

Geoscientist

Volume 19 • No 11 • November 2009



Filing a dentist's cavity
Pressures beyond rubies
Pacific paradigm fights back



Cast out Ted Nield proposes a boo for the Government and three cheers for the plucky extra mural Earth Science tutors at Bristol University.

No doubt there are those who would cite this fact as reason enough to close them down, but I owe my introduction to geology to what used to be called “extra mural” classes at my local university. Now referred to as Lifelong Learning (LL), these admirable programmes of lectures and field excursions for the general public used to be part of every UK university’s outreach programme. Each institution would publish annually an eagerly awaited prospectus of courses on offer in the coming year. There would follow an exciting scramble

for places, for which one was expected to pay a reasonable sub. Facilities were provided by the institution.

Sadly, because the “product” of such classes (positive publicity, good public relations, enlightenment) is hard for universities to quantify to the satisfaction of the moronic bean-counting processes to which they are in thrall, LL courses now find themselves under threat everywhere. This has suddenly become serious because the Government – represented by its creature the Higher Education Funding Council for England (HEFCE) – recently decided to withdraw funding from “equivalent or lower level qualifications” (ELQs), leaving cash-strapped institutions to fund them unaided.

Latest casualties are the successful geology courses run at the University of Bristol. Because such decisions devolve onto individual universities, the decision to close courses will tend to depend upon wider funding issues. Courses may therefore find themselves forced to close even though they may have been very popular. Such is the case at Bristol, where geology courses have seen annual enrolments of more than 600 in recent years. The decision to close has been reached, according to a university spokeswoman, “with deep regret”.

Nothing daunted, some course tutors at Bristol – Nick Chidlaw, David Green, Rodney Hillier and Bill Dixon – have decided to soldier on alone. Their new, independent courses are now being advertised online (see link below) under a rather sad “thank you to all our customers” notice, announcing the closure decision.

Chidlaw told *Geoscientist*: “It’s very regrettable that HEFCE has caused this – I have taught LL geological courses continuously for Bristol for 21 years, and there has always been a clear and sustained interest from the public – attracting people from all over the country. People attending these courses come from many walks of life, and learn a great deal about the geological past and geoconservation in the company of like-minded people. It’s clear that LL provision goes towards informing and enriching their lives.”

The support of local organisations has been crucial. Says Chidlaw: “The West of England GA and the Bath Geological Society have been exemplary in contacting their membership and putting details on their blogs quickly I’d also like to emphasise the support from Professor Mike Benton, who has long supported and organised the Lifelong Learning Programme in his Department.”

This magazine applauds their efforts and wishes them all the best for the future. 🐶

• For further information: www.gly.bris.ac.uk/lifelong



Front cover: Rocks and Dust Devils on Mars. Similar dust devils have been photographed on Mars from the ground and from orbit. The painting is based loosely on a California landscape, but with details and colours altered to create a Martian view. It is one panel of a 5-panel mural. (Collection Ted Buttner and Rosemary Chang; copyright William K. Hartmann). Bill Hartmann was a keynote speaker at the British Science Festival’s “Great Mars Field Trip”, co-organised by the Society. See p6

Geoscientist

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This tape will self-destruct

Adler de Wind wonders what geo-pedagogues will do when nobody can remember how a tape recorder works.

When I was growing up, not very far from the Cape of Good Hope, I asked my father why, in all those old adventure books about derring-do in the Sahara that I used to read, they talked about night falling almost with a bang. Why should the night fall more quickly in Ouagadougou than in Kommetje, I asked?

My father showed me a vinyl disc playing on the turntable. The surface of the Earth travels faster at the equator, he said, like the outer grooves of the LP. So it takes less time to travel through the twilight zone there than it does at higher latitudes – where the ground travels a smaller circle in the same 24 hours. It kept me awake at night for a bit, but the analogy worked. Now, hardly anybody sees a turntable any more.

I find that I can index-fossil my life's phases by tape recorders. In the late 50s we had the old *Sonomag* half-track mono machine, the size of a tea crate. Then came the luggable *Philips* quarter-track mono machine, which could record at four different speeds – use the high speed for higher quality. Then there was the *Tandberg* four-track stereo machine with its interesting four-way joystick. And then came a (second-hand) *Ferroglyph*, king of the audio jungle, and an *Akai* with its strangely exciting oversize external pinch-wheel, and finally a mighty *TEAC*. And then what happened? Cassettes



invaded. Reel-to-reel became extinct. Then cassettes succumbed in the digital mass extinction. Now we are come to our ipods.

And yet, how useful the tape-recorder analogy was! A spreading centre like the Mid Atlantic Ridge is like a tape that records the polarity of the Earth's field as the lavas slowly congeal and move away. Sedimentation records the events in a shallow sea like a magnetic tape, moving slowly when sedimentation rates are low and quickly when high. When rates are low, there is a chance that information might be lost, too, just like a recording made at one and seven eighths inches per second, when you got drop-outs – disconformities in the music - from the imperfections of the magnetic coating.

Yet already, young people reading such explanations may be struggling to know what we are talking about. How can we adapt our explanations to new technology? And will it even be possible? Will download speeds, or pixel concentrations or the packet switchstream system, ever provide us with the rich imagery that the tape or vinyl recording machine once did, with its simple ideas and real, moving parts? Somehow, I doubt it; but if you have any suggestions, please share them! ☞

• Any ideas? Write to ted.nield@geolsoc.org.uk.

Soapbox is open to all Fellows of the Society. If you have a bee in your bonnet and can explain it entertainingly in 500 words, the column is yours. There is no waiting list, because (shame on you) for the second time this year this column has this month been written by a member of the editoriat...

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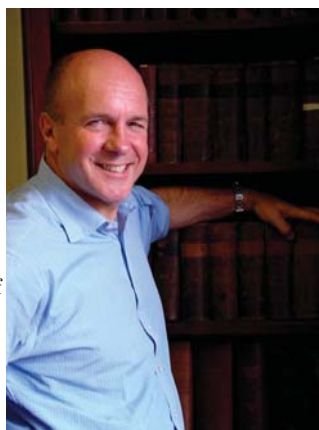
by Alan Wright




Carousel



Stephen Self has left the Open University (in late February 2008) to take up a US government scientific position as Senior Volcanologist with the US Nuclear Regulatory Commission (NRC). He is currently based at NRC HQ in Rockville, Maryland, just north of Washington DC. Please note a change of my work address to: US Nuclear Regulatory Commission, MS EBB-02-02, Washington, DC 20555-0001 Phone: (301) 492-3185; email: stephen.self@nrc.gov. Steve retains a Visiting Professorship at the Open University and checks his OU e-mail regularly. Private Email: steve.self1815@gmail.com.



Simon Winchester OBE has been elected Honorary Fellow of St. Catherine's College, Oxford. 



Earth Science teacher Stuart Hitch (right) and his pupils from years 12 and 13, King Edward VI Grammar School, Chelmsford, visit the Society to examine the William Smith map before attending a Shell Lecture.

World Heritage Sites


Peter Bobrowsky, IUGS Secretary General, has issued a call for help choosing future UNESCO World heritage Sites.

Each year, as an Advisory Body to the UNESCO World Heritage Committee for natural heritage the International Union for Conservation of Nature (IUCN) is required to evaluate new nominations for the UNESCO World Heritage List. IUCN's year-long evaluation process involves seeking comments from international experts on the global importance and integrity of the nominated sites, whether they are nominated for their geological, biological or scenic values.

In evaluating geological sites, IUCN works closely with the International Union of Geological Sciences to identify expert reviewers interested in providing a technical, desk-top review of one of the new proposals nominated for its geological value.

Occasionally reviewers are asked to participate in on-site evaluations.

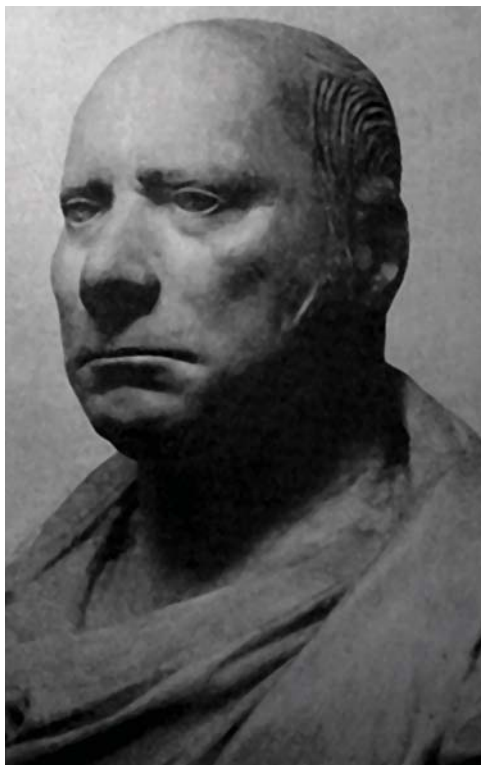
Your volunteer input as an IUGS reviewer into IUCN's evaluation will contribute to the conservation of globally outstanding geological heritage as well as to IUCN's efforts to maintain the credibility of the World Heritage Convention by providing high quality technical advice to the World Heritage Committee. All comments will be treated as confidential.

If you would like to be added to the IUGS database of evaluators please contact me (pbobrows@nrcan.gc.ca) immediately with full details (email, mailing address, telephone, etc.) and a clear indication of your particular area of geo-specialisation. 

DISTANT THUNDER

The mysterious Mrs Smith

Geologist and science writer Nina Morgan reports on a first-hand account of the woman who married the Father of English Geology.*



Apart from the facts that her name was Mary Ann(e), that she died aged 52 in 1844 in the York Lunatic Asylum and was buried at St Olave's York, not much is known about Mrs Smith, the woman William Smith – Father of English Geology – is thought to have married in 1809, when he was 40. Candid eyewitness descriptions of Smith himself are few and far between. Descriptions of his elusive wife, Mary Ann, are even rarer. But William Crawford Williamson (1816–1895), son of the first curator of the Scarborough Museum and a scientific polymath remembered (among his many achievements) for an important monograph on living Foraminifera published in 1858 and a recipient of a Royal Society royal medal in 1874 for his work on fossil plants, had ample time to get to know her.

In 1826, Smith, accompanied by his 'eccentric wife', arrived at the Williamson's family home at 2 Huntriss Row, Scarborough. They stayed for the next two years. Although, Williamson was just 10 when the Smiths arrived, the visit remained fresh in his mind for the rest of his life. In a short article that appeared in 1877 in the magazine *Good Words*, Williamson provides a vivid impression of what Mrs Smith was like, as well as the state of the Smith marriage.

She was, he writes, a "small and somewhat stunted figure, oddly attired, with her cheeks rouged up to the highest point of which they were capable, with short, dark-coloured girlish curls gathered closely round her brow." Although she was subject to occasional "violent outbursts of temper, which, for a time disturbed the even tenor of her husband's way" Williamson observes that Smith apparently didn't regret his choice of life partner. "... notwithstanding these occasional outbursts, and their intellectual un-congeniality[sic]," he notes, "their domestic life was, on the whole, a happy one." No accounting for taste! ☞

Acknowledgements

The description of Mrs Smith is taken from *Reminiscences of a Yorkshire Naturalist*, published in 1877 in *Good Words* vol 18, pp 62-66 and quoted in *An Introduction to the Life and Times of William Smith (1769-1839)* by Hugh Torrens, which is included in the reprint of the *Memoirs of William Smith, LL.D* by John Phillips, first published in 1844. A shorter version of this story appears in Williamson's autobiography, also called *Reminiscences of a Yorkshire Naturalist*, edited by his wife and published posthumously in 1896. Biographical information is derived from an article about William Crawford Williamson by John Pickstone in the *Oxford Dictionary of National Biography*.

