

# Geoscientist

Volume 20 • No 7 • July 2010

- Field mapping for the digital age
- Ask a geologist
- No arguing with the rocks please

Photo: This picture is believed to have been taken by a Chevron worker.

# Deepwater

*Ted Nield remembers the 11 workers who died on Deepwater Horizon and wonders where the sympathy for our industrial heroes has gone.*

Talk about heroes of industry all sounds a bit Soviet these days. Yet, perhaps because I was born in Wales and count among my ancestors men who went down collieries at the age of 11, I preserve strong admiration for all those who find and win the Earth materials upon which we all depend, and whose supply we now take so much for granted.

Miners, until they became an inconvenience in the 1970s, commanded enormous public admiration. Their work was ghastly, tough and dangerous, and until fairly late in the game, badly paid. Moreover when everyone had to dig their own coal from the bunker on cold nights and hump it indoors, people maintained a physical connection with their source of heat – instilling a visceral understanding that doesn't come from turning on a switch.

When mining disasters struck as they too often did, everything stayed out of sight. Miners at least knew their place and had the decency to die privately, alone, and in darkness, without offending our view. Yet

even after 21 October 1966, when millions of tonnes of colliery spoil overwhelmed Pantglas Junior School in Aberfan, killing 116 children – among which dreadful toll, but for a fluke of history my own name would have figured – the national reaction never expressed itself in terms of hatred for the evil coal industry.

Forty-four years on, with coal little more than a folk memory, things are different. Oil and gas have taken its place, and so superior are they both as a fuel and raw material, that our dependency upon them is almost completely overlooked. This makes it even easier for us to forget the genius, drive, creativity and, yes, heroism of those who make it possible. Worse still, when things do go wrong in oil, everyone gets to share the suffering.

On 20 April this year every oil worker's nightmare came true at *Deepwater Horizon*, in the Gulf of Mexico, when everything that could have gone wrong did – seemingly at the same time. Eleven oil workers died, 50 miles off the Louisiana Coast; yet there was no outpouring of grief for them – beyond a small, private memorial service in Jackson, Mississippi.

The reason seems clear, and manifestly unjust. Unlike miners, oil workers are perceived to earn too much money, in a profession that is (thankfully) nothing like as dangerous as mining once was. Moreover, oil's disasters not only inconvenience others, but threaten the environment – to the extent that State Governors and Presidents line up to take shots at the very industry that not only feeds and clothes them as human beings, but as politicians pays for them through its taxes. In this futile blame game, the real culprit, our society's addiction to hydrocarbons and its persistent refusal to wean itself from the habit, goes unaddressed. Nobody acknowledges that the fact we enjoy the luxury of caring so much about the environment – apparently more than we care about human life – almost solely because Big Oil, and the heroes who work in it, have made our lives so comfortable and convenient. Politicians take note: this is not *Avatar*. This is reality. 



Front Cover: Gros Piton, Petit Piton, St Lucia (770m and 743m resp.). The Pitons are eroded volcanic plugs linked by the Piton Miton ridge. The volcanic complex includes a geothermal field with sulphurous fumaroles and hot springs, near the town of Soufrière. The Soufrière Volcanic Centre is a collapsed andesitic stratovolcano complex displaying cumulo-domes, explosion craters, pyroclastic deposits and lava flows. The area was inscribed on the UNESCO World Heritage Site list in 2004. Photo: Ted Nield.



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A Palaeogene cone-sheet at Mingary Pier, Ardnamurchan, defaced by core sampling. Originally featured on the cover of this magazine in January 2010, the line of smaller holes to the left was drilled around 30-40 years ago. See *Geoscientist* 20.1 cover & p5) © Colin MacFadyen, SNH.



# Vandalism by coring

Colin MacFadyen\*, *Scottish Natural Heritage, is bored by irresponsible sampling*

In 1989 the Geologists' Association published their *Code of Conduct for Rock Coring*. It was required to raise awareness of the need to core responsibly, owing to the increasing number of samples taken for geological research purposes, the legacy of which defaced exposures across the UK. Twenty years on, the problem appears to be as bad as ever.

Coring, which is aimed at securing samples for palaeomagnetic and/or geochemical studies, is a necessary element of geological research and therefore essential for the advancement of geoscience. However, an increasing number of classic and other locations across the UK have been defaced by thoughtless researchers, operating without adherence to any code of good conduct, whose behaviour is nothing short of vandalism.

On a recent trip to Ardnamurchan Site of Special Scientific Interest (SSSI), I was horrified to discover that Palaeogene cone-sheets at Mingary Pier had been extensively cored (pictured). Of international conservation value, the natural exposures in this Scottish geological crown jewel have effectively been vandalised to the extent that they would not look out of place in a working quarry. Within the geoscience community this damage has been described as a "desecration ... the equivalent of raiding an eagle's nest", and "utterly unacceptable".

The outrage at this recent incident stems from the fact that no effort at all was expended to sample in less visually intrusive parts of outcrop or to fill in the holes after the sample had been extracted. It would appear that some researchers behave as if rock exposures are their own private resource to be used in a manner that disregards future use by anyone else - researchers, teachers or geotourists. Irresponsible coring is not restricted

to Scotland. Depressingly it is ubiquitous across the UK and is internationally recognised as having become a serious conservation issue.

Irresponsible and reckless coring defaces our natural heritage in a manner that is visible to all and sundry. When an outcrop is cored without adherence to good practice guidelines, it is effectively destroyed in terms of imaging, and its teaching and geotourism potential are often considerably diminished. Irresponsible coring gives geological research a bad name, irritates landowners and therefore threatens future research. Legislation exists in the UK to protect designated sites from the reckless activities of third parties. If good practice guidelines continue to be ignored prosecutions are a possibility.

In the UK some researchers claim that they would behave differently toward exposures within SSSIs, suggesting that irresponsible coring *outside* a designated site is, in their eyes, acceptable. The fact is that whenever and wherever any exposure is sampled, sampling should be undertaken responsibly, respecting its value to conservation. If it's worth coring it's worth conserving.

A change in attitude is required to end this geo-vandalism. It is sad that there is a need to resurrect the Geologists' Association *Code of Conduct for Rock Coring*, as geoscientists nowadays should know better. ☹

\* Dr Colin MacFadyen is Policy and Advice Officer (Geologist), Scottish Natural Heritage. E: colin.macfadyen@snh.gov.uk. The Coring Code of the GA forms part of the fieldwork code and can be downloaded at [www.geologists.org.uk/downloads/GAfieldworkcode.pdf](http://www.geologists.org.uk/downloads/GAfieldworkcode.pdf)

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Win a special publication of your choice

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

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- Artic Russia, by Geoff Glasby
- William Buckland, a bat, and its urine, by Nina Morgan

# Carousel

**Peter Cawood**, President of the Geological Society of Australia, will join the University of St Andrews as Professor of Geology from August 2010. He will be the sixth holder of the Chair since geology was first established as a degree subject at the university in 1920.



**Howard Falcon-Lang**, Senior Lecturer and NERC Advanced Fellow, Royal Holloway, University of London has been awarded a BA Media Fellowship with a placement at BBC Radio and BBC News Online for the coming summer. 

# 100 years of Engineering Geology

*If you graduated from Imperial College with “Engineering Geology” in your degree title then you are invited to the Engineering Geology Centenary Celebration, says Dawne Riddle*

In 1910 Dr Herbert Lapworth presented a series of 10 lectures on Engineering Geology to students at Imperial College. This marked the beginning of 100 years of continuous teaching for the subject at College. To celebrate this event, a reunion will take place on Saturday 10 July. All Engineering Geology graduates of the course and the research school are invited to attend.

The programme will include sessions on how the course has changed throughout its life, reminiscences from past graduates, thoughts on the impact of engineering geologists internationally and a gala dinner. 

For more information:  
[www.imperial.ac.uk/alumni/engineeringgeology](http://www.imperial.ac.uk/alumni/engineeringgeology).  
 Contact: Rosie Tipples, Alumni and Communications Officer, Faculty of Engineering, Level 2, Faculty Building, Imperial College London SW7 2AZ T: 020 7594 8606

## Deaths

- Read obituaries online at [www.geolsoc.org.uk/obituaries](http://www.geolsoc.org.uk/obituaries).

The Society notes with sadness the passing of:

### **Davies, Rhys\***

Locke, Matthew\*

Mann, Paul Dunstan\*

Pearson, Christopher Martin \*

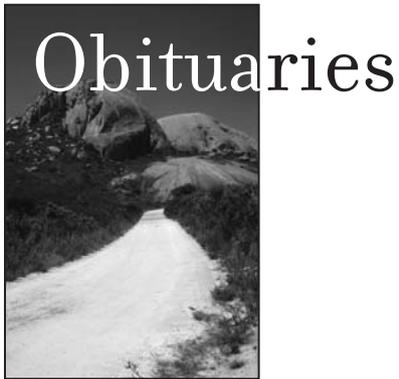
In the interests of recording its Fellows' work for posterity, the Society publishes obituaries online, and in *Geoscientist*. The most recent additions to the list are in shown in bold. Fellows for whom no obituarist has yet been commissioned are marked with an asterisk (\*).

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

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

### **Help your obituarist**

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



## Knud Ellitsgaard-Rasmussen 1923–2009



Knud Ellitsgaard-Rasmussen was born on 23 June 1923 at Gilleleje (a small fishing town north of Copenhagen) in Denmark. He initially trained as a joiner, entering higher education after the Second World War, studying geology and obtaining his masters degree from Copenhagen University in 1952. In the immediate postwar years the Danish government decided that systematic geological mapping should be undertaken in Greenland and established the Geological Survey of Greenland (Grønlands Geologiske Undersøgelse, GGU). In the 1946 summer field season Ellitsgaard went to Greenland, as a field assistant in the mapping of Precambrian basement rocks between Nuuk (Godthaab) and Disko Bay.

He was one of several Danish students employed as part of the Survey policy of training young geologists who would go on to map in Greenland and in 1948 he was

assigned an area of Archean low-metamorphic rocks near Aasiaat (Egdesminde). This study formed the basis of his masters' thesis, for which he was awarded a gold medal from the University of Copenhagen. In 1949–50 he overwintered in southern Peary Land, North Greenland, as a member of Eigil Knuth's Danish Peary Land Expedition. Accompanied by a Greenlander sledge driver and dog sledge, he undertook a reconnaissance of deformed sedimentary rocks in part of the Palaeozoic Ellsmere fold belt, publishing the results in 1955.

Ellitsgaard was appointed leader of GGU in 1956 and director in 1966, and he remained in this position until his retirement in 1983. During these 27 years he was instrumental in building GGU into an institution with a staff of more than 120, nearly half of whom were geoscientists and many coming from several European countries in addition to Denmark. In the summer field seasons groups of up to 150 scientists and support staff went to Greenland, including foreign geologists and research students from universities in Great Britain, Holland, Switzerland and Scandinavia. Initially the work of the Survey concentrated on basic mapping and field geology, with the emphasis gradually changing more towards economic geology, but throughout Ellitsgaard encouraged basic research, to the great benefit of those on summer contracts who were enabled to pursue a variety of investigations based on field work in superbly exposed and frequently geologically unknown terrains.

The opportunity to engage in fieldwork alongside geoscientists from a wide variety of backgrounds was a stimulating experience, for which many are much indebted to Ellitsgaard for having made possible. Initially the Survey concentrated on coastal areas in West Greenland, working from small boats, coastal camps and 'lightweight' tents carried inland, but to allow coverage of less accessible parts Ellitsgaard introduced the use of helicopters and, when the survey extended to East Greenland, he obtained funding to provide a ship with helicopter pads as a floating base for exploration around Scoresby Sund and, later, for a substantial tent base when it was necessary to work farther north. Obtaining the necessary funding for these activities demonstrated Ellitsgaard's considerable skills as a negotiator as well as a scientist. The large number of geological maps and publications from GGU are a testament to the effectiveness of his leadership.

Ellitsgaard's contributions to geoscience were widely recognised. He was a Foreign Member of the Geological Society (1968), received the Egede Medal from the Royal Danish Geographical Society (1976) and was awarded an honorary DSc by Exeter University (1984). He was a member of the Danish Commission for Scientific Research in Greenland from 1965–1983 and of the Danish Academy for Technical Sciences from 1967–97, and was elected to the Danish Academy of Sciences and Letters in 1974. He served on Greenland Home Rule's National Park Council and on the boards of mining companies prospecting in Greenland.

Although Ellitsgaard was inevitably much occupied with administration, he was always approachable and those who worked with him will always remember the kindness and hospitality he and his wife Else extended to all, whether from Denmark or abroad.

We are indebted to N Henriksen and CTR Pulvertaft for help with this account and to the Geological Survey of Denmark and Greenland, GEUS, for the photograph. 📷

*Henry Emeleus, Brian Upton*

## William Iredale Stanton 1930-2010



Dr William (Willie) Stanton MBE died in his sleep on 30 January 2010 having been diagnosed with bone cancer. Willie was a well respected geologist, hydrogeologist, caver, author, and in many ways a man before his time.

Willie grew up in his beloved Mendip Hills, gaining an unrivalled

knowledge of the area's geology. Apart from undergraduate and postgraduate study at Imperial College London and 20 years of his early career working on African mines, Willie spent the remainder of his life living, working, caving and gardening on The Mendips.

He spent the next 20 years of his career with Wessex Water, and saw many name changes. Willie's knowledge of the area was a huge value to the organisation and admired not only by his fellow employees. He was often asked to comment on radio and television, and was a regular contributor to *Geoscientist* and *New Scientist*.

Friends describe Willie as a most charming, modest man, who got on well with everyone. He was keen to share not only his knowledge, but his research, experiments, and thought-provoking opinions. Everyone who knew Willie will have a story to tell. While I worked with him in the 1980s the environment, rising sea levels, population control, and his beloved Renault 5 and its contribution to the failing finances of the French Government were all discussed over his coffee, with four sugars, and a mars bar.

Research centred on limestone, caves and the hydrogeology of the Wessex region, the concern of the effect of quarrying on the Mendips and the implications for the Hot Springs in Bath, artificial recharge, and many weekends spent with water diviners who contacted Willie requesting to undertake his 'test'. Willie would take great delight on a Monday morning, producing a map of known cave systems overlain by the latest water diviner's assessment of the underground features, showing obvious differences.

