

Geoscientist

Volume 20 · No 4 · April 2010



Change and decay
Seismic soldiers
Greenly's map

Read it first at *Geoscientist Online* - www.geolsoc.org.uk/geoscientist



Into the fryer

As the Society considers the agents of climate change, Ted Nield contemplates agent nouns, and finds himself in denial.

Needing to be right is a personality trait that shows up strongly among scientists. But when their hypotheses must always be tested for “rightness” against nature, this is no handicap – even if it may look to others as little more than the point-scoring pedantry of an eight year-old. Most people’s experience of everyday life is rarely so black and white.

As editors struggle in the web of words, some will tend to adopt a more absolutist approach. One such was the late Professor Anders Martinsson (1930–83), founder of the journal *Lethaia* and of Uppsala University’s Department of Palaeobiology. White space in his fine publication was rarely left so for long, as Anders delivered yet another pronouncement on the proper spelling of scientific terms. With a scholarly certainty that rivalled the pronouncements of A E Housman, Anders would make it clear that (to take my personal favourite example) the terms “planktonic”, “nektonic” and “benthonic” were illiterate, and that the *correct* formations from their Attic roots were “planktic”, “nektic” and “benthic”.

While such etymology is amenable to a scientific “right or wrong” approach, living languages are as they are spoken like innit, and this creates a perpetual tension between advocates of correctness and those of popular will, exemplified by editors of *Collins Cobuild*, the first dictionary to use computers to analyse English usage statistically. Both approaches have merit for editors, practical souls all, who recognise, as they strive for consistency in house style, that while etymology may be dictated by near absolutes, much usage is mere convention. Take prepositions. Are you “bored with” this editorial, or “bored of” it? If the former, you are probably middle aged. If the latter, you are probably under 35. Neither, though, is “right”. So what are we

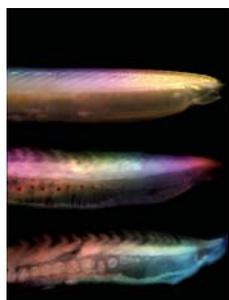
to do about that vilified group known as “climate change deniers”?

“Denier”, in the sense of “one who denies”, is an “agent noun”, and there is a horrid inconsistency about agent nouns formed from verbs in “-y” (like cry, dry, fly, fry – and deny). A machine that makes your hair dry is a “dryer”. One that fries chips is a “fryer”. An aviator is a “flyer” (and a handbill a “flier”). However it is more common to hear a “town crier” than a “town cryer”. In 1926, H W Fowler’s *Modern English Usage* urged Anglophones to standardise on the “-ier” form; but that was before we had very many dryers, fryers – and frequent flyers.

Moreover, like “drier” and “flier”, the “-ier” form “denier” already has *another* distinct meaning – as a unit of thread weight, amounting to one gram per nine thousand metres. We cannot distinguish between those who deny climate change and those who don’t by the thickness of their stockings. So, although nearly everyone currently writes “denier” for a denier of climate change (or of Christ, its other common usage), and although Mr Gates’s pernicious spellchecker wishes me to go along with them, I won’t – and neither will this magazine.

The history of science is littered with examples of ideas that were not made right just because everybody agreed over the same mistake for centuries. But preferring “denyer” over “denier” is not about right or wrong. It merely embodies a wish not to introduce further irregularity into a language that already has far too much of it. Deny that, if you dare. 

**There is still time for Fellows to contribute to the Society’s Climate Change statement. Please send your thoughts and observations on the subject to sarah.day@geolsoc.org.uk.*



Front Cover:
What happens when the rot sets in. See page 21.

Geoscientist The magazine of THE GEOLOGICAL SOCIETY OF LONDON

Geoscientist is published by The Geological Society Publishing House, Unit 7, Brassmill Enterprise Centre, Brassmill Lane, Bath BA1 3JN
Tel: 01225 445046, Fax: 01225 442836

Editorial Team Editor-in-Chief: Professor Tony Harris, Editor: Dr Ted Nield, Features Editor: Dr Robin Cocks, Editorial Adviser: Dr Joe McCall
Contributing Editor: Dr Sue Bowler, Reviews Editor: Dr Martin Degg, Council Representative: Dr Jonathan Turner

Fellowship Queries The Geological Society, Burlington House, Piccadilly, London W1J 0BG Tel: +44 (0)20 7434 9944,
Fax: +44 (0)20 7439 8975, Email: enquiries@geolsoc.org.uk, Society website: www.geolsoc.org.uk

Library Tel: +44 (0)20 7432 0999, Fax: +44 (0)20 7439 3470, Email: library@geolsoc.org.uk.

Advertising Society Media Sales Ltd, Unit 25, The Coach House, 2 Upper York Street, Bristol BS2 8QN Tel 0117 923 2951 Fax 0117 923 2467
Email: sales@societymediasales.co.uk

Designed and printed by City Print (Milton Keynes) Ltd, 17 Denbigh Hall, Bletchley, Milton Keynes MK3 7QT Tel: 01908 377085,
Fax 01908 649335 Email: sales@cityprint.net

©The Geological Society of London is a Registered Charity, number 210161

ISSN 0961-5628

Trustees of the Geological Society of London

Prof L E Frostick (President); Prof P A Allen (Secretary, Science); Dr I D Bartholomew (Vice President); Mr M Brown; Mr M Daly; Prof E Derbyshire (Secretary, Foreign & External Affairs); Prof A J Fleet (Treasurer); Prof C M R Fowler; Dr R Herrington; Dr R Hughes; Dr A Law; Prof A Lord; Dr B Lovell (President-designate); Dr J Ludden; Mr P Maliphant; Prof D Manning (Secretary, Professional Matters); Prof S B Marriott (Vice President); Prof J D Marshall; Prof S K K Monro; Dr G Tuckwell (Vice President); Dr J P Turner (Secretary, Publications); Prof D Vaughan; Mr N Walton.



The day after tomorrow

“The future of the geosciences in the 21st Century” was recently made the subject of a joint Geological Society/BGS meeting. Kathryn Goodenough, and her colleagues at the BGS Futures Team, have already been stroking the crystal ball...



Geoscience can be divided into two broad (and overlapping) strands: curiosity-driven (‘blue skies’) science; and applied science. The first is driven by the big, unanswered scientific questions, while the second is driven by the needs of society. The Natural Environment Research Council (NERC) funds research in both these strands, and in recent years a fair amount of funding has been directed towards the understanding and prediction of climate change. The priorities for Earth science research are bound to change over time: can we predict what these future priorities are likely to be?

One popular tool for looking at future trends is “scenario planning”, in which researchers consider possible futures based on a small number of variable factors. However, as geoscientists we know that there are many other variables. Even with our modern understanding, there is still much we still don’t know about how the Earth System will change in the short-term under the pressures we are placing upon it. So, BGS’s Science Futures team has based its first scenario assessment on two axes: one denoting the rate of change of the Earth System, and the other a political/economic axis described as the amount of global cooperation versus competition.

At one extreme of this axis lies a ‘Global Village’ scenario – a utopian world where all countries work together to reduce emissions, slowing the rate and overall impact of climate change. As standards of living rise, natural resources continue being traded in a free and open market, and new technologies continue to drive the global economy. By cooperation, the world’s special places are protected, so that loss of biodiversity is also slowed. This ideal situation seems, to us, rather unlikely.

At the other end of the spectrum, governments do not cooperate fully on emissions reduction, and national protectionism leads to insecurity and instability. Britain becomes a ‘fortress’, fiercely protecting its coal, water and renewable energy sources. Large numbers of people move away from areas affected by flooding,

drought and rising sea level. This may be what we all want to avoid, but every time that targets are not met and agreements fail, we potentially move one step closer. You can find more information about these and intermediate scenarios at www.bgs.ac.uk/sciencefutures. We would greatly appreciate your views on which you feel is most likely.

Some conclusions can be drawn now. At the moment it seems vital to quantify the Earth System’s rate of change. However, sooner or later, we may well reach a “tipping point” – some would say we have already reached it – from which the System will be unable to return to what most people think of as the *status quo ante*. From then on, the rate of change becomes moot; what matters then is adaptation and mitigation strategies in a world of rising population, where natural resources (water, productive land, space for waste disposal, energy and minerals) can only ever become more precious.

Geoscientists must be prepared to adapt. Today’s priorities may suddenly look like yesterday’s news. 

**on behalf of the BGS Science Futures Team (Jon Chambers, Kathryn Goodenough, Daren Goody, John Laxton, Jon Naden, Barry Rawlins, Helen Reeves, David Schofield). BGS Science Futures Team was set up two years ago, to identify the main challenges for BGS scientists over coming decades.*

Contents

4 People

Geocientist in the news and on the move

12 Opinion

Reviews

21 Geonews

News items relevant to the interests of working geologists

23 Society at large

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

29 Calendar

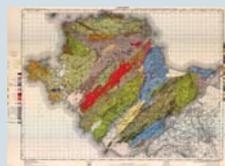
A forward plan of Society activities

31 Crossword

Win a special publication of your choice

14 People -

Greenly and the Geological Map of Anglesey
by Jack Treagus



14 Society at large -

Petroleum Geoscience: 2010 and beyond
by Phil Christie



16 Feature -

All under heaven - by John Bell



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

Carousel



Craig Barrie (SUERC) has been named as *JGS* Young Author of the Year, for the paper: Barrie, C D, Boyce, A J, Boyle, A P, Williams, P J, Blake, K, Wilkinson, J J, Lowther, M, McDermott, P & Prior, D J: *On the growth of colloform textures: a case study of sphalerite from the Galmoy ore body, Ireland* (JGS 166/3). He received the award at the Annual Publications Reception on 3 March.

Eduardo F J de Mulder, Honorary Fellow, prime mover behind the UN International Year of Planet Earth, has been awarded AAPG's Division of Environmental Sciences (DEG) 2010 Public Outreach Award.



Richard Fortey, past President, has been elected Fellow of the Royal Society of Literature. He joins Richard Dawkins in the distinguished group of scientific writers to be elected both FRS and FRSL.

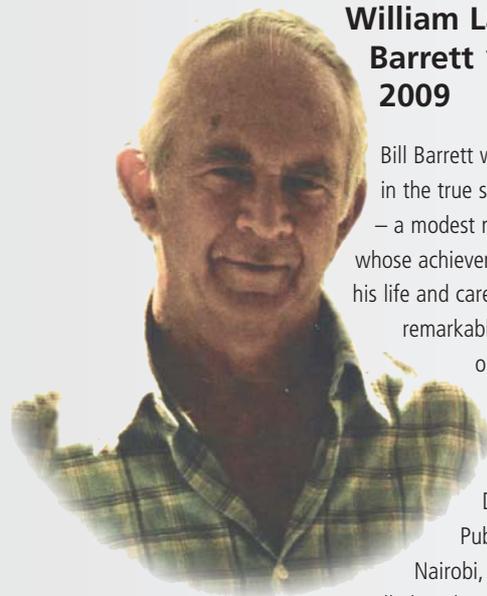
All Fellows of the Society are entitled to entries in Carousel. Please email ted.nield@geolsoc.org.uk, quoting your Fellowship number

Obituaries



Ted Nield writes: This year, the Society's *Annual Review*, in which the Society's obituaries have hitherto been published, will change radically and the printed report will henceforward be a much lighter, more easily digestible offering. We have taken this opportunity to change the system for publishing obituaries. In future, as well as publishing them immediately in our online archive (www.geolsoc.org.uk/obituaries) we shall include them in *Geoscientist* – thus affording more timely publication. Obituaries so far collected for 2009 will therefore be included in the next few issues of the magazine, during the lead-in to May, when the new-style *Annual Review 2009* will be distributed to all Fellows.

William Lawrence Barrett 1937 - 2009



Bill Barrett was a gentleman in the true sense of the word – a modest man, but one whose achievements throughout his life and career were

remarkable. He was born on 10 June 1937, in Fort Portal, Uganda and attended the Duke of York Public School in Nairobi, Kenya, where he

excelled at shooting, cricket and

hockey – in later life he was to play hockey at international level.

At Aberystwyth University he studied Geology and gained a Postgraduate Diploma in Micropaleontology. It was at

Aberystwyth that he met Isabel, his future wife. In 1961 he returned to Africa, where he took up his first appointment, with Kilembe Copper Mines in Uganda, as a Field Geologist. Isabel joined him and they were married in 1962 at Virika Cathedral in Fort Portal. Within seven years Bill had risen to Senior Mine Geologist and had the three children - Mark, Andrew and Gill - before moving with his family to the UK to complete his doctorate, at the University of Leeds, on the Stratigraphy, structure and mineralisation of the South East Ruwenzori Mountains.

On returning to Kilembe Mines in 1970, Bill became Chief Geologist before the political and economic climate became too unstable under Idi Amin in 1973, when the family was moved again to the UK. Bill joined Tarmac in 1974 as their first Geological Manager and spent over 25 years with them before retiring in 2000. The early years were quite primitive by modern standards but Bill relished those pioneering days and helped lay down the foundations for a career as a geologist in the quarrying industry.

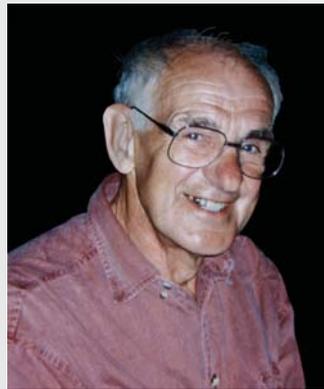
As the company grew at such a phenomenal rate, Tarmac relied very heavily upon his judgement throughout numerous acquisitions and mergers, which extended overseas into North America, South Africa, the Middle East and Europe and he therefore learnt to speak both French and German proficiently. He loved the little challenges associated with this work - flying through a thunder storm in a light aircraft in America or eating ducks' feet in China.

Bill's influence extended beyond his role with Tarmac. He was a member of the first Extractive Industry Geology conference held at Burlington House in 1978 and became chairman of the Organising Committee for the 1989 event at Birmingham University. He was actively involved with a variety of government and national bodies, including the Programme Board of the British Geological Survey, and contributed to a range of publications while also acting as an external examiner at Leicester University.

However, perhaps the thing of which he would have been most proud professionally was the recruitment and training of numerous young geologists. He gave them the skills and confidence to progress – many to attain senior roles throughout the quarrying industry.

Bill Barrett was indeed a remarkable man. He advanced the role of the geologist within the quarrying industry and nurtured so many geologists. His companionship and considered judgement will be greatly missed.

Paul Brewer



Frederick Munro Broadhurst 1928-2009

Frederick Munro Broadhurst, known to all simply as Fred, has died after a short illness. He was a 'Manchester Man' throughout his life, spending his early childhood in Burnage and attending William Hulme Grammar School from 1939-46.

On leaving school Fred became a 'Bevin Boy' rather than undertake National Service, and worked underground at Bradford Colliery, East Manchester. This work inspired in him a fascination for geology and to further his education he attended day release and night school at Stockport College. In 1948 he left the pit and entered Manchester University's Department of Geology where W J Pugh was Professor and Head.

Fred graduated in 1951 with a First Class Honours degree and immediately became Assistant Lecturer, gaining his MSc in 1953. In 1954 Fred was made Lecturer and obtained his PhD in 1956 for his work on Upper Carboniferous non-marine bivalves, supervised jointly by S H Straw and R M C Eagar (Keeper of Geology at Manchester Museum). Later he became a Senior Lecturer and eventually retired from the Manchester Department in 1990, thus completing 42 years' continuous service.

