block size by insertion of photographs, and dual columns to accommodate the Welsh text alongside the English.

The three-page reference list provides a good overview of the pertinent literature and will help facilitate further study. Perhaps the only omission is reference to one or two good books on structural geology, for instance: Price and Cosgrove’s *Analysis of Geological Structures* (1990) or Pollard & Fletcher’s *Fundamentals of Structural Geology* (2005).

This book is strongly recommended and good value for money!

Mike Rosenbaum, Ludlow

Letters

Geoscientist welcomes readers’ letters, and every effort is made to publish them as promptly as possible. You can help by keeping letters to around 300 words or fewer. Please write to **Dr Ted Nield**, Editor, at The Geological Society, Burlington House, Piccadilly, London W1J 0BG or email ted.nield@geolsoc.org.uk

All letters are published at www.geolsoc.org.uk/letters, and a selection subsequently presented in the magazine. Please note that letters may be edited.

Charnia dating error

From Roger Mason (Rec’d 23 May, Pub’d 27 May 2009)

Sir, I agree with the message of Joe McCall’s article in the May issue of *Geoscientist* that Martin Brasier and Jonathan Antcliffe’s recent studies and publications about the holotype of *Charnia* and other Ediacaran fossils represent a major advance in the study of these important organisms. Their observation and documentation is of the highest quality and I was therefore disappointed by a mistake in Joe McCall’s article. I discovered *Charnia masoni* in 1957 not 1958, which was the date of publication of Trevor Ford’s paper in the *Proceedings of the Yorkshire Geological Society*.

I have recounted the story many times and it appears in a paper by Ford (2007) and an abstract by me (Mason, 2007). Thanks to my father’s diary, I am able to be confident about dates. Ford also recounts how news of the discovery spread to Australia in 1957 ahead of Martin Glaessner’s *Nature* paper, a monumental example of ‘shoehorning’ thirty years before Gould’s (1989) description of the phenomenon.

- Ford, T.D. 1958. Precambrian fossils from Charnwood Forest. *Proceedings Yorkshire Geological Society*, Vol. 31, 211–217.
- Ford, T.D. 2007. *Charnia masoni* – 50th birthday party. *Mercian Geologist*, Vol. 16, p. 280–284.
- Glaessner, M.F. 1959. Precambrian Coelenterata from Australia, Africa and England. *Nature*, Vol. 183, 1472–1473.
- Gould, S.J. 1989. *Wonderful Life: The Burgess Shale and the Nature of History*, p.263–277. New York: Norton & Co.
- Mason, Roger. 2007. The discovery of *Charnia masoni*. *Transactions of the Leicester Literary & Philosophical Society*, Vo. 101, p.48 (abstract).



From the Geological Society Publishing House

The Geological Society

July Online Bookshop Sale

Friday 3rd July - Friday 10th July 2009

www.geolsoc.org.uk/bookshop

HOW TO REGISTER:

The sale will last one week only and is only available via the online bookshop. To take part please register via the Online Bookshop home page, and sign up by clicking on "Login/My GSL", found in the right hand corner; then click on "register". Remember to register your details with the Geological Society Online Bookshop Newsletter by **Friday 2nd July**. Once registered, you will receive an email at the start of the sale detailing the publications on offer.

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All publications will be reduced to **£25.00 each** for the duration of the sale (Friday 3 July – Friday 10 July).

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DARWIN THE GEOLOGIST: HIS LEGACY

23 November 2009

The Geological Society, Burlington House



While Charles Darwin (1809–1882) became world renowned as a biologist with the publication of *On the Origin of Species* in 1859, there are few who are aware that he was also an accomplished geologist. As naturalist for the Beagle voyage under Capt. Robert FitzRoy from 1831–36, Darwin developed a fascination for geology.

This one day meeting will take place in the bicentenary of Darwin's birth, to celebrate the legacy of Charles Darwin the Geologist. A series of internationally renowned speakers will offer an analysis of Darwin's contribution to various fields of geology, and show how these subjects have since developed and continue to be relevant at the present day.