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

Deaths

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

The Society notes with sadness the passing of:

Baumer, A*

Bishop, Richard*

Francis, Christopher Michael

George*

Knight, Jack*

Mills, Anthony B*

Moseley, Frank

McKinlay, Alex C M*

Truss, Stephen*

Walton, Ewart Kendall

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

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

Deceased Fellows for whom no obituary is forthcoming have their names and dates recorded in a Roll of Honour in the next available *Annual Review*.

Help your obituarist

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

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.

Space and time

The Society helped stage two successful events at the British Science Festival 2009 at the University of Surrey. Earth Science Communicator Sarah Day reports.



Balme



Bridges



Hartmann



Grindrod

‘If you can’t paint it, you don’t understand it’.

As a motto for a scientist, this isn’t quite what you’d expect. But it was with this nineteenth century idiom that the first of two Geological Society-sponsored sessions at this year’s British Science Festival kicked off. The events were organised with the help of Dr Matt Balme, Geology Section President, and Dr Richard Waller of Keele University, the Geology Section Recorder.

Giving the keynote talk at *‘The Great Mars Field Trip’*, Dr William Hartmann of the Planetary Science Institute spoke about his love of painting and of planetary science – two areas with more in common than might at first appear.

“We bring different talents to bear on our science”, he told me later. “We shouldn’t assume that the only valid talent is a numerical one”.

This is particularly relevant for planetary scientists. Dr John Bridges, Dr Peter

Grindrod and Dr Sanjeev Gupta spoke at the event about their work on understanding Mars based on using Earth as an analogue model, while Dr David Parker from the British National Space Centre gave a presentation about the UK’s own space programme in relation to Mars. Based on the concept of ‘comparative planetology’, the session was chaired and organised by Dr Balme, who is a research scientist at the Planetary Science Institute.

“In terms of geology”, he explained, “it’s very hard to start from the ground up and imagine all sorts of new geological processes. Really we’ve only got the Earth to go by, as an analogue for Mars”.

In this context, Hartmann’s emphasis on the importance of creative thinking in science stands out as a vital tool. Painting, like science, is grounded in careful observation. Being able to link seemingly disparate things and draw analogies between them is an invaluable skill shared by scientists and artists alike, and was a methodology demonstrated by all five speakers. In particular, Dr Grindrod of University College London gave an excellent talk about his work on searching for water sources on Mars. Using Epsom salt as an example, he



Gupta



Parker

explained how minerals with water bound into their crystal structures might be a potential source of water on Mars – another example of how important analogies with Earth are.

What the session demonstrated was that there are many surprising similarities between Earth and Mars, which can be used to find out more about both planets. It also demonstrated the importance of integrative thinking to the work of scientists. As Hartmann pointed out: “There’s a tendency to be encouraged to be a scientist if your brain works in one way. I suspect it’s real that there are brains with multiple talents, and that some of these other talents are now being recognised as being useful in science”.

‘The Earth is the key to Mars’

Although this approach is uncovering a huge amount of new information about Mars, such a methodology is one which will be familiar to Earth scientists used to Charles Lyell’s famous principle – ‘the present is the key to the past’.

Lyell’s guiding principle, which remains an important one for geologists today, was to draw analogies between what he observed and what he was studying, using these to reconstruct the geological past. It was the importance of this method to the history of science, and its future development, that the second GSL sponsored event, ‘*Out of Charles Lyell’s Head*’, demonstrated.


Professor Jim Secord of the University of Cambridge, and Dr David Norman from the Sedgwick Museum, discussed the significance of Lyell’s methodology to the development of geology in the nineteenth century, and how important this would become for the work of one of that period’s most famous scientists, Charles Darwin. The event was chaired by Leucha Veneer from the University of Leeds.

Lyell’s *Principles of Geology* was, among many other things, a total rejection of all things catastrophic. Seeking explanations to geological phenomena ‘by references to causes now in operation’, he had no time for theories of deluges or miracles, grounding his ideas in purest observation. Like the painter, Lyell trusted his own eyes and interpretation of what he saw. As Secord pointed out, this led to considerable criticism at the time, with cartoons deriding the notion of ‘seeing through Lyell’s eyes’ as obstructive.

Darwin’s theory of evolution could be seen as the culmination of analogical thinking. Using what he learned from Lyell and others about geology, he developed a model for how life may have developed along similar incremental changes. In his talk, David Norman pointed out the striking analogies between Darwin’s geological work, and the theory which would eventually make his name famous.

“Weathering will allow rocks to evolve in different ways. Fractional crystallisation will subtract from the original melt and lead to diversity in rock types. What he was generating was an approach to all sorts of understandings of how diversity can be generated within the world of rocks”.

In the end, of course, Darwin’s big idea was a biological theory, but it could easily have been an analogous geological one. “Darwin was convinced that the dynamic Earth had a number of integrated dynamic processes, and he knew intuitively that they were all linked, and that the explanation of the dynamic nature of the world was simple at heart”, Dr Norman explained. “He just didn’t know what the heck it was”.

What he suspected was “the grandeur of one motive power, its cause completely unknown, but its action slow, intermittent but irresistible”. What he was describing, plate tectonics, took another century to be discovered. For Darwin, this was one analogous leap too far, but it was a theory which he applied to his biological work, with extraordinary impact. As both events demonstrated, geological expertise can be applied to a huge range of subjects, from the study of how life evolved to the question of whether it did so on other planets. 



Norman



Secord



Veneer

Reviews

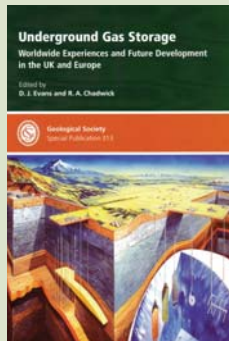
Books available for review:

- Connor, C.B.; Chapman, N.A. & Connor, L.J. (eds) (2009), *Volcanic and Tectonic Hazard Assessment for Nuclear Facilities*, Cambridge.
- Fleet, A. (2009), *North Sea Tigers*, Vanguard Press.
- Knight, J. and Harrison, S. (eds), *Periglacial and Paraglacial Processes and Environments*, GSL Special Publication No.320.
- Ragan, D.M. (2009), *Structural Geology: An introduction to geometrical techniques (4th Edition)*, Cambridge.
- Vita-Finzi, C. (2008), *The Sun: A user's manual*, Springer.

Interested parties should contact the **Reviews Editor, Dr. Martin Degg 01244 392749; m.degg@chester.ac.uk**, only.

Reviewers are invited to keep texts. **Review titles are not available to order from the Geological Society Publishing House unless otherwise stated.**

Underground Gas Storage - Worldwide Experiences and Future Development in the UK and Europe Geological Society Special Publication No.313



D J Evans and R A Chadwick (eds)

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360 pp

www.geolsoc.org.uk/bookshop

Underground Gas Storage (UGS) is currently a hot geopolitical topic. With the current energy climate, rising concerns regarding security of energy supply and environmental degradation, this publication is most timely.

The continuing gas supply and transit dispute between Russia and Ukraine has obvious implications for the rest of Europe's gas consumers. The average European country's natural gas storage capacity is of the order of 20% of annual demand, compared to the UK's total capacity of less than 5%. By 2010 it is predicted that up to 40% of UK gas supply could be imported and by 2015 up to 80%. This is due to a decline in indigenous gas supplies, principally from the North Sea, coupled with an increase in demand. In order to ensure future security of supply, in terms of availability and reliability, a diversity of supply sources and UK entry points, and the ability to store large quantities of gas are essential. In the event of supply disruption, lack of storage would leave the UK in a particularly vulnerable position.

Energy security has also raised the possibility of a new generation of coal-fired power stations, which in order to be environmentally sustainable will require near zero CO₂ emissions. A key element in achieving this goal will be carbon capture and underground storage. This book reviews the technologies and issues associated with storage of natural gas and CO₂ by means of case studies and examples from the UK and overseas. The potential for underground storage of hydrogen and of compressed air energy (linked to renewable energy) is also reviewed.

Geological storage options for gases underground are clearly explained, together with the associated geomechanical, environmental, community safety and public confidence issues. The editors have succeeded in pulling together, from the various contributing authors, a series of very cogent and high quality contributions on all these issues. The book is well produced with good supporting figures and diagrams.

This publication is highly recommended as an essential primer on underground gas storage for geologists and other professional practitioners, as well as for those with a general interest in this extremely important field of geoscience.

Martin Broderick

Golder Associates, Oxford

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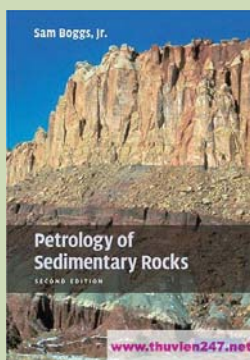
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Petrology of Sedimentary Rocks (Second Edition)

S Boggs Jr
Published by: Cambridge University Press
Publication date: 2009
ISBN: 978-0-521-89716-7 (hbk)
List price: £50.00 (also available as an e-book)
600 pp

www.cambridge.org

This book is the Second Edition of a text originally published by Macmillan in 1992. Like its predecessor, it focuses on the properties of sedimentary rocks rather than on sedimentary processes and modern sediments. As such, it is intended mainly for use by undergraduate and graduate geology students taking courses in sedimentary petrology, and by researchers and professional petroleum geoscientists who wish to develop an understanding of the petrographic characteristics of sedimentary rocks and their geological significance.

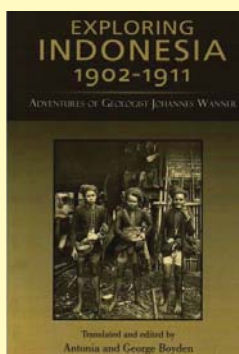
The new edition follows the same fundamental structure as the original, and has 13 chapters grouped into four parts. Part I, entitled *Principles* and consisting of a single chapter, provides a very brief summary (16 pages) of the origin, classification and occurrence of sedimentary rocks. Part II deals with siliciclastic rocks and contains chapters dealing with sedimentary textures, sedimentary structures, sandstones, conglomerates, mudstones and

shales, the provenance of siliciclastic sedimentary rocks, and diagenesis of sandstones and shales. Part III deals with carbonate rocks and contains chapters on limestones, dolomites and the diagenesis of carbonate rocks. Part IV consists of two chapters, one dealing with evaporites, cherts, ironstones and phosphorites, and the other with carbonaceous sedimentary rocks. Each chapter ends with a list of further reading. There is also an extensive reference list and a useful index at the end of the book.

Some of the original text and illustrative material has been re-used, but the discussion has been substantially modified to take account of new analytical techniques developed since the First Edition. However, there are no references to published work after 2006, and relatively few post-2004.

Overall, this book continues to provide a useful introduction to sedimentary petrology that complements the author's companion work *Principles of Sedimentology and Stratigraphy* (4th edition published by Pearson Prentice Hall in 2004). The text is generally well written and logically structured. There are numerous black and white line diagrams and photographs, although the information value of quite a number of the latter is limited by their small size (9cm x 6cm). No use is made of colour - a significant limitation in the case of many of the photomicrographs and some field photographs. However, the paper and print quality are good and the hardback edition offers very good value for money. The book should be an essential purchase for libraries in all higher education institutions offering geology courses, and for researchers and industry professionals with practical interests in sedimentary petrology.

Ken Pye
Kenneth Pye Associates Ltd



Exploring Indonesia 1902-1911: Adventures of geologist Johannes Wanner

(Translated and edited by) Antonia and George Boyden
Published by: Pen Press
Publication date: 2009
ISBN: 978-1-906710-71-2
List price: £9.99
128 pp

www.penpress.co.uk

Johannes Wanner was one of the giants of Indonesian geology. Not only did he make important contributions to our understanding of its regional and economic geology, but his extensive collections of Permian and Triassic fossils from Timor were key elements in the early recognition of the magnitude of the end-Permian extinction event. For all of these reasons, the diaries he kept during his three expeditions to the archipelago should make fascinating reading. Moreover, we are told, on the back cover of this translation, that it includes "moments of suspense and high drama as he encounters violent storms and hostile tribesmen, and in his terrifying fights for life in bouts of malaria and typhoid".

