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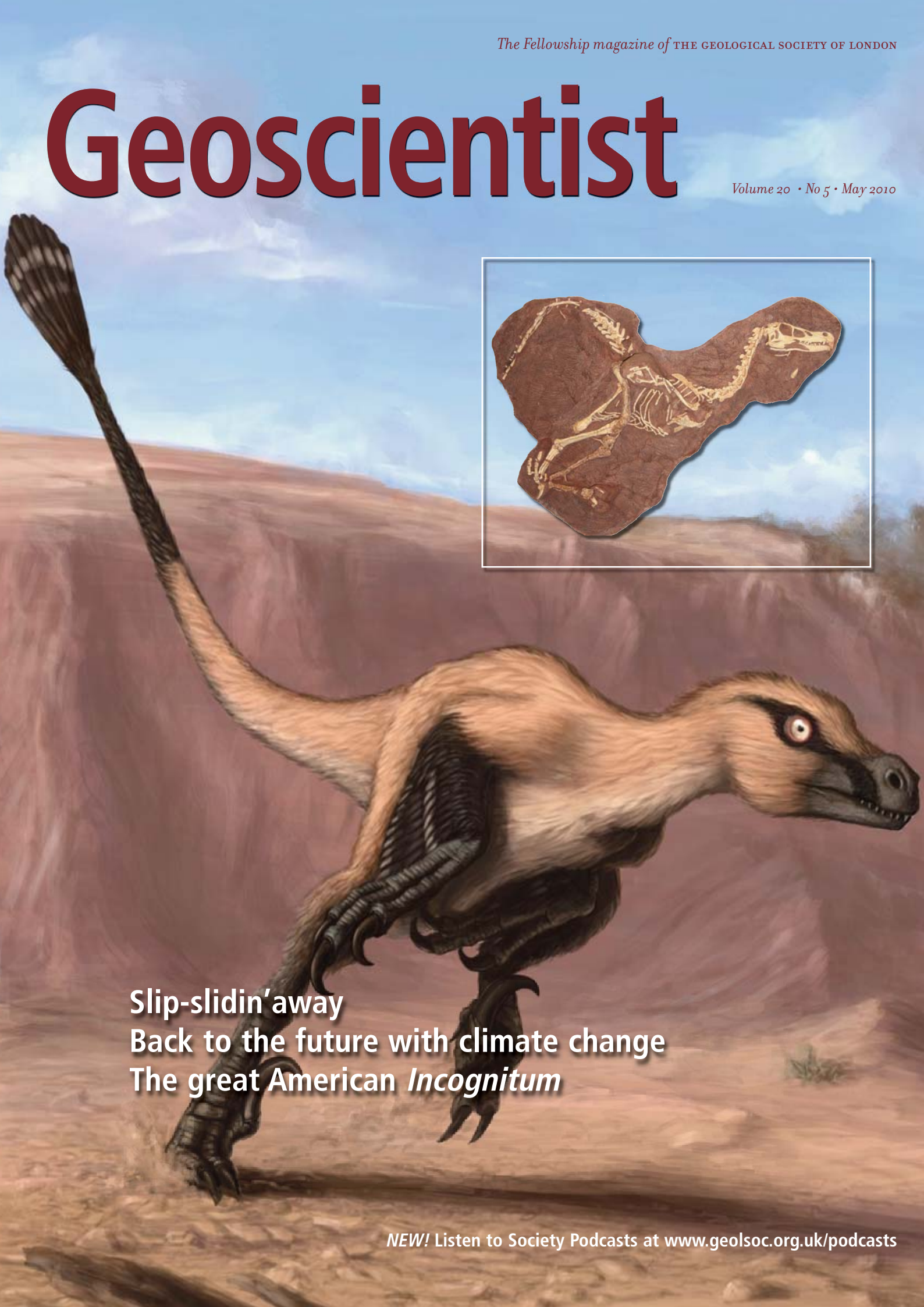

Slip-slidin'away
Back to the future with climate change
The great American *Incognitum*

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Pincer movement

Academics are increasingly facing threats to their freedom both from governments and the law, says Ted Nield.

There was a time when a career in public service was considered noble and praiseworthy. But recent scandals embroiling our highest public servants, who blatantly debased the high office into which they were elected, has brought public esteem to a new nadir.

Universities are not public bodies, nor their staff public servants; but they once also basked in this same worthy glow, while their institutions' independent status helped ensure their freedom. If you don't cost much, people leave you alone. However, universities are now a huge industry, high up the political agenda, and facing calls for "accountability" that can easily be at odds with the need to preserve intellectual freedom.

During the passage of the 1988 and 1992 Acts that now govern them, universities fended off attempts by the Government to take greater control. The price they paid was having to set up their own internal Quality Assurance Agency (QAA), with the rarefied function of inspecting and reporting on the quality, not of the teaching, but of the university's mechanisms for ensuring the quality of the teaching – a fig-leaf, modestly covering the private parts of institutional autonomy. But the QAA was only established "for fear of finding something worse". Between it and all the other inspectors who now regularly call, one would be very naive to take up an academic career today expecting to be left alone to follow one's star uninterrupted.

Academics' second historical bonus was freedom of expression, which did remain protected under law after 1992. Academics are as subject to the laws of libel as anyone else; but at least if convicted, they would not lose their jobs and might, if they lived as long as Old Testament patriarchs, thus be able to pay off any damages awarded against them. But anyway, when would any academic go running to law to settle an academic dispute?

Well, across the Channel, one Professor Joseph Weiler, Editor in Chief of the *European Journal of International Law*, will face a Paris criminal tribunal this June for refusing to suppress a review of a book by Karin Calvo-Goller of Israel's Academic Centre of Law and Business. Calvo-Goller is claiming that the unfavourable review he published could "cause harm to [her] professional reputation and academic promotion". Keller refused to pull the review because he did not feel it constituted "egregious unreasonableness", but was part and parcel of normal academic hurly-burly.

This is perhaps the first time that a more general curse of our times - compo culture - has afflicted the academy. As with the recent legal wrangle between the British Chiropractic Association and science journalist Dr Simon Singh, should this case go awry the consequences for free and open discussion of ideas are serious – not least for academic recruitment. The UK's draconian libel laws, designed to protect the weak but which now serve to safeguard the strong, combine repressiveness with disproportionate damages. As a result, libel tourists flock here, including every manufacturer of a gimcrack gizmo based on dodgy science, seeking redress each time an academic tries to speak the truth.

Between the Scylla of an overweening "accountability" industry and the Charybdis of legal proceedings, there remain precious few freedoms for a profession that once drew the admiration of all.

Front Cover: Reconstruction of *Linheraptor exquisitus*, discovered by a research student part-funded by the Society. See p.12. Skeleton replica cast photo: David Hone. Colour reconstruction: Matt van Rooijen.

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Frozen on the beach

Robin Bailey on uniformitarianism and the rare, untypical events that allow us to apply it…

Chris Garland, in a recent Soapbox (*Geoscientist 19.7*), suggests that the uniformitarian axiom implies that we can watch the processes that formed the Late Jurassic Piper Sand reservoir of the northern North Sea at work today on Worthing beach. Given that modern sandy beach accumulations feature low-angle cross-stratification and wave-rippled surfaces, it seems reasonable to assume that ancient sandstones showing similar features record beach sedimentation. But repeated visits to a sandy, tidally-influenced, Worthing-type, beach would show that the pattern of ripples is subject to twice-daily change and liable also to variation in response to monthly fluctuations in the tidal range and unpredictable, weather-related, variations in wave direction and power.

So, if *millions* of essentially similar, but individually unique, ripple patterns could be generated in a beach environment in 100kyr time-frames, then what circumstances could have led to any one *particular* pattern being preserved in the stratigraphical record? This might imply that the ripple-marked sand layer was atypical of the beach's erosion-dominated sedimentary processes (which normally would have created a new and different set of ripples within hours). On the other hand, given the millions of opportunities to capture the sedimentary imprint of typical beach processes, under a variety of wave and tidal conditions, why not accept that this has occurred?

Net increase in coastal accommodation space[1] increases the chances of such capture, but does not explain it. Sand can be added or removed from Worthing beach at rates of centimetres per day, whereas typical rates of increase in accommodation are less than a centimetre per year and would be completely overwhelmed by this sedimentary 'noise'. Likewise, there is no way that sandstone packages with the typical low-angle cross-stratification could be the outcome of *continuous* accumulation at these slow net rates. It is easier to suppose that metre-scale units of beach facies, such as the Piper Sand, are the cumulative effect of very rare centimetre-scale sedimentary 'frozen accidents'[2] in an environment where the slow net rate of accumulation reflects the dominance of erosion.

Is the present the key to the past and the future? We certainly do not know whether sedimentary processes currently operating on Worthing beach will remain in the local record, 5000 or five million years hence. It seems unlikely, since they have low preservation potential. So is the uniformitarian axiom flawed? No: the processes encapsulated by the concept 'beach' are global and everywhere leave the same sort of sedimentary imprint; so, where we see analogous features in the record, it is safe to assume that we *are* looking at one of those rare series of 'snapshots' of beach sedimentation. But uniformitarianism, in this instance, may depend on 'frozen accidents'.

References

1. Neal, J and Abreu, V 2009. *Sequence stratigraphy, hierarchy and the accommodation succession method*. Geology 37, no. 9, 779-782.
2. Gell-Mann, M 2002. Plectics: *The study of simplicity and complexity*. Europhysics News, Jan/Feb issue, 17-20.

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.

Contents

In next month's issue

- Glaciologists respond to Ollier. Read it now in *Geoscientist Online* features.

Carousel

Martin Broderick FGS CGeol has been appointed by Rt Hon John Denham MP, Secretary of State for Communities and Local Government, to the Register of Commissioners for the Infrastructure Planning Commission (IPC). The IPC is a one stop development consent process for major infrastructure projects such as large wind farms, power stations and railways.

Matthew Eynon, a Chartered Geologist and 2008 winner of the Southern Wales Group Early Careers Geologist Award, has recently been asked to join the Board of Directors of Earth Science Partnership (ESP). Matthew joined the company as a Project Engineer 2005 and progressed to Associate Director level. Matthew has recently led the company through ISO accreditation and has driven the firm towards full member status of the Association of Geotechnical and Geoenvironmental Specialists.

Anwar Khan, DGM of Al Hoty Stanger Ltd. Saudi British JV, has recently been appointed Senior Geotechnical Consultant. This year also marks his Silver Jubilee as a Fellow of the Society. Mr Khan is pictured in 1986, supervising a geotechnical site investigation at an Alsthom power project in Riyadh, Saudi Arabia.

Stuart Monro OBE (foreground), recipient of a Society Distinguished Service Medal 2009, has been elected a Fellow of the Royal Society of Edinburgh.

Nick Petford, Pro Vice-Chancellor for Research and Enterprise at Bournemouth University, has been appointed Vice-Chancellor of the University of Northampton. Nick is an igneous petrologist, a previous Chair of the Volcanic and Magmatic Studies Group and a former member of Council. He will take up his post on 1 September 2010.

Joseph D Quinn, winner of the 2009 Professor William R Dearman Young Author of the Year Award, receives his prize from Dr George Reeves (q.v.), at Burlington House. Dr Quinn works in Canada for Klone, Crippen, Berger (Calgary). The award was made for his paper "Understanding the recession of the Holderness Coast, East Yorkshire, UK: a new presentation of temporal and spatial patterns" (Quinn JD; Philip, LK and Murphy, W. QJEGH Vol 42, pp165-178, May 2009).

George Reeves, formerly of Newcastle University, UHI Millennium Institute/DERC and more recently at HydroGEOtecH Consultants, Lybster, has moved to Cumbria to work for LLW Repository Ltd, based near Drigg, Cumbria. Dr Reeves has joined the Environmental Safety Case Team as Technical Specialist.

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

The great American *incognitum*

American painter Charles Willson Peale (1741-1827) was also a palaeontologist, and his painting Exhumation of the Mastodon (1806) *depicts the first palaeontological dig in American history. Alexis Drahos* investigates.*

From the second half of the 18th Century, particularly following the publication of Georges Cuvier's influential works, fossil elephants came to occupy a privileged position in vertebrate palaeontology – endowed with the sort of prestige accorded today to dinosaurs. The discovery of "mammoth" bones in Siberia, and of similar skeletons later in the United States, posed insistent questions about their origin, extinction, and place in nature. With this painting Charles Willson Peale bore witness to a new passion among his compatriots for fossil remains of vanished worlds – one which has continued unabated until the present day.

In its quest for new knowledge of the deep past, the United States of America, then a new nation, made major contributions to improving the academy's acquaintance with fossil vertebrates of all kinds and not the least with that group of extinct quadrupeds, the mastodon elephants, slightly smaller than European woolly mammoths at just over two metres tall, but without hair - and known mainly (though not exclusively) from North America.

Mastodons first appeared almost 40 million years ago, and their most recent species – the American mastodon *Mammut americanum* – appeared just under three million years ago, becoming extinct with the European mammoths 10,000 years ago at the end of the last Ice Age. But people had been discovering their fossils long before scientists took an interest in them. Long before the true significance of these huge prehistoric mammals was realised, folk wisdom had developed its own explanations. For

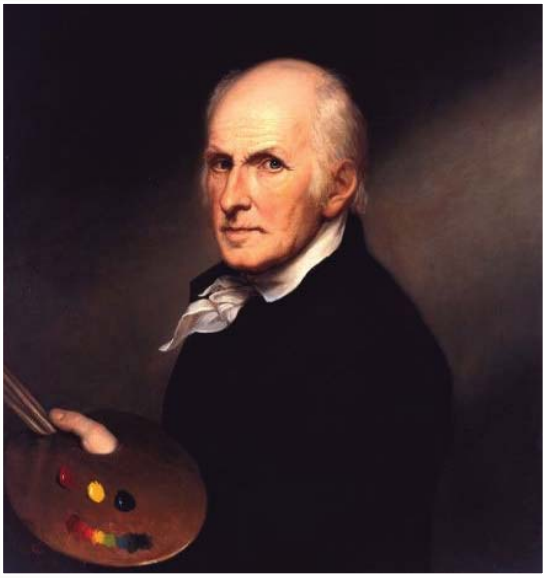
example, in April 1700, about 60 mammoth tusks brought to light by le duc Eberhardt-Louis had been sent to a pharmacy, to be sold as "unicorn" horn. Nevertheless, a few years later, President Thomas Jefferson (1743-1826), convinced as early as 1780 of the presence of "mammoths" in America, promoted several scientific expeditions, and a series of excavations was undertaken to search for remains of giant all-American quadrupeds.

Peale took part eagerly. Fascinated by natural history and a fervent collector, Peale was clearly a busy man. As well as being a famous portrait painter, as a scientist and collector he opened the first true American museum, in Philadelphia in 1786. This institution exhibited many of the miscellaneous fossil objects unearthed by its founder-curator, as well as the more usual portraits and stuffed animals.