FOR FURTHER DETAILS CONTACT: Alys Hilbourne
The Geological Society, Burlington House, Piccadilly, London, W1J 0BG
Tel: 020 7432 0981; Email: alys.hilbourne@geolsoc.org.uk
Web: www.geolsoc.org.uk/events



From the Geological Society
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NEW



• Special Publication 313

Underground Gas Storage: Worldwide Experiences and Future Development in the UK and Europe

Edited By D. J. Evans and R. A. Chadwick

The UK became a net importer of natural gas in 2004 and by 2020 will import up to 90% of its requirements, leaving it vulnerable to increasing energy bills and risk of disruption to supply. New pipelines to Europe and improvements to interconnectors will meet some demand, but Government recognises the need for increased gas storage capacity: best met by the construction of underground storage facilities. Energy security has also raised the likelihood of a new generation of coal-fired power-stations, which to be environmentally viable, will require clean-coal technologies with near-zero greenhouse gas emissions. A key element of this strategy will be underground CO₂ storage. This volume reviews the technologies and issues involved in the underground storage of natural gas and CO₂, with examples from the UK and overseas. The potential for underground storage of other gases such as hydrogen, or compressed air linked to renewable sources is also reviewed.

• ISBN: 978-1-86239-272-4

• June 2009

• 292 pages

• Hardback

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Anglo American Environmental Geochemistry Poster Competition



To underline our commitment to improving environmental quality for all, Anglo American is funding a prize for the best poster on environmental geochemistry by a young researcher (PhD student or post-doctoral researcher) at a special meeting of the Geological Society, on Monday 5 October 2009.

If you would like to submit a poster, please describe its scope and intention in no more than 250 words and up to three illustrations and submit your proposal as a Word file to Georgina Worrall no later than 31 July 2009. A panel will select the best eight proposals and invite those shortlisted to prepare their posters. These will be exhibited in the Society during the afternoon and evening of 5 October, when judging will take place.

A prize fund of £6000 is available for the judges to award as one, or a number of prizes.

For further information or to submit your poster proposal, please contact:
Georgina Worrall Email: georgina.worrall@geolsoc.org.uk
Tel: 020 7432 0983 Or visit our website: www.geolsoc.org.uk/angloposter



JOINT PG AND SPE WORKSHOP:

HPHT Arena 2009

- a one day workshop dedicated to the North Sea's hottest plays

Friday 11 December 2009

Kings College Conference Centre, University of Aberdeen



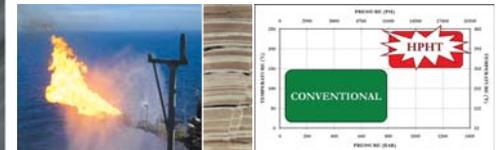
Convenors:
Stuart Archer
(University of Aberdeen)

Matthew Allen
(Maersk)

Tom McKie
(Shell)

Peyman Nurafza
(E.ON Ruhrgas)

Heather Auld
(ConocoPhillips)



This informal workshop plans to summarise the current status of the North Sea's high pressure, high temperature (HPHT) plays. We jointly invite geoscience, engineering and integrated talks addressing the theme of "subsurface challenges":

- Remaining exploration potential,
- Recent discoveries and appraisal drilling,
- Producing fields, reservoir behaviour and management, and life of field considerations including well bore failure and condensate banking
- Recent advances in drilling technology, production wells and depleted reservoirs, seismic imaging, reservoir monitoring, data acquisition and geomechanics
- Controls on reservoir quality and its preservation with depth
- Fault seal and compartmentalisation

Abstract deadline is October 16th 2009 (one colour figure encouraged in 2 page extended abstracts of 11 pt text size)

For further information about this conference, please contact:
Steve Whalley, Events Co-ordinator: +44 (0)20 7432 0980
or email: steve.whalley@geolsoc.org.uk



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- **7 July - Symmons Madge Associates** – *Site investigation* Dublin E-Mail: admin@symmonsmdage.co.uk
Website: <http://www.symmonsmdage.co.uk>
- **14 July - Symmons Madge Associates** – *Interpreting Soil Test Results* Bristol E-Mail: admin@symmonsmdage.co.uk
Website: <http://www.symmonsmdage.co.uk>
- **17 September - Symmons Madge Associates** – *Interpreting Soil Test Results* Glasgow E-Mail: admin@symmonsmdage.co.uk
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JULY 2009

South West
Regional

• **2 July** – *Quiz Evening* - Geological Quiz & Social Event, City Gate Hotel, Exeter, 19.15 -19.30 start - come and test your geological knowledge! Food can be purchased until 21.00. **Contact:** swrg@geolsoc.org.uk