Unfortunately, the book rather fails to live up to the expectations raised. Whatever his merit as a palaeontologist, Wanner was no great hand at

setting a scene, painting a picture or describing an event. Suspense is notably lacking, and his various illnesses and setbacks are treated with a *sang-froid* that, while admirable and very much of its time, does not make for an exciting read. Much of the book is a litany: his having travelled here, waited there, and been impeded by swamps, sinking canoes and vicious insects somewhere else. Some of the events must have been truly horrifying, possibly terrifying; but it requires a real stretch of imagination to appreciate either. Nor is there much for the geologist, geological material having presumably been reserved for the author's many reports and monographs. All too typical is the entry in which Wanner notes that he "... came upon a geologist's paradise, and ... returned with our pack horses heavily loaded with fossils", without indicating in any way what those fossils might have been.

Historically, the book provides a few interesting insights. The brief mention of fighting between the Dutch and Portuguese in Timor testifies to what must have been one of the 20th Century's least known wars. The brevity of effective Dutch rule in many parts of its Indonesian empire is also emphasised. A mere 30 years elapsed between Wanner's final expedition, when Aceh, the interior of Borneo (where head-hunting was evidently commonplace) and much of the east were still virtually uncontrolled, and the loss of the entire area to the Japanese in World War II. As a result, conditions on some of the islands in the 1970s differed little from those recorded by Wanner. There is interest here, but perhaps chiefly for those that have followed the same paths in more recent decades.

John Milsom

Letters

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

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

Unsafe practice

From Alan Edwards (Rec'd 23, Pub'd 24 September 2009)

Sir, My comments relate to a picture that was presented as part of the article *Harappan Collapse*, (*Geoscientist* 19.9). The picture shows members of the field team at the bottom of a deep trial pit with bystanders sitting around the edge of the pit.

I work for an environmental consultancy and we spend considerable time and effort educating/supporting our employees (many of whom are geologists/hydrogeologists) to be safe when carrying out field work. Being buried is one of the greatest risks facing a field geologist (from stock piles, collapsing trial pits etc) and I can't help but think that it was totally irresponsible to show two members of the field team carrying out field work within an unsupported deep trial pit. Junior geologists or geologists who don't know any better may look at this picture and assume that this is the way that things are done. It is particularly inappropriate given that a young geologist was killed last year in the Cotswolds after being buried in an unsupported trial pit.

I am sure you will agree that we need to promote health and safety and to ensure that geologists/hydrogeologists don't endanger themselves or others. *Geoscientist* has a particular responsibility in this matter as it is distributed throughout the professional community.

Editor writes: Alan is quite right - I have now added a safety warning to the caption on the online version.

Cores undervalued?

From Robert Leppard (Rec'd & Pub'd 23 September 2009)

Sir, The British Geological Survey (BGS) stores one cut of all offshore and onshore cores drilled in and around the UK. Offshore cores are stored in Edinburgh in a high-quality, secure store whose facilities have been upgraded over the years to provide three large inspection rooms which can be opened up to produce one large area that is ideal for core workshops. There is enough spare capacity to accommodate new cores and cuttings for the next 30 to 35 years. Onshore cores are stored at Keyworth, near Nottingham. Current users of the Edinburgh facility are happy with the location and quality of service. Edinburgh is a capital city with an excellent transport network of flights, trains, taxis and buses together with an outstanding choice of accommodation, restaurants and evening entertainment.

On 10 August BGS were granted planning permission to build an extension to their storage facility at Keyworth and a press release issued (www.bgs.ac.uk/news/NEWS/gilmerton_consolidation.pdf). Once the extension has been constructed they will move all the offshore cores from Edinburgh to the new facility during 2010. The extension, transport etc. will cost taxpayers several million pounds.

The reason for moving approximately one million feet of core in 175,000 boxes from Scotland to England is to have all the onshore and offshore cores under one roof for the good of the science, although it would be very rare for anyone to want to view both onshore and offshore cores at the same time. Access to the core will become problematic for users as Keyworth is 16.5 miles from East Midlands airport which is served by a few flights per day from Aberdeen; but for visitors from other destinations it is likely to mean a long drive, or train and taxi. It would be better were they not moved in the first place.

Dr John Ludden, BGS Executive Director, has written elsewhere* that the BGS instructed independent consultants Tribal Group to undertake a review of all its information management facilities, during which consultations were held, including with the Society. Stakeholders were asked to comment on new possible storage options, including re-locating the existing Scottish facilities to Keyworth. Concerns were expressed that such a move would put further distance between the UKCS data/collections and the hydrocarbons industry users. However usage analysis of Gilmerton store showed that only 25% of visits were made by users based in Scotland and that the remaining 75% had had to travel from various parts of England, Wales and abroad.

* *PESGB Newsletter, October 09*

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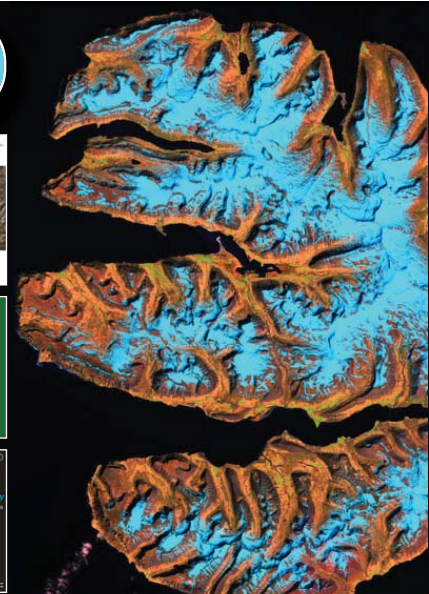
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IN *Brief*

Ussher a new era

The Ussher Society, named after the geologist W A E Ussher, was formed in 1962 and promotes geoscience research in South West of England and related areas. The Society publishes the annual double refereed journal *Geoscience in South-West England*, which includes papers on geology, geomorphology, engineering and environmental geology. The archive of back issues is a substantial resource covering much of the geoscience research undertaken in the region over the last fifty years. The Society is happy to announce that all of the papers published between 1962 and 2002 are now freely available to download in pdf from its website. More recent papers are available free to members of the Society. The next Annual Conference is in Plymouth between the 3rd and the sixth of January 2010, and generous financial support is available to students who present new research results relating to the SW region. See www.ussher.org.uk for details. *Duncan Pirrie*

Hot potato

Geologists often get brought “strange objects” – most of which turn out to be not strange at all. However...

Joe McCall writes: A friend recently brought to me a strange pebble, picked up near Germany's border with the Netherlands. It consisted of a flat, tabular core of brown flint, about two centimetres long, surrounded by black flint. The core was probably not an artefact and the assemblage likely represented a two-stage concretion, originally within chalk, but later tumbled in a river. So far, so ordinary.

However, Eric Robinson adds an interesting historical postscript. During the first World War, the Germans used such black flints to construct pill-boxes on the Western Front. Such black flints come from the Rhine system; the Scheldt system (in Belgium) does not carry them. This gave rise to doubts about the supposed neutrality of the Netherlands. True, they might have been sourced from the German stretches of the Rhine, but would the Germans transport aggregates over such large distances to the front? Could the flints have been purchased from the “neutral” Netherlands?

North Sea bares teeth



Fossilized shark teeth reveal a fresher, more isolated Paleogene North Sea, writes Sarah Day.

A team of German and British scientists has used fossilised shark teeth to reconstruct the climate of the North Sea during the Palaeogene period, between 40 and 60 million years ago. The results suggest that the North Sea was for a brief period isolated from surrounding oceans, resulting in surface-water freshening and a significant reduction in the diversity of life.

The Paleogene was a time when greenhouse conditions prevailed and mammals began to diversify in the wake of the mass extinction event that saw the demise of the dinosaurs, along with 65% of all species. It also featured a brief episode of global warming known as the Paleocene-Eocene thermal maximum (PETM), a rapid climatic disturbance that saw temperatures rise by around six degrees in a 20,000 year period.


While scientists already have a lot of information about the climate on land and in open water during the period, very little has previously been known about the climate of marginal seas like the North Sea. The researchers used oxygen isotope data obtained from shark teeth recovered from the London and Hampshire basins, as well as sites in Denmark, Belgium, the Netherlands and Sweden. They cover a 33 million year period during the Paleocene-Eocene epochs, representing both shallow and deeper water depths.

Sharks shed their teeth continually throughout their lives, and so are relatively abundant in the fossil record. Often they are the only part of a shark to be fossilised, with specimens from as far back as 450 million years ago having been discovered.

When the teeth grow, their oxygen isotope ratio mirrors that of the sea water in which their owners are swimming, so fossilised teeth can be used as a record of palaeo-temperature. Warmer seas contain more of the heavier isotope, 18O, as it is easier for the lighter 16O to be removed by evaporation. The isotopes are also used to indicate the salinity of water, as the water becomes more salty with increased evaporation.

Results indicate that the North Sea was once far less salty than it is today. For a period of between two and four million years, the ratio of 18O to 16O was a substantially lower than the average for sea waters of that period, with the value lower even than some contemporary freshwater lakes.

The period of surface water freshening began close to the PETM. At this time, around 55 million years ago, relative sea-level fall, tectonic uplift and volcanic activity meant that the North Sea was temporarily isolated from surrounding oceans. Tectonic uplift raised Western Scotland by around 2-3 km, causing a land bridge to form between the Faeroe-Shetland and Rockall basins.

With circulation between the North Sea and the North Atlantic Ocean restricted, the waters of the North Sea became significantly fresher. This freshening increased as rivers and precipitation flowed into the isolated North Sea. The result was a significant drop in the diversity of life, with the foraminifera being particularly affected. 

The results of the research were published in the September issue of the *Journal of the Geological Society*.

Pacific rise

In answer to the criticisms of James and Lorente (Geoscientist 19.9), Iain Neill sets out the stall for the widely-accepted “Pacific Origin Paradigm” model for the origin of the Caribbean Plate.*

Pro-POP – some of the fundamental concepts^{1,2,3}

- Andean/Cordilleran arc history due to Pacific subduction and the presence of passive Atlantic margins indicate that the Americas have moved westwards in the mantle reference frame during the Atlantic opening history. Lesser Antillean subduction can only be explained by the *relative* eastward movement of the Caribbean plate with respect to the Americas. Arc magmatism has been more or less continuous with a westward-dipping subduction zone, for the last ~85 Ma⁴ ~125 Ma^{3,5}, even ~130+ Ma. Assuming 125 Ma of westwards subduction at a reasonably slow rate (say 2 cm/yr) the leading edge of the Caribbean plate will have originated 2500 km westward of its present location – that is, in the Pacific.
- Plate motion determinations for the Caribbean and North and South America indicate the Americas did not split until ~160 Ma and the present day Caribbean plate does not fit into the space available geometrically during the Jurassic-Cretaceous.^{3,5}
- Most sedimentary successions in in-situ Caribbean margins do not show any evidence of island arc-related tuffs deposited during the Early Cretaceous, when the Caribbean island arc system was very much active. So the arc was hundreds, nay thousands of kilometres distant - in the Pacific.
- Pacific and Tethyan faunal successions merged only during the late Cretaceous, indicating that the two seaways were previously separate. We should expect to find Tethyan fauna in the older marine sediments of the Caribbean had it been formed “in situ”.
- Seismic tomography actually images the Atlantic slab descending beneath the Caribbean plate - confirming at least 1500km of subduction, and therefore eastward displacement, of the Caribbean plate through time⁶.