Willie then worked four days a week to allow him time to develop systems to allow rainwater to wash debris from Mendip Roman lead mines and caves, or to check whether the garden snails had dissolved any limestone boulders they had been encapsulated with, or the slugs had met their end in the, then unheard of, beer traps.

Following retirement from the Environment Agency, Willie continued to research his concerns over world population growth, publishing a book in 2003 *The Rapid Growth of Human Populations* arguing that the population explosion marks a shift from Darwin's theories on competition and that wars arise, and will arise, due to the world's dwindling resources.

This, and his other interests, continued to keep him active through his illness. As has been widely reported, Willie's experiments kept him going right to the end of his life with his devoted wife Angela, and their two daughters. Willie will be remembered by many people for his different interests and enthusiasms, chiefly for a man who would give things a go, live by his beliefs, and share them widely and generously. ☞

Rebecca Exley

## Claud William Wright 1917-2010



C W Wright (Claud to his contemporaries, Willy to the rest of us), who died on February 15 aged 93, was that most English of things: an amateur naturalist and archaeologist who was a world authority in more than one field while at the same time pursuing a demanding

professional career, in his case in the Civil Service.

Willy Wright was fascinated by the natural world as he grew up in North Ferriby. The first contact with science came when the zoologist Sir Arthur D'Arcy Thomson stayed at the Wrights' during the 1922 meeting of the British Association for the Advancement of Science. Both parties were deeply impressed.

Early education at Bramcote Preparatory School in Scarborough was followed by a move to Charterhouse School in Surrey in the early 1930s. Here, Willy and his younger brother Ted collected fossils from the Chalk, exposed during the construction of the Guildford Bypass through the Chalk ridge of the Hog's Back. Their first publication on fossils appeared in 1932. Wright went up to Christ Church, Oxford, in 1936, where he read Greats (Classics), graduating in 1939. At Oxford, Wright met W. J. Arkell, the seminal experience that

### DISTANT THUNDER

## Purple prose

*Geologist and science writer, Nina Morgan, experiences the thrills and chills of science writing in the 19th Century*

When it comes to promoting science, capturing the public imagination is a key goal. But achieving this can be difficult. Finding the right balance between education and entertainment has always proved problematic. The standard advice for successful presentations of any kind is to know and play to your audience. In the 19<sup>th</sup> Century, the public preferred to take their science on board as a spectacle. Models, dramatic visual displays and galleries of curiosities were all popular. The same applied to popular science writing. Animated language and highly imaginative descriptions were deemed to be what the public wanted. And from the fossil collector and author Thomas Hawkins (1810-1889), this is certainly what they got!

Hawkins collected and prepared (some would say over-prepared) important collections of ichthyosaurs and plesiosaurs from the Jurassic rocks in quarries in Somerset, and also purchased specimens from

was to make him into a scholar of international repute. Arkell invited Wright and his brother to contribute chapters to the Geological Survey memoir on the Geology of the Country around Weymouth, Swanage, Corfe, and Lulworth, an extraordinary undertaking for a couple of undergraduates with no formal training in geology.

By 1939, the Wright brothers had already published 20 articles. He entered the Civil Service, and joined the War Office as Assistant Principal Secretary a fortnight after war broke out. His subsequent career was: 1940, Private, Essex Regiment; 1942: Second Lieutenant, King's Royal Rifles; 1942-1945, War Office, rising to GSO2 (Major); 1944, Principal, War Office; 1951, Principal, Ministry of Defence; 1961-1968, Assistant Secretary; 1968-1971, Assistant Under Secretary of State. In 1971 he transferred to the Department of Education as Deputy Secretary. In this position his career and his hobbies converged. Between 1971 and 1973 he chaired the Committee on Provincial Museums and Art Galleries. The Wright Report, as the subsequent publication became known, led to the establishment of the Museums and Galleries Commission, the renaissance of provincial museums nationwide, and the vibrant museums community we have today.

The publication in 1957 of his contribution on ammonites in the *Treatise on Invertebrate Paleontology* established him as an international authority in the field, as did benchmark publications on fossil crabs and starfish. Retirement in 1977 brought more time for research, in Oxford as a Research Fellow of Wolfson College, and in London as a Research Associate of the Natural History Museum. Our collaboration led to Palaeontographical Society monographs on the ammonites of the British Chalk, and that with Andrew Smith on British Cretaceous sea

urchins. The revised *Treatise* volume on *Cretaceous Ammonoidea* appeared in 1996, and is the only revised ammonoid volume to have seen the light of day. In all he was the author of over 150 papers, monographs, and treatises.

His contributions were recognised by numerous awards, including the Lyell Fund of the Geological Society of London in 1947; the Foulerton Award of the Geologist's Association in 1955; the R. H. Worth Prize of the Geological Society of London in 1958; the Stamford Raffles Prize of the Zoological Society of London in 1961; an Honorary Doctorate from the University of Uppsala in 1977; an Honorary Doctorate from the University of Hull in 1987; the Prestwich Medal of the Geological Society of London in 1987, and the Strimple Award of the Paleontological Society (USA) in 1989. He was President of the Geologists' Association from 1956-1958.

Fifteen genera or species of fossils: ammonites, starfish, a brachiopod, snail, and crab bear his name.

Years ago, when asked how he found the time to combine a demanding career with a pastime more productive than the careers of many full-time palaeontologists, he remarked that his fossils, ferns, and porcelain were an island of sanity in a mad world, an island found by others in his profession who rose at six, and devoted a quiet hour to their postmarks, butterflies, stamps, or poetry. He also noted that, come the end of the day, no work went home. ☞

For a fuller account of a remarkable man, see: Kennedy, W. J. 2006. C. W. Wright: a most professional amateur. *Proceedings of the Geologists' Association* 117, 9-40.

*Jim Kennedy*

professional collectors such as Mary Anning. Many of the specimens that he sold or donated to the British Museum of Natural History and the natural history museums at Oxford and Cambridge are still on display. But although he was respected as a collector and preparator, Hawkins was notoriously eccentric. He wrote crank letters to the great and good, as well as to newspapers. And in the 1871 Census he described himself as the 'Rightful Earl of Kent'.

This aspect of his personality stood him in good stead when it came to popularising geology. In massive tomes with titles like *Memoirs of Ichthyosauri and Plesiosaurs*,

*extinct monsters of the ancient earth*, and *The Book of the Great Sea-Dragons*, he described the imagined appearance and lifestyle of these Liassic marine reptiles in vivid and gruesome terms. For example, in the *Book of Great Sea-Dragons* he discusses the "exquisite" killing machines from which "our Naval Architects might learn a lesson or two".

His descriptions of an ichthyosaur as an "ardent Monster fleeing through the expanse of Seas like lightning to his distant prey, with a lust unquenchable in gore", and the "deathly paddles of Plesiosaurus... his hide, black or freckled or russet, his eyes blood-shot fiery, or green, lizard-like; his teeth whetted sharp, gloating upon and crunching the gristles of his dying prey" must certainly have sent shivers down the spines of his readers. With technicolour prose like that, who needs *Jurassic Park*? ☞

### Acknowledgments

Sources for this vignette include *Thomas Hawkins and geological spectacle* by Ralph O'Connor, *Proceedings of the Geologists Association*, vol 114, 2003, pp.227-241, from which the quotes from Hawkins' books are taken; and Oxford Dictionary of National Biography entry for Thomas Hawkins by Michael Taylor.

Hawkins' life and work will be discussed at the Geological Curators Group Seminar meeting this month: *200 years of West Country Sea Dragons* - 23 July 2010 at the Strode Theatre, Street, Somerset. The meeting will be followed by a field excursion on 24 July to visit some of the modern Lias quarries in the Street area.

For more information contact: Dr Leslie Noe Curator of Natural Science, Thinktank, Birmingham Science Museum, Millennium Point, Curzon Street, Birmingham B47XG E: Leslie.Noel@thinktank.ac.uk.

**If the past is the key to your present interests, why not join the History of Geology Group (HOGG)? For more information and to read the latest HOGG newsletter, visit the HOGG website at: [www.geolsoc.org.uk/hogg](http://www.geolsoc.org.uk/hogg).**



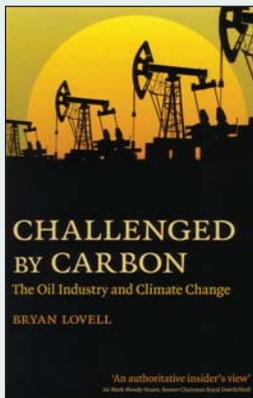
An illustration by John Martin from Hawkins's *'The Book of the Great Sea Dragons'*.

# Reviews

## Copies available for review:

-  Alcantara-Ayala, I. & Goudie, A. (eds) (2010), *Geomorphological Hazards and Disaster Prevention*, Cambridge.
-  Aqrabi, A.A.M. *et al.* (2010), *The Petroleum Geology of Iraq*, Scientific Press.
-  Dunai, T.J. (2010), *Cosmogenic Nuclides: Principles, concepts and applications in the Earth Surface Sciences*, Cambridge.
-  McGuire, B. *et al.* (eds) (2010), Climate forcing of geological and geomorphological hazards. Theme issue of *Philosophical Transactions of the Royal Society A*, 368 (1919), pp2309-2588.
-  Westwood, R. (2010), *Walking the East Jurassic Coast: Portland to Studland*, Coastal Publishing.
-  Westwood, R. (2010), *Walking the West Jurassic Coast: Orcombe Point to Fleet*, Coastal Publishing.

Interested parties should contact the **Reviews Editor, Dr. Martin Degg 01244 513173; m.degg@chester.ac.uk**, only. Reviewers are invited to keep texts. **Review titles are not available to order from the Geological Society Publishing House unless otherwise stated.**



## Challenged by Carbon: The Oil Industry and Climate Change

**Bryan Lovell**

**Published by: Cambridge University Press**

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**212 pp**

**[www.cambridge.org](http://www.cambridge.org)**

The three main problems with climate change are: it is multidisciplinary and few people have the scientific expertise to understand all its interwoven strands; second, anthropogenic climate change is not universally accepted and third, the world is now beginning to suffer from "climate change fatigue".

Bryan Lovell is well placed to overcome these problems. He has had a distinguished career first as a lecturer, then as an oil company geologist and latterly as a senior manager with BP. In the late 1970s he was a parliamentary candidate, and energy spokesman for the Scottish Liberal Party. Dr Lovell is also President Designate of the Society, and it is worth noting that the Society has played a major role in the climate change debate, convening a key conference in 2003 in which senior oil company executives participated, and arranging as part of this year's Shell lecture series an important talk on carbon capture and storage by Martin Blunt.

The book addresses the challenge facing the world, which will continue to need hydrocarbon products for many years to come, but cannot afford to ignore the effect that use of these products has on climate. At the outset Lovell poses six fundamental questions, asking, for example, whether oil company shareholders will be willing to finance expensive carbon-capture schemes, and whether governments can be persuaded to give the same level of priority to reducing *per capita* carbon output as to health or education services.

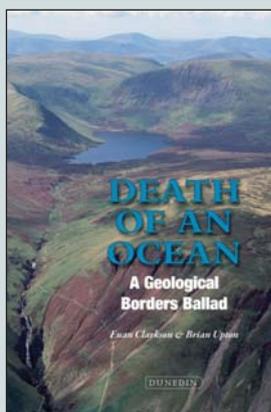
Lovell's analysis of the problem is addressed from a variety of standpoints. Chapter 1 describes the growing scientific unease that led to the Kyoto summit of 1997. Chapter 2 is a detailed

review of the PETM (Paleocene-Eocene Thermal Maximum) event of 55Ma, chosen because the unfolding of this event can be detailed with great precision. Very large volumes of carbon were released into the atmosphere over a period not exceeding 20,000 years, and the book discusses in some detail the consequences and possible trigger mechanisms of this. Chapter 3 is an account of the pivotal confrontation between BP and ExxonMobil at the Geological Society's Petroleum Group conference in 2003, which Lovell identifies as the first sign of a convergence of views between European and American oil companies.

The remainder of the book addresses the role that oil companies might play in the carbon challenge. Lovell is a strong advocate of carbon capture and storage, which is technically feasible - but which cannot be implemented without the forceful involvement of government and 'the Establishment' in creating a strong regulatory framework. The final chapter is a 'personal coda' in which the author makes some interesting connections between rocks, Romans and reservoirs.

This is a thought-provoking book, which incorporates much of the latest research. But does the author provide convincing answers to the six questions of the Introduction? Can oil companies transform their role from villains to heroes? Will government respond effectively to the challenge? Will the public be willing to pay for the cost of carbon capture? I am sceptical; but read the book - and make up your own mind. 

*Don Hallett*



## Death of an Ocean: A Geological Borders Ballad

**Euan Clarkson and Brian Upton**  
**Published by: Dunedin Academic Press**  
**Publication date: 2010**  
**ISBN: 978-1-906716-02-8**  
**List price: £25.00**  
**210 pp**

[www.dunedinacademicpress.co.uk](http://www.dunedinacademicpress.co.uk)

As a long-standing Southern Uplands devotee I was intrigued to see this book describing the closure of Iapetus. It is written by two geologists with abundant knowledge of the area and is well produced, printed on good quality paper and beautifully illustrated. On reading the book my overall impression was favourable, but with some misgivings.

The area covered is the Borders region of Scotland rather than the Southern Uplands as a single entity. This seemed rather an odd choice and leads to the authors' having to add disclaimers that some of the geology they describe is outside the area under consideration. The authors also sit on the fence regarding some of the tectonic interpretations, even where recent work has clarified the position. A popular book of this kind can allow more certainty, especially when presenting the 'expert view'.

As I read on I realised that the authors had set themselves a gargantuan task. The Southern Uplands require the integration of many geoscience disciplines such as sedimentology, structural geology, biostratigraphy and petrography. The consequence of writing for a lay audience is that each of these areas has to be explained. The book therefore takes several excursions to cover topics such as plate tectonic theory, magma genesis and marine plankton. Diagrams include a section through the entire Earth and illustrations of modern plankton. As the authors cover so much background I think that it would have been useful to

include references to some accessible books that explain aspects of the Earth sciences to the general public, rather than the more 'local' list at the back of the book.

