The Fellowship magazine of THE GEOLOGICAL SOCIETY OF LONDON

Geoscientist

Volume 20 • No 6 • June 2010

Glaciers - no nonsense science
First, find your fossils
Make your publication Special!

NEW! **Follow us on Twitter - www.twitter.com/geoscientistmag**

Unreasonable doubt

The difference between scepticism and denial is the criterion of reasonable doubt, says Ted Nield.

When issues become charged, they also become polarised; and when those issues are scientific, conflict ensues because doubting, sceptical science and the dogma of belief make uneasy bedfellows. Nevertheless, scientists are only human and alas share our species' natural tendency to form gangs when threatened, and even to act in ways that do violence to what should be a dispassionate calling.

On more than one occasion, following the report of a minority viewpoint, orthodox heavyweights have buttonholed your editor, uttering words to the effect of "I would really like to sit down with you and *convince* you!". Although flattering, this betrays, I think, a basic problem that scientists have both with news in general, and the nature of "belief".

First, *Geoscientist* is a magazine and is interested in what is *news*. Journalists are, of course, also interested in "truth": but only in so far as they accurately reflect the news. Whether the ideas that make the news are themselves "correct", in the way that a scientist would define it, is another matter entirely, and not awfully relevant. It is for scientists, not journalists, to decide what is scientifically correct.

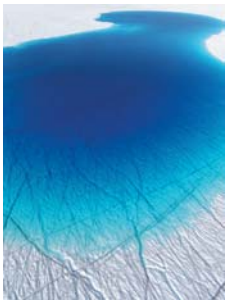
One definition of "news" is "something that someone doesn't want you to print", so all good news stories annoy someone. A science reporter is often drawn into scientific discussions, rehearsing the arguments of the opposition, to see how each side responds. At this point a common reaction from the orthodox is: "Ah, you're being sceptical now, because you're a journalist". Well, that may indeed be so; but isn't it also scientists' job to be forever sceptical? *Nullius in verba* and all that?

This question comes down to what constitutes "reasonable" doubt. We distinguish Young Earth Creationism from science by YECs' unreasonable determination to ignore *overwhelming* evidence. Because there is no effective counterargument to *unreasonable* doubt, YECs are true "denialists" because no evidence will ever convince them. The word "denyer" always marks out adherents of a different dogma - "denyers of Christ", for example – or those whose contrary convictions surpass what a rational person would consider reasonable – as with denyers of the Holocaust, or evolution. The fact that denyers then attempt to don the mantle of respectability by styling themselves "sceptics" only goes to show that language is an early casualty of politics.

This month we publish a riposte to Cliff Ollier's feature (March 2010) which cast doubt on whether the world's ice sheets could "collapse" - and caused a furore among glacial geologists (while drawing applause from others). It is for you now to judge of their respective claims. Yet while there remains little reasonable doubt that anthropogenic climate change is real, much perfectly reasonable doubt remains over much else. We shall continue therefore to publish views that run counter to consensus, but not beyond what is reasonable and with "facts are sacred" as our guiding principle.

Geoscientist is a forum for debate, because its readers want discussion, not preaching. But we also firmly believe that the best way truly to *convince* is to treat people as adults and thrash out the issues out in public. What we will never become is a pulpit for unreason.

- Online Special – see *Geoscientist Online* this month for Gerta Keller's latest on why the Chicxulub Crater cannot be the smoking gun of the K-T impact, despite recent attempts to enforce "science by democracy".



Front Cover: Seasonal meltwater lake on the Greenland Ice Sheet. Note the network of supraglacial channels flooded by the lake. See feature, p18.

Geoscientist *The Fellowship magazine of* THE GEOLOGICAL SOCIETY OF LONDON

Hoops spring eternal

Christopher Jack wonders whether we really need a UK Register of Ground Engineering Professionals

Ivan Hodgson, Chair of the Engineering Group of the Geological Society, urges UK ground engineering professionals to inscribe their names upon a new official professional register (*Geoscientist 20.4 April 2010, p24*). The issue is important - the roles defined in it may soon be included in the revised Site Investigation Steering Group specification, and that might effectively make the register compulsory.

Proponents of the Register say: "We don't know which UK Chartered Engineers and Geologists are ground engineers". Do we need a register to do this? These individuals and their employers surely know who they are. "If we don't have a register, an EU Directive will force something worse upon us" advise others, recalling Hilaire Belloc's cautionary verse. But surely, an EU Directive only says what a member state has to achieve, not how it should do it. So, our implementation could potentially be: 'Geotechnical designs must be signed off by a Chartered Engineer or Chartered Geologist competent and experienced in the field of geotechnics.' Or is this too simple?

Some say: "We need it so that clients can be confident the ground engineer is competent". Is this not perhaps a solution looking for a problem? Clients can already employ reputable engineering firms to provide competent experts.

"We need to raise the profile of ground engineering, encourage training and promote best practice." Wouldn't it be better to focus on improving the Chartered Geologist (CGeol) application process and the Engineering Geologist Training Guide?

"We need the register to provide a post-chartership career path." But is anyone really asking for this? Are there not enough hoops to jump through already?

Would a register really be worthwhile? The register requires applications similar to those for CGeol. Those who have applied for chartership know the effort this involves. We will also be taking up the time of another raft of sponsors, assessors, and administrators. Wouldn't we all be a lot more competent if we actually did some work? We must also remember that these onerous requirements will place a disproportionate burden on smaller companies, while larger organisations will reap the protectionist benefits.

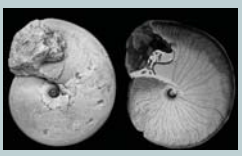
Each application will cost £75 with a £12 annual subscription charge. Assuming it takes twelve years to progress from Professional to Advisor, this will cost £369 in addition to Geological Society fees. Money well spent?

Why isn't a combination of CGeol, a CV and my employer's opinion good enough? Remember, all Fellows are also bound by the Society's Code of Conduct. Let's place trust in our integrity. We are already drowning in CPD records and competency evidence. Do we need this as well? I don't think so. I feel it is being foisted on an unconvinced profession without proper consultation.

If you agree, sign the petition at www.gopetition.co.uk/online/35294.html before it is too late!

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



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.

Alan Archer 1923 - 2009

Alan Archer, who died at the age of 86 on 31 May, 2009, possessed an enormous passion for life and action. After war service he graduated with First Class Honours in Geology from University College and joined the Geological Survey of Great Britain in August, 1950. For the next 15 years he worked largely on the geology of the South Wales coalfield and prepared the Special Memoir entitled "Gwendraeth Valley and adjoining areas", which was published in 1968. During this period he also made an important contribution to a survey of the base metal deposits and mines of North Wales for a major symposium, the proceedings of which were published in 1959. He was promoted to Principal Geologist in 1958.

When the Ministry of Natural resources and Land Planning was formed in 1965 he was appointed to the Natural Resources Planning Unit and became Technical Secretary of the Sub-Committee on Minerals of the Natural Resources Advisory Committee. In this role he rapidly became acquainted with the ways in which geology impinges on policy problems, in particular those affecting future supplies of aggregates, notably sand and gravel. With the demise of the short lived Ministry Alan returned to the Survey, where he was appointed Head of the new Mineral Assessment Unit formed to undertake a survey of sand and gravel resources for purposes of land planning. He embarked on this task with characteristic energy and helped set up the high level interdepartmental Mineral Resources Consultative Committee (MRCC) of which he became Technical Secretary. Some of the technical papers prepared for the committee by the IGS were later published in the unique "Mineral Dossier" series dealing with the resources, production, trade and use of all the mineral commodities, except coal, produced in the United Kingdom. It was entirely appropriate that Alan should be appointed Head of the Mineral Resources Division in 1969 and subsequently promoted to Assistant Director in 1973.

Under the Rothschild arrangements for funding of Government science, Alan negotiated for most of the work of his Division to be funded by the Department of Industry. This and other contracts enabled his Division to take an increasingly important part in major policy matters, notably in planning, foreign policy, foreign aid and intelligence. Alan also played a prominent role in the Natural Resources Committee of UNESCO, and chaired two of its Working Groups one of which, established to bring clarity and standardization to mineral resources definitions, had profound repercussions following misunderstandings about such matters featuring in the report of the Club of Rome "Limits to Growth". His interests became increasingly focused on the possible exploitation of deep ocean polymetallic nodules. In 1969 he was appointed a member of the UK delegation to the UN Sea Bed Committee and to the Third UN Law of the Sea Conference on the First Economic and Technical Committee of which he played a leading part until the Conference ended in 1982. He was also Chairman of a Technical Experts sub-group of the First Committee on Production Limitation. He spoke and wrote widely on metal resources in nodules, deploying with advantage the considerable reservoir of ability and expertise which he had built up in his Division, encompassing minerals assessment and commodity intelligence and statistics.

In 1977 Alan accepted the duty of Secretary to the annual meetings of the Directors of Western European Geological Surveys, achieving an almost legendary reputation for efficiency. In the same year, following reorganisation of the IGS, his Division was expanded to include the Geological Museum. In this new role he oversaw preparation of the major museum exhibit "Treasures of the Earth", which received wide acclaim.

Alan, who retired from the Survey in 1983, was an assiduous and inspiring leader who communicated his enthusiasm to his staff while demanding from them a high standard of performance. He was highly charismatic and had no difficulty in communicating at the highest levels, but in his relaxed moments he loved intelligent company and was very sociable and amusing. He was a keen supporter of the Aston Martin Owners' Club, of which he was Chief Registrar from 1967 to 1988 and Chairman in 1989/90, and wrote extensively about the marque, publishing the popular book "The Aston Martin" in 1988. After retirement he enjoyed frequent holidays in France and made three long voyages with his wife as a passenger on container ships.

He is survived by his wife Jane, whom he married in 1949, and by two sons, Stephen and Jeffery.

David Slater

Viktor Efimovich Khain 1914 – 2009

Honorary Fellow Viktor Efimovich Khain, who died on 24 December 2009 at the age of 95, was an admired and respected Professor in the Department of Dynamic Geology of the Geology Faculty of Moscow State University, an Academician of the Russian Academy of Sciences, and one of the leading geologists of our time. His scientific interests embraced a wide range of geological and general natural history topics including problems of general geology, comparative planetology, the influence of close and far space on the Earth's evolution, the origin of life, deep subsurface geology, the evolution of the Earth's tectonosphere, the theory of geological formations, general geotectonics, problems of regional and oil geology, Precambrian geology, neotectonics, structural geomorphology, palaeogeography, history and philosophy of geological science, and geological education.