The “Origin of the Caribbean Plate” meeting at Sigüenza in 2006 should have been the final resting place of the “in situ” model of the Caribbean. The POP is over two decades old. It is a well established, tested model with more arguments in favour than space allows. I have outlined just five general pro-POP arguments in the box, and will respond in summary to James and Lorente’s article by challenging first their reading of the POP, and second their “in situ” interpretation of existing data.

Understanding the POP

In their provocative piece *POP goes the paradigm?* (*Geoscientist* 19.9 pp 12-14: see their Figure 2) James and Lorente argue that the “Great Arc” of the Caribbean bends and lengthens “impossibly” in Pacific Origin models. We know that the arc has a long and complex history passing through oblique extension, collision, obduction, rotation, even polarity reversal. At a glance, what James and Lorente mark as “the Arc” is not telling the full story and their objection does not consider the numerous geological processes capable of occurring to change the surface shape of the arc.

On their Figure 3, magnetic lineations are marked in the Venezuelan basin. This basin is largely covered by the Caribbean Oceanic Plateau, and these lineations do not exist in anyone else’s model, POP or otherwise. Occam’s razor suggests that James misinterprets, or over-interprets the data.

The authors’ description (p 13) of the POP is factually incorrect in places and seems to rely upon the “traditional” view of Burke, (1988)⁷. Many recent models (e.g. Pindell et al., in ³⁵) do not necessarily accept that the oceanic plateau collided with an arc, causing polarity reversal. So here it would seem that James and Lorente choose to ignore half the literature. It is vital, in proposing an alternative model to any theory, that the protagonists are up to date, in detail, with what they are fighting. Furthermore, it is now becoming established that the Caribbean Oceanic Plateau cannot be formed above a slab gap.⁸

The “in situ” model’s interpretations of seismic lines (page 14 of the printed article) prompt me to ask how a salt diapir can possibly protrude a substantial distance above the sea floor when it would surely either dissolve or spread out. Such structures are more likely seamounts. In erroneously suggesting the presence of salt in the Venezuelan basin, the conclusion they then make, that much of the basin represents continental crust, is no longer valid.

Interpretations of existing data

As for James and Lorente’s alternative interpretations of the known geology, I would make the following points.

1. Crust of 45km thickness does not necessarily indicate continental material. Data suggest the presence of arc roots, but not necessarily continental crust, in the Caribbean plate. Average continental crust is intermediate in composition, so are mature oceanic arcs. Gravity cannot distinguish the two. Understanding geochemistry is vital in this respect. High silica does not indicate continental rocks. Crystal fractionation from a basaltic melt and crustal re-melting generate high silica contents in an intra-oceanic setting and are extremely common processes. The trace element and isotopic record from the Oceanic Plateau and arcs, through dozens upon dozens of publications, shows that there is little continental material beneath the Caribbean Plate. Salt diapirs are not present.
2. The authors appear to argue for punctuated phases of extension from the Triassic through to the Oligocene. Broadly extensional tectonics lasting up to 170 Ma seems geologically unfeasible and certainly cannot account for the formation of the Oceanic Plateau. Accepting that renders much of the discussion that follows irrelevant.



Author finds fault. All photos: Iain Neill

3. In paragraph 4 (page 14) the authors argue that the Caribbean Plateau formed by “serpentinization of the mantle”. However, in reality, we know - from geochemical and isotopic investigations of extensive land and a number of offshore samples - that it could *only* have formed in a short space of time by the impingement of a hot mantle plume beneath the Caribbean lithosphere. James and Lorente may argue that little of the Plateau has been drilled to work out exactly what it is. I hold my hand up: I would love to see more samples, but everything we have today fails to counter a Pacific origin model.
4. James and Lorente suggest that mid, late Cretaceous and mid Eocene unconformities are present in the Caribbean. Convergent events are not correlated across the region and I suspect their contention is a generalisation. A pause in volcanic events certainly doesn’t ring true for the Cretaceous period; the Caribbean arc successions were active throughout.
5. There is no evidence in the geochemical or isotopic record for significant continental input into the Caribbean arc(s) during their early history. Why then should continental input appear at an arbitrary point during the middle of the history of the arc, if continental material was always present in the Caribbean region? The change from island arc tholeiite to calc-alkaline compositions reflects changing sediment input and arc maturity.

6. The authors speak of back-arc spreading occurring along the Aves Ridge. The Aves Ridge is an extinct island arc - I have the geochemical data to prove it. Geophysical surveys point to thicker, arc-like crust. Hence I presume this is a mistake on the authors' part.

James and Lorente suggest that our chemical and isotopic data need to be completely re-examined and "statistically tested". It is over this point that I take particular umbrage. Geochemists are examining and re-interpreting their data all the time, whatever model is presumed. I cannot accept the trashing of over four decades of good geological practice in the Caribbean.

I would readily admit that the Caribbean community has faced challenges regarding the exact details of the POP, challenges that are being ironed out as new information becomes available. Any model is allowed to evolve. However, James and Lorente suggest that the POP model invokes processes that are difficult to explain or test. We *are* explaining, we *are* testing. I simply do not recognise their argument, especially as the "in situ" model in itself breaks so many fundamental geological and especially geochemical concepts.

The positive upshot from the Sigüenza meeting is that there are a number of cracking articles which will appear in Special Publication 328. Research in the Caribbean has moved far beyond the objections raised by James and Lorente. Let the "in situ" model rest in peace. ☪

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* Iain Neill BSc FGS, Postgraduate Student, School of Earth & Ocean Sciences, Cardiff University, Main Building, Park Place, Cardiff, CF10 3YE, Wales. Co-convenor of "Circum-Caribbean and North Andean tectonomagmatic evolution," a workshop in Cardiff, 2-4 September, 2009.



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Oceans and Climates

This series is a programme of 6 regionally-based lectures which will run November 2009 to March 2010 at approximately fortnightly intervals, and the umbrella theme for this is Oceans and Climates.

The programme, with lecture locations, speakers and the title of their talk is below and comprises established international speakers. Students will receive priority places, but we will also welcome anyone with an interest in Earth-science, so please contact us for further information if you would like to attend.

The lectures will begin at 5.30pm and last for about an hour. This will be followed by a reception which will enable those attending to meet the speaker and other members of the diverse audience. The lectures are free of charge to attend, but are by ticket only. We will assist students with any related travel costs - please get in touch with us to enquire about this.

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DATE	TOPIC	SPEAKER	HOST UNIVERSITY
18 November	Ocean Circulation and Climate	Helen Johnson, University of Oxford	Bristol
2 December	Reconstructing the history of the Antarctic ice sheet: Clues from the past for the future	Tina van de Flierdt, Imperial College London	Birmingham
3 February	Disposing of fossil fuel CO ₂ : A test of our understanding of Oceans and Climates	Andy Ridgwell, University of Bristol	Oxford
17 February	Palaeo-perspectives on Human-Climate-Environment Interactions	David Hodell, University of Cambridge	Manchester
3 March	Corals, sea level and climate reconstruction	Sandy Tudhope, University of Edinburgh	Durham
17 March	TBC	Peter Nederhof, Shell	Aberdeen

For further information please contact:
Alys Hilbourne, Geological Society, Burlington House, London.
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The
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The "Star of Tanzania"

*Alan Wright**
investigates the
biggest ruby
porphyroblasts you're
ever likely to see...

Anyone keeping up with the financial pages of the national press recently (and who isn't these days?) may have been intrigued to read a story about a very large ruby, said to be worth £11 million, which was a major "asset" of Wrekin Construction when it went into administration earlier this year.[#] Given an exotic name the "Star of Tanzania" and the huge valuation, it was nonetheless pictured as a large, undistinguished red lump, 13cm across. The valuation was said to be an estimate of the value of gems that might be cut from it. If you wondered how it comes about that large rubies the size and appearance of house-bricks come to be lying about in Tanzania, I will try to explain.

When I was working in the Petrology Lab. of the Tanganyika Geological Survey (1957-60) one of the most interesting investigations John Harpum and I had to make was on a zoisite-corundum rock from the Merkerstein area of Northern Tanganyika. Two very large fragments of ruby are in the collections (fragments of single crystals approx. 13cm x 12cm x 11cm) found in the same localities as the zoisite-corundum rock. It seems highly likely that the "Star of Tanzania" comes from the same deposit.

So how do such rubies come to be formed? The zoisite-corundum rock is a remarkable deposit, possibly unique to the Merkerstein area (about 50 miles WNW of Kilimanjaro) of Tanganyika. Outcrops of the rock are spread over an area of roughly 400sq. miles set in granitic gneisses. Only reconnaissance mapping of the area had

Pressures beyond rubies

been done at that time, but they seem to occur in a series of metamorphosed basic igneous plutonic rocks.

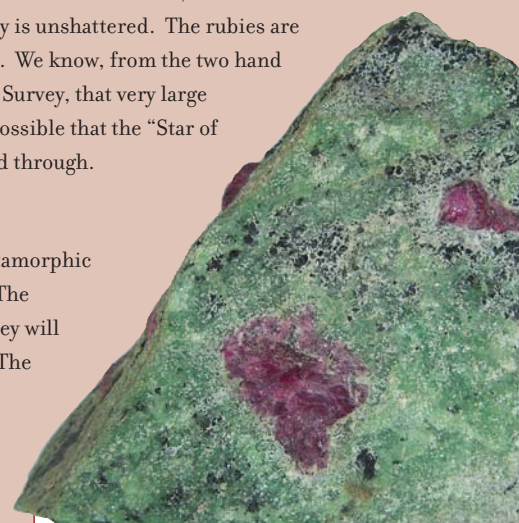
The ruby occurs as euhedral porphyroblasts in a rock made up largely of apple green chromiferous zoisite with a dark green edenitic hornblende. The red colour of the ruby and the green of the zoisite are due to the presence of chromium. The rock had already attracted the attention of mineralogists at the British Museum and the zoisite had been described by P M Game (in 1954). He also noted that the small amounts of plagioclase present were unusually anorthite rich (An_{97} , from its optical properties). I subsequently confirmed this by XRF analysis at Birmingham University, when I analysed the individual minerals in order to determine their trace elements. The chromium contents of the three major minerals, were found to be: ruby 4500ppm; zoisite 2200ppm and hornblende 5500ppm.

We were able to make thin sections of a wide variety of these rocks, and the ruby shows several interesting properties. It quite often had concentric colour zoning and lamellar twinning, gave a red fluorescence under ultraviolet light and, most unusually, was strongly triboluminescent, which is to say it gave a bright red flash when hit with a hammer. Surely not many mineralogists ever come across rubies large enough to try this experiment! (We were forced to hit it with a hammer, to get a fragment for chemical analysis, since corundum is so hard that our normal cutting wheels made very little impression on it.) The normal porphyroblasts are still of substantial size and are platy rather than the normal barrel shape. The platy form, though, has nothing to do with the metamorphic foliation as the rubies lie across it at almost any angle.

The zoisite-corundum rock was given the name "Anyolite" from the Masai word for green. It is a most unusual and attractive rock, sometimes called Tanganyika Artstone in an attempt to create a market for it as decorative stone. The rubies in it, although a very good, deep red colour, are not of gem quality, as all the corundum shatters into small fragments. However some gem-quality rubies were won from the area, so it seems that there are pockets of rock where the ruby is unshattered. The rubies are always at least a few centimetres in size. We know, from the two hand specimens in the Tanganyika Geological Survey, that very large crystals are found in that area; so it is possible that the "Star of Tanzania" is of gem quality through and through.

The origin of Anyolite

In order for corundum to grow in a metamorphic rock, it has to be very rich in alumina. The commonest such rocks are clays, but they will not normally have chromium in them. The presence of chromium in all the major minerals suggests a basic igneous parent, and the basic igneous rock with the highest alumina is anorthosite (which is composed entirely of calcic plagioclase). Large layered basic intrusives with abundant anorthosite and chromitite layers were



Anyolite from the Merkerstein area of Northern Tanganyika. A green zoisite, red ruby corundum and very dark green hornblende. The cut side of the specimen is 11cm long.



