

GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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Generating Geo-Data

Wind farm footings spotlight hidden UK geology

BIG BANG THEORY

New dating correlates mass extinctions LIPs, climate change

RADWASTE DISPOSAL

Towards a new approach to finding a repository site in the UK

ACADEMIC ISSUE

Why academics and the Society need each other

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Wind farm footings are revealing a wealth of hidden treasures under the UK, say Peter Jones and Vanessa Banks

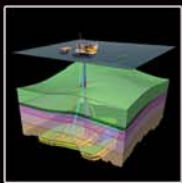
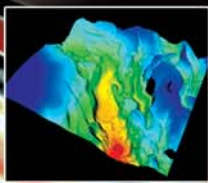
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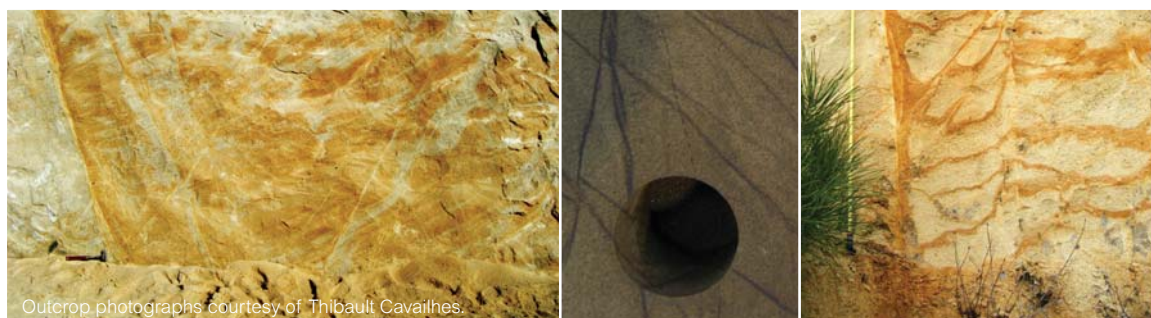


REGISTRATION NOW OPEN

Small to Subseismic Scale Reservoir Deformation

29-30 October 2014

The Geological Society, Burlington House, Piccadilly, London



Outcrop photographs courtesy of Thibault Cavailhes.

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

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

Confirmed Speakers:

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

For further information please contact:

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“ WIND FARMS BRING IN A NEW HARVEST OF GEOLOGICAL INFORMATION ”

Cover image: Matt Howcroft, University of Derby

FROM THE EDITOR'S DESK:

Wages of sin?

Sir John Barrow, Secretary of the Admiralty (1804-1845), found himself embarrassed by a Royal Navy that had nothing much to do after the defeat of Napoleon. Hearing tell of an ice-free arctic (in 1817) from the whaler William Scoresby was music to his ears. Alas, Scoresby had found the waters north of Canada only briefly ice-free thanks to Tambora's 1815 eruption. Normal service soon resumed, and all Barrow's expeditions failed.

News that military planners in the Pentagon have been ordered not to include climate change in any future prognostications – evoking the image of the US military's futurologists collectively sticking their fingers in their ears and singling 'la-la-la' very loudly – it is encouraging that the House of Lords Arctic Committee was not so hamstrung in its 29 July quizzing of shipping experts in Committee Room 1.

Giving evidence, Dr Martin Stopford, (Clarksons Research Services), told the committee that ports in northern Europe and America, for whom even Panama and Suez are a major detour, would find the opening of arctic sea routes useful, for it would 'balance up the transport world'. Colin Manson, (Manson Oceanographic Consultancy) explained that while the route across the pole may have to wait (as may Barrow's Northwest passage), the

northern sea route over Siberia might be open for the minimum 60 days by 2020 – representing 'a huge saving in time and emissions' (money).

The International Chamber of Shipping's members were all excited by this, said Kiran Khosla. The IMO has committed shippers to cutting their carbon footprint in half by 2050, so this must surely be a good thing. Questioned by Lord Moynihan about the current costs of icebreaker support, Stopford admitted with a smile that companies hoped 'the weather is going sort that one out for us'.

Outraged? Well, no. Having just finished Gaia Vince's *Adventures in the Anthropocene* (see Jan Zalasiewicz's review, p23) I am reluctant to throw up my arms in horror at such 'profiting from climate change'.

While opening up the Arctic might have dire consequences if we burn the hydrocarbons buried there, or fail to cut emissions before the permafrost releases its methane, the world we have is a world we have made - and are doomed henceforth to manage. There already is no true wilderness. Managing our planet wisely (instead of stupidly) includes taking advantage where we can find it, and resisting fruitless kneejerk moral outrage at any and all commercial inevitabilities.

▶ Listen to the Committee's hearing here:
www.parliamentlive.tv/Main/Player.aspx?meetingId=15881

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

SOCIETY NEWS

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



Society Awards

Fellows of the Society are invited to submit nominations for the Society's Awards for 2015 to the Awards Committee. Full details of how to make nominations are on the website at www.geolsoc.org.uk/AwardNominations. Nominations must be received at the Society no later than 1 October 2014.

Nominating for other societies' awards

In order to reward excellence and promote international recognition of Fellows of the Society, we encourage Fellows to nominate colleagues for awards of other societies, such as the American Association of Petroleum Geologists, the American Geophysical Union, the European Geosciences Union and the Geological Society of America. There may be special eligibility requirements for these awards; details can be found at:

- ◆ www.aapg.org/business/honors_awards/
- ◆ www.agu.org/honorsprogram/
- ◆ www.egu.eu/awards-medals/proposal-and-selection-of-candidates/
- ◆ www.geosociety.org/awards/aboutAwards.htm

Honorary Fellowships

Following a proposal from the External Relations Committee, Council recommends the following candidates for election to Honorary Fellowship at a future Ordinary General Meeting.

► Prof Patrick De Deckker



Patrick De Deckker, Belgian by birth and Australian by naturalisation, is one of Australia's most distinguished Earth scientists. Having graduated in Australia in 1971 he worked briefly in Europe before returning to carry out research. He has spent most of his career at the Australian National University in Canberra, including time as Head of Department. Patrick recently took early retirement to focus on research. He was awarded a DSc by the University of Adelaide in 2002 but

his contribution to Australian and international Earth science is more accurately reflected by his list of c.200 publications, in refereed journals and seven edited volumes, in the fields of limnology (especially of salt lakes), aeolian dust & deposits, and in palaeoceanography. Patrick holds the Verco Medal, Royal Society of South Australia, 1992; Australian Society for Limnology Medal, 2005; Order of Australia Medal, 2007; Christoffel Plantin Medal, 2008; Mawson Medal of Australian Academy of Sciences, 2010.

► Dr John (Jack) Hess



Jack Hess has been Executive Director of the Geological Society of America since 2001, a role from which he will retire shortly (see p.25). During Jack's tenure, collaboration between our Societies has developed dramatically in terms of co-sponsored meetings and marketing, and as a joint influence in international geopolitics. On retirement Jack is expected to assume the role of Chair of the GSA Foundation. This is an important function and will ensure his continuing

links to geosciences both in the United States and internationally, and the Society can look forward to the continuation of a mutually beneficial relationship with GSA. Much of Jack's scientific career was spent at the Water Resources



LONDON LECTURE SERIES

Groundwater - the Good, the Bad and the Ugly

Speaker: Natalyn Ala (Atkins Ltd., & GSL Council)

Date: 10 September

Programme

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

Further Information

Please visit www.geolsoc.org.uk/gslondonlectures14. Entry to each lecture is by ticket only. To obtain a ticket please contact the Society around four weeks before the talk. Due to the popularity of this lecture series, tickets are allocated in a monthly ballot and cannot be guaranteed.

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

Center of the Desert Research Institute in Las Vegas and Reno rising from Assistant to Associate to full Research Professor including Director of the Environmental Isotope Laboratory. Latterly he was Executive Director of the WRC and Vice President for Academic Affairs. He spent a year carrying out research at the SURRC, East Kilbride, UK and another secondment was to a Senatorial office in Washington, DC as a Legislative Fellow to advise on radioactive waste, renewable energy and other science and technology matters. His research career was carried on in parallel with teaching and student supervision and steadily increasing administrative responsibilities.

► Fellows may nominate candidates for Honorary Fellowship at any time. To find out how to do this, please go to www.geolsoc.org.uk/honoraryfellowship

FELLOWSHIP ELECTION

The following are put forward for election to fellowship at the OGM on 25 September 2014:

ABOKHODAIR Abdulwahab; ADAMS Cameron; ADAMS Nicholas; ADU Florence; AFZAL Saima; ALAM Mohammad Ayaz; AL-FARRAJ Asma; ALI Dilshad; ALLEN Conrad; ALLEN James; ALLEN Nathan; AMENTA Giovanni Paolo; AMGBARE Edwin Braye; ANDERSON Gemma; ANDREOU Andreas Costas; APPIAH Moses Kwame Ofori; ARCHER Jean Barbara; ARLOTT Leah; ARMITAGE Shaun; ARNOLD Annabelle; ATKINS Stephen David; AYLOTT Craig; BALL Edward; BARBAGLI Francesco; BARCLAY Stuart; BARKER Daniel Stuart Charles; BARNET James; BARRETT Sean Andrew; BATES Rory Nathaniel; BEHRENS Graham; BELL Martin; BETTENCOURT MACHADO Hugo; BIRD Anna; BIRNEY Stella; BORELLA Riccardo; BORRELL Anthony; BOVENIZER Hannah; BOWDEN Bryan; BRADLEY-WATSON Kirsten; BRIGGS Steven; BROOK Christopher Alexander John; BROWNHILL Laura; BUCK Heidi; BUGGENHAGEN John; CHAMBERS Andrew; CHUI Wai Hong; CHUNG Wai-Kin Johnny; CICCARELLI Francesco; CIPPITELLI Giuseppe; CLARK Alexander William James; CLARK Ian Richard; CLARKE Ian; CLARKE Karen; CLARKE Lee; CLARKE Stephen; CLARKE Stuart; COFFEY Peter Martin; COMFORT Guy; COMRIE-SMITH Nicholas James; COOKSON Elisabeth; COTTERILL James Edward; COUPERTHWAITE Fiona; COURTIER Kathleen Sarah; CRIGHTON Colin; CROSBY Anthony; CUNNINGHAM Andrew; DANIEL Ron; DAVIES Beth; DAVIS Joseph; DASSANAYAKE Dassanayake Mudalige Guththika; DAWKES Kirsty; DEELEY Sam; DEVITT Philip; DIAPER Lucy; DICKIN Michael Joseph; DICKSON Graeme; DIKER Caner; DILLON Jamie; DOBBS Victoria Elizabeth; DONOVAN Kate; DOUGAN Paul Thomas; DUGGAN Richard; DUNCAN Ian; DUTTON Kirsten Emily; DYCK Brendan; EDWARDS Luke; ELLIS Stuart; ELSON Peter; ESLER Olivia; FABUEL-PEREZ Ivan; FAIRBAIRN Ian; FAIRWOOD Duncan Steven; FALLON Emily; FARNELL Ross; FAROPPA James; FEELY Paul; FINLAYSON Roderick; FITTON Joanne; FRANCHI Marianne; FROST David; FROST Kerry; FUENTES Alexander Francisco; FUH Calistus Gentry; GAN Fengwei; GARVEY John Phillip; GATH Marc Richard; GIBSON Jennifer; GILLIGAN Amy; GLANCY George; GOLDIE Stephanie; GOODE Thomas; GOODSHIP Alastair; GOSAI Sachin Luke; GRANT Geoffrey George; GREGORY Logan Shane; GRIFFITH Simon; GULFI Veronica; GUY Matthew; HAGGER Kathryn; HALIBURTON Michael Ian; HANDS Neil Adamson; HANNATH Jake; HARDWICK Alexander; HARRISON Katherine; HARRISON Arthur; HATTER Stuart James; HAWKSWOOD Rose; HAWLEY Helen; HE Tianchen; HEATH Justin Henry Stewart; HENRY Felicity; HERBERT Christopher; HERRETT Tim; HOGGETT Murray; HOLLINGWORTH Anne; HOLM Gordon; HOME Robert; HOOLEY Claire; HOOPER Sophie; HOPE David; HORSEMAN Robert; HOUGH Victoria Helen; HOULLEBERGHS Eric; HOWARD David; HUNT Katherine; HURLEY Roger William; HYETT Richard; IKPERE Jonathan Achoja; ILOUGA Dieudonne Charles Isidore; IRVING Callum; IWALEWA Tajudeen; JAMES Matthew; JAMIESON Byron Dayne; JEGEDE Ayodele; JOHNSTONE Heather; JOHNSTONE Luke; JONES Jack; JONES Michael; JONES Thomas; JONES William; JONES Glyn; JUETT Timothy William; KAMAL Mohamed; KARVELAS Alexander; KELLY Jennifer Victoria; KENNY Jon; KING Jess; KLOPPENBURG Armelle; KNEALE Christopher; KOMOLAFE Ncube; KOMORI Onyerhouwo Raymond; KOREVAAR Aernout; KWOK Pui Tin; LAIDLAW Ross; LEADBEATER Maureen; LEVER Helen; LEVIEN Joseph; LEWIS Kerri; LEWIS Tara; LI Yang; LITTLE Simon David; LO Ming Yan; LOACH David; LOPPAS Andria; LORD Oliver Thomas; LOWNSBROUGH Gemma; MACLEOD Ian Connor; MACNEIL Craig; MALCOLM Isabella; MALONI Elana Dawn Jessica; MARSHALL Joanna Katherine; MARZUKI Sarah; MATTS Katie Anne; MCDERMOTT Ken; MCKENDRICK Robert; MCKENNA Stacey; MCQUISTAN Dhugal; MEADOWS Holly Rachael; MELLOR Kathryn; MELTON Antony; MEYER Glenn; MICHELAKI Sofia; MIDDLETON Matthew; MIKOLAJEWSKI Przemek; MINSHALL Ben; MOL Lisa; MOORHEAD Nicola; MORGAN Emily; MORRISON Andrew; MULHOLLAND Philip; MURGATROYD Jennifer; NG Yue Hi; NGU Ateh Banilia; NICOLE Samuel; NUGRAHA Abang Mansyursyah Surya; NUNN Lisa Deborah; NUZZO Marianne; NWOKIDU Chinyere Ngozi; OAK Ryan Carl; ODELL John; O'DONNELL Martin; OLLIER Michael Neale; OLUFELO Olufolahan; ONEA Alexandra; ORI Gian Gabriele; ORMOND Julia; OSMOND Jo; PACKMAN Adam; PARKES Graham; PARKINSON Dennis Neil; PARR Rhys; PARVAZ Daniel; PATTINSON Ronald; PAULO Bervindo; PEARCE Monique; PEREIRA Ricardo; PERRIMENT Thomas; PESKETT Haf; ►



Durdle Door, Dorset

Geosites project

Sarah Day (Earth Science Communicator) sends a big thank-you to everyone who nominated a site for the '100 Great Geosites' project.