Fred's early research was on the embryonic subject of palaeoecology, integrating analysis of fauna,

sedimentology, sedimentary petrography and geochemistry of Lancashire Coal Measures. In 1963 he took a sabbatical year at the Palaeontology Museum in Oslo working on Silurian palaeoecology in the Oslofjord and Ringerike areas, but during the 1960s and 70s most of Fred's research was directed towards Dinantian reefs of the Peak District with his colleague Morven Simpson. More than 15 post-graduate students came under Fred's supervision at this time.

It was with Morven that he developed his interest in building stones, and they published their pioneering guide to the building stones of Manchester in 1975, revised in 2008. He later became interested in cyclicity in sedimentation, recognising seasonal sedimentation in the Lancashire Westphalian and published on tidal cycles in the Mazon Creek deposits of Illinois.

But it was for his wonderful teaching that Fred will be best remembered. For the whole of his time at Manchester Fred taught palaeontology, first with Sidney Straw in the 1950s, and then with John Pollard through the 1960s, 1970s and 1980s. Hundreds of undergraduates came under his influence and even though Manchester was a 'hard rock' Department, it is always Fred that they remember with his boundless enthusiasm and energy, both in the classroom and in the field.

It was on one such student field trip in 1960 that he discovered a complete plesiosaur in the Lower Jurassic of Ravenscar, Yorkshire. Realising that the fossil would not survive the winter, Fred led an expedition to recover the skeleton, battling storms to extract the fossil and drag it up the cliffs using a 'human husky' team! For many years it was displayed in the Geology Department, and in 2000 it took pride of place in the refurbished galleries of Manchester Museum and is about to be described as a new species. Unfortunately the museum has decided to remove it from display.

For the whole of his career Fred was heavily involved in adult education, both

for the University and for the WEA. On his retirement in 1990, this work was to take up an increasing amount of his time, leading countless evening classes and study trips at home and abroad, first with the Extra-Mural Department, and later with the Wilmslow Guild. When he eventually retired from the study tours, following a valedictory trip to Norway in 2001, he continued to take evening classes right up to this summer, and had already planned his courses for 2010.

Fred also popularised the geology of the Manchester area and the Peak District by contributing to or editing several editions of the GA Guides and authoring the book *Rocky Rambles in the Peak District* in 2001. He was a 'father figure' (and honorary member) of the Manchester Geological Association.

Everyone who came under Fred's influence will speak of his patience and inspiration as a teacher and it is fitting that he was honoured in 2000 with a national award as Adult Tutor of the Year from the National Institute of Adult Continuing Education for his enormous contribution to the wider community. In 1982 he had received the John Phillips Medal of the Yorkshire Geological Society for major contributions to knowledge of the geology of Northern England, and also the Silver Medal of Liverpool Geological Society in 1976.

Fred was born on 5 February 1928 and died on 1 October 2009. He was a devoted family man and celebrated his golden wedding with Rosemary in 2008. He is survived by Rosemary, by his children, Andrew and Caroline, and his grandchildren, Ben, Anna, Tom and Talisker.

John Nudds, John Pollard, Paul Selden

Frank Moseley 1922-2009



Frank was the archetypal 20th Century field geologist. His great love was the outdoors and he always said he didn't regard teaching geology, or finding out what rocks in the field meant, as work at all.

Born in Bradford in 1922, he volunteered as a pilot in the RAF during World War II. He flew Blenheim bombers in Africa and the Middle East where the cockpit panoramas inspired in him the desire to find out how rocks came to form such wonderful and awe-inspiring features as Nanga Parbat and Kilimanjaro. He climbed the latter during leave in 1942, long before it was a routine tourist adventure. So, in 1946 he studied geology at Sheffield University, where he started a life-long association with his Professor, Fred Shotton. He obtained a First Class Honours degree (with the Sorby Prize for mapping) and a PhD (Namurian of the Bowland Fells). He then spent six years at Keele and Cambridge universities before moving to Birmingham under Fred Shotton from 1958-89, becoming Reader in Geology.

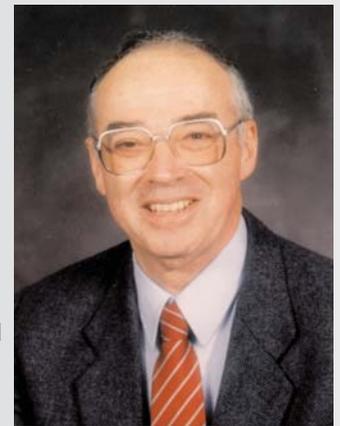
Edward George Purdy 1931-2009

Dr Edward (Ed) Purdy, internationally renowned carbonate and petroleum geologist, died On October 13 after a very short illness, in Weybridge, Surrey. Purdy's distinguished career, which began in academia and continued in the oil industry, spanned almost 50 years.

Ed was born on 4 December 1931 in New Rochelle, New York. After finishing high school at Rahway, New Jersey in 1950 and following two years' service in the US Marine Corps, Ed studied agriculture at Rutgers University - graduating in 1956. He then became a graduate student in geology at Columbia University, New York, where professors Norman Newell and John Imbrie took him under their wing and where he began his study of carbonate sediments on Great Bahama Bank. Through this work the area became a natural laboratory for carbonate geologists. He published his first scientific paper (with Louis Kornicker) in 1957 on the origin of peloids, the non-skeletal sedimentary grains that make up many carbonate rocks. In 1960 Ed got his PhD and his thesis (*Recent Calcium Carbonate Facies of the Great Bahama Bank*), published in volume 71 of the *Journal of Geology* (1963), has since become a classic.

By 1959, Ed had accepted a post as assistant professor at Rice University in Houston, Texas. Ed began work on Belize (formerly British Honduras), location of the largest reef area in the Atlantic Ocean. In subsequent years, Ed and several students worked on many aspects of the Quaternary mixed carbonate-siliciclastic system. Research topics included modern sediment distribution, antecedent control on facies distribution, carbonate mud formation, clay minerals, foraminifera, molluscs, palaeoecology, river coastal and intertidal systems, Pleistocene facies, and sedimentary geochemistry. Seven PhD theses and many publications resulted from this project. A key theme of his work was the antecedent platform model, which explained carbonate facies distribution pattern by the topography of the underlying karst geomorphology.

A major change to Ed's career came in 1965 when he left Rice University to take up a position with Esso in Houston. He stayed with Esso Exploration & Production for the next 21 years, filling positions in Canada, Singapore, England, Norway and working in North America, Southeast Asia, the North Sea, the Mediterranean, and Africa (Niger, Angola, Kenya). From 1986 Ed worked as consultant in international exploration and since 2001 had been active as independent petroleum exploration consultant.



Frank's most enduring scientific contribution will undoubtedly be to Lake District geology. He researched the lithostratigraphy and structural evolution, supervising many PhD students. He was the first post-war geologist to make any sense of the Borrowdale Volcanic rocks. He was a pioneer in the interpretation of aerial photographs in geology, and his meticulous mapping and careful detailed study of these rocks opened up the way to our modern understanding of this Ordovician volcanic complex. For nearly 30 years he inspired Birmingham students in field mapping classes at Coniston and Keswick, showing how aerial photographic detail could be combined with field data into an accurate knowledge of the geology. As well as original scientific papers and synoptic reviews, he also published field guides to the Lake District and Southern Spain. His book *Methods in Field Geology* (1981) is a testament to his field craft and is typically illustrated by his technique of diagrams produced by photocopying photographs with judicious enhancement to clarify and explain the geology.

Ed remained in contact with academe, acting as associate editor for scientific journals such as *Sedimentology*, *Geologica Romana*, *Coral Reefs*, and *Petroleum Geoscience*, worked as adviser in geoscientific funding agencies such as NERC and ODP, and was active in the council of the Geological Society of London (1983-85), and in committees of AAPG. In 1990, he was Esso Distinguished Lecturer and spent time at the University of Sydney, Australia. From 1992-95, he was an appointed visiting professor at Imperial College and visiting professor at Royal Holloway, University of London. In 1998, Ed received the Special Commendation Award from AAPG. From 2002-2004, he was a guest scientist and invited lecturer at Goethe-University in Frankfurt am Main, Germany.

Ed was a driving force behind seismic and core studies in the Maldives to further the investigation of Neogene platforms and their response to sea-level change. This resulted in a cooperative expedition aboard *RV Meteor* between the universities of Hamburg, Kiel, and Frankfurt am Main. Sadly, Ed was not able to participate in the expedition. In 2004, he suffered a stroke and was forced to retire more and more from scientific work. In 2007, he donated his entire library to Goethe-University in Frankfurt. Still, he finished his project reviewing and analysing Jack Sepkoski's taxonomic diversity database and relating it to sea-level change and strontium isotope data throughout the Phanerozoic. The results of this work were published 2008 in the *International Journal of Earth Sciences*. Ed sent me a reprint of this paper, describing it as his last contribution to science.

I am thankful that I knew Ed Purdy, and I know that many colleagues feel the same. The geological profession has lost an honorable and distinguished colleague, who made a lasting impact on sedimentology. He is survived by his wife Christine and his daughters Rosita, Claudia, Kim, and Patty.

Eberhard Gischler

The influence of Fred Shotton is also seen in Frank's other research interests: Quaternary deposits of the Midlands, hydrogeology and engineering geology. The last two were his principal interests as a Major in the Geology Pool of the Royal Engineers from 1953-70; he was awarded their Montgomerie Prize in 1967. He worked in East Africa, Libya, Cyprus, South Yemen and Oman, these assignments often leading to major publications, e.g. the first geological map of Socotra.

In his youth he was a notable athlete, being a 440 yards, high jump and pole vault champion and he continued to vault and play rugby into his 40s. Frank was awarded the Murchison Fund of this Society in 1973, the Charles Edmonds Memorial Prize of the Cumberland G.S. in 1979 and the Sorby Medal of the Yorkshire Geological Society in 1987. In his retirement he continued to explore the world in the company of Pat, his wife for 56 years, his two daughters, son and grandchildren.

Alan Wright, with David Millward

Deaths

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

The Society notes with sadness the passing of:

Beltrandi, M D*	Khain, Viktor Efimovich
Baumer, A*	Knight, Jack*
Bishop, Richard*	Manley, Edwin C*
Chambers, Gordon*	McKinlay, Alex C M*
Francis, Christopher Michael	Roberts, David Keith *
George*	Stanton, William Iredale*
Guilford, Colin*	Truss, Stephen*
Hodgson, Alan*	Wright, Claud William
Hopkins, Graham Leslie*	

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

If you would like to contribute an obituary, please email ted.nield@geolsoc.org.uk 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 at www.geolsoc.org.uk/obituaries.

Help your obituarist

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

DISTANT THUNDER

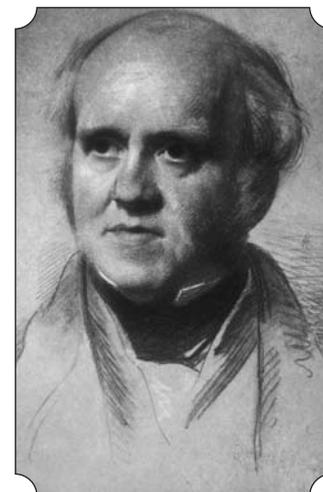
Honouring Horner

Patrick Corbett (Heriot-Watt University) recently took part in the Society's Chartership programme as a scrutineer. Interestingly, the Society had chosen to host the meeting in the Leonard Horner Hall at Heriot-Watt University

Leonard Horner entered Edinburgh in 1799 at the age of 14 and learned, among other subjects, mineralogy - which stimulated a lifetime interest in geology. After leaving university he spent a quarter of a century as a linen merchant, travelling extensively and keeping up his intellectual interests. During this time he became a fellow of the Geological Society (in the second year of its existence, 1808), was Secretary (1810-14) and twice President (1845-46, 1860-61). His first paper to the society was "On the mineralogy of the Malvern Hills". In 1835 he helped initiate the Geological Survey of Great Britain. In his obituary WJ Hamilton, then President, recorded that Horner possessed a "cautious manner in which he avoids a too hasty generalisation" and concluded that he had laid the foundation of the principles that Murchison and Sedgwick subsequently applied to understanding the Palaeozoic rocks. Charles Lyell was obviously influenced by Horner, because he married the latter's daughter, Mary. Horner did much to promote a wider public interest in geology. After he retired as "the Inspector General of Factories" at age 74 in 1859, in the five years before his death, he spent time rearranging and cataloguing the Society's museum collection.

In 1821, Horner founded the Edinburgh School of Arts (the first ever Mechanics' Institute - for training skilled artisans) to promote high academic standards for the élite while extending useful knowledge to the labouring classes. Its prospectus stated the objectives "for the purpose of enabling industrious Tradesmen to become acquainted with such principles of mechanics, chemistry and other branches of science as are of practical application in several trades". Classes were held in the evening and included mineralogy for tradesmen working in the textiles industry for use in dye-making.

Karl Marx admired the work of Horner as a reforming factory inspector and eulogised that "his services to the English working classes will never be forgotten. He carried on a life-long contest, not only with the embittered manufacturers, but also with the cabinet". In 1827, Horner was also invited to be the warden of the new University of London. He was



effectively both Vice-chancellor (Principal) and Secretary of the new University. From this position of patronage, he was able to invite Charles Lyell to the chair of mineralogy at King's College London in 1828.

The Edinburgh College of Arts was the progenitor institution from which Heriot-Watt University was created in 1966. Today the University retains the ethos of teaching practical subjects in a way that people in industry can participate, through international distance learning programmes - very much in the style of Leonard Horner - one of the founding fathers. I suspect Leonard Horner would have approved of the idea of professionalism (which is now embedded in Chartership and rather more evidence-based than in his day!) and the need for Continuing Professional Development (see p. 24 *et seq*).

Further reading

O'Farrell, P.N., 2004 *Heriot-Watt University, An Illustrated History*, Pearson Education, 511pp. Watch out for Patrick's next book, a biography of Leonard Horner, the research for which has involved him in many happy hours in the Burlington House Library.

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.

STICKS AND STONES

Editor writes: Sticks & Stones will return next month, after Dalston has completed his task as Dr Gibbet's Campaign Manager for the 2010 Council election.

Jack Treagus investigates the tangled story behind a map of some very tangled rocks.

It is 100 years since Edward Greenly completed the fieldwork for the 1:63,360 geological map of Anglesey, and 90 years since the map's publication, complete with its two-volume Memoir. The map was the sole work of Greenly, taking him just over 15 years to complete. Although small parts of the island had been mapped before 1894 when his work began, it was mostly unexplored territory.

Greenly and the Geological Map of Anglesey

This small island contains perhaps the greatest variety of geology of any comparable area in the British Isles – ranging from the Precambrian gneisses through to the Carboniferous Red Measures, with ultrabasic and acid intrusions and traversed by dykes. The whole of Anglesey is affected by glacial erosion and deposition and this received equal attention. Inland, exposure is patchy but is almost complete on the rugged, indented, coastline, some 200km in length.

Greenly was born in Bristol in 1861 and was taught at home up to the age of nine by his pacifist parents. He remembers his father, a doctor, pointing out the varieties of limestone used in the local walls and buildings, commenting on the vast age of the Earth and at this time he developed a great interest in volcanoes. In 1884 he climbed Cader Idris and reading about the columnar jointing that he had observed, he further developed his geological interests.

Greenly was sent to University College, London to study chemistry, but Professor Bonney's classes in petrological microscopy confirmed his intention to become a geologist. At home he attempted to understand some of the geology in the Bristol district and by chance met Professor Green, who taught at the Yorkshire College, and who had become his hero through reading his "*Physical Geology*". A friendship developed and they spent three weeks mapping together. Green, impressed, recommended his new protégé for a post at

the Geological Survey. Even though only half way through his degree course, he was accepted and resigned from the University.