This view shows the foliation of the zoisite and hornblende and the cross-cutting nature of the rhyolite porphyroblasts; also an unusual cross-twin.

commonly developed in Archaean times in most ancient shields. The rocks most closely similar to anorthite occur in Madagascar² and Madras³ although not with quite such extreme chemistry. Both areas have corundum and other alumina rich minerals in metamorphosed anorthosites from layered basic intrusions.

Readers who remember their first-year mineralogy may recall that zoisite is a metamorphic proxy for anorthite, the calcic end-member of plagioclase. Game³ recognised that the plagioclase remaining in the rock is one of the most anorthite rich examples found, until that time, in nature. Zoisite is, however much denser than plagioclase, and Game's determination was 3.36. (It is of interest that the original zoisite from Zoissa, Carinthia comes from an eclogite). The other two major minerals rhyolite (3.85) and the hornblende (3.13) are also very dense, suggesting that this rock was metamorphosed at very high pressure. To develop an excess of alumina, from an original anorthosite, the rocks must have been desilicated. It is also likely that they have lost soda, as the only soda bearing mineral now is the hornblende with only 2.38%. It is therefore postulated that the formation of migmatitic granites, by partial melting of the country rocks, resulted in the abstraction of silica and soda from anorthosite layers in the basic igneous complexes, giving rise to the zoisite and rhyolite-rich rocks.

So igneous differentiation of a basic igneous magma, followed by metamorphic differentiation, then elevation to eclogite facies finally resulted in the crystallisation of this very pretty, and perhaps very valuable, rock. The reason for the enormous size of the rhyolite porphyroblasts, however, remains as much a mystery as the source of its original £11m valuation... ☞

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* Alan Wright retired some aeons ago but is still Honorary (i.e. unpaid) Research Fellow at Birmingham University.

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More recent news (October 1) suggests that the "Star" may in fact be worth about £100.



DARWIN THE GEOLOGIST: HIS LEGACY

23 November 2009

The Geological Society, Burlington House



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

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

FOR FURTHER DETAILS CONTACT: ALYS HILBOURNE
The Geological Society, Burlington House, Piccadilly, London, W1J 0BG
Tel: 020 7432 0981; Email: alys.hilbourne@geolsoc.org.uk
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The Geological Society Careers Day 2009



Wednesday 25 November 2009
East Midlands Conference Centre, Nottingham.

Careers Day is for Geoscience undergraduates and postgraduates to find out about the latest career developments and opportunities.

The day will run from 10.00am - 15.00pm followed by a beer reception, and will include presentations and an exhibition fair.

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ende.



A filling for

Nottingham's troglodyte caves add interest and beauty to D H Lawrence's "dismal town". On the other hand, they bring many structural and geotechnical problems. Andrew J Brown tells us how he gave a Nottingham dentist a taste of his own medicine...

Figure 1



the dentist

Introduction

Members of the public walk around the city centre of Nottingham blissfully unaware of the rocks upon which the buildings around them are founded. Various outcrops located around Nottingham show that the city centre is underlain by the Triassic Nottingham Castle Sandstone, and as the name would suggest the primary reference location for this stratum is Nottingham Castle itself – beneath whose walls many troglodytic excavations have, over past centuries, been dug.

During 2007, a dental practitioner discovered a problem in the basement of his dental practice which required a special kind of surgery. This highlighted some contradictory features associated with the Nottingham Castle Sandstone - principally concerning the formation's strength and fracture frequency.

The sandstone, taken '*en masse*', is a competent rock. Despite the fact that the upper unweathered horizons can be readily excavated without the requirement for rock breakers, bearing pressures within the formation can range between 400kPa and 2000kPa¹. This competency can be attributed to the stratum's apparent lack of fractures. While relatively closely-spaced joint sets can be viewed on the escarpment west of the Castle, fractures are generally widely spaced, and are not as common throughout the formation as might be anticipated.

Under the microscope, however, we see a completely different picture, the formation's upper sections exhibiting a notable lack of cement. Under the electron microscope, the predominant

mineral components (quartz grains) are not 'bound' together. Any cement within the formation consists mainly of calcite, which through the percolation of groundwater over the last 250 million years has been leached out. This is not surprising, given that the formation is a sub-division of the largest major aquifer in the UK (namely, the Sherwood Sandstone Group, Lower and Middle Triassic). Groundwater is therefore a common feature. The calcite that has been dissolved out tends to have been transported downwards and redeposited closer to the base of the formation.

Softness, combined with the lack of fractures has, particularly from the 16th through 19th centuries, provided ideal conditions for cave excavation, and numerous examples of troglodyte dwellings still exist in Nottingham City Centre – many still in day-to-day use (see map). These are often located at very shallow depths below rock-head. The only physical controls over the location of these caves are the presence or absence of groundwater, and roof stability. At shallow depths the maximum possible roof span is about five metres.

The dental practice is situated about one kilometre west of Nottingham City Centre, and 500m north of Nottingham Castle. The basement of the structure housing the practice comprises a cave excavated into the sandstone bedrock. Excavation marks on the faces surrounding the fissure show that the cave was hand-dug with metal



Figure 3

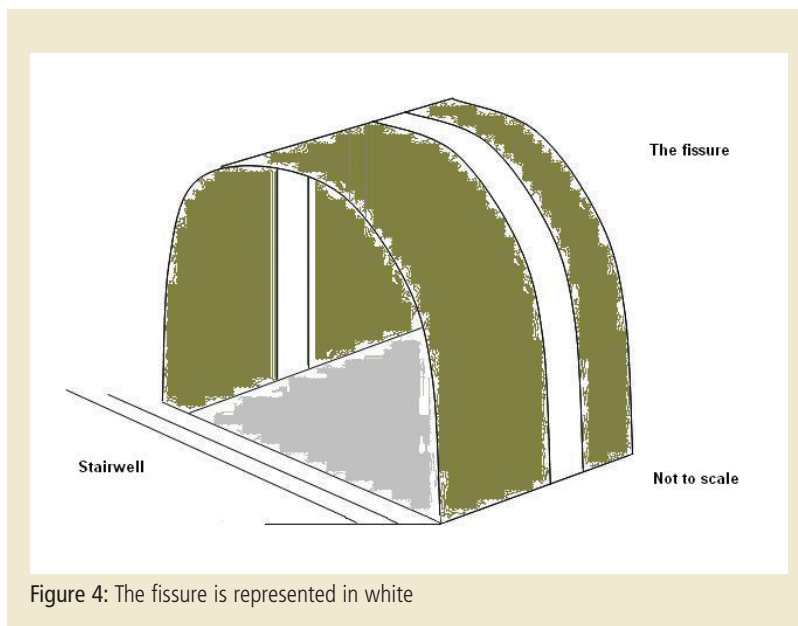


Figure 4: The fissure is represented in white

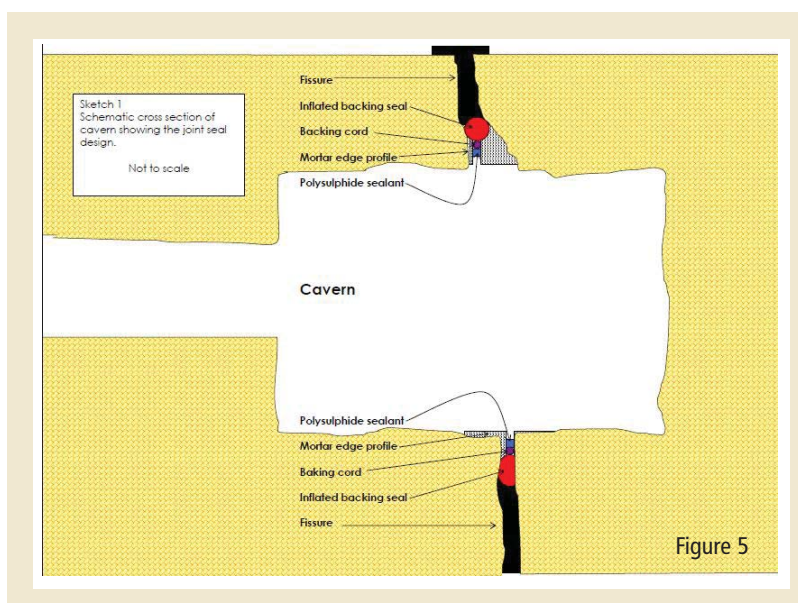
tools. While many of Nottingham's caves date back to pre-mediaeval times, the cave in question was excavated in the 19th Century, and probably over 150 years ago. It is located beneath a two-storey Georgian townhouse, approximately 3.5 - 4m below street level. It is mainly used for storage, in addition to housing two small compressors used by the dental practice.

During the summer of 2007, heavy rainfall inundated the grey-water storage system used at the practice, causing a leak that transported water *outside* a drainage pipe positioned vertically through the sandstone beneath the practice. Inspecting the cave after the heavy rainfall, the dentist discovered that a large fissure had developed.

Send for a geologist

Upon discovery of the problem, a consulting engineer was called out to make an inspection and identify the risks in, and possible solutions to, this unusual problem. In late June 2007 the fissure was at least 150mm wide and opened to a maximum height of 1.70m into the cave roof. Parts of the footings of the townhouse above were exposed in the top of the fissure.

The fissure trended approximately north-south. This tied in well with the overall joint/fracture system in the Nottingham Castle Sandstone, which runs roughly NNE-SSW in the cliffs on which Nottingham Castle is built². All the evidence indicated



that we were dealing with a pre-existing fracture that had been subsequently infilled by soft sediment in more recent geological times.

So what to do? If the fissure were left untreated, clearly the townhouse would be living on borrowed time. Rapid cave collapse is not uncommon in Nottingham City Centre and when failures do occur they generally do so without warning. Ultimately the costs of resolving such an issue are far lower than those of catastrophic failure, and after much consultation the dental practice opted to remediate the fissure. Given the various spatial constraints on the job, we saw immediately that this would not be an easy task.

By late summer 2008 the consulting engineers had devised a remedial solution and a contractor had been engaged to install it. The design solution advocated (picture) would take five days to complete. The sectional diagram (Fig 5) presents a view looking downwards from the cave roof, showing how we intended to infill the fissure using a medium that could be then be injected with an expanding resin.

The black medium seen in the picture is a 2mm-thick rubber sock, specially fabricated for this job and fitted with two valves (top and bottom). The sock needed two valves for two reasons - to ensure that the resin could be injected into the sock, and to ensure adequate compression was achieved.

The first step was to ensure that the sock was firmly bound to the rock. This was achieved by buttering the faces with an epoxy resin, which was left to cure. After curing the sock was filled with a polyurethane resin, ensuring that maximum compression was achieved between the sock and the adjacent stratum. The elastic properties of the polyurethane would ensure that the remedial solution would be able to cope with any movements within the fissure up to 12.5mm in any direction.

The main design challenge was to maintain support to the foundation loading, while coping with the compressive and tensile forces generated by lateral movement of the fissure sides. Small vertical shear movements would also have to be accommodated by the remedial solution. Once or twice, the sock became over-filled with resin - which resulted bursts exposing the resin within. Luckily, these were confined to the southern part of the fissure and were remediated by filling behind the backing seal with mortar.