The authors also discuss the history of research into the geology of the region. The contributions made by Lapworth, Peach and Horne among others cannot be underestimated, but the history tends to make the overall narrative of the closure of the ocean somewhat disjointed. Including the Carboniferous and the Ice Age makes sense in terms of completeness but does not fit with supposed emphasis of the book. But I imagine that '*Geology of the Borders*' would have sounded less enticing than '*Death of an Ocean*' (a title first given to a Nature Conservancy Council booklet on the same subject, written many years ago by, I believe, one Ted Nield).

So - at whom is the book aimed? It isn't an excursion guide, although it strays into this territory on occasion when discussing turbidites - a case of too much detail. It isn't sufficiently advanced or referenced to allow an entry into the regional geology, and therefore falls into 'keen amateur' territory, with a 'coffee table' feel. Given the book's emphasis, that table is most likely to be situated in Edinburgh. ☞

*Tim Needham*

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# Letters

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

## Poles in peril

*From Geoff Glasby\* (Rec'd 13; Pub'd 18 May 2010)*

Sir, The November 2009 issue of *Geographical Magazine* presents a disturbing account of the present status of the Arctic region, mainly the Arctic North, and the impact of global warming there. Most importantly, Arctic Ocean temperatures have increased by about 0.6°C between 1982 and 2009. As a result, there has been a steady decline in the thickness of Arctic ice. For example, the average extent of sea ice has declined from 8.2 x 106km<sup>2</sup> in 1979 to 6.3 x 106km<sup>2</sup> in 2009, a decrease of 23% in 20 years. Similarly, ice thickness at the North Pole has decreased by 50% between 1958-1976 and 2003-2007.

These results suggest that Arctic multi-sea ice will disappear in summer within 20-30 years. The situation in the Antarctic appears to be even more extreme with the Antarctic Peninsula warming by 3°C between 1983 and 2009. This led to the collapse of the Larsen B Ice shelf in 2002. Some estimates suggest that sea level could rise by more than 40cm by the end of the century. Melting of the Arctic and Antarctic ice sheets would pose major problems for an overpopulated planet in the late 21<sup>st</sup> Century.

Over the last 20 years, atmospheric CO<sub>2</sub> concentrations at Mouna Lau Observatory in Hawaii have increased from about 350ppm in 1989 to about 388ppm in 2009, an increase of about 11%. If atmospheric CO<sub>2</sub> concentrations continue to increase at this rate for the rest of the century, the atmospheric CO<sub>2</sub> concentration in 2100 would be about 435 ppm. The best estimate suggests that anthropogenic factors have contributed 75% of the rise of global temperatures since 1987†.

In addition, world population will be significantly higher in 2100. One estimate suggests that the median value world population will peak around 2070 at nine billion people and then slowly decreases to 8.4 billion by 2100.

In Russia itself, environmental stewardship is not a strong point. There are several major types of environmental impacts in the Russian Arctic as a result of waste discharges during offshore oil and gas activity, smelting of ore deposits to produce metals and nuclear weapons testing. Pollution is a serious problem wherever smelting is taking place. In such areas, the landscape is often degraded to a barren wilderness as far as the eye can see.

Global warming will be the most pressing problem faced by mankind over the course of the 21<sup>st</sup> Century. The most dramatic effects of global warming will occur in polar regions. Deep cuts in atmospheric CO<sub>2</sub> emissions are a prerequisite for maintaining a stable environment into the future. 

† Lockwood, M. 2008. Recent changes in solar outputs and the global mean surface temperature. III. *Proc. R. Soc.* 464 no. 2094: 1387-1404

\* Geoff Glasby is a marine geochemist who has spent the last 22 years working around the world. His feature article on the geology of Arctic Russia appears in the August issue.

## Does global warming matter?

*From John Heathcote (Rec'd & Pub'd 11 May 2010)*

Sir, I have seen plenty of evidence of less recent Holocene climate change. However, properly controlled experiments are not readily possible, and I accept that others, for various reasons, remain sceptical.

I think geologists can probably agree that we are currently using fossil fuels at a rate greater than they are forming. This cannot be continued indefinitely, so we have to change at some time. If we are erroneous in the belief that fossil fuel consumption is adversely affecting climate, we will give up fossil fuel earlier than we may need to, but we would always have had to do it.

For those who make their livelihood from fossil fuel exploitation, maybe it's not so good. Others will earn a living out of alternatives. None of this is catastrophic. If global warming is real, the effects will be far-reaching, and are likely to place unbearable strains on our globally integrated civilisation. I'm sure life on the planet will survive, but it may not include us!

In most other areas of life, if something might be really bad but we are not quite sure, the precautionary principle comes into play, even if it's inconvenient. Despite the effect on the fossil fuel industry, my belief is that there are grounds for caution, and we should seek to reduce emissions of warming gases substantially. It will involve major change to my lifestyle as well as everyone else's, and it won't be politically popular; but that is not a reason not to do it. 

The early Earth (Palaeoarchaeon, 3.5Ga) had until recently been thought of as inimical to life, with ocean temperatures of up to 85°C and an atmosphere consisting mostly of methane. However, controversial new evidence from Blake *et al.* using revolutionary new phosphorus-measuring techniques, suggests that Palaeoarchean oceans were not only temperate - at a mere 40°C - but even biologically productive, with a highly developed biological phosphorus cycle<sup>1</sup>.

# Cool sea - and phosphorus's voyage

*The Palaeoarchean ocean may not have been a scalding, lifeless sump, if a new model based on revolutionary new analytical methods is to be believed. But is it? Harriet Jarlett\* investigates.*

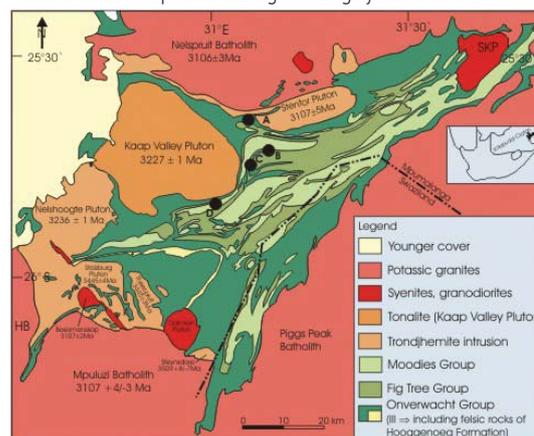
The South African Barberton Greenstone Belt consists mostly of volcanic rocks inter-layered with minor sedimentary units, including cherts, banded iron formations and variably silicified terrigenous and volcanoclastic sediments. The origin of the cherts has long been disputed, but the ratio of <sup>18</sup>O to <sup>16</sup>O isotopes in them and their co-existing sedimentary phosphates have been the subject of intense interest because oxygen isotopes can be used as a palaeo-thermometer.

Biological processes concentrate phosphate in modern, low-temperature marine environments, and modern marine phosphates have typical <sup>18</sup>OP values between 19 and 26‰. The new analytical methods used by Blake *et al.* put the isotope ratios in Barberton phosphates at 9.3-19.9 ‰, suggesting that the Archaean Ocean had an ambient temperature of 26-35°C - not too far from the 25-30°C of our modern day, life-sustaining oceans.

One of the biggest arguments favouring a much hotter Archaean ocean centres on the high temperature required to dissolve silica in water. Clearly, the joint occurrence of apparently cool-precipitated phosphate and hot-precipitated chert is hard to reconcile. However, Blake *et al.* suggest that the reason previous researchers estimated such warm ocean temperatures is because the phosphates and cherts formed by two different processes on the Palaeoarchean sea bed. According to them, "high phosphate <sup>18</sup>OP would record low-temperature biological processing - in equilibrium with cooler surface waters - while some chert <sup>18</sup>OP values could record warmer seafloor conditions", under the influence of hot springs, belching hydrothermal fluids.

Low temperature biological processing could even, the authors suggest, represent an exchange of oxygen resulting from enzymatic catalysis - opening the possibility that the ocean chemistry was being mediated by microbial metabolism. In other words, they suggest that microbes had developed, and were promoting evolved phosphate

The Barberton Greenstone Belt. Acknowledgement: "Highly Allochthonous" <http://scienceblogs.com/highlyallochthonous/>



cycling much earlier than many (but not all) estimates for the origin of life on Earth. Barberton Chert was also the source of attention at the EGU meeting in Vienna this May, when researchers announced that they had pushed back the time at which the Earth first developed a magnetic field - an event that would also have facilitated the origin of life.

This paper remains controversial. Professor Paul Knauth, who co-wrote the definitive paper on Barberton Cherts as evidence for a hot early Earth<sup>2</sup>, think Blake *et al.* have prematurely announced findings based on unproven methods. Knauth told *Geoscientist* he considered the paper "flawed" and planned with others to submit a critical comment. However, even their research did uncover some cherts that gave lower, 40°C temperatures (although they attributed this to anomalous weather conditions).

The new ideas put forward by Blake *et al.* are an interesting development in Palaeoarchean research. However, it is likely, that, until their analytical methods become better established and more widely accepted, the Earth's ancient ocean will still be thought of by most as sizzling and barren, rather than the balmy habitat Blake *et al.* envisage. [CR](#)

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\* Harriet Jarlett is an MSci student at University College London and working as an intern on *Geoscientist*.

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In the 1960s, drilling schemes were initiated in Bangladesh to exploit the supposedly clean, shallow aquifers of the Ganges Delta for water supplies, and so remove the threat of water-borne disease. Misfortune struck when it was found that, while bacterially clean, waters pumped from these wells were often contaminated with natural arsenic. Having affected the health of 70 million people for over three decades, a noble humanitarian effort turned into the largest case of mass poisoning in human history.

After a lengthy project to identify As-contaminated wells, attention turned to the country's deeper aquifers as a source of clean water. Yet, as *Nature Geoscience* reported earlier this year<sup>1</sup>, a new study of the aquifer system has shown that even this salvation may bring risks were such resources to be over-used.

The arsenic of the Bengal Basin is found in grey, reducing Holocene deposits, often accompanied by a ferric oxyhydroxide coating. The

That said, the path taken by descending groundwater can offer some protection, especially if As concentrations are low, or if the distance is great – the so-called 'flow-pattern defense'. Additionally, ferric oxyhydroxides capable of absorbing As may occur along the migration route – although over time, they may lose their effectiveness as their absorptive potential is exhausted.

Such defences might be acting at a locality called Kulna, where "groundwater has been pumped from 200-350m depth for municipal supply for over 30 years, without inducing vertical flux of As or chloride-rich water from shallower levels," Burgess says<sup>1</sup>.

The team notes that, while hand-pumped water for domestic use has little effect on flow patterns, and may offer security to around 90% of deep wells for the next thousand years, deep pumping for irrigation can

## Deep waters may leave bitter taste

*The citizens of Bangladesh may have a new reason to reflect that the road to hell is paved with good intentions, says Ian Randall\*.*



region is underlain by Late Cretaceous rocks, above which many hundreds of metres of permeable fluvio-deltaic sediment have built up. Groundwater can be extracted from depths of up to 350m.

Arsenic is released by microbial reductive dissolution of this ferric oxyhydroxide coating – an effect increased by the presence of organic carbon. Concentrations of As in pore waters appear to depend on a number of factors, including the availability of organic carbon, groundwater flow and local sedimentology. Where reduction does not occur, and oxidised sediments that can absorb the arsenic are present, groundwater tends to be As-free. This is notable in Pleistocene (and older) sediments, and any younger deposits emplaced nearby. As a result, fewer than one per cent of wells deeper than 150m show significant concentrations of As.

The groundwater itself forms a hydraulically connected network of regional aquifers spanning most of the basin. Within this, the shallow aquifer is predominantly (but not wholly) separated from the deeper groundwaters by the presence of an impermeable silt-clay layer (known as an "aquitard"). This study, which analysed data from over 2000 deep boreholes, has shown that breaks in these aquitards become the focus of vertical flow, which might allow shallow waters to contaminate lower aquifers if pumping from these were to create a sufficiently high hydraulic gradient.

considerably reduce flow travel-times to deep aquifers, and could potentially pollute deep groundwater with As, affecting future supply for both irrigation and domestic purposes. Says Burgess: "...widespread deep irrigation pumping might effectively eliminate deep groundwater as an As-free resource for domestic supply, possibly in less than 100 years".

Continued shallow pumping on its own, however, would actually have the opposite effect – acting to create a hydraulic barrier against arsenic drawdown. [ca](#)

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*\*Ian Randall is geologist studying journalism at City University and is working as an intern on Geoscientist.*

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# Early bird feathers

*New fossils from China have thrown new light on the developmental differences between ancient and modern birds, reports Harriet Jarlett.*

Two astonishingly well-preserved *Similicaudipteryx* fossils have been discovered in a Lower Cretaceous formation in China. As part of the Family Oviraptorosauria, they represent some of the earliest feathered dinosaurs. Xu Xing and colleagues have discovered that both juvenile specimens show several stages of feather development, suggesting that at some point during the evolution of feathers a profound genetic shift occurred<sup>1</sup>.

The two specimens, both juveniles, appear to provide new insight into early feather development. The smaller specimen is about the size of a magpie suggesting it is barely more than a chick. The other, more the size of a turkey, also appears not to have quite reached adulthood. The smaller specimen shows two types of feather: large “pennaceous” ones (resembling quill pens with a central shaft that runs through its entire length) along the vertebral column, and more downy, “plumulaceous” ones over the rest of the body. The wing and tail feathers of the more mature specimen are entirely pennaceous, whereas the feathers of the younger dinosaur display both a flat, ribbon-like stem with pennaceous morphology confined to the tip.

This development of a fully adult feather through adolescence is a phenomenon not seen in any modern bird, whose chicks show fully developed feathers, even while still within the egg. “This baby dinosaur has bizarre flight feathers, which are strikingly different



from those of adults” says Prof. Xu Xing from the Institute of Vertebrate Paleontology and Paleoanthropology, Beijing.