Central
Scotland
Regional

• **14 July** – *The New Chartership process*. Speaker: Bill Gaskarth (Society Chartership Officer) Tea and coffee from 5.45pm, event starts at 6.30pm. Venue TBC (Glasgow). **Contact:** Julie Parsons E: j.parsons@donaldsonassociates.com

Forensic
Geoscience
Group

• **15 July** – *3rd International Crime Science Conference*. Venue: University College London. This conference will concentrate on prevention, disruption and detection of terrorism, organised crime and crime. Technologies and methodologies from the fields of biometrics, forensic science, surveillance and crime science will be explored with planned plenary sessions on topics including data forensics, infrastructure protection and gangs and guns. Speakers: Bill Hughes (Director General, SOCA); Professor David Kennedy (Center for Crime Prevention and Control at John Jay College of Criminal Justice). **Contact:** Katie Carter. E: k.carter@ucl.ac.uk W: <http://www.crimescience.org/>

Yorkshire
Regional

• **18 July** – *Field trip: National Coal Mining Museum*. Details TBC. Contact: Katie Dunn. E: katie.dunn@WorleyParsons.com

AUGUST 2009



• **31 August-2 September** – *Micro-Analysis, Processes, Time (MAPT)*. The meeting will be held in Edinburgh and the lead convener is Professor Simon Harley of Edinburgh University. There are field trips before and after the meeting and workshops on quality assurance in microanalysis and ion microprobe techniques and applications. For full details visit: www.minersoc.org/pages/meetings/MAPT/MAPT.html. **Contact:** Simon Harley. E: simon.harley@ed.ac.uk

SEPTEMBER 2009



• **6-13 September** – *Fermor Meeting 2009: Supercontinents, Superplumes and Scotland*. Conference & field trip. The 2009 meeting and field trip will focus on the formation, configuration and break-up of Rodinia. The meeting will be hosted in Edinburgh from 6-9 September 2009, followed by a four-day field trip to see some fabulous and classic geology in the Western Highlands of Scotland. Full details and registration: www.geolsoc.org.uk/gsl/events/listings/page4772.html **Contact:** Alys Hilbourne E: alys.hilbourne@geolsoc.org.uk



• **21-23 September** – *William Smith Meeting 2009: Environmental Pollution and Human Health*. Venue – Burlington House. This conference aims to bring together "traditional" geoscientists (geochemists, hydrogeologists, engineers, geophysicists, mineralogists) and scientists outside traditional Earth sciences (toxicologists, microbiologists, physicists, chemists) from both academic and industrial communities in the understanding of environmental pollution and the potential threats to human health. The meeting may also act as a forum for research projects supported under the joint NERC *Environment and Human Health* programme. Full details and registration: www.geolsoc.org.uk/gsl/events/listings/page4598.html **Contact:** Alys Hilbourne E: alys.hilbourne@geolsoc.org.uk