Figure 6: The fissure is 150mm wide at this point

This backing seal was inserted across the whole of the fissure and ensured that the resin was in compression across all axes. The mouth of the fissure could then be filled primarily with a cementitious mortar, with a polystyrene board being used as formwork. The final step was to fill the gap left by the formwork with a polysulphide sealant, to ensure that the fissure was waterproof. ☞

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www.opusjoynespike.co.uk; www.opusinternational.co.uk

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1. BGS Technical report WA/90/1
2. www.emgs.org.uk/files/publications/castlerock.htm

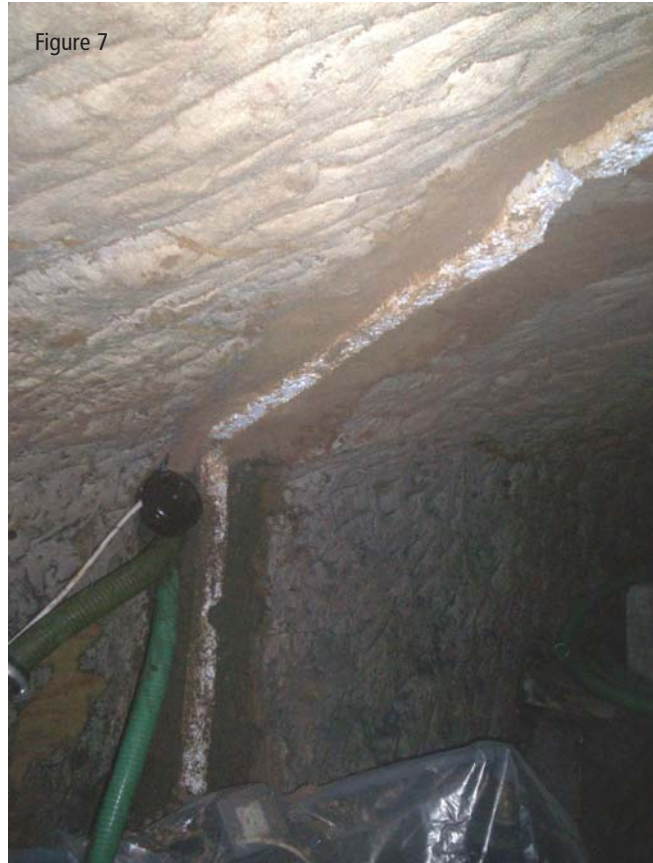


Figure 7



Figure 8: The width of the sealant is approximately 70mm

Election of Fellows

The following names will be put forward for election to Fellowship at the Ordinary General Meeting to be held on 25 November 2009.

ADAMS, Gregory Thomas; ANTHONY, Adam; BEALE, Maria; BERRYMAN, Christopher James; BLOOR, Daniel James; BONNARD, Pierre; BROOK, Anthony James; BOWDEN, Bryan; BOWDEN, Peter; BROWN, Kevin; CHEUNG, Wai Ming; CLARKE, Huw William Robert; COPLEY, Matthew; CROSSLEY, Laura Kate; CURINI, Andrea; DAN, Gabriela; DECKER, John; DURPE, Sigfrid Christophe Gerard; EVANS, John Walter; GALLAGHER, Liam Thomas; GODDARD, Oliver James; GORDON, Sarah Helen; GRAFEN GREANEY, Robert Galliano; GREEN, Damian Charles; HARPER, Nicholas Philip John; HOUGHTON, Donald Andrew; HUDSON, Thomas William; ILOUGA, Dieudonné Charles Tsidore; JONES, David William; KEAN, Oliver; KALIN, Robert M; LEECH, Jon Adam; MAGEE, Craig; McCORMACK, Niall James; McGEE, Kevin; NEUMAYER, Petra; PASCALL, Joanne; PHILIP, Lendyn Marcus; POLLARD, Tracey Emma; ROSEVEARE, Martin James; SCRIVENS, Christopher; SHAW, Alexander Iain; SHEEHAN, Gerrard N; SHEFFIELD, Cameron Kyle; SHILLITTO, David; SIDHU, Jasveen Kaur; SMITH, Reginald; STODGELL, Daniel John; TAM, Ka Wai Janice; TUSCU VURAL, Bahar; VAROL, Denise Melika Surreyya; WATERFALL, Elizabeth; WILLIS, Michael; YAU, Wai Yin; YORSTON, Christopher Jon.

Changes to terms and conditions

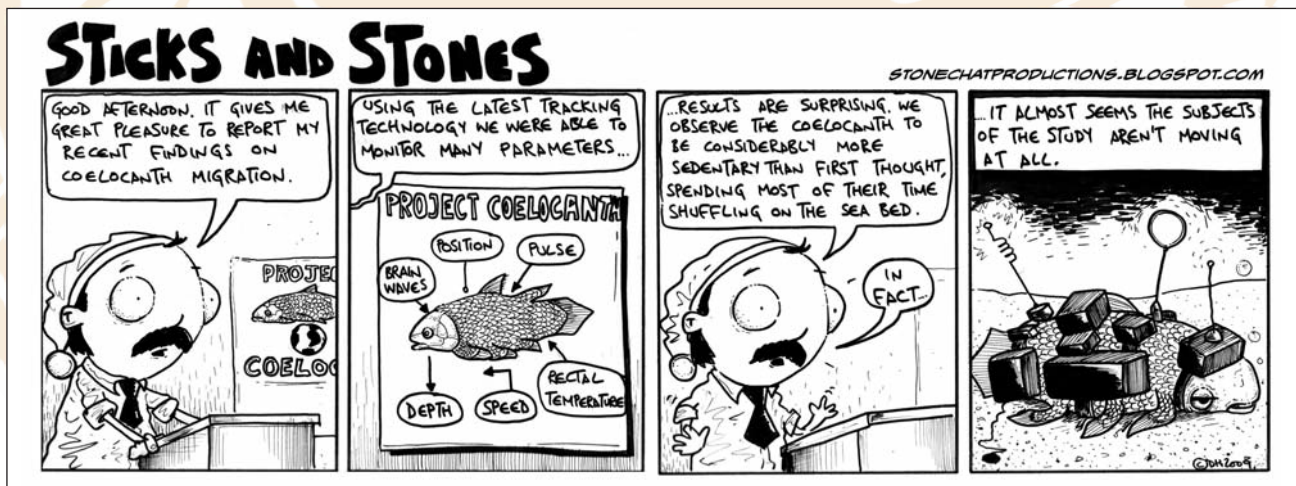
Those wishing to receive a printed journal of their choice next year will have to pay an extra £10 for the privilege. The Executive Secretary explains why the Society has moved to "online only" access.

As those who attended the AGM on 3 June this year will know, on the recommendation of Council the meeting agreed to freeze Fellowship fees for most categories in 2010, to assist Fellows as much as possible during the current economic downturn.

At the meeting it was reported that in the light of the overall financial position of the Society Council has decided to introduce a £10 supplement that would be payable by any Fellow wishing to continue to receive a printed version of their journal of choice (**not** *Geoscientist*, which will continue to arrive in print on all Fellows' doormats). Fellows will notice, therefore, that the 2010 standard Fellowship subscription will cover online access to journals only. The intention to introduce a supplementary charge for journal hard copies drew no adverse comment at the AGM.

The impact of these difficult economic times is being felt by us all – by the Society, as much as by our Fellows as individuals. The reduction in our expected income in 2010 means that we must take early action now to control our costs – while at the same time offering an affordable Fellowship fee. The cost of printing and posting paper journals to Fellows constitutes a considerable expense and is an obvious area for cost-saving, particularly as many Fellows have made it clear over the years that they find the compulsory delivery of a paper journal oppressive. These measures will allow us to protect our continued investment in young researchers through our Research Grants (see below) and our commitment to maintaining the Society as a world-class geological information resource.

Council has taken the view that now is the right time to adopt a more environmentally sensitive approach to journal circulation. Most other publishers have reached similar decisions, and are now moving towards the adoption of "online as standard". Council believes that most Fellows will be happy to receive online-only access. Council also believes it is only fair that those still wishing to receive a print copy should pay part of the cost of doing so. *Edmund Nickless*



Society Research Funds!

The 2010 round of Society Research Funds is now open for applications. Applications for support from any of the Society funds must be made on the appropriate form, which can be downloaded from the Society Awards and Research Grants page on the website - www.geolsoc.org.uk/grants.

The form must be completed in full and accompanied by two letters of support from Fellows of the Society. Please send to the Awards Secretary at the Geological Society. Applications and supporting documents should reach the Society no later than **1 February**. The average award has been about £1000.

Mike Coward Fund

For fieldwork in structural geology as applied to regional tectonics.

William George Fearnside's Fund

To advance geological science.

Edmund Johnson Garwood Fund

For the encouragement of research in stratigraphy, with palaeontology, and in physical geology. Must be between 28 and 51 years of age.

Gloyne Outdoor Geological Research Fund

For the prosecution of outdoor research preferentially of a palaeontological or stratigraphical character, and preferentially within the limits of the British Commonwealth.

Annie Greenly Fund

For detailed geological mapping.

Timothy Jefferson Field Research Fund

Must be under 28 years of age; for a field project for research in Earth science. Not for military activity or development.

Elsbeth Matthews Fund

For members of the Society for geological field-based research anywhere in the world. Preference for those under 30 years of age.

Daniel Pidgeon Fund

To promote geological original research. Must not be more than 28 years of age.

Jeremy Willson Charitable Trust

The Jeremy Willson Charitable Trust, and the Willson family, generously supports the Geological Society Grants programme, in memory of their son and brother, Jeremy Willson.

Jeremy was a great athlete, geologist and adventurer. He sadly died of new variant Creutzfeldt-Jakob Disease (vCJD) in March 2006. In the spirit of Jeremy's interests, the Jeremy Willson Award supports field-based projects with a distinct focus on the physical environment. To find out more visit www.jwct.org.uk.

Joseph Burr Tyrrell Fund

To assist geologists of Great Britain and Ireland to travel to and in Canada; or to assist in the publication of meritorious papers by geologists of Great Britain and Ireland upon the geology of Canada; or to assist such geologists in any other way best adapted to further this object.

Distinguished Geologists' Memorial Fund

To a geologist under the age of 30; in the form of travel bursaries to enable recipients to broaden their experience and for professional development.

Challenged by Carbon



Dr Bryan Lovell, President Designate

*Lecture and discussion,
Burlington House, 17.30,
Wednesday
25 November
2009*

Is there a low-carbon future for the oil industry? As the debate over climate change evolves, can the oil industry be saviours rather than villains, through the capture and underground storage of carbon dioxide? Challenging the prejudices of both environmentalists and the oil industry, Bryan Lovell will speak to a mixed audience of policy-makers, oil industry figures and others, on the subject of his recently published book 'Challenged by Carbon: The Oil Industry and Climate Change'. The talk will be followed by a short debate, and an opportunity for informal conversation with the author and other guests. If you would like to attend, please contact Nic Bilham (nic.bilham@geolsoc.org.uk), or go to www.geolsoc.org.uk/challenged_by_carbon for further information.

STOP PRESS: Sir Peter Kent Lecture



Sir Peter Kent

*Burlington House,
Thursday
7 January
2010*

The Society's flagship science policy lecture will be delivered by

Professor Sir David King, Director of the Smith School of Enterprise and the Environment, University of Oxford, and former Chief Scientific Adviser to the UK government. Further details will be published in December's Geoscientist and at www.geolsoc.org.uk/spkl.

Christmas and New Year closure

The Society (London and Bath) will be closed from 24 December to 31 December inclusive, re-opening on Monday 4 January 2010.

2009 Glossop Lecture and Award

Chris Martin writes: The Glossop Award is made annually to an outstanding engineering geologist under the age of 30. The Engineering Group of the Geological Society has decided that it should go in 2009 to Stacy English of W A Fairhurst & Partners for her presentation '*Rockfall Protection of Jamestown Wharf, St Helena.*'



Installation of rockfall containment netting, St Helena



Jamestown Wharf, St Helena

W A Fairhurst & Partners were appointed by St Helena Government to undertake a rockfall protection scheme on a 200m high, 400m long basaltic cliff on the island of St Helena, South Atlantic Ocean. Stacy played a key role in each stage of the scheme from the early review of previous studies, through the field data collection and design process, preparation of tender documentation and supervision of the construction phase of the works. Due to unusual travel constraints, because the island has no airfield facilities, the initial site visit was limited in time and a high level of organisation was essential to ensure that all the necessary data was obtained for the design process.