On reporting to the Edinburgh office in 1889, Geikie and Peach gave him a kind reception and, to his delight, he was sent to the Northwest Highlands of Scotland to work under Horne, another hero. Greenly's first field area was on Ben Eighe, a complex zone of isoclinal folds and thrusts, and was warned by Horne that not a note, symbol or line must be put on a map that wasn't drawn on the ground itself. Horne was most disparaging about surveyors 'who saved shoe leather by means of opera glasses' and of

another 'who kept his shoes dry by drawing lines from across a stream' and others 'who did parlour-table mapping'. Greenly suggested to Horne that some Moine schists contained original pebbles, but this was dismissed; the Moine was then regarded as reconstructed

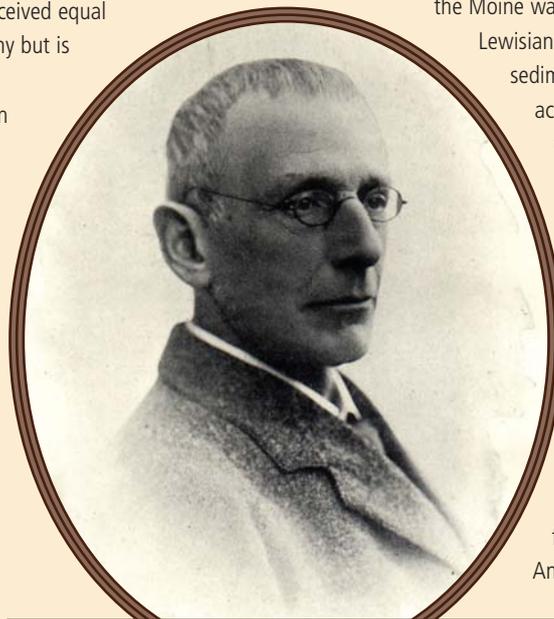
Lewisian Gneiss. However four years later the

sedimentary origin of the Moine was accepted. In the company of Horne he was one of the first to see the Arnaboll and Moine Thrusts at Eriboll - though during such a fierce gale that they were forced to crawl on their hands and knees. Although a baptism of fire, Greenly said that he learnt many things on that expedition that prepared him for the Monian of Anglesey.

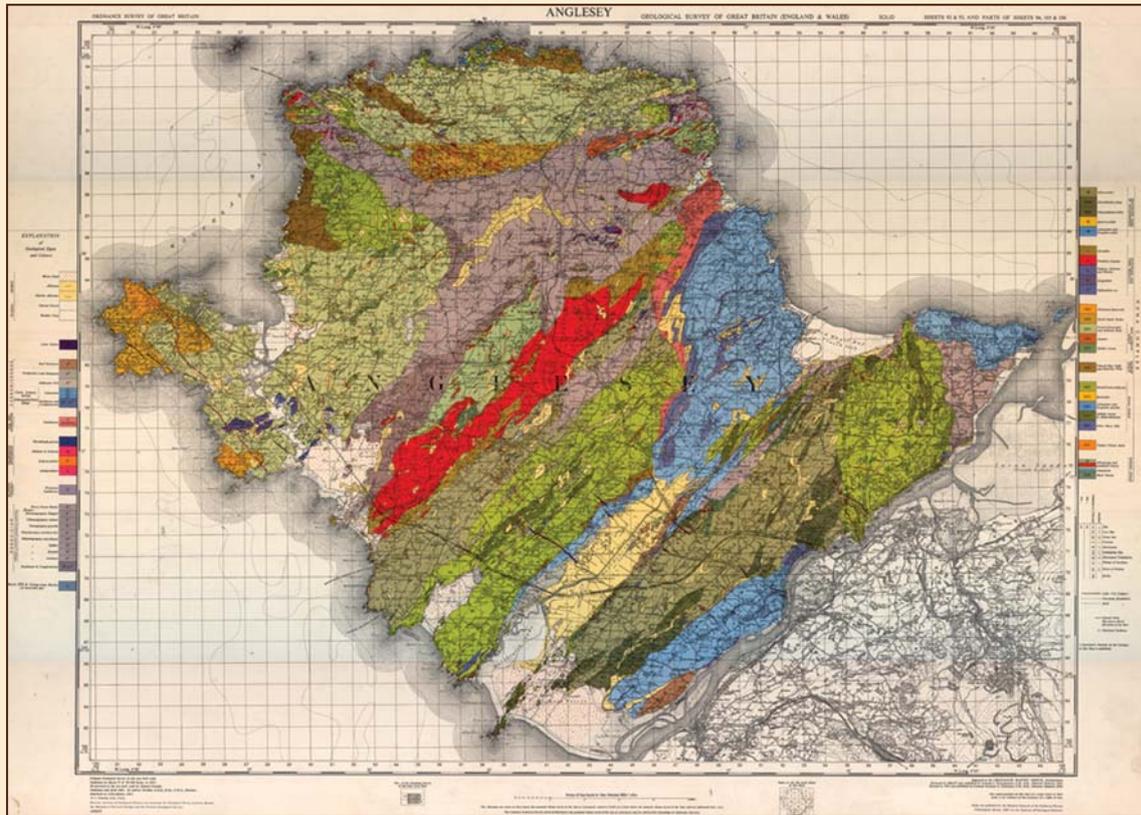
In 1891 Greenly married Annie Barnard, 11 years his senior, and his friend since the age of 14. He took Annie to live in primitive cottages in the wilds of northwest Scotland, while he worked for the Survey. Annie only had sight in one eye and

couldn't find employment, although (he said) she never complained. Aware of her isolation he reluctantly left the Survey in 1894, but was determined to continue with mapping at his own (and Annie's) expense. He considered areas in Shropshire and the Llyn Peninsula, but settled on Anglesey as it was a self-contained area that had never been mapped and contained a large area of schists, with which he was familiar.

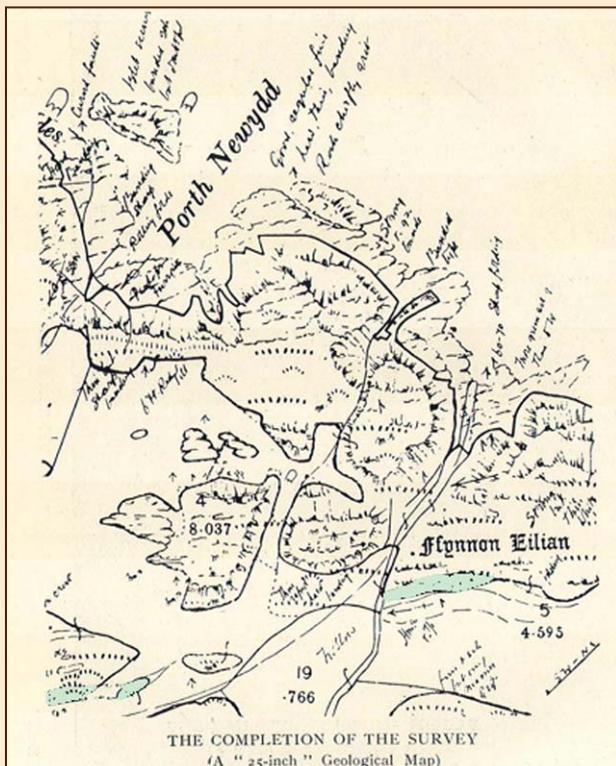
He attributed much of his outcrop-style mapping – now universally adopted - to Annie's advice. He felt that outcrop



EDWARD GREENLY IN HIS LATE THIRTIES



The 1920 1:63,360 map of Anglesey republished as a solid edition in 1967. Reproduced with the permission of the British Geological Survey © NERC. All rights reserved.



An extract from Greenly's mapping at 25 inches to the mile. One of the spilitic lavas in the dominant schists of this area has been coloured green by the present author.

shapes should be sympathetic to the topography – “feel the curves” – and insisted that “a map must be beautiful”.

During the First World War (he was exempted from military service) he had a permit to work along the guarded coast - but was once arrested when observed working in a deep gully. Although soon released he was set upon by an angry mob believing him to be a spy and was saved by a policeman who escorted him to the railway station.

As Greenly moved away from the simpler rocks of the Carboniferous and Ordovician he had to face the complexities of the glaucophane schists, gneisses and the Coedana granite in the centre of the island. Eventually he also had to confront the schists and quartzites of Holy Island, which he viewed with “great trepidation”. Clough visited him in 1907 and suggested that there might be repetition by nappe-like isoclinal folds within these rocks, a concept that was becoming clear in the Alps and which Clough was developing in the Dalradian. Greenly readily adopted this idea although it was later proved incorrect by Shackleton (1957) on the basis of sedimentary structures; although Greenly was aware of cross-bedding and graded bedding he would not have expected them in these older schists and quartzites.

However, Greenly became aware of the presence of the magnificent, large-scale, upright folds in these rocks when he drew the coastal section, during a perilous journey in a steam life-boat. It is clear from his beautiful drawings in the Memoir that he was also aware of the relationship of minor to major folds, and of the consistency of axial plunge of the various scales of folds. Moreover he clearly appreciated what we now call ‘refolding’ on various scales.

Greenly received many geological visitors, especially Barrow, Clough, Dakyns, Lamplugh, Horne, Kilroe and Matley. Barrow stayed for two weeks and gave great help with the schists and gneisses. He became great friends with Blake and Calloway, despite their opposing views about the Moine.

Annie Greenly was a frequent spectator, often sitting on hilltops while her husband mapped, and acted as his look-out for express trains in railway cuttings. Transport around the island, which has an intricate network of minor roads (then unpaved), was by foot, bicycle and train. Their home was a cottage that the couple had built within easy reach of Bangor station. For remoter areas Greenly took 'country quarters' which, as work progressed, meant being away from home for most of the year. Otherwise, Annie would go ahead by rail to find quarters in cottages, inns and farms. Annie visited Edward at weekends, bringing home-made food, often walking five miles from the nearest station. She made him send her 'quarterly returns', just as he would have done in the Survey, giving the linear miles of boundaries and the square miles mapped. The square mileage was often not more than 20, but his boundary mileage to the square mile was often as much as 30. It is worth noting that Greenly was one of the first geologists to outline exposures precisely on his maps.

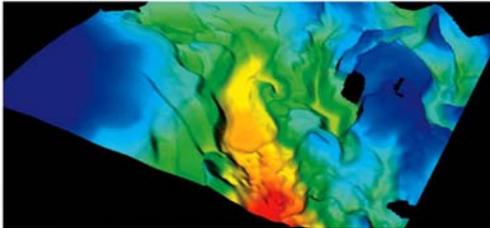
The mapping was completed after "15 years, 4 months and a fortnight" on 8 October 1910, on a remote hillside in the north of the island. He shut his map-case and embraced Annie, who was by his side. In 1920 the 1:63,360 map, delayed by the Great War, was published together with its detailed two-volume Memoir. In 1927 Annie, aged 75, died at home in his arms. Greenly later donated money to the Geological Society of London for the Annie Greenly Fund, awarded to this day for detailed geological mapping.

Sources

Greenly's autobiography (1938. *A Hand Through Time*, Thos. Murby & Co, London) and Memoir to the Anglesey map (1919. *The Geology of Anglesey; Memoirs of the Geological Survey of Great Britain* HMSO, London, 78, 980 pp). Also: Williams T P T, *The role of Annie Greenly in the elucidation of the geology of Anglesey*. In: Burek, C V & Higgs, B (eds) *The Role of Women in the History of Geology*. Geological Society, London, Special Publications, 281, 319-324.




International Conference:
Modelling Sedimentary Basins and their Petroleum Systems
 22 - 23 April 2010
 The Geological Society, Burlington House, Piccadilly, London



Advances in modelling of basin formation, fill and fluids.

Themes:

- Basin formation (tectonic and crustal modelling)
- Sediment forward modelling - predicting reservoir, source and seal quality
- Petroleum systems modelling - Predicting hydrocarbon generation, expulsion, migration and timing
- Fluid distribution, pressure, fluid type and biodegradation
- Calibration of models using observed fields and fluid distribution
- Building better integrated models and new technologies

Confirmed Keynote Speakers:

- Prof. Joe Cartwright: Cardiff University
- Dr. Johannes Wendebourg: Shell
- Dr. Nicky White: Cambridge University

To submit an abstract or for further information, please contact:
Steve Whalley, Events Co-ordinator: +44 (0)20 7432 0980
 or email: steve.whalley@geolsoc.org.uk



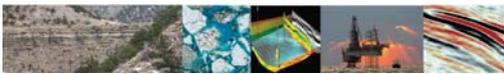
At the forefront of petroleum geoscience
www.geolsoc.org.uk/petroleum



PETEX 2010
From Volatility to Value



International Conference: CALL FOR ABSTRACTS
Petroleum Geoscience Research Collaboration Showcase
 23 - 24 November 2010
 Earls Court, London



ABSTRACT DEADLINE - MONDAY 31st MAY

The Petroleum Group, in conjunction with the PESAGB and AAPG are re-launching this event as part of PETEX 2010 (23-25th Nov). This international conference showcases the business challenges addressed by research projects, enables researchers to demonstrate societal and economic benefits from research, and provides an early-stage forum for post-doctoral and postgraduate presentations. It is an excellent opportunity for industry and academia to meet, get inspired and to develop future collaborative research links. Graduates and potential future employers can also establish connections.

We strongly encourage and preference will be given to joint or sequential presentations by industrial sponsors (or academic supervisors) and student researchers. This "buddy system" is intended to frame the industrial problem before technical results are reported and/or to conclude by showing the applied, economic benefits of the research. We also welcome overview presentations from the principal investigators of major Joint Industry Projects.

Suggested themes include but are not limited to:

- Reservoir geology, petrophysics, characterization, analogues and modelling
- Clastic and carbonate stratigraphy and sedimentology
- Structural geology and basin evolution
- Applications of geophysical imaging and interpretation in geological analysis
- Unconventional energy and carbon sequestration
- Case histories of joint industry-academia research and knowledge transfer

Prizes will be awarded for the best oral presentation and best poster, which includes the recipients attendance at the Petroleum Group's annual dinner at the Natural History Museum in 2011.

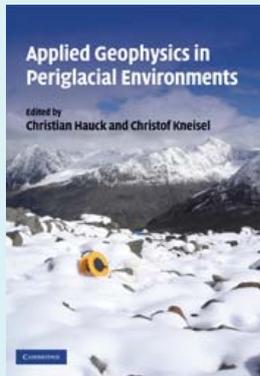
For further information and abstract submissions please contact Steve Whalley:
 +44 (0)20 7432 0980 or email: steve.whalley@geolsoc.org.uk



At the forefront of petroleum geoscience
www.geolsoc.org.uk/petroleum

Reviews

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



Applied Geophysics in Periglacial Environments

Hauck, C and Kneisel, C (eds)

Published by: Cambridge University Press

Publication date: 2008

ISBN: 978-0-521-88966-7 (hbk)

List price: £70.00

240 pp

www.cambridge.org

The book is divided into two parts, the first dealing with four specific types of geophysical method (electrical, electromagnetic, refraction seismic and Ground Penetrating Radar (GPR)). The second part comprises 12 overly brief case-histories, illustrating the use of the methods outlined in Part 1. The book concludes with an appendix listing geophysical parameters and comments on the use of the various geophysical methods in periglacial environments.

Of the textbook-style first four chapters, three conclude with a checklist aimed at helping with fieldwork planning. However, for the target readership the advice is superfluous and in places patronisingly basic – e.g. “save your data”. The principles of each method are covered more comprehensively and better in existing textbooks. However, the chapter on electrical methods very usefully describes aspects of the inversion of tomography data using the widely-available software package RES2DINV with specific reference to periglacial materials. The EM and seismic refraction chapters are far too brief to be of much help even at a basic level and are not supported by many of the case histories in Part 2.