Between March and July this year we received over 500 nominations via Twitter, Facebook and email, covering 360 different geosites in the UK and Ireland.

The final 100 will be decided based on public votes and the deliberations of an expert panel,

and will be announced during Earth Science Week 2014 (13-19 October). The full list of nominations can be found at www.geolsoc.org.uk/100geosites, where you can vote for your favourites.

► Get in touch on **twitter @geolsoc**, using **#100geosites**, or email us on **100geosites@geolsoc.org.uk**

Accreditation Officer (First announcement)

The post of Accreditation Officer will become vacant with the retirement of the present incumbent, Dr Colin Scrutton, in 2015.

The Society, therefore, seeks applications for the post of Accreditation Officer from 1 May 2015, or as soon as possible thereafter.

The post involves the processing of applications for the accreditation and reaccreditation of first degrees and taught MSc programmes in geosciences (www.geolsoc.org.uk/Education-and-Careers/Universities/Degree-Accreditation), arranging meetings of the Accreditation Panel and maintaining the lists of accredited programmes for the Society's website. The postholder is also responsible for recruiting members to the Accreditation Panel.

The ideal candidate will have experience of the planning and assessment of degree programmes and have a good knowledge of the present Higher Education system and the changes it is undergoing (has recently undergone). The work requires considerable attention to detail in the manipulation of course descriptions and make-up, so that this can be presented intelligibly to

the Panel for decision. He/she will also be required to interface with Universities to ensure that applications are presented in a way that satisfies the requirements of the Society's Accreditation scheme and also be able to explain what changes might be required by the Panel to meet those criteria. Further details of the work involved can be obtained from Dr Scrutton (Colin.Scrutton@dunelm.org.uk), who will be available for support during the changeover period.

The post would suit an academic geoscientist about to retire or considering switching to a part-time academic post. The applicant should be a Fellow of the Society and either Chartered or prepared to apply for Chartership if appointed. The post is part-time and remuneration is based on a daily rate.

Applicants should send a letter of application outlining their interest in the job and relevant experience, together with their curriculum vitae by email to the Executive Secretary, Edmund Nickless (edmund.nickless@geolsoc.org.uk) to arrive no later than noon, 31 October 2014.

SOCIETY NEWS...

Implementing geological disposal

Bruce Yardley (Chief Geologist, Radioactive Waste Management Ltd) on the new White Paper on the geological disposal of radioactive waste.

The UK government has taken the next step towards constructing a Geological Disposal Facility (GDF) for High Level and Intermediate Level Radioactive Waste, with the publication in July of a new White Paper: *'Implementing Geological Disposal'*, available at:

www.gov.uk/government/uploads/system/uploads/attachment_data/file/332890/GDF_White_Paper_FINAL.pdf

Earlier policy developments were summarised in these pages recently by Peter Styles (Geoscientist 24.3 April 2014) and led to a process laid out in a 2008 White Paper *'Managing Radioactive Waste Safely'*. This process was initiated by local councils volunteering to host a GDF and proceeded by staged technical assessments. A number of failings in the process became apparent after it came to end last year in Cumbria, and the new process is intended to address these. It is the result of an extensive public consultation, to which the Geological Society contributed.

Principles

The original principles remain. The safety case for a GDF must take into account the geological setting and the interactions of the GDF with the surrounding geosphere, and the local community must have actively volunteered to host the site and retain the right to withdraw; but geological evaluation is now a priority from the outset. The Government's emphasis on this is a result of the widespread demand for geological information to be available before communities are invited to volunteer.

In particular, the White Paper sets out an initial action for Radioactive Waste Management Limited (RWM), now identified as the developer, to carry out a National Geological Screening Exercise. This aims to make geological information available in an accessible form to communities so that they can address questions about their geological potential at an early stage. It also proposes that GDFs are brought within the definition of 'Nationally Significant Infrastructure Projects' and requires DECC to develop a generic National Policy Statement to support the planning process. A third action is to develop guiding principles for working with communities - how decisions are made, how communities are represented, what would be an appropriate test of public support, and how community investment should be distributed.

The National Geological Screening Exercise is a response to evidence from the Society and others who have argued for a number of years that it is important to provide more information on geology at depth before encouraging communities to volunteer, because geology



Olkiluoto, Finland – the repository entrance is in the foreground

Image: Postiva Oy

is fundamental to a GDF safety case. In recognition of the importance of communicating with the public and ensuring that the process is open and transparent, the screening exercise will include a consultation on the "screening guidance". RWM will assemble its own team, including outside experts, to develop guidance for screening, i.e. identify widely available parameters which appear to be useful for assessing the potential of a site for a GDF, such as mapping the distribution of rocks with specific properties occurring at appropriate depths in the subsurface, or of non-potable groundwaters, structural features etc.

It must be possible to evaluate these parameters over a significant part of the country purely from desk studies. The RWM team plans to consult widely with the geological community and other interested groups to gather input, including a meeting at Burlington House on September 30, and regional meetings. At the same time, DECC has asked the Geological Society to set up an independent review panel to peer review the quality and applicability of the work that RWM proposes.

Benefits

Only when this process is complete will the guidance be applied across England, Wales and Northern Ireland. Again, the process will be overseen by the independent review panel. The outcome, expected late in 2016, will include maps and accompanying narrative, showing the distribution of features - some positive and some negative - that may be of relevance. There will be no 'magic bull's-eye', but there will be a sound basis for discussions with communities who might wish to take advantage of the undoubted economic and employment benefits that a GDF will bring, so that they can establish with greater certainty whether their area is likely to be viable before expending needless time and effort.

Even by the standards of major infrastructure projects, the timescale for constructing a GDF in the UK is long, and many issues still remain to be resolved. The challenge will be to ensure that we remain on track to finally and safely dispose of our radioactive waste. Here the involvement of the geological community, which recognises the importance and viability of geological disposal more than any other group, will be of enormous value.

FUTURE MEETINGS

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

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

GEOLOGICAL SOCIETY CLUB

New diners are always welcome!

- ◆ **2014:** 24 September; 15 October. ◆ **2015:** 4 February (Burlington House - buffet); 4 March (Athenaeum); 8 April (Venue tbc); 6 May (Athenaeum)

For further information contact **Cally Oldershaw** (Hon Sec) at cally.oldershaw@btopenworld.com or **T: 07796 942361**.

Contested geoscience

On 20 June the Society hosted a one-day meeting on 'Communicating Contested Geoscience' writes Flo Bullough.

The aim was to discuss the issues around communicating the geology underlying some of the key questions that communities across the UK will face as we address future resource needs. The meeting focused on three issues: Shale Gas, Carbon Capture and Storage (CCS) and Radioactive Waste Disposal - all areas where effective communication of relevant geoscience to non-specialists is essential for the public to engage in informed debate and decision-making.

Delegates at the lively and well attended meeting included those working in government, natural and social science academics, representatives from industry, and specialists in science communication and public engagement, and geologist and TV presenter Professor Iain Stewart (University of Plymouth).

Introductory talks on each topic were followed by panel-led discussion sessions, addressing features unique to each sub-topic as well as broader cross-cutting issues. These included the need to look at energy choices in the round, rather than presenting people with decisions about particular energy sources in isolation – using DECC's UK 2050 energy calculator (<http://2050-calculator-tool.decc.gov.uk>) for example, to show the implications and trade-offs associated with these choices.

The meeting also discussed the challenges of communicating about risk, uncertainty and long timescales; the potential disconnect between what scientists may wish to communicate and what stakeholders want to know; and lessons learned from past engagement.

➤ For more information: www.geolsoc.org.uk/Communicating-Contested-Geoscience

Himalaya - Sustainable Resource Development

Nic Bilham (Director of Policy and Communications) on a conference organised jointly by the Society and the University of Jammu, Leh.

Earth scientists from the Himalayan nations and around the world gathered on 24-26 June in Leh (Ladakh, India) to discuss with social scientists, development practitioners, policy-makers and community representatives how to develop the rich and varied resources of the Himalaya sustainably, so as to benefit local communities and nations to which they belong.

Ladakh is developing rapidly, and both the Jammu and Kashmir state government and Indian national governments wish it to become an exemplar of sustainable development. Just days before the conference, Narendra Modi said he was considering establishing a new ministry of Himalayan affairs.

Much of the discussion focused on the challenges of balancing conflicting factors – the material needs of local people and those further away (for example, the billion people who rely on Himalayan glaciers for their water); local, regional and national economic growth, and impacts on

the environment, human health and wellbeing – exacerbated by rapid population growth and climate change.

Student programme

A two-day student programme was attended by over 100 children from nearby schools, focusing on topics which affect them directly – the origin and use of natural resources, climate change, the geology of landslides and earthquakes, and disaster risk reduction. Students were asked to design posters on the conference themes, the best of which were displayed at the main conference. A shorter schools programme was delivered at two further schools, at Nyoma and Puga, where many students come from nomadic communities.

At the request of local policy-makers, we will produce a briefing document on the policy and planning implications of the conference, as well as basic useful information for local communities written in their own language.

➤ To find out more: www.geolsoc.org.uk/himalaya14



FELLOWSHIP ELECTION

Continued from page 7:

PETERS Isabel; **PETERS** Rowan; **PETERSON** John Richard; **PETRONE** Chiara Maria; **PLAYER** Tiffany; **POCOCK** Nicola Margaret; **POWER** Jamie; **POYNTZ** Ian; **PRYDE** Sam; **PUGH** Glen; **RAMASWAMY** Siddhartha Kirk; **REID** Jennifer Lynne; **REID** Lindsay; **REVITT** Anthony; **RICHARDSON** Graham; **RICHARDSON** Nicholas James; **RICHARDSON** Stephen; **RIGG** James; **ROBINSON** Adam Hackett; **ROBLA** Vaughn; **ROELOFSE** Frederick; **ROPE** Adam; **ROUND** Michael; **RUST** Timothy Michael; **SAINSBURY** Courtney; **SALAMI** Ayobami; **SAMMARCO** Carmelo; **SAROGLOU** Charalampos; **SEBRO** Barry; **SELLARS** Nicola; **SHANKS** Sean; **SHARDLOW** Christopher David; **SHARROCK** Jeremy Mason; **SHAW** Felicia; **SHEPARD** Grace; **SHINGLETON** Samuel Albert; **SIBERT** Edward; **SILLAH** Salim Karamohba; **SKUCE** Rebecca; **SLIGHTAM** Clare; **SMEATON** Craig; **SMOUT** Richard; **SOLER** - PUJOL Roser; **SOUTHWELL** James; **SPALDING** Emily; **SPRATLEY** Brian Clive; **SPRINGALL** Lucy Amanda; **ST JOHN** Thomas; **STARCHER** Michael; **STEFANOPOULOU** Despoina; **STEPHENS** Natalie; **STERNICKA** Agnieszka; **STOCKWELL** Simon; **STRATFORD** Henry; **STROUD** Martyn Arthur; **SULAIMAN** Sofiana; **SWAMYNATHAN** Bharani; **TAM** Jesse; **TEZCAN** Esra; **THOMPSON** Natalie; **TORNAGHI** Maria; **TOWELL** Craig; **TSOUMELEKAS** Apostolos; **TSZ KI** Cheng; **TUFFIN** Peter; **TYSON** Douglas; **URBAN** Mark; **UTLEY** Thomas; **VALDIVIANO HUERTAS** Jhonatan Dany; **VAN HERK** Adriaan; **VANDEGINSTE** Veerie; **VARDEN** Chris; **WAHLMAN** Gregory; **WALSH** Ainslie; **WALTERS** Jack Andrew Leslie; **WARD** Amy; **WARD** Matthew Thomas; **WARDLE** Paul; **WATERFALL** Elizabeth; **WATERHOUSE** Adam; **WATTS** Camilla; **WEBB** Samantha; **WHEELIKER** Sean Anthony; **WIGNALL** Brent; **WILBUR** David Greaves; **WILKINSON** Deborah Marie; **WILKINSON** James; **WILLIAMS** Gareth David; **WILLIAMS** Robert Coleman; **WILLIAMSON** David; **WILTSHIRE** Sam; **WINSTANLEY** James Michael; **WOOD** Paul; **WOODCOCK** Ruth Elizabeth; **WRIGHT** Jessica; **WU** Kam Kuen; **WYLLIE** Andrew; **WYTON** Joanne; **YAO** Xue; **YATES** Amy Karolynn; **YEUNG** Rory; **YOUNG** Charles; **ZAREMBA** Kaja; **ZEPEDA LUNA** Tania.

The following Candidate Fellows graduating this year must upgrade to Fellowship within 12 months following graduation, if they wish to continue with membership.

Those who complete the application process before the OGM on 25 September 2014 will be elected at that meeting.