The origin of this particular painting dates back to spring 1801, when the artist first heard that huge bones, still articulated and apparently belonging to an unknown giant beast, had been unearthed not far from Newburgh, in New York State. Peale went there straight away, buying the bones from the landowner and also purchasing the right to make further excavations. He employed a small army of workers; first to divert a nearby stream and to erect a dam with the aim of loosening the ground in which the finds lay, to reduce the risk of breakage. To avoid flooding, workers built two pieces of apparatus – a crane and a water pump, depicted in the painting.

This enormous contrivance is seen being operated as a treadmill by two men like hamsters in a wheel. In use in Europe from the Middle Ages, such windlasses, moved by the force of one or a few workers and driving a bucket-chain, had been imported from China to Europe and became a common sight from the 14th Century to the mid 19th. As a sign of its importance, the windlass occupies the centre of the composition. The presence of children gives the scene a playful character, while the colour palette, based on shaded tones of yellow and brown, lend the scene an air of mystery and obscurity as the remains of the prehistoric animal (not yet revealed) are awaited, expectantly.

The eventual extraction of this skeleton took on a significance surpassing the purely scientific. In 1749, the French naturalist Georges Buffon had asserted in his *Natural History* that the European extinct species had been bulkier and more developed than those of the



United States. So, confirming the past presence of mammoth-like creatures on American soil had become almost a patriotic duty - asserting the fact that the New World was at least the equal of the Old, right down to its prehistoric bones.

Proud of the interest created by his enterprise, Peale invites witnesses to marvel at this sight of a young science serving a young nation. The artist even borrows the pose of the Belvedere Apollo, one of the most admired sculptures of antiquity; and with this reference to the Greek god of light and the knowledge, identifies himself as an Enlightenment man, a man of science, casting light on the distant past.

According to palaeontologist John Ostrom (1928-2005), Peale's dig was the first organised excavation ever conducted in search of prehistoric mammals in North America. It successfully unearthed an almost entire skeleton, which became universally known as *The Great American Incognitum*. Peale's Museum eventually failed; the *incognitum*, which had become such a symbol of American national pride, had to be ignominiously sold to European collectors to pay off the museum's creditors. For a hundred years the incognitum's fate was truly unknown, until turning up in the *Hessisches Landesmuseum,* Darmstadt, Germany, in the 1950s. It can be seen there to this day. ☙

Further reading

Paul Semonin explores the story of the Incognitum in his book *American Monster: How the Nation's First Prehistoric Creature Became a Symbol of National Identity* (New York, 2000). You can read an article by him, *Peale's Mastodon – the skeleton in our closet*, at www.historycooperative.org/journals/cp/vol-04/no-02/semonin/index.html. See also Semonin's website www.americanmonster.net.

**Dr Alexis Drahos is an art historian with a special interest in Earth science's influence on 19th Century painting. He lives in Paris.*

Ted Nield writes: This year, the Society's *Annual Review* has become a lighter, more digestible offering, and as a result we have changed the way we publish obituaries. In future, as well as our permanent online archive (www.geolsoc.org.uk/obituaries) we shall include them in *Geoscientist*. Obituaries for 2009 are being published through 2010 until the backlog is cleared.

Peter Stephenson Rhodes 1919 – 2009

Peter Rhodes was born in New Moston in north-east Manchester in 1919. He was educated at Rock Ferry High School, Birkenhead and Liverpool University where he read architecture, without much enthusiasm he admitted, before joining the practice of Clarke & Sons. Almost immediately he was conscripted into the army where his facility with trigonometry, slide rule, seven figure logarithms and surveying paraphernalia placed him in the 41st Survey Training Regiment, Royal Artillery. He was now 959103 Gunner Rhodes PS. After basic training he was posted to the 155th Field Regiment RA and embarked on the *SS Strathmore* in March 1941 destined for India and then on to Port Swettenham (now Port Kelang), Malaya.

He was captured by the Japanese following the fighting retreat to Singapore and marched off to the notorious Changi Jail. The harrowing nightmare of this period, an experience that shaped the rest of his life, is related in his book *To Japan to Lay a Ghost*, published in 1998. The brutal and sadistic regime, first on the docks in Singapore and later in the coal mines of Orio in Japan, left an indelible mark. He once dug his own grave and, reduced to 5 stones 2 pounds, barely survived the war. His characteristic tenacity pulled him through.

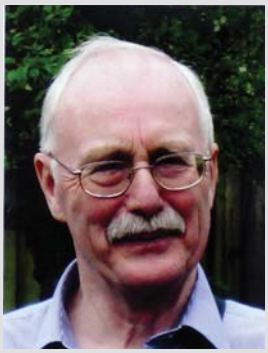
He had long decided during his incarceration that he wished to abandon architecture to train as a civil engineer but despite government promises to provide university training to all men returning to civvy street, his "grateful" government denied him this opportunity and he had to return to Clarke & Sons. He reacted typically and after four years of night school gained his M.I.Struct. E. in 1950: three years later he moved to Northern Ireland. His career from then on was as a structural engineer in the architects' branch of the Ministry of Finance with a particular responsibility for the stability of historic buildings but during the IRA bombing campaign in the 70s and 80s his skills and judgement were in increasing demand as adviser on the many damaged structures throughout the province. He ended his career, aged 65, as Chief Structural Engineer for Northern Ireland in 1984. It is also worth recording that he led the introduction of metrication there.

Two years after his arrival in Northern Ireland he became a founder member of the Belfast Geologists' Society and was elected a Fellow of the Geological Society of London in 1957. He remained a vigorous member of the Belfast society up to 1973. During that time he was President in 1964/65 and Treasurer from 1966/68 and featured regularly on the summer and winter programmes, introducing radical elements such as field sketching and panorama drawing to the programme. He also authored an impressively practical geological guide, *The Antrim Coast Road*, assisted in the detailed geology by Professor J K Charlesworth of Queen's University, Belfast. Geology in Northern Ireland has lost a truly remarkable man.

He was predeceased by his wife Dea (Dorothy) and is survived by his daughter Janet.

Philip Doughty.

Richard Barrie Rickards 1938-2009



Barrie Rickards was a world-renowned palaeontologist; an expert on the palaeobiology of graptolites and their biostratigraphic use. He was even better known as an angler and influential fishing writer.

Barrie was born in 1938 on the eastern outskirts of Leeds. He went to primary school there and then in Hook, east Yorkshire. A boyhood freedom to roam over the Yorkshire countryside nourished a talent for observing, documenting and interpreting the natural world. Indeed, he was more interested in this outdoor education than in formal study, both at primary school and then at Goole Grammar School. He was more distinguished as a cross country runner and footballer, although he did show enough aptitude for chemistry to gain entry to Hull University. Here he chose to do Geology, getting his BSc in 1960. An undergraduate mapping project across the Dent Fault and Howgill Fells stimulated his interest in Early Palaeozoic fossils. This led to a PhD at Hull in 1963, for a meticulous revision of Silurian graptolites and their biostratigraphy. As his academic reputation grew, Barrie held short appointments at University College London, the University of Cambridge, the Natural History Museum, and Trinity College Dublin. He particularly impressed Oliver Bulman, the graptolite expert and Woodwardian Professor in Cambridge, who lured him back there in 1969.

Barrie spent most of his career in Cambridge, as successively Lecturer,

Reader and then Professor in Palaeontology and Biostratigraphy. His work was recognised by the Geological Society with the award of the Murchison Fund (1982) and the Lyell Medal (1997) and by the Yorkshire Geological Society with the John Phillips Medal (1988). Barrie was Curator of the Sedgwick Museum from 1969-2000, and a Fellow of Emmanuel College from 1978. He had two spells on the Council of the Geological Society, and served also the Yorkshire Geological Society, the Palaeontological Association, the Ludlow Research Group, and the British and Irish Graptolite Group.

Barrie's internationally renowned geological research, published in over 275 papers and five books, focused on the palaeobiology of graptolites, collected by him in areas from Australia to Argentina and from Canada to Russia. He had a legendary ability to find distinctive fragments of these fossils in the field, even in unpromising rocks. He used their rapid evolution to accurately date and correlate Ordovician and Silurian strata. He used new technologies to shed light on the behaviour of graptolites. Working with doctoral students and young research fellows, Barrie used scanning electron microscopy to show that their skeletons were actively constructed by the colony of animals that inhabited them, meaning that they were more like floating beehives than typical shelly fossils. His collaborations on their hydrodynamics started with simple models in the Emmanuel College swimming pool before progressing to wind tunnels and computer modelling.

His study of the enigmatic fossil *Promissum pulchrum* with Dick Aldridge and Johannes Theron found that, rather than being the oldest land plant as was previously considered, this organism was an exceptionally preserved conodont, consequently revealing the complete anatomy of this primitive vertebrate. Barrie taught geology with the same quiet enthusiasm that he researched it, being particularly influential with the many supervision students who passed through his care in Emmanuel, Christ's and Girton Colleges. He also set up the Cambridge geological mapping course in the Howgills Fells, and taught it for over 35 years, training over 1500 students.

Barrie's activities as an angler even eclipsed those as a geologist. He wrote more than 800 fishing articles and about 30 books. Through his guides to fishing technique he taught a generation of anglers with the same skill that characterised his geological teaching. The two subjects also came together in his campaigning on environmental issues, particularly over drainage policy. He was an expert on fisheries management, and himself managed a succession of lakes and rivers. He was a scientific adviser to the Anglian region of the Environment Agency in the 1990s.

Barrie was by birth and character a Yorkshireman, though never a parody of one. He was generous to others but thrifty in spending on himself: using the same trusted rucksack and Barbour jacket for over 30 years. He liked proven technology, preferring his Morris Minor to other cars, and the pen to the computer keyboard. He could be confident and forthright, but was more naturally gentle and shy. His friends will remember him for his integrity, honesty, and an infectious sense of humour, there until the end. Barrie's only son Jeremy died in 2000. He is survived by his partner Mandy Lyne, step-daughters Rebecca and Louisa, and granddaughters Fern and Alice.

Nigel Woodcock & Alex Page

Ewart Kendall Walton (1924-2009)

Ken Walton, Emeritus Professor of Geology at the University of St Andrews, died on June 23, 2009, aged 84. Ken was born in 1924 in Ashington, Northumberland, and attended Bedlington Grammar School before entering the University of Durham's King's College at Newcastle-on-Tyne. He graduated in 1949, gained a PhD in 1952 and began his academic career (Assistant, Geology Department, Glasgow University), progressing to Lecturer and then Reader at Edinburgh University. In 1968 he was appointed to the Chair of Geology at the University of St. Andrews and a year later was elected a Fellow of the Royal Society of Edinburgh. Most of his professional career was spent as Professor of Geology at St Andrews (1968-88) where he also served as Master of the United College (1972-76).

Ken made two very important contributions to geological research. First, he elucidated the processes involved in the deposition of sediments from turbidity currents traversing continental shelves. His work centred on the interpretation of structures in turbidites, such as sole marking and flow structures. This work was done in collaboration with his colleagues Gordon Craig and Donald Duff along with his first research student Gilbert Kelling and Polish contemporary Stanislav Dzulinski. His fruitful collaboration with Dzulinski led to Ken's being elected to Foreign Membership of the Polish Academy of Arts and Sciences. Second, his study of Lower Palaeozoic turbidites in the south of Scotland made him an expert on the geology of the Southern Uplands and his publications, including chapters in Craig's *Geology of Scotland,* laid the foundations for modern accretionary prism and terrane interpretations of this key piece of the Caledonian orogen. Many of his PhD students generated data which fed into these interpretations.

At St Andrews Ken had the challenge of modernising a rather traditional department. He managed the task well and in 1972 was invited by Principal Steven Watson to become Master of the United College to help modernise and strengthen the University following the separation a few years earlier of Queen's College, Dundee, into an independent University. He could not have anticipated the rough ride he would receive concerning disproportionately high failure rates in the Science Faculty of Scottish students with Higher grades compared with English entrants with A-levels. The data seemed to support the case so, with astuteness and charm, Ken quickly put in place the changes that would finally solve the disparity, but not without some bruising encounters and much media attention.

Following his Mastership, Ken was invited to join the

Physical Sciences Committee of the University Grants Committee (UGC). This was an important national role that influenced the funding of every university physical science department, and the committee visited each department in every university on a regular cycle. The end of his academic career coincided with the UGC's Earth Science Review that culminated in the closure of several university geology departments across the UK. Geology staff spent weeks on a strategy to save the Department, which proved successful; Geology at St Andrews was one of the smallest departments to survive nationally. However, the price of survival was a merger with Geography and Ken opted to take early retirement in 1988. He remained active as a consulting geologist for a few years and ran local field excursions for youngsters and enthusiasts for many more years in his new-found home in the village of Crail.

Ken was always keen on sport, a passion he shared with his first wife Margaret. Even in his 50s he regularly out-performed staff half his age on the football field or the squash court. After retirement he became an active member of tennis and badminton clubs in Crail, and did much to encourage youth participation in sport. He also became involved in community work, particularly in relation to heritage and youth activities, and convened a local Writers' Club. A hallmark of Ken's life was a common humanity that clearly stemmed from his roots in a northern mining community. He was a genial man who put the interests and welfare of the student before the bureaucracy of the "bean counters". His first wife, Margaret, predeceased him, in 1982. Soon after he married Sue, and became a fond stepfather to her three children. The marriage was later dissolved. He is survived by his children, Judith and Richard, five grandchildren and one great-grandchild.

Richard Batchelor, with contributions from Ed Stephens and Gilbert Kelling.

Cyril Williams, 1922-2009

The geological community in Ireland lost one of its most respected and influential members on 4 January 2009. Cyril Williams, OBE, MRIA, BA, MA, PhD, FGS, was one of the longest serving directors ever of the Geological Survey of Ireland, from 1967 to 1987. He was a geologist of outstanding international experience. As Director of the GSI he transformed it, after years of neglect, into a modern, confident and internationally respected organisation.

Cyril was born in Durban, South Africa on 9 November 1922 and studied geology at Cape Town University. After a break for military service in World War II, flying many missions in the Mediterranean theatre, his first professional work was contract mapping for the Geological Survey of South Africa. He then served with geological surveys in Uganda, Mauritius and the New Hebrides before returning to the Uganda Survey where he was Commissioner for Mines and the Geological Survey from 1962-67. He was awarded the OBE for his services to geology and mining in Uganda.

Mainly as a consequence of the revival of the Irish metal mining industry, the government recognised the need to revive the GSI as a source of expert and independent advice. Thus the post of Director was advertised around the world and Cyril Williams was appointed to the post in 1967.

The GSI was then a technical division within the Department of Industry and Commerce and Cyril's first task was to submit to that department an ambitious and comprehensive plan for the revival and expansion of the GSI. He argued it was needed to meet the needs of the nation for practical, applied specialist advice to government, industry and the public in relation to all aspects of its Earth resources.