Three of the 12 case histories cover GPR applications marginal to periglacial environments, with two being on glacial investigations and the third on frazil ice within rivers. While individually interesting, these three chapters are extraneous to the geographical focus of the book. The remaining case histories, although brief, are useful to the intended readership.

The book is well produced with clear illustrations including eight pages of colour plates. The references cited are strongly biased towards the work of the contributing authors and therefore lack the balance of a broader review of much more widely available literature. According to the preface, the book is intended as a reference guide for the application of geophysical techniques in mountainous and polar terrain, and as a handbook for planning and conducting field surveys. It is aimed at graduate and postgraduate students and researchers intent on using geophysical methods for the investigation of periglacial regions.

The limited space available could have been better used to concentrate on the applications to periglacial environments rather than trying to cover material that is available elsewhere. The book is likely to appeal to researchers serious about using geophysical techniques in periglacial environments, but they should also refer to more mainstream geophysics textbooks and field manuals. The scope of the content and price are likely to discourage other potential readers from buying the book.

John M. Reynolds



Heaven and Earth. Global warming: the missing science

Ian Plimer
Published by: Quartet Books Limited, London
Publication date: 2009
ISBN: 978-0-7043-7166-8
List price: £25.00
504 pp

www.quartetbooks.co.uk

In the opening paragraph of this controversial book, Ian Plimer makes his case that geology should be at the heart of discussions on the climate; what has happened in the past can teach us about the present. Plimer, himself a geologist and an Honorary Fellow of this Society, feels that few scientists are as well equipped as we are to take the necessarily broad, integrated view of the problem of climate change - except he does not see it as a problem, since he believes that in geological and historical times warmth tended to equate with a "bountiful" Earth.

He is uncomplimentary about the work of the Intergovernmental Panel on Climate Change (IPCC) and lambasts the narrowness of its science, its lack of rigour and errors, as well as the Panel's reliance on computer modelling - omitting even to model clouds, which he says have a massive effect on climate. (The book was written before the recent controversies surrounding the IPCC.) The well-known IPCC 'hockey-stick' graph of Mann and others, purporting to show the 20th Century warming as unique, comes under particularly detailed attack.

Plimer accepts the evidence for 20th Century global warming although, as every geologist knows, Earth has warmed many times in the historical and geological past; and it cooled from about 1940 to 1976, and, according to Plimer, has again since 1998, notwithstanding the continued rise in CO₂.

He devotes chapters to the Sun, Earth, ice, water and the atmosphere, and his arguments are dense and detailed, supported by no fewer than 2300 footnote references. His theme throughout is that climate systems are far too complex to be modelled by computers, and that the effect of anthropogenic CO₂ is small compared with, for example, variations in solar and cosmic activity. CO₂ undeniably absorbs infra-red energy, but water vapour has a far greater effect.

Moreover, most of the absorption by CO₂ is achieved by quantities up to about 200 ppmv; above that the 'law of diminishing returns' comes into play. In former geological times (particularly the Early Palaeozoic and Mesozoic) CO₂ levels were many times their present level (385 ppmv) and yet there was no runaway greenhouse or 'tipping point' as alarmists warn.

There is much to ponder in this encyclopaedic *tour de force*, but even apart from the obvious (climate change adherents have already attacked it vociferously) it is not without irritations. For example, Plimer employs dozens of graphs to make his points, but annoyingly some plot time from left to right and others from right to left. Worryingly, from the unsupported assertions it contains, and contradictory statements it makes, one gets the impression the book was written in a hurry.

Nevertheless it is an important book, written in what the author perhaps sees as a repeat of his earlier campaign against Christian fundamentalist "Young Earth" creationism in Australia. In Plimer's words: 'Global warming has become the secular religion of today'. If this book encourages scientists to exercise their natural scepticism, it will have achieved its purpose. Plimer has little time for the 'But there's a consensus.....' argument, mindful of the consensus of experts who steered the world economy into its present problems. Science does not progress by consensus, he points out, but through free-thinking.

Michael F Ridd

A major Lyell Collection benefit for Geological Society Fellows The Full Book Collection

- Features all Special Publications, Memoirs and Engineering Geology Special Publications – including all the most recent titles
- Online access immediately on publication
- Full text files and electronic reference linking
- Fully integrated with the Lyell Collection
- Approximately 10 000 new peer-reviewed pages added every year

The price for one year's access to the Full Book Collection is £55 (including VAT). To subscribe email the Fellowship Office at membership@geolsoc.org.uk.

Visit the Lyell Collection at:
<http://www.lyellcollection.org>

Lyell
Collection
 Geological Society publications online

Foundation Sponsors:



Shell London Lecture Series

Geology and Ecology - The evolution of a megaproject on Sakhalin Island

Speaker: Chris Finlayson (Shell)

Date: Wednesday 12 May 2010

Sakhalin Island has the ingredients for a tremendous geological challenge – an area isolated in sub-arctic conditions, with moving ice floes, numerous seismic fault lines, and vulnerable ecological habitats across the landscape and sea. Lying beneath all that is some four billion barrels of oil equivalent of natural gas, which could substantially contribute to meet the ever-increasing global demand for energy. This is the setting for a success story called the Sakhalin II Project, a technical marvel of many industry firsts, built and operated in those extreme conditions. Equivalent in size of five world-scale projects, Sakhalin II is the world's biggest integrated oil and gas project that, when running at full capacity at 9.6 million tonnes per annum, can add 5% to the world's current liquefied natural gas (LNG) capacity.

From north to south of the island, Sakhalin II is an interlinked network of unique engineering feats. The project involves the installation of two offshore platforms, a 300km network of underwater pipelines, two parallel 800km onshore oil and gas pipelines, an onshore processing facility, an oil export terminal, and Russia's first LNG plant. Technological innovation in Sakhalin II ensures its survival in harsh climate conditions, for instance making the platforms capable of withstanding enormous pressure from ice floes and major earthquakes that occurs in Sakhalin perhaps once in 3,000 years. With a talented pool of local and international resources, Sakhalin II not only endured but also tapped into the elements to achieve a technological masterpiece, and emerged as a sustainable model of future projects. It is a venture like no other.

Chris Finlayson is the Shell Projects and Technology Executive Vice President for Global Solutions Upstream. He is responsible for front-end project development across Shell's portfolio. Born in 1956, Chris graduated with a First Class Bachelor's degree in Physics/Geology from Manchester University, UK. In 1977, he joined Shell and was posted to Aberdeen. The years 1982 to 1996 took Chris to Brunei, Turkey, London and Nigeria. In 1996 he returned to Aberdeen and took the role of Deputy Managing Director of Shell UK Exploration and Production from 1998-2000.

- Matinee: Tea and coffee 14.30; Lecture 15.00 – 16.00
- Evening: Tea and coffee 17.30; Lecture 18.00 – 19.00

Further information

Please visit our website www.geolsoc.org.uk/shellondonlectures10. Entry to each lecture is by ticket only. To obtain a ticket please contact Alys Hilbourne. Due to the popularity of this lecture series, tickets are allocated in a monthly ballot and we cannot guarantee that you will get tickets when they are requested.

Contact: Alys Hilbourne, Event Manager, The Geological Society, Burlington House, Piccadilly, London W1J 0BG,
T: +44 (0) 20 7432 0981
E: alys.hilbourne@geolsoc.org.uk.

In association with 

IMPORTANT NOTICE TO ALL FELLOWS

Please remember that your journal access will be online-only in 2010.

If you wish to receive a print copy as well please be sure to choose this option when renewing your Fellowship. The surcharge for the receipt of a print copy is £10.

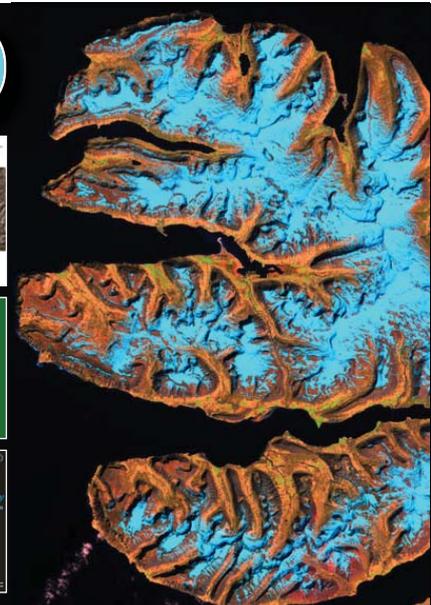
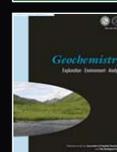
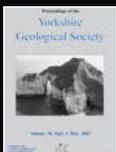
For further information see

<http://www.geolsoc.org.uk/gsl/geoscientist/atlarge/page6221.html>

The Geological Society's Lyell Collection journals, Special Publications and books online.

For more information visit

www.geolsoc.org.uk/LyellCollection



Dates for your diary

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



DEVEK 2010, 12-13 May 2010

The seventh DEVEK event will again be held in Aberdeen – a world-class centre of subsurface production techniques and expertise. The conference, held at the Aberdeen Exhibition & Conference Centre (AECC) is designed for geologists, geophysicists, reservoir engineers, petroleum engineers, production technologists, well engineers and drilling engineers



North Sea Course, 24-26 May 2010

Due to the popularity of this course, it is to be repeated in Aberdeen for 2010!

The course will review the structural and stratigraphic components of the North Sea and their role in hydrocarbon generation, migration and trapping, but will have a new focus on reservoir geology and exploitation of the remaining reserves. Leading experts from industry and academia are contributing their experience and the course will be invaluable for all new entrants to the industry, whether geology graduates, postgraduates or other specialists or generalists.



North Africa Course, 29 June - 1 July 2010

This course will be presented by leading academic and industry geoscientists who are actively involved in research or exploration in North Africa. Over 3 days it will provide a review of the regional geology of North Africa, geological setting, structural evolution, regional stratigraphy and basin development. The course examines the key petroleum systems, Palaeozoic to Lower Mesozoic, Mesozoic to early Tertiary and Cenozoic, and reviews the main producing basins in Libya, Algeria, Egypt, Tunisia and Morocco. Numerous case studies and field examples will be presented, and the course will conclude by looking at current exploration and development activity, assessing potential future trends.



FOUNDERS' DAY LECTURE AND DINNER

Thursday 11 November 2010

Tickets are limited

FROM PAVILAND TO PAKEFIELD: 700,000 YEARS OF HOMO BRITANNICUS

SPEAKER: **Chris Stringer**
 Natural History Museum

The search for human origins has always been, and continues to be, fraught with issues of identity, race, religion and nationality. This, combined with a palaeontological record that is extremely fragmentary and difficult to interpret, makes palaeoanthropology one of the most hotly debated issues in science. Professor Chris Stringer will trace our attempts to make sense of the origins of Homo britannicus, from Dean Buckland's "Red Lady" to the present day.



And afterwards at Le Meridien, Piccadilly
 Dress: Black Tie
 Ticket price: £70

After dinner speaker, Dick Selley (Imperial College, London)

Dining with dinosaurs



CONTACT DETAILS

For further details contact: Alys Hilbourne,
 The Geological Society, Burlington House, Piccadilly, London, W1J 0BG
 Tel: 020 7432 0981; Email: alys.hilbourne@geolsoc.org.uk Web: www.geolsoc.org.uk/founders10

WILLIAM SMITH 2010

Landscapes into Rock



21 – 23 September 2010

CALL FOR PAPERS, DEADLINE 31 MAY

Please visit our website or contact us on the details below for further information

The aim of this meeting is to bring together geoscientists from different sub-disciplines to address the problem of the interactions between erosional and depositional landscapes, sediment routing systems and the building of stratigraphy. By studying these interactions we gain a better understanding of the dynamics of the coupling between exhumation, erosion, transport and deposition of sediment in source to sink systems, and an enhanced ability to invert stratigraphy for forcing mechanisms.

CONVENERS

- Philip Allen
Imperial College London
- Hugh Sinclair
Edinburgh University
- Paul Bishop
Glasgow University
- Robert Gawthorpe
Manchester University

CONFERENCE THEMES:

- THE EROSIONAL ENGINE
- THE DYNAMICS OF SEDIMENT ROUTING SYSTEMS
- LANDSCAPES INTO ROCK: THE MAKING OF STRATIGRAPHY
- INTEGRATIVE STUDIES OF SEDIMENT ROUTING AND THE PETROLEUM SYSTEM

For further information about submitting a paper, please visit our website at www.geolsoc.org.uk/williamsmith2010, or contact us on:
 The Geological Society, Burlington House, Piccadilly, London, W1J 0BG.
 Tel: 020 7432 0981 Email: alys.hilbourne@geolsoc.org.uk





Aerial view of burial mound



陶俑、陶马大多是由几十甚至上百个破碎的陶片粘接修复起来的。

The pottery warriors and horses were stuck together from hundreds of broken pieces.

Figures being stuck together



John Bell believes that the accepted explanation for the destruction suffered by the Terracotta Army of China's First Emperor is mistaken. Seismicity, not human agency, was to blame...

In 247 BC, 13 year-old Crown Prince Zheng became King of the state of Qin. Work on his necropolis began immediately, a city for him to inhabit in the next world. By 221 BC he had conquered six rival states, created a nation that became known as China, and declared himself *Qin Shi Huang Di*: The First Emperor of Qin. The necropolis, still incomplete when he died in 210 BC, had taken 38 years to build, and spread over more than 56 square kilometres. The First

All under

Emperor was entombed beneath a burial mound similar in size to the larger pyramids in Egypt. Originals or replicas of his most precious possessions were buried in over 600 pits surrounding the mound. Seven thousand life-size Terracotta Warriors stood guard in rank and file, 1500 metres to the east, five metres underground. The Emperor had created what are now the most widely recognised historical figures in the world.

Qin Shi Huang Di is a legendary figure. Stories of his life and deeds continue to fascinate and have spread across the world, from Sima Qian's *Shi Ji* (Records of the Grand Historian) written c. 100 BC, to the movie *The Mummy: Tomb of the Dragon Emperor* and the Tan Dun opera *The First Emperor*.

Today's visitors to the Museum of the Terracotta Warriors, Horses and Chariots (Lintong County near Xi'an) are given explanations of the near total destruction that has taken place since 210 BC. Sometimes, the devastation is passed over. The books and other documents produced by the British Museum for the 2008 exhibition *The First Emperor: China's Terracotta Army* include no written references to the destruction of the figures, or the processes used to stick them back together for their 21st Century exhibitions.

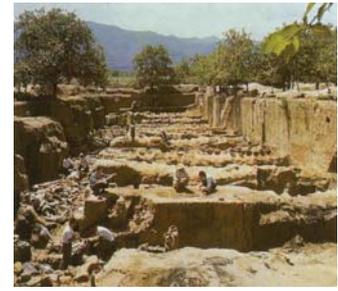
However, I believe I have solid and convincing evidence that reveals the truth about these figures' destruction for the first time. The answer lies in the geology and seismology of Shaanxi province and the remarkable earthquake records kept by Chinese officials since 1177 BC.

Discovery and excavation

When completed, the necropolis included a pyramid-shaped burial mound constructed from the area's loess clay. It is claimed that it stood 115 metres high in 210 BC, though its current dimensions are 76 metres high on a base 355 x 345 metres. The necropolis had tombs, palaces and halls, inner and outer walls and subterranean pits containing items to make the Emperor feel at home in his next life. Many of the pits, including those containing the Terracotta Warriors and Horses, lie outside the walls. Farmers first unearthed fragments of the Warriors in 1974, leading to the discovery of thousands of figures and other items.