Initial activities included targeted rope access stability inspections and a number of field trials to gain an understanding of the behaviour of the failure masses. The cliff, which sits immediately above Jamestown Wharf, was characterised with respect to its geological formation, principal rock types and structural controls, together with the typical failure mechanisms and block sizes. Rock trials included trajectory surveys and vertical drop experiments to establish site specific parameters for rockfall models and for model calibration purposes. The final design included standard and reinforced rockfall containment netting, together with rockfall catch fences to provide the required level of risk reduction to Jamestown Wharf, while ensuring a safe and efficient construction method. The system was also designed to be straightforward to safely maintain, making it feasible for this to be carried out by trained local labour resident on the island, without the need for constant external specialist intervention.

Also shortlisted for the 2009 Glossop Award were:

Andrew Brown of Opus on '*Geotechnical Investigation and Analysis of a Backfilled Opencast Mine Site, Llanilid, South Wales*'

Tom Casey of Arup on '*Marine Ground Investigation & Engineering Geological Assessments, Forth Replacement Crossing, Scotland*'

Paul Quinlan of Scott Wilson on '*Slope Stability Assessment for Oil and Gas Pipelines, Sakhalin Island, Russia.*'

Glossop evening

Stacy English will give her presentation on Wednesday 25 November 2009 at the premises of the Royal Geographical Society London, prior to the **10th Glossop Lecture** by Professor Paul Nathanail (University of Nottingham) on the '*Engineering geology of sustainable risk-based land quality management.*'

The Glossop Lecture and Award will be preceded by the bi-annual Engineering Group Forum on '*Planning and Engineering Geology*' and followed by the Glossop Dinner. See www.geolsoc.org.uk/engineering or contact david.waring@atkinsglobal.com for further details.

Shell London Lecture Series 2009

The sameness of rocks, the uniqueness of Earth history, and what all that means for hydrocarbon exploration

Speaker: Bruce Levell (Shell)

Date: Wednesday 9 December 2009

Matinee: Tea and coffee 14.30; Lecture 15.00 – 16.00

Evening: Tea and coffee 17.30; Lecture 18.00 – 19.00

Since the publication of Lyell's *Principles of Geology*, there has been a clear realisation that although uniformitarianism based on consistency of physical laws is a valid and useful approach to Earth science, there are also "directional" trends, cycles of change or "events" in the Earth's history which make the geological record far from simply a repetition of the consequences of those actual causes we infer from direct observation. The hydrocarbon industry has in general been at the Lyellian, uniformitarian end of the spectrum. Carbonate geologists are more circumspect, being aware that dealing with the consequences of organic evolution and changing sea water chemistry that they need to modify conclusions based on actualistic examples to apply them to the rock record. However, with the advent of Earth Systems Science, could this be about to change?

Dr Bruce Levell is a geologist who has spent his working life in Petroleum Exploration. He graduated from Oxford University with a BA and PhD in Geology in 1978, specialising in sedimentology. Bruce has worked for Shell Exploration and Production for 30 years. He began in Research with assignments in seismic and sequence stratigraphy, stratigraphic and basin modeling and regional geology. Operational assignments followed as an exploration geologist in Sabah, and Sarawak, Malaysia; Manager of Geology for the Mid Continent Division of the USA (principally Texas, Oklahoma, Michigan); Head of Geological Services for the North Sea; Team leader responsible for UK/Irish Atlantic Margin exploration, and Exploration Manager in Oman.

From 2003 to 2008 Bruce was Vice President responsible for New Ventures in Shell's Global Exploration unit. In September of 2008 he was appointed Chief Scientist: Geology for Shell, based in The Netherlands.

Further Information

For further information on the Shell London Lecture series and programme for 2009 please visit our website www.geolsoc.org.uk/shelllondonlectures09. Films of all past lectures can be watched here also.

Entry to each lecture is by ticket only. To obtain a ticket please contact Alys Hilbourne. Please note that due to the popularity of this lecture series, tickets are allocated on a monthly ballot basis and we cannot guarantee that you will get tickets when they are requested.

Contact: The Geological Society,
Burlington House, Piccadilly,
London W1J 0BG

Tel: +44 (0) 20 7432 0981; Email: alys.hilbourne@geolsoc.org.uk

Sponsored by Shell



Friends united

The Society is launching a new category of membership – "Friend of the Geological Society." Dawne Riddle explains.

The continuing success of the Shell Lecture Series, which began in 2007 as part of the Society's Bicentennial outreach programme, has demonstrated that there is widespread public interest in both geology and this Society. Those who have attempted to obtain tickets for these popular lectures, now (usually) running matinée as well as evening performances, will know that they are regularly sold out. Moreover, even though the core of the audience may be familiar with the interior of Burlington House, the series has succeeded in recruiting from a much broader public – many of whom come to know of the lectures from the posters now regularly displayed in Piccadilly.

To cater for this new constituency, the Society has launched a 'Friends of the Geological Society' scheme. This new category of membership is open to everyone who is not eligible to become a Fellow, and will offer these individuals a great opportunity to show support to The Geological Society and learn more about Earth science. Almost a hundred people have already signed up.

If you know anyone who might be interested in becoming a Friend of the Society, please email Joanna.mears@geolsoc.org.uk.

Author? Donate your book

Shelia Meredith writes: The Library currently faces increased periodical subscription costs, both as a result of the economic downturn and the currently unfavourable poor exchange rates. We are therefore inviting Fellows who have published books to donate a copy to the Library. This is a long and noble tradition in the Society, dating from our foundation, and explaining why we have such a wonderful collection of inscribed volumes from the likes of Lyell, Darwin and many others from the "heroic age".

You can join them. We have already had some success in approaching authors, and we are very grateful to everyone who has given us copies for the Library in the past. We would like to point out that books sent to the Society for review in *Geoscientist* are **not** subsequently deposited in the Library, but retained by the reviewer. All new books benefit from the publicity afforded by appearing in the Library's *Recent Additions* list, compiled bi-monthly.

Please contact the Librarian at: library@geolsoc.org.uk.



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

From the Library

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

Where are they now?

Sheila Meredith writes: We have discovered that the following books are missing from the library shelves and lack of funds means that we cannot afford to replace them. The Library would be very grateful for their return.

- Whittaker, Alun. *Mud logging handbook*. Prentice Hall, 1991.
- Phillips, Jonathan D. *Earth surface systems: complexity, order and scale*. Blackwell, 1999.
- Extended abstracts volume: 1998 AAPG International Conference & Exhibition, November 8-11, 1998, Rio de Janeiro, Brazil, 1028pp.

Sponsor-a-Book update

Michael McKimm writes: To celebrate one year of the Library's *Sponsor-A-Book* appeal a small exhibition showing some of the restored titles will be on display in the Lower Library during November and December.

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.html. 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>.

Copies ordered personally via BL Direct will *automatically* incur the copyright fee, regardless of whether the copy is required for private study/non-commercial research rather than for commercial purposes.

The Geological Society Library continues to offer a photocopying service to its members, charging 25p per A4 page or 30p per A3 page plus a handling charge and VAT. A standard copyright fee of £7.66 +VAT is added to each 'commercial research' request. Further details of the service, its charges and appropriate forms can be obtained by contacting the Library or looking on the Website.

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.

The Geological Society Club



The Geological Society Club, the successor to the body that gave birth to the Society in 1807, meets monthly (except over the field season!) at 6.30 for 7.00 in the Athenaeum Club, Pall Mall. Once a

year there is also a special dinner at Burlington House. New diners are always welcome, especially from among younger Fellows. Dinner costs £45 for a four-course meal, including coffee and port. The Founders' Dinner has its own price structure. There is a cash bar for the purchase of aperitifs and wine. Next year two meetings will be held at new venues yet to be arranged.

Please note – you should keep checking dates here as they may be subject to change without notice.

2009: November 12 (Founders' dinner – organised by the Society – please apply to alys.hilbourne@geolsoc.org.uk for tickets, not to the Club. Price £65.)

2010: 13 January; 17 February (Venue tba); 17 March; 21 April (Burlington House) 19 May (Venue tba)

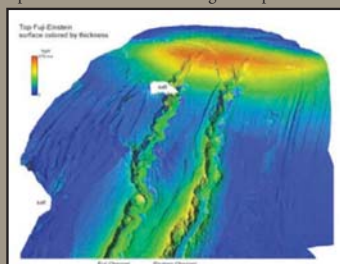
Any Fellow of the Society wishing to dine should contact Dr Andy Fleet, Secretary to the Geological Society Dining Club, Department of Mineralogy, The Natural History Museum, Cromwell Road, London SW7 5BD. Email: a.fleet@nhm.ac.uk - from whom further details may be obtained. DR

SEPM INTERNATIONAL CONFERENCE:

Application of Seismic Geomorphology Principles to Continental Slope and Base-of-Slope Systems: Case studies from seafloor and sub-Seafloor analogues

12-13 November 2009 Houston, Texas











Seismic geomorphology is the application of analytical techniques traditionally used in the study of landforms to the analysis of ancient, buried geomorphological surfaces as imaged by 3D seismic data. This conference is a natural follow-up of the 2005 SEPM - GSL conference on Seismic Geomorphology: Applications to Hydrocarbon Exploration and Production, as it now focuses on one of the critical depositional areas for the industry. The study of seafloor and shallowly buried deepwater analogues is as important to the understanding of deep marine depositional processes as the study of modern environments is to our understanding of fluvial and shallow-marine environments. In fact, these sub-seafloor studies follow in the great tradition established by earlier clastic sedimentologists in using modern systems to understand ancient environments.



REGISTRATION AND CONFERENCE DETAILS ARE AVAILABLE AT:
http://www.sepm.org/activities/researchconferences/deep_water/deep_waterhome.htm

Discounted registration is available for Students and Academic attendees and for members of SEPM or GSL.





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Kings College Conference Centre, University of Aberdeen

Convenors:
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• Special Publication 323

Palaeoproterozoic Supercontinents and Global Evolution

Edited by S. M. Reddy, R. Mazumder, D. A. D. Evans and A. S. Collins

The Palaeoproterozoic era (2500-1600 Ma) is a critical period of Earth history, with dynamic evolution from the deep planetary interior to its surface environment. Several lines of geological evidence suggest the existence of at least one pre-Rodinia supercontinent, named Nuna or Columbia, which formed near the end of Palaeoproterozoic time. Prior to this assembly, there may have been an older supercontinent (Kenorland) or perhaps only independently drifting supercratons. The tectonic records of amalgamation and dispersal of these ancient landmasses provide a framework that links processes of the deep Earth with those of its fluid envelope. The sixteen papers in this volume present reviews and new analytical data that span the geological record of Palaeoproterozoic Earth. The volume is useful as a reference book for students and professional geoscientists interested in this important period of global evolution.