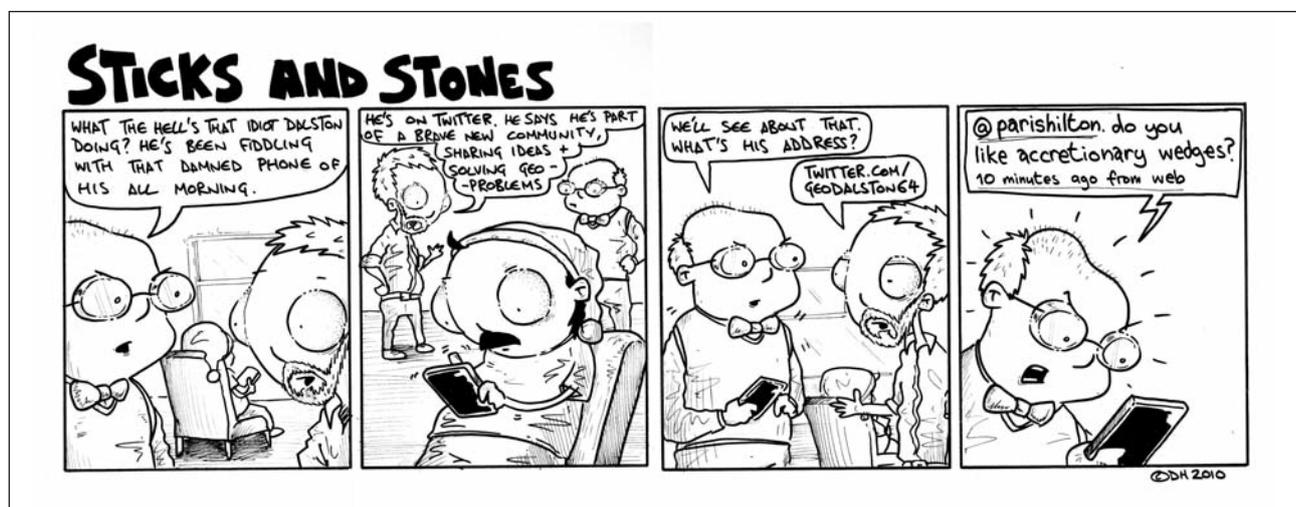
Ribbon-like pennaceous feathers have been described before in Confuciusornithids and other basal birds. This has prompted Xu Xing and colleagues to suggest that semi-developed feathers represent an early stage of feather evolution, not seen in birds today. This suggests that the maturation of the feathers of proto-birds was far more diverse, and spanned the growth of the organism. Modern birds have been lost these stages through evolution.

It is likely, the researchers suggest, that these partly developed feathers formed as a “low dose” of certain bird genes cause their feather’s keratin sheets not to divide into barbs. Such genes are activated very early in the growth of modern birds, but could have been suppressed until later during the growth of *Similicaudipteryx*, resulting in the partially pennaceous morphology of younger feathers.

This new evidence of feather development may force palaeontologists to look for new evidence for early feather evolution and morphological types to see whether or not these new ideas about the genetics of early birds are well grounded, or just another flight of fancy. [CR](#)

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## IN *Brief*

### Palaeontological problems?

*Joe McCall celebrates his 90<sup>th</sup> birthday this month. As the longest-standing contributor to Geoscientist, we salute him. He meanwhile has thoughts of his own...*

I am not a palaeontologist, though have always maintained an interest and in fact once discovered a vertebrate fossil locality of unique age at Karmosit<sup>1</sup>, Baringo district, Kenya, and carried in sacks of Miocene corals from the Makran, Iran, back to the Natural History Museum<sup>2</sup>. But reaching my 90<sup>th</sup>, and having been associated with *Geoscientist* virtually since its inception, I have found myself pondering two palaeontological topics that bother me - and I believe need an airing in these pages. The Molecular Clock method of deriving branching ancestries that reach back to a common ancestor in the distant past, is widely used by palaeontologists, and indeed I have referred to it in my monograph on the Ediacara fauna<sup>3</sup>. However, I must admit that I have taken it on trust while the details of how it works have eluded me. Perhaps some expert could describe for our readers in detail the method's nuts and bolts, in language that the non specialist can understand!

My other problem concerns what is known as 'cognition' – to which subject a special journal is solely devoted. Evolution is widely accepted as an "undesigned" process, mutations happening randomly, producing fortuitously changed organisms that enjoy an advantage over others, and benefit accordingly. There is, however, a problem in how information is communicated.

Dave Martill, whose articles I always find most stimulating, recently published a splendid small article on pterosaurs<sup>4</sup>. What intrigues me is how the very first organism to take to the air came to adopt flight. Did random "preadaptive" mutations just happen to enable take-off, or did some system of communication "tell" the developing organism what was required to enable it to fly? A simpler example perhaps is the mimicry displayed by the butterfly *Papilio dardanus*, illustrated by Colin Patterson<sup>5</sup>. Is this mimicry the cumulative result of billions upon billions of accidental advantageous mutations being preserved by natural selection? I wonder by contrast if there is some form of transmission of knowledge that allows one butterfly to mimic another. Cognition permeates the history of life: is it fully understood? After 90 years, I remain baffled. 

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*In 2009 the Society began a web-based service whereby members of the general public could ask a geologist a question that has always been bugging them, but which they had never found a well-informed answer. All answers are published online.*

#### Question: from Mr Michael

**Rosenbaum:** *If the Moon is slowly moving away from Earth presumably it was previously closer and had a stronger gravitational pull on our planet than it does at present. Does this mean that the tides were more extreme in the geological past? If so, what is the geological evidence for this, and what does it tell us about the magnitude of the tidal range at different periods of time?*

#### Reply: by Dr Russ Evans (British Geological Survey, Edinburgh):

Briefly, the geological record offers little if any direct evidence about the magnitude of the tidal range in the past. Nevertheless, there is geological evidence related to tidal periodicity that confirms results derived from astronomical and geodetic considerations. These calculations tell us that tides in the past, although on average a little greater than currently, were of similar magnitude to those we see today.

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# eologist!

We must first remind ourselves of the relevant astronomy. The gravitational force exercised by the Moon on the Earth tries to pull its oceans (and with lesser success the solid Earth) into a slightly ellipsoidal shape. The Earth's rotation means that this gives rise to two tides per lunar day at most locations. Because of the geometry of the ocean basins and the viscous response of the "solid" Earth, this process dissipates the rotational energy of the Earth, which means that the days are getting longer! The presence of friction means that the tidal "bump" in the Earth's topography does not lie directly beneath the Moon. Since the Earth rotates in the same direction as the Moon's orbit, the "bump" lies a little ahead of that point. Because of this, the Moon experiences a small but steady pull, speeding it up, increasing its kinetic energy, causing it to move into a higher orbit, lengthening its orbital period and reducing its tidal pull on the Earth. The net loss of energy to the Moon is an additional factor in slowing the Earth's rate of rotation.

If no other event occurs to stop this process, the rotational period of the Earth will eventually come to match the orbital period of the Moon. This phenomenon ("tidal locking") has already happened to the Moon itself, early in its history – it always presents the same face to the Earth. The same is true for many satellites in the solar and other stellar systems, for essentially the same reasons.

This process is, obviously, very slow. The distance between the Earth and Moon, as determined through lunar laser ranging, is currently increasing by 38mm/yr and the length of day is increasing by around 2mins/century. Since the semi-major axis of the Moon's orbit is 384,399km, this means that the Earth-Moon distance is increasing by almost exactly one part in 10 billion per year. Because the gravitational force exercised by one body on another is inversely proportional to the square of the distance between them, for small changes in distance, the proportional change in force is twice the proportional change in distance. So the tidal force is decreasing by two parts in 10 billion per year. Clearly, geological timescales are required to effect significant changes in these figures.

Cycles are recorded in the geological record as "rhythmites", bedding or lamination in rocks such

as sandstone, siltstone or mudstone, and are classified according to the period of the phenomena that generated them. Rhythmites associated with annual cycles are often referred to as "varves", and Milankovitch cycles are ascribed to very-long-period cyclical phenomena. Tidal flows modulate currents in a marine environment, even where these contain a consistent sediment load, varying the amounts and distribution of particle sizes laid down from hour to hour. Thus tidal rhythmites can potentially develop in any situation where sedimentary processes are influenced by tides. They have been identified in a variety of marine environments ranging from the neighbourhoods of deepwater hydrothermal plumes through estuaries to the distal parts of a deltaic system. The latter are particularly favourable to generating lengthy sequences.

As far as I have been able to determine, no-one has yet found a way to use the data from rhythmites to determine tidal heights directly, and even if that were possible, measurement from a single location would tell us little if anything about global tidal behaviour, as tidal heights in marginal seas vary greatly throughout the modern world due to the shape of ocean basins, and we have no reason to believe that matters were any different in the past. Tidal rhythmites can, however, provide confirmation of the astronomical observations and the associated calculations can be used to determine the length of day, lunar distance, rate of lunar recession, and other features of this process.

Tides vary in intensity on a number of cyclical patterns determined by the orbit of the Moon, and these variations are recorded in the thicknesses of rhythmite layers. By subjecting measurements of layer thicknesses from very long rhythmite sequences to harmonic analysis, it is possible to determine the ratios between these cycles at the time the sediments were laid down. The astronomical theory outlined above can also be used to calculate the ratios for any given Earth-Moon distance. So, by comparing the geological observations with the theoretical results, it is possible to determine the Earth-Moon distance at that time quite accurately. Once the distance is known, values for the length of the month, the tidal forces and tidal heights can all be calculated very easily.

Based on information obtained from tidal rhythmites, Williams<sup>1</sup> showed that at 620Ma the Earth-Moon distance was 0.965 of its present value, and that at 2450Ma it was 0.906 of its present value. These and other considerations regarding the Earth-Moon system<sup>1,2</sup> lead us to conclude that the distance between the Earth and the Moon was perhaps only 20% or so less than its current value, even at the start of their joint evolution 4+ billion years ago. Williams's results also imply that the rate of recession of the Moon has accelerated over that period.

In terms of tides, if the Earth-Moon distance has never been more than ~20% less than the present value, then tidal forces have never been much more than 40% greater than current values. Since tidal heights today vary far more than this, from less than 1m in the deep ocean (and much less in confined seas such as the Mediterranean) to 17m in the Bay of Fundy, it seems unlikely that tidal heights, even at unusual locations like Fundy or at any point in the past, were significantly more extreme than those seen today. 

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# Field mapping for the c



*Adler deWind reports on an exciting new collaborative initiative aimed at updating the traditional mapping exercise using new technology.*

Many readers of *Geoscientist* will be acutely aware of the demise of traditional field mapping skills in university geology departments around the globe. In an attempt to help reverse this trend, and improve the knowledge base in practical fieldwork skills for future generations, Glasgow-based consultancy Midland Valley launched its Field Mapping Initiative (FMI) in 2008. The Initiative has brought eight leading university geoscience departments together and aims to develop close integration between the traditional skills of field mapping (as taught at undergraduate and postgraduate levels) and computer-based modelling techniques.

Midland Valley, which describes itself as a world leader in the field of structural geology and the development of analytical geological modelling tools, donated multi-user floating licenses of their Move™ software and support packages (worth over £500,000) to each participating department. The universities involved act now as a consortium with the company, developing teaching and support materials to help improve field mapping training and to integrate more traditional teaching methods with digital modelling and analysis. This new training material will soon be distributed to more than 150 university departments who are also using free copies of Move™ in their teaching and research programmes.

Roddy Muir of Midland Valley told *Geoscientist*: “The Midland Valley Field Mapping Initiative grew from the recognition that good field mapping training is a vital skill for all geoscientists, because skills learned in the field are transferred to model building and digital interpretations in academia and in industry. The best way to develop these 3D skills is to train students in both the construction and interpretation of geological maps and cross-sections in the field, with students observing and recording data and using this to build an

understanding of the geology in 3D. We all did this using paper maps and notebooks; but the world is changing and there is much to be gained by introducing this software to aid visualisation, model-building and analysis further “upstream”.”

## The journey so far...

In early 2009, members of the Field Mapping Initiative met at Midland Valley's Glasgow offices for their second consortium workshop. They discussed how they had been using the software with their students, and shared their experiences of integrating IT into the curriculum over the previous year. Many brought examples of their student's field and classwork - ranging from simple 2D section construction and restoration to full 3D model-building and analysis.

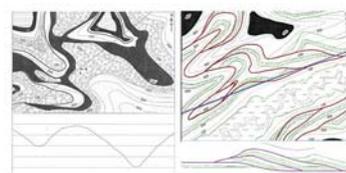
Says Muir: “The most useful aspect of the meeting proved to be the discussion of shared experiences of how members have used the software in their classes so far: what exercises they devised and what presentations, datasets and workflows were successful. In particular, the meeting provided opportunity to share experiences of how the students responded to using modern technology in field mapping as a teaching tool.”

## Applying the software

In the universities of Milan and Milano-Bicocca, Professors Fabrizio Berra and Stefano Zanchetta have been teaching geological cross-section construction to first degree students, using field mapping and exercises within 2DMove™<sup>2</sup>. The departments developed two simple exercises for students to check and improve precision in their construction of geological sections with the aid of validation tools in 2DMove™.

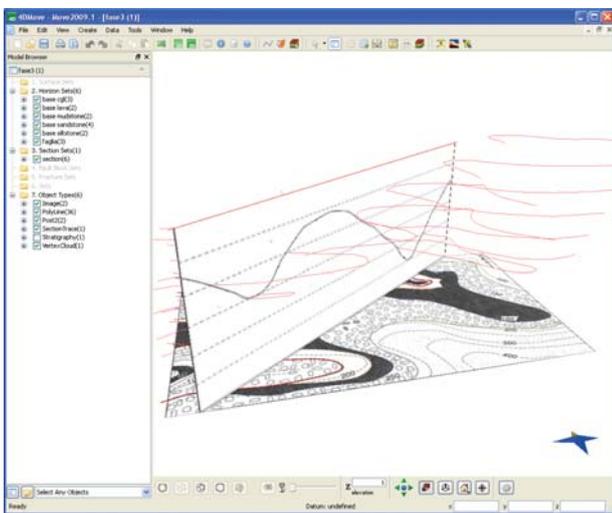
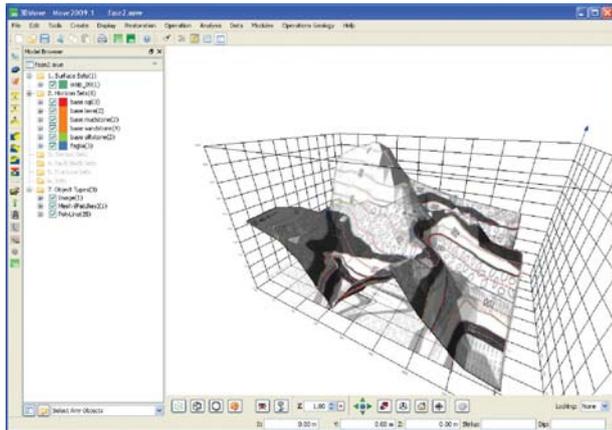
Bachelor degree students are firstly trained on the creation of geological sections from simple maps, quickly moving over to working with real geological maps with deformed (faulted and folded) sedimentary successions from a range of environmental settings. Following that, students are introduced to 2DMove™, where two simple exercises are selected from Powell<sup>1</sup> (A, 9.7.1 and B, 14.0.1).