The plan was approved and an expanded multi-disciplinary team of new geologists was recruited. Through the 70s and 80s the GSI became a dynamic productive organisation under Cyril Williams's leadership. The GSI reclaimed its place at the centre of national developments in many fields of the practical Earth sciences, including the licensing and promotion of the booming mining and mineral exploration activity, the establishment of a legal and regulatory framework for the nascent offshore oil and gas exploration developments, ensuring the effective but sustainable development of groundwater resources and building national databases of sub-surface data so valuable to the infrastructure developments of the 90s.

A priority for the revitalised survey was to expand the basic knowledge of Ireland's geology, through field mapping, data collection and interpretation so that all the publications and advice coming from the Survey would be of the highest quality possible.

The revolution of plate tectonics in the mid-1960s had come from the seabed discoveries in the world's oceans. Cyril had seen at first hand the manifestation of ocean dynamics in the New Hebrides. He also recognised the importance to island nations with no onshore hydrocarbon resources of looking offshore. He therefore advocated to government the need for Ireland to have detailed knowledge of its offshore territorial waters as a vital national interest. He established a marine geology capability in the survey early in his directorship that over the years led to the major National Seabed Survey managed by the GSI.

With Cyril Williams's international background and perspectives, he also encouraged and empowered the Survey to become involved in wider, international geoscience issues; for example, Survey staff provided important technical input to the series of Law of the Sea Conferences that set international agreements on marine law and resources.

The growth of the GSI through the 70s and 80s led to it outgrowing its historical headquarters at 14 Hume Street. A major achievement of Cyril Williams later career was leading the designing and negotiating the building of a new headquarters, with appropriate modern facilities, on the Beggars Bush Barracks site, which the GSI still occupies.

Cyril and Margaret Williams retired in 1987 to Ogenelloe in County Clare above Lough Derg. There he enjoyed welcoming and entertaining many visitors from around Ireland and abroad and sailing on the Shannon waterways. He never retired, however, from his love of the Earth and its rocks. He debated and wrote to the end on the volcanoes of Africa and the wider world.

Ralph Horne

Deaths

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

The Society notes with sadness the passing of:

Beltrandi, M D*
Baumer, A*
Bishop, Richard*
Browning, Geoffrey Robert John
Callomon, John
Chambers, Gordon*
Francis, Christopher Michael George*
Guilford, Colin*
Hodgson, Alan*
Hopkins, Graham Leslie*
Knight, Jack*
Manley, Edwin C*
McKinlay, Alex C M*
Oliver, Derek*
Roberts, David Keith *
Shuker, D E*
Truss, Stephen*
White, Robert*

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

The ultimate excuse

As geologist and science writer Nina Morgan discovers, procrastination rules OK – so long as you've got a good excuse


John Phillips – courtesy, Oxford University

In the 19th Century, and as it remains today, peer reviewing was an essential part of academic life. A series of four letters written between winter of 1836 and the spring of 1837 and found bound into a copy of Roderick Murchison's great work, *The Silurian System*, provides an insight into just how seriously the geologist John Phillips took this obligation. Even an injury to his right hand, sustained during the winter of 1836, did not deter Phillips from corresponding with Murchison in very great detail about an early draft of *The Silurian System*. While Phillips was prevented from holding a pen, his sister Anne served as his amanuensis. Murchison seems to have been suitably grateful for this Phillips' heroic effort to respond, and quoted large sections of the Phillips' letters nearly verbatim in his book.

Nevertheless, on some occasions Murchison seems to have expressed impatience at having to wait for answers – provoking Phillips to turn to the weather for an excuse. On 30 March 1837, while based near Lancaster and engaged in fieldwork of his own, Phillips wrote to Murchison to excuse a delayed response by saying: "I suppose you will shoot me in the marketplace for keeping this proof: but in fact I only got it late last night having been snowed up among these mountains for many days in search of Coal. (Snow!)."

But, of course, snow could never serve as justification for a late reply during the summer. Perhaps this was why Phillips and his sister decided to acquire a pet dog. Their first, Prince, took up residence in 1838. He was succeeded in the summer of 1839 by an equally loved canine companion, Cholo, who, like Prince, shared a liking for gingerbread; but research so far has failed to turn up any examples of these canines' taste for manuscripts. We still await the discovery of a Philips letter to Murchison concluding "The dog ate my homework".

Acknowledgments

I am grateful to Bernard J Shapero Rare Books for permission to quote from the 1837 letter from John Phillips to Roderick Murchison. The references to the dogs Prince and Cholo occur in the series of 234 letters written by John Phillips to his sister Anne which are held by the archives of the Hope Library at the Oxford University Museum of Natural History.

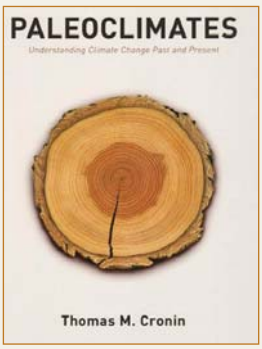
If the past is the key to your present interests, why not join the History of Geology Group (HOGG)? For more information and to read the latest HOGG newsletter, visit the HOGG website at: www.geolsoc.org.uk/hogg.

Reviews

Copies available for review:

- Clarkson, E. & Upton, B. (2010), *Death of an Ocean: A geological borders ballad*, Dunedin.
- Edwards, S. *et al.* (2010), *Cyprus. Classic Geology in Europe Series*, 7, Terra Publishing.
- Fortey, R. (2010), *The Hidden Landscape: A journey into the geological past*, Random House.
- Trewin, N. & Hurst, A. (eds) (2009), *Excursion Guide to the Geology of East Sutherland and Caithness*, Dunedin.
- Welland, M. (2009), *Sand: A journey through science and the imagination*, Oxford University Press.

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.***



Paleoclimates

Thomas M. Cronin
Published by: Columbia University Press
Publication date: 2010
ISBN: 978-0-231-14494-0 (hbk)
ISBN: 978-0-231-51636-5 (ebook)
List price: £61.75
441 pp

www.cup.columbia.edu

In the months since the publication of the University of East Anglia CRU emails, there has been renewed debate about whether humankind is responsible for ostensible global warming. Thomas Cronin's comprehensive study is therefore timely, applying great erudition even-handedly around a very vexed topic. His key perspective appears on page 298: *"Recent studies of LIA (Little Ice Age) climate have taken two equally important approaches leading to differing opinions on its climatic significance. These can be called, for want of better terms, the geographical and geological approaches. The geological approach is "forward-looking," starting from the perspective of long-term climate variability…..The geographical approach "looks back" at the LIA from the standpoint of the 20th and 21st centuries and is adopted mainly by specialists in geography and climatology, including tree-ring experts".*

Following a thorough discussion of the scope and methods of paleoclimatology Cronin describes the range of climatological evidence found in the geological record, extending from 3.8 billion years ago through the Cenozoic Era. He then sets the scene for subsequent events, describing significant changes in the Earth's orbit. The discussion of glacial and Holocene variability is comprehensive, detailed, and places the evolving climate of the Anthropocene in an appropriate long-term context.

Chapter 11 provides a balanced discussion of the current controversy, examining forensically the roles of solar forcing, volcanic forcing and greenhouse gases. "Growing evidence … suggests that there is 'anomalous behaviour' in some segments of the climate system but great uncertainty surrounding others. Climate response over the past millennium is regionally variable in scale and sign (warming in one region, cooling in another) and often asynchronous because of feedbacks".

Taken within the more extensive context, the geological approach points to firm evidence for a warm but regionally complex MWP (Medieval Warm Period). There were multiple temperature minima during the global LIA climate anomaly, although there was inter-hemispheric asymmetry. For instance southern hemisphere warming is seen in LIA ice-core records from the Antarctic peninsula at times when the northern hemisphere cooled.

The geographical approach, which uses tree-ring proxies, is handicapped by the relatively few annually resolved records older than 400 years, so it is considered premature to use these to establish temperatures over the entire 1000 years. Additionally, tree-ring reconstructions of temperature during the late 20th Century that show cooling, or no change, fail to reflect the warming seen in instrumental records.

Chapter 12 reviews the range of climatic and hydrological change of the past 2000 years. Commenting on the IPCC report, the author notices its lack of sufficient late Holocene proxy records. He says that compelling evidence exists for anomalous 20th century climatic patterns in some instances. In others, pre-industrial decadal-to-centennial scale variability complicates any effort to quantify human-induced impacts.

There follows discussion of certain factors that would reflect the combined impacts of inherent climate variability and greenhouse gas forcing: precipitation and drought, tropical cyclone activity and changes in ocean temperature, circulation and chemistry. This section concludes with a review of polar regions, glaciers, sea ice and their effect on sea level if widespread melting continues.

In conclusion, Professor Cronin considers that some evidence suggests that 20th Century climate behaviour is anomalous in relation to that constructed from proxies over centuries or longer. This suggests at least some human influence on the non-temperature parts of the climate system. Other records show significant decadal to centennial climate variability caused by external forcing. The amplitude of pre-industrial variability can equal or exceed that seen in the recent instrumental record. Climate variability during the MWP and LIA was especially large, but the causes are only partially understood.

Paleoclimates was completed just before the controversy at UEA erupted, so I find that it shuffles somewhat in the author's attempts to avoid stepping on academic toes. This style imparts faithfully the rather stultifying atmosphere that existed in climate science before the CRU emails smashed open a window and let in the fresh air of fully objective enquiry. In this respect this otherwise excellent book brought to my mind the concluding remarks of Ian Strangeway (2010) in *Measuring Global Temperatures* (Cambridge University Press): "I am aware that by stressing the complexity of the climate system, the uncertainty of the measurements and the intricacy of what they show, I run the risk of offending the committed environmentalist and possibly encouraging the sceptics. I sit in the middle, unhappy with the often petulant tone of the sceptics but also unable to support the appearance of certainty and simplicity that many climatologists try to convey. We have a long way to go yet".

Malcolm McClure

Letter

Global warming pseudoscience

From Kyrios Paralogou* (Rec'd 1 April 2010, and published as soon as possible thereafter...)

Sir, Congratulations on having the courage to publish Cliff Ollier's *Glaciers – Science and Nonsense, Geoscientist, 20.3)* - thus bringing to the attention of your readers the findings of his seminal paper for the Lavoisier Group: *The Greenland-Antarctica Melting Problem Does Not Exist*#. Ollier's contributions complement the more wide-ranging survey of climate science in the monumental *Heaven & Earth – Global Warming: The Missing Science* by fellow-Lavoisierian, Ian Plimer.

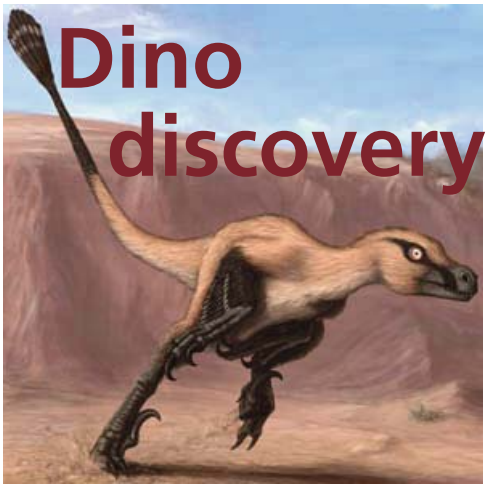
If I have one scientific criticism it is that Ollier's mention of "the global warming that took place between 1975 and 1998" is less explicit than Plimer's "There is no problem with global warming. *It stopped in 1998*" [my emphasis]. But of course, as Plimer cogently argues, global temperature data are so riddled with flaws that we cannot really be sure that there has been any warming at all. Or cooling. Or indeed anything.

As both authors note, man-made global warming is just another politically-driven pseudoscience, comparable to the ideological Lysenkoism of Stalin's Soviet Union. As Ollier has put it: "Lysenkoism was eventually replaced by real science; the same will happen to Global Warming eventually, because real science will not go away". In fact, the current tyranny of the global warming orthodoxy is the reason I have to write pseudonymously (as a geoscientist working in an industry whose future is now hitched to the "global warming" bandwaggon).

Already, critics have lined up to berate Ollier's *Geoscientist* paper (see *GeoscientistOnline*, and next month's feature). No surprise that they include people styling themselves "glaciologists", "climatologists" and "people who know what they're talking about". Well, as Plimer observed on *Today*, these people are mere "rent-seekers", with careers staked on this artificial war against non-existent climate change.

No, if there is any question as to where the majority of scientific opinion lies on global warming, Plimer's observation that the "most abundant number of scientists (in Australia) are geologists" must carry some weight. As a geologist myself, it is indeed heartening to have "Australia's best-known geologist" (and an Honorary Fellow of this Society at that) as our spokesman.

*Name and address supplied. Editor.
#www.lavoisier.com.au/articles/greenhouse-science/glaciation-icecaps/ollierglaciersnov2007.pdf



Dino discovery

A research student partly funded by the Geological Society has discovered a new species of dinosaur in Inner Mongolia, closely related to the famous Velociraptor, *reports Sarah Day*

Michael Pittman, a doctoral student at University College London (UCL) and Jonah Choiniere, a doctoral candidate at George Washington University, came across a spectacular find buried in red sandstone rocks approximately 75 million years old during an expedition carried out as part of the Inner Mongolia Research Project in 2008.

"I only saw the tip of the claw sticking out of a cliff face", says Choiniere. "It was a total surprise that the whole skeleton was buried deeper in the rock". What they had found was a nearly complete, exceptionally well preserved skeleton of a relative of the infamous predator *Velociraptor*.

"Jonah saw a claw protruding from the cliff face", Pittman told *Geoscientist*. "He carefully removed it and handed it to me. We went through its features silently but he wanted my identification first. I told him it was from a carnivorous dinosaur and when he agreed I'm surprised nobody in London heard us shouting!"

The dinosaur has been named *Linheraptor exquisitus*. At approximately 2.5 metres long and weighing 25kg in life, the researchers believe it would have been a fast, agile predator preying on small horned dinosaurs related to *Triceratops*. The artist's impression depicts the dinosaur covered in primitive feathers.

The find is important in understanding the evolution of the Dromaeosauridae, a family of bird-like theropod dinosaurs that lived during the Jurassic and Cretaceous Periods. As well as *Linheraptor* and *Velociraptor*, theropod dinosaurs include *Tyrannosaurus rex* - and modern birds.

Professor Xu Xing of the Chinese Academy of Sciences' Institute of Vertebrate Paleontology and Paleoanthropology, and an Honorary Fellow of the Geological Society, led the research. He told *Geoscientist:* "This is a really beautiful fossil and it documents a transitional stage in dromaeosaurid evolution".