A dedicated naturalist and geologist, his studies took him to many regions of the former Soviet Union, including the Caucasus, the Yenisei Range (Siberia) and the Tien Shan mountains (Kazakhstan). He examined folded areas in Eastern and Western Europe, Asia, North and South America, Africa and Australia, and took part in sailing expeditions in the Atlantic and Pacific Oceans as well as the Caribbean and Mediterranean. The Caucasus was Viktor Efimovich's geological 'motherland'. His first paper, in 1937, was entitled *Geological studies and search for oil in the Lagich mountains [South-eastern Caucasus]*, and the promising young geologist's unconventional way of thinking immediately drew the attention of the geological community. In 1940, he gained his PhD on *Jurassic and Cretaceous Facies of the South-eastern Caucasus* and, in 1947, his DSc on *Geology and Oil-bearing capacity of the South-Eastern Caucasus*. In 1945, he was appointed lecturer in geotectonics at the Azerbaijani Industrial Institute where, in 1949, he was awarded a Professorship.

At various stages of his scientific career, Viktor Efimovich returned to the geology of the Caucasus which was the proving ground for his theoretical interpretations. From 1954, he began to work at Moscow State University, first as Head of Section in the Earth Sciences Museum and, from 1960, as Professor in the Department of Dynamic Geology. In 1961, together with A B Ronov and V D Nalivkin, he published the *Atlas of lithological-paleogeographical maps of the Russian Platform and its geosyncline margins*, followed by four volumes of the *Atlas of lithological-paleogeographical maps of the USSR* (1968) and, much later, by two volumes of the *Atlas of lithological-paleogeographical maps of the world. Late Precambrian and Palaeozoic. Mesozoic and Cenozoic* (1984-1989).

In 1966, Viktor Efimovich was elected a Corresponding Member of the Academy of Sciences of the USSR, allowing him even closer collaboration with the institutions of the Russian Academy of Sciences. He was always interested in oil geology, and together with I O Brod and V V Veber was justifiably considered to be a founder of the concept of oil-bearing basins. Later in life, he studied the problems of oil-bearing geology in association with geodynamics, and recognised the global oil-bearing belts on our planet, introducing a new classification of oil-bearing basins based on the tectonics of lithosphere plates. He showed patterns in the global distribution of oil-bearing deposits across continents and oceans, and the relationship between oil-bearing basins and rift formation.

As early as 1956, Viktor Efimovich had joined the international project on tectonic mapping and, from 1972, he became the Secretary General and, from 1984, President of the Subcommission on tectonic maps of the world, and Chairman of the National Commission on Tectonic Maps at the Academy of Sciences of the USSR. Tectonic mapping became the main focus of his research.

From 1977 to 1996, he took an active part in the compilation of five international tectonic maps. He combined the production of global tectonic models and palaeogeographic atlases with a fundamental five-volume series Regional Geotectonics (1971-1985) for which he was awarded the State Prize of the USSR. His three-volume monograph Historical Geotectonics (1984-1988), coauthored with his former pupils N A Bozhko, K B Seslavinsky and A N Balukhovsky, was a logical continuation of this work. The 1970s were critical years in the transformation of scientific ideas for many geologists. In the semi-popular Russian natural history magazine Priroda, Viktor Efimovich wrote an article entitled 'Is a scientific revolution in geology really happening?' in which he responded to the public discussion that started in Geotimes between V V Beloussov and J T Wilson; he supported the latter. This was the beginning of a new stage in the debate between the so-called 'fixists' and 'mobilists', which was particularly intense in Russia, and he became convinced of the soundness of the principles of plate tectonics based on his experience of geodynamic interpretations in the Caucasus.

In 1987, Khain was elected Academician of the Academy of Sciences of the USSR and, in 1992, he was awarded the highest award of the Academy of Sciences (Gold Karpinsky Medal) for a series of works on historical geotectonics and palaeogeography. In 1993, he won the Moscow University First Degree Lomonosov Prize for a series of papers on *Global tectonics of the Earth*. In 2000, he published the monograph *Tectonics of continents and oceans*, which was awarded the A D Arkhangelsky Prize. Viktor Efimovich began teaching at his alma mater – the Azerbaijani Industrial Institute. At the Geology Faculty of Moscow State University, he taught courses on geotectonics, regional geology, and the history and methodology of geological sciences. As recently as spring 2009, he gave several lectures to the masters students on major problems of geology. As well as many hundred papers, he wrote textbooks for many major geological courses including *General Geotectonics* (1985), *Geotectonics and Basic Geodynamics* (1995, 2005), *Historical*

Geology (1997, 2006), *Geology and Geochemistry of Oil and Gas* (2004), *Regional Geotectonics* (2004), *History and Methodology of Geological Sciences* (1997, 2004, 2008) and *Planet Earth, from Core to Ionosphere* (2007).

Viktor Efimovich was well known and recognised outside of Russia. He was an Honorary Doctor at Université Pierre et Marie Curie in Paris, honorary member of the European Academy, foreign member of the Academy of Sciences of Azerbaijan and foreign member of the Academy of Sciences of Georgia. His awards include the Paul Fourmarier Prize and Gold Medal from the Royal Academy of Belgium, Gustav Steinmann Medal from the German Geological Association, the Prestwich Medal from the Société Géologique de France and three prizes of the Moscow Society of Nature Explorers. He was also a member of the editorial boards of many Russian and foreign journals. His scientific activity and participation were amazing. In the last seven years, he published seven text-books, three monographs, and over 50 papers on the most up-to-date and acute problems of geology. His monograph Major problems of modern geology (2003) contained the philosophy and ideas of a scientist who, for over 70 years, was witness to and participated in the evolution of many major concepts in the geological sciences. In 2008, he delivered a plenary talk at the international meeting in Baku (Azerbaijan) and lectured in the USA.

Viktor Efimovich was not only an outstanding scientist, but also had a sparkling, exciting personality. During his 60 years of teaching, he supervised 67 PhD students, and 25 DScs were among his pupils. He was interested in various fields of science and life – from continental drift to world politics, from the problem of the origin of life to the music of Mussorgsky and Wagner, from scientific debates to parties with friends. Those who knew him were enthused and amazed by his alertness, activity, zest for life and benevolence, as well as his constant attention and care about the work of his colleagues, especially young researchers. The many friends and colleagues of Viktor Efimovich express their sincere condolences to his family, and will always retain heartfelt fond memories of him.

Anatoly Ryabukhin (Moscow State University) on behalf of colleagues, students and friends of Viktor Khain. Translated from the Russian by Svetlana Nikolaeva (HOGG). Reproduced from the HOGG Newsletter, where it first appeared.

David George Clayton 1915-2009

David Clayton, a former Executive Secretary of the Society, was born in India in 1915 but returned to England aged five upon the death of his father. Educated at Bedford school, he subsequently joined the Royal Military Academy, Sandhurst from which he was commissioned into the King's Own Royal Regiment and joined them in India in 1936. During the Second World War, he saw distinguished service in Iraq in the relief of Al Habbaniyah (about 90km west of Baghdad) where he was wounded and recommended for a mention in dispatches. On his recovery he rejoined his Regiment and was sent to North Africa to join the Eighth Army. He also had a spell in Cyprus on the way to which his ship was torpedoed and sunk. He ended the war as Company Commander of his Regiment in Italy, fighting their way up to Trieste.

It was after the War with the Royal West African Frontier Force commanding the first Ghana Regiment at the insurrection in Togoland that he suffered severe spinal damage and was invalided back to the UK. It became clear that he would never be able to re-take command of an infantry regiment and this resulted in his retirement from the army in 1960.

Returning to civilian life and obtaining gainful employment as a retired officer at the age of 44 proved something of a challenge but ultimately led to a post with the British Productivity Council for 10 years. This was followed by his appointment as Executive Secretary of the Society in 1971.The Society's fortunes were at a low ebb and such was the state of the apartments, he almost decided not to go through with his interview! But as the Society's Annual Report of 1979 records, it was to go through a transformation under his stewardship. The apartments were refurbished, new specialist groups were formed, thematic meetings were launched, the publications programme expanded, appeals for funds were made and the membership increased at an unprecedented rate. He was an excellent administrator at a critical moment in the Society's history and his firm and unflustered hand on the executive tiller kept it afloat during the vicissitudes of its rebirth.

Following his retirement in 1980, the recently formed Joint Association for Petroleum Exploration Courses (JAPEC) was fortunate in securing his services as its first Secretary and his contribution to its administration played a significant part in establishing JAPEC's role and reputation. He held this post until his final retirement in 1985, when JAPEC paid tribute to his services through a valedictory dinner and a case of claret sent at Christmas.

Earlier in his life, he was a distinguished athlete and rugby player and also was a keen golfer. He was a person of great courtesy and a fine and generous host with a sharp sense of humour and invitations to join him in London or in his retirement in Swanage with his wife Marjorie, were always occasions to look forward to and to savour. He was very sociable, loved a party and enjoyed recounting an episode at one President's Evening, when despite concern for them at the time, some high spirited Fellows slid down the banisters of the Piccadilly entrance at Burlington House! He was also an enthusiastic supporter of the Geological Society Club and proud to have been elected as its first non-geologist member.

In retirement, through his Fellowship of the Society and Geoscientist, he enjoyed following the Society's fortunes and maintaining a keen interest in them, something which he did until the end. He leaves his wife Marjorie and his three daughters, Jennifer, Judith and Miranda.

Richard Bateman

Anthony Brandon Mills 1925 - 2009

Tony Mills, eldest son of Horace and Jessie Mills, was born at Wallasey, Cheshire on February 19 1925. He was educated at Birkenhead School, Cheshire (1934-42) and at Liverpool University (Civil Engineering 1942-43). Military service (1943-46) Middlesex Regt. Army Education Corps, ranked Sergeant. He attended Wigan Mining College (1946-49) in Intermediate Science and took the External BSc Hons. Engineering Degree, London University (1949-51).

Tony joined the National Coal Board Opencast Executive in 1952 and was posted to its No 4 North West Region as a Prospecting Officer based at Manchester. In 1956 he transferred as PO in charge, to the Cumberland Area at Maryport, supervising a staff of four geologists, four to six drilling rigs and a pitting gang. Production sites were just beginning to operate and expansion of prospecting for future production was required.

However in 1961 NCB policy required a cut-back in Opencast Executive operations, which meant that national opencast production was to be restricted to the production of anthracite and specialist coking coals. Further development in the Cumberland Area was abandoned, and he was transferred to No 7 South Wales Area at Swansea.