FOUNDERS' DAY LECTURE AND DINNER

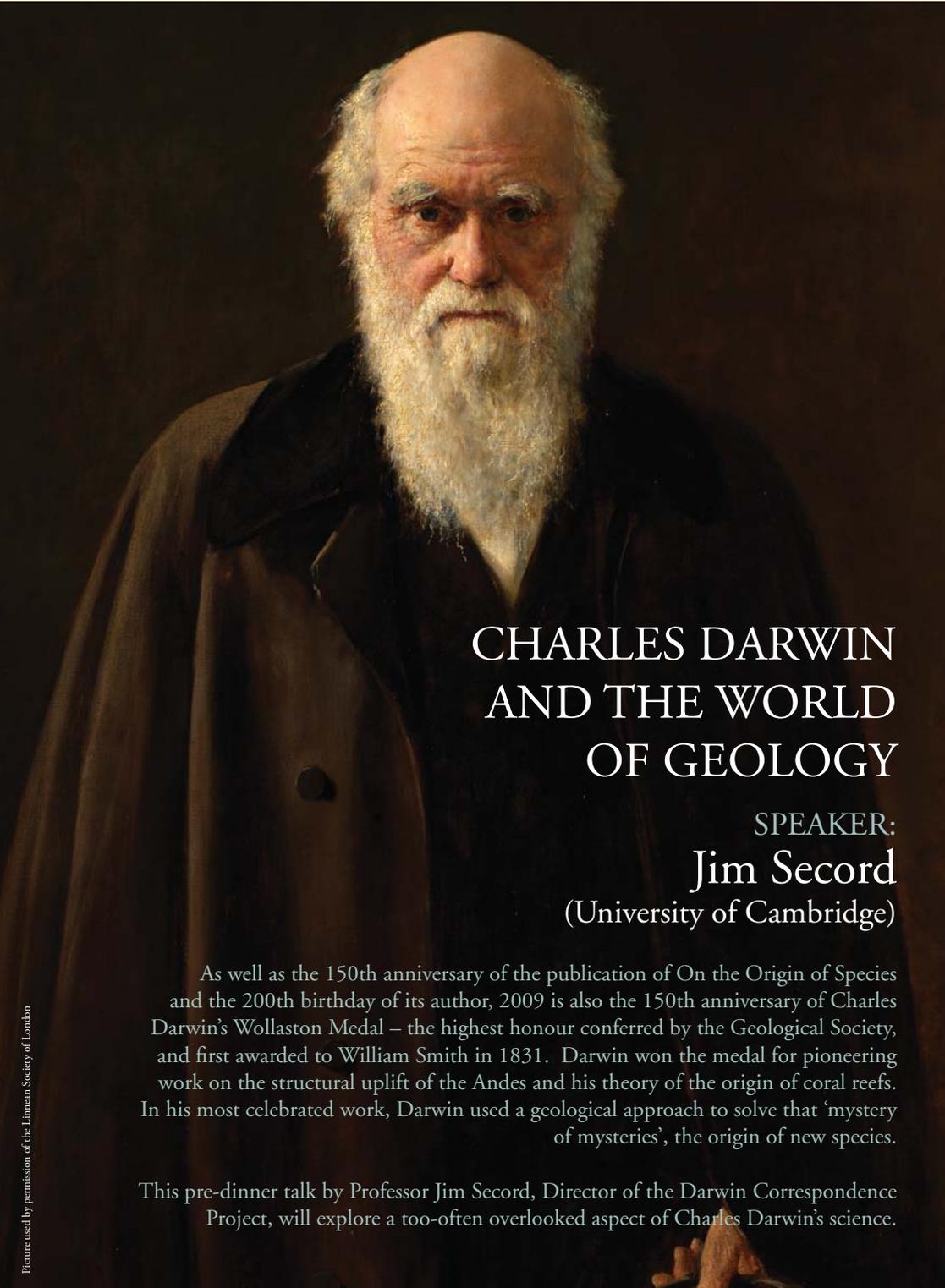
Thursday 12 November 2009

Tickets are limited

And afterwards
at Le Meridien,
Piccadilly

Dress: Black Tie

Ticket price: £65



CHARLES DARWIN AND THE WORLD OF GEOLOGY

SPEAKER:

Jim Secord
(University of Cambridge)

As well as the 150th anniversary of the publication of *On the Origin of Species* and the 200th birthday of its author, 2009 is also the 150th anniversary of Charles Darwin's Wollaston Medal – the highest honour conferred by the Geological Society, and first awarded to William Smith in 1831. Darwin won the medal for pioneering work on the structural uplift of the Andes and his theory of the origin of coral reefs. In his most celebrated work, Darwin used a geological approach to solve that 'mystery of mysteries', the origin of new species.

This pre-dinner talk by Professor Jim Secord, Director of the Darwin Correspondence Project, will explore a too-often overlooked aspect of Charles Darwin's science.

CONTACT DETAILS

For further details contact: Alys Hilbourne, The Geological Society, Burlington House, Piccadilly, London, W1J 0BG
Tel: 020 7432 0981; Email: alys.hilbourne@geolsoc.org.uk Web: www.geolsoc.org.uk/events

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To sustain and develop a comprehensive range of Petroleum Engineering activities at Heriot-Watt University, the Institute announces the following position in :



PETROPHYSICS

This appointment is planned at Senior Lecturer level (£44,931 - £52,086), however there is flexibility to consider a wider range of candidates. We seek a self-starting, team player, with a proven research track record in Petrophysics. Principal activities will be teaching Formation Evaluation on the IPE MSc program, building a research group in Petrophysics, and collaborating with the established Engineering and Geoscience community in IPE and at our ECOSSE partners. Candidates should have a first degree and PhD in a relevant science/engineering topic. Operational experience in Formation Evaluation would be an advantage. The successful applicant will also support the Institute's international teaching commitments.