The remainder will be put forward for election at future OGMs and the AGM as and when they submit applications:

ADAMS Robert; **ADAMS** James; **ADEYEMI** Susan Jesudara Omobola; **AINSCOE** Eleanor; **ALLHUSEN** Matthew John Oliver; **AL-SULAITI** Nawal; **AMAESHI** Nneka; **ANDERSON** Rory; **ANDREW** Mary; **ANRUDE** Alexander; **ARNOTT** James Hamilton Walter; **ATKINSO** Douglas; **ATKINSON** Joshua; **BACKHOUSE** Tom; **BALL** James; **BARAN** Alicja; **BARONE** Grace; **BARRY** Jonathan; **BARUWA** Oluyinka; **BASRAVI** Graham; **BATCHELOR** Dominic David; **BATTISTEL** Giordano; **BEAGLE** JamGlen Stacey; **BEASLEY** Lewis; **BESSANT** Chanel Annabelle; **BESTEL** Ryan; **BILLS** James Alexander Jackson; **BINGHAM** Hannah; **BISSELL** Christopher Paul; **BITHELL** Carmel; **BLOM** Vincent; **BOLTON** Samuel; **BOOTH** Matthew; **BRADLEY** Ginny-Marie; **BRADNUM** William; **BROCKLEHURST** Hannah Faye; **BUCHANAN** Robert; **BUNKER** Edward; **BURBIDGE** Rosalind Ann; **BUTTERICK** Martin; **CALLCUTT** Matthew; **CAMPBELL** Roderick William; **CARLEY** Sonia Jeanette; **CASTILLO** Alexander; **CLAUSON** Matthew Jon; **CLAYTON** Jack Tyrone; **CLEMENCE** David Andrew; **CLIFFORD** Grace Hannah; **CLIFFORD** Grant Gordon Stewart Warren; **COATES** Thomas William; **COEN** Thomas William; **COFFIN** Nicola; **COLLETT** Emily Joanna; **COMBLEY** Nigel Stephen John; **CONWAY** Sean Ryan; **CRADDOCK** Lisa; **CRAWFORD** Alexandra; **CREHAN** Sahun; **CROMPTON** Hannah Victoria; **DAVIES** Peter Andrew; **DAVIES** Paul John; **DAVISON** Natalie; **DAY** Jason; **DE AGUIAR** Oliver Charles; **DE LEEUW** Lawrence Willem; **DEANS** Karen; **DENIS** Grace; **DIAMOND** Katherine Elizabeth; **DOBZANSKI** Andrew Jan; **DODD** Matthew; **DOODY** George William; **DOWNING** Charlie Jack; **DOWNING** India; **DUDLEY** James David Francis; **DUFEL** Ojahme; **DUNN** William; **DUNNACHIE** Alison Allan; **ECOTT** Jessica; **ELLIOTT** Claire; **ELLIOTT** Alexander; ➤



Picture library launched

The Library has launched its own Picture Library, write Caroline Lam and Paul Johnson.

The Society Library's new Picture Library, showcases some of the drawings, prints, maps and book illustrations to be found across its unique historical collection.

Here are just a few of the jewels to be found on our new site, www.geolsoc.org.uk/PictureLibrary. More images will be added regularly, so keep checking back to see what's new. All the images are available to purchase, including map prints.

◆ **Main image above:** 'Cunaig in Assynt, Sutherlandshire', by Charles Henry Lardner Woodd, 20 August 1847. [Image ref: 05-65]

Charles Henry Lardner Woodd (1823-1891) was elected a Fellow on 20 May 1846 but despite being a member until his death in 1893, never submitted a geological paper. He was a gifted artist and the Archives hold a series of eight drawings of geological features around Cromarty and Assynt (Scotland) drawn in August 1847 when apparently following the footsteps of



Hugh Miller (1802-1856). This image is of 'Cunaig [Quinag] in Assynt, Sutherlandshire'. Woodd notes that it shows 'Great conglomerate, quartz rocks in foreground, white as snow'.

◆ **Above:** 'Geological Map of the Environs of Lyme Regis' published by F Dunster, 1826. [Image ref: 07-84]. Henry Thomas De la Beche (1796-1855) was raised in Lyme Regis which, thanks to Mary Anning, had become a popular fossil-hunting destination. This four-penny map, easily folded for the pocket, was published in Lyme and sold to those scouring the local rocks.

Smith county maps

The Publishing House announces the availability of high-quality facsimiles of William Smith County maps, writes Emily Milroy.

These may now be purchased directly from our Online Bookshop. With a choice of 20 counties, originally published between 1819 and 1824, each print is available individually on sheets of varying sizes approximately 53cm by 62cm. Order online and a print can be shipped worldwide.

➤ Visit www.geolsoc.org.uk/bookshop

Chartership news

Chartership Officer Bill Gaskarth writes:

Card Geotechnical Ltd is the latest company to have their training scheme Accredited and that from Fugro Hong Kong will have been accredited by the time this issue is published. These schemes will join nine already accredited, (from Atkins, Arup, Jacobs China, CH2MHill, CEDD GEO in Hong Kong, Gammon Construction Hong Kong, RPS Energy, URS and RSK).

An application has been received from WSP Ltd, and will be assessed shortly.

➤ Email chartership@geolsoc.org.uk

FELLOWSHIP ELECTION

Continued from page 9:

EMMS Lucinda; **EVANS** Jonathan; **EVANS** Nerys Ann; **EYLES** Christopher Thomas; **FAIRMAN** David; **FITT** Petr; **FLANAGAN** Sinead; **FORD** Helen Marie; **FOX** Andrew Christopher; **FRANCIS** Scot; **FRANKS** Matthew; **FUNG** Cho Yan; **FURNISH** George; **GALLAGHER** Rachael; **GAYNOR** Peter James; **GERSTGRASSER** Andreas; **GIBSON** Robert; **GILLHAM** Stephen; **GLASS** James Henry; **GODWIN** Hal; **GOULD** Francesca Nancy; **GOWLAND** Christopher; **GRAABEK** Kimberley; **GRANTCHAROVA** Mihaela Mihaylova; **GREEN** Joshua; **GREGSON** Laura; **GRUCHY** Janine; **GUICE** George; **GUTHRIE** Ronald; **GUY** Daniella; **HAM** James; **HARDMAN** Kristian Matthew Seabridge; **HARRIS** Katherine Isobel; **HARVEY** Valerie Ann; **HARVEY** Benjamin Edward; **HATCH** Callum Neil; **HEDGER** Abigail; **HEMUS** Matthew James; **HENRY** Delano Gerardo; **HERRON** Christopher Stephen; **HILL** Harriet; **HINDL** Ruth; **HIRST** James Samuel Alexander; **HODGES** Susan; **HOLBOURN** Matthew; **HOLT** Thomas Richard; **HONOUR** Victoria Claire; **HOOPER** Ian; **HOSKING** Louise; **HOYLE** Danielle; **HUNT** Sophia Xanthe; **HUNT** Thomas; **HUNTER** Karen; **HURCOMBE** Russell; **JACKSON** Candace Bronwyn; **JENKINS** Rosemary; **JENNINGS** Christopher; **JENNISON** Daniel; **JESS** Scott; **JOHNSON** Jennifer Louise; **JOHNSON** Shaun Robert; **JOHNSON** Sharif George; **JOLLY** Emma Louise; **JONES** Bethan Louise; **JONES** Leigh-Ann; **JOSEPH** Rebecca; **JOSHI** Darsha; **JURY** Alistair; **KARHUNEN** Otava; **KAVANAGH** Emmanuel; **KEITH** Katherine Sheila Rose; **KENISON** Alexandra Claire; **KENT** Emma; **KOSKY** Jack Michael; **KTISTI** Nicole; **LAM** Chloe Kwan; **LAWNICKA** Gabriela Katarzyna; **LAWRENCE** Amy; **LAWRENCE** Stephanie; **LAYFIELD** Jessica; **LE CORNU** Christopher; **LEE** Lok; **LEWIS-BATES** Anthony; **LLEWELLYN** Jayne; **LOCKETT** Thomas; **LOWRIE** Gemma-Louise; **LYNES** Rhian; **LYTTON** Wilfrid; **MADDOX** Brenda; **MADELEY** Anna Elizabeth; **MAGUIRE** James; **MAHONEY** Jonathan Giles; **MAN** Benjamin; **MARSH** Deryck; **MARTIN** Bronwen; **MARTIN-SHORT** Robert; **MCEACHERN** Jonathan; **MCGEACH** Kayleigh Dawn; **MCKAY** Rosie Elizabeth; **MCKEEVER** Josephine; **MCLEOD** William; **MCMAHAN** William; **MCQUEEN** Gavin; **MICHAELS** Gillian; **MILLER** James Benjamin; **MITCHELL** Andrew Richard Christian; **MOLLER** Torsten Henrik; **MOLLER** Alison Gillian; **MOORE** Chris Antony; **MOORE** Bryan Andrew; **MOORE** Jemma; **MORGAN** Rebecca Leigh; **MORGAN** Tom; **MORTON** Michael; **MORTON** Codi; **MOSLEY** Kyle; **NANDHRA** Satvinder; **NARAYAN** Nadia; **NAYLOR** Thomas; **NUJURALLY** Ahad; **O'BRIEN** Shaun; **O'BRIEN** John; **O'DONNELL** Megan; **O'GORMAN** Luke; **OGUNADE** Adelola; **OKONOMIDOU** Romina; **OWEN** Emily; **PACHECS** David; **PALLORDET** Daniel Marcel Georges; **PALMER** Robert; **PANTING** Benjamin; **PARKES** Michael; **PATEL** Jay; **PATES** Stephen; **PATTERSON** Rachael; **PAWSON** Georgia; **PEARCE** Donovan; **PEARCE** Stuart Daniel; **PEASGOOD** Andrew; **PERERA** Ramesh; **PERRY** Joshua Michael; **PESKIN** Ahron Moshe; **PLIMMER** Gareth; **PLOWMAN** Rachel Louise; **POMBAL** Jose Arsenio Felix; **POMERY** Jack; **POPE** Andrew Richard; **PORT** Hannah Louise; **PRITCHARD** Joseph; **PTASZYNSKA** Paulina Joanna; **PUTTOCK** Sophie; **QUEENAN** Craig; **RAE** Auriol; **RAVAL** Holly Anna; **RAY** Debra Jayne; **READER** Caroline; **READER** David; **REYNOLDS** Andrew Robert; **RICHARDS** Huw Alexander; **RIKSON** Koit; **ROBERTS** Ewan; **ROBERTSON** Jennifer Louise Searing; **RODRIGUEZ GIL** Teresa; **ROGIC** Nikola; **ROWELL** Catherine Jane; **RUSH** Julian; **RUTTER** William Andrew John; **RYAN** Graham; **RYAN** Meghan; **SCANLAN** Devan Margaret Lorraine; **SCHUURMAN** Jan; **SEDGWICK-HOUSEGO** Liam Francis Erik; **SELBY** Margaret Norah; **SELLERS** Carl; **SHELTON** Richard William; **SIBY** PODIPARA Gift; **SIEDLECKI** Paul; **SKINNER** Toby; **SMITH** Christopher James; **SMITH** Heather Grace; **SMITH** Jacob; **SMITH** Alicia; **SNOW** Kelly Rebecca; **SOLEY** Imogen; **SOMERVILLE** David; **SORRELL** William; **SORRELL** Paul; **SPENCE** Matthew; **SPERANZA** Stefano; **STEPHENS** Tomas Gwyn; **STOJANOVIC** Denis; **STOKES** Thomas; **SWIFT** Russell; **SYLVESTER** Laura; **TAYLOR** David Mark; **TAYLOR** Lamorna; **THOMAS** Joshua; **THORNBOR** Alexandra Rebecca; **TOVEY** Simon John; **TRICK** Rebecca Louise; **TURNER** Matthew; **TURRINI** Lia; **TWEED** Lucy; **USHER** Gareth; **VALE** Charis; **VARGAS** Antonio Carlos; **VAROTSIS** Paul; **VERNON** Daniel Christopher; **WALKINSHAW** Alex; **WANMER** Sapphire Rose; **WATKINS** Hamish; **WEBSTER** Simon Harley; **WENBORN** Alice Rose; **WESTERN** Andrew; **WHITEHEAD** Elizabeth Mary Kerry; **WHITTENBURY** Charlotte Ann; **WILDE** Oliver; **WILKIE** Hannah; **WILLIAMS** Alex Robert; **WILLIAMS** Scott; **WILLIAMS** Alison; **WILSON** Jordan; **WISEMAN** Sam; **WOOD** Elliot; **WOOD** Julian Andrew; **WOOD** Harriet; **WORKMAN** Timothy Samuel; **WORTHINGTON** Daniel; **WRIGHT** Bryn Alun; **WRIGHT** Jordan; **XIA** Changyou; **YUSAF** Adam.

Why academics should join

David Manning, President, explains why, despite the numerical dominance of industrial geologists in membership, academic Earth scientists and the Geological Society still need one another



I asked the Editor if I could write a Soapbox, and he explained that being President did not mean I ceased to be a Fellow: so here goes. In fact, I've been a Fellow since 1977 - a long time. During the last 37 years the Society has changed almost beyond recognition. When I joined the Fellowship numbered about 5000. It was more or less automatic that academics became Fellows – it was the 'done thing'.

I remember APIPG, and was a member of the Institution of Geologists that it spawned; the professional matters that IG represented became part of the Geological Society in 1991. Since then, the Geological Society's Fellowship has greatly increased in number, to around 12,000 at present. It has become preponderantly non-academic, with about 75% of our members working in industry. My own career has been academic, with 10 years running a spin-out company, and very close engagement with industry that continues to this day.

Taken for granted?

When talking to academics about the Geological Society, I'm often asked: 'Why should I join?'. The key answer is that without academics actively playing their part in the Fellowship there would be no Geological Society. We in the academic world perhaps take it for granted that the Journal of the Geological Society is a top-quartile journal, that the Special Publications

and memoirs continue to be published, and that the more specialist journals are there as part of the pantheon of high quality deliverables that we, our students, and our graduates, use. We assume that there will always be a varied and lively programme of scientific meetings, many organised by groups that come under the Society's umbrella, but which enjoy considerable autonomy.

We celebrate the esteem that comes to academic colleagues of all ages when they receive one of the Society's awards or research grants. We can be proud of the authority that underlies statements made on our behalf by the Society in response to consultations from Government, and to meet the needs of other interested parties. That authority draws on the knowledge and practical expertise of the academy and industry speaking with a single voice. Frequently such submissions are made jointly with other kindred geoscience bodies.

Leadership

For the Society to deliver these benefits to the academic community, it needs one thing – academic leadership, and active involvement in the Society's life, at the right time, and in the right place. That can take many forms – service on specialist group or regional group committees, on key management committees, and on Council. None of these tasks can be undertaken by those who are not Fellows, and they can be very rewarding, especially in this impact-laden climate. The Geological Society offers academics a vehicle to shape the future of geology as a science that supports very significant industrial activity. It has always done this, and with your continued support, will continue to do so.