Excavation has continued, but has not been continuous. The most recent dig in Pit 1 commenced in June 2009. The front ranks from Pit 1 have been glued together from excavated pieces. Further back there is a clear view of fragments that have been fully or partially exposed by the removal of hard-packed

Early excavations before the museum building was begun



r heaven

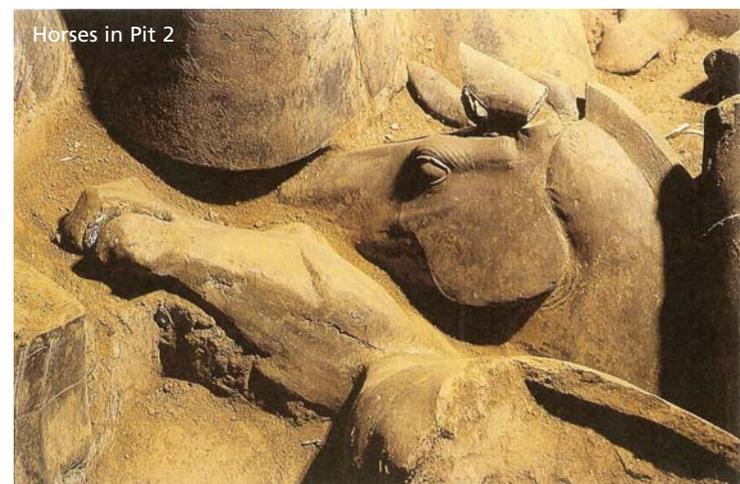
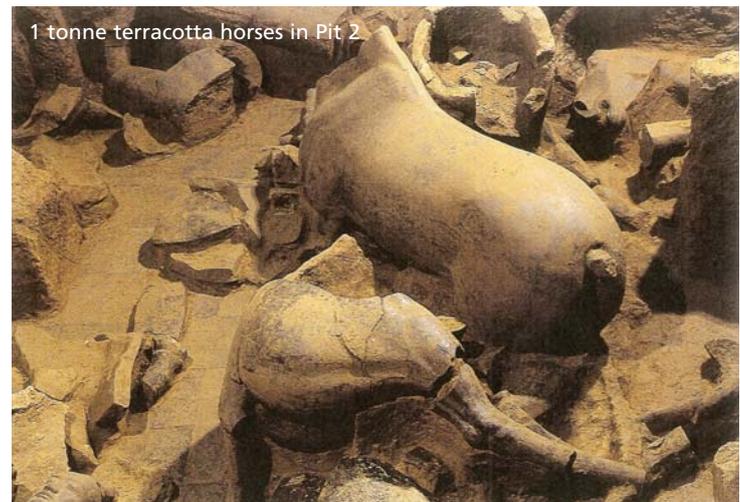
covering earth. The pit is 230m x 62m, with lengthwise rammed-earth walls dividing it into 11 corridors.

Pit 2 has a different appearance. Substantial areas of timber support pillars and roofing have been uncovered. Terracotta figures lie in pieces, made visible by the partial removal of some timbers. Warriors weigh from 110 to 300kg; horses weigh 1000kg. These massive objects have been smashed to pieces. Horses are seen with limbs torn off. Warriors lie in every direction.

Finds from other areas of the necropolis include; two half-size decorated bronze chariots, each pulled by four bronze horses (1980); terracotta acrobats (1999) and 44 life-sized bronze water birds with 15 terracotta attendants, possibly dancers and musicians, (2001). The bronze chariots and horses were in a wooden box measuring 6.8m x 2.1m x 2.0m, eight metres below ground in a pit 20 metres east of the mound.



Archive view of excavation of bronze chariots and horses



All of these artefacts were seriously damaged, bronze much less than terracotta. Museum displays show water birds, acrobats and musicians with images of repair processes. The bronze horses and chariots were found in 1555 pieces, taken to Beijing for restoration, and now occupy a central position in the museum.

Construction and destruction

An official notice reads:

The Construction of the Terracotta Army Pits

The three underground pits are built in similar basic earth-and-wood structure, but vary in size and shape. The way to construct the pits is as follows: They were about five meters beneath the present ground level with the terracotta figures placed in corridors. The corridors, divided by earth-rammed partition walls, were paved with pottery bricks on which the figures were placed. The earth walls sustained wood roof that was composed of huge and strong rafters, the roof was covered by layers of fiber mats, earth fill and tilled earth. The sloping roadways were rammed by earth. All these were constructed to totally conceal the Terracotta Army.

... while the guidebook reads:

Unfortunately, soon after their completion, these pits were seriously damaged. Many terracotta figures were broken, a great number of bronze weapons were looted, the wooden structures in the pits were burned down, and their roofs caved in. According to archaeologists, the damage was caused by the rebel army led by Xiang Yu, Overlord of West Chu, when the army entered the Land Within the Passes at the end of the Qin Empire.

This is commonly quoted as taking place in 206 BC when Xiang Yu is said to have led a 'peasant army' seeking revenge on the Qin Empire after the death of Qin Shi Huang. After entering the Terracotta Warrior pits, flaming torches were used to set fire to the 'huge and strong rafters' that weakened and collapsed, bringing down the roof and compacted earth, so crushing the figures.

This explanation raises many issues and questions. Pit 1 contains



Collapse



Restored chariots and horses now on display in the museum

unburned combustible material, including chariot wheels and parts of weapons. Pit 2 contains large areas of unburned roof timbers. Pit 2 is divided into smaller 'cells' that would prevent fire from spreading. How could fires spread through pits with limited oxygen supply and egress for the products of combustion? There is damage and destruction in every underground part of the 56km² necropolis. How long would it take to dig down to the pits to destroy the figures? How could the rebels survive the fires underground in pits up to 230m in length, 5m wide and containing Warriors, Horses and Chariots in close formation? Terracotta is fired clay, baked at 950°C to 1050°C. It is fire resistant - and strong in compression.

My first visit to see the Warriors was in February 2008 during the Chinese New Year holiday. My doubts about the underground fires were soon put aside, until events brought them back into focus.

Sichuan Earthquake 2008 AD - Shaanxi Earthquake 1556 AD

When the Sichuan earthquake struck at 2:28pm on 12 May 2008, I was at home from school in Xi'an. It took 15 seconds for us to realise what was happening. Wall tiles crashed to the floor in the bathroom, and with shouts of 'earthquake' we rapidly descended the emergency stairs to ground level.

As I left the stairway, I turned and saw a tower crane topple onto the roof of a construction some 25 stories high. More than 90 people died in Xi'an that day. Inanimate objects were also affected:

"XI'AN: Seven terracotta warriors and horses suffered slight damage in the May 12 earthquake, the Shaanxi provincial administration of heritage has said. Altogether, 56 heritage sites and 41 relics suffered damage of different degrees. But "fortunately, no immovable heritage or conservation facility was destroyed" Guo Xianzeng, deputy director of the administration, said. The heads of two warriors in pit No 1 have loosened and cracks have appeared in five warriors and horses in pits 2 and 3, said Wu Yongqi, director of the terracotta museum in Xi'an, capital of Shaanxi province." (*China Daily News*, 29 May 2008).



Photo: Samantha Bell

30 minutes after the Sichuan earthquake 12 May 2008 Erin Bell and John Bell in Xi'an

I used *Google Earth* to determine the distance from the Magnitude 7.9 Sichuan epicentre to our apartment (630km) and the Warriors (688km). If such a distant earthquake could damage the terracotta warriors, what would be the effect of a closer one?

Questions and discussions with students and friends in Xi'an produced the same response: "we never have earthquakes". Yet an Internet search for 'Xi'an earthquake' followed by 'Shaanxi earthquake' gave an astonishing result. Pages of sites came up, detailing, "... the most devastating earthquake in human history..." at midnight on 23 January 1556 AD. The 'Shaanxi Earthquake' (or 'Huashan/Huaxian Earthquake', Magnitude 8.0-8.3, epicentre intensity 11) killed 830,000 people. It devastated a vast area of China, wiping out whole towns. Hundreds of thousands were buried alive in their homes in hand-dug caves in the loess plateau of Shaanxi and neighbouring provinces. After entering the coordinates with the USGS, I found that the epicentre was a mere 40km from the warriors.

A wider search revealed that earthquake records had been kept in China for over 3000 years and were without doubt the most comprehensive in the world. I obtained, *'A catalog of historical earthquakes in China compiled from recent Chinese publications'*, Bulletin of the Seismological Society of America (v 66.6, pp 2003-16), which lists earthquakes from 1177 BC. A simplified fault map based on LANDSAT images with historical (1177 BC - 1900 AD) and recent (1962 - 1974) data plotted separately allowed the authors to conclude that: "the most notable difference... is the apparent seismic quiescence of Western China in the pre-instrumental period. This is due entirely to the lack of data there"... 'On the other hand, (there is) activity along well-delineated belts such as the Weihe graben in Shensi (Shaanxi) province".

In one sense, the students and friends I had questioned were right. The data for the province record 35 earthquakes between 1177 BC and 1834 AD, with many coming in groups just a few years apart. From the perspective of people and communities, earthquakes separated by long periods of inactivity are effectively "unknown". I followed up my single placemark plot with all 35 listed in the catalogue in Shaanxi and several more in neighbouring provinces. In addition to the 8.0 to 8.3 Magnitude event of 1556, nine earthquakes of M4.5 to 6.75 were

recorded within 40km of the Terracotta Army site, in years BC 35, AD 600, 791, 879, 1487, 1559, 1563, 1569 (twice). The closest in distance was the 1563 event (M5.5, 7.2km away). When all these are plotted, it looks like someone has been taking pot shots at the necropolis, and often getting very close to a bull's-eye!

Amateur seismology

In this region of northern China sizeable earthquakes are not frequent, indicating that the underlying Ordos Block is stable and solid. It lies north of the Tibet Plateau and the resulting interaction between the block and the northward moving plateau has produced significant seismic events, including the Haiyuan earthquake (M8.6, 1920). The block rotates counter-clockwise, influencing the seismic activity in the Weihe graben basin that is the subject of this article. The geology and seismology of the basin has been the subject of considerable research; it is an active area.

Huashan mountain (Ed Garrett)



In March 2009 a visit by friend Ed Garrett, a postgraduate student of geography at Durham University, gave my researches renewed impetus. With my wife Sue, we travelled the 65km east from Xi'an to Huashan to ascend midway up the sacred mountain by cable car.

Approaching the Weihe graben floor, the effects of the 1556 event are clearly visible. Hou J *et al.* describe the range of techniques available to gain evidence for the occurrence and causes of the earthquake, concluding: "... we need to consider the potential for active faulting, and prepare for another possible large earthquake in the region, since the faults are active now." (*Journal of Structural Geology*, vol. 20, no5, pp. 549-557, 1998). Zhang A *et al.* subdivide the fault zone into two and ascribe the 1556 event to the "...obvious activity of the piedmont fault of Huashan mountain". They estimate the earthquake recurrence interval at 2000 to 2500 years for the fault and 2000 to 4000 years for the zones. (*Quaternary International*, vol. 25, pp. 25-31, 1995).



Students continue work in the open, following the Gaoling County earthquake at 07:31 on 5 November 2009 (Photo: China Daily News)

This paper has renewed relevance following a M_{4.8} event on 5 November 2009 at 07:23 (GMT +8) in Gaoling County, Shaanxi province. The epicentre was 16km from the Qin mausoleum and 5km from the Weihe (River Wei) and therefore in a central position towards the western end of the Weihe graben. Media reports suggested that the Terracotta Warriors were undamaged.

As well as affecting the Emperor's terracotta guardians, earthquakes seem certain to have caused the reduction in height of the burial pyramid. The combination of high intensity seismic action, high riparian water table and loess closely resembles the New Madrid Fault Zone in the

Mississippi valley. Close examination of photographic evidence, the results of ground-penetrating radar investigations and thermal analysis support the view that the mound has been shaken, liquefaction has occurred, and the upper section of loess originally forming a 'true' pyramid has collapsed into the burial chamber.

Research has confirmed the veracity of ancient historical records in China. There can be no doubt that the necropolis has been subjected to very strong earthquake action many times since 210 BC. It is my belief that the Emperor lay undisturbed for at least 175 years until the recorded earthquake sequence began in 35 BC with a M_{5.0} event, recorded at a distance of 20km.

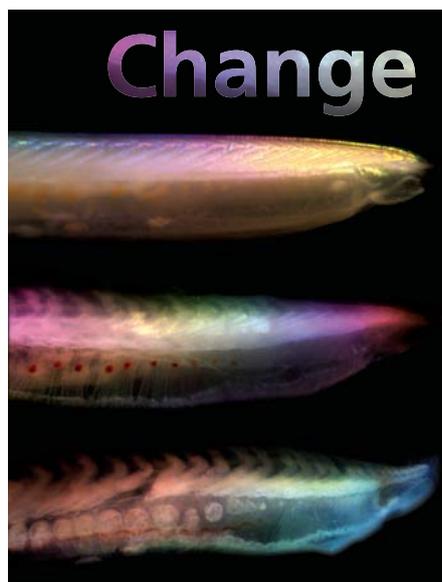
Sima Qian's historical records of the events of the Qin Dynasty are very detailed, but do not include any raids by Xiang Yu's 'rebel army' on the Terracotta Warriors. In fact, Sima Qian does not mention the Terracotta Warriors at all. This is not surprising, since modern accounts assert that *no one* knew about them until their rediscovery in 1974. It is inconceivable that the Warriors were unaffected by at least the 1556 Huashan earthquake, when above ground there was total devastation. The recent M_{4.8} event at Gaoling caused no damage; but my estimate of its epicentre intensity is some 10,000 times smaller than the Huashan event. Huashan is 40km from the Warriors location, Gaoling 16km. I have attempted to calculate the effect of the earthquake waves as they passed through the underground pits, using estimates of the accelerations produced, but have decided that this would be taking amateur seismology too far.

I am hoping that this account will act as a catalyst for research.

** John Bell, 68, is a teacher from Durham (UK). He teaches physics at Jinling High School, Nanjing, PRC. He was a teacher and Centre Principal at the Cambridge Advanced Learning Centre in Gaoxin No. 1 High School, Xi'an, PRC, from 2007 to 2009. Following John's diagnosis with Parkinson's disease in 1998, he and Sue have continued to live actively, believing that challenging exercise is as good for the brain as it is for the rest of the body.*

The mausoleum of Qin Shi Huang Di





Three rotting heads. A sequence of images showing how the characteristic features of the body of *Amphioxus*, a close living relative of vertebrates, change during decay.

Palaeontologists in Leicester University are studying rotting chordates in an attempt to explain something very fishy about the fossil record. Sarah Day explains...

University of Leicester palaeontologists have been studying rotting lampreys and lancelets – specimens of the Cephalochordate *Amphioxus* - to reconstruct the pre-fossilisation processes of decomposition. Dr Mark Purnell, one of three co-authors, said: "To say it was unsavoury and unpleasantly pungent is an understatement".

By studying the decay processes, researchers can get a clearer picture of what might have

Change and decay

happened to ancient fish-like creatures as they rotted, prior to fossilisation - which in turn helps them to interpret fossil remains. "What we want to get at is what an animal was like before it died", says Dr Rob Sansom, lead author of the paper. "As with forensic analysis, knowing how the decomposition that took place after death altered the body provides important clues to its original anatomy".

The results of the study, published yesterday in the journal *Nature*, show that characteristic features of early vertebrate fossils may have been lost during decomposition. This could mean rewriting our understanding of our earliest ancestors. With characteristic features such as a tail, eyes, and the beginnings of a backbone, fish-like fossils from half a billion years ago represent part of our earliest ancestry.

"These fossils provide our only direct record of when and how our earliest vertebrate ancestors evolved" says Purnell. "Did they appear suddenly, in an evolutionary explosion of complexity, or gradually over millions of years? What did they look like? In what ways did they differ from their worm-like relatives and how did this set the stage for later evolutionary events? Answers to these fundamental questions – the how, when and why of our own origins – remain elusive because reading the earliest vertebrate fossil record is difficult".