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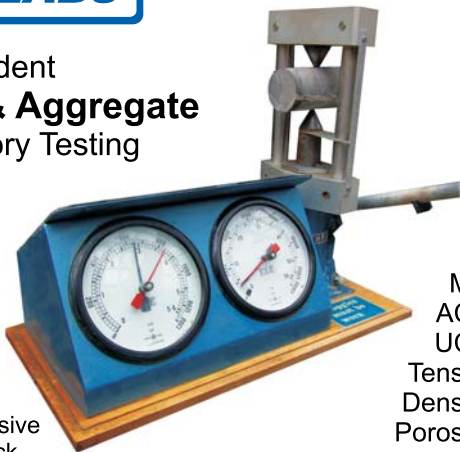
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- **4 November – First Steps Ltd.** - *Developing Geological Knowledge for CGeol Status*. This course is designed to assist those who wish to become chartered in Engineering Geology and feel the need for support in developing basic skills. Contact: Christine Butenuth. T: 0207 736 6889 E: info@firststeps.eu.com **W: www.firststeps.eu.com**
- **10-12 November - Groundwater Protection and Restoration Group, University of Sheffield** - *Fate and Transport of Pollutants in Groundwater*. Contact: Pat Rayner T: 0114 222 5758 E: p.rayner@shef.ac.uk **W: www.shef.ac.uk/civil/shortcourses/**
- **11 November - First Steps Ltd., Emerson and Moore Geosciences Ltd.** - *Rock and Soil Logging Course (Eurocode 7 - BS 5930)*. Contact: Christine Butenuth. T: 0207 736 6889 E: info@firststeps.eu.com **W: www.firststeps.eu.com**
- **13 November - Groundwater Protection and Restoration Group, University of Sheffield** - *Unsaturated Zone Processes*. Essentials of water and gas flow; how pollutant fate and transport differs above and below the water table. Contact: Pat Rayner T: 0114 222 5758 E: p.rayner@shef.ac.uk **W: www.shef.ac.uk/civil/shortcourses/**
- **17 November - Land Quality Management Ltd.** - *Introduction to Chemistry for Contaminated Land*. Contact: Land Quality Management Ltd E: administrator@lqm.co.uk **W: www.lqm.co.uk**
- **17 November – First Steps Ltd.** - *Digital Data for Engineering, an introduction to the AGS Format*. An introduction to the use of Digital data in geotechnical Engineering. Contact: Christine Butenuth. T: 0207 736 6889 E: info@firststeps.eu.com **W: www.firststeps.eu.com**
- **18 November – Land Quality Management Ltd.** - *Introduction to Toxicology for Contaminated Land* - Contact: E: administrator@lqm.co.uk **W: www.lqm.co.uk**
- **24 November - Land Quality Management Ltd.** - *Geology for Contaminated Land* - Contact: E: administrator@lqm.co.uk **W: www.lqm.co.uk**
- **27 November - Fugro Engineering Services** - *Cone Penetration Testing (CPT)*. Free one-day CPD course. Venue: Wallingford. Contact: Steve Poulter T: 0870 4021423 E: s.poulter@fes.co.uk **W: www.fes.co.uk.**
- **27 November – Land Quality Management Ltd.** - *Statistics for Contaminated Land* - Contact: E: administrator@lqm.co.uk **W: www.lqm.co.uk**
- **27 November – First Steps Ltd.** - *Physical Hydrogeology: Basic Tools for Geotechnical and Geo-environmental Engineers*. Contact: Christine Butenuth. T: 0207 736 6889 E: info@firststeps.eu.com **W: www.firststeps.eu.com**

A Professional School in Ground Engineering at the Building Research Establishment (Watford), 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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• **2 November – Hydrogeological Group** - *Groundwater Tracers and Quantitative Hydrogeology* (incorporating the 2009 Darcy Lecture, sponsored by the National Ground Water Association, USA). Venue: Burlington House. **Contact:** Daren Goody T: 01491 692328 E: dcg@bgs.ac.uk



• **11 November – Shell London Lecture – Mountains in the Sea**. Speaker: Prof. Tony Watts (Oxford University). Venue: Burlington House. Afternoon (1500) & Evening (1800) performances. **Contact:** Alys Hilbourne E: alys.hilbourne@geolsoc.org.uk



• **12 November – Founders' Day Lecture & Dinner – Celebrating Charles Darwin and the World of Geology**. Speaker: Prof Jim Secord (University of Cambridge) This pre-dinner talk by Professor Jim Secord (Director, Darwin Correspondence Project) will explore an oft-overlooked aspect of Darwin's science. Venue: @ Burlington House, & Le Méridien, Piccadilly 1800 Lecture 20.00 Dinner. Black Tie. **Contact:** Alys Hilbourne E: alys.hilbourne@geolsoc.org.uk



• **18 November – History of Geology Group – The military uses of hydrogeology**. Venue: Burlington House. **Contact:** Ted Rose T: +44 (0)1494 728776 E: ted.rose@virgin.net



• **18 November – Shell University Lecture Series: Ocean Circulation and Climate** – Speaker: Helen Johnson (University of Oxford) Venue: Bristol University. This lecture is part of the Shell University lecture series. Entry to all lectures is free to all, but by ticket only. To obtain a ticket please **Contact:** Alys Hilbourne E: alys.hilbourne@geolsoc.org.uk



• **23 November – Darwin the geologist – his legacy**. This one day meeting will take place in the bicentenary of Darwin's birth, to celebrate the legacy of Charles Darwin the Geologist. A series of internationally renowned speakers will offer an analysis of Darwin's contribution to various fields of geology, and show how these subjects have since developed and continue to be relevant at the present day. Venue: Burlington House. **Contact:** Alys Hilbourne E: alys.hilbourne@geolsoc.org.uk



• **25 November – Challenged by Carbon: The Oil Industry and Climate Change**. Venue: Burlington House. Challenging prejudices of environmentalists and the oil industry, Bryan Lovell will speak to a mixed audience of policy-makers, oil industry figures and others, on the subject of his recently published book 'Challenged by Carbon: The Oil Industry and Climate Change'. **Contact:** Nic Bilham nic.bilham@geolsoc.org.uk



• **25 November – Careers Day 2009**. Venue: East Midlands Conference Centre, Nottingham. Careers Day is for Geoscience undergraduates and postgraduates to find out about the latest career developments and opportunities. The day will run from 1000 – 1530 followed by a beer reception, and will include presentations and an exhibition fair. **Contact:** Georgina Worrall E: georgina.worrall@geolsoc.org.uk.



• **25 November – Engineering Group Forum and Glossop Lecture 2009**. See Website for further details and registration. Venue: Royal Geographical Society, London. **Contact:** Malcolm Whitworth E: malcolm.whitworth@port.ac.uk

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Edited by F. Lisker, B. Ventura and U. A. Glasmacher

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Edited by M. G. Bassett

Following the late Neoproterozoic–early Cambrian breakup of the supercontinent Rodinia, Gondwana evolved as one of the principal continental masses on Earth, embracing most of South America, Africa, Australasia, Antarctica, much of western Europe and parts of Asia. Around its margins were various other terranes that had varying tectonic and biogeographical affinities with the main continental block. This book incorporates a series of reviews and multidisciplinary research papers that together explore the tectonic, palaeogeographical and palaeobiogeographical evolution of the elements that made up the peri-Gondwanan collage. The stratigraphical scope of the coverage embraces the late Precambrian through early Devonian, providing a comprehensive overview of structural, stratigraphical and biological evolution through this significant interval of Earth history. Integration of these various processes throughout the volume will be of broad-based interest to a wide range of geoscientists.

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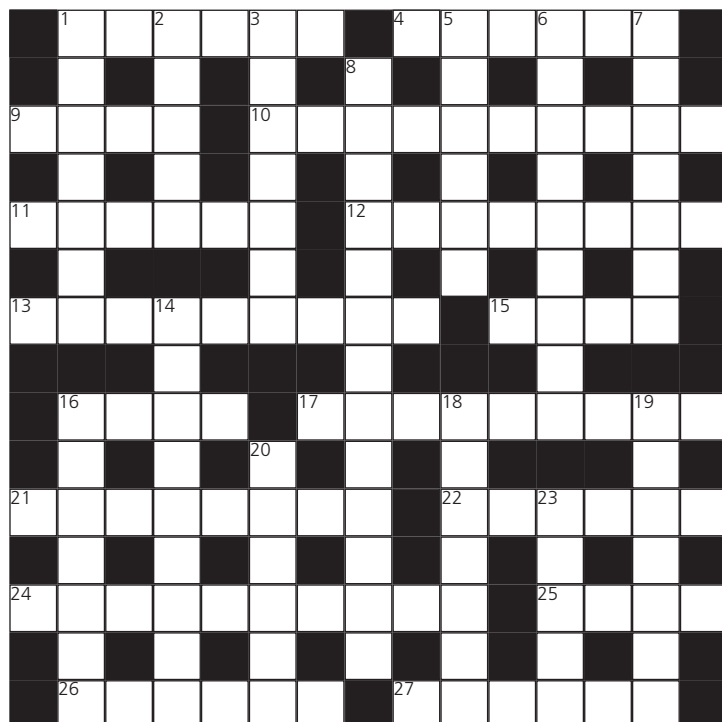
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Crossword no. 129 set by Platypus



Solutions September:

Across: 1 Lizard 4 Azores 9 Onan 10 Sexualised 11 Gangue 12 Isomeric 13 Zechstein
15 Haze 16 Pore 17 Circadian 21 Zonation 22 Vizier 24 Fertiliser 25 USSR 26 Nurses
27 Esters

Down: 1 Lineage 2 Zingg 3 Respect 5 Zealot 6 Rhineland 7 Sterile 8 Exhibitionist
14 Hereafter 16 Protein 18 Caverns 19 Asepsis 20 Willie 23 Zeuge

Across

- 1 Elizabethan has orgasm at a price (6)
4 Microscopic carbonate excreta (6)
9 Shivering fever (4)
10 Clotted micritic structure found in some limestones (10)
11 Between crust and core (6)
12 Stone polisher and cameo maker (8)
13 Incurved meander and good-luck talisman (9)
15 Goddess of the shining Nile (4)
16 Major component of oceanic circulation (4)
17 Determine outcome in advance (or be born in a dog collar, perhaps) (9)
21 Knight who sang "tirra lirra by the river", according to Tennyson (8)
22 They give birth to live young without using a shell (6)
24 Thixotropic (10)
25 Frequently hit on the head to hammer home a point (4)
26 Looking, with intent (6)
27 Soft metal, atomic number 49 (6)

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The winner of the September Crossword draw was **Iain Neill** of Cardiff University.

All correct solutions will be placed in the draw, and the winner's name printed together with the December winner, in the February 2010 issue. The Editor's decision is final and no correspondence will be entered into. Closing date – 10 January 2010.

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.

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Down

- 1 Classic cactus of the Western - *Carnegie gigantea* (7)
2 Upright, like 1 down (5)
3 The perfume from a dress is likely to make J Alfred Prufrock do this (7)
5 Not liable (6)
6 Taken more than is wise (9)
7 Abandons to the waste and rolling sands (8)
8 Any protein structurally associated with nucleic acid (13)
14 Unique arrangement of atoms in a particular crystal (9)
16 Coarse grained acid igneous plutonic rock (7)
18 Eight-sided figure (7)
19 Very hard metal found in anomalously high concentrations at the K-T boundary (7)
20 An unsaturated chemical compound containing at least one carbon-to-carbon double bond (6)
23 French boredom (5)

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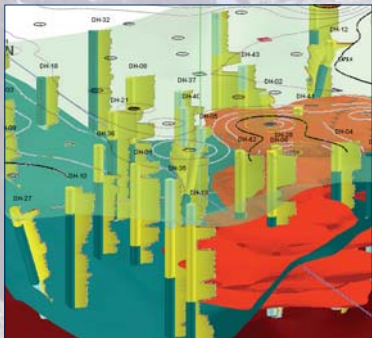
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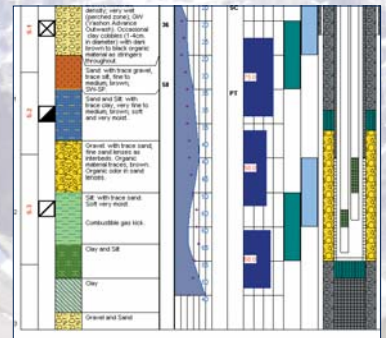
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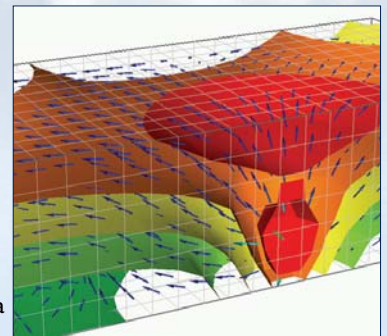
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