➤ Not yet a member? You can apply for membership of the Geological Society online www.geolsoc.org.uk/join or print and complete an application form and return it to us

* **David Manning** President of the Geological Society of London, is Professor of Soil Science at Newcastle University

SOAPBOX CALLING!

Soapbox is open to contributions from all Fellows.

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

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

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

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

“ WE CAN BE PROUD OF THE AUTHORITY THAT UNDERLIES STATEMENTS MADE ON OUR BEHALF BY THE SOCIETY... THAT AUTHORITY DRAWS ON THE KNOWLEDGE AND PRACTICAL EXPERTISE OF THE ACADEMY AND INDUSTRY SPEAKING WITH A SINGLE VOICE ”
David Manning

Active involvement in the Society can be very rewarding



GENERATING NEW GEO-DATA



**Peter Jones and
Vanessa Banks***
on the research
potential of the
geology uncovered
by the construction
of a wind farm

Above: Wind farm at Carsington Pasture

The construction of wind farms is on the rise. According to the UK Wind Energy Database (UKWED)¹, 4366 onshore wind turbines are currently operating at 584 sites in the UK, with a total onshore capacity of 7172 MW. In addition, 722 turbines (79 onshore) are under construction, and a further 2305 (814 onshore) where construction approval has already been granted.

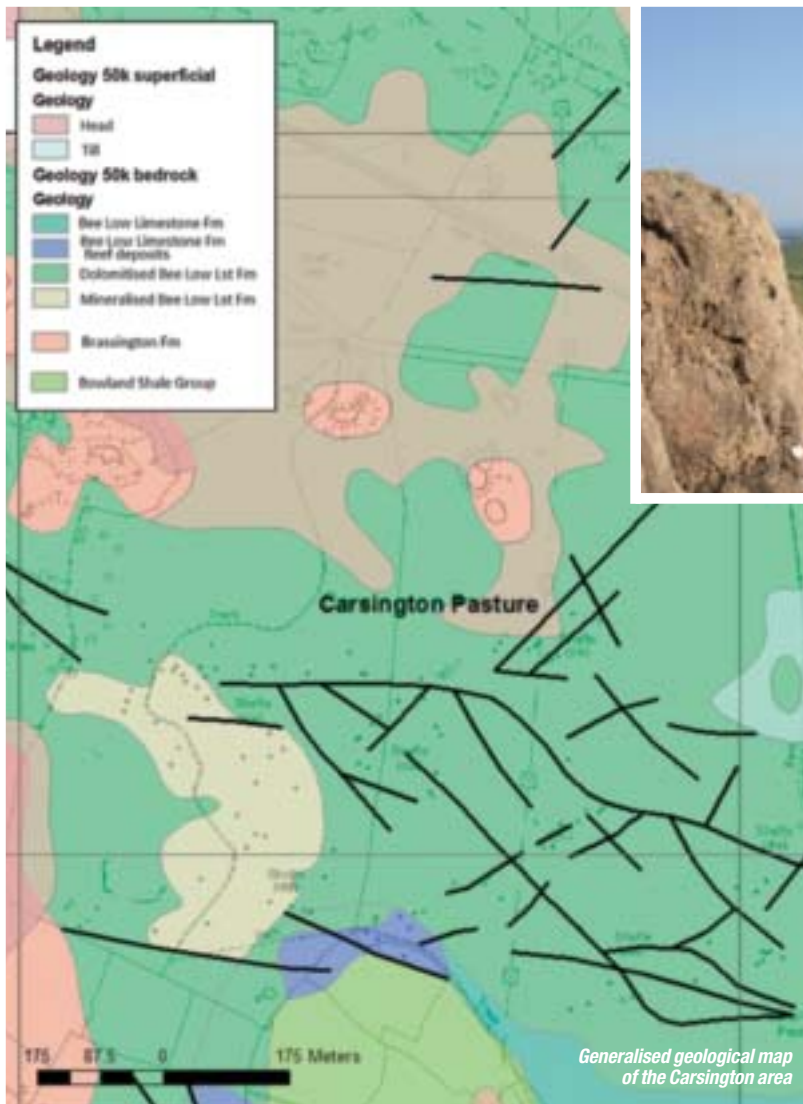
The growing development of onshore wind farms is often controversial, particularly in relation to concerns over their environmental impact. This is a matter for the planning approval process; but where approval is granted, construction can have some significant but unintentional geological benefits.

As noted by Chris King (*Geoscientist* 22.4, May 2012, p.23) temporary exposures arising from the excavation of footings for wind turbines may provide valuable opportunities to assess and record new data. This was certainly our experience with the construction of Derbyshire's first commercial wind farm at Carsington Pasture, three kilometres west of Wirksworth. The temporary exposures on this site revealed a range of interesting and potentially important geological features.

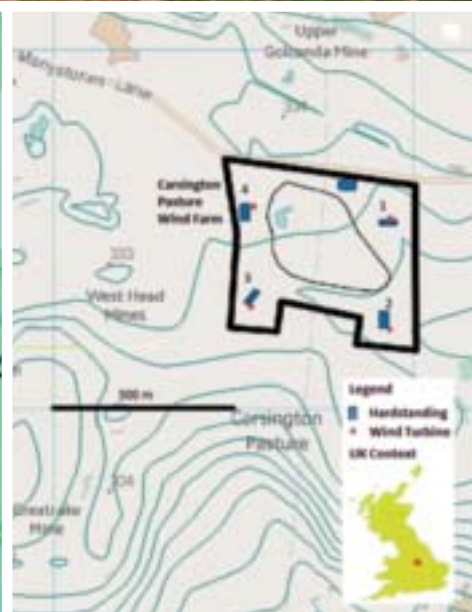
Carsington Wind Farm

Carsington Pasture is a broad tract of limestone grassland on a moderately undulating upland plateau at around 300m OD. It is bounded to the

“THE GROWING DEVELOPMENT OF ONSHORE WIND FARMS... CAN HAVE SOME SIGNIFICANT BUT UNINTENTIONAL GEOLOGICAL BENEFITS”



View from Harboro' Rocks across construction site to Carsington Reservoir



northwest by the prominent outcrop of Harboro' Rocks rising to 379m OD, while immediately to the south, the plateau edge forms a steep slope towards Carsington village. Archaeological evidence indicates that the local landscape has undergone a long history of human activity extending back to prehistoric times.²

The wind farm was constructed on the plateau surface and involved erecting four Repower MM82 turbines together with access tracks, and an ancillary substation. Each three-blade turbine has a hub height of 59m and a blade length of 41m giving a total height of 100m. With a combined output of 8.2MW, the wind farm will generate sufficient electricity annually to power the equivalent of at

least 4500 homes.

A planning application for the wind farm was submitted in January 2007 by Carsington Wind Energy Ltd., a subsidiary of West Coast Energy Ltd. Located on elevated ground just outside the southern boundary of the Peak District National Park and overlooking the popular visitor attraction of Carsington Water, the project provoked opposition from the outset.

Environmental concerns contributed to a lengthy planning process, involving a public inquiry followed by an appeal hearing in the High Court, delaying the project by several years. Following planning approval, construction work at Carsington Pasture started in May 2012 and was expected to take approximately

six months. However, the work was subject to further delay due to unforeseen and problematical ground conditions. The turbines eventually became operational in March 2014.

Geological context

The geology of the site comprises Lower Carboniferous limestones with a variable cover of natural and anthropogenic superficial deposits. Included in the latter category is widespread spoil resulting from a long history of mining activity, primarily for lead and zinc ores. Additional spoil was produced during the more localised extraction of silica sand and clay from dissolution pockets in the limestone, for use mainly in the ►

Inclined clay wayboard in dolomitised limestone at T4 with Harboro' Rocks in the distance to the NW



Far right: Vuggy dolomite in T4

Right: Down-warp of clay wayboard into sediment filled fissure in T4



Deep pocket deposits in Bees Nest Pit



Small U-shaped pocket in T1 with deformed sediments



► manufacture of refractory bricks. Most of the pits have been backfilled and relatively few sections remain. The natural superficial deposits include Quaternary head deposits, tills and localised accumulations of fluvioglacial gravels.

The limestones belong to the Bee Low Limestone Formation (Asbian) and were deposited on the southern margin of the Derbyshire Carbonate Platform adjacent to the subsiding Widmerpool Gulf. Interbedded with these rocks are layers of weathered volcanic ash (clay wayboards). The edge of the platform is characterised by a series of Waulsortian mud mounds (apron-reefs) composed mainly of fine-grained micrite. In the deeper water off-shelf province farther south, the sediments of the Widmerpool Formation comprise a thick sequence of mudstones and dark thinly-bedded turbiditic limestones.

At Carsington Pasture, the Bee Low Limestone has been fractured, dolomitised, mineralised and subjected to deep karstification. The onset of compressional tectonics associated with the Variscan orogeny resulted in multiple phases of fault/fracture controlled movement of mineralising fluids. The geological setting of the mineral deposits in this area has been described by Ford (2007)³ and conforms to a 'Mississippi Valley' type model. An extensive distribution of capped shafts and spoil heaps demonstrate that the ground has been extensively worked for minerals, mainly cerussite and galena as sources of lead.

A significant result of karstification was the formation of dissolution hollows and widened fissures that have been infilled by a variety of unlithified

sediments. These scattered features are traditionally referred to as “pocket deposits”. The sediments predominantly comprise gravels, sands and clays, which are often deformed by subsidence or collapse into the solution cavities. More than sixty pockets are known from the southern part of the limestone outcrop of the Peak District and the sediments are thought to be the remnants of a former continuous cover.⁴ They constitute the Brassington Formation, which has been ascribed a Late Miocene age on the basis of pollen.⁵ The type locality at Bees Nest Pit is located approximately 450m west of the wind farm site. Previous workers have suggested that the Brassington Formation was deposited in a fluvial environment close to sea level and this view has implications for interpreting the post-Neogene evolution of the area’s current upland landscape.

Temporary exposures

Foundation work for the turbines involved excavating roughly circular pits up to 16m in diameter and 3m deep. These temporary exposures were subsequently deepened and widened to allow for more substantial foundations as the extent of intensively fractured rock, sediment filled fissures and deep pockets of unlithified sediment became apparent. The difficult ground conditions also necessitated additional site investigation work, involving drilling, trial pitting, trenching and geophysical surveys prior to emplacement of the foundations. From a geoscience perspective, this happy hiatus of several months (between the initial breaking of ground and the eventual construction phase) provided valuable research opportunities. While appropriate foundation solutions were being considered, it was possible to undertake detailed logging and recording of the geology of the site.

Temporary sections in the dolomitised limestone showed that jointing is extensively developed, although frequent variations in joint spacing and continuity were apparent. Unsurprisingly, the dominant joint-sets were closely aligned with known mineral veins. Various closely spaced fractures and curvilinear joints require further interpretation but may be related to phases of hydrofracturing. Commonly, the rock forming the joint walls and zones of closely spaced fractures had been locally altered to dolomite sand, suggesting the preferential leaching of a former calcite cement. Upon exposure, this loose granular material was readily

removed by wind or rain and clearly would be equally susceptible to groundwater flow.

Karst features recorded in the temporary exposures were variable in morphology and scale. Particularly notable was a subdued form of pinnacle karst. This was usually associated with the zones of dolomite sand and tended to collapse upon exposure. Other karst features indicative of vadose-zone dissolution range from joint enlargement to more extensive doline forms up to tens of metres in diameter. The shallower dolines are commonly “U” shaped, while the deeper features are more irregular and their development appears to have been influenced by both bedding and jointing.

In all cases, the dissolutional cavities were filled by sediment. Evidence for deeper (>15 m) karst features comes from the observation that loose sediment was lost into joints following periods of rain. In addition, caverns up to 30m high and containing in-washed sediment have been reported from the nearby Golconda mine at depths up to 48m or more below ground level.³

Many of the karst features were lined with a relatively low density, brownish-grey to black deposit that is currently being subject to a suite of chemical analyses. Preliminary results indicate the material is wad (manganiferous soil). This has been reported previously in the vicinity of Carsington Pasture and in the past was worked for pigment. A notable feature of the deposit at this location is its continuity in lining many of the karst features and its highly sinuous form in both vertical and horizontal sections.

Sediments

The range of sediments and structural deformation exposed within the dolines was particularly interesting. The sediments included vari-coloured silty clays (red, brown, purple, green, yellow) interbedded with reddish brown and yellowish brown sands and gravel. The clasts were commonly rounded quartzites of small to large pebble and cobble grade. Locally, and particularly in the shallower features, the gravels comprised fractured cherts. Although the sediments display similar lithologies to those present at Bees Nest Pit, they represent a more varied assemblage both stratigraphically and structurally. This probably reflects a multi-phase history of emplacement. ▶



Above top: Collapsed dolomite blocks and sand with wad-lined diamicton contact in T2

Above lower: Vari-coloured clay in T1

“FROM A GEOSCIENCE PERSPECTIVE, THIS HAPPY HIATUS OF SEVERAL MONTHS (BETWEEN THE INITIAL BREAKING OF GROUND AND THE EVENTUAL CONSTRUCTION PHASE) PROVIDED VALUABLE RESEARCH OPPORTUNITIES”

► A brown, overconsolidated, matrix-dominated diamicton was revealed in several locations. It is likely to be equivalent to the till deposits mapped by the British Geological Survey (BGS) in pockets to the east of Carsington Pasture; but in some cases it may represent the product of debris flows.

Extensive sediment fill was noted in some joints. This ranged from slightly clayey dolomite sand to sandy clay and creamy white clay wayboard that had been squeezed into the joints in locality T4. The range of structures revealed a complex interplay between the dissolution and the sediment fill, with sediment structures providing further evidence of the extent of deformation. Some of the joint fills may have been introduced by pressurised meltwaters during Quaternary glaciation.

As the excavations were extended, serial sections revealed the geology in 3D. At times this was particularly intriguing. For example, what appeared at first sight to be inclusions of wad in dolomite sand sometimes proved to be an irregular subvertical wall of an adjacent wad-lined pocket as the dolomite sand was cut back. Similarly, the detailed geometry of the sediment-filled pockets was typically much more

complex than might have been predicted from initial evidence.