In 1964 NCB policy regarding opencast mining was reconsidered with an expanding demand for low cost output and prospecting operations were again needed in all Regions. Tony was appointed to No 2 Northumberland and Durham Region taking charge of two geological staff and two to three drilling units at Newcastle, and was later promoted to Regional Opencast Manager (Development). As well as maintaining the continuity of large site production in Northumberland, prospecting operations were recommenced, with additional staff and drilling capacity in the Durham coalfield and west Cumberland.

He was responsible at this time for teams of geologists operating under four Area Geologists, and up to 35 staff. The search for future resources was extended into the detached Tyne Valley coalfields and also into the Lower Carboniferous Limestone Coal deposits in the Alston and Scremerston areas. His responsibilities entailed the supervision of drilling contracts for this purpose and at peak, some 30 drilling units and borehole logging teams were in operation in the Region. His other responsibilities included research projects into shallow depth seismic and ground-resistivity techniques and automated borehole logging.

He was a founder Member of the Association for the Promotion of an Institute of Professional Geologists (APIPG), which eventually led to the creation of Chartered Geologist status under the Institution of Geologists (IG) and eventually, the Geological Society.

Tony married Pamela Leslie Lane at Birkenhead in October 1955 and they had two sons, Nigel Brandon and Robin Perry. In leisure he was very much an outdoor man, a keen walker and Member of the National Trust and most holidays were spent walking in Scotland. He was an authority on Wainwright and owned an extensive library of his books, as well as making a comprehensive collection of British stamps and books.

Tony retired in 1986 but continued to take an interest in opencast mining despite deteriorating health which caused loss of mobility in his later years. He died in March 2009.

Thomas Gatenby

Deaths

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

The Society notes with sadness the passing of:

Locke, Matthew*

Pearson, Christopher Martin *

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

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

Call out the boys in blue!

Geologist and science writer Nina Morgan on a mystery that the "Old Bill" failed to solve.

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.

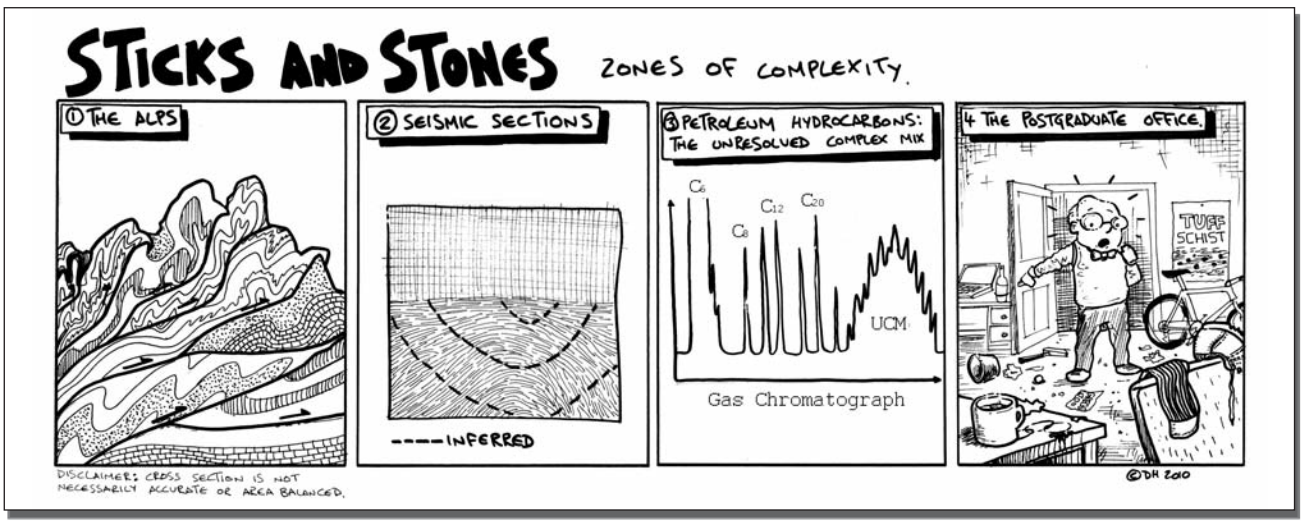
Acknowledgement

This vignette is drawn from *The legend of John Phillips's "lost fossil collection"* by J.M. Edmonds, *J. Soc. Biblphy. Nat. Hist,* vol 8(2), pp. 169-175, 1977, which quotes from the 234 letters from Phillips to his sister Anne, housed in the archives in the Hope Library and the Oxford University Museum of Natural History.

"What a malheur!" wrote John Philips to his sister Anne on 14 May 1837. "A thief quitting the Somerset [Hotel] has stolen one of my boxes of fossils, imagining it to be plate, at least so we think." The fossils in question were part of a teaching collection Phillips was intending to use during a course of lectures to be given at King's College London. A loss, certainly. But not one that Phillips took very seriously. "Perhaps the police may recover it;" the letter continues. "If not, I will not die of despair." Two days later he wrote again, tongue-in-cheek, to report "I have not heard of my fossils perdus, but 5000 police officers are in quest of the thief," and asked Anne to send some replacements. The loss of the first box, he assured her, was "of no avail & I only regret the waste of time and labour".

Although the monetary value of the stolen fossils was negligible – the story of the theft did lead to a rich vein of rumours. In February 1857, Thomas Wright reported that valuable type specimens had been lost in the incident. By 1896 Wheelton Hind was claiming that the thieves had thrown the box of fossils off Blackfriars Bridge (picture). This rumour persisted into the 1940s and grew in the telling when C D Sherborn recounted how the whole of the fossil collection, comprising several boxes, had been stolen and subsequently thrown over Blackfriars Bridge by the disappointed thieves. This version was still circulating in the 1950s.

The reality is far more prosaic. At least some of the 'valuable type specimens' referred to by the rumour-mongers were far from lost. Recent research has shown them to be safely incorporated into the systematic collection of the Palaeontology Department at the Natural History Museum (NHM) in London. To find out more, turn to *First Find Your Fossils*, on page 15 of this issue.



Reviews

Copies available for review:

McKillup, S. & Dyar, M.D. (2010), *Geostatistics Explained: An introductory guide for earth scientists*, Cambridge..

Park, G. (2010), *Introducing Geology: A guide to the world of rocks (Second Edition)*, Dunedin.

Stephenson, J. (2009), *Crevasse Roulette: The first Trans-Antarctic crossing, 1957-58*, Rosenberg.

Young, J.R. *et al*. (eds) (2010), *Fossils of the Gault Clay*, Palaeontological Association

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

Applied Geostatistics with SGeMS

Nicolas Remy, Alexandre Boucher and Jianbing Wu
Published by: Cambridge University Press
Publication date: 2009
ISBN: 978-0-52151-414-9 (hbk)
List price: £50.00
264 pp plus CD-ROM containing SGeMS

www.cambridge.org

At last! Here is a publisher who has prepared a thoroughly practical and well presented guide to geostatistics, together with software in a form that can be run by most on their own computers. This attractively printed volume includes a brief overview of spatial statistics (geostatistics) before going on to demonstrate how basic data can be treated. The book then develops concepts of modelling including simulation and analysis.

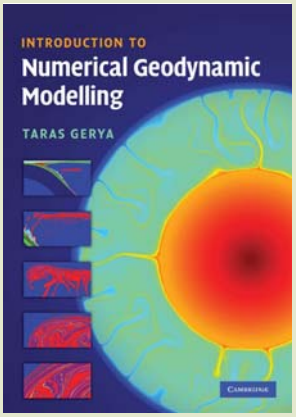
Two decades have passed since the release of GeoEAS (Geostatistical Environmental Assessment Software) by the US Environmental Protection Agency, the first geostatistical package to be made freely available and in a form suitable for teaching as well as basic geostatistical processing. However, it is limited to 2-D data and runs in a DOS environment, and so it is somewhat alien to today's students. Furthermore, although the source code was later released, it does not readily lend itself to modification by the user. A decade ago GSLIB (Geostatistical Software Library) filled this gap, enabling modules to be compiled and readily rewritten to suit the user's needs. The source code was suitable for running in a DOS environment but in compiled form was also available for Windows, for those who paid an appropriate registration fee.

Able to read data in similar format, SGeMS (Stanford Geostatistical Modelling Software) has now been released by staff associated with the Centre for Reservoir Forecasting at Stanford University, with the object of providing a basic and adaptable package "for solving problems involving spatially related variables. It provides geostatistics practitioners with a user-friendly interface, an interactive 3-D visualisation and a selection of algorithms". There are two main groups of algorithm: kriging (ordinary, indicator, cokriging and block kriging) and simulation (variogram-based, such as Gaussian and sequential, and multiple point), together with utilities to facilitate data transformation.

The book will prove a valuable companion to anyone learning to run the software. It is not, however, an introductory text on geostatistics nor is it a software manual *per se*. The former is already well catered for by published textbooks and the latter can be downloaded from the support website, together with an example data file concerning porosity that is used in the book. The constraints provided by known and modelled outcrops of sand channels produce striking simulations that are likely to be particularly attractive to geoscientists concerned with environmental and hydrocarbon investigations. The accompanying CD-ROM contains the full SGeMS software and there is a web site to support users in their endeavours: http://sgems.sourceforge.net/. The approach will be intuitive to those already familiar with GeoEAS and GSLIB, and hopefully can be readily followed by others.

This book is recommended for those wishing to conduct their own geostatistical modelling and analysis, and is suitable for students and practitioners alike.

Mike Rosenbaum, Ludlow



Introduction to Numerical Geodynamic Modelling

Taras Gerya
Published by: Cambridge University Press
Publication date: 2010
ISBN: 978-0-521-88754-0 (hbk)
List price: £40.00
345 pp

www.cambridge.org

Geodynamics seeks to help our understanding of the workings of the solid Earth. Numerical modelling of geodynamic processes has developed rapidly since computing power became widely available in the late 1970s. This book provides an excellent introduction to the subject for anyone wanting to understand more about this important area of geoscience.

The book has a practical focus and is written in user-friendly, straightforward language. A minor criticism is the use of the symbol Δ, both for difference and for the Laplacian operator; however any confusion can be quickly dispelled by a check of units! The material is reinforced by in-chapter exercises that promote active reading and by well structured end-of-chapter exercises. Those working through this book in detail would be advised to have access to MATLAB to develop the appropriate code and, equally importantly, to display the results visually; they will then be able to compare their solutions with those presented by the author on the book's accompanying website.