This is largely because so many features of an organism's anatomy are lost during the process of decay, although it could also suggest rapid, explosive evolution. Developing a better understanding of how decomposition happens will help to answer these questions. As Dr Sarah Gabbott, who conceived the study with Purnell, explains: "Only in the most exceptional circumstances do soft-tissues, such as eyes, muscles and guts, become fossilised, yet it is precisely such remains that we rely on for understanding our earliest evolutionary relatives: half a billion years ago it's pretty much all our ancestors had". However the researchers discovered that the most diagnostic features – in these cases, the head and brain – tended to suffer from decay first, with the effect that any fossil would tend to appear "lower" down the evolutionary tree than it should. The processes of decay therefore tend to make the fossil remains appear more "primitive".

Reference: Robert S Sansom, Sarah E Gabbott & Mark A Purnell: *Non-random decay of chordate characters causes bias in fossil interpretation*. *Nature* 463, 797-800 (11 February 2010).



IN *Brief*

Joe McCall's review of the science news that caught his eye is available online this month.

••••• *Most GeoNews appears first in Geoscientist Online* •••••

When the Med *filled up*

How did the Mediterranean fill up after the Straits of Gibraltar were breached? Ian Randall reports on a new model that constrains the evolution of the “Zanclean Flood”.

The Zanclean Flood inundated the Mediterranean Basin after the almost complete evaporation of the Mediterranean Sea in the event known as the Messinian Salinity Crisis, around 5.6 million years ago.

The exact nature of this flood, which occurred when Atlantic waters breached the present-day Straits of Gibraltar, had previously been poorly understood. It is thought that the deluge was most likely triggered by the sinking of a slab of lithosphere beneath the Betic-Rifean orogen.

Studies of boreholes and seismic surveys taken from within the Straits have revealed deep, Messinian age incisions beneath the present-day sea floor. These cuts are seen to extend over 200km laterally and exceed 250 metres in depth on both Atlantic and Mediterranean sides of the Straits. These channels were previously thought to have been generated by headward erosion by rivers and streams during the period of desiccation.

However a new study, by researchers from the Institut de Ciències de la Terra, Jaume Almera, Spain, published in *Nature*, models these as being generated at the time of the flood by the gouging effect of returning Atlantic waters. This study also envisages the flood not as a thunderous Niagara-like waterfall, but like a giant “ramp” leading down from the Atlantic to the dried-out sea below.

The new model, which has enabled the researchers to estimate how long the Mediterranean Basin might have taken to become full, envisages the water’s erosive action as comparable to riverine incision. “To quantify and understand the abruptness of the post-Messinian flood we needed to incorporate the dynamics of rock incision as the mechanism that progressively excavated the floodway and let ever increasing flow of Atlantic waters into the Mediterranean basin” the researchers write.

The researchers believe that, while a preliminary, low level discharge may have lasted for thousands of years, 90% of the flood waters were transported from the Atlantic in a



period of less than two years. Such a mighty influx would, at its height, have caused sea levels in the Mediterranean to have risen by over 10 metres per day.

“Our findings suggest that the feedback between water flow and incision in the early stages of the flooding imply discharges of about a billion cubic metres per second (three orders of magnitude larger than the present day Amazon River),” the team says. They also believe

that the rate of bedrock erosion may have been as fast as 0.4 metres per day.

“This is a very exciting paper”, says Imperial College’s Dr Sanjeev Gupta, who is known for his work on a similar catastrophic flood event in the English Channel. “It focuses people’s attention on the flood in more detail.” Dr Gupta hopes that this flooding model might prove to be applicable in other such deluges from geological history, adding that it would be useful to see if we “can find more flood-associated landforms and deposits from the flood.”

The oceans do not provide the only examples of megafloods – overflows from many large lakes have had a sizable impact on their local topography: such as Utah’s former Lake Bonneville, and the Ebro basin in Spain. However, the Zanclean event is unique in both the size of the source basin, and of the eventual sink.

Evidence for the cyclic desiccation of the Mediterranean Sea has come from the presence of deep (up to 2500m) fluvial canyons that were carved into the empty seabed during the Messinian, when water levels were around a kilometre lower. Similar evidence is also found in the salt deposits from the centre of the basin, which can be found in outcrop in Italy, Libya and Sicily. Messina, which is in Sicily, gave its name to the salinity crisis.

Reference: D Garcia-Castellanos, F Estrada, I Jiménez-Munt, C Gorini, M Fernández, J Vergés & R De Vicente: *Catastrophic flood of the Mediterranean after the Messinian salinity crisis*. *Nature* 462, 778–781 (10 December 2009)

* Ian Randall is a geologist studying science journalism, currently working as an intern at Geoscientist.

••••• *Most GeoNews appears first in Geoscientist Online* •••••

Society Business

Council meetings and OGMs

The dates for meetings of Council and Ordinary General Meetings until June 2010 shall be as follows: Council: 21 April. OGMs: 21 April



Last admissions to the Apartments

From the sixth of this month, new arrangements apply for those wishing to be admitted after 1700.

Council decided on 28 January that the Society would introduce a "last admission" policy. The Apartments in Burlington House will remain open from 0930 until 1730 as at present; but any Fellow wishing to be admitted after 1700 may come *by prior arrangement only* – and should telephone Reception to this effect no later than midday. DR

President's Day 2010

The Society announced last month the names of the winners of its medals and funds 2010. The winners were: **Rick Sibson** (Wollaston Medal); **Bill Ruddiman** (Lyell Medal); **Randall Parrish** (Murchison Medal); **Henry Posamentier** (William Smith Medal); **Richard Curtis Selley** (Coke Medal); **Euan Neilson Kerr Clarkson** (Coke Medal); **Sara Russell** (Bigsby Medal); **Peter Furneaux Friend** (Prestwich Medal); **Jurassic Coast World Heritage Site core team** (R H Worth Prize); **Zoe Shipton** (William Smith Fund); **Kirsty Penkman** (Lyell Fund) **Margaret Wood** (Distinguished Service Award) **Laura Robinson** (President's Award) **Tom Dunkley Jones** (President's Award) **Tom Gernon** (President's Award).

The Awards will be presented at President's Day, to be held on 2 June 2010. On that day (full details in the next issue), Rick Sibson will talk on using geological and geophysical data to understand the source of shallow earthquakes. Bill Ruddiman will talk on the anthropogenic contribution to the gradual increase in CO₂ and CH₄ levels over the last several thousand years. Randy Parrish will talk on recent advances in geochronology and Henry Posamentier will talk about exploring the subsurface using integrated seismic stratigraphic and geomorphologic analyses – from abyss to alluvial plain.

Renewals – an apology

The renewals process this year has not run as smoothly as we would wish and I apologise if Fellows have been inconvenienced or have felt harassed by our reminders when as far as we were aware they had not completed their renewal. Some of the problems have been caused by the widespread postal strikes during October and November last year but nevertheless there are lessons to be learnt and we will be looking at our internal procedures in light of this year's difficulties. *Edmund Nickless*

Names for Election

The following names are put forward for election to Fellowship at the OGM on 21 April

ADDISON Stephen Paul; AITCHISON Andrew; ALDRIDGE Julian John; ALLCOCK Katherine Mary; ANGUS Paul Stuart; AULD Heather Anne; BAKER Louise Amanda; BALDWIN Samuel Francis; BALKARTAT Holly Mary; BARKER Nicholas; BERGH Judolene; BOTTOMLEY John; BREAM Stephanie Jane; BROCK Craig Michael; BROWN Jaime Arthur Soans; BUNCE James; BURBURY Darren; BURDEN Joseph William; CAMPBELL Allan Ewan; CARRUTHERS Thomas Daniel; CASSIDY Una Therese; CHAMBERLAIN Paul; CHANDLER Kevin Stephen David; CHANDLER Dafydd Neville; CHENG Ming Chit; CHENG Wai Ki; CLARKE Amy Louise; COLLIER Mark John; CONRAD Alexander; COWBURN Andrew John; COX Nicholas Daniel; COX Ryan Andrew; CRIDFORD Jane; CROOK Anthony James Lister; DALE LACE Simon David; DAVIDSON Matthew James; DAVIS Timothy John; DIXON Natasha; DODDABALLAPUR Jayanth; DOREY Marcus Roy; DOW Louise Jayne; DUNKERLEY Elizabeth Sarah; DUNKLEY David Richard; EDWARDS Susan Laura; EDWARDS Paul; EVANS Lara Elizabeth; FASHOLA Olaitan Ayodeji; FOLLEY Aidan Eugene; FORBES Anne Elizabeth Stansfield; FRANKLIN Benjamin Samuel Garrick; FRASER Alistair James; GLASS Adam David; GLUCK Oliver; GODFREY Stuart Lyle; GOODWIN Nicholas Robert John; GRAHAM James Thomas; GRIFFITHS Mark Anthony; GUY-SMITH Hazel Dann; HADLEY-JONES Frankie; HAIDER Romeena Shaista; HALLINAN Peter Michael; HARRIS Thomas; HARRISON Zara Helen; HARROP John Christopher; HAYES Richard David; HICKMAN Graham Peter; HINXMAN David Samuel; HODGSON James; HOLDAWAY Keith Richard; HOLMES Ian Michael; HORNIBROOK David; HUTTON Perran Sean; IRESON Andrew Mark; IRVINE Susan; IVANOVIC Ruza Francesca; JONES Gareth Hopkin; JONES Matthew Alexander; KALINDEKAFE Leonard Samuel Newton; KINNAIRD Timothy Charles; LAM Yu Ha; LANDIN John Mark; LETCH Stephen; LOHR Tina; LOWE Rebecca May; MANUEL John Alexander; MARTIN Aine Louise; MARTIN Jessica Catherine; McConvey Peter James; McLAREN Stuart Andrew; MEAD Samantha Lydia Ellen; MORGAN John Philip; NG Lorraine; NICOL Mhairi; NIKOLAS Michael; NORTJE Gustav Stefan; OSWALD Erik John; OWEN Sarah Caroline; OXFORD Melissa Jane; OXLADE David; PEIRCE Christine; PEREIRA Pedro Maria Lopes da Conhan; PHILIPS Lewis Benjamin Morris; PLUMB Helen Louise; RABEY Jonathan David; RATEAU Remi; RICE Timothy Douglas; RICHARDS Francis Lewis; RODRIGUES Katie Marie; ROEMMEL Janet S ; SHEPHERD Matthew Alistair; SIDDLE Richard John; SISMONDI Shawn; SLATER Phillip Stephen; SMITH Barry Michael; SMITH Andrew James; SMYTH Dermot; SPENCE Mark George; SPRINGETT Joshua William John; STOCK Paul Robert; STOVELL Robert; TAYLOR Christine Mary; TEGEGNE Fikadu Kassa; TEMPLE Ryan; THOMAS Samuel Mark; THOMSON Paul; TIPLER Peter; TRAPANESE Assunta; TYLER Andrew David James; WARREN Andrew John; WAZIRI Ibrahim Kashim; WHEELER Paul Simon; WHITE Jonathan David; WHITFORD James; WILLIAMS Luke; WINEFIELD Peter Richard; WOODYARD Grant; WYLDE Ann; WYNNE Andrew John.

Chartership News

Chartership guidance

Applicants still need more guidance in preparing a Professional Report, in selecting supporting documents and CPD, writes Chartership Officer Bill Gaskarth.



In the **Professional Report** the candidate states his/her case for becoming a Chartered Geologist. It should include a description of how, when and where they developed and obtained their professional skills and expertise. It is not simply an expansion of the employment record. The field of expertise in which candidates consider themselves competent must be defined - and the limits of their knowledge/expertise spelt out. There should also be a statement of intent for further development of competence, with aims and objectives outlined. This Report should give a clear picture of the candidate's skills, limitations and ambitions.

It is necessary for candidates to demonstrate their competence in a defined area of geological expertise. Work in associated areas, such as geotechnical engineering or contaminated land risk assessment, needs to be put into the geological context to emphasise geological competence in these areas. Remember that the application is for Chartered Geologist rather than Chartered Engineer or Chemist!

Supporting documents must be carefully selected to showcase, and give examples of, the skills, knowledge and judgement that are described in the Professional Report. These should clearly show the candidate's true role/contribution to the interpretative reports submitted and are signed off by their line manager. The selection of the documents is itself a measure of professional skill.

It is important that candidates discuss their applications with their sponsor/mentor to get further guidance on the areas of competence claimed. The role of the sponsor/mentor is important here and they must have clear knowledge of the candidate's skills, ability and experience as they are saying that, in their professional opinion, the candidate is qualified for Chartership.

CPD is a topic that causes applicants - and also some Chartered Geologists - considerable grief. It is not simply a list of courses/lectures attended; it must show some structure, to indicate that thought has gone into the development of expertise and career. It is too easy just to aim to achieve the total points required as shown on the website for CPD records. This is not really what CPD is about. It is about learning and professional development. We all do CPD in different ways. A good, useful CPD record will show aims and objectives for CPD activities over the year; a description of what was done and then an appraisal/reflection of what has been achieved. Much of this in early career years may well be part of an employer's training scheme. Early career CPD will therefore commonly be a steep learning curve, with training courses involved, but it will be structured to ensure that there are aims and objectives and appraisal of achievements. In later years of a career CPD will change and the learning and development will occur in different ways.

For mid to late career geologists, the learning curve is more of a plateau, with increases in gradient where learning is developed into new areas. Many will spend their CPD time not only keeping up to date with techniques, regulations etc., but also in promoting the profession (giving talks to schools; Geological Society Committee work, mentoring, scrutineering). For all, however, a big part will be CPD in professional practice. This is not one's day-to-day work, but the learning

Ground Engineering Professionals – register now!



The launch approaches of the UK Register of Ground Engineering Professionals, says Ivan Hodgson.*

In the UK, ground engineering professionals are found within the Chartered memberships of the Geological Society, Institution of Civil Engineers and Institute of Materials, Minerals and Mining; but there is no accurate way of identifying them within these bodies, whose memberships are diverse. The UK Register of Ground Engineering Professionals will be launched in the next few months, to put this right.

Why do we need a register?

In the UK there is no requirement for ground engineering designs to be signed off by an appropriate person. It is almost certain that this will become mandatory at some stage, probably as an EU directive. The Register anticipates this requirement and provides the basis for a mechanism tailored to the UK.

To inform anyone procuring ground engineering services, for example for specialist opinion, design, independent review, or expert witness.

To help raise the profile of our disciplines, encourage training and promote best practice.



undertaken prior to starting a project, the learning while doing the work, and then assessment of what has been achieved in terms of learning and development. George Tuckwell discusses CPD in his article "It is what you know" (see p. 25).

The above notes are offered to give some further clarification as to what it is and to emphasise that structured learning is the main objective. We all carry out CPD, sometimes subliminally, but reflection on what has been learned over the year sometimes is missing.

To provide a framework for post chartership career development through its tiered structure.

There are three grades within the Register: Ground Engineering 'Professional' – which can be obtained at the same time as chartership, and the higher grades of 'Specialist' and 'Adviser'. The grades mirror the categories in the revised Site Investigation Steering Group documents to be published later this year.

Who should join?

The primary areas of ground engineering recognised in the Register are: coastal/marine, contaminated land/landfill, engineering geology, hydrogeology, foundations and retaining structures, ground investigation,



ground treatment, materials, earthworks, mining and quarrying, soil and rock mechanics, slopes stability and underground works.

Applicants will have to provide a CV, a personal statement demonstrating competence against six specified attributes, statements from two sponsors and their CPD record. Professional level can be assessed by interview at the same time as validation for CGeol. Other applicants will generally only be interviewed if they are considered borderline.