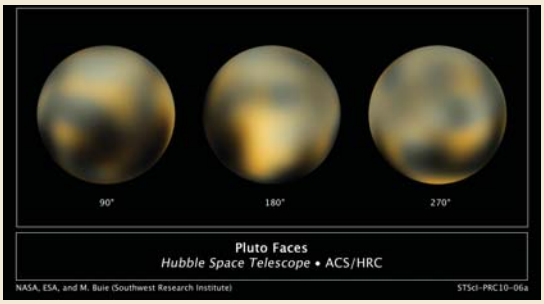
The Inner Mongolia Research project aims to better understand the Late Cretaceous ecosystem of Inner Mongolia, China. Michael Pittman's is researching the evolution and biomechanics of dinosaur tails at UCL, and is the recipient of a Geological Society research grant.

"The Society has this great resource, funding fieldwork", says Pittman. "The money that I got was specifically for geological outdoor work, and it funded my participation in the project. Without it, I wouldn't have been able to go, so I'm very much indebted to the Society, and I hope they continue to fund paleontological research".

- Michael Pittman is interviewed about his discovery by Sarah Day on the latest Society podcast: www.geolsoc.org.uk/podcasts

IN *Brief*

Joe McCall's review of geoscience news that caught his eye



Active Pluto

Pluto, radius ~1142km, downgraded to the status of a "dwarf planet", was thought to be a ball of ice and rock with little contrast and little activity. New images taken by the Hubble telescope show a completely different picture[1]. Trying to resolve the detail on such a small and distant object is like trying to see the markings on a soccer ball 60km away – but Hubble has revealed a mottled planet, with dark orange areas and charcoal black areas, and a mysterious central bright white spot rich in carbon monoxide frost.

The changes are probably due to surface ice, sublimating on the sunlit pole and then refreezing on the other pole. The seasonal cycle takes 248 years. The overall colour is believed to be caused by ultraviolet radiation from the distant sun breaking up methane on the surface, leaving behind a dark, orange-red, carbon-rich residue. Pluto is an active world, with both its orbit and axial tilt driving seasonal changes, unlike the Earth where the axial tilt is the main driver. The seasons are asymmetric because the orbit is elliptical. The New Horizons spacecraft is due in 2015 to fly by Pluto and obtain more detailed images.

1. www.nasa.gov/mission_pages/hubble/science/pluto-20100204.html

READ GEONEWS FIRST IN GEOSCIENTIST ONLINE

Lunar meteorites

My attention was taken by a description of the petrography, mineralogy and trace element geochemistry of lunar meteorite Dhofar 1180, from Oman[1]. This is an unusual polymict regolith breccia with both highland feldspathic and Fe –rich mare components, and with lithic clasts representing highly fractionated rocks or their residual melts. It is a *mingled breccia*. It is similar to Apollo 16 soils, but there are differences. Isotopic evidence points to a lunar source.

Out of >1000 meteorites discovered in the Dhofar desert of Oman, it appears that no less than 50 came from the Moon[1]. Even allowing for multiple finds from the same fall, this is an astounding figure, and reflects the modern, highly organised searches of desert regions, which really commenced with the realisation that the Nullarbor limestone desert in Western Australia was 'littered with meteorites'[2]. This many finds within a small area of desert indicates that the Earth must have been continuously showered with meteorites spalled off the Moon. Finds in North Africa, Oman and Antarctica relate to quite recent impacts – not more than a million or so years ago. None relates to the so-called 'Great Bombardment' of the Moon, which ended about 3900 million years ago.

I have long been worried by two aspects of this hypothesised bombardment. Firstly, there is not a trace of it in Earth's geological record, and the Archaean-Hadean boundary at 4000 million years, erected by Preston Cloud[3], can only realistically be defined by the appearance of life on Earth after it[4], which remains a very uncertain date[5]. Geological evidence from this far back is scanty indeed[5], and the lack of evidence in the geological record is by no means fatal to the hypothesis. What is astonishing is the second anomaly that, whereas asteroidal meteoroids collide frequently with one another to form mixed breccias, there is no trace of lunar material in any asteroidal meteorites.

Planetologists seem to have neglected the problem of throw-out from the Moon during the 'Great Bombardment'. If Mare Imbrium is really a huge impact scar 1250km in diameter, the mind boggles at the volume of target material that must have been thrown out, and, though such a huge impact might have vaporised all the target material, just think how much rocky material, ejected from the smaller impacts, would have reached us when we consider how much reaches us today! The total lack of mixed asteroidal/lunar meteorites on Earth and in space is surely a major unexplained anomaly. So - did the 'Great Bombardment' ever happen? Questions remain to be answered.

Clearly, if Dhofar is so productive, what about the Kavir and Jaz Murian deserts in Iran and the Mashkel Depression in Pakistan? They might be the 'wrong kind of desert' for meteorite finding, but I am familiar with the Jaz Murian and I think they are all worth a look!

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Online Special – GIT feeling: Joe McCall finds his doubts about the Giant Impact Theory vindicated, and has a better idea….

Funny old world

Unconsidered trifles, by 'snapper'

Dino Barbie

"One modern saurian woman, Professor Patricia Vickers-Rich, Australian/American geologist, palaeontologist and author, of Monash University Science Centre and geosciences department, Australia, was the inspiration for a Palaeontological Barbie." From the as yet unpublished paper: *Forgotten women in an extinct Saurian (Man's) World* by Susan Turner, Cynthia V. Burek & Richard Moody, in: *Dinosaurs and Other Extinct Saurians: A Historical Perspective* Editor: Eric Buffetaut.


Prof. Vickers-Rich.

Sticking his oar in

""I can definitely tell you that the world is not coming to an end" Bob Holdsworth, an expert in tectonics at Durham University in northeast England, said Monday." www.thestar.com 9 March 2010.

Prof. Holdsworth was responding to reports that the legendary Oarfish was being washed up in large quantities. Japanese legend has it that the Oarfish surfaces prior to major earthquakes.

Monitors: *Tamzin Anderson; Alan Roberts. All contributions gratefully received. Please write to the Editor at Burlington House, or email ted.nield@geolsoc.org.uk marking your submission "Snapper".*

Back to the future with climate change

Current carbon-driven global warming has its palaeo-analogues. Jonathan Cowie notes that a forthcoming Geological Society symposium will address some key questions.

There is huge political and societal concern over, as well as scientific interest in, current climate change and global warming. It comes as something of a surprise, therefore, to discover that we are not learning from past warming episodes with more than a passing similarity to the one we are currently initiating.

One such possibly analogous climate event took place in the early Eocene 55 million years ago and is usually known as the Paleocene-Eocene Thermal Maximum (PETM). Back in 2007, when I last wrote in these pages about it, the IPCC's newly published fourth scientific assessment skated around the early Eocene-analogue issues. Its chapter on palaeoclimates had a sub-section on it and the chapter on the atmosphere did cover the present carbon isotope excursion (CIE) due to fossil fuel release and deforestation. Otherwise the IPCC does not connect the two – coming closest when it wrote:

"*Although there is still too much uncertainty in the data to derive a quantitative estimate of climate sensitivity from the PETM [Paleocene Eocene Thermal Maximum], the event is a striking example of massive carbon release and related extreme climatic warming.*"

One of the preferred theories is that back in the late Paleocene to early Eocene, volcanic activity caused the realease of greenhouse gases, which warmed the Earth sufficiently to destabilise marine methane hydrates (clathrates) that then further warmed the planet. Because both fossil fuel and methane clathrate carbon is photosynthetically derived (photosynthesis prefers the C-12 isotope) there is a difference in the isotope ratio of both organic and carbonate carbon in sediments of this time, and we can use the resulting carbon isotope excursion (CIE) to estimate how much carbon was involved, and ask: is the current pulse of warming that we have initiated likely to destabilise present-day ocean clathrates in the same way? We do not have to go back as far as the PETM to find indications of methane release from ocean hydrates affecting the climate. Methane clathrate releases may account for some climatic change within the last glacial, and even may have helped take us out of the last glacial maximum towards its end around 18,000 years ago. So even if Milankovitch was the glacial end's "pacemaker", methane clathrate destabilisation may have been one of the climate amplifiers.

So here we are, a couple of years on from the IPCC 2007 assessment; but are we any the wiser? Geological research into CIEs continues but remains a somewhat esoteric area. The distribution and chemistry of methane clathrates have still to be adequately mapped. The discovery of a new type of clathrate along the Cascadia Margin (of a form only previously deduced in the laboratory) was reported as recently as 2007! Only when we are confident that we know about all deep-ocean clathrates can we begin to estimate the amounts in the marine reservoir, and model the proportion susceptible to thermal dissociation. The environmental potency of all biogenic methane makes its study a research priority (a fact recognised by the UK Natural Environment Research Council - see www.methanenet.org).

Past changes in the global climate have profoundly affected biome ranges, let alone individual ecosystems. At the end of the last glacial there was considerable migration. While in Europe species migration was restricted by the Pyrenees and Alps, in North and South America habitation zones moved by as much as 1700–2400km. The past ecological response to glacial-interglacial climate change is therefore illuminating, with a global temperature difference of around 5°C. To put this into present-day context, the IPCC (2007) estimate that the warming over this century will be between 2 and 4°C: so a 5°C increase by a few decades after the end of this century seems quite possible. The PETM also increased Earth's temperature by about 5°C on average. If an analogous event were triggered by current warming, then it would be *in addition to* the IPCC's estimated temperature rise and would involve roughly twice the temperature difference between our current moderate climate, and the depth of the ice age - taking us not into a cooler world, but a far hotter one! The biological impacts would be tremendous. *All* the ecosystems upon which we reply to provide us with food and other resources would be re-organised.

Of course we must not be alarmist. The Earth was perhaps two or three degrees warmer than today in some previous interglacials, and there was no PETM-type event. We have a decade or two before we go through this half-degree barrier; but even then, this will not immediately trigger a PETM-like event. Ocean mixing times throughout their 5–7km depth are approximately 500–1000 years. This seems reassuring; but how long will it take to warm some ocean waters to depths of just 1.25–3.5km, at which most methane clathrates occur? How long before a significant clathrate reservoir is destabilised by local warming due to regional currents, kick-starting a positive feedback? It would certainly be a lot less than 500–1000 years. Might it be beginning now?

Earlier this year Graham Westerbrook and colleagues reported more than 250 plumes of gas bubbles, emanating from the seabed

off of the West Spitsbergen continental margin, in a depth range of 150-400m, at and above the present upper limit of the gas hydrate stability zone (GHSZ). Warming of the northward-flowing West Spitsbergen Current by one degree Celsius over the last 30 years may have increased this release of methane. If this process becomes widespread along Arctic continental margins, tens of Teragrams of methane a year could be released. The problem (once again) is that some clathrate-sensitive areas are known to have been venting methane for years - possibly decades; but because their true extent remains unknown, we do not know if things really are changing.

If (or when) warming triggers ocean clathrate destabilisation and there is a major addition of methane into the atmosphere, the warming effect will be considerable. Methane is a far more powerful greenhouse gas than carbon dioxide, despite its shorter atmospheric residence time. Within 10 years much of the methane is oxidised to carbon dioxide, some of which interacts with the oceans to form carbonic acid. As in the late Paleocene and early Eocene, ocean acidification is happening today, although this time due to carbon dioxide from our use of fossil fuels, as well as deforestation. Were there to be a substantial methane clathrate destabilisation event, acidification (and warming) would become even more pronounced.

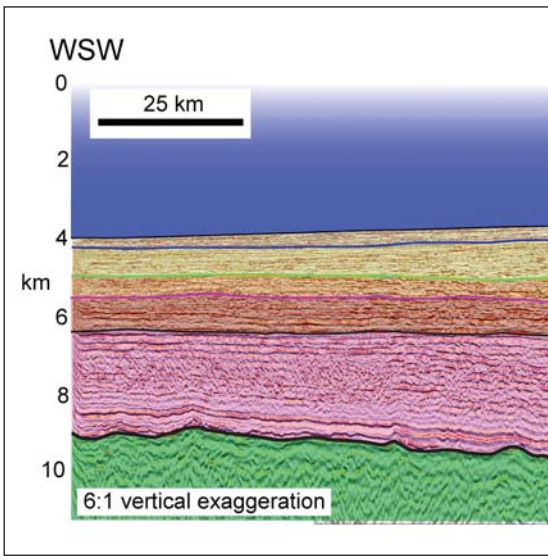
The PETM event is of direct relevance today. Geologists and palaeoecologists need to come together with those concerned with present-day climate change to pool knowledge. This is why the Geological Society is facilitating matters. With the support of the British Ecological Society, the Open University and NuInstruments plc, there is to be a two-day symposium on November 2-3 to bring together geologists, ecologists and policymakers, among others. Entitled *Past Carbon Isotopic Events and Future Ecologies*, the symposium will look at the terrestrial and marine aspects of past carbon isotope excursions (mainly, but not exclusively, the PETM event), their likely causes, and their relevance to current warming. A wide range of experts from the UK and overseas have agreed to speak at the meeting.

If you are interested in this event, you can request that the Geological Society send you details as they become available by emailing Georgina Worrall on georgina.worrall@geolsoc.org.uk – or see www.geolsoc.org.uk/events.

** Jonathan Cowie works in science communication http://www.science-com.concatenation.org. His 2007 book* Climate Change: Biological and Human Aspects? *(CUP) was cited by the UN Environment Programme as one of the top university climate textbooks of the 21st century for the UN World Environment Day 2008. He is convening the Geological Society and British Ecological Society symposium 'Past Carbon Isotopic Events and Future Ecologies' this November with Anthony Cohen of the Open University. A longer version of this article appears in* Geoscientist Online.

It began in the mountains. Generations of structural geologists have cut their teeth on dramatic outcrops of large-scale folds and thrusts in the Alpine ranges of Europe, the Canadian Cordillera and Rockies. But for those who seek definitive structural geometry, the outcrop is too often unsatisfying. Critical parts of the structure necessary to test geometric models remain buried or have been eroded away. And this uncertainty leaves us with many different models competing for the same piece of real-estate, and occupying an expanding volume of literature. In a few cases boreholes may provide subsurface control. But generally, seismic data are sparse and unhelpful. Acquiring 3D seismic data in mountain ranges is hugely complex and very expensive – too expensive - except for those who track down large hydrocarbon fields.