The book is structured to cover "mechanical" modelling of deformation and flow, followed by "thermal" modelling of heat transfer. The author then brings these two strands together to consider thermo-mechanical geodynamic models within a variety of plate tectonic settings. The theoretical background to each topic is clearly and succinctly explained in a qualitative way; the relevant equations are then developed by informal proofs that, as the author promises, involve nothing more than algebra and simple calculus. Theory is then followed by the nuts and bolts of numerical implementation, where the appropriate finite difference methodology is clearly explained and illustrated by examples with any pitfalls pointed out. Throughout the book there is useful advice on modelling in general, including a chapter on benchmarking (model validation) and advice on the debugging of errant code.

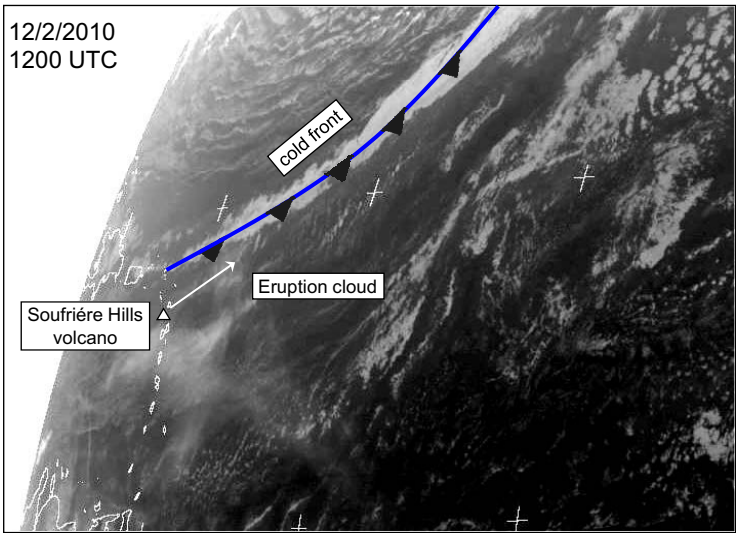
This is a well produced hardback in a clear type with excellent supporting diagrams. It has been very well proof-read, especially considering the mathematical nature of some of the text. In short, the book provides excellent value for those wanting an introduction to the field. Anyone who works carefully through this book and completes all the exercises should be well prepared for further work in geodynamic modelling.

Duncan C Woodcock

ABB Limited, Warrington

Volcanoes and storms

Two recent disastrous east Atlantic storms were exacerbated by the Soufrière Hills eruption, say Wyss Yim, Judy Huang# and Johnny Chan#. Adler deWind has the story.*



Meteosat SEVIRI Channel 7 (8.3-9.1m infrared) image of the southern part of the North Atlantic Ocean on 12 February, 2010 showing the Soufrière Hills eruption cloud caught up within the warm sector of frontal system spreading in a northeasterly direction. Satellite image from www.sat.dundee.ac.uk.

The best time for achieving a better understanding of climate change is surely the present, because we have both instrumental records and satellite records for verification. It is therefore somewhat surprising that relatively few Earth scientists are involved in 'modern' climate change research.

Yim and colleagues have studied the possible connection between a volcanic eruption and successive disastrous east Atlantic winter storms during February 2010. Global warming has been argued as an important cause for the increase in intensity of tropical cyclones as the oceans warms[1,2,3]. Recently Bender[4], in a state-of-the-art computer model study, predicted that the number of strong storms in the western Atlantic could double by the end of the century through anthropogenic warming. However, the role of natural variability through volcanic eruptions, which are difficult to predict, has not been taken into consideration, the scientists believe.

On February 11, 2010 1635 UTC/GMT the Soufrière Hills volcano (latitude 16043'N longitude 62011'W) on Montserrat in the eastern Caribbean Sea erupted, sending an ash plume reaching 15.2km above sea level. On 12 February at 1200 UTC/GMT, Meteosat SEVIRI Channel 7 (8.3-9.1 m infrared, available from www.sat.dundee.ac.uk) shows the ash plume from the eruption was caught up within the warm sector of a frontal system spreading in a northeasterly direction (picture) towards Western Europe. This has provided insight into how volcanic eruption clouds become involved in generating of east Atlantic winter storms.

"During February 2010 there were two successive disastrous East Atlantic winter storms with torrential rain and high winds" says Yim. "Both were associated with active cold fronts and low-pressure areas in the southern part of the North Atlantic Ocean, moving northeastwards. These storms were bolstered by an unusually strong temperature contrast of the sea surface across the Atlantic Ocean. Abnormally warm waters were widespread off West Africa and extended into the eastern Caribbean Sea through the modification of surface wind circulation by the eruption plume. To the north of this warm surface water and air, relatively cold surface waters stretched between Western Europe and the southeastern United States."

On the morning of February 20 a severe storm from the southwest passed over the island of Madeira (maximum elevation 1862m, total land area 741km^2). "This frontal activity was exacerbated by the orographic effect of the mountainous island, as well as by the volcanic ash and aerosols arising from the eruption about eight days earlier (which provided condensation nuclei). Between 0600 and 1100, torrential rain occurred on the southwesterly slopes of Madeira, with 165mm recorded at Pico do Areeiro. This is almost double the average rainfall for the whole of February at the weather station of the city of Funchal. Damage was confined mainly to the south of the island with widespread floods (picture overleaf) and mudslides, resulting in at least 48 fatalities and severe damage to infrastructure and property."

On February 26-28, yet another violent windstorm (named "Xynthia"), with maximum wind gust of 241km per hour and torrential rainfall, crossed Western Europe

Flooding in the city of Funchal on February 20, 2010. See http://en.wikipedia.org/wiki/2010_Madeira_floods_and_mudslides.

causing at least 63 fatalities and an estimated damage within the range of €1.3-3bn. In France, where damage was most severe, one million homes were left without power and cities like La Faute-sur-Mer, L'Aiguillon-sur-Mer and La Tranche-sur-Mer were flooded with water up to 1.5m deep.

Yim told *Geoscientist*: "The climatic effects of the volcanic eruption include the reduction of solar radiation causing cooling; interference of the 'normal' atmospheric circulation by the eruption cloud; interaction between the atmospheric circulation and oceanic circulation; condensation nuclei from ash and aerosols; transfer of moisture from the troposphere into the stratosphere; anomalously high precipitation including extreme floods and landslides, and acid rain."

"The formation of the volcanic plumes and the release of ash and aerosols are possible contributors to the complexity of storms and seem to have caused a dramatic increase in severity of these two east Atlantic winter storms."

References and further reading

1. Trenberth, K. 2005. Uncertainty in hurricanes and global warming. Science 308: 1753-1754.
2. Emanuel, K. 2005. Increasing destructiveness of tropical cyclones over the past 30 years. Nature 436: 686-688.
3. Elsner, J.B., Kossin, J.P. and Jagger, T.H. 2008. The increasing intensity of the strongest tropical cyclones. Nature 455: 92-95.
4. Bender, M.A., Knutson, T.R., Tuleya, R.E., Sirutis, J.J., Vecchi, G.A., Garner, S.T. and Held, I.M. 2010. Modeled impact of anthropogenic warming on the frequency of intense Atlantic hurricanes. Science 327: 454-458.

Http://en.wikipedia.org/wiki/2010 Madeira floods and mudslides
Http://en.wikipedia.org/wiki/Xynthia_(storm)

**Guy Carpenter Asia-Pacific Climate Impact Centre, School of Energy & Environment, City University of Hong Kong, Hong Kong Science and Technology Parks, Shatin, NT, Hong Kong. # Department of Earth Sciences, The University of Hong Kong, Pokfulam Road, Hong Kong, China*

Opinion

Blessed are the toymake

*…for they shall be palaeontologists too, says Dave Martill**

In 2003, the Geological Society, under the editorial guidance of Eric Buffetaut and Jean-Michel Mazin, issued Special Publication (217) *Evolution and Palaeobiology of Pterosaurs*. This valuable tome is a collection of papers presented at the Toulouse meeting of 2001 celebrating 200 years of pterosaur research. I remember being excited about this meeting, as never before had so many pterosaur specialists been assembled in one place and had so many new discoveries to discuss.

At this time hardly anything was known of the fabulous Chinese pterosaur-bearing deposits; but the Brazilian Santana and Crato formations were yielding exciting new taxa and revealing many previously unknown aspects of pterosaur soft tissue anatomy. Dino Frey and I, with Marie-Céline Buchy, announced to the world the discovery of a new genus and species of ornithocheirid we named *Ludodactylus sibbicki*. The specific epithet honours renowned palaeo-artist John Sibbick who has brought so many dinosaurs (and pterosaurs) alive for so many people; but the generic name is somewhat frivolous. *Ludodactylus* more or less translates to toy finger (*ludo* Gr. = game, plaything: *dactyl* L. = finger) and celebrates the animal's predicted existence - by a toy manufacturer.

Toy manufacturers are in the business of making money by entertaining. Some way down the list comes education - and a bit further down might come scientific accuracy. *Pteranodon*, the stereotypical giant, crested Late Cretaceous pterosaur of the Kansas chalk formations and star of numerous B movies (and A movies?) has always been a popular subject for model producers. But its lack of teeth has posed a bit of a problem; most manufacturers seem to think teeth are – if you will forgive me - essential selling points. For this reason it is not uncommon to find a '*Pteranodon*' model bearing a full set of dentures.

rs...

Toy pterosaur. This model was considered highly inaccurate. It sported a *Pteranodon*-like head crest but a mouthful of teeth. *Ludodactylus* has this. Furthermore, it has a long tail, *Darwinopterus* has this. What will be the next amazing discovery? To find out, pop down to the toy shop.

However, our *Ludodactylus* not only had a *Pteranodon*-like head-crest, it also possessed a gnashing mouthful of the finest curved fangs anyone could ever wish for. We had, we realised, discovered the animal behind toymakers' model, and had instantly vindicated their perceptive powers in one short paper. To celebrate these powers Frey *et al.* included a picture of the head of such a toy and, bless them, the editors didn't reject it.

What we hadn't realised was just *how* perceptive the toymakers were. Everybody knows that there were long-tailed pterosaurs (so-called 'rhamphorhynchoids') in the Triassic and Jurassic and short-tailed pterosaurs (pterodactyloids*) in the Late Jurassic and Cretaceous. But clearly, short-tailed pterodactyloids must have evolved from long-tailed 'rhamphorhynchoids'. In deed they did, and last year Lü Junchang of the Chinese Academy of Geological Sciences and David Unwin of Leicester University announced the discovery of a long-tailed pterodactyloid from the mid-late Jurassic Dhouagou Formation of China. This fabulous fossil was a 'missing-link' between these two pterosaur evolutionary grades and, being discovered in a Darwin bicentenary year, was named *Darwinopterus*.