- To find out more, please visit the extended online version of this article at www.geolsoc.org.uk/groundengineeringprofessional.

**Chair, Engineering Group*



It is what you know



...but does it matter who knows you know it? George Tuckwell thinks it does, if only to avoid turning into a sessile urochordate...

Knowing that a tomato is a fruit is *knowledge*. *Wisdom* on the other hand is not putting it into a fruit salad. Swap the term 'competence' for wisdom, and you are not far away from the essence of what distinguishes a Chartered Fellow from a fresh graduate with a head full of newly acquired facts.

To be passed as a Chartered Fellow (CGeol) you have to demonstrate competence in a number of core areas. These include your ability to operate professionally. OK, so you know the 'what', but do you know 'how' and understand the 'why'? A Chartered Fellow has demonstrated to other CGeols through the scrutineering process (more scrutineers still needed, please!) that they can implement their knowledge as a professional, at a high level.

So what role knowledge and - dare I mention it - Continuing Professional Development (CPD)? Past articles on this topic have generated passionate discussion. The Chartership Panel has taken soundings from experienced fellows from different sectors of the

Society (and with, as it turned out disparate views). However, through all the discussions not one person has ever suggested that a geologist progressing through their career does not need to learn anything new; quite the opposite, in fact.

Fellows may know of the humble sea squirt, which spends its formative days searching for food, growing and developing, until it matures and attaches itself to a piece of coral or rock. Thereafter, needing only to eat and reproduce, it famously eats its own brain. Like a sea squirt, an enthusiastic new geoscientist swims vigorously, making progress through the seas of professional practice, to reach the stage where they have the competence to attach to the rock of Chartered status. But once they achieve this, do they morph into a brainless filter feeder for the rest of their careers? Of course not.

Professionals can, should, and do continually learn new things. The differences emerge when a particular approach to CPD does not match the CPD requirements of an individual. One size does not fit all. If we strip away the details, the essence emerges as this:

"A professional should undertake sufficient CPD activity to maintain competence. As a minimum they should stay up to date with the relevant technical knowledge, best practice and legislation in their area of expertise."

The way CPD is recorded should be flexible enough to cope with the wide variety of useful CPD activities from 'looking it up' to doing an exam in it, but robust enough to capture the underlying premise – maintenance and development of competence.

Society has an online recording system, effortlessly used by some and rather disliked by others. It is clear that while an excellent system, it does not suit everyone. Because of this, the Society has always accepted CPD records in other formats, such as perhaps an employer's annual appraisal scheme. Our online system is there for the majority; but all Fellows can choose whatever recording system suits them best.

With the focus on flexibility and clarity of outcome, CPD quietly assumes its place as the foundation of professional practice. Not box-ticking for the sake of it, not a burden; just something we all do, and which it is very useful to demonstrate has been done.

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

The library is open to visitors

**Monday-Friday 0930-1730.
From the Library**



Rare book of the month!

Michael McKimm features a treasure of the Society's Rare Book collection

***De omni rerum fossilium genere, gemmis, lapidibus, metallis, et huiusmodi, libri aliquot, plerique nunc primum editi* by Konrad Gesner 1565**

It might not be the oldest volume in the Society's collection – that accolade goes to Agricola's *De ortu & causis subterraneorum* (1546); but Konrad Gesner's *De Omni Rerum...* is certainly one of the most interesting. Gesner (1516-65) – nicknamed 'the German Pliny' by Cuvier – was a prolific writer on a variety of subjects, including theology, zoology, botany, and linguistics, and famously produced *Bibliotheca universalis* (1574), a catalogue of all the writers that had ever lived.

De Omnis Rerum, a little door-stop of a book, re-bound at a later date with intricate gold tooling on vellum, shows Gesner off as a collator, editor and translator. We might think that collecting essays by various authors into one edited volume is a relatively recent development in academic publishing; but here we see that it has a long history. Gesner collected together and introduced, in Latin, eight separate books by different authors, on subjects ranging from fossils to gems, lapidaries to 'variae & eruditae' observations on metals.

This beautiful book is not just an account of scientific advancement, or a historical collector's item; it is an introduction to these learned men's thinking; a tribute from one eminent scientist to others whom he admired. It is, indeed, a very early form of 'special publication'.

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

E: michael.mckimm@geolsoc.org.uk

Petroleum Geoscience: 2010 and beyond

Phil Christie, former President of the European Association of Geoscientists and Engineers (EAGE), recently became chief editor of Petroleum Geoscience.*



I must have done something really awful in an earlier life, because no sooner had I handed over the EAGE Presidency to Mahmoud Abdulbaqi last June, than I found myself taking over from Tony Doré as Chief Editor of *Petroleum Geoscience*. I jest, of course, because it is actually a great privilege to edit the journal which I often exemplified during my Presidential overviews as representing the multi-disciplinary ethos of the association as a whole. In fact, because *Petroleum Geoscience* (PG) is jointly owned by the EAGE and the Geological Society of London (GSL), I am also proud to champion the cross-disciplinary values of GSL as well as being a channel for cooperation and good relations between the two societies. So now that I have been in office for just over six months, I thought I would describe the progress that has been made in PG as well as our plans for the next few years.

First, I should stress that I am by no means alone in this venture: there is an editorial team and I must pay tribute to Alastair Fraser, John Underhill and Paul Worthington for their unstinting efforts. The co-editors are supported by an international Editorial Board of 37 members, representing a huge resource of experience in academic and applied geoscience. These folks squeeze extra hours into the day to arrange reviews and to reconcile the evaluations for a recommendation to the co-editors. All this work is voluntary, with no reward save the warm feeling that a positive contribution is being made to quality literature and the profession.

PG publishes four issues a year, with the help of the Publishing House's excellent Production Editor, Sally Oberst. The journal features papers that advance our understanding of the sub-surface, often through the type of cross-disciplinary analysis epitomised by asset teams but also often found in universities or research institutes who operate at the overlaps between traditional disciplines. Although the Editorial Board's membership is largely European-based (even if the American and Asian-Pacific representation is growing), our content is truly global, with case studies and analyses from Asia-Pacific, the Middle East, Africa, Australasia, the Indian sub-continent and Latin America as well as



North-Western Europe. Although most papers published come from individual submissions, PG dips into thematic sets from time to time and has featured return to rifts, Australasia,

igneous and tectonic processes in sedimentary basins and a much-cited set on 4D seismic technology. PG welcomes papers on any topic within its broad scope, but recent developments (unconventional gas, passive seismic monitoring, geomechanics of producing reservoirs, heavy oil and carbon storage monitoring) also deserve to be aired within its covers.

PG boasts over 5000 individual subscribers, broadly spread across the globe. It is available at concessionary rates to members of GSL, EAGE and, by a special arrangement, the Petroleum Exploration Society of Great Britain (PESGB). With the advent of on-line copy, individual subscribers can access articles either in hard copy, or electronic format, or both. While this has reduced the physical print run, it has also improved global access without incurring the delay of mail. A growing number of institutional subscribers form a truly international community, represented by the UK (12%) and continental Europe (18%), North America (4.0%), Asia-Pacific (23%) and the rest of the world (7%).

For an applied journal such as *Petroleum Geoscience*, "impact factor" is probably not as relevant as it is for an academic one; but nonetheless, in the most recent year for which figures are available, PG has an impact factor of 0.808, compared to the *AAPG Bulletin* (1.364) and the *Journal of Petroleum Geology* (0.727); not too bad for a journal which is just celebrating its 15th birthday.

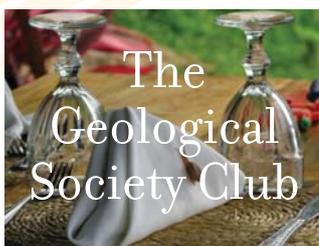
At PG our plan is to build the journal organically through broadening further the geographical base of authors and readers, targeting especially North America and Asia-Pacific. A recent key decision was to put PG into an electronic basket of titles offered to

institutions by *GeoscienceWorld* (GSW), a non-exclusive, Earth science aggregate, run by professional societies and university presses, of which GSL is the only European founder-member. GSW has its strongest presence in North America and Asia-Pacific, so PG's visibility in these regions has increased enormously with very little cost. The year 2008 was the first full year of placement and the number of online (free) abstracts downloaded almost doubled (to over 100,000) while the number of (paid) articles downloaded increased six-fold to 68,000. As well as increasing access, this also represents fresh income and our challenge is to capture more innovative papers dealing with sub-surface research in these regions.

We are doing this by recruiting more Editorial Board members from North America, Asia-Pacific and Australasia. As well as assisting the journal with paper evaluations, EB members bring fresh papers to the attention of reviewing colleagues and raise awareness of the journal to potential authors and readers. PG is assisting authors by reducing its review times. Last year was the first full year of electronic manuscript submission and evaluation, using the AllenTrack on-line manuscript tracking system. The switch from manual logging to AllenTrack has been remarkably pain-free and although there have been minor teething problems, these have been addressed promptly and effectively. As a result, submission is straightforward, reviewer selection is simpler, and the status of any manuscript can be determined anytime, anywhere. All e-mails are logged and so the system should avoid communications gaps, lost bits of paper and yellow post-it notes surrounding the editors' computer screens, so speeding manuscript turnaround.

In summary, whether you are a potential reader, author, reviewer or editor, take a look at *Petroleum Geoscience* at either the *Ingenta* or *GSW* websites. Later in 2010, PG will also be accessible from the Lyell collection. Even if you are not a subscriber, you can browse abstracts and reference lists as well as accessing a free, on-line issue. Try it – you might find this is what you've been waiting for! Whether you are an existing reader or a newcomer to PG, I would also be delighted to receive your ideas, grumbles, comments and suggestions on how to continue improving the quality, interest and readership of the journal. Even better, why not submit a manuscript?

* *Phil Christie can be reached at: pafc1@slb.com*



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.

2010: 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

GEOLABS

Independent
Rock & Aggregate
Laboratory Testing



In addition to our wide range of soil tests, we offer a comprehensive range of rock and aggregate testing.

We can re-core, trim and face cylindrical specimens, and we have a compression capability of 2000 kN (equivalent to 254 MPa UCS at 100mm dia).

- MC
- ACV
- UCS
- Tensile
- Density
- Porosity
- Durability
- 10% Fines
- Abrasiveness
- Poisson's Ratio
- Young's Modulus
- Water Absorption
- Direct Shear Strength
- Ultrasonic P & S Waves

GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44 (0) 1923 892 190
Fax: +44 (0) 1923 892 191
email: admin@geolabs.co.uk
www.geolabs.co.uk

EARTHWORKS

www.earthworks-jobs.com

More than 230,000 unique users per month point their browsers to www.earthworks-jobs.com to see the latest, worldwide, research, academic and professional jobs in the Geoscience, Environmental, Engineering, Water, Marine and Oil & Gas Sectors.

Advertisers e-mail copy to
copy@earthworks-jobs.com
for publication within 2 hours of receipt,

call +44(0) 1223 248346
fax +44 (0) 1223 709513.



Earthworks-jobs.com

Fugro Engineering Services Limited

Fugro House, Hithercroft Road, Wallingford, Oxfordshire, OX10 9RB, tel. 01491 820 400, fax 0 1491 820 499, www.fes.co.uk



**CONE
PENETRATION
TESTING**



**FREE
1 DAY CPD COURSES**

in cone penetration testing, geophysics and ground investigations

• **NEW** includes pile behaviour analysis & testing

GEOPHYSICS Wallingford Thursday April 29th 2010
CPT Wallingford Friday April 30th 2010

CPT London Friday May 21st 2010
CPT Wallingford Friday June 25th 2010

Registered for CPD with Geological Society. To register please send your contact details to: s.poulter@fes.co.uk



Continuing Professional Development (CPD) Courses

•**20-21 April** *An Introduction to Contaminated Land Risk Assessment* Venue: Shrewsbury An essential introduction to quantitative risk assessment for human health, controlled waters and ecological receptors, covering the fundamental principles and techniques for the assessment of contaminated land risks, focusing on the requirements of the Environment Agency's 'Model Procedures'. Organised by: ESI Ltd Convener: **Course Administrator** T: 07143 276100 E: CoursesUK-ESI@esinternational.com **W:** <http://www.esinternational.com/esi-courses.html>

•**21 April** *Groundwater Levels and Dataloggers (1/2 day seminar)* Venue: Tullamore, Ireland The requirements of the Water Framework Directive have given a new emphasis to the need for groundwater level monitoring, and for obtaining reliable data. These half day seminars are highly practical, and designed to improve delegates understanding of loggers as well as to build confidence in their use and accuracy for water level measurements in boreholes. Organised by: Waterra Groundwater Equipment **Contact:** Julie Rose T: 0121 733 3533 E: Julie.rose@waterrauk.com **W:** <http://www.waterrauk.com/Pages/general/training.asp>

•**22 April** *Field Mapping in stratified rock, basic measurements and interpretation for geotechnical and environmental purposes* Venue: Cheddar Gorge, near Bristol. Decisions on investigation, instrumentation, design and analyses are based on field observations, their measurement and interpretation. This course revisits geological principles encountered on site, terms, quantification where possible and production of a ground model for geotechnical and environmental purposes. How to make field notes so as to leave a clear paper trail. Organised by: First Steps Ltd. **Contact:** Christine Butenuth T: 0207 736 6889 E: info@firststeps.eu.com **W:** <http://www.firststeps.eu.com>

•**29 April** *Geophysics*. Venue: Wallingford Free 1-day CPD course in geophysics. Course covers: How and when to use geophysical methods for brownfield sites, rail, road, structural and geo-environmental investigations - includes a demonstration of techniques such as Ground Penetrating Radar, resistivity and magnetometry. Organised by: Fugro Engineering Services. **Contact:** Steve Poulter T: 0870 402 1400 E: s.poulter@fes.co.uk **W:** <http://www.fes.co.uk>

•**30 April** *Cone Penetration Testing (CPT)* Venue: Wallingford. Free one-day CPD course. Covers: How does CPT work? How to make use of CPT data in geotechnical and geo-environmental investigations - includes a demonstration of various cone types, geophysical downhole logging and core-scanning. Organised by: Fugro Engineering Services. **Contact:** Steve Poulter T: 0870 402 1400 E: s.poulter@fes.co.uk **W:** <http://www.fes.co.uk>

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.

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

Managing Performance through People, The Open University. Online Course. Contact David Robinson, d.t.robinson@open.ac.uk, 0870 900 9577, www.open.ac.uk.

Effective Leadership Skills, The Open University. Online Course. Contact David Robinson, d.t.robinson@open.ac.uk, 0870 900 9577, www.open.ac.uk.

Managing Organisational Performance, The Open University. Online Course. Contact David Robinson, d.t.robinson@open.ac.uk, 0870 900 9577, www.open.ac.uk.

For endorsed courses run by ESI Ltd, visit www.esinternational.com or contact CoursesUK-ESI@esinternational.com

For endorsed courses run by FUGRO Engineering Services, visit www.fes.co.uk/courses or contact s.poulter@fes.co.uk

APRIL 2010

HOGG

•**9 April** – *Geology in the History of Provincial Scientific Societies* Venue: Williamson Building, University of Manchester. The meeting will look at any aspect of the history of provincial societies - membership, activities, publications, collections, their relationship with each other and with national societies, the personalities, and the future. See website for registration. **Convener:** Beris Cox E: beris.cox@btinternet.com.