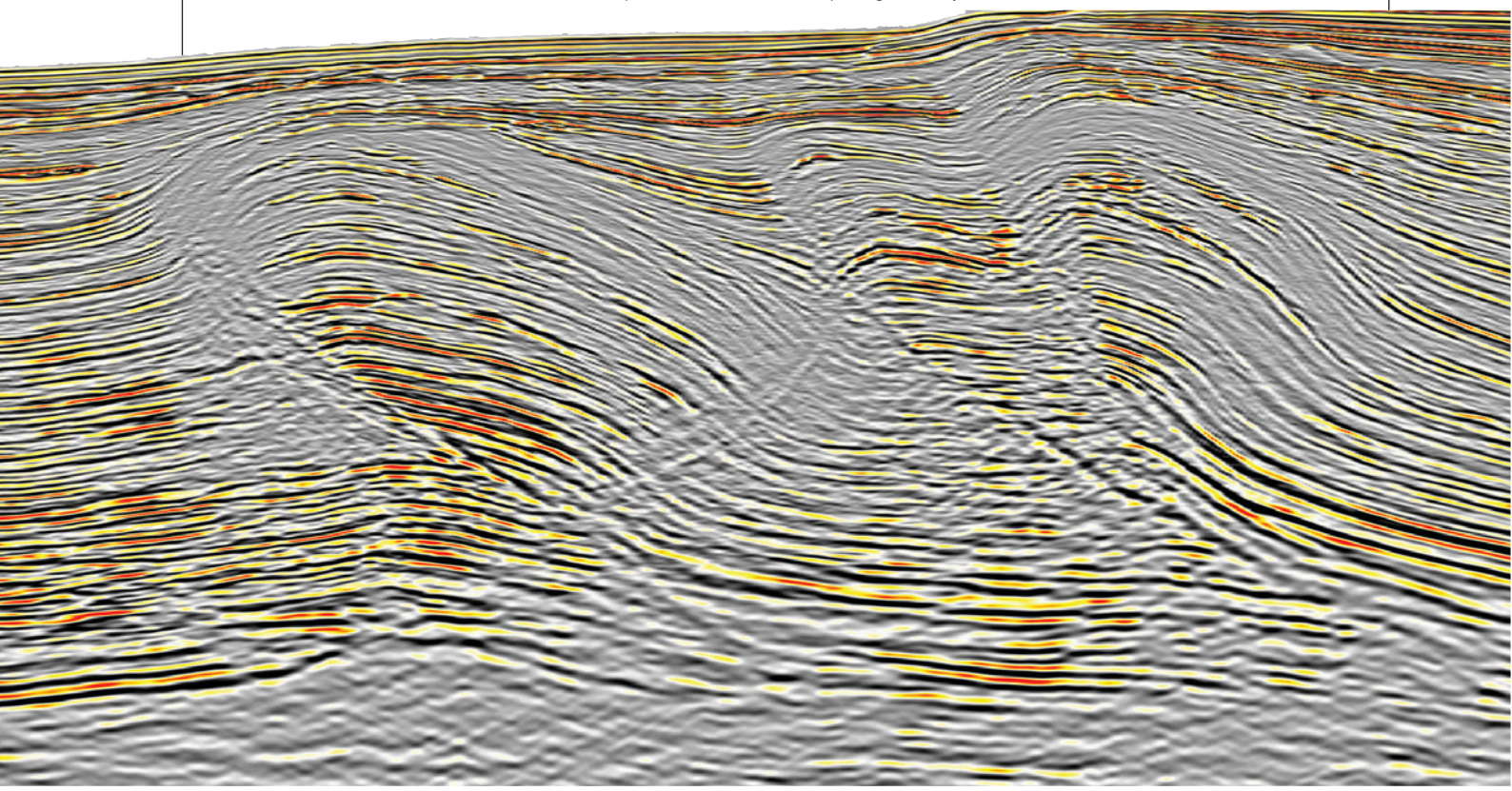
The last decades of the 20th Century saw the search for hydrocarbons step off the shallow continental shelves and into the deeps. Two areas drove this move: the Gulf of Mexico offshore Louisiana and Texas, and the Niger Delta. Both regions are tectonically quiescent – and both have thick sediment accumulations. At the toes of their slopes lie thrust and fold belts.

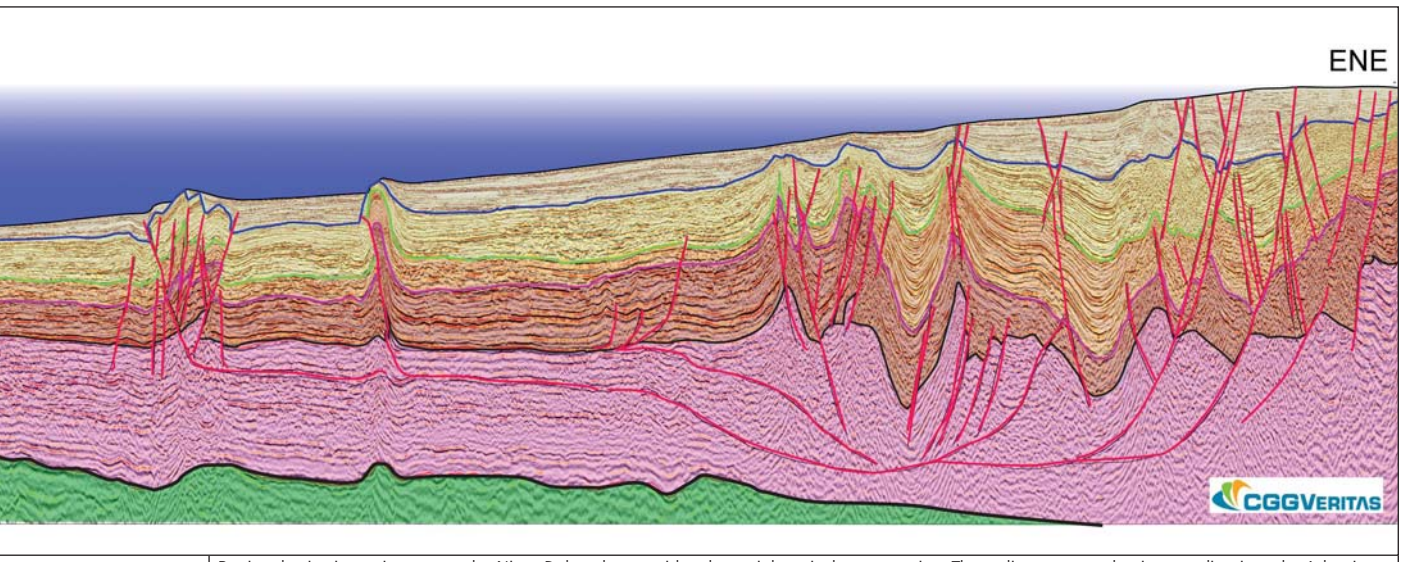


Slip-slidin' away

As the Journal of the Geological Society *publishes a thematic set of papers on the subject, Rob Butler* explores the not so peaceful world of the passive continental margin.*

Detail of thrust structures and folds, some of which reach the modern sea bed, deepwater western Niger Delta. Even great data like these can contain surprises when drilled. The section is about 15 km across and the equivalent of about 4 km deep. Image courtesy of CGGVerirtas and the Virtual Seismic Atlas.





Regional seismic section across the Niger Delta, shown with substantial vertical exaggeration. The sedimentary wedge is spreading into the Atlantic. Original interpretation by Richard Morgan, image from the Virtual Seismic Atlas.

Being marine, seismic data are far cheaper to acquire and of spectacularly higher quality than on land. Imaging is made more complicated by shallow salt in Gulf of Mexico examples but for the Niger Delta thrust structures are exquisitely displayed in seismic data. This is the place to argue about how compressional deformation works at the kilometre scale – at least in poorly lithified sedimentary successions. Do thrusts cut up simply through the strata or do they relay and splay? How do the large-scale anticlines – the structural targets for the oil of course – relate to displacements on the thrusts? How rapidly do thrust structures vary along their length?

All these questions are now being answered, and it's taking more than seismic. The well penetrations are encountering steep beds, sub-seismic folds, multiple fault strands which make for complex imaging. These structural complexities increase the risk inherent in assessing the amount of oil in place, and how it will produce. The stakes are high, when wells cost hundreds of millions of dollars each. Putting in the infrastructure to produce these fields runs into billions. So it is worth spending some money to improve the imaging and capturing the range of possible structural models. Unsurprisingly there are lots of structural geologists working the data now – few go into the mountains any more!

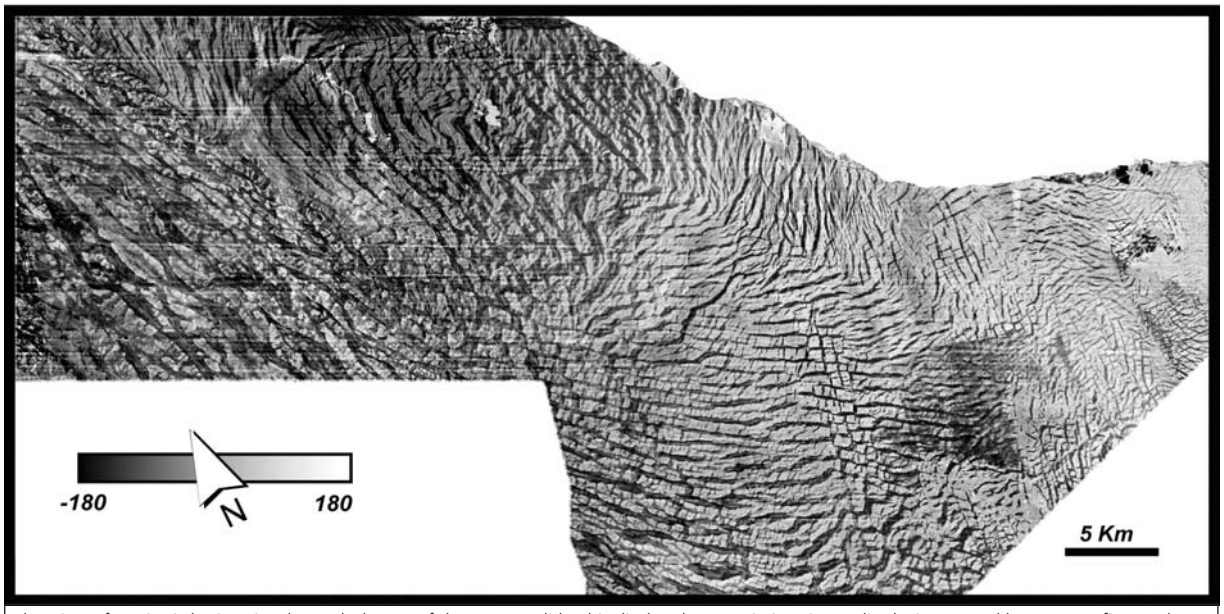
The greatest throw on Earth

So what are thrusts doing on passive continental margins? The answer comes not from the spectacular 3D seismic volumes that image the thrusts but from regional 2D data, often patched together from different surveys. For the Niger Delta the thrusts in deepwater appear to detach on a regional tract of over-pressured mud. Back on the delta top, seismic images show large listric normal faults – which have some of the greatest throws on Earth. So the whole delta complex, over 12km of sedimentary thickness, is on the move - slowly creeping into the Atlantic. And it has been doing so since at least the middle Miocene – 15 million years or more. It's a gravity spreading system that's wider than the Alps.

Elsewhere along the margin of West Africa the sedimentary wedge is collapsing too, but the style changes. Offshore Namibia, within the Cretaceous strata that accumulated after the South Atlantic opened, lie some of my favourite thrusts. They, too, pass back up-dip into extensional faults; but this system all dips down into the Atlantic. Here the slope failed by sliding. This collapse only happened for a short period (perhaps two or three million years) and is covered by a barely-deformed drape of Tertiary strata. If you look at shallow seismic or bathymetric data, you would never know that the thrust belt was there.

As more and more seismic data are acquired from continental margins around the world, the more we are realising that large-scale gravitation collapse is a common occurrence in thick sedimentary piles. The first decade of the 21st Century has seen a surge in oilfield discoveries driven by this exploration. Understanding how the sedimentary units collapse is generally important for modelling Earth surface processes: whether a margin is slowly creeping down-slope impacts on the long-term sediment flux into the deep oceans. On the scale of the margin, sediment can be ponded in shallow water, preferentially trapped in the extensional basins. On a finer scale sediment pathways are influenced by the faults, folds and gradient changes on the seabed caused by the deformation.

Of course sediments on continental margins can fail in other ways, beside wholesale gravity spreading and sliding. Submarine landslides are another form of gravity collapse. The speed of these need not be measured in millions

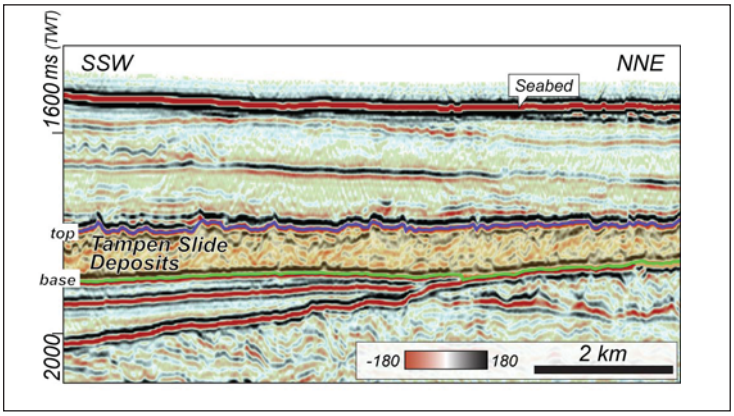


Plan view of a seismic horizon just beneath the top of the Tampen Slide. This display shows variations in amplitude, interpreted by Joana Gafiera and co-workers *(J. Geol. Soc. 2010)* as reflecting fractures and faults akin to crevasses in a glacier. The surface itself is well-organised indicating that at least this part of the Tampen Slide is not a tract of chaotic rubble. The 3D seismic data were acquired by Statoil. Image courtesy of Gafiera.

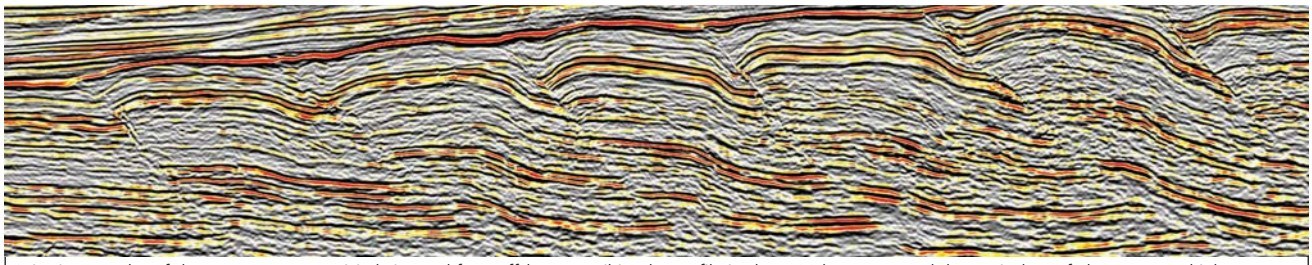
of years but in a few hours or less. Some are implicated strongly in the generation of tsunamis. Slumps, slides and debris flow deposits are being recognised in outcrops of submarine slope deposits for decades. They have been encountered by ocean drilling and imaged by high resolution bathymetric data.