The Institute of Petroleum Engineering has been world-leading for 30 years, with top ratings over the last two research assessment exercises. We are located on the outskirts of Edinburgh in a modern campus with good access to local and international transport networks. For more information about IPE, see our website www.pet.hw.ac.uk. You can contact the Head of Institute (Prof Simon Stewart) if you wish to discuss this position informally.

Formal applications need to be made via the Heriot-Watt website (see www.hw.ac.uk/hr/v_academic.php), quoting Ref 59/09/GEO.

Closing date is 24 July 2009.

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Non-Executive Chair of the BGS Board

The British Geological Survey (BGS) is seeking to appoint a non-executive, part-time, Chair for its Board. The BGS is part of the Natural Environment Research Council and is the nation's principal supplier of geological expertise and information for decision making for governmental, commercial and individual users. The BGS carries out research in strategically important areas, including energy and natural resources, earth system science and vulnerability to environmental change and hazards.

The BGS Board takes full responsibility for:

- helping the BGS develop and fulfil its long-term vision and strategy;
- supporting the Executive Director and senior directors in representing the views of the Survey to the public;
- ensuring high standards of corporate governance.

The BGS Board normally meets four times a year at the BGS head office near Nottingham and at other locations in the UK. The appointment will start in December 2009 and will be for two years in the first instance. You will receive honoraria of £4,575 per annum plus expenses.

Candidates should be able to demonstrate a proven track record of leadership at a senior level in the public or private sector.

Further details can be obtained by contacting the BGS HR Office on 0115 936 3209.

Applications should consist of a CV and covering letter, quoting reference number BGS_BOARD_09, and must be returned by 31 July 2009.

The Natural Environment Research Council is an equal opportunities employer and welcomes applications from all sections of the community. People with disabilities and those from ethnic minorities are currently under-represented and their applications are particularly welcome. The British Geological Survey is an Investors in People organisation. There is a guaranteed Interview Scheme for suitable candidates with disabilities.



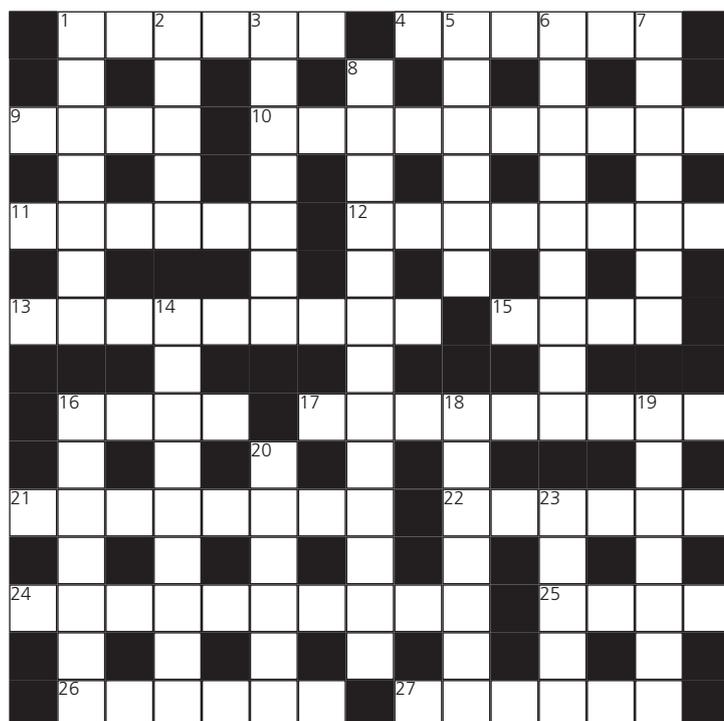
British Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL



WE HELP KEEP THE WORLD MOVING

Crossword no. 125 set by Platypus



Solutions April:

Across: 1 Tethys 4 Walton 9 Orbi 10 Supratidal 11 Hawaii 12 Trifocal 13 Antedates 15 Mica 16 Grit 17 Asymmetry 21 Absences 22 Marble 24 Continents 25 Mace 26 Sketch 27 Assays