Research potential

Ongoing studies will help to elucidate the following aspects:

- ◆ Dolomitisation and fluid flow processes on the carbonate platform edge
- ◆ Karst hydrogeological evolution
- ◆ Provenance and age of the sediments in the pocket deposits
- ◆ Mode of sediment emplacement and subsequent history
- ◆ Denudation chronology of the southern Peak District, including rates of uplift.

The site investigation at Carsington Pasture produced a large quantity of borehole core that was scheduled for disposal at the end of the construction contract. Negotiations via the site manager resulted in the developer agreeing to the bulk of the core being donated to BGS. Some 250 boxes of core have since been indexed and are now housed in the BGS Core Store at the National Geoscience Data Centre, Keyworth.

One project that will immediately benefit from this new resource is a CASE studentship based at the University of

Manchester. An aim of the PhD research is to determine whether the reconstruction of (Carboniferous-Permian) palaeofluid flow paths in an intensely dolomitised carbonate platform margin can provide insight into the extent of hydrocarbon migration from clay-rich successions in adjacent hanging wall basins.

This will be achieved by investigating the interdependency between fracturing, dissolution and fluid flow (resulting in dolomitisation, silicification, hydrocarbon emplacement and lead-zinc mineralisation) at the platform edge. It will involve field and core-based sedimentological and structural analyses, petrological studies, isotope analyses, fluid inclusion studies and some fluid-flow modelling. The starting hypothesis is that the source of the fluids was initially deep seawater and basinal brines carrying hydrocarbons and Mississippi Valley type mineralising fluids derived from the subsiding Widmerpool Gulf.⁶

Conclusions

The study has generated a wealth of geological information that will contribute to understanding the geological evolution of the carbonate platform edge. Moreover, detailed



Soft sediment deformation adjacent to fractured dolomite in T1



Layered sediment fill to wad-lined buried doline in T2

laboratory analysis of the borehole cores and other samples obtained from the site is continuing and promises to yield further useful geodata for some time to come.

Our experience at Carsington Pasture supports the view expressed elsewhere in this magazine by Chris King that the current expansion in wind farm projects presents a valuable opportunity to acquire new data. A key point made by King is that the geoscience community would benefit from a more integrated approach in such circumstances to facilitate the retrieval of potentially useful non-geotechnical information.

This also underlines views expressed by John Powell *et al.*, (*Geoscientist* 21.11, December 2011, p.7) of the value of capturing and archiving scientifically important information revealed by temporary exposures before it is lost to science. Some geologists would like to formalise such a process. For example, David Nowell (*Geoscientist* 24.4, May 2014, p.15) suggested that legislation is needed to facilitate access to temporary sections to ensure that relevant information is added to a national database.

At present, the investigation of

temporary exposures requires the cooperation and goodwill of the client, the geotechnical consultants, the construction contractor and other operatives as well as compliance with the relevant health and safety procedures. Equally, it requires that the researcher engage in flexible working practices around the site operations. Our work at Carsington Pasture certainly benefited from such relationships. Additionally, we believe that on-site discussions with members of the project team were mutually beneficial. ♦

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ACKNOWLEDGEMENTS

The authors are grateful to Carsington Wind Energy Ltd and West Coast Energy Ltd (GDF Suez) for permission to investigate the temporary exposures at Carsington Pasture. We also wish to thank **Roger Durrant** (Raymond Brown Construction Ltd) for facilitating access to the site, **Dr Jim Riding** for reviewing this article and **Matt Howcroft** for the post-construction images of the wind farm.

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Soft sediment deformation
of quartz sand in T2



Turbine T2 behind outcrop
of dolomitic limestone

BIG BANG THEORY



New dating is drawing closer parallels between Large Igneous Province events and modern climate change, says **Howard Lee***

Usually copious eruptions known as Large Igneous Provinces (LIPs) have long been associated with mass extinctions, ocean anoxic events and environmental stress in the geological record. These include the Permian¹ Triassic,² PETM,³ Toarcian,⁴ Cretaceous Ocean Anoxic Events, and the Columbia River Basalt event,⁵ among others.

The most lethal of these was the Permian Mass Extinction 251.9 million years ago, otherwise known as “The Great Dying,” which was the closest this planet has come to extinguishing all complex life on Earth.^{6,1} For years the cause of the Permian Mass Extinction has been linked to the Siberian Traps eruptions through the mechanisms of volcanic CO₂ and a cocktail of noxious gases, combined with burning coal deposits⁷ and sill-baked methane emissions,⁸ all of which produced a combination of toxic effects, ocean acidification and, most importantly, global warming. It led to a world where equatorial and tropical regions were lethally hot on land and in the oceans.⁹ The cascading extinctions in ecosystems across the planet unfolded over tens of thousands of years, and it took¹⁰ million years for the planet to recover.^{9,1}

Until recently, the scale of the Permian Extinction was seen as just too massive, its duration far too long, and dating too imprecise for a sensible comparison to be made with today’s climate change. No longer.

New dating

In “High-precision timeline for Earth’s most severe extinction,” published in PNAS on February^{10, 1} authors Seth Burgess, Samuel Bowring, and Shu-zhong Shen employed new dating techniques on Permian-Triassic rocks in China, bringing unprecedented precision to our understanding of the event. They have dramatically shortened the timeframe for the initial carbon emissions that triggered the mass extinction from roughly 150,000 years to between 2,100 and 18,800 years.¹ This new timeframe is crucial because it

brings the timescale of the Permian Extinction event’s carbon emissions shorter by two orders of magnitude, into the ballpark of human emission rates for the first time.

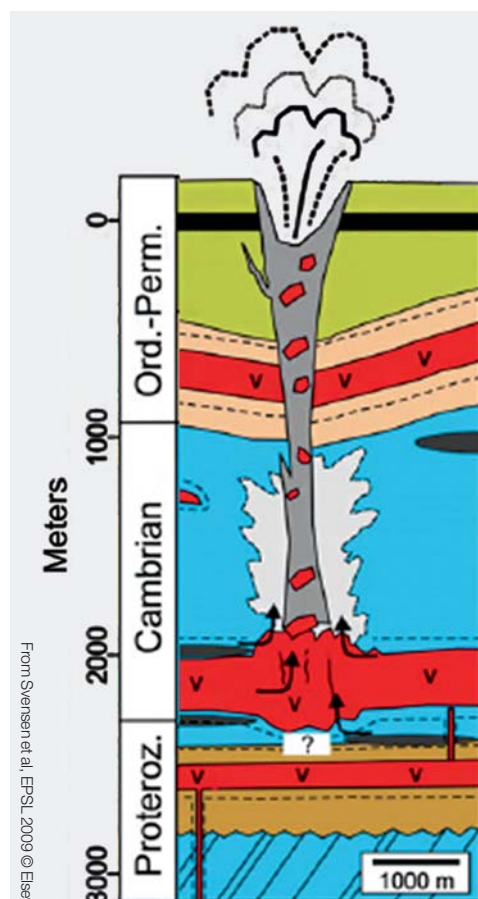
How does this relate to today’s global warming? Most readers of *Geoscientist* will be familiar with the fact that climate and CO₂ have changed hand-in-hand through geological time. Mostly these changes happened slowly enough that the long-term feedbacks of Earth’s climate system (deep oceans, ice sheets, rock weathering, sedimentation) had time to process them. This was true during the orbitally-induced glacial-interglacial cycles in the Pleistocene ice ages.

In warmer interglacials, more intense northern hemisphere insolation led to ice-sheet melting and warmer oceans that reached equilibrium with slightly higher CO₂ concentrations in the atmosphere by adjusting their carbonate levels. In glacial times, with slightly less intense northern insolation, the cooler oceans dissolved more CO₂, and carbonate levels adjusted accordingly. The changes occurred over gentle timescales of tens of thousands to hundreds of thousands of years – slow enough for feedbacks to keep pace.¹¹

Belches

Rapid carbon belches, such as in the Permian and today, occur within the timeframe of fast climate feedbacks (surface ocean, water vapour, clouds, dust, biosphere, lapse rate, etc.), but take place more rapidly than the vast deep ocean reservoir and rock weathering can buffer. The carbon overwhelms the surface ocean and biosphere reservoirs so it has nowhere to go but the atmosphere, where it builds up rapidly, creating strong global warming via the greenhouse effect and feedbacks. Surface ocean waters turn near-acidic as they become increasingly saturated in CO₂.^{11,12} Oceans warm, so sea levels rise. Those symptoms should sound eerily familiar.

The Burgess *et al.* paper is the latest in a series that has shortened the timeframes of LIP events and strengthened ►



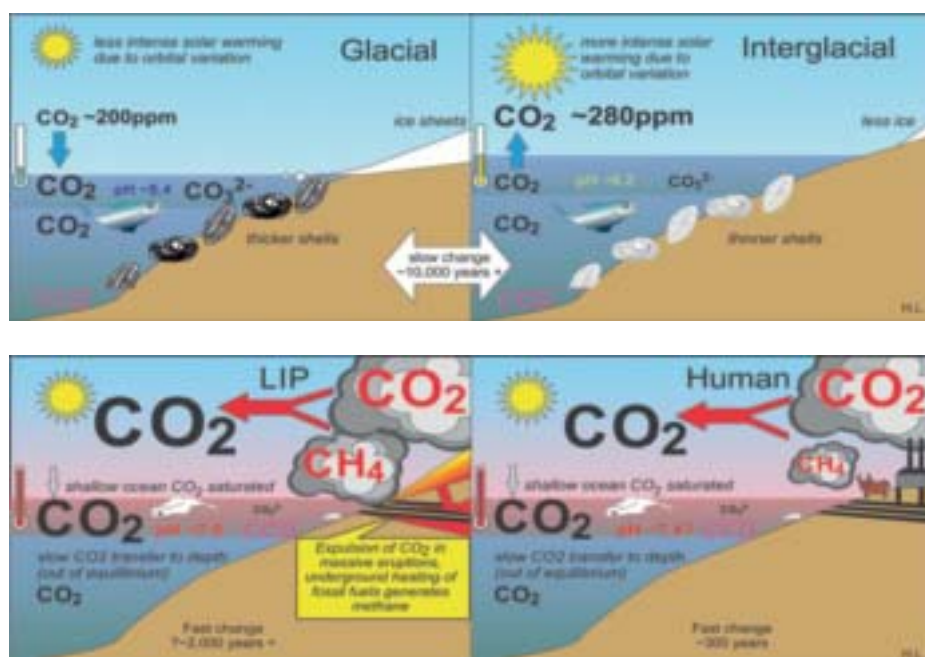
Above top: Earliest flood basalts of the Siberian Traps at Krasni Kamini (“Red Rocks”) near Talnakh, Siberia.

The lavas here contain lumps of bitumen and burnt trees

Above middle: Formation of Tunguska Basin pipes and the venting of carbon gases and halocarbons to the atmosphere, from sill intrusion into organic-rich sediments

Left: Large sill in the Siberian Traps

“THE SCALE OF THE PERMIAN EXTINCTION WAS SEEN AS JUST TOO MASSIVE, ITS DURATION FAR TOO LONG, AND DATING TOO IMPRECISE FOR A SENSIBLE COMPARISON TO BE MADE WITH TODAY’S CLIMATE CHANGE. NO LONGER”



Images: © H.Lee based mainly on Zeebe, Annu. Rev. Earth Planet. Sci. 2012, with additional input from A. Ridgwell



Above: The Siberian Traps

Left (top): How oceans responded to slow changes in insolation and CO₂ feedback in the Pleistocene
Left: How oceans respond to rapid carbon emissions by LIPs and humans

► the association between LIPs and extinction events. Blackburn *et al.* in their 2013 paper in *Science*, declared causality between Central Atlantic Magmatic Province (CAMP) eruptions and the end-Triassic extinctions, suggesting the pulse of carbon emissions occurred “near instantaneously”, and the main extinction event occurred in as little as 3000 years.²

This idea was strengthened by Dal Corso *et al.*, just this year in the *J. Geol. Soc.* who link the Carbon Isotope Excursion (from the carbon emission slug) to the initial eruptive phase of the CAMP.¹³ The PETM has been linked to North Atlantic Magmatic Province eruptions and sill emplacement, with vent chimneys strikingly similar to those identified for the Siberian Trap eruptions.^{3, 8} One recent paper controversially suggested that the PETM carbon slug was emitted in as little as 13 years, citing a possible cometary impact cause - though that is strongly disputed.^{4, 15}

Microbes

In March, an alternative hypothesis for the Permian Mass Extinction was proposed by Rothman *et al.*¹⁶ – a runaway microbe swarm generating massive methane emissions. It is good science to test existing theories by throwing alternatives at them to see if they stick. But the microbe idea seems a poor fit to what we know because it is a one-off explanation, whereas LIPs have a criminal record – they are a serial killer with a consistent “MO”: greenhouse gas

release, warming, rising sea levels, ocean acidification and anoxia.

Moreover, Rothman *et al.* use a time window for the horizontal gene transfer that enabled the runaway methanogenesis that is 82 million years wide. Even if we overlook the often elastic nature of molecular clocks, and that their clock is not calibrated to fossils, that’s a time window extending from the lower Permian to the lowest Jurassic. For the mutation to have happened exactly coincident with the Siberian Traps eruptions is surely improbably lucky. The authors explain the coincidence by citing nickel fertilization by the Siberian Traps eruptions – but that would place the mutation (even more luckily) as having occurred between the Emeishan and Siberian LIPs, or else we should have had the Guadalupian Mass Extinction.

On the other hand, Burgess stated (at the 2013 AGU fall meeting) that “intrusive and extrusive magmatism began within analytical uncertainty of the onset of mass extinction, permitting a causal connection with age precision at the ~ 0.06 Ma level.”¹⁷ At the point of writing, new published dates on the volcanics are anticipated from the MIT team, which should clarify the issue. Regardless of initial cause, the Permian remains an extreme example of a CO₂/methane greenhouse-gas generated hothouse.

Parallels

The point of all this is that the parallels between LIP-induced climate crises and modern climate change are becoming

ever stronger and clearer. By shortening the timeframes, the *rates* of LIP CO₂ and methane emissions are looking more comparable to today’s emission rates, even if LIP emission *volumes* look far larger.^{10, 3, 2, 1, 18, 6, 19} It is this fast rate that is crucial for catastrophic climate change because of the ability to overwhelm fast feedbacks, versus the normal benignly-slow adjustments to carbon-cycle and insolation changes.