The biggest of all the modern collapses is the Storegga slide, offshore Norway. Failure on the upper reaches of the continental slope, where thick accumulations of glacial deposits had accumulated during the last ice maximum, drove debris out across the floor of the Atlantic, almost as far as the mid-ocean ridge. The last serious collapse happened about 8200 years ago, probably triggered by a large earthquake in response to glacial rebound, and caused a tsunami that dumped debris along the Northern Isles and on cliff tops along the North Coast of Scotland. Modern understanding of the Storegga Slide has come from a set of investigations by Statoil (and its merged forerunner Norsk Hydro) designed to quantify the risk of further slope failures along this sector of the Norwegian Sea. This is not altruistic. One of Europe's largest gas fields – Ormen Lange - lies beneath part of the main scar and pipelines drape back up the failure headwall. The prize is worth having, nearly 400 billion cubic metres of gas, representing 20% of the UK's demand for the next 30-40 years. Understandably, it has been important to understand the near-surface and the potential hazard it poses to seabed infrastructure.

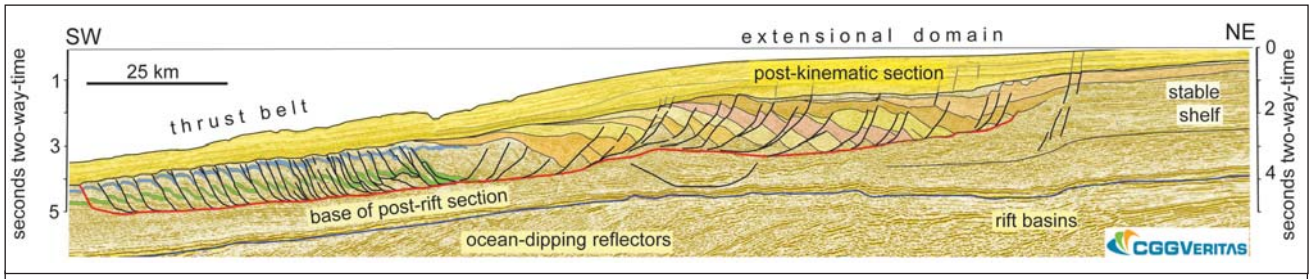
Geologists with a penchant for classification have saddled the products of submarine slope failure with a lexicon of "slides", "slumps", "debris flows" (strictly, "debris flow deposits") and "olistostromes". These terms have a long tradition in field geology – each implying differing degrees of stratal disruption and sediment mixing. The advent of seismic data has tended to gather all of these terms under the single banner of the "mass transport complex" (MTC). The Storegga surveys have slipped revealed blocks of strata, hundreds of metres thick and wide that have retained the integrity of their seismic reflectors. These slide blocks are surrounded by chaotic reflectors or regions that are seismically transparent. So the character of deposits resulting from individual failure events can be complicated in space, and presumably evolved in time. So it is useful to have the blanket term MTC.



A profile through the Tampen Slide, a buried Pleistocene MTC on the Norwegian continental margin (just south of the Storegga Slide), extracted from a 3D seismic survey. Image courtesy of Joanna Gafiera. The top and base of the slide are defined by bright reflections. Between lies a packages of discontinuous and dimmed reflections – an apparently chaotic internal structure.



Seismic examples of thrust structures exquisitely imaged from offshore Namibia. The profile is about 20 km across and the equivalent of about 1500m high. Image courtesy of CGGVeritas and the Virtual Seismic Atlas.



Interpretation of a regional 2D seismic profile acquired by CGGVeritas from offshore southern Namibia. Interpretation is after Butler & Paton (GSA Today, 2010). There are many more gravity slides like this, buried under the lower sediments offshore west Africa and only imaged on industry datasets. Image courtesy of the Virtual Seismic Atlas.

In the earlier days of imaging, MTCs revealed little of their internal structure. Large slide blocks, more disorganised regions, shears, break-away scars and "pressure ridges" have all been recognised for a long time on high resolution bathymetric surveys; but many shallow, 2D seismic profiles failed to reveal MTCs' internal structure. Indeed, chaotic or transparent seismic character is generally interpreted as how MTCs manifest themselves in the subsurface. Logically, this reasoning is perhaps curious - based as it is on the absence or obscurity of data, rather than anything positively diagnostic. Chaotic reflections or transparency have generally been thought to represent stratal chaos and intense disruption. It is as if the interpreter is saying that the internal structure of an MTC is too complicated to be resolved, or perhaps even understood.

Modern 3D seismic datasets are changing all that. It still takes some imagination to pick out structure in 2D profiles cut through 3D seismic volumes, but maps and timescales are far more revealing. The other technological advance is to display the seismic data not in terms of amplitude (the standard way) but by using so-called "seismic attributes". These identify variations in seismic character, such as subtle variations in amplitude strength. Suddenly, all sorts of structures appear – organised fractures and faults, looking like crevasses in glaciers. Other examples show imbricate thrusts, stacking stratal reflectors. If individual structures like these can be identified, it means that the surrounding material must be reasonably coherent – not a jumble of material. It does not take too much to mess up the seismic character seen on profiles – narrow faults every few tens of metres, broad fold structures between. If you came across this in the field, the strata might appear only slightly disrupted – albeit translated along a basal detachment. Rather like a conventional thrust belt in fact! Just because the seismic character in profiles is "chaotic" does not mean the MTC is a debrite.

Why does this matter? Some ancient, heavily-disrupted MTCs represent significant drilling hazards because they have significantly reduced permeability that allows formation pressures to build up beneath. Their very heterogeneity makes drilling a challenge. But the geological community needs to understand them more, because they are such common components of continental margin successions. How many more lie beneath the blanket of seabed sediments, awaiting discovery by seismic surveys? How does internal structure and the propensity for disruption within MTCs reflect emplacement mechanics and especially, rates of translation? We need answers if the geological record on margins is to be useful in providing probabilistic assessments of tsunami risk.

So passive margins are not so passive. Many are in a state of collapse. Deep-water thrust structures can be just as large, and in some cases larger, than the fold-thrust complexes found in mountain belts. Even MTCs can be many hundreds of metres thick. Others have speculated that these gravitational structures will become incorporated into mountain belts as continents collide. So how many of the deformation structures described from ancient mountain belts may have formed, not during that ancient orogeny, but in earlier times? It may be hard to tell.

Conclusions, further reading & acknowledgements

This article has barely scratched the surface of gravitational tectonics on continental margins, but one thing I hope is clear. It is no coincidence that the images illustrating this article all come from the oil and gas industry and the seismic companies that service them. Ninety-nine percent of the geophysical data from margins are collected for these commercial ends – while only a tiny proportion comes from academic research campaigns. If we want to understand and quantify the hazard of submarine slope failure – we need to work with commercial data.

A joint meeting of the Petroleum Group and the Tectonic Studies Group was held at Burlington House in October 2008 - *Gravitation Collapse on Continental Margins: Processes and Products*. A taste of the issues raised - the importance of excellent seismic data, coupled with carefully directed fieldwork on ancient analogues - can be gauged from the Thematic Set of papers arising from the meeting.

These were edited by Jonathan Turner and myself and appear in the May issue of the *JGS*. You can also find a great introduction to deep-water fold and thrust belts in Rowan, Vendeville & Peel (2004; *AAPG Memoir 84*). If you wish to gain an insight into structural interpretation and its potential uncertainties, even in these settings, take a look at the paper by Kostenko and others (2008, *AAPG Bulletin*,). Much of the Storegga description can be found in a special issue of *Marine & Petroleum Geology* (volume 22, parts 1-2) from 2005. Some of the modern approaches of structural mapping within mass transport complexes made possible by 3D seismic data are provided by Moscardelli, Wood & Mann (2006, *AAPG Bulletin*), Bull *et al.* (2009, *Marine & Petroleum Geology*), and references therein.

The images used in this article are a small sample of those that image gravitation tectonic structures, available on the Virtual Seismic Atlas (www.seismicatlas.org).

Dr Rob Butler is in the School of Geosciences, University of Aberdeen.

From the Geological Society Publishing House

The Geological Society

May Online Bookshop Sale

Friday 7th May - Friday 14th May 2010

35 publications will be reduced to
£25.00 each
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HOW TO REGISTER:
The sale will last one week only and is only available via the online bookshop. To take part please register via the Online Bookshop home page, and sign up by clicking on "Login/My GSL", found in the right hand corner; then click on "register". Remember to register your details with the Geological Society Online Bookshop Newsletter by **Thursday 6th May.** Once registered, you will receive an email at the start of the sale detailing the publications on offer.

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www.geolsoc.org.uk/bookshop

Sale 7 May - 14 May 2010

Mt Everest from base camp by Martin Lack

Society Business

President's Day – 2 June 2010

President's Day will begin with the Annual General Meeting at 11.00 followed by a buffet lunch with the award winners (ticket only – £25.00 per head). As in previous years, the Awards Ceremony will be followed by presentations from Wollaston, Lyell, Murchison and William Smith medallists.

The timetable for President's Day and the AGM agenda are below. Apart from lunch, no tickets are required and you may attend for all or part of the day's events. To obtain luncheon tickets please send cheques (made payable to "The Geological Society") to Stephanie Culver at Burlington House or email stephanie.culver@geolsoc.org.uk.

Timetable

11.00	Annual General Meeting
12.30	Lunch with the Award winners
14.00	Awards Ceremony
15.30	Talks by Lyell, Murchison and William Smith medallists
16.45	Tea
17.15	Talk by Wollaston Medallist
17.45	Presidential Address
18.30-20.00	Drinks reception

Medallists' talks

Wollaston Medallist Richard Sibson will talk on: *How Faults Get Loded - coupled fluid and fault activity near the base of the seismogenic zone.* William Ruddiman (Lyell Medal) will speak on *New support for the Early Anthropogenic Hypothesis.* Randall Parrish (Murchison Medal) will deliver a talk entitled: *Exploring the earth system, grain by grain, with a map, hand lens and mass spectrometer.* Henry W Posamentier (WilliamSmith Medal) will talk on: *Exploring the subsurface – applications of integrated seismic stratigraphic and geomorphologic analyses from the deep abyss to the alluvial plain.* Abstracts of these talks are available online, in the Events Calendar. *See advert, back cover.*

AGM Agenda

- Apologies
- Minutes of the Annual General Meeting held on 3 June 2009
- Appointment of Scrutineers for the ballots for Council and Officers
- Ballot for Council
- Annual Report and Accounts for 2009
- President's Report
- Secretaries' Reports
- Treasurer's Report
- Comments from Fellows
- Formal acceptance of the Annual Report and Accounts for 2009 and approval of the Budget for 2010
- Fellowship subscriptions for 2011
- Deaths
- Report of Scrutineers on the Ballot for Council
- Ballot for Officers
- Appointment of Auditors
- Report of Scrutineers on the ballot for Officers
- Election of new Fellows
- Any other business
- Provisional date of next Annual General Meeting

Election - Fellows

The following names are put forward for election to Fellowship at the OGM on 16 June 2010

BARKWITH Andrew; BEMAND Elizabeth Valerie; BIRD Stephanie Marie; BORTHWICK Andrew Heywood; BUCK Darrell James; BURDETT Heidi Louise; BURMAN John Frank; BUTTERWORTH Eleanor; CADMAN Victoria; CAVANAGH Andrew James; EDWARDS Paul; ENGLAND Matthew Lawson; FARRIS Matthew Anthony; FISHER Adam; GILLSON Sam William; GIRLING Hans Robert; GORMAN Christopher Paul; GREEN Melanie Jane; HADRO Paula Agata; HARWOOD Graham; HEWITT Peter John; HO Chiu Shek; HUI Steve Chi Wai; JAMES David Richard; JOHNSON David Harry; LEACY Laurena; LEIGH Christopher; LEIGH Gerwyn James; LEWIS Simon Gareth; LOWE Rebecca; McCARTY Jennifer Lynne; McCLUSKEY Andrew Nicholas; McLOUGHLIN Stephen John; MORAN Naomi Louisa; MOORE, Alexander James; MORELOS Pamela Roths; OPATA Henry Tettah; OWENS Desmond John; PINFIELD Simon David; QUAYLE Blae Mylchreest; RAE Stuart Iain; RICE Susan Rachel; RITTNER Martin; SIMMONDS Alehni Claire; SLATER Phillip Stephen; SOMMERVILLE Craig William James; STOVELL Ronald Albert; TORRANCE Keith William; TURNER Jennifer Anne; VEAL Steven Loring; WARD Oliver Simon William; WIDYAT Agus Haris; YANRONG Li.

Future meetings

OGMs:
16 June 2009; 29 September 2009; 24 November 2009; 3 February 2010; 13 April 2010.

Council:
16 June 2009; 29 September 2009; 24 November 2009; 2/3 February 2010; (residential); 13 April 2010.

Annual subscriptions 2011

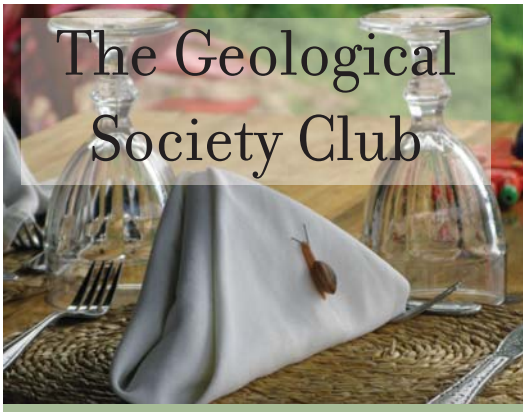
Council agreed to the following subscription rates for 2011 at its meeting on 21 April 2010. These will go forward to Fellows to agree at the AGM.

	2010 £	2011 £
Junior Candidate Fellows	10.00	10.00
Candidate Fellows	15.00	15.00
One-off payment for undergraduate course	40.00	40.00
21 and under	31.00	31.00
22-27	62.50	64.00
28-33	114.00	117.00
34-59	173.00	178.00
34-59 (Overseas)	133.00	137.00
60-69	87.00	90.00
70+	61.00	62.00
Concessions	87.00	90.00
Full time postgraduate MSc	35.00	36.00
Full time postgraduate PhD	49.00	50.00
Supplement (to payer) for Joint Fellowship	50.00	52.00
CGeol supplement payers	26.00	27.00
CSci supplement payers	21.00	22.00

Full accounts

Full statutory audited accounts of the Society are available to view online as a PDF download – as is the *Annual Review 2009*. To access these please go to www.geolsoc.org.uk/annualreview2009.

Copies of the full statutory audited accounts will be made available at the AGM, and can be supplied by surface mail to those who request them **in writing beforehand.** Please write to Stephanie Culver at Burlington House. Email requests will not be accepted for this service.



The Geological Society Club

The Geological Society Club, the successor to the body that gave birth to the Society in 1807, meets monthly (except over the field season!) at 6.30 for 7.00 in the Athenaeum Club, Pall Mall. Once a year there is also a special dinner at Burlington House. New diners are always welcome, especially from among younger Fellows. Dinner costs £45 for a four-course meal, including coffee and port. The Founders' Dinner has its own price structure. There is a cash bar for the purchase of aperitifs and wine. Next year two meetings will be held at new venues yet to be arranged.