- Exercise A was mainly focused on the collection of data from the geological map and the geometric reconstruction of a geological cross-section.
- Exercise B was mainly focused on the restoration of the cross section.



Maps used for the exercises <sup>1</sup>

# Digital age



## EXERCISE B

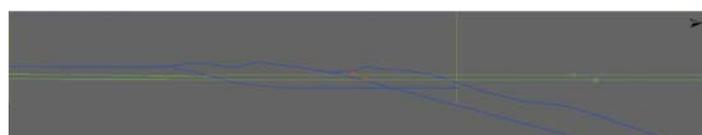
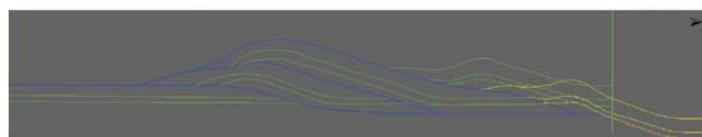
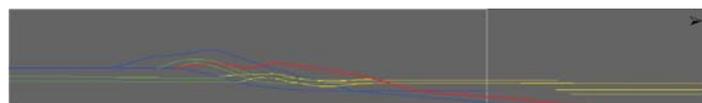
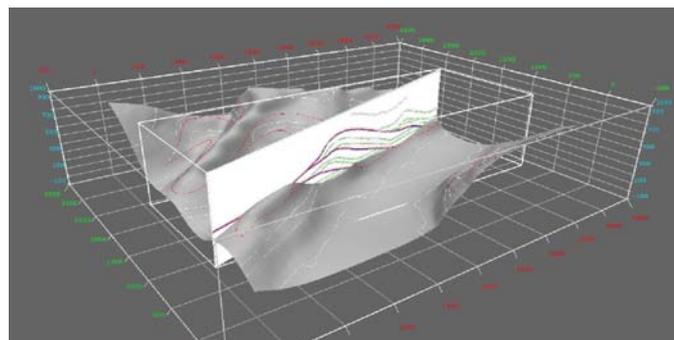
The students used 2DMove™ to draw the geological section and then to retro-deform it. The iterative process of retro-deformation and correction of the geological section improved the precision and coherence of the geological cross section. Stefano Zanchetta says: "The opportunity to check the precision of hand drawn sections with computer-analysis was greatly appreciated by all the students who learnt the basic functions quickly and easily, so the results are encouraging. The hand-made geological cross section, even if relatively good, turned out to be pretty imprecise, mainly in terms of the position of the tie points. Furthermore, the retro-deformation of the cross sections highlighted again the geometrically incompatible solutions drawn in the hand made sections."

## EXERCISE A

Before using 2DMove™, students first drew a cross section by hand. They scanned in the hand-drawn geological cross sections before importing them into the software using the following workflow.

- 1) Georeference and upload the geological map.
- 2) Digitise contour lines and geological boundaries.
- 3) Upload a trace of the section, geo-referenced with respect to the map.
- 4) Upload a DEM and project the geological boundaries on it with the inclined shear algorithm.
- 5) Construct support lines for the projection of geological data (i.e. connection of intersection of geological surface with contour lines) placed at the correct altitude.
- 6) Collect the intersection of the section plane with the lines from the map (no attitude data were present but how to project them was explained).
- 7) Upload geological section drawn by hand.
- 8) Comparison of the "hand-drawn" section with the data collected in the software and re-drawing of the sections as necessary.
- 9) Restoration of the sections iteratively, with correction of the hand-made section.

The workflow took approximately five hours (with about 15 students) over two consecutive days. The students managed to learn the main function of the software relatively quickly and rapidly understood its utility as a tool to improve the precision of geological cross sections.

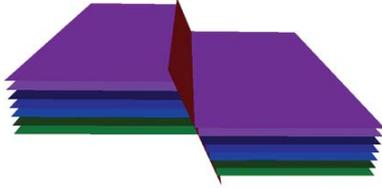


## STRUCTURAL BLOCK MODELS

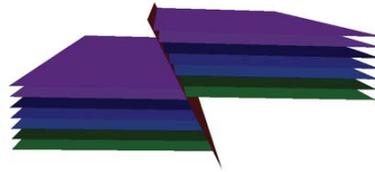
A range of basic 3D block models for both folds and faults for basic teaching and visualisation have been produced by both Midland Valley and the University of Birmingham.

### FAULTS AND FOLDS

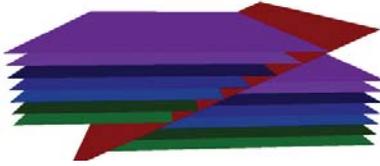
NORMAL FAULT



REVERSE FAULT



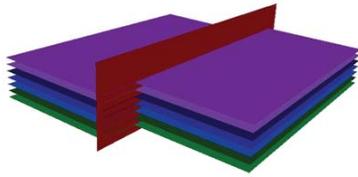
THRUST FAULT



RAMP-FLAT FAULT & ANTICLINE



STRIKE SLIP FAULT



ANTIFORM



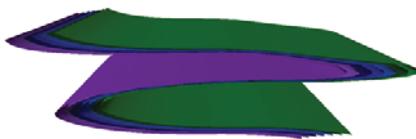
SYNFORM



OVERTURNED FOLD



RECUMBENT FOLD



RE-FOLDS



Meanwhile, back in Britain the University of Birmingham has been using Move™, along with ArcGIS and Adobe Illustrator for classes with their undergraduate students. These software packages are being integrated into classes in three main ways:

- First year structural students interact with simple 3D block models.
- Second year structural students explore restoration techniques.
- Third year mapping students use the software packages to aid their analysis and communication.

The idea is to assist in the understanding of 3D visualisation for first-year students, and to introduce them to Move™. It is hoped that by interacting with these models students will gain a better geometrical understanding of geological structures. This improved geometrical understanding can then be applied at more advanced levels for mapping, analysis and interpretation. Guides have been produced so that lecturers can construct these models, and students can easily interact with them.



Crackington Haven Restoration

## Photo mosaic of Crackington Haven

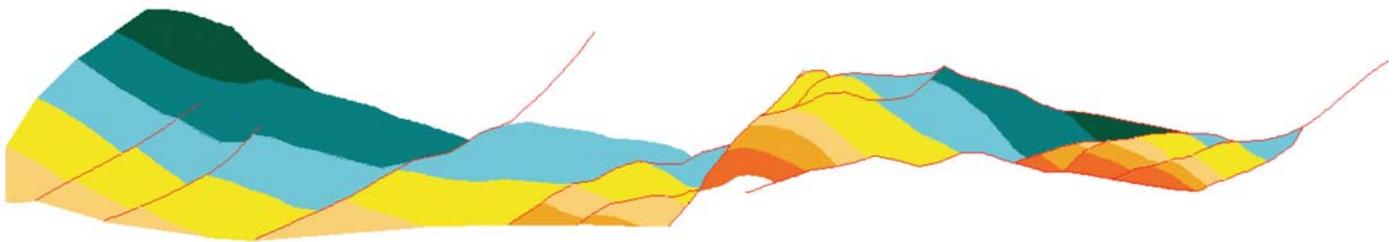
As part of the second year field trip to Bude (N Cornwall), students interpret the extensional section at Crackington Haven (interpreted photo mosaic above), to gain an understanding of restoration. This exercise introduces them to restoration techniques and illustrates the versatility of the Move™ software package.

The two applied processes of restoration are:

1. Block restoration: internal deformation in individual fault blocks is restored (involving rotation of the fault block and unfolding) and then the section pieced back together.

2. Move™ on- fault-restoration: marker horizons are restored by moving the hanging wall along the interpreted fault, to model the effects of fault geometry on hanging wall deformation.

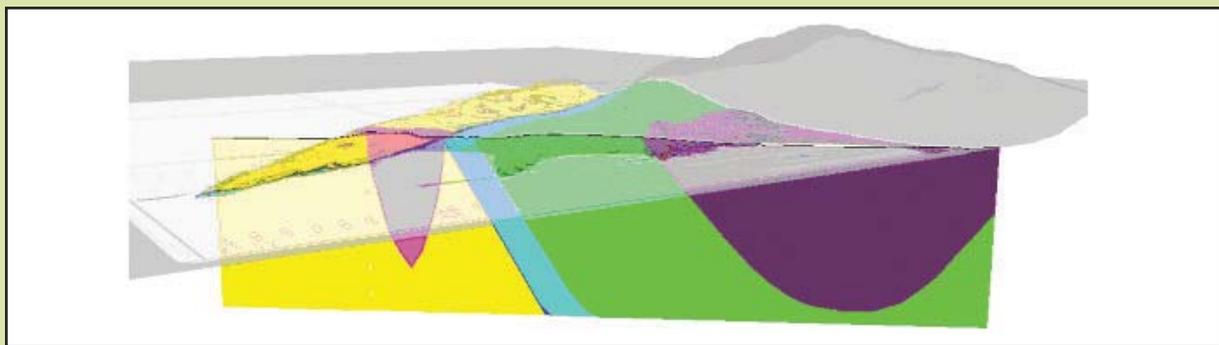
The outcomes of these two restoration methods are validated using forward modelling. Understanding these techniques, and the ability to visualise, are the key to producing valid interpretations at a later stage.



## Third year mapping projects

Third year mapping projects remain the culmination of students' fieldwork experience at Birmingham. Students are given the opportunity to use the various software packages to analyse their maps and field data, produce cross sections and validations and communicate their interpretations.

To aid them, a guide has been produced so that the software can be learned quickly and efficiently. In this guide Cuil Bay, NW Scotland is used as an example (picture). Students will produce similar digital final maps and cross-sections. Exposure to the software packages before students go into the field should increase their enthusiasm to use the programs, so that they are used to their maximum potential.



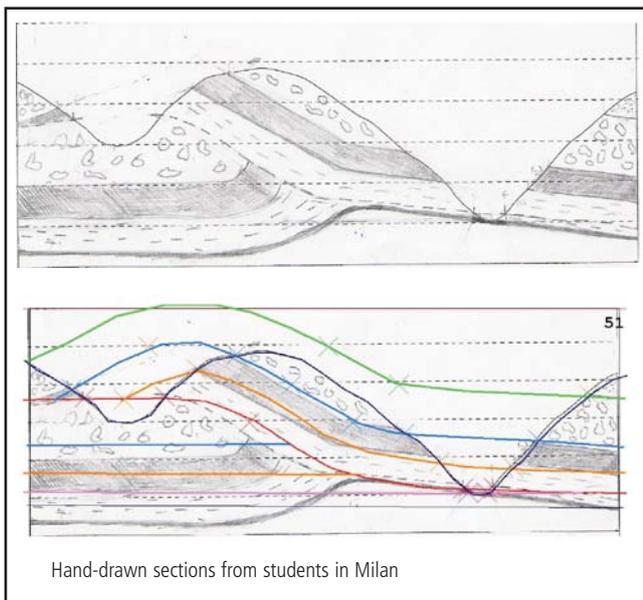
## What next?

Student reactions so far have been enthusiastic: "I just loved being able to build my model and see it in 3D"; "I just couldn't get those paper exercises straight in my head and it seems so obvious now" are two typical responses. Colette Lyle, second year, University of Birmingham, said: "The software showed a fantastic and easily understandable animation of the movement along the faults. It provided a vital insight into the kinematic history of the cliff face in a way that had not been seen before."

Consortium members left their meeting with new perspectives and ideas about how to improve and expand the teaching of field mapping to undergraduate and postgraduate students in their classes.

The University of Birmingham resolved to integrate the software into its degree courses in the following 12 months. It would, they decided, form part of their continuing programme within the department to enhance the digitisation of all geological mapping. The Department also pledged to encourage collaboration between universities and to gain feedback and advice from other departments currently implementing similar changes.

In the University of Milan and Milano-Bicocca, Midland Valley presented posters on the field mapping teaching initiative as applied in Milan University at their booth in the AAPG Conference in Denver in June this year. The software is now also being used in the Masters Degree programme. The experience in Milan showed that the

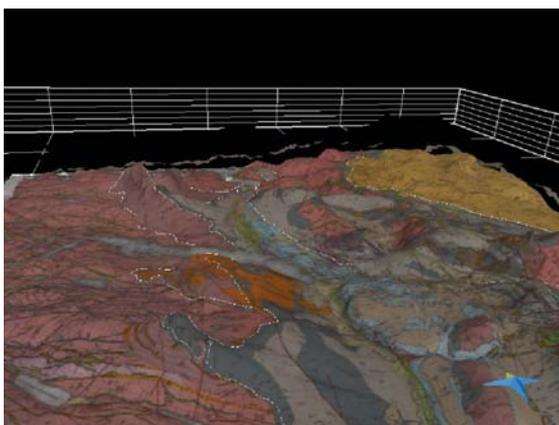


Hand-drawn sections from students in Milan

opportunity to check the precision of hand-drawn sections with computer-derived data was greatly appreciated. All the students easily learnt the basic functions of 2DMove™, and the results were encouraging.

In the University of Urbino, Students are learning digital mapping techniques using field tablet equipment. From their first experience of field mapping using this new method, the Department plans to introduce of computer tablets from the very start and work entirely within a digital environment. "We have decided to take this route to bypass the problems caused by the mis-match between paper and digital maps; students will now go into the field with pen-computer and software for their field mapping", says Mauro De Donatis, a lecturer at Urbino. Students collecting their data in this way ensure that their dataset is immediately suitable for the 3D environment and its import into 2DMove™ and 3DMove™.