But this amazing fossil had also been predicted by the toymakers and I take this opportunity of again publishing a picture of the toy that was the harbinger of fossils to come (and now arrived). Notice, if you will, that the toothy *Pteranodon* sports a splendid 'rhamphorhynchoid' tail, complete with terminal vane.

If you have a model of a prehistoric animal that you have bought for your kids (or for your very own collection!) and have noticed an irritating inaccuracy, please, don't scoff, or ridicule the toy maker, the fossil is in the ground just waiting to be discovered.

Ludodactylus sp.

* The term "rhamphorhynchoid" is used here in quotation marks because it is a vernacular for a paraphyletic clade, whereas "pterodactyloid" is a vernacular for the monophyletic, and therefore true, clade Pterodactyloidea. So in conversation, when talking about 'rhamphorhynchoids' (as you do), always raise your hands, isolate two fingers on each hand and, as you say 'rhamphorhynchoid', waggle them like twitching rabbit ears.

** University of Portsmouth*

IN *Brief*

Earth probe

Recent advances in the understanding of neutrinos and improved detection instruments have recently given an intriguing glimpse into the deep interior of the Earth, says Roger Mason.

An article in the May 2010 issue of *Scientific American*[1] included the comment: "Our Earth glows feebly in neutrinos". Neutrinos are the most elusive nuclear particles and most of them travel right through the Earth. A few interact with matter, giving brief flashes of light and a stream of neutrinos from the core of the Sun was detected several decades ago. Detection systems are often buried deep in disused mines where the majority of cosmic ray particles have been stopped by overlying rocks. Identification of neutrino interactions requires large volumes of matter such as water or ice to interact, very sensitive detectors, long periods of measurement, and many careful checks to eliminate flashes from particle interactions that do not involve neutrinos. Detection systems have recently improved and even better detectors are on the way, either under construction or at the planning stage. Neutrinos change their energy, mass and a property called 'flavour' as they travel, but it is possible to identify some of the nuclear reactions that released them. For instance, neutrinos from the Sun are produced by the standard solar nuclear fusion reaction. Gelmini and her colleagues describe other extra-terrestrial neutrino sources and their nuclear reactions, for example supernova explosions.

In a paper submitted to Elsevier in March 2010, Bellini[2] and a large team of colleagues who operate the Borexino neutrino detector at Laboratori Nazionali del Gran Sasso in Italy explain how they have detected neutrinos generated within the Earth. They were able to tell the difference between neutrinos released by natural nuclear decay and those formed in artificial nuclear reactors. The natural neutrinos' characteristics suggest that most of them formed by nuclear decay reactions of uranium and thorium isotopes, familiar to Earth scientists from geochronology. The system does not detect neutrinos from potassium decay. Although only a small number of neutrinos were found, there are more than standard estimates of Earth composition would indicate, raising the intriguing possibility that there may be some other type of nuclear reaction occurring in the deep Earth, possibly interaction between mysterious dark matter and the core.

References

1. Graciela B. Gelmini, Alexander Kusenko and Thomas J. Weiler, 2010. *Through Neutrino Eyes,* Scientific American 302, 20-27 (May 2010).
2. G. Bellini and other members of the Borexino Collaboration Team, 2010. *Geo-neutrinos*, manuscript Geo-Nus-1003.0284v2[1] [in press].

Funny

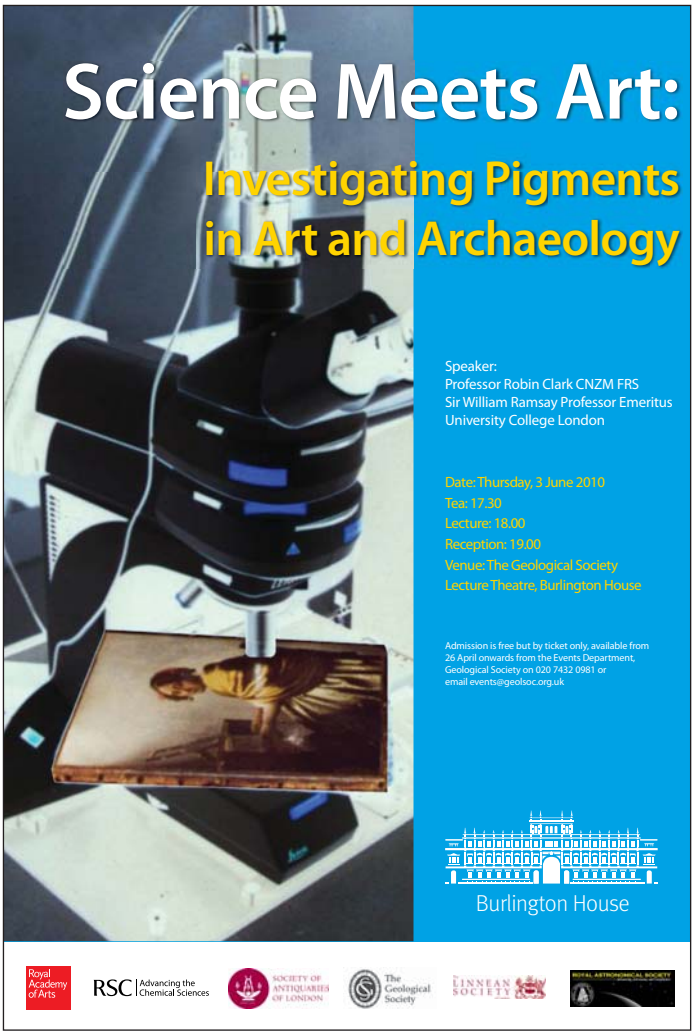
old world

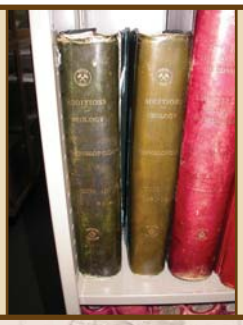
Unconsidered trifles, by 'snapper'

"EVENT CANCELLATION – Please note that due to the disruption of air travel the event on Turbulent Trade Routes programmed for next week had to be cancelled. It will be rescheduled for next autumn and details will be circulated in due course. Apologies for any inconvenience this might have caused." – **Event at Lancaster University Environmental Centre**

We were going to publish this picture ourselves, but someone told *Private Eye*, which being a fortnightly, beat us to it…

***Monitors**: Snapper, Dick Selley, Tom Sharpe and many others. All contributions gratefully received. Please write to the Editor at Burlington House, or email* ted.nield@geolsoc.org.uk *marking your submission 'snapper".*





First find your fossils

Just because a historical fossil collection is said to be 'lost' doesn't mean it can't be found, says Svetlana Nikolaeva. Nina Morgan reports.*

If you want to study the fossils illustrated in a particular book, one of your first tasks is to find your figured fossils. This, it turns out, can involve a considerable amount of detective work – even when the fossils in question are preserved in the collections of major museums.

A case in point is the figured and referred specimens illustrated in John Phillips's monograph *Illustrations of the Geology of Yorkshire Part II The Mountain Limestone District (Illustrations Part II)*, published in 1836. Orphaned at seven and brought up by his uncle, William Smith, Phillips learned his geology and palaeontology working as Smith's apprentice, and grew up to be a prolific author and recognised palaeontological and geological expert. Lacking a university education, Phillips nevertheless rose to become Professor of Geology at Oxford in 1860 - a post he held until his death in 1874.

Lost, stolen or mislaid?

In *Illustrations Part II* Phillips figured and described a large number of Carboniferous fossils, many being new species and thus of considerable importance. When Svetlana began studying Carboniferous ammonoids, she was advised of the 'regrettable but inevitable' fact that most of Phillips's type specimens had been lost, and therefore we could never be completely sure of the names he proposed. Even before this loss was first publicised by the great science archivist Charles Davies Sherborn in 1940, lurid rumours had spread suggesting that these fossils had been stolen or worse, dumped into the Thames from Blackfriars Bridge (see *Distant Thunder*, p 8).

However, because some specimens figured in *Illustrations Part II* surfaced from time to time in scientific publications, Svetlana became convinced that the collection had not disappeared forever. Her hunch turned out to be correct. It turned out that the illustrated fossils were neither lost, stolen nor even strayed. Rather, they had been incorporated into the systematic collection of the Palaeontology Department at the Natural History Museum (NHM) in London. Locating individual specimens in order to bring back together the ammonoid collection that Phillips figured turned out to be a fascinating project requiring much historical sleuthing.

A convoluted fate

The figures published in *Illustrations Part II* mostly derive from Phillips's original drawings, and are largely based on a collection made by William Gilbertson of Preston, a pharmaceutical chemist and enthusiastic amateur naturalist. Although he purchased some material, Gilbertson was a keen collector and paid close attention to locality details whenever possible. Because he understood the potentially important contributions that amateur collectors such as he could play in advancing palaeontology, he generally sent his materials to experts, including Phillips, for examination.

Phillips was suitably grateful and full of praise for Gilbertson's 'liberal and genuine devotion to science'. He chose to picture specimens from the Gilbertson collection in his book because 'they are generally the best that could be found'.

After the publication of *Illustrations Part II*, Gilbertson's collection suffered a convoluted fate. In 1841 at least some of it was purchased by the Zoological Branch of the then Natural History Department of the British Museum, (now the Natural History Museum) by the recently appointed Keeper of the Zoological Branch, J E Gray. Its housing stimulated much debate. Gray insisted that fossil organisms should be studied and housed along with living counterparts and resolved this debate in a very straightforward way – by one day taking the collection and moving it all to his branch!

As with many historical collections in the NHM, the specimens from the Gilbertson Collection were gradually re-numbered and re-labelled by several different curators before being fully incorporated into the general collection. When the museum was moved to its new quarters in South Kensington in 1882, the collection again changed hands and ended up in the Geology Department, now the Department of Palaeontology.

Making matches

Separating out the ammonoid specimens referred to in *Illustrations Part II* from the general cephalopod collections in the NHM proved an interesting – if time-consuming – puzzle. Svetlana began by examining all the ammonoid specimens in the NHM collection that could potentially be Phillips's "types" (see Box *What types?*). By looking carefully through the collection she could see that this collection also appeared to contain other specimens that Phillips had recognised as belonging to his new species.

Because Phillips's descriptions are very short, and his drawings do not always give a clear idea of the specimens (some species were not illustrated at all!) she went on to examine the originals of the Phillips drawings and the accompanying list of identifications in Phillips's handwriting, in the Hope Library at the Oxford Museum of Natural History.