Down: 1 Terrain 2 Taiga 3 Yeshiva 5 Ataxia 6 Trilobite 7 Niagara 8 Apotheosising 14 Epicentre 16 Gibbous 18 Mimesis 19 Relicts 20 (Clue inadvertently omitted) 23 Rumba

Across

- 1 Variety of bituminous coal suitable for devolatilizing (6)
 4 Barium sulphate mineral (6)
 9 Broad, low-relief volcanic crater caused by a phreatomagmatic eruption, which fills with water (4)
 10 To steal the intellectual property of others (10)
 11 Seven players (6)
 12 Otter-hunting Yorkshire terrier (8)
 13 Moving staircase (9)
 15 Northcountry lake commonly in glacial corries (4)
 16 Rage, but only in the H&S approved cupboard please (4)
 17 Shared cultural norms governing individual behaviour (9)
 21 Steep cliff behind a cirque - or indeed a 15a (8)
 22 Proposition neither proved nor demonstrated, but assumed as self-evident (6)
 24 A screw corvette launched 1858, converted in 1872 for famous voyage of discovery. (10)
 25 Floating chunk of ice less than 10 kilometers in its greatest dimension. (4)
 26 Asteroid or moon in approximately the same orbit as a planet or large moon and about 60° ahead or behind (6)
 27 Sound reproduction with two audio channels (6)

Win a Special Publication of your choice!

The winner of the May Crossword draw was **Paul Finlow-Bates** of Derby.

All correct solutions will be placed in the draw, and the winner's name printed in the September 2009 issue. The Editor's decision is final and no correspondence will be entered into. Closing date – 11th August

The competition is only open to all Fellows and Candidate Fellows 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 enter by scanning the signed form and emailing it as a PDF to ted.nield@geolsoc.org.uk.

Name

Fellowship Number

Address for correspondence

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.....Postcode

Down

- 1 Barringer, Manicougan, Chicxulub & co (7)
 2 Limestone country (5)
 3 Distillation product of petroleum (or 1a) tar, containing hydrocarbons, used primarily as feedstock for producing high octane gasoline (7)
 5 Where beehives are (6)
 6 Zap with gamma rays, for example (9)
 7 Greek letter used to designate Uranus' most distant and most visible ring (8)
 8 The study of fossil organisms (13)
 14 This beast, related to fossils of the extinct Pampatheriidae and Glyptodontidae, is classified in the modern family Dasypodidae (9)
 16 A flood resulting from heavy rain or spring thaw. (7)
 18 Measured and marked rectangle, often a square, used in ecology to isolate a sample (7)
 19 Depositional landform: an island attached to the mainland by a narrow spit or bar (7)
 20 Natural mineral form of lead sulfide (6)
 23 To derive a logical conclusion from premises (5)

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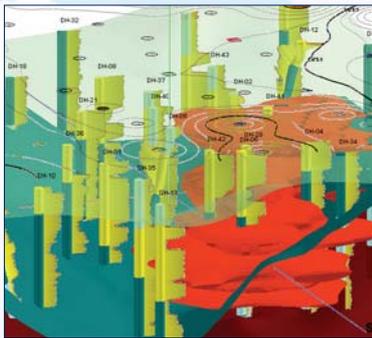
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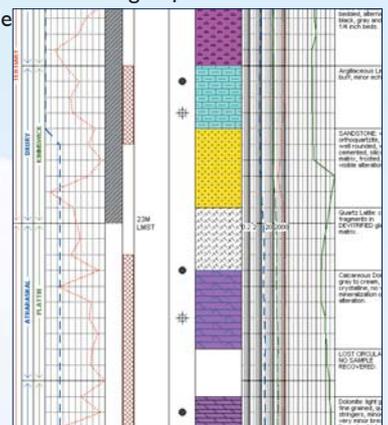
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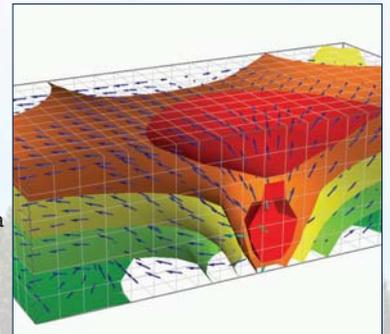
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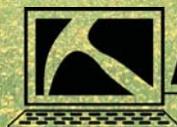
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