South East Regional

•**13 April** – *Soft Ground Tunnelling under London*. Venue: Gatwick Manor Hotel. Speaker: Dr Ursula Lawrence Time: 1800 for 1830. This talk will introduce the Crossrail project and describe the risks and challenges of soft ground tunnelling under London associated with the classic geology of southern England. **Contact:** Ron Williams. T: 01737 553740 E: rew182@btinternet.com



•**14 April** – *The Search for Source Rocks on Mars*. A Shell London Lecture. Venue: Burlington House. Speaker: Prof. John Grotzinger (CalTech). Matinee 1430 for 1500; Evening 1730 for 1800. Recent rover and orbiter missions to Mars show that sedimentary rocks are surprisingly common. Billions of years old, these rocks are remarkably well preserved and represent diverse aeolian, fluvial, deltaic, and evaporitic environments. Tickets allocated by ballot. **Contact:** Alys Hilbourne T: 020 7432 0981 F: 020 7494 0579 E: alys.hilbourne@geolsoc.org.uk

South West Regional

•**15 April** – *Slope Stability*. Venue: Ley Arms, Kenn, nr. Exeter. A talk on Slope Stability by Len Threadgold, Company Chairman, Geotechnics Ltd. Time: Light refreshments 6.15pm, talk to commence 6.45pm. **Contact:** Cathy Smith E: swrg@geolsoc.org.uk



•**19 April** – *Managed Artificial Recharge*. Venue: Burlington House. See website for details (none available at time of going to press). **Contact:** Sarah Beeson E: Sarah.Beeson@mottmac.com. Willy Burgess E: william.burgess@ucl.ac.uk



•**20 April** – *Engineering Geology and Terrain Evaluation*. Venue: Burlington House. Time and Speaker details – see website (none available at time of going to press). **Contact:** Malcolm Whitworth E: Malcolm.Whitworth@port.ac.uk.

Western Regional

•**21 April** – *The Role of the Conceptual Model in the Mode of Landslip Failure*. Venue: S H Reynolds Lecture Theatre, University of Bristol. Time: 1800 for 1830. Speaker: Dr Kevin Privett (Hydrock Consultants). The conceptual ground model is a vital tool in engineering geology. If used correctly, it illustrates the main issues and forms the basis for good technical designs. **Contact:** Toby Hopkins E: tobyhopkins@googlemail.com.



•**22-23 April** – *Modelling Sedimentary Basins and their Petroleum Systems*. Venue: Burlington House. Advances in modelling of basin formation, fill and fluids. Details and registration – see Website. **Contact:** Steve Whalley, Events Co-ordinator: T: +44 (0)20 7432 0980 E: steve.whalley@geolsoc.org.uk

North West Regional

•**22 April** – *Landslide Assessment and Management*. Venue: tbc – see website. Time: 1830 start. Speaker: Ian Nettleton of Coffey Geotechnics. **Contact:** Gillian Hurworth T: 0161 499 6836 E: gillian_hurworth@coffey.com.

Central Scotland Regional

•**27 April** – *Mitigating Ground Risk in Onshore Windfarm Development*. Venue: The Teacher Building, 14 St. Enoch Square, Glasgow G1 4DB. Time: 1815. **Contact:** Julie Parsons, Donaldson Associates Ltd., The Pentagon Centre, Washington Street, Glasgow G3 8AZ.

North West Regional

•**29 April** – *The Updated Specification for Site Investigation (SISG)*. Venue: Williamson Lecture Theatre, Manchester University. Time: 1830. Speaker: Derek Smith of Coffey Geotechnics. **Contact:** Gillian Hurworth T: 0161 499 6836 E: gillian_hurworth@coffey.com.

Can't find your meeting? Visit www.geolsoc.org.uk – full, accurate, up-to-date

Creating Land Value....is full of risky decisions!

Taking advantage of this innovative programme isn't one of them, but it will improve your ability to make good ones!!

An Effective Professional Practice Programme in
Land Quality and Development
June 2010 to February 2011

Six one-day events starting with a single day conference, all delivered by land industry and regulatory specialists. Focussed on real issues and professional requirements in a flexible, interactive style.

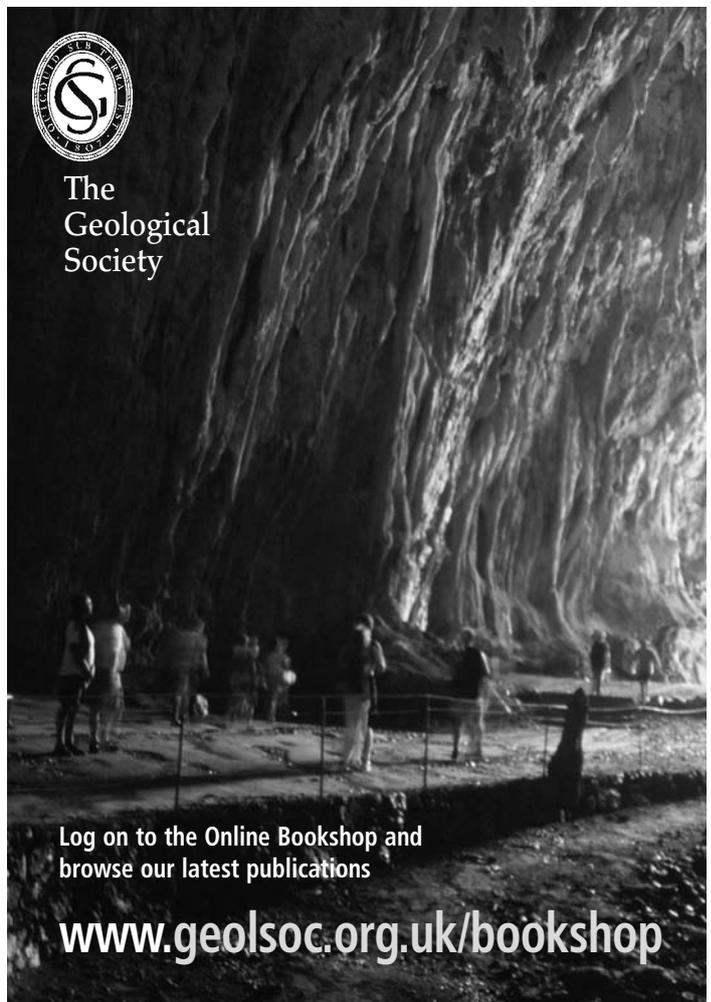
Select the events that meet your needs or sign up to the full accredited programme (Post Graduate Level)

For more information, pricing and range of options contact: Dr P Hopkinson, Tel 01274 236929, email: p.g.hopkinson@bradford.ac.uk.

www.bradford.ac.uk/ecoversity/effectiveprofessionalpractice



The Geological Society



Log on to the Online Bookshop and browse our latest publications

www.geolsoc.org.uk/bookshop

United Kingdom



Geologists Equipment

www.ukge.co.uk

From the same owners of the highly acclaimed Deposits Magazine, www.depositsmag.com



Offering over 10,100 tools, field equipment, maps and books for the professional geologist online

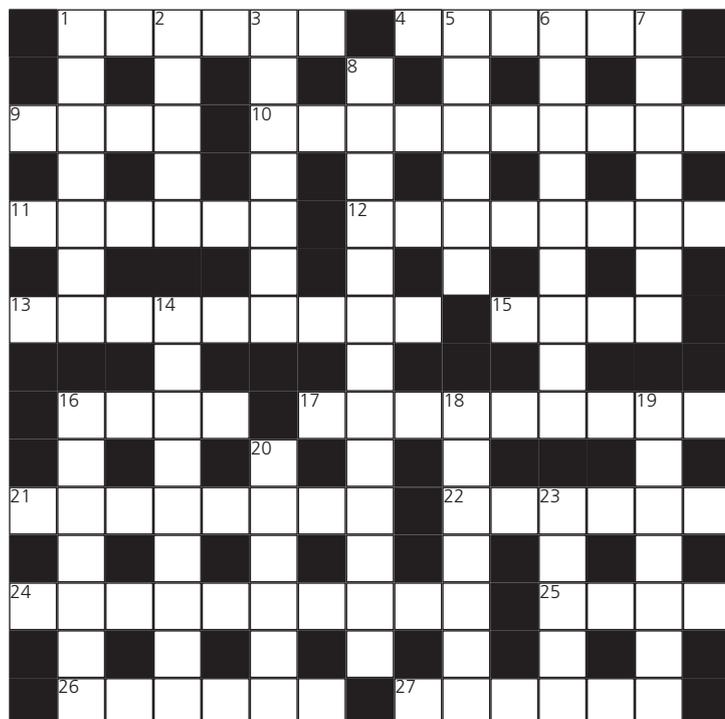


- 0800 0336 002 -

Trade accounts welcome for educational establishments, organisations and geological service companies.

Suppliers to education, organisations, business, and to the general public. We also offer wholesale products.

Crossword no. 134 set by Platypus



Solutions: February

Across: 1 Median 4 Valley 9 Onyx 10 Legislates 11 Orient 12 Latitude 13 Elucidate
15 Bird 16 Keys 17 Analgesic 21 Ziggurat 22 Miller 24 Phenomenon 25 Alto 26 Social
27 Errata

Down: 1 Mineral 2 Dixie 3 Ablated 5 Assets 6 Leastwise 7 Yielded 8 Agglutinating 14
Cryogenic 16 Knights 18 Laminar 19 Inertia 20 Crimea 23 Liana

Across

- 1 To heat a powder until it fuses without melting (6)
- 4 Upper, near-horizontal portion of a cross bed (6)
- 9 Beard-like jag near the point (4)
- 10 Covered with surface relief, as in certain ammonites, for instance (10)
- 11 Connect to (6)
- 12 Rights to property (8)
- 13 High pressure, high temperature metamorphic rock (9)
- 15 Lake type, common in rift valleys, where water has a high Na content (4)
- 16 Point at which a hill stops going up (4)
- 17 Proverbially delicate calcium carbonate coatings of for example the avian ovum (9)
- 21 Device for maintaining constant low temperatures (8)
- 22 Most widely used Christian creed (6)
- 24 Gold-bearing (10)
- 25 Thin strip, often plastered (4)
- 26 Gets on the nerves (6)
- 27 Structures in sediment indicative of post-depositional movement of pore-water (6)

Win a Special Publication of your choice!

The winner of the February Crossword puzzle prize draw was Dr J D Dewar of Oakham.

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

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

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

Name

Fellowship Number

Address for correspondence

.....

.....

.....

.....

.....

.....

.....Postcode

Down

- 1 Cone formed of molten lava ejected from a volcanic vent like toffee (7)
- 2 Region in the south of Egypt, along the Nile and in northern Sudan (5)
- 3 Considered important enough to have created a new age - though in geological terms, at the level below (7)
- 5 Hard, brittle, blue-gray or blue-black metal in the platinum family, the densest natural element (6)
- 6 Collapse brought on by over exposure to the solar ray (9)
- 7 Saint of Avila (8)
- 8 Structured inquiry (13)
- 14 Cretaceous epoch 145-131Ma (9)
- 16 British Overseas Territory more famous for its non-existent triangle than its reefs (7)
- 18 Inward-pointing excursions of the pallial line, for example (7)
- 19 Arcuate dune (7)
- 20 Metallic glint, most usually found in resolve (6)
- 23 Short hairs on a cell (5)

© 2010 The Geological Society of London

The Geological Society of London accepts no responsibility for the views expressed in any article in this publication. All views expressed, except where explicitly stated otherwise, represent those of the author, and not The Geological Society of London.

All rights reserved. No reproduction, copy or transmission of this publication may be made without written permission. No paragraph of this publication may be reproduced, copied or transmitted save with written permission or in accordance with the provisions of the copyright act 1956 (as amended) or under the terms of any licence permitting limited copying issued by the Copyright Licensing Agency, 90 Tottenham Court Road, London W1P 9HE. Users registered with Copyright Clearance Center: the Journal is registered with CCC, 27 Congress Street, Salem, MA 01970, USA. 0961-5628/02/\$15.00. Every effort has been made to trace copyright holders of material in this publication. If any rights have been omitted, the publishers offer their apologies.

The Editors reserve the right to reject, revise and change text editorially.

No responsibility is assumed by the Publisher for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein. Although all advertising material is expected to conform to ethical (medical) standards, inclusion in this publication does not constitute a guarantee or endorsement of the quality or value of such product or of the claims made by its manufacturer.

Subscriptions: All correspondence relating to trade subscriptions should be addressed to the Journals Subscription Department, Geological Society Publishing House, Unit 7 Brassmill Enterprise Centre, Brassmill Lane, Bath BA1 3JN, UK. Tel: 01225 445046. Fax: 01225 442836. The subscription price for 2010 to institutions and non-members is £105.00 (UK); rest of world £120.00/US\$2240.00, post free. *Geoscientist* ISSN No 0961-5628 - USP 007-097 is published monthly by The Geological Society, Unit 7 Brassmill Lane, Bath, BA1 3JN. Periodicals postage paid at Middlesex, N J POSTMASTER: send address changes to Geoscientist, PO Box 177, Middlesex New Jersey 08846. US Agent: Pronto Mailers International, 200 Wood Avenue, Middlesex, New Jersey 08846.



ESI is the leading UK soil and groundwater specialist recognised for its practical solutions to land contamination, groundwater resource and ground source energy problems.

Consultancy Services

Land contamination

◆ contaminated land investigation and monitoring ◆ risk assessments for human health, controlled waters, ecology and soil gas ◆ environmental data and risk management ◆ environmental audit and due diligence ◆ landfill hydrogeology and permitting

Groundwater resources

◆ assessments for groundwater resource and environmental impact ◆ wetland hydrogeology ◆ quarry and tunnelling dewatering ◆ groundwater source (borehole) protection ◆ contaminant transport modelling and groundwater flooding

Ground source energy

◆ thermal response testing ◆ feasibility assessment ◆ groundwater modelling support ◆ regulatory negotiation

Expert Witness

ESI have a hand picked team of both nationally and internationally recognised experts in relevant sub-specialisms and a large team of supporting technical staff. This allows us to provide services to suit a wide range of projects from small, site specific court cases to some of the largest and most complex planning applications, waste management and contaminated land issues in the country.

Please contact Mark Fermor on 01743 276 100 or MarkFermor@esinternational.com.



Training

ESI offers a course schedule which focuses on soil and groundwater problems faced by environmental professionals. We also provide bespoke courses, tailored to your company's specific needs and offer **software discounts** to course delegates. Our **2010 training courses** include:

- ◆ practical groundwater flow and contaminant transport modelling
- ◆ groundwater risk assessment of contaminated land
- ◆ applying the Environment Agency's remedial targets methodology
- ◆ geostatistics for contaminated land
- ◆ detailed quantitative risk assessment using RISC
- ◆ an introduction to contaminated land risk assessment
- ◆ human health detailed quantitative risk assessment

For details and availability of courses, please contact Susannah Way on 01743 276100 or CoursesUK-ESI@esinternational.com.



Environmental Software

ESI is a globally recognised leading developer, publisher and reseller of environmental software. We provide market-leading groundwater and environmental software tools to assist in solving technically complex issues related to the storage, modelling, analysis and visualisation of environmental data.

We deliver the following groundwater and environmental software:

- ◆ Groundwater Vistas
- ◆ AquiferWin³²
- ◆ FEFLOW
- ◆ MIKE SHE
- ◆ RAM
- ◆ RISC
- ◆ EQuIS
- ◆ EnviroInsite
- ◆ Contaminated Land Statistical Calculator

Technical support

Our experienced consultants offer technical support for our environmental software and can provide pragmatic, informed advice on your projects. For further details, please contact Susannah Way on 01743 276100 or supportmanager@esinternational.com.



Please quote reference: GEO1 for all enquiries relating to this advert.

New Zealand House
160 Abbey Foregate
Shrewsbury
Shropshire SY2 6FD
Tel: 01743 276100
Fax: 01743 248600
info@esinternational.com
www.esinternational.com