In the University of Durham the Move™ resource is being developed to support a second-year mapping training course in the Assynt region, NW Scotland. This will allow the students to visualise the interaction of the main geological units with the topography and act as a check on their own mapping and section construction in the evenings at the Inchnadamph field centre. The plan is to introduce Move™ cross-section and 3D model-building into second year Earth Visualisation modules.



## And finally...

The eight members of the consortium firmly believe that the construction of geological maps and cross-sections is a fundamental skill that needs to be learned by all students hoping to qualify and work as professional geoscientists. "The availability and development of tools such as Move™ has significantly improved the ability of the consortium members to deliver effective training in this area, and we hope that the wider geoscience community will be able to benefit from this initiative over the coming years" says Muir.

The consortium will now pool its collective information and make the training materials available for all universities wishing to improve field mapping teaching in their own departments.

Following input and feedback from the consortium members, Midland Valley have been continuously adding new functionality to Move™, to further enhance the application for field mapping. We have recently tested Move™ on a rugged laptop linked to a GPS system, to facilitate direct use in the field in primary data collection, as well as analysis. At the time of writing, a team of Midland Valley geologists is currently working in the field in the NW Highlands of Scotland, one of the classic areas for training generations of students, to test the new mapping functionality. Watch this space for some exciting new workflows and models! ☺

## Active Departments and contacts involved in the initiative

University of Delft (NL) - Jan Kees Blom; University of Milan (I) - Fabrizio Berra; University of Birmingham (UK) - Carl Stevenson, Samantha Spendlove, Jonathan Turner; University of Glasgow (UK) - Zoe Shipton; University of Milano-Bicocca (I) - Stefano Zanchetta; University of Portsmouth (UK) - John Whalley; University of Durham (UK) - Kenneth McCaffrey; University of Aberdeen (UK) - Robert Butler; University of Urbino (I) - Mauro De Donatis

## Acknowledgements

Joanna Sterling, Midland Valley; Samantha Spendlove, University of Birmingham; Stefano Zanchetta, University of Milano-Bicocca; Fabrizio Berra, University of Milan wish to thank everyone involved in the Field Mapping Initiative (FMI) program and to Derek Powell for permission to use his maps for the exercises for this article. Thanks also go to Carl Stevenson, and Jonathan Turner from the University of Birmingham, Mauro De Donatis from The University of Urbino, Kenneth McCaffrey, University of Durham for their contribution.

## References

1. Powell, D. (1991) Interpretation of geological structures through maps: an introductory practical manual. 176 pp., Longman
  2. Berra, F., Zanchetta, S., Zanchi, A. (2008) Teaching geological cross sections to bachelor students: exercises with 2DMove™. Conference Poster
  3. Spendlove, S. J., Stevenson, C. T., Turner, J. P. & Smith, M. P., (2008) Embedding Enterprise into Geological Mapping, TSG Conference Poster
- For more information on the FMI and how you can get involved please get in touch with Roddy Muir at Midland Valley (E: roddy@mve.com or T: 0141 3322681).

# Society Business

## Awards 2011

Nominations for Society Awards 2011, which will be presented at President's Day next year, should be submitted to the Awards Committee to arrive no later than **Friday 8 October 2010**. Fellows wishing to nominate persons for an Award should go to [www.geolsoc.org.uk/gsl/site/GSL/lang/en/page2978.html](http://www.geolsoc.org.uk/gsl/site/GSL/lang/en/page2978.html) and follow instructions.

*Edmund Nickless*

## Future meetings

### OGMs:

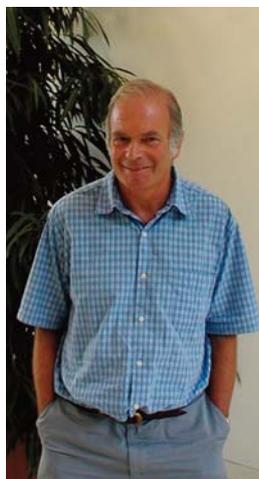
29 September 2010;  
24 November 2010;  
3 February 2011;  
13 April 2011.

### Council:

29 September 2010;  
24 November 2010;  
2/3 February 2011;  
(residential);  
13 April 2011.

## Honorary Fellows

Fellows are reminded that they may nominate candidates for Honorary Fellowship at any time. To find out how to do this, please go to [www.geolsoc.org.uk/gsl/society/honoraryfellowship](http://www.geolsoc.org.uk/gsl/society/honoraryfellowship). EN



## No arguing with rocks, please

*President Bryan Lovell concludes that while opinion should be hot, strong and freely available in the Society, facts remain golden.*

You can't argue with a rock, but you can certainly argue with a geologist: we do spend a fair amount of time in cheerful dispute. These arguments are particularly effective when we are standing in front of rocks in the fresh air. When we cannot agree subsequently, we go back and look at the rocks again. So an incoming President may reasonably call for a lot of argument within the Society, and may act accordingly.

At the kind invitation of my predecessor, Lynne Frostick, I've already presented one suitably disputatious topic in a lecture at Burlington House last November. Geology is central to my conviction that our current concerns about human-induced climate change are highly plausible. The evidence from the geological record suggests that when a thousand or so gigatonnes of carbon are released rapidly to Earth's atmosphere, as we are now doing, certain things happen on this planet. These include a rise in global temperature, a rise in global sea level, acidification of the oceans and notable extinction of life. (See reviews, p8.)

The Society is hosting a meeting to consider these carbon excursions this November (see the article by Jonathan Cowie in May's *Geoscientist*). This joint meeting with the British Ecological Society will concentrate on the latest science, discussion of which will be deliberately separated from any consideration of economic, political and social implications. That is not because we consider these matters are unimportant, it is simply that we are geologists, not economists, politicians or sociologists. (Some of us may aspire to be one or more of those characters, but that is not why we are FGS and CGeol)

A second line of argument in my talk last November was that the oil industry could be paid twice, once for pumping all that mighty handy carbon out of the ground, and again for putting it back when we've had the use of it. The technical feasibility of storage of carbon dioxide in rocks is to be considered in a series of scientific meetings to be run jointly by our Society and the American Association of Petroleum Geologists, beginning with a meeting at Burlington House later next year. Once again, there will be a clear separation of scientific discussion from consideration of the significant social issues involved in the application of that science.

In this month's *JGS* I set out another topic on which I'd like to argue with you as I lumber around on my Presidential duties over the next couple of years. I am claiming that recent research at Bullard Laboratories helps us to answer a question of long standing: what controls high-frequency changes in regional sea-level in non-glacial times? (Putative answer: hot blobs in mantle convection.)

Together with much more science, and its application, there is the prospect of further nourishment for body, mind and soul. It is high time that the geology of beer, historically a major fuel for our Fellows in the field, is given a prominence in our affairs comparable to that deservedly enjoyed by Dick Selley's masterly work on the geology of wine. I am also looking for the best geological poetry, original or otherwise, to be judged by literary celebrities at an evening of high culture at Burlington House - with appropriate refreshment! ☘

# New politics – old problems

*Will anyone put the coal in coalition? Nic Bilham, Head of Strategy and External Relations, reads the runes for science and the new politics.*

During the general election campaign this spring – and the months of unofficial campaigning that preceded it – the Society worked closely with other societies and institutions to ensure that science and engineering issues were on the political agenda. These issues included research funding, skills needs and education policy, the role of the science base in shaping the economic recovery, scientific advice to government, libel law reform and others. The Campaign for Science and Engineering (CaSE, formerly “Save British Science”) were particularly effective in getting politicians to engage with these issues, and in building genuine collaboration and momentum among scientific societies and other bodies – a community that has struggled to work together effectively in the past, and whose message has suffered as a result. The involvement of the Royal Society in these collaborative projects (not

something which could historically be taken for granted), and especially their enthusiasm to include others in taking forward their own major pre-election report ‘*The Scientific Century*’, also advances the cause of effective communication between the science and engineering community and government.

Continuing and developing dialogue with government is essential. Make what you will of the claim that we are witnessing the dawning of a ‘new politics’, the awkward questions will not go away. The Society must build on its relationships with CaSE, the Royal Society, the Royal Society of Chemistry and many others in working to our shared goals in terms of policy for science. But we are also uniquely placed, as a Society and as a geoscience community, to offer *science for policy*. Earth scientists must play a major role in addressing some of the fundamental societal and economic challenges of the 21st Century. It is incumbent on the Society – where Earth scientists from industry, academia and government come together – to communicate to policy makers and other non-specialists the scientific debate which goes on within the walls of Burlington House and the pages of our publications, and why it matters so much. We must also help politicians and officials to access appropriate advice from Earth scientists.

We have made good progress in developing relationships with policy communities, especially over radioactive waste management and carbon capture and storage, alongside our expanded education and outreach activities. We are starting to plan work on other major policy challenges, including management of water and mineral resources, sea-level change and management of the coastal zone, and land use (including flooding and remediation of contaminated land). With Council and colleagues, I am currently developing a science-led communications strategy, as a central component of the Society’s next three-year business plan, to ensure that our work with policy makers and other non-specialist audiences is coordinated, well targeted, and built on excellent science. 

- To find out more, read the Society’s statement on its approach to ‘science for policy’ at [www.geolsoc.org.uk/21st\\_century](http://www.geolsoc.org.uk/21st_century), or contact me at [nic.bilham@geolsoc.org.uk](mailto:nic.bilham@geolsoc.org.uk).

## Chartership news



*Chartership Officer Bill Gaskarth has advice about choosing the appropriate professional qualification for you, and being wise when choosing your supporting documents.*

### CGeol, CSci or CEnv?

A growing number of Fellows of the Society do not work solely in geology. They work largely in the area of contaminated land and environmental science, with and alongside geologists. They commonly have a first degree in geology (geoscience) and hence consider themselves geologists, but their work has developed away from geology to some degree despite remaining linked with it. Their involvement in the Society is vital, and we hope that they consider it their natural home.

Chartership is important for this group of Fellows but for some, because of the variable quantities of geology in their work, qualifying for CGeol may become difficult. We must remember that CGeol is for practising professional geologists who work as geologists in a variety of fields. Assessment of an application for Validation as a Chartered Geologist will therefore concentrate on the candidate’s knowledge of geology and their competency in this work (Chartership Criteria I, ii and vii).

Many will be qualified to apply for both CGeol and CSci and in fact we would wish to encourage them to apply for both (and EurGeol). For others, whose work has less geological content, it may well be better to apply for CSci instead. We would not want to discourage applicants from applying for both; but it would help if they discuss this with their sponsors (or the Chartership



# Shell London Lecture Series

The remainder of the programme for the 2010 Shell London lectures is listed below. Entry to lectures is free and open to all, but by ticket only. To obtain a ticket please contact the Conference Office using the contact details below. Tickets will be allocated on a monthly ballot basis and we will not be taking indications of interest months in advance, so if you would like to attend any of the talks, please email us to let us to be added to the mailing list, or let us know around three or four weeks in advance of the talk date that you would like to attend. Most talks will be given twice on the same day, once at 3pm and once at 6pm.

Each talk will appear online shortly after the talk has been given. To view the presentations please visit the individual talk's event page, accessed via [www.geolsoc.org.uk/shellondonlectures10](http://www.geolsoc.org.uk/shellondonlectures10)

DATE	SPEAKER	TITLE
Weds 8 September	Marie Edmonds (Cambridge University)	A lot of hot air: Degassing and volcanic eruptions
Weds 13 October	Jay Melosh (Purdue University)	Impacts
Weds 10 November	Rob Kleibergen (Shell)	Half empty or half full: How much oil and gas can we recover from our fields?
Weds 8 December	Martin Culshaw	Geological hazards: How safe is Britain?

#### Further information

To be added to the mailing list, or to request a ticket, please contact the Conference Office at the Geological Society.

To view abstracts and biographies, and to view films of past talks, please visit our website. T: +44 (0) 20 7432 0981;

E: [events@geolsoc.org.uk](mailto:events@geolsoc.org.uk) W: [www.geolsoc.org.uk/shellondonlectures10](http://www.geolsoc.org.uk/shellondonlectures10).

In association with



Officer, or both) to clarify this dilemma. As yet the Society does not offer CEnv, though plans are afoot to remedy this. With the three professional qualifications on offer the Society will be well placed to support the broad church of the modern Fellowship.

#### Supporting documents

We ask that CGeol candidates provide a maximum of six documents supporting the Professional Report. These are meant to illustrate the claims to experience, knowledge and competence made in that report. Candidates should ensure that these focus on their own work, rather than present large reports through which the Scrutineers must sift for nuggets of relevance. Scrutineers donate their time to do this work and prefer not to waste it. A candidate who has not exercised selectivity is unlikely to make a good impression! A short paragraph attached to the front of each document explaining its relevance and the points to be gathered from it would be very helpful.



## Son of Planet Earth

Eduardo F J deMulder Hon FGS, who spearheaded the United Nations

*International Year of Planet Earth (IYPE)* project that finally wound up at the end of last month, has announced "significant progress" towards the creation of a Planet Earth Institute (PEI) to keep the IYPE torch alight. The Government of the Netherlands is reported to be in talks aimed at hosting the Planet Earth Institute in Holland, from an office at Wageningen University.