Some have pointed out that since we began our modern climate change in an “icehouse” era with ice sheets to melt and low starting CO₂ levels, we might not reach a Permian-like hothouse.¹⁹ In addition, since the Permian, calcareous algae have changed the way deep oceans process carbonate, providing more of a buffer.²⁰ But that buffer only comes into play if the deep oceans come into play, which most estimates consider will not happen for a few more centuries.¹¹

All in all, the parallels between the many LIP-linked mass extinctions in the geological record and today’s climate change offer no comfort about the legacy we are leaving for our children and grandchildren. Rather they stand as signposts for an increasingly scary future. ♦

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Worlds apart

Sir, Philip Allen's ideas set out in his *Soapbox* piece (*Geoscientist* 24.6 July 2014 p 11) suggesting academic geologists are superior beings living on a different planet and too highfalutin' to bother about professional qualifications seems to be predicated on a novel interpretation of 'serving science and profession'.

Of course 'Science' actually means those branches of the natural sciences that relate to geology, and 'Profession' means those who engage in the pursuit of it - whether by research and teaching or its application to real-world practical problems.

Prof Allen may not feel a need to take the 'geological version of the Hippocratic Oath' although as a Fellow he is already required by the Society's Regulations to follow the Codes of Conduct prescribed by Council. But it is important to recognise that our professional qualification is far more than a simple adherence to these Codes. Increasingly, society requires those who provide professional advice to be regulated by a system administered by the members of the profession.

The Society first offered the professional title in January 1991 and has greatly developed the process of validation since. Each candidate is required to demonstrate the attainment of academic qualifications; the ability to apply geological principles to solve practical problems; to have gained a minimum period of experience and achieved a sufficient standard for chartership; to appreciate his/her responsibilities and duties to employers /clients, colleagues and also to society at large; to undertake Continuous Professional Development and maintain a record; and of course, to adhere to the Society's Codes of Conduct.

Not all academic geologists share Prof Allen's views; indeed many played a leading role in establishing 'Chartered Geologist', including eminent folk from Imperial College; and many actively support it. However, those who think like Prof Allen should reflect on their duties - both moral and professional - towards the students they teach, most of whom will be planning careers outside academe. By becoming Chartered Geologists not only will they show leadership but will also be supporting the Society in its important work in regulating the geological profession for the benefit of society at large.

An important part of 'serving science' is accrediting undergraduate and postgraduate degree courses. This process involves interaction between the Society and academics and has often resulted in course improvement. It seems to me that accreditation should include a requirement for those teaching accredited courses to be Chartered Geologists - or if their geological credentials are not adequate, be Chartered Scientists or hold similar appropriate qualifications such as Chartered Engineer.

RICK BRASSINGTON



Those who think like Prof Allen should reflect on their duties - both moral and professional - towards the students they teach

RICK BRASSINGTON

More better mentoring

Sir, As a registered Chartered Geologist and European Geologist who first put hand to rock professionally in 1979 - I have seen many ups and downs in the commodity industry. With the present economic situation, a situation that recurs regularly (dire for geologists of all levels of experience) what can be done to assist the skills of the current crop of young people and to get them into the marketplace?

The Society of Economic Geologists ("SEG") has, on its website, a 'mentoring' section, aiming to bring young geologists into contact with industry experts. I am listed on this, and probably once or twice a year receive an e-mail - to which I send out a stock answer. I am duly thanked, but I do not know if I really help. I am also not sure this is the right way to approach the problem.

The aim of the SEG system is not to help people get jobs but to mentor them while they are in work - to develop a 'more complete geologist'. This is especially true in the metals and minerals industry where geologists can move from commodity to commodity and one mineralisation style to another. Therefore the mentoring team is there to help in this transition. Remember, this might happen within a company and its various projects. The mentoring system, though, does need direction.

What does the GSL do for young geologists looking for work or for seeking career guidance? My feeling is - not a lot, at present. Should GSL having a 'mentoring site' as part of the current website?

MARK DAVIS.

Coal - price not everything

Sir, I read your July 2014 editorial "The wages of cheap" with interest as someone who has worked for over thirty five years in the global mining industry I share your obvious anger if not your analysis.

Coal is cheap because we are producing more than the world consumes. At the same time the market for coal, while still growing in Asia, is under pressure in Europe and North America due to alternatives such as shale gas and concerns about AGW. As a result the price of thermal coal has fallen around 45% since 2011. This supply and demand at work.

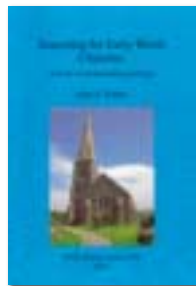
Deaths in Turkey, China, India and Russia have common themes. Most of these mines

supply coal into their domestic markets, often at a prices and quality lower than the global seaborne coal. Most seaborne coal is produced at modern, efficient and safe mines which UK mines can't compete with for reasons well understood.

Higher coal prices would not lead to a renaissance in the British coal industry nor would it stop deaths in China or Turkey, as recent history has shown when coal prices were double what they are now. Change has to come from within problem countries themselves and needless to say there has to be the political will to do it.

JOHN THEOBALD

Searching for Early Welsh Churches



John Potter, compiler of this monumental survey of the ecclesiastical geology of ancient Welsh churches, is a phenomenon – a veritable octogenarian prodigy. Long-term readers of this

magazine will remember perhaps their first exposure (so to speak) to the geological reading of ancient churches when they read his 2005 feature 'Ecclesiastical Geology – a return to Victorian field standards' (*Geoscientist* 15.10 pp4-7).

By that time Potter had already visited over 10,000 churches, extant and ruined, in the region of the Thames Valley, and had shown how the story of the ancient courses of the Thames and its tributaries was written into them – a story sadly no longer visible in working gravel pits. But because ancient buildings used materials on or close to site, they now provide windows into the geology concealed beneath.

Potter has also been using his geologist's eyes to help archaeologists (whose lithological observations are generally woeful) recognise Anglo Saxon work where no definitive diagnostic architectural details survive: for example, in the 'patterned' use of stone in quoins, where Saxon work is discernible as alternating 'long and short' work.

Potter has since conducted extensive surveys of almost all 'Anglo Saxon' religious sites in England, and extended his researches to the ancient churches of Ireland, Scotland, the Scottish islands and the Isle of Man. Now, supported by a British Academy Research Grant, he has completed this mighty compilation of stonework in the churches of Wales – hitherto deemed a pre-Romanesque desert.

Faced with the less forthcoming Palaeozoic limestones and greywackes of Wales, and the lamentable practice of lime-washing and rendering encouraged there by CADW, Potter found greater difficulty than he expected in substantiating his contrary belief. Over 400 sites were examined, yielding perhaps over 30 with 'patterned' style fabrics recognisable from his previous work. This is, very largely, the first time that Welsh churches have been surveyed



St. Brynach's Church at
Cwm Yr Eglwys,
Pembrokeshire

Images: Dr. Morley Read / Shutterstock.com

in this way, and his work has been able to explain much about the unique features of church building in the Principality, such as the wide variety of wall batters (castle-like thickening to the base).

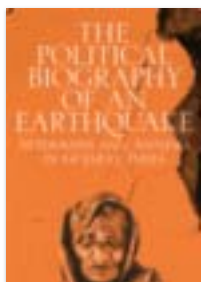
I could point to more examples in areas where I personally happen to know the churches well; and I suppose every Welshman with a local patch (mine being Gower) could do likewise. But this is a stupendous achievement which, despite being a massive illustrated litany, also manages to be feisty, opinionated and readable. It is a most valuable addition to the growing literature of a subject still in its infancy.

Reviewed by **Ted Nield**

SEARCHING FOR EARLY WELSH CHURCHES – A STUDY IN ECCLESIASTICAL GEOLOGY

JOHN F POTTER, Archaeopress 2013. 457pp sbk BAR
British Series 578 ISBN 978 1 4073 1098 5
List price: £64.00 www.hadrianbooks.co.uk

The Political Biography of an Earthquake



On India's Republic Day in January 2001, a M7.7 earthquake struck the western part of Gujarat. It killed an estimated 14,000 people, mostly in the coastal region of Kutch, next to the border with Pakistan.

It totally destroyed 178 villages, more than 70% of 165 other villages and damaged four major towns—Bhuj, Bhachau, Anjar and Rapar—seriously enough for emergency measures to be imposed on them. In Bhuj, there was an oil leak; at Kandla port, highly toxic

chemicals leaked into the air, while coal dust and fluorspar spilled into intertidal waters at Navlakhi. Nine months later, partly as a result of the state government's incompetence at reconstruction, the chief minister resigned, and was succeeded by a virtually unknown and unelected politician also from the Bharatiya Janata Party named Narendra Modi, who has now become India's prime minister.

The *Political Biography of an Earthquake* is a revealing study of what has happened to the devastated area since 2001, based on a decade of field research beginning in the 1990s by Edward Simpson of London's School of Oriental and African Studies. It attempts to answer the question that arises in the aftermath of any major natural disaster: to what extent has the post-disaster reconstruction changed and even benefited the area struck by it?

Under Modi's chief ministership, Kutch has experienced a dramatic and much-reported spate of industrialisation, accompanied by extensive, if largely unreported, environmental degradation. According to Simpson, the earthquake's destruction was one of the principal catalysts or 'enablers' of this rapid development.

Earthquakes have struck the region before. Unfortunately, the historical record is almost non-existent, with the exception of a 1956 earthquake centred on Anjar, and one in 1819 at the time of the British takeover of Kutch. This worked to the political advantage of the colonial power, but also threw up a natural dam, known as the Allah Bund, which diverted the waters of the River Indus and caused the fertile lands of Kutch to fail.

"As agricultural lands withered," writes Simpson, "the population of Kutch turned to trade, commerce and international migration for its fortune"—thereby helping to generate a Gujarati diaspora with a commercial reputation evident in today's Britain. Many of them donated handsomely to the reconstruction in 2001. But one cannot help wondering what will happen to Kutch's burgeoning industries next time the Earth shakes.

Reviewed by **Andrew Robinson**

THE POLITICAL BIOGRAPHY OF AN EARTHQUAKE: AFTERMATH AND AMNESIA IN GUJARAT, INDIA

EDWARD SIMPSON, Published by Hurst Publishers
2014 ISBN 978-1-84904-287-1 302 pages
List price: £22.00 www.hurstpublishers.com



Jurassic Coast Fossil Finder



Chances are that the fossil you actually find is not one of those illustrated in the various fossil guides available, such as the excellent NHM handbooks. It is therefore useful to have a guide

which figures specimens from the localities you may well have visited. The material from collections of museums across east Devon and Dorset are included in this compilation.

In addition to the fossils a wealth of information can be accessed from the website, including safety in the field, collecting, conservation, and even a selection of accommodation available in the area. But it is on the fossils that this guide must be judged; the colour photographs are excellent, but beyond this there are some serious reservations.

'Search the database' allows the user to select a fossil group and then scroll through fossils of a particular age. Thus, entering 'ammonites' reveals '252 fossils found'. Unfortunately the caption under each photo merely says 'ammonite'; it would have been far more useful to have the generic name under each. Clicking on the photo may reveal a generic (with or without) a specific name, stratigraphical information and a locality. These are often from ancient museum labels, so identification is sometimes lacking or inaccurate and, totally un-necessarily, each bears an absolute age of the specimen. These are often wrong and it would have been far better to have a geological time-scale alongside the Heritage Coast succession and a few appropriate radiometric ages appended to that.

Some of the 'scientific names' are just nonsense, such as a leaf labelled as *Angiosperm dicotyledon* or a crinoid given the 'scientific name' *Echinodermata crinoidea*. These should have been checked before publication, as should the palaeontological howlers. Thus 'Ammonites moved by sucking water through the mouth, pumping it over the gills, then squirting it out again'; 'Bryozoans are colonial animals made up of many jellyfish or anemone-like polyps' or 'Bivalves shells are held together by a strong muscle, and hinged at the pointed end'. Such errors are further compounded by loose wording: such as in the statement

that ooliths are composed of 'layer upon layer of calcium'.

Proof checking has been poor throughout so that there are frequent mis-spellings, not only of technical terms such as phragmocone, ichthyosaur and Wealden, but even of words like 'symmetry'.

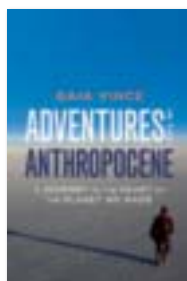
Richard Edmonds, Jurassic Coast Earth Science Manager has said that he would 'welcome any input that helps us enhance or improve the content'. Regrettably a great deal is needed and one is led to the conclusion that the site has been released prematurely.

Reviewed by **John C W Cope**

JURASSIC COAST FOSSIL FINDER

Website, published by Jurassic Coast Museums Partnership 2014
www.jurassiccoast.org/fossilfinder

Adventures in the Anthropocene



Our world, we have always known, is changing. But now we realise that the Earth is changing, and that is a little different. It is becoming clear that humans have collectively refashioned the surface processes of this planet, to alter the course of its geological history. One response to this growing realisation is the suggestion that we no longer live in the Holocene, but in a new, human-driven epoch, the Anthropocene. It's a term that now enjoys wide currency.

What is the Anthropocene world really like, though? Science editor and journalist Gaia Vince set off to find out, travelling the world to observe the human reality of living on a planet in transition. This book is an account of that journey. I approached it with trepidation - a book of this sort might easily descend into a combination of self-indulgent travelogue and dystopian forecast. I need not have worried. Gaia Vince, with her background at *Nature*, *New Scientist* and the BBC, has done her homework well (the scientific context is well explained) and picked her way deftly through the terrain.

The book is patterned on the Earth's main geographic regions: rivers, deserts, forests, mountains, the oceans - together

with our species' own additions to geography, in the form of farmlands, mines and the burgeoning cities. Within this, Vince has targeted people and places that range from the remarkable - the retired engineer in the Himalayas, say, who is trying to re-grow mountain glaciers, or the man building a whole island out of rubbish in the Caribbean - to the commonplace of daily life in the slums of Latin America.