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

2010: 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*

Council Election

The ballot for Council closed on 31 March. A total of 1109 valid votes were cast for the five vacancies on Council. There were 23 invalid votes. The results are as follows:

Samantha Brough	615 (55.50%)
Sally Gibson	608 (54.80%)
Rob Butler	523 (47.20%)
John Tellam	437 (39.40%)
Colin Summerhayes	435 (39.20%)
Ian Sims	392 (35.30%)
John Cripps	385 (34.70%)
Chris Carlon	363 (32.70%)
Sanjeev Gupta	337 (30.40%)
Hugh MacDonald	323 (29.10%)
Joseph John Lowe	264 (23.80%)

The five candidates receiving the most votes will go forward to the AGM for election as Council members.

Shell London Lecture Series

Chemistry of the oceans: past, present & future

Speaker: Prof Derek Vance (Bristol University) **Date:** Wednesday 9 June 2010

The story of the evolving chemistry of the oceans, as told in chemical precipitates subsequently preserved as sediments and rocks, is endlessly informative about the past environment of the Earth. As the home of life for close to nine tenths of its entire span on Earth, this history is also a tale of interactions between the biosphere and its surroundings. The interest in this history is restricted neither to the biosphere nor the oceans, however. The atmospheric evolution of a minor – but climatically hugely important – constituent of the atmosphere, carbon dioxide (CO_2), is also part of this story. The oceans both control CO_2 on short timescales, and carry an imprint of the atmospheric evolution of CO_2 in their chemistry. This lecture will focus on what the evolving chemistry of the oceans tells us about the history of the surface of our planet and consider the consequences of human activities for the future.

The speaker, Professor Derek Vance, works at the University of Bristol. Derek's research has applied the methods of isotope geochemistry. Most recently he has published on the use of transition metal isotopes in the oceans as signatures for the earliest life on the planet, on tracing the wet episodes in the Sahara that may have facilitated the migration out of Africa of early modern humans, and on the consequences of recent glaciation on Earth for ocean chemistry and the controls on atmospheric carbon dioxide.

There will be no matinee performance.
Tea and coffee 17.30; Lecture 18.00 – 19.00.

Further Information and tickets

To obtain a ticket please contact us around four weeks in advance of the talk, using the details below. Please note that due to the popularity of this lecture series, tickets are allocated on a monthly ballot basis two weeks in advance of talks, and we cannot guarantee that you will get tickets when they are requested. We will always let you know whether or not you have been successful.
For further information on the Shell London Lecture series and the full programme for 2010 please visit our website www.geolsoc.org.uk/shelllondonlectures10
Films of all past lectures will be posted to be watched online here.
The Geological Society, Burlington House, Piccadilly, London W1J 0BG; Tel: +44 (0) 20 7432 0981; Email: events@geolsoc.org.uk

In association with

Rare book of the month!

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

Istoria dell'incendio del Vesuvio accaduto nel mese di maggio dell'anno MDCCXXXVII [1737] by Francesco Serao. 1740

Where does a "rare books" collection come from? A substantial number of the Society's volumes are in our possession through the benevolence of just one man: the Society's first President, George Bellas Greenough (1778-1855). During his life Greenough presented many volumes to the Society and in his Will he bequeathed to the Society "all his books, maps, charts, sections, and engravings relating to geology (amounting to upwards of 1,150 volumes, and 60 cases of maps)." He also left "the sum of 500 [pounds] for the purpose of defraying the expenses of finding accommodation for these collections" (proof that *sponsor-a-book* schemes are nothing new!)*.

Here is just one of the volumes he bequeathed to the Society: Francesco Serao's *Vesuvio* (1740). What is fascinating about this volume is the trace it carries of its previous owner: there, in the top right hand corner, directly onto the surface of the white vellum, G B Greenough has signed his name. We can only guess why. Perhaps he held this book in particularly high esteem, or perhaps he just jotted his name there when lending the book to a friend, to make sure it found its way back to its rightful owner. Whatever the reason, it makes this book a rather intriguing and special artefact.

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

* Woodward, Horace B. *The History of the Geological Society of London* London: Geological Society, 1907.

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

Two new e-journals available offsite

Offsite access to the (English language) journal *Paläontologische Zeitschrift* and *Journal of the Geological Society of India* is now available. Currently this is limited to issues from 2009 and 2010, but older issues will be available eventually. Visit the Virtual Library (www.geolsoc.org.uk/gsl/op/preview/info/lyellcentre) to read more about online access to over 60 e-journals provided by the Library.

Virtual 'Help yourself box'

The Library has a selection of journal issues which are not required due to duplication, defect or damage. A list of these can be found on our website in the section on Library Collections - Serials, under the heading 'Surplus Journals'
www.geolsoc.org.uk/gsl/info/collections/serial/page3358.html.
Here you will find information on how to request them. They are available to both individuals and libraries. Please note that there may be a charge depending on the type of material and the weight, if posted.

Postal Loans

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

WiFi access

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

Pick of the crop

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

From the Regions

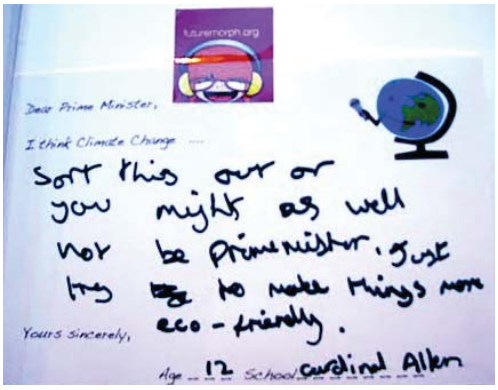
Bang goes communication

Sarah Day visits the 2010 Big Bang Fair *in Manchester and discovers that when communicating "climate change" science, nothing – even the terms we use, should be taken for granted.*

Thomas Hearing, Thomas Hardye School, Dorset, with his winning project. Photo: Sarah Day.

The writing of the Geological Society's statement on climate change is currently underway, and has caused a fair few raised eyebrows, as well as eager anticipation, among the Fellowship. While some might question the wisdom of wading into the increasingly muddy waters of the 'great debate' on climate change, it is becoming increasingly clear that effective communication between scientists and the public is about more than just edification.

Climate change, despite having been the flavour of the month with journalists and politicians for a long time, is still desperately misunderstood by much of the public. No wonder, with so little of what's being discussed being about real science, rather than endless back-and-forth about politics and conspiracy theories. Especially worrying is that these misunderstandings are not about what scientists and science writers might expect.



The problem came to light at the *Big Bang Fair* in Manchester, where the Science Council was asking young people between the ages of 7 – 19 (and a few over enthusiastic adults) to write a postcard to the Prime Minister stating what they thought about climate change. Among the nearly 2,000 responses, a predictable spread of opinions was gleaned, from '…is very bad' and 'needs sorting out' to 'is not real' and 'is a natural thing'.

Among these, a trend emerged. Several responses were along the lines of "climate change is good. We need to stop polluting the air". Some children were viewing climate change as a man-made response to global warming, a bit like "geoengineering"; which goes to show, when it comes to communicating science, assume no prior knowledge. When the very definition of phrases like 'climate change' is misunderstood, how can we be sure the messages we try to put across are being understood in the way we intend?

When it comes to engaging the public over changing climate, young people are the most important target group, and their enthusiasm for science is an important place to start. The *Big Bang Fair*, part of National Science and Engineering Week, is one of a number of initiatives that share this aim. Now in its second year, the March event was bigger and better organised than the inaugural show in London. Four coloured 'zones' divided up the vast and airy space of Manchester Central, a former railway station, now a modern conference centre.

The theme of National Science and Engineering Week 2010 was '*Earth*'. Despite this, Earth science was not prominently featured at *Big Bang*, either by exhibitors or students taking part in the National Science and Engineering competition. So it was all the more heartening, then, when the overall winner of 'Young Scientist of the Year' was Thomas Hearing, an A-level geography student from the Thomas Hardye School, Dorset, with a project entitled *'The Dorset and East Devon Coast World Heritage Site: A Baseline Study of Monmouth Beach's 'Ammonite Pavement'*.

Thomas was enthusiastic about the importance of good communication between geoscientists and the public. "I really want to push geology", he said, "because it's such a good way of getting kids interested in science – all sciences – it encompasses biology, chemistry, physics, maths…It's such a diverse and interesting subject".

The response of some of the visitors to the Science Council's stand suggested that they would welcome more opportunities to be engaged with geoscience, and climate science in particular. After filling in her postcard, 13 year old Clare said, "it's not really that understandable, the way they explain it to people. We don't know enough about why it's happening, or how to stop it".

When the Society puts together its climate change statement, it will be with this plea in mind.

O. T. who?

Ted Nield visits Cardiff to watch geology students from six Welsh schools face some tough questioning at the South Wales Regional Group's first Schools Geology Challenge.

My heart went out to the thirty or so young competitors (from years 12 and 13, in six teams), as they faced a question to which the answer was "O T Jones"; but this was, I reminded myself, the Land of my Fathers, where nothing lives quite as vividly as a dead hero.

Wales remains rightly proud of its heroes and heritage and all those rather tiresome little trains; but today there is a sense of futurity and (in the capital at least) prosperity, that I don't remember from my years as a student in the 1970s and 80s - when the only upwardly mobile thing in Cardiff was a late-night kebab from El Greco's. The Society's vibrant South Wales Regional Group is a case in point. They obtained extensive sponsorship to mount an ambitious quiz evening, which drew pupils from schools as far afield as Monmouth and Llanelli to Whitchurch High. There each team presented their ideas on "What can geologists do to save the planet", and were put through their paces in a series of written and oral tests.

As the teams' opening presentations unfolded it became clear that they had been tipped off that President Designate Dr Bryan Lovell was not only among the judges but was going to be speaking after the first round. A pattern swiftly emerged. Whether teams presented jointly or singly, used PowerPoint, or included a *Planetary Rap* from a dude in dreads, not one failed to conclude that the main way in which geoscientists could contribute to the future of our planet was through Carbon Capture and Storage (CCS). This was handy, because that was exactly the subject on which Bryan later expanded - after first grilling the teams about what, in their presentations, they were "sure enough to tell a judge under oath", and what they felt less confident about.

This exercise proved highly revealing. The ideas that instilled most confidence were - that CCS was going to be big; that whatever humans do to it, "the planet" would be fine; and that while earthquake forecasting would become more accurate, it would only be about *where*, and sadly not about *when*. Teams were less confident that CCS would be allowed to fulfil its potential. Some were less than totally confident that the anthropogenic element in climate change was as large as global warmers would have us believe; though they also felt that this hardly mattered from a policy point of view, because it would be folly to exacerbate a natural trend. Finally, one team noted that CCS should not be considered a long-term solution. It was a stop-gap measure, buying crucial time to develop the clean technologies that would ensure a sustainable future. And so, as well as showing that they had swotted their science, all teams displayed a remarkable ability to make reasoned assessments of risk and practicality that would put many a politician – indeed, many an adult – squarely to shame.

Winners by a narrow margin were the team from host institution, Whitchurch High. The magnificent trophies (courtesy of Halcrow) went to them; but as in all the best caucus races, everyone got prizes – teachers included – and quite right too. The biggest prize of all, though, went without a doubt to the Southern Wales Regional Group, which intends to run another Schools Challenge next year, hopefully with even more teams.

Everyone left Whitchurch feeling uplifted, for reasons of their own. For me it was finding that, after all this effort, inspiration, dedication and administration, nobody I asked could give me a reason *why* they went to all this trouble. Sated as I am with bloodless wonders who must name reasons for doing everything (and then as often as not can't think of any), I felt a rush of gladness when the evening's leading light, honorary Welshman Paul Maliphant, said: "We don't really know why we do it – we just know that we *should*".

Hugh Jones-Williams, Head teacher, said: "Whitchurch High School was delighted to host the inaugural Schools Geology Challenge. It will no doubt become an annual event and the School looks forward to travelling away next year to defend its title, having won on home bedrock this year!". President Designate Bryan Lovell said afterwards: "You've got to get out there and meet the people who are actually doing things, not just sit in London talking to prefects. That way, you might actually learn something."

- The South Wales Regional Group Schools Geology Challenge 2010 was held on Wednesday 23 March at Whitchurch High School, Cardiff. Competing schools were Whitchurch High, Barry Comprehensive School, Cowbridge Comprehensive School, Amman Valley Comprehensive School, Monmouth Comprehensive School, and Coleg Sir Gar, Llanelli. The event was sponsored by Halcrow Group Ltd., Dargo Associates Ltd., WSP Remediation Ltd., Amgeuddfa Cymru (National Museum of Wales). Judges: Prof. Ian Hall (Cardiff University); Dr Bryan Lovell (Cambridge University); Ms Margaret McBride (Chair, SWRG); Paul Maliphant (Halcrow Group); Dr Ted Nield (*Geoscientist*).

Continuing Professional Development (CPD) Courses

•**5 May** *Applying the Environment Agency's Remedial Targets Methodology.* Provides hands-on guidance on how to apply the Environment Agency's 'P20' remedial targets methodology & spreadsheet. Venue: Shrewsbury Organiser: ESI Ltd. Convener: Course Administrator T: 07143 276100 E: CoursesUK-ESI@esinternational.com W: www.esinternational.com/esi-courses.html

•**5-7 May** *In Situ Groundwater Remediation* On this course, you will gain a conceptual understanding of what controls the fate and transport of organic and inorganic contaminants in both unconsolidated and fractured rock geology. Venue: University of Sheffield Organiser: Groundwater Protection and Restoration Group. Contact: Pat Rayner T: 0114 222 5758 E: p.rayner@shef.ac.uk W: www.shef.ac.uk/civil/shortcourses/

•**11-13 May** *Practical Groundwater Flow and Contaminant Transport Modelling.* The UK's most popular, hands-on introduction to groundwater modelling. A 3 day course covering all aspects of model development, calibration and use. The course is based around the MODFLOW family of modelling tools. Venue: Shrewsbury. Organiser: ESI Ltd Contact: Course Administrator E: CoursesUK-ESI@esinternational.com W: www.esinternational.com/esi-courses.html

•**21 May** *Cone Penetration Testing (CPT)* Free 1-day CPD course in cone penetration testing. 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. Venue: London Organiser: Fugro Engineering Services. Contact: Steve Poulter T: 0870 402 1400 E: s.poulter@fes.co.uk W: www.fes.co.uk

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

MAY 2010

Solent Regional
•**5 May** *Chartership with the Geological Society.* Evening Meeting. Venue: Burnaby Building, University of Portsmouth. Bill Gaskarth, Chartership Officer of the Geological Society, will talk about the new process for applying for Chartership. **Contact:** Wendy Furgusson E: wendy.furgusson@gifford.uk.com.