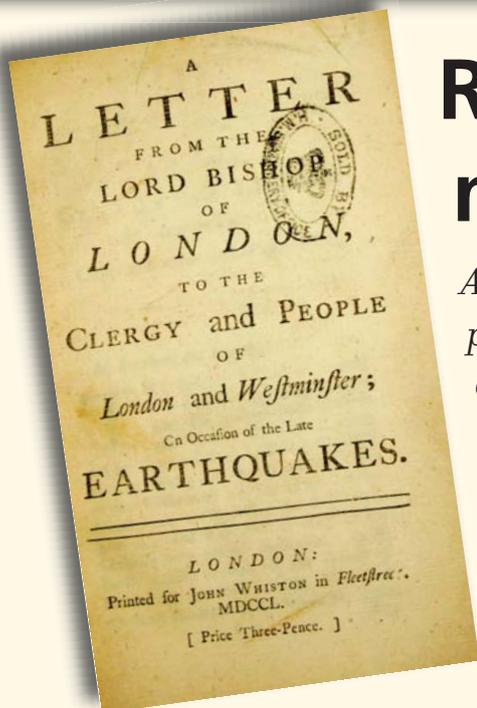
The message came in an email to the IYPE's national committees sent at the end of May. The latest version of a brochure describing the envisaged Institute, complete with a business model, is now posted on [www.yearofplanetearth.org](http://www.yearofplanetearth.org). Dawne Riddle



# From the Library

For a list of **new acquisitions** click the appropriate link from <http://www.geolsoc.org.uk/gsl/info>

The library is open to visitors **Monday-Friday 0930-1730.**



## Rare book of the month!

*A letter from the Lord Bishop of London, to the clergy and people of London and Westminster; on occasion of the late earthquakes by Thomas Sherlock. 1750.*

On 8 February 1750 a slight tremor rippled through London. Exactly a month later, on 8 March, a larger earthquake struck the capital, sending waves of fear and panic among the people. From the pulpit of St. Paul's Cathedral, the Bishop of London, Thomas Sherlock (1678-1761), pronounced the earthquakes manifestations of God's wrath at the depravity of London's citizens, and shortly after published his 'pastoral letter', of which, according to Horace Walpole, 'ten thousand were sold in two days and fifty thousand have been subscribed for since the first two editions'.

In this short rhetorical essay, Sherlock blames the earthquakes on everything from plays and operas, to cock-fighting and boxing during Lent, to the availability of novels, which he dubs 'vile abominable Pictures of Lewdness'. We can of course be amused by this today - the response to natural disaster in a less informed and more superstitious age. And yet the reaction and opportunistic proselytising by some Christian evangelicals after the January earthquake in Haiti, or the speech by an Iranian cleric in April blaming earthquakes on "women who dress inappropriately", are not dissimilar.

This title's place in the Society's collection provides a reminder of the hard-fought battle between rationalism and religious rhetoric which, in many arenas 250 years on, has changed very little.

- The Library operates a sponsorship scheme to help preserve and restore its rare books. For more information, contact Michael.McKimm@geolsoc.org.uk, or go to the "Sponsor A Book" page on the Society's website.

### References

- Walpole, Horace. Letter to Sir Horace Mann, April 2, 1750. The Letters of Horace Walpole Volume 2. pg 81 <http://www.gutenberg.org/etext/12074>
- Zajac, Andrew. 'Pat Robertson links Haiti quake to pact with devil' Los Angeles Times January 13, 2010 <http://articles.latimes.com/2010/jan/13/world/la-fg-haiti-robertson14-2010jan14>
- 'Women to blame for earthquakes, says Iran cleric' Guardian.co.uk April 19, 2010
- <http://www.guardian.co.uk/world/2010/apr/19/women-blame-earthquakes-iran-cleric>

## New oil books

The publisher has generously donated to the Library a copy of *The Petroleum Geology of Iraq* by A A M Aqrawi, J C Goff, A D Horbury and F N Sadoon. Beaconsfield: Scientific Press, 2010. ISBN: 978-0-901360-36-8 (available from <http://www.petgeoliraq.com/>).

The Library has recently purchased a copy of *Petroleum geology of the Persian Gulf* by Fereydoun Ghazban. Tehran: Tehran University Press, 2009. ISBN 978-964-03-9420-5 (available from [www.cuprimedia.com](http://www.cuprimedia.com)).

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### Virtual 'Help yourself box'

The Library has a selection of journal issues which are not required due to duplication, defect or damage. A list of these can be found on our website in the section on Library Collections - Serials, under the heading 'Surplus Journals' [www.geolsoc.org.uk/gsl/info/collections/serial/page3358.htm](http://www.geolsoc.org.uk/gsl/info/collections/serial/page3358.htm).

Here you will find information on how to request them. They are available to both individuals and libraries. Please note that there may be a charge depending on the type of material and the weight, if posted.

### Document delivery

Don't forget that the Geological Society Library can usually supply photocopies more cheaply than other providers e.g. British Library & the publishers. Remember - our journals have been bought with your money, and are here to be used!

### Electronic copies

The Library is now able to arrange the supply copies of papers by Secure Electronic Delivery (SED) direct to your PC, if preferred to standard photocopies. The cost of this service via the Society's Library is £8.50 + title-specific copyright fee (if applicable) and VAT. For more information and to check whether you can receive documents in this way visit <http://www.bl.uk/sed>.

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### Postal Loans

We use Royal Mail's Special Delivery to send all loans to borrowers, in order to guarantee next-day delivery and more particularly, so that the packages are insured in case of loss. Many books are now very expensive and if lost are difficult to replace. Please will borrowers ensure that all loans are returned to the Library by this means, or by a reputable courier who can guarantee the same protection.

### WiFi access

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

### Pick of the crop

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

## When you renew, use Direct Debit!

*Sharon McIntyre, Fellowship Services Manager, writes:* As the AGM comes and goes for another year, it will soon be time for you to make arrangements for your renewal.

Although the payment date (November 1) may seem far away, invoices will be soon dropping on your doormat. Direct Debit is by far the simplest way, both of renewing your Fellowship and ensuring that you continue to belong to the professional body for Earth scientists. Chartered Geologists in particular can be assured that their status will be maintained uninterrupted by an inadvertent failure to pay. Direct Debit also allows you to spread the cost of Fellowship over the year - in this economic climate, an added benefit.

What's more, you can now do all this online. Online payment has been a resounding success and when renewing we encourage all Fellows who have yet to log in to the Fellows area of the website to do so, and see for themselves how simple the process is.

The benefits flow both ways. Processing cheques and credit cards places a heavy burden on the Society's resources. Direct Debit and online payment release staff time - which we can then devote to delivering core Fellowship services. As banks will be phasing out cheques in the near future, why not make 2010 the year you change to quick and easy payment by Direct Debit? 



## Searching for FACTS?

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## Resource Geologists – Midlands

You will be a Resource or Mining Geologist, who specialises in coal and will join the Minerals Team. You will have at least a degree in Geology, Applied or Mining Geology ideally with some experience in the mining industry; specific knowledge of or interest in the coal sector is essential.

## Senior Mining, Social & CSR Specialist – South West

You will join the Mining Environmental Team whose diverse range of projects includes ESIA, social and environmental management plans, permitting, mine closure and post-mining regeneration. You should have at least a degree in Social Science, Socio-Economics, Social Anthropology or similar technical area, or be from a mining or geological background with subsequent experience in social impact assessment.

## Senior Geological Resource Modeller – South West

The Mining / Geology Team is primarily involved in resource modelling and reserve estimation. You will have at least a degree in Geology, Applied or Mining Geology or Mining Engineering and preferably some experience in the Mining Sector; knowledge of or interest in the metalliferous mining sector is essential. Able to use 2D & 3D geotechnical software.

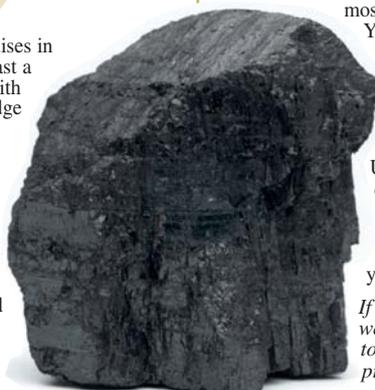
## Senior Minerals Process Engineer – South West

You will join the Mining Team to carry out mineral process testing using laboratory and pilot plant to optimise flowsheet design and recommend the most cost-effective process for projects throughout the world. You will have at least a degree in Minerals Engineering and 10-20 years experience in the Mining Industry.

## Senior Hydrogeologist – Midlands

You will be a key member of the Hydrogeology Team and will work on waste and construction projects both in the UK and overseas. You will have field mining and well construction experience, be able to use pumping test and groundwater modelling packages and prepared to work overseas. You will have at least a degree in Hydrogeology or a related subject. Ideally you will be Chartered with 5-10 years experience some of which will be in the Mining Sector.

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## Dates for your diary

The following highlights PESGB forthcoming events, for more information on all our events please visit our website



### The Billion Dollar Volcano: Iceland, volcanic rocks and our future, Aberdeen, 31 August 2010

#### An Additional PESGB Evening Lecture by Dougal Jerram (Durham University)

As the dust settles from the recent volcanic crisis, this talk takes a brief look at just what happened during the recent volcanic activity, an event which brought volcanology to the coffee tables of the world. But what role do volcanic rocks have in our future? The topical exploration and production targets at the fringes and underneath the volcanic margins in the North Atlantic and beyond may have the answers. Volcanic margins form the main focus of the presentation where ancient volcanic activity from the Iceland plume may hold the key to some new discoveries in possibly the final frontier of the UK petroleum industry.

(Picture courtesy of Eyjólfur Magnússon)



### Stoney Lecture Series, 5 October 2010

#### Geology in the Anthropocene or why environmentalists should stop hugging trees and hug geologists instead by Julian Rush Science Correspondent for Channel 4 News

The PESGB are proud to announce Julian Rush will be our inaugural speaker to launch our Stoney Lecture Series in memory of Professor Robert Stoney.

The PESGB were honoured that Bob Stoney's family gave their permission for us to name this new series of eminent lectures after such an esteemed and well known member of our industry.



### PETEX, Earls Court 2, London, 23-25 November 2010

PETEX is the largest UK conference and exhibition dedicated to oil and gas exploration. The Conference theme this year will be 'From Volatility to Value' and a full technical programme is planned.

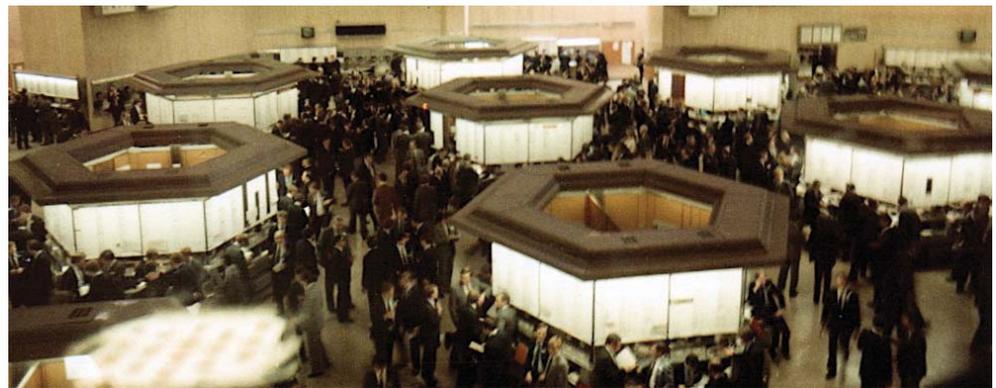
NEW to the Exhibition floor this year is the introduction of the Graduate Career Centre and the Collaboration Conference, a sub-conference within the main event.

With these additional features Earls Court 2 promises to be a vibrant forum to exchange ideas and view the latest technical advances within the industry. Complementing the conference and exhibition is a full Social Programme allowing networking opportunities for each day.



# Unconventional Resources have Unconventional Reporting: True or False?

Wednesday 15th September 2010, 6.30 - 9.30pm  
The Geological Society, Burlington House, Piccadilly, London



Three presentations will offer differing perspectives on the assessment of unconventional resources.

#### SPEAKERS

The Investor - Paul Wheeler, Bank of America Merrill Lynch  
The Independent Auditor - Paul Chernik, ERC  
The Operator - Dave Decker, BG

The event will start at 6pm with tea & coffee on arrival with the first talk starting at 6.30pm. The talks will be followed by a panel discussion and refreshments in the Lower library.

#### REGISTRATION

£25 GSL Fellows / SPE & SPEE Members  
£35 Non Fellows

For further information and to register, please contact:

**Steve Whalley, Events Co-ordinator: +44 (0)20 7432 0980**

**steve.whalley@geolsoc.org.uk** or visit our website [www.geolsoc.org.uk](http://www.geolsoc.org.uk)



#### Convenors:

**Bernie Vining**  
(Baker Hughes)

**Duncan Wade**  
(Equipoise Solutions)



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## Continuing Professional Development (CPD) Courses

•13 July *Geophysical Field Data Acquisition Master Class*. See Events below for full details.

•20-22 July *Surpac Foundation & Underground Engineering Workshop*. Venue: Coalville. The Surpac Foundation & Underground Engineering Workshop is an amalgamation of both the Foundation and the Underground Engineering Course. It is a comprehensive three-day workshop designed for new users of Surpac and will give the attendee an understanding of the fundamental concepts of Surpac as well as introducing and utilising the use of Surpac's engineering toolset. Fellows of the Society will receive a 15% discount. Please mention this when registering. For further details, please download the PDF on the Society website. **Contact:** Gemcom T: +44 (0) 1530 835554 E: sales-eu@gemcomsoftware.com W: www.gemcomsoftware.com

*Developing Geological Knowledge for CGeol Status*, First Steps Ltd. For reservations and information **contact** Christine Butenuth, info@firststeps.uk.com, 0207 589 7394, www.firststeps.eu.com.

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JULY 2010

South West Regional

•4 July *Guided Fossil Walk - Jurassic Coast*. Venue: Charmouth, Dorset. Guided 3hr Fossil Walk led by Chris Pamplin. Chris will guide a walk around the coast at Lyme Regis, world famous for its highly fossiliferous cliffs and foreshore. There is such a vast variety of fossils at Lyme Regis that one can expect to find (almost) anything! Fossils may include ammonites, rare fish and sometimes sea reptiles. Starting time: 1400 Cost: £5.00 per person (families / friends welcome). Pre-booking essential. **Contact:** Cathy Smith E: swrg@geolsoc.org.uk.

South West Regional

•7 July *Chartership talk* Venue: Ley Arms, Kenn EX6 7UW. Speaker: Dr Bill Gasgarth (Chartership Officer) Refreshments 1815 for 1845. Bill Gasgarth was an early member of the Institution of Geologists (IG), formed c. 30 years ago to offer professional qualifications. IG and GSL subsequently merged. The Society's influence and membership have expanded greatly since then, and it is now recognised as *Serving Science and Profession*. Bill served two terms on IG Council and one term on Council of the GSL during the recombination period, and continues to act for the Society as Chairman of its Accreditation Panel and member of Professional and Education Committees. **Contact:** Cathy Smith E: swrg@geolsoc.org.uk.