Even with such a wealth of information, matching the drawings to the figures in *Illustrations Part II,* let alone to specimens in the NHM collection, was far from straightforward. Svetlana found that the original drawings for the plates contained more specimens than were actually published. On some drawings, figured specimens were marked 'may be omitted' or 'omit' - and these had never appeared in the final publication.

Perhaps the reason for these omissions lies in the fact that Phillips planned to use some specimens in later publications. Some of the omitted specimens were subsequently described and figured in Phillips's *Figures and descriptions of the Palaeozoic fossils of Cornwall, Devon, and West Somerset; observed in the course of the Ordnance Geological Survey of that district* (1841). In the case of *Goniatites spiralis* (now *Neoglyphioceras spirale*), Phillips provides an insight into the reasons behind the delay in publication when he writes: "I have seen this species in the mountain limestone in Yorkshire and Ireland, but not good specimens. Those, from which I describe are compressed flat, but shew the dorsal aspect of the shell….".

This statement, and the presence of the drawing of *Goniatites spiralis* in Phillips' notes, suggests that this specimen (NHM C268) should be regarded as a syntype [see Box]. This is an important discovery because the actual type specimen of *Goniatites spiralis* figured by Phillips in his 1841 book is lost. It is also a good example of how re-examinations of historical collections can help to clarify the taxonomic identities of species. Altogether, in the course of her work Svetlana managed to locate 182 specimens of ammonoids (some of which were later re-identified as nautiloids and gastropods) figured by Phillips in the *Illustrations Part II*. Most had been purchased from Gilbertson in 1841.

Expert amateurs

This sort of information not only serves to excite taxonomists. It also provides new insights into the important role played by dedicated and highly skilled amateur collectors in discovering new species and sorting out stratigraphy – something Svetlana will be studying in more detail in a new grant-funded research project examining historical collections in the Palaeontology Department at the NHM. Her new project will include collections made by civil engineer William Bisat, 19th Century whitesmith Samuel Gibson, and medical man Wheelton Hind – all of whom pursued their professional careers while writing papers and monographs on Carboniferous fossils and rocks. Although none were professional palaeontologists, they all made important contributions to the field of stratigraphic palaeontology.

Svetlana is keen to find out more about their lives and work. If you can help, please do get in touch!

What types?

- According to the rules of zoological taxonomic nomenclature type specimens can be of several kinds.
- A **holotype** is the particular individual taken by the original author of a species as 'the type' to represent the species
- A **paratype** is a specimen referred to in the description alongside the holotype in the original designation of a new species.
- A **syntype** is one of several specimens of equal rank used in the original description of a species and upon which the species is based when no holotype is designated.
- A **lectotype** is a specimen subsequently selected from several syntypes to represent the species.
- A **neotype** is a specimen selected to replace the holotype (or lectotype or syntypes) of a species if they are lost or destroyed.

Acknowledgments

Svetlana Nikolaeva thanks the many people who helped at all stages of her research. Special thanks are due to Sarah Long, Michael Howarth and Adrian Rushton (all NHM); J D D Smith (ICZN); N J Riley (BGS); Derek Siveter, Stella Brecknell and Rennison Hall (OUMNH); and Mark Williams (Leicester University). Nina Morgan thanks Svetlana Nikolaeva for the invitation to co-author a feature about this research for publication in *Geoscientist*, and Philip Powell of the OUMNH for providing background information about zoological nomenclature and palaeontological curation.

**Dr Svetlana Nikolaeva, is Scientific Editor of the Bulletin of Zoological Nomenclature, and an employee of the Paleontological Institute of the Russian Academy of Sciences. Her own palaeontological research interests focus on the Palaeozoic. To find out more about her study, contact Svetlana at:* s.nikolaeva@nhm.ac.uk. *Dr Nina Morgan is a geologist and freelance science writer based near Oxford.*

Further reading

Cleevely, R J, 1983, *World Palaeontological Collections*, BMNH, Mansell, London, 365pp.

Edmonds, J M 1977, *The legend of John Phillips's 'lost fossil collection'*, J. Soc. Biblphy. Nat. Hist., **8(2)**, pp. 160-175

Nikolaeva, Svetlana, 2008, *The Carboniferous ammonoids from the Gilbertson collection described by John Phillips*, Palaeontographical Society Monograph, part 626 of volume 160: pp. 1-70.

Phillips, John, 1836, *Illustrations of the geology of Yorkshire; or a description of the strata and organic remains: accompanied by a geological map, sections and diagrams and figures of fossils, Part II* (Scanned version at http://tinyurl.com/Phillips1836)

Sherborn, C D, 1940, *Where is the ... collection?: an account of the various natural history collections which have come under the notice of the compiler Charles Davies Sherborn between 1880 and 1939*, The University Press, Cambridge, 140 pp.

Trustees of the British Museum, 1904, *The History of the Collections contained in the Natural History Departments of the British Museum*, volume 1.

Fig. 7. Large supraglacial stream on the surface of the Greenland Ice Sheet.

Glaciers - no nonsense science

Ice sheets can indeed collapse, say Michael Hambrey[1] Jonathan Bamber[2] Poul Christoffersen[3] Neil Glasser[1] Alun Hubbard[1] Bryn Hubbard[1] Rob Larter[4]

As glaciologists and glacial geologists, we respond to the article "Glaciers – science and nonsense" by Cliff Ollier in the March issue of *Geoscientist*[1]. We argue that the standfirst of this piece, which states that the author "takes issue with some common misconceptions about how ice-sheets move, and doubts many pronouncements about the "collapse" of the planet's ice sheets" is misconceived because it assumes Ollier's arguments are correct. We demonstrate in this article that they are not based on an accurate understanding of contemporary glaciology.

First, It is important to understand that when glaciologists occasionally refer to the 'collapse' of ice sheets they do not mean disappearance in a few years, but refer to a positive feedback whereby incremental change can lead to larger changes and, ultimately, to complete demise. The contentious issue of glaciology is *not* whether such collapse can occur, because it has and does (see below) - but the timescale over which collapse occurs.

Ollier argues that ice sheets cannot collapse and that research that demonstrates rapid ice sheet melting and thinning resulting from acceleration of flow ("dynamic thinning") is 'alarmist'. Ollier's stance largely disregards fundamental developments in our understanding of glaciers and ice sheets that have been achieved since the 1950s through a combination of laboratory experiments, fieldwork and (more recently) remote sensing – as reading of fundamental texts such as that by Paterson would reveal. Physical glaciology is undoubtedly a young discipline founded in the post-WWII 'process-engineering' era, but to suggest, for example, that scientists are unaware of the basic principles of ice motion through creep deformation, basal sliding and sub-glacial sediment deformation is countered by the fact that there are thousands of critically-reviewed papers that investigate these processes on a variety of scales.

In this article, we redress the balance, and in so doing demonstrate the basis of our concern for current and future ice-mass recession and its contribution to sea-level rise. Our response is structured around five general themes that are misrepresented by Ollier in his argument that ice sheets are not responding to recent climate warming. These are (i) that ice motion is predominantly achieved through 'creep', (ii) that iceberg calving and calving-related processes do not influence the motion of the interior ice sheet, (iii) that current rates of ice-mass flow and iceberg release are not controlled by recent, but by ancient, changes in climate, (iv) that ice sheets have been stable for long periods of time and are therefore insensitive to changes in climate, and (v) that contemporary advance of certain valley glaciers indicates that there is no evidence of climate warming.

Misconception I: theories based on ice sliding on a lubricated base have very limited application because ice motion is predominantly achieved through 'creep'

Ollier states that "theories based on ice sliding on a lubricated base have very limited application" and that ice-sheet flow is achieved almost entirely through ice deformation or creep. This statement is erroneous, and ignores the fact that the majority of the Earth's ice masses move through a

combination of ice deformation and basal motion, composed of basal sliding and the deformation of subglacial sediments. Indeed, where direct measurements have been made of the relative contributions of the different motion components, basal motion often accounts for as much as 80% of the total ice velocity. This has been observed at small temperate mountain glaciers as well as at 50km-wide ice streams in Antarctica. Indeed, it has been estimated that ~90% of the annual ice loss from Antarctica, and ~50% of that from Greenland[2,3], occurs through the discharge of ice streams and outlet glaciers, the rapid motion of which is facilitated by the presence of basal meltwater. Numerous studies correspondingly reveal that fast ice motion, and rapid changes in motion, are overwhelmingly controlled by variations in basal motion and not creep – which is rate-limited and relatively steady, and insensitive to changing external forcing factors. It is only variations in basal motion, therefore, that are capable of explaining the dramatic changes in the rates at which ice streams move that have been recorded in the past decade or so.

Satellite images clearly show that surface meltwater forms lakes and supraglacial rivers on the Greenland Ice Sheet, even well up into the firn zone, and much of this water seasonally drains to the bed. The seasonal speed up of the western margin of the Greenland Ice Sheet has been observed from satellites[4] and from ground-based GPS measurements[5]. In some cases the ice surface has speeded up by up to a factor[4]. Continuous centimetre-accurate geodetic-GPS measurements made across and up to 100km from the margin of the Greenland ice sheet further indicate a strong daily cycle of horizontal and vertical displacement, both synchronous with, and proportional to, the timing and magnitude of diurnal surface melt-water production[6,7]. That this observed daily velocity cycle is also accompanied by extensive vertical uplift of the ice surface, both of which are in phase with peak melt-water production, provides a direct link between surface melt and subglacial ice dynamics, and specifically with hydraulic-pressurisation (inducing uplift) at the ice-bed interface.

Ollier disregards a large body of observational evidence by claiming that meltwater does not form on ice caps. He also disregards observational evidence when he claims that water can only penetrate through the ice if crevasses reach the bed. Every part of these statements is inaccurate. For example, the process of hydro-fracturing provides a mechanism for extending surface crevasses to depth, while water-melted sink holes, or 'moulins' very effectively transfer water from the surface of ice masses to their bed – even through ice thicknesses of up to one kilometre[8]. Although the impact of this process is still unclear, the evidence for drainage of water through thick polar ice, from the surface of the ice sheet to the bed, is incontrovertible.

Even in areas where there is little or no surface melting, as is the case for most of Antarctica, the beds of ice streams are generally lubricated as a result of basal melting. Basal melting occurs under thick ice where the combination of overburden pressure and the geothermal heat-flux result in ice at the bed being at the pressure-melting point even though mean annual surface temperatures are -20°C or even colder. Once fast flow has been initiated, strain-heating and bed friction also contribute to basal melting.