How are people coping in a world of growing populations, shrinking resources and changing climate? she asks. There is a keen focus on the practical, in this now tightly-coupled and increasingly rapidly evolving human-Earth-environment system, as to what might be done to nudge this new co-evolutionary system along a more hopeful path. That is, for its human component at least. Vince acknowledges that many of our kindred species - the coral reef communities, for instance - will probably not last the century. But people, she shows, can be remarkably adaptable.

The writing is vivid and pacy - nicely attuned in style with the breathless pace of global change. Like the best journalism, it gives a keen sense of people and places (think the excellent 'From Our Own Correspondent' of the BBC). Highly recommended.

Reviewed by **Jan Zalasiewicz**

ADVENTURES IN THE ANTHROPOCENE: A JOURNEY TO THE HEART OF THE PLANET WE MADE

GAIA VINCE, Published by: Chatto & Windus 2014.
ISBN-13: 978-0701187347 448pp hbk.
List price: £20.00.

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- ◆ **NEW! Sediment Provenance Studies in Hydrocarbon Exploration & Production** by Scott et al., 2014, Geological Society of London SP 386420pp, hbk
- ◆ **NEW! Geophysics for the Mineral Exploration Geoscientist** by Dentith, M & Mudge S T 2014 Cambridge University Press 438pp, hbk
- ◆ **NEW! Geodynamics (3rd Edn)** by Turcotte D and Schubert, G 2014 Cambridge University Press 623pp sbk
- ◆ **NEW! Harness oil & Gas Big Data with Analytics** by Holdaway, K R. 2014 John Wiley 364pp hbk

PEOPLE NEWS

CAROUSEL

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

◆ Geoffrey Boulton



Geoffrey Boulton, Regius Professor Emeritus of Geology at the University of Edinburgh, has been awarded a Royal Medal of the Royal Geographical Society for his contributions to glaciology. The medal was first awarded by George IV in 1832 and must be approved by the reigning monarch. Previous recipients include Sir Roderick Murchison, Alfred Russel Wallace, Fridtjof Nansen, R A Bagnold, Louis Leakey and Sir Nicholas Shackleton.

◆ Stuart K Monro



Stuart K Monro, Scientific Director of Dynamic Earth Enterprises Ltd., has been awarded a DSc by Heriot-Watt University and Honorary Fellowship of the Royal Scottish Geographical Society. Among many other awards, Stuart received the title of Officer of the Order of the British Empire (OBE) for services to science, in the New Year Honours list, announced on 30 December 2006.

◆ Catherine Mottram



Catherine Mottram, recently graduated with a PhD from the Open University, has received Fulbright Scholar Award to enable her to continue her research at The University of California, Santa Barbara for 12 months. Catherine will be investigating how deformation in mountain belts affects the way geological time is recorded by radioisotopes in mineral grains. The results should lead to better understanding about the way key Earth processes operate in some of the most dynamic tectonic settings on Earth.

Lord becomes Chartered

Alan Lord, External Affairs Secretary, has decided to become a CGeol in his 70s. Why?

Alan Lord writes: The Geological Society I joined 50 years ago was a learned society that included a number of Fellows working in industry, of whom Peter Kent was a distinguished example, but most were academics of one sort or another. The world has moved on and following the merger with the Institution of Geologists the balance of the Fellowship between academic and industry has shifted steadily towards the latter, in part reflecting far greater career opportunities in applied geoscience these days.

Regulation of our professional activities has increased and



Alan Lord

academic qualifications are no longer sufficient for a practising Earth scientist - even if retired! In becoming Chartered I hope to encourage my former students and present and past colleagues to themselves seek CGeol status.

➤ See Letters (P21) for more on Chartership. *Editor*

And, because we all think of Stevns Klint as a person:

◆ A new World Heritage Site

Malcolm Hart (Chair: International Sub-Commission on Cretaceous Stratigraphy & Plymouth University) writes: The Stevns Peninsula (Sjælland south of Copenhagen) was proposed by Édouard Desor in 1847 as the classic 'Danian' location. Over the last 30–40 years the Cretaceous/Paleogene boundary exposed in the 14km-long cliff has increased in importance as the debate over the end-Cretaceous extinctions has gathered momentum since the identification of the iridium anomaly.

In 2012 Tove Damholt (Østsjælland Museum) and Finn Surlyk (University of Copenhagen) prepared a nomination for UNESCO in an attempt to gain inscription on the World Heritage List of natural sites. At the 38th Session of the World Heritage Committee (Doha, Qatar 15 – 25 June 2014) the bid was successful and Stevns Klint is now fully recognised as of global significance. The International Sub-Commission on Cretaceous Stratigraphy congratulate Tove and Finn on their achievement.

STICKS AND STONES





DISTANT THUNDER

What's in a name?

As geologist and science writer Nina Morgan discovers, the shorter the name, the more memorable the character

In the 19th Century, the study of natural history captured the imaginations of many women, partly to relieve the boredom associated with the lives of the affluent, and partly because it provided a welcome freedom, allowing women to get out into the fresh air on their own. Although they were forbidden to present the fruits of their research in person to the learned societies, many women – for example, Etheldred Benett (1776 – 1845) and Mary Anning (1799–1847) – became known as experts in their own right.

Children's books

For Beatrix Potter (1866–1943), best known today for her charming children's books featuring cuddly creatures, the study of natural history offered a welcome opportunity to get out,

alone, and escape from the attentions of an overbearing mother. Possessed of an observer's eye and natural artistic talent, Potter was attracted by many aspects of natural history, including botany, entomology, ornithology and mycology. She produced a number of impressive watercolour illustrations of fungi by the time she was 21.

Then, while enjoying a family holiday at a rented house near Coldstream in the Scottish Borders in 1894, she developed an interest in geology. She soon went on to acquire copies of James Geikie's *Outlines of Geology* and Andrew Ramsay's *The Physical Geology and Geography of Great Britain*.

Sand pits

Although at Coldstream she visited stone pits and examined signs of past glacial activity, it was fossils that became her particular passion. She enjoyed fossil hunting on family holidays at seaside towns in Dorset, Devon and Cornwall as well as in

the Borders country.

And in 1895, while on holiday in the Lake District, she overcame her reservations about the dangers of quarries and quarrymen and visited quarries above Troutbeck to collect and illustrate fossil corals. These are now preserved as paintings. But a visit to a potentially unstable quarry in Swanage a year later seems to have put her off, and she decided that it "was better not to expect or worry much about geology...".

Fear of injury may not have been the only reason Potter decided to give up on geology. Although she was interested in fossils mainly as collectable objects, rather than subjects for a systematic study, she still wanted to identify and learn their names. And this was where she hit the proverbial rock wall. After spending a frustrating day in the Natural History Museum trying to identify and discover the scientific names for her fossil specimens she began to wonder "whether geology names the fossils, or the fossils geology".

And with this, she may have had a point. Fossil names like *Parapallasea kyotodermogammarus abyssalis* or *Gammaracanthus kyotodermogammarus lobricatobaicalensis* could be enough to put anyone off. No wonder when she began writing her books for children she plumped for simpler names for her characters – like Peter!



Acknowledgement

The idea for this vignette came from the article titled: A scientist's eye, by Linda Lear, *Nature*, vol 508, 24 April 2014, pp 454–455. Further information came from *Beatrix Potter: The extraordinary life of a Victorian genius* by Linda Lear (ISBN 978-0-141-00310-8) and the Wikipedia entry for Beatrix Potter. David Martill of the University of Southampton, Darren Naish of the University of Portsmouth, and Philip Powell of the Oxford University Museum of Natural History kindly provided information about unusual fossil names.

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

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

Hull, John Hewitt*
Scott, Barry*

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

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

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



Hess to retire

Jack Hess, Executive Director of the Geological Society of America, will retire on 2 January 2015.

Jack Hess will then have been in post for 13 years, and, according to Geological Society of America President Hap McSween, 'leaves the Society in much better shape than he found it', having 'helped right the ship financially, opened a geoscience policy office in Washington, increased global engagement, enhanced education and outreach activities, strengthened efforts to improve the diversity of the profession, launched two new journals, embraced GSA's entry into social media, and started down the path to change the

publishing financial model.'

Hess was also instrumental (with GSA Foundation President Geoff Feiss, who is also retiring) in making GSA and GSAF a fully functioning team, McSween said in a statement issued in July. 'Jack is modest about his role ... but those who have been involved know just how critical his directorship has been to our Society.'

GSA Council has meanwhile begun the search for a new Executive Director. GSA Vice President Jon Price (jprice@unr.edu) is chairing the search committee. See P6.



OBITUARY

ALBERT VINCENT 1919-2012

Professor E A Vincent, known always as 'David', died on 24 December 2012.

His interest in science, and particularly chemistry, may have been first awakened by his aunt, a bacteriologist at the Royal National Institute of Dairying in Reading. From Reading School he went to the University of Reading, where one of his teachers was L R Wager. Graduating in 1940, Vincent was drafted into wartime research on the analysis and testing of explosives in Scotland - where he also met his future wife, Myrtle, a botanist.

After the War Vincent entered Durham University, where Wager had succeeded Arthur Holmes as Professor, and worked on the Tertiary dyke rocks of East Greenland for his PhD. Wager became Professor of Geology at Oxford in 1950 and Vincent joined that department one year later as University Demonstrator with responsibility for petrology, teaching crystal structure and setting up a new silicate analysis laboratory.

Analytical

He continually modernised the Oxford department's analytical capabilities, adding photometric and spectro-photometric methods to precise gravimetric determinations of whole rock and mineral compositions. He also introduced neutron activation techniques (developed by A A Smales' Analytical Chemistry Group at AERE Harwell) for minor

Distinguished mineralogist, geochemist and influential academic manager



and trace-elements.

The sulphides and opaque oxides in Skaergaard rocks provided ideal material for analysis using these techniques. Vincent, having mastered reflected light ore microscopy after a period in P Ramdohr's laboratory in Heidelberg (where his fluent German eased the way), worked with Smales and a succession of Oxford DPhil and Part Two Chemistry undergraduates in fundamentally revising and extending the list of rare element geochemical data. This became a standard of comparison for other igneous rock sequences and was a significant contribution to our understanding of the important role played by

immiscible sulphide melts in magmatic processes. It is fitting that the PdPt arsenide 'vincentite' is named for him.

In 1956 Vincent was elected to the Readership in Mineralogy at Oxford, becoming responsible for administering the Sub-Department of Mineralogy in the (then) Department of Geology and Mineralogy. His administrative duties increased relentlessly with time; first, when he left Oxford to become Professor of Geology (at Manchester, 1962) and still further on his return to the Chair in Oxford (1967). Although continuing to work with his research students, in the course of five happy years at Manchester he had been able

to recruit important new staff and to commence building a large new extension to the department.

Isotopes

During his subsequent 22 years as Professor at Oxford he was able to do more – notably, overseeing the move to the Faculty of Physical Sciences; the arrival and rapid expansion of geophysics; the incorporation of Surveying and Geodesy into the re-named Department of Earth Sciences; the establishment of diploma and MSc courses; the continuation of age and isotope research, and much more. Somehow he also found time to be President of the Mineralogical Society and organise a very successful Symposium of the IAVCEI. At the end of his tenure the Oxford Department may be said to have changed out of all recognition.

David Vincent was a dedicated scientist and a cultured man. He had a deep love and knowledge of classical music, a gift for photography (be it with a reflected light microscope or a Twin-lens Rolleiflex and SLR Leica). He was a linguist, at ease in French, Italian and especially German - enabling him to translate A Rittman's classic *Vulkane und ihr Tätigkeit* into, arguably, better English. He was a gentle, courteous and kind character who never spared himself in fostering the well-being and careers of others.

► By David Bell



ENDORSED TRAINING/CPD

COURSE	DATE	VENUE AND DETAILS
Field Observation and Geomorphological Mapping	29 Sept – 3 October	Week-long field course in Dorset, Isle of Wight: training in field observation, geomorphological mapping and dGPS surveying skills. University of Sussex: Prof Roger Moore. See website for details and registration.
Lapworth's Logs	n/a	'Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. Contact: info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

DIARY OF MEETINGS SEPTEMBER 2014

MEETING	DATE	VENUE AND DETAILS
23rd Annual Symposium of Palaeontological Preparation & Conservation, Geological Curators	1-6 September	Venue: The King's Manor, University of York. For Registration and Abstract Call – see website. Charges.
British Science Festival British Science Assoc.	6-11 September	Venue: University of Birmingham, Edgbaston. For Convener contact and registration follow links on website.
Palaeo' to the People! Fossils in the Service of Man, Geologists' Association	6-7 September	Venue: Lecture Theatre 2, Bennett Building, University of Leicester. For details and registration see website. Contact: Sarah Stafford E: geol.assoc@btinternet.com
Field Trip to Barnet (Stanmore Gravel) Home Counties North Regional	7 September	Day field excursion. Venue: London Borough of Barnet. Leader: John Wong. Contact: homecountiesnorthregionalgroup@gmail.com
Groundwater - the Good, the Bad and the Ugly London Lecture	10 September	Venue: Burlington House. Speaker: Natalyn Ala. See p.6 for details.
North West Highlands Geopark: Geotours 2014	10-17 September	Venue: NW Highlands of Scotland. Cost: £230. See website for registration and details. Contact: Pete Harrison E: pete@nwhgeopark.com
Workshop: Geo-Materials Sample Preparation for Microscopy. Geological Curators Gp/Royal Microscopical Soc.	11 September	Venue: Department of Earth Sciences, University of Oxford, UK. See website for details and registration. E: Helen.Kerbey@museumwales.ac.uk
Scarborough Fossil Festival 2014. Scarborough Museums Trust, The Palaeontological Association	12-14 September	Venue: Rotunda Museum, Scarborough. Free. See website for links and details. Contact: info@smtrust.uk.com
Deep Earth Processes: windows on the working of a planet. Geological Society	15-16 September	Venue: Burlington House. See website for registration and details. Charges. Contact: Naomi Newbold T: 020 7432 0981 F: 020 7494 0579 E: naomi.newbold@geolsoc.org.uk
Antarctica Evening: Double Event Home Counties North Regional	16 September	Venue: Sir Robert McAlpine, Hemel Hempstead, HP2 7TR. Time: 1800 for 1830. Speaker: David Brook. See website for details and registration. E: homecountiesnorthregionalgroup@gmail.com
The Geology of The Isle Of Man Geologists' Assoc.	19-22 September	Venue: TBC. Field excursion. Leaders: Dave Quirk And Dave Burnett. See website for details and registration. Contact: Sarah Stafford E: geol.assoc@btinternet.com
North West Highlands Geopark: Geotours 2014 Option 2. NW Highlands Geopark	19-22 September	Venue: NW Highlands of Scotland. Cost: £140. See website for registration and details. Contact: Pete Harrison E: pete@nwhgeopark.com
The Future of Sequence Stratigraphy: Evolution or Revolution? William Smith Meeting ,GSL	22-23 September	Venue: Geological Society, Burlington House. See website for details and registration. Charges. Contact: Naomi Newbold (coordinates above).
Feet on the Ground: Engineering Geology, Past, Present and Future Engineering Group/Yorkshire Regional	24 September	2013 Glossop Lecture. Venue: Leeds University. See website for details and registration. Speaker: Prof. Jim Griffiths. Contact: James Barr E: james.barr@atkinsglobal.com
Arsenic in Airborne Dust. South West Regional	26 September	Venue: Cornwall Council Chambers, Luxstowe House, Greenbank Road, Liskeard, Cornwall. Time: 0900-1230. Free, registration required. See website. E: jenniferg@johngrimes.co.uk
Dorset Coast Weekend. Geologists' Assoc.	27-28 September (TBC)	Venue: TBC. Leader: Prof. John C W Cope. Limited numbers. Contact: Sarah Stafford E: geol.assoc@btinternet.com
Cavanacaw Gold Mine & Curraghinalt Gold Project.Northern Ireland Regional	28 September	Venue: Meet at the Silverbirch Hotel, Omagh Time: 10.00. Limited numbers. Contact: Sarah Coulter E: GeolSocNI@gmail.com
INCISE 2014: The 2nd International Symposium on Submarine CanyonsBGS	29 September – 1 October	Venue: BGS Murchison House, Edinburgh. See website for details and links for registration.
ESGOS 2014: European Shale Gas & Oil Summit ESGOS	29-30 September	Venue: TBC, Central London. See website for details and links for registration. Contact: Lauren English E: lauren.english@charlesmaxwell.co.uk