Near Surface Geophysics

•13 July *Geophysical Field Exhibition*. Venue: Stoughton Road Test site, Leicester. The latest in the series of geophysical field exhibitions will this year be conducting a field data acquisition masterclass (which will qualify as a **CPD event** for those attending) the aim of which is to tutor the attendees in how to acquire the best possible field data for each techniques. Independent experts in field data acquisition will tutor each section of the course. Two techniques will be covered this year, GPR and magnetic surveying, which are complimentary, are applicable to near-surface investigation. Topics covered will include survey design and layout given different field constraints, data sampling regimes to reduce aliasing effects, knowing the errors in the survey, the importance of accurate positioning in the overall error envelope, sensor selection, heights and positioning, noise reduction, in-field QC of your data, the importance of field notes and general good field practice applicable to each technique. Hands on field experience will be given using typical modern instrumentation in each technique. This event is suitable for geophysical practitioners, users of geophysical surveys and those responsible for both specifying and selling a survey as it aims to set out the boundaries of capabilities of both techniques. Best of all attendance is FREE, but we would need confirmation of your attendance to one of the convenors below to assess catering arrangements. **Contact:** Dr Ian Hill, Geology Department, University of Leicester, LE1 7RH T: 0116 252 3920 F: 0116 252 3918 E: iah@le.ac.uk.



•16-18 July *Annual Field Meeting - Engineering Geology of North East England*. Venue: Grey College, University of Durham. The Meeting will convene on the evening of Friday 16 July and will be of interest to engineering geologists, geotechnical engineers, engineering geomorphologists, civil engineers, coastal engineers and geologists of all levels of experience. The meeting will consider various aspects of the engineering geology of the North East England and will visit a variety of sites of engineering and geological interest. Travel will be by coach each day to selected localities around the Durham area. The delegate fee will be £80.00 for waged delegates and £40.00 for un-waged delegates and full-time students. Meeting accommodation is en-suite single in Grey College. Please advise on registration your reservation requirements. **Contact:** David Giles, School of Earth & Environmental Sciences, Burnaby Building, University of Portsmouth, Burnaby Road, Portsmouth [http://userweb.port.ac.uk/~gilesd/Pages/engineering\\_group\\_durham.htm](http://userweb.port.ac.uk/~gilesd/Pages/engineering_group_durham.htm)

East Anglia Regional

•22 July *CGeol - New Process, Requirements and Benefits of Becoming Chartered* Venue: The Sexton Room, Assembly House, Norwich. Speaker – Dr Bill Gasgarth (Chartership Officer). We invite all fellows to come along and learn about the new chartership process. We also welcome any chartered engineers who wish to come along and talk to fellows about what being chartered means to them. Refreshments from 1830 for 1900. **Contact:** Sue Armour E: sharriman@hotmail.com



•23-24 July *GCG Seminar: 200 years of West Country Sea Dragons* Venue: Strode Theatre, Street, Somerset. Following on from the highly successful PalAss review seminar *Sea Dragons of Avalon*, GCG have teamed up with three of the meeting organisers to run a similar event to mark the 200<sup>th</sup> anniversary of the birth of Thomas Hawkins (see *Distant Thunder*, pp. 6,7, this issue), the eccentric collector of Street and Lyme Regis marine reptiles. The meeting will take place on Friday 23 July followed by a field excursion on Saturday to visit some of the modern Lias quarries in the Street area. The meeting will focus on Thomas Hawkins, his collections, legacy and modern collecting. Topics will include current locations and state of Hawkins's specimens, including issues of acquisition, mounting methods and conservation, as well as restoration/forgery. **Contact:** Dr Leslie Noe, (Curator of Natural Science), Thinktank, Birmingham Science Museum, Millennium Point, Curzon Street, Birmingham B4 7XG E: Leslie.No@thinktank.ac.uk W: www.geocurator.org/meet/meet.htm

AUGUST 2010

South West Regional

•11 August *Beer Quarry Cave Visit*. Venue: Beer, South Devon. Visit to Beer Quarry Caves with in-depth special interest guided tour (90 minutes). Cost: £6.00 adult, £4.25 senior citizen. Time: 1815 at caves. Pre-booking required. **Contact:** Cathy Smith. E: swrg@geolsoc.org.uk.

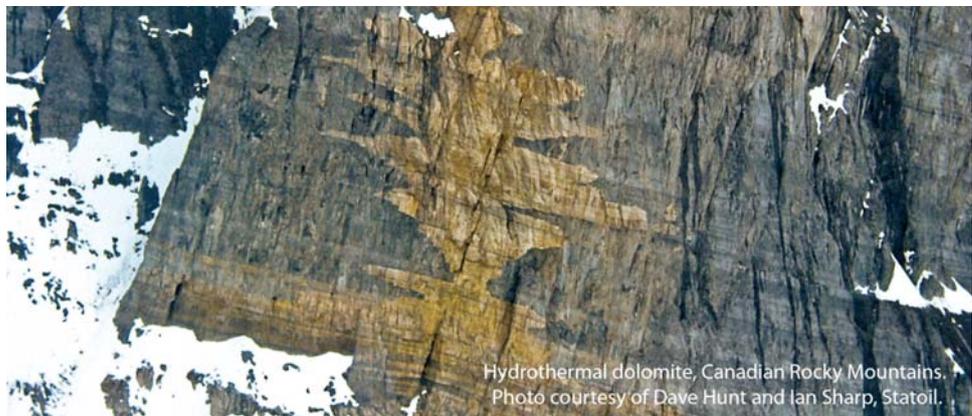
Can't find your meeting? Visit [www.geolsoc.org.uk](http://www.geolsoc.org.uk) – full, accurate, up-to-date



# Advances in Carbonate Exploration and Reservoir Analysis

Thursday 4 - Friday 5 November 2010

The Geological Society, Burlington House, Piccadilly, London



Hydrothermal dolomite, Canadian Rocky Mountains. Photo courtesy of Dave Hunt and Ian Sharp, Statoil.

**REGISTRATION NOW OPEN**

**Sessions include:**

- Middle East
- Emerging Plays and Concepts
- Advances in Outcrop Studies
- Faults/Fractures, Karst and Interaction with Sequence Stratigraphy
- Carbonate Reservoirs in Rift Settings
- Impact on Reservoir Quality of Fracture Diagenesis and Burial Karst
- Hydrothermal Dolomitisation
- Porosity Classification and Evolution
- Geomodelling Challenges in Carbonates

**Confirmed keynote speakers:**

**Susan Agar** - ExxonMobil (faults/fractures), **Trevor Burchette** - BP (Industry perspective on carbonates), **Wolfgang Blendinger** - TU Clausthal (Geomodelling), **Al Fraser** - Imperial College (rifts), **Andrew Horbury** - Cambridge Carbonates Ltd (Iraq), **Charlie Kerans** - University of Texas (Karst interaction with sequence stratigraphy), **Paul Wright** - BG & University of Cardiff (Emerging Plays).

To register click on [www.geolsoc.org.uk/carbonate\\_exploration](http://www.geolsoc.org.uk/carbonate_exploration) or contact Steve Whalley using the details below. There will also be a half day workshop by Task Geoscience held in the afternoon of Wednesday 3rd November on "Carbonates and Image Logs" There is a maximum of 15 spaces and these will be allocated on a first come first served basis. Registration for the workshop opens on 4 October.

For further information please contact:

**Steve Whalley, Events Co-ordinator: +44 207 432 0980, or email: [steve.whalley@geolsoc.org.uk](mailto:steve.whalley@geolsoc.org.uk)**



**Convenors:**

**Joanna Garland**  
(Cambridge Carbonates Ltd)

**Joyce Neilson**  
(University of Aberdeen)

**Steve Laubach**  
(BEG)

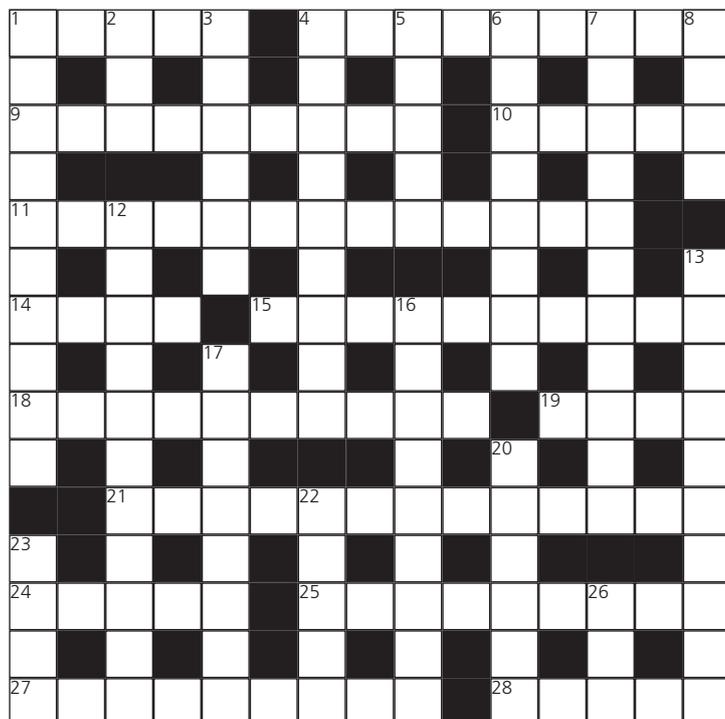
**Kate Whidden**  
(USGS)



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## Crossword no. 137 set by Platypus



## Solutions: May

**Across:** 1 Divot 4 Oratorios 9 Antlerite 10 Titan 11 Ichthyosauria 14 Tide 15 Decrepitly 18 Trousseau 19 Abba 21 Terpsichorean 24 Teton 25 Enigmatic 27 Rochester 28 Nepal

**Down:** 1 Diamictite 2 Vat 3 Teethe 4 Oligocene 5 Arena 6 Outcrops 7 Intractable 8 Sand 12 Hydrostatic 13 Tyrannical 16 Raunchier 17 Estrange 20 Dolmen 22 SWEAT 23 Star 26 Tip

## Win a Special Publication of your choice!

The winner of the May Crossword puzzle prize draw was John Evans of Topsham.

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

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

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

Name .....

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## Across

- 1 Red, sandy soil of desert districts, with a high clay content (4)
- 4 Tornado (9)
- 9 Participants in a chemical process (9)
- 10 Essential for life (5)
- 11 Solnhofen early bird (13)
- 14 Ultimately fine unit of geological time (4)
- 15 Pertaining to church ritual (10)
- 18 Ruling philosophical theories (10)
- 19 As it was, editorially (4)
- 21 Given the reverse order (13)
- 24 Biblical wilderness (5)
- 25 Cleaving, metaphorically, like societies to umbrellas (9)
- 27 For ever (9)
- 28 Ariadne's 23 down (5)

## Down

- 1 Reef-building (10)
- 2 Large extinct flightless bird (3)
- 3 Starry (6)
- 4 Aeolian sorting of chaff from wheat, or fines from sand (9)
- 5 Small sub-figure in the corner of a larger diagram (5)
- 6 Mechanically advantageous bargaining power (8)
- 7 Incapable through drink (11)
- 8 Canadian igneous petrologist, solid Earth physicist and early proponent of Continental Drift and impact origins of lunar craters (4)
- 12 Coming together to form a single whole (11)
- 13 State of high spirits (10)
- 16 Otherworldly (if you happen to come from this world) (9)
- 17 Alaskan volcanic arc (8)
- 20 Motherly senior nurse (6)
- 22 American footpath (5)
- 23 Land completely surrounded by water (4)
- 26 Absolutely nothing, in common speech with Germanic roots (3)

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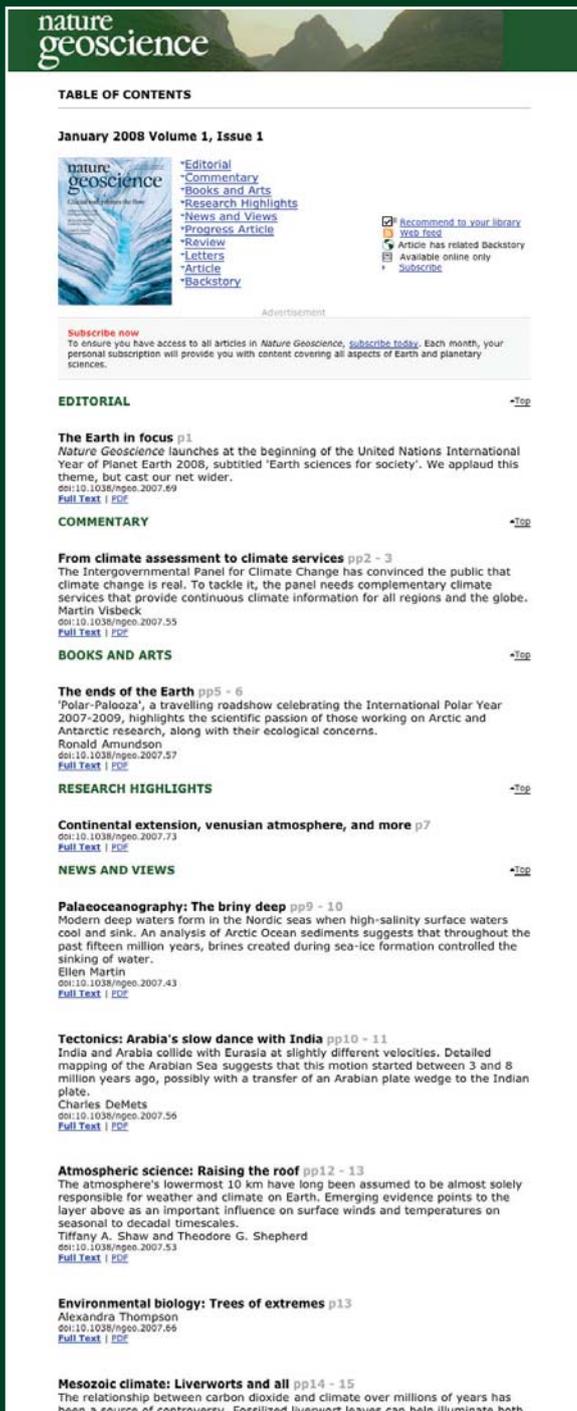
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