Misconception II: iceberg calving and calving-related processes do not influence the motion of the interior ice sheet

Penetration of surface meltwater to glacier and ice sheet beds is not the only process that has been observed by glaciologists in the regions where satellite remote sensing has revealed rapid variations in glacial activity. Accelerated ice motion has also been detected in places where warm ocean conditions have resulted in high rates of submarine melting and retreat of calving glacier fronts. However, Ollier's simple, but invalid, assumption is that glaciers only flow by creep. The fact is that retreat and thinning of calving glacier fronts is accompanied by loss of resistance to flow, and as a consequence the grounded portion of the glaciers do indeed speed up. Two mechanisms contribute to this acceleration. The immediate response to loss of ice-frontal resistance is inland transmission of longitudinal stresses, which stretches and thins the lower part of the glacier. The second and delayed response is inland migration of thinning, which further increases speed because downstream thinning increases the flow-parallel surface gradient and thus elevates the gravitational driving force.

The current acceleration of Pine Island Glacier in West Antarctica is a good example of the delayed response to coastal forcing. Data acquired with high-precision GPS instruments on this 40km-wide ice stream show that thinning originating from the calving front travelled 200km inland in less than a decade and that annual acceleration of 4% per year is taking place 170km from the grounding-line[9]. Speed is changing by ~12% per year near the coast where this ice stream moves at rates of more than 3km per year. This change is obviously important because Pine Island Glacier and the neighbouring Thwaites Glacier account for 35% of all ice discharge from the West Antarctic ice sheet, and their current state of imbalance are responsible for >60% of the current net annual ice mass loss, which is estimated to be >100 Gigatons per year[2].

The immediate response to ocean-forcing is best exemplified by the recent doubling of glacier speeds of several glaciers in Greenland[10]. These events were rapid, widespread and synchronous, and their occurrence from 60°N to 70°N in southeast Greenland[11] coincides with observed warming of waters in coastal currents[12]. The events were clearly caused by current environmental factors and not by internal instability. Natural glacier surges can be ruled out because simultaneous surging on this spatial scale is extremely unlikely. The direct link between oceanic conditions and glacier dynamics is

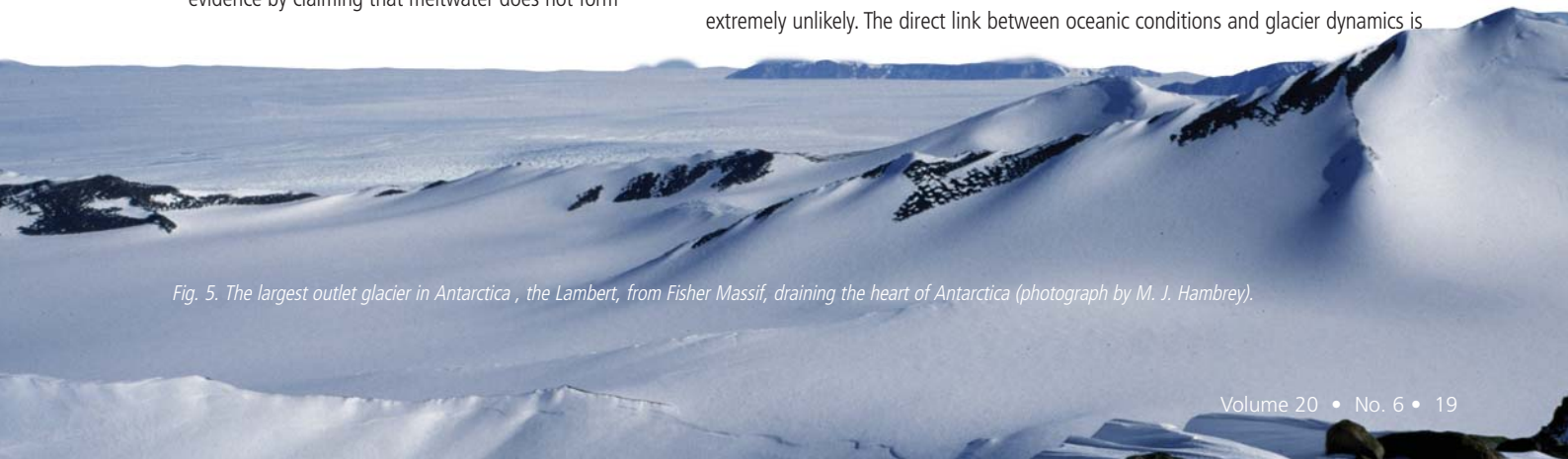


Fig. 5. The largest outlet glacier in Antarctica , the Lambert, from Fisher Massif, draining the heart of Antarctica (photograph by M. J. Hambrey).

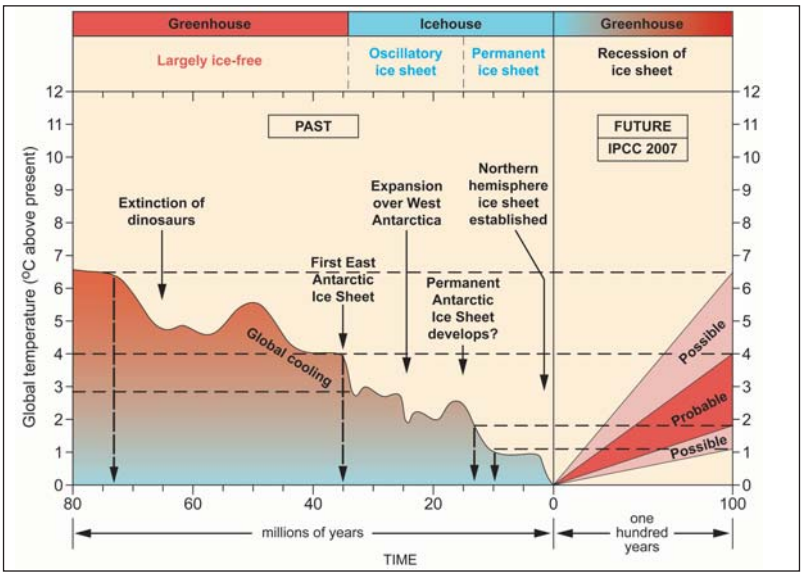


Fig. 1. Generalised global palaeotemperature curve derived from the isotopic signature of marine sediments for the last 80 million years, showing a general cooling, with projected temperature rises for the next 100 years based on IPCC scenarios. From Shell Lecture by M. J. Hambrey, Geological Society, 20 March, 2007; based on Barrett[36] and IPCC[30].

Fig. 2. Rapid recession and iceberg generation has been a characteristic feature of many Greenland glaciers in recent decades, as depicted here by Kangerdlussuak Glacier in East Greenland (photograph by M. J. Hambrey).

Fig. 4. One of many Himalayan glaciers losing mass, Khumbu Glacier, Nepal. The uneven glacier surface mantled by debris. Substantial downwasting evident from the Little Ice Limit, defined by fresh moraine scar across middle of picture (photograph by M. J. Hambrey).

clearly seen in the melting of calving glacier fronts, which occurs at rates of several metres per day in summer and up to tens of metres per year on average. The proposition that these events are completely unrelated to the modern environmental factors is clearly wrong. The ice loss resulting from acceleration of outlet glaciers in southeast Greenland was 70 Gigatonnes per year in 2003-2008[3]. This is 74% of the ice sheet-wide mass imbalance by discharge or 30% of the total annual mass imbalance. Ice-water interactions at calving glacier fronts are complex and difficult to document, but it is clear that calving processes influence the rates at which ice is discharged to the ocean.

Misconception III: ice sheet discharge and iceberg release are controlled by ancient changes in climate

Ollier states that "destruction at the ice front [calving] does not depend on present day climate…. that the point to remember is that the release of icebergs at the edge of an ice cap does not in any way reflect present-day temperature". We cannot let this statement go unchallenged. Ollier seems to believe that abrupt and widespread glacial phenomena, such as glacier acceleration, are the result of palaeoclimatic temperature fluctuations and creep. This idea can be readily discounted, given that a vast and growing body of non-contentious scientific evidence clearly shows that discharge from ice sheets is not controlled by creep, and that current changes in glacier dynamics can be explained by present-day climate and ocean interactions. It is true that the interior basal parts of large ice sheets may typically take thousands of years to respond and equilibrate completely to mass-balance changes in their interior. However, as noted above, the Earth's ice sheets now lose mass not as a result of these (relatively slow) changes, but by submarine melting and iceberg calving from fast-flowing ice streams that terminate in ocean water. The rate of calving from these ice streams is related to the rate at which ice is supplied to them, i.e., to ice velocity, and these velocities have been shown to have increased recently as a result of ice-marginal processes. Short-term increases in iceberg production therefore reflect correspondingly recent warming-related processes and not more widespread ice sheet-scale equilibration to past climate change, as Ollier incorrectly states.

It is worth noting here that these processes of iceberg calving may be fundamentally different from the well-documented break-up and loss of major portions of the Earth's largest ice shelves, which intermittently occurs naturally. These events are part of a long-term cycle of slow build-up over many decades, followed by sudden break-out when they become unstable. That said, the rapid break-up of seven out of twelve ice shelves in the Antarctic Peninsula (with a total reduction of ice shelf area of 28,000km^2 over the last 50 years), where temperatures have risen at a rate of 3.7±1.6°C per century, can clearly be attributed to

regional atmospheric and oceanic warming[13]. Here, there is a clear correlation between the break-up events, the southward migration of isotherms, and the incidence of summer surface-melt (measured in terms of positive degree days). In the case of Larsen A and B ice shelves, basal melting may also have been a factor, but we don't have the historical record to be certain that the rates preceding break-up were unusual. Ollier is correct in saying that ice shelves do not contribute directly to sea level rise (because they are floating in equilibrium with the sea). However, their collapse *does* contribute to sea-level rise because they can no longer buttress the outlet glaciers that feed them, causing destabilisation and draw-down[14,15,16]. For example, remotely sensed glacier velocity and elevation measurements show that tributary glaciers thinned and accelerated following the collapse of the Larsen B Ice Shelf, increasing ice discharge into the ocean[17,18].