•**5-7 May** *Remote Sensing and the Carbon Cycle.* Venue: The Geological Society (Burlington House). This event includes the RSPSoc Annual Lecture and Conversazione (evening, 5 May). Prof Philippe Ciais (LSCE, France) will give an evening keynote lecture on uses of satellite remote sensing to monitor terrestrial and atmospheric transfers of carbon. **Contact:** RSPSoc. T: 0115 9515435 E: rspsoc@rspsoc.org.

Western Regional
•**11 May** *Offshore Geotechnics* Evening Meeting. Venue: S H Reynolds Lecture Theatre, University of Bristol. Speaker: David Shilston (Atkins Global). **Contact:** Toby Hopkins. E: tobyhopkins@googlemail.com.

•**12 May** *Geology and Ecology - The evolution of a megaproject on Sakhalin Island.* Shell London Lecture. Speaker – Chris Finlayson, Shell. The talk will be given twice on the same day, once at 3pm and once at 6pm – please note that if you would like to attend the talks, the 3pm matinees generally have more availability. Tickets allocated by ballot. **Contact:** Alys Hilbourne T: 020 7432 0981 F: 020 7494 0579 E: alys.hilbourne@geolsoc.org.uk.

South Wales Regional
•**12 May** *Ground Sourced Heating and the Geological Environment – Thermogeology and Aestifers.* Evening lecture. Venue: Room 1.25, Main Building, Cardiff University. Speaker: James Dodds (JDIH Envireau). **Contact:** Margaret McBride E: margaret.mcbride@jacobs.com

South West Regional
•**13 May** *Kelly Mine, Lustleigh.* Evening Lecture. Venue: Ley Arms, Kenn, near Exeter. A talk with artefacts on Kelly Mine, Lustleigh, by Nick Walter. Light refreshments 1815, talk 18.45. **Contact:** Cathy Smith E: swrg@hotmail.co.uk.

•**18 May** *Geotechnical Baseline Reports.* Evening Meeting. Venue: The Geological Society (Burlington House). **Contact:** Darren Page E: geoscience@hotmail.com

South East Regional
•**18 May** *Chartership Evening (Provisional).* Evening Meeting. Venue: The Bell Inn, Godstone. **Contact:** Ron Williams; T: 01737 553740 E: rew182@btinternet.com

South East Regional
•**22 May** *Field Trip - Upper Greensand Mines, Godstone.* Meet at Venue at 10am - the visit is expected to take about 3 to 4 hours (finish around 1.30pm). Peter Burgess leading. **Contact:** Lucie Clatworthy E: Lucieclatworthy@hotmail.com

North West Regional
•**25 May** *Field Trip to Quarry Bank Mill, Styal Country Park* Leader: Fred Owen of the Manchester Geological Society. This is an evening field trip, lasting approximately 2 to 2.5 hours. Time: 1730. **Contact:** chrisberryman@terraconsult.co.uk or Helen Beeden T: 01925 464160.

JUNE 2010

•**1 June** *Frontiers of Seismic Geomorphology* Venue: Burlington House. A one-day showcase and celebration of subsurface and seabed imaging from 3D seismic data. Topics include: submarine channel systems, mass wasting processes, tectonic sub-seascapes, glacial processes, lava sequences, palaeokarsts and much more. **Contact:** Steve Whalley. T: 020 7432 0980 F: 020 7494 0579 E: steve.whalley@geolsoc.org.uk.

•**2 June** *President's Day and AGM 2010* See details on Page 22, this issue.

•**3 June** *Burlington House Lecture - Science Meets Art.* Venue: Burlington House. Speaker: Professor Robin Clark (Sir William Ramsay Professor Emeritus, University College London). Tea: 17.30 Lecture: 18.00 Reception: 19.00 Admission free but by ticket only, available from 26 April onwards from the Events Department. **Contact:** Alys Hilbourne T: 020 7432 0981 F: 020 7494 0579 E: events@geolsoc.org.uk

South East Regional
•**8 June** *Medical Geology.* Evening Meeting. Time: 6pm for 6.30pm Venue: The Gatwick Manor Hotel, Crawley. Speaker: David Thomas.

•**9 June** *The Chemistry of the Oceans: Past, Present & Future* A Shell London Lecture. Speaker – Derek Vance, University of Bristol. Evening performance only, 1730 for 1800. Tickets allocated by ballot. **Contact:** Alys Hilbourne T: 020 7432 0981 F: 020 7494 0579 E: alys.hilbourne@geolsoc.org.uk.

•**16 June** *Petroleum Group Annual Dinner* Venue: Natural History Museum. **Contact:** Steve Whalley T: 020 7432 0980 E: steve.whalley@geolsoc.org.uk

•**16-17 June** *Climate Change: Impacts and Opportunities.* For more information visit www.bgs.ac.uk/climateconference/home.html. **Contact:** BGS climate change team E: climatechange@bgs.ac.uk.

MSc by Research:
Controls on Mesozoic and Cenozoic Tectonics and Sedimentation in the Southern Adriatic and Ionian Sea

Cairn

Cairn Energy PLC in partnership with The University of Edinburgh seeks applications for a one year, full-time, fully-funded Masters by Research (MRes) project.

- The project aims to undertake a seismic stratigraphic interpretation of regional 2D seismic data and a new 3D seismic volume and integrate its results with a re-evaluation of strategic field exposures and borehole data in Greece, S Albania and SE Italy to understand the fundamental controls on the tectono-stratigraphic evolution of the area and its effects on petroleum prospectivity.
- The study will be based at Edinburgh's Grant Institute of Earth Science under the supervision of Professor John Underhill and Dr Pierre Eliet (Cairn Energy). There will be close liaison with the sponsor company including the opportunity to work in-house during the course of the project.
- The project should appeal to any undergraduate geoscientist who holds or is expected to gain a good Upper Second or First Class Honours Degree (or equivalent) in Earth Science, Geology or Geophysics. It would be of particular interest to a student who wishes to pursue a career in the oil industry or continue to a higher degree in academia.

For further enquiries please email: Helena.Sim@ed.ac.uk

To apply please send a written CV and covering letter containing the names of two academic referees to:

Helena Sim, Postgraduate Secretary
School of Geosciences
The University of Edinburgh
The King's Buildings, West Mains Road
Edinburgh, EH9 3JW

The closing date for applications is: Friday 14th May 2010

The project is expected to start on: 1st September 2010

Cairn Energy PLC is one of Europe's largest oil and gas exploration and production companies. It is based in Edinburgh and listed on the London Stock Exchange. The Company focuses its activities primarily in India, Greenland and the Mediterranean.

For further information on Cairn Energy please go to: www.cairnenergy.com

DISCOVERING HIDDEN VALUE

VSA

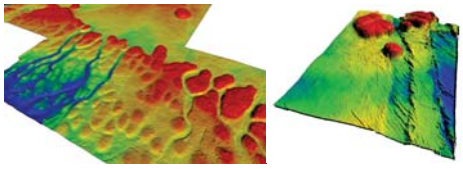
The Geological Society

A joint meeting of the Petroleum Group and the Virtual Seismic Atlas.

Frontiers of Seismic Geomorphology

1 June 2010

The Geological Society, Burlington House, Piccadilly, London



Statoil

bp

Chevron

Convenors:

Rob Butler (Aberdeen)

Russell Wynn (Southampton)

Bill McCaffrey (Leeds)

REGISTRATION NOW OPEN

A one-day showcase and celebration of subsurface and seabed imaging from 3D seismic data. Topics include: submarine channel systems, mass wasting processes, tectonic sub-seascapes, glacial processes, lava sequences, palaeokarsts and much more.

SPEAKERS:

Zoltan Sylvester, Shell.
Ian Clark, University of Cardiff
Carl Fredrik Forsberg, Norwegian Geotechnical Institute.
Russell Wynn, NOC, Southampton
Jenny Collier, Imperial College
Mads Huuse, University of Manchester.
Nick Schofield, University of Aberdeen
Dave Hunt, Statoil
Henry Posamentier, Chevron

KEYNOTE ADDRESS:

Henry Posamentier, Chevron

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

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Lyell Meeting 2010

30th June, 2010, Flett Lecture Theatre
Natural History Museum, Exhibition Road,
London SW7 5BD

Comparing the geological and fossil records: implications for biodiversity studies

The rock and fossil records must to some extent be correlated. This symposium asks how strong this linkage is, explores possible causal factors, and examines the consequences for our estimates of biodiversity patterns through time.

Keynote speakers
Anthony Barnosky, University of California, Berkeley
Michael Benton, University of Bristol
James Crampton, GNS Science, Lower Hutt
Shanan Peters, University of Madison-Wisconsin

The Lyell Meeting forms part of IPC3 and is open to all congress delegates. Members of the Geological Society, Palaeontological Association and Palaeontographical Society who are not registered to attend the congress have free access to the Lyell Meeting. However, pre-booking is essential.

To reserve a place please complete the electronic form at http://www.paceprojects.co.uk/IPC3-Lyell_Free_Registration.htm.

Sponsored by the Geological Society, The Palaeontolological Society and the Palaeontographical Society

THE GEOLOGICAL SOCIETY OF AMERICA®

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Tectonic Crossroads: Evolving Orogens of Eurasia–Africa–Arabia

A forum for geoscientists to compare and contrast extraordinary regional geology and plate boundary processes together, in one of the world's greatest natural geological laboratories.

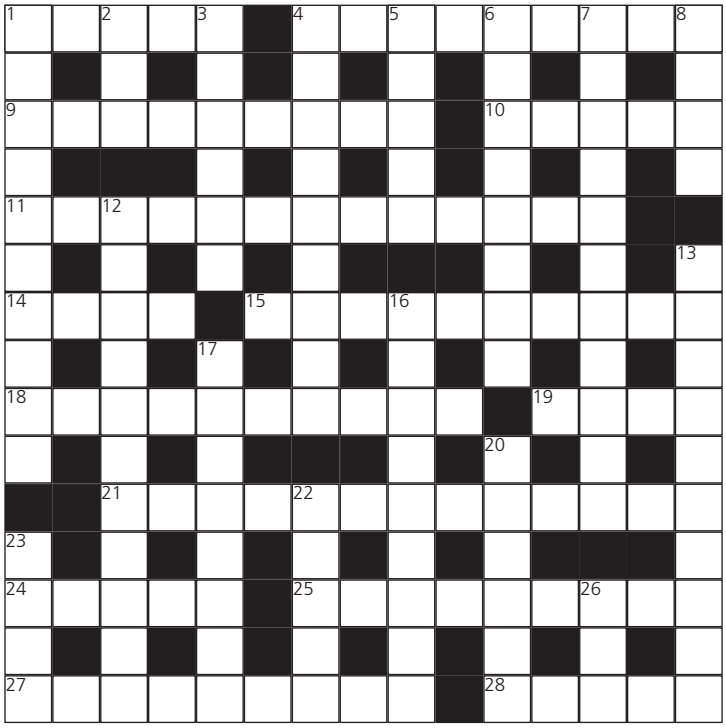
Ankara, Turkey, 4–8 October 2010

Cultural and Convention Centre, Middle East Technical University

Abstract Submission Deadline: 25 May 2010
Standard Registration Deadline: 23 August 2010

For information visit: www.geosociety.org/meetings/2010turkey/

Crossword no. 135 set by Platypus



Solutions: March

Across: **1** Tundra **4** Nausea **9** Bear **10** Bacchanals **11** Diesel **12** Narwhals **13** Genitalia **15** Alps **16** Gape **17** Ellipsoid **21** Reactant **22** Camera **24** Viviparous **25** Afar **26** Needed **27** Eddies

Down: **1** Taenite **2** Norms **3** Rubella **5** Abhors **6** Sinkholes **7** Alleles **8** Scintillation **14** Impactite **16** Grecian **18** Incised **19** Inroads **20** Facade **23** Miami

Win a Special Publication of your choice!

The winner of the March Crossword puzzle prize draw was James Rayner of Oldham.

All correct solutions will be placed in the draw, and the winner's name printed in the July issue. The Editor's decision is final and no correspondence will be entered into. Closing date – 24 May.

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

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

Name .....

Fellowship Number .....

Address for correspondence .....

.....

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.....

.....Postcode .....

Across

1 Clod of earth thrown up by club (4)
4 Messiah, Judas Maccabeus etc. (9)
9 Fossil horns? No, more a copper sulphate hydroxide mineral. (9)
10 Largest moon of Saturn (5)
11 Order of fossil marine reptiles which, anticipating the end Cretaceous mass extinction, went early at 90Ma. (13)
14 Lunar-induced sea-level change (4)
15 In an aged manner, with creaking joints (10)
18 Bridal accoutrements in toto (and in plural) (10)
19 Swedish singing quartet (4)
21 Pertaining to the muse of the dance (13)
24 Grand Wyoming Rocky mountain (5)
25 Mysterious, like Elgar's other, "larger theme that goes but is not played" (9)
27 The delightfully disgusting John Wilmot was the second of this ilk (9)
28 Eight of the world's highest mountains are to be found in this newest Republic (5)

Down

1 Terrigenous sediment with particles from clay to boulder size (10)
2 Large and heavily taxed barrel (3)
3 Develop dentition (6)
4 Youngest Paleocene epoch (9)
5 Sporting venue covered in 8 down (5)
6 *In situ* rocks breaking surface (8)
7 Hard to govern, manage or direct (11)
8 Between silt and gravel (4)
12 Pressure exerted by a fluid at equilibrium due to the force of gravity (11)
13 Oppressively despotic (10)
16 Even more crudely earthy (9)
17 Alienate (8)
20 Megalith (6)
22 An alternative hypothesis to AUSWUS (5)
23 Celestial nuclear furnace (4)
26 Spoil heap (3)

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.

The Geological Society

President's Day 2010

2nd June 2010

President's Day is the Society's gala event, held at Burlington House each year to celebrate the achievements of the Society in the previous year, and to honour its award winners. The Awards Ceremony begins at 2.00pm and will be followed by talks from the senior medallists beginning at 3.30pm. The President, Lynne Frostick, will be giving her address at 5.45pm followed by a Drinks Reception.

New Support for the Early Anthropogenic Hypothesis

William F Ruddiman (Lyell Medal)
Professor Emeritus, Department of Environmental Sciences, University of Virginia

Exploring the earth system, grain by grain, with a map, hand lens and mass spectrometer

Randall Parrish (Murchison Medal)
Head of NERC's Isotope Geosciences Laboratory

Exploring the subsurface - applications of integrated seismic stratigraphic and geomorphologic analyses from the deep abyss to the alluvial plain

Henry W Posamentier (William Smith Medal)
Senior Consultant Geologist, Chevron Energy Technology Company, Houston, Texas

Coupled Fluid and Fault Activity Near the Base of the Seismogenic Zone (How Faults Get Loded)

Richard H Sibson (Wollaston Medal)
Professor Emeritus, Department of Geology, University of Otago, New Zealand

Places are limited so if you would like to come along please contact:
Stephanie Culver at Burlington House on 020 7434 9944 x305
or email stephanie.culver@geolsoc.org.uk