OBITUARY EDWARD HOWEL FRANCIS 1924-2014

Edward Howel Francis, generally known as 'Howel', was born in Cwmavon, (West) Glamorgan, on 31 May 1924. He attended Port Talbot County School (1935-42), and University College, Swansea (now Swansea University), whence his studies were deflected, from 1944-47, by army service. He was awarded his BSc in 1949.

In 1952 he was appointed as a field geologist to the Edinburgh Office of the British Geological Survey (BGS), serving in the North Lowland Unit, rising through the ranks from Senior Geologist to Senior Principal Scientific Officer (District Geologist). In 1962, he was elected Fellow of the Royal Society of Edinburgh (FRSE). From 1971-1979 he was Assistant Director (Deputy Chief Scientific Officer) based in the BGS Leeds Office, responsible for directing BGS activities in Northern England and in Wales.

Medals

Subsequently (1969), in recognition of his original contributions, many of which are outlined below, he was made DSc (Wales) and, in 1989, was appointed an Honorary Fellow of this Society. Further recognition of distinguished contributions to his subject and to the geological community at large included the award, in 1963, of the Murchison Fund of the Geological Society of

Distinguished Survey geologist and President of the Geological Society of London



London and, in 1983, both the Clough Medal of the Edinburgh Geological Society and the Sorby Medal of the Yorkshire Geological Society. In 1989, the Geological Society of London awarded him the Major John Sacheverell A'Deane Coke Medal in recognition of his major contributions to British Palaeozoic volcanism and stratigraphy and "his wide-ranging contributions to the geological community".

Apart from his substantial scientific activity, he made important contributions to the organisational work of the Geological Society and to the standing of 'geologist' as a profession. Notably, he was a member of the Working Party on Professional Recognition (1972-1976), and was Chair of the Working Party on the future of Geological Science in Higher Education (1992). He had served as External

Examiner for the BSc degrees in the Universities of Edinburgh, Oxford, Portsmouth, the Open University, St Andrews, Derby, Sheffield, Keele, Liverpool, Sultan Quaboos (Oman), Oxford Brookes and Hong Kong.

“ HOWEL MADE IMPORTANT CONTRIBUTIONS TO THE ORGANISATIONAL WORK OF THE GEOLOGICAL SOCIETY AND TO THE STANDING OF 'GEOLOGIST' AS A PROFESSION **”**

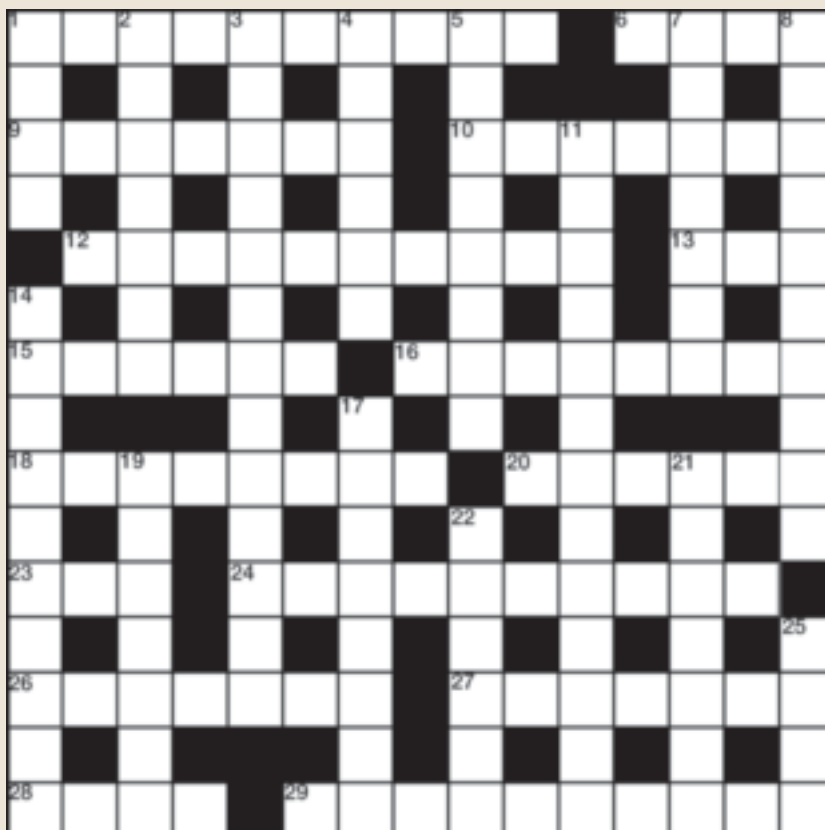
President

He served as President of the Geological Society of London (1980-82) and from 1970-72, as Chair of its Volcanic Studies Group. He was appointed President of Section C (Geology) of the British Association for the Advancement of Science Meeting held in Lancaster in 1976.

Howel enjoyed relaxing on the golf course, and at home, with Edwina his partner of later years, allowing his gentle humour free range, was excellent company and a generous gourmet host. He is survived by Susan, daughter of his marriage to Cynthia, and by Susan's two children.

► By **Tony Harris**

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

CROSSWORD NO.183 SET BY PLATYPUS**ACROSS**

- 1** The 'straight fracture' feldspar, Greekly (10)
- 6** Between sand and clay - the forgotten grade (4)
- 9** All around (7)
- 10** Famous Californian nudist and trembler (7)
- 12** Counterbalance (10)
- 13** Evolutionary palaeontologist, sci fi author, Tolkien authority and *Nature* senior editor (3)
- 15** Backswirling currents (6)
- 16** That which falls or has fallen to Earth (8)
- 18** Useful implements (8)
- 20** Boilerman (6)
- 23** Fantastical goblin-like creature (3)
- 24** Backwardly metamorphic (10)
- 26** South coast castle and town, long a refuge of Anglo-catholicism (7)
- 27** Secondary sexual cranial excrescences (7)
- 28** Place of work for an engineering geologist (4)
- 29** What John Ronald Reuel did when he dreamt up Middle Earth (10)

DOWN

- 1** Hydrated amorphous silica which diffracts light (4)
- 2** Compact format newspaper (7)
- 3** Formation whose pore pressure exceeds that in the hole (13)
- 4** Lying dormant, like heat (6)
- 5** Adorned with sub-parallel linear markings (8)
- 7** Whole number (7)
- 8** Sixty (10)
- 11** Jellyfishes and their kind (13)
- 14** Brouilly, Fleurie, Julienas, for example (10)
- 17** Fleet of small ships (8)
- 19** To cement in place, like barnacles, serpulids, oysters and other sea creatures (7)
- 21** Blood-filtering mammalian organs (7)
- 22** Frequently nickel-associated transition metal, found native in meteoric iron (6)
- 25** Previously enjoyed (4)

WIN A SPECIAL PUBLICATION!

The winner of the July Crossword puzzle prize draw was **Caroline Soderman of Solihull, UK.**

All correct solutions will be placed in the draw, and the winner's name printed in the November 2014 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - 19 September.**

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

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

Name

Membership number

Address for correspondence

Postcode

SOLUTIONS JULY**ACROSS:**

1 Wolframite **6** Argo **9** Denuded **10** Rupture
12 Gadolinium **13** IFS **15** Gneiss **16** Prorogue
18 Roentgen **20** Skewed **23** Gut **24** Plesiosaur
26 Thrusts **27** Blinded **28** Sack **29** Unfriendly

DOWN:

1 Wadi **2** Lineage **3** Radioisotopes **4** Madrid
5 Tarsiers **7** Rausing **8** Overspends
11 Pembrokeshire **14** Aggregates **17** Peterson
19 Enteric **21** Wounded **22** Timber **25** Eddy

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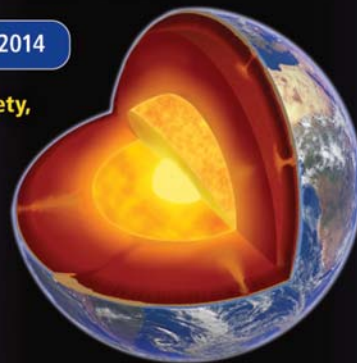


Deep Earth Processes

windows on the workings of a planet

15-16 September 2014

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



Further information

For further information about the conference please contact:

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

T: 0207 434 9944 E: naomi.newbold@geolsoc.org.uk

W: www.geolsoc.org.uk/deepearth14



Follow this event on Twitter #deepearth14

Image credit: Planetary Visions Ltd

PETEX 2014

18 - 20 November 2014, ExCeL, London

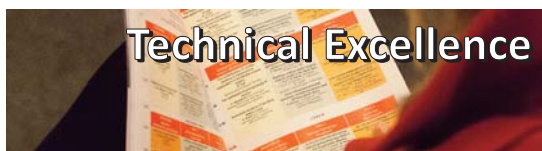
Celebrating 25 Years 1989 - 2014

Event Information



Largest Ever Exhibition

PETEX is the largest subsurface-focussed E&P conference and exhibition in the UK, attracting thousands of delegates from across the world and across a spectrum of industry sectors, from supermajors to consultancies. Exhibition space is already 90% sold out, featuring the ever popular International Pavilion.



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This year PETEX is celebrating 25 years of technical excellence. We're promising a comprehensive programme illustrating the latest global activity in exploration, field development, reservoir management and unconventional exploitation, in addition to the latest developments in the North Sea.

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Following the success from last time, PETEX will again host the Petroleum Geoscience Research Collaboration Showcase, which this year will be moving into a larger area.



Lively Social Programme

PETEX has a rich social programme with an event on every evening - all of which are included in your standard ticket price.

We are particularly pleased to say that the Wednesday night Evening Excursion will be returning in 2014, bigger and better than ever before!

To register, or for more information: www.petex.info

Keep up to date with us on.....



The William Smith Map Bicentenary (1815-2015)



DATE/VENUE	EVENT/ORGANISER
14 February 2015 University of Nottingham	William Smith lecture – by Hugh Torrens East Midlands Geology Society
03 March 2015 Yorkshire Museum	'William Smith, Father of English Geology: his maps – lecture by John Henry' Yorkshire Philosophical Society
19 March 2015 University of Oxford	William Smith lecture – by Hugh Torrens Oxford Geology Group
23 March 2015 Geological Society	William Smith birthday celebrations – plaque unveiling & reception Geological Society
23-25 April 2015 Geological Society	William Smith Meeting I: 200 Years of Smith's Map – GSL flagship conference Geological Society
01-03 May 2015 Lyme Regis Fossil Festival	Mapping the Earth – Lyme Regis Fossil Festival Lyme Regis Fossil Festival
22 May 2015 Yorkshire Museum	The story of the rocks: William 'Strata' Smith's geological map – exhibition Yorkshire Museum
04 June 2015 Bath Royal Literary and Scientific Institution	William Smith's Earliest Careers to 1810 – lecture by Hugh Torrens Bath Geological Society
06 June 2015 tbc	Bath fieldtrip Geologists' Association
13 June 2015 tbc	Bath fieldtrip Bath Geological Society
26 June 2015 Natural History Museum	The Map That Changed the World – lecture by Simon Winchester Natural History Museum
mid June – mid October 2015 Natural History Museum	'William Smith: his maps, rocks & fossils – exhibition' Natural History Museum
03 July 2015 The Geological Society	William Smith Lecture by Tom Sharpe Geologists' Association
26 September 2015 – 28 February 2016 National Museum Wales	Reading the rocks: the astonishing map by William Smith – exhibition National Museum Wales
30 September – 3 October 2015 Dorset	William Smith event & fieldtrip Geologists' Association
07 October 2015 University of Bristol	'Visualising Landscapes & Geology, Past, Present & Future – commences with lecture by Iain Stewart' University of Bristol
October 2015 – January 2016 Oxford University Museum of Natural History	Handwritten in Stone: the life & legacy of William Smith – exhibition Oxford University Museum of Natural History
05 November 2015 Geological Society	William Smith Meeting II: 200 Years & Beyond: the Future of Geological Mapping – GSL flagship conference Geological Society
19 November 2015 Keele University	William Smith lecture – by Hugh Torrens North Staffordshire GA Group

For further information about any of the events, please visit www.williamsmith2015.org



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16-23 September 2014

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