Misconception IV: ice sheets have been stable for long periods of time and are therefore insensitive to changes in climate

Ollier argues that ice-sheet longevity is synonymous with a stable history, and states that "the Greenland icecap [sic] has existed for three million years and the Antarctic ice sheets 30 million". These claims are misleading; all ice sheets (defined as having a surface area of >50,000km^2, which therefore include Greenland, the Antarctic Peninsula, East Antarctica and West Antarctica) have fluctuated dramatically in both shape and volume, as indicated by a combination of deep-sea and continental shelf drilling. Whilst the Greenland Ice Sheet appears to have first formed at least 7.3 million years ago[19], it has waxed and waned markedly since then. For example, it was much reduced during the last interglacial (the Eemian) around 110,000 years ago, when global sea level was 5 – 8m higher than at present[20]. Similarly, the West Antarctic Ice Sheet has been characterized by widespread fluctuations during its ~15 million year history. Even the largest and longest lived ice sheet, East Antarctica, which probably first reached the coast ~34 million years ago, has experienced notable fluctuations – although the extent and timing of these fluctuations is hotly debated by experts. These changes have been determined from 30 years of drilling on the Antarctic continental shelf and the surrounding oceans, most recently by the international ANDRILL programme[21]. The Earth's ice sheets have therefore been anything but stable through geological time.

In an associated argument, Ollier claims that the Earth's ice sheets are stable because they are constrained within deep bedrock basins. Again, this claim is false for at least three reasons. First, the stresses driving grounded ice motion depend sensitively on ice thickness and ice surface gradient, and only to a lesser degree on the gradient of the bedrock upon which they lie. Thus, to state the obvious - ice flows downhill - but 'downhill' here relates strictly to the ice sheet surface and not to the bedrock basin on which it rests. Hence, ice can, and commonly does, actually flow up and over reverse bedrock slopes because of the higher surface elevation of the interior ice. Second, and more detrimental to Ollier's argument, the bedrock boundaries of ice sheet basins are frequently breached by major troughs through which the bulk of accumulated ice is discharged as fast-flowing ice streams or outlet glaciers (as noted above). No other process other than basal sliding of glaciers and ice streams can explain the over-deepened basins found in areas affected by glacial erosion. It is these ice streams and outlet glaciers that overwhelmingly drain the ice sheets' interior reservoir of ice to the oceanic sink. As noted above, it is realistically only through variations in the rate of movement of these ice streams that rapid changes in climate can be transformed into (almost) equally rapid changes in ice motion and mass loss. Thirdly, part of the topography of these "deep bedrock basins" is the result of isostatic depression by the ice load itself. When ice starts to thin, the isostatic rebound reduces the depth of the basin (by the ratio between ice and upper mantle densities, i.e. about 3m for every 10m reduction in ice thickness[22].

Misconception V: that contemporary advance of certain valley glaciers indicates that there is no evidence of climate warming

Thus far we have described how ice masses respond dynamically to climate change – and most of the Earth's ice masses are currently responding in this manner. However, it is also true to point out that several glaciers are currently advancing – and Ollier incorrectly cites such cases as evidence that ice masses are not currently receding in the face of climate change. Once again, Ollier's argument cannot be substantiated – for every glacier that is currently advancing there are probably hundreds that are receding. The relationship between climate and any single ice mass is actually fairly complicated, with mass changes being driven by both temperature and precipitation and being mediated by processes of glacier motion (which redistributes the ice, continuously adjusting the glacier's geometry). Thus, a particular glacier can advance because of, for example, local increases in snowfall, despite summer warming. That some glaciers advance is therefore not at all surprising; indeed it is a major cause for concern that, allowing for local precipitation changes, so few of the Earth's glaciers are currently advancing. Glaciers grow or shrink in response not only to temperature but also to precipitation. Ollier cites the Hubbard Glacier in Alaska (Fig. 3), which has been advancing since 1895, largely because it emanates from a large accumulation area at exceptionally high elevation where significant snowfall has been maintained[23]. He refers to it surging in 1986 "at the height of global warming", but this contradicts the fact that it has been advancing nearly continuously for over a century. In fact it was a tributary (the Valerie Glacier), that enters Hubbard Glacier at the snout, which surged. It is worth noting that surge-type glaciers, which account for about 4% of all glaciers (although Hubbard Glacier is not one of them), actually recede and advance cyclically over decades for internal mechanical reasons that are almost completely decoupled from climate. One cannot draw climatic inferences from the current state of such glaciers.

Current and future cryospheric change

In contrast to the message portrayed by Ollier, extensive scientific evidence indicates that ice masses are in fact melting at rates that far exceed background trends and this is happening in nearly all glacierised (glacier-covered) regions on Earth. These changes are already reducing certain water supplies, increasing the rate of global sea-level rise, influencing ocean circulation, changing ecosystems and generating new hazards.

The East Antarctic Ice Sheet has the potential to raise sea levels by ~60m, but the available evidence shows that it is the most stable of Earth's ice sheets, as losses at the periphery appear to be roughly compensated by snowfall in the interior[24]. This stable state stands in marked contrast to the increasing losses occurring from West Antarctica where annual ice losses are estimated to be >100 Gigatons per year, which is equivalent to ~0.3mm per year of sea-level rise, with a potential total contribution of c. 3.3m sea-level rise[25]. The Antarctic Peninsula ice sheet is also losing mass at a relatively high rate of 25 Gigatons per year[11].

In the northern hemisphere, the Greenland ice sheet, which could potentially contribute ~7m to sea-level rise, has been experiencing both increasing discharge velocities and mass loss over the past decade[3]. The area of the ice sheet experiencing surface melt

increased by ~30% between 1979 and 2008. Furthermore, recent data indicate equivalent loss of ice from accelerated ice flow into the ocean, more than compensating for the measured increase in accumulation in the interior of the ice sheet. These losses are mirrored by very large reductions in sea ice cover in the Arctic Ocean[26]. It is obviously important to examine the role of natural and regional climate fluctuations, but these appear to be secondary to global warming[27].

Taken together, rigorous net mass-budget accounting for the Greenland and Antarctic Ice Sheets indicates that they are currently losing mass at a rate of at least 330 Gigatons of ice per year and this includes accumulation gains in their interior from enhanced precipitation in a warmer climate[2,11]. This is in good agreement with satellite detection of gravity, which shows ice sheet losses of at least 370 Gigatons per year. The actual losses may be as high as 500 Gigatons per year according to both methods and this is equivalent ot ~1.5mm of sea-level rise per year.

Outside the polar ice sheets, glaciers around the world are shrinking at an even more dramatic rate, with the largest mass losses per unit area being in the European Alps, Patagonia and NW parts of America. In the European Alps, glaciers experienced marked advances during the so-called Little Ice Age, culminating in ~1850. The subsequent recession is evident not only from kilometres of ice-frontal retreat, but also tens to 100+ metres of thinning of glacier tongues. Similar trends have been reported throughout the Western Cordillera of North America. For example 98% of glaciers monitored there are receding, although there are anomalous exceptions like the Hubbard Glacier (as mentioned above). The Himalayan region (Fig. 4) and the tropical Andes are characterised by down-wasting and recession behind potentially unstable moraine dams which pose an additional threat – that of outburst lake flooding. The Himalaya have been the focus of recent media attention since the correct identification of an erroneous statement in chapter 10.6 of the contribution by Working Group II to the IPCC 2007[28] report that glaciers would disappear by 2035. Monitoring of this region has been poor because of its inaccessibility, but apart from a few notable exceptions in the Karakorum, satellite imagery clearly shows that most glaciers are losing mass.

The World Glacier Monitoring Service regularly summarises all glacier mass balance and ice-margin positional data from around the world. So far their data-base consists of 36,000 length change observations from 1800 glaciers, reflecting changes since the Little Ice Age, and 3400 mass balance measurements on 230 glaciers reflecting changes since the mid-20th century. These data show that glaciers have been shrinking worldwide, except for short-lived periods of stability and advance in the 1920s and 1970s. Today, the trend is one of rapid and accelerating recession, and deglaciation of many mountain ranges is likely in the coming decades[29].

The impact of this glacier melting on rising sea level is proving to be more extreme than predicted by Working Group 1 of IPCC[30]. From 1993 to 2007 global sea level rose 3 - 4mm per year, double the 1.7mm average recorded over the 20th Century. Melting of land ice has become the dominant contributor to sea-level rise, exceeding that caused by the thermal expansion of the oceans. Sea level projections from the IPCC[30] now appear to be underestimates[31].

It is a fact that the overwhelming majority of the Earth's ice masses are shrinking and receding, probably at an accelerating rate, and well beyond the influence of natural climate fluctuations such as the Little Ice Age. Reconstructions of past climate and ice-mass volume from ice core records indicate that global temperature during the last interglacial period was 2-3°C warmer than at present and that sea-levels were 4-6m higher than present[30]. From a range of models, the IPCC[30] (p.13) has predicted best-estimate global warming scenarios ranging from 1.8°C ('likely range' 1.1-2.9°C) to 4.0°C ('likely range' 2.4-6.4°C) by the end of the century, with amplification of these values in the Polar Regions. At the lower end of the spectrum the emission scenario (B1) is based on mid-century population peak, change of economic structures and the introduction of clean and resource efficient technologies, whereas at the upper end of the spectrum (scenario A1F1) it is 'business as usual' with continued reliance on fossil fuels. The last time global temperatures were sustained at the 4°C or higher level than that of today for hundreds of thousands of years or more was in pre-Oligocene time, prior to the formation of all of the world's ice sheets (Fig. 1).

Coda

Ollier argues that ice sheets are inherently stable (1) because current patterns of flow are unrelated to modern climate, (2) because basal lubrication is not important, (3) because meltwater does not form on the surface of ice sheets, and (4) because iceberg calving dynamics do not influence the interior of ice sheets. Above we explained why each of these assumptions is incorrect.

The article we respond to is not new. An almost identical article was published in 2007 on the website of the Frontiers of Freedom Institute in the USA (http://ff.org) and in 2009 in the Quarterly Newsletter *of the Australian Institute of Geoscientists* (http://aig.org.au/newsletters). Seeking multiple publications of near identical articles is uncommon practice in science. By appearing in *Geoscientist* in 2010, we feel it has become necessary to refute the misconceptions in Ollier's article clearly.

Acknowledgements

We thank David Vaughan for general advice and reviewing an earlier version of this manuscript.

Fig. 3. Hubbard Glacier, Alaska, has been advancing for over a century; but this behaviour is anomalous, since 98% of Alaskan glaciers are in recession (photograph by M. J. Hambrey).

References and further reading

This article does not pretend to be a comprehensive review of the points of view raised by Ollier[1], but it draws on a range of peer-reviewed materials that are based on credible science. As background, for a comprehensive understanding of glaciology, Paterson's classic *Physics of Glaciers*[33] is a 'must-read' treatise; for an up-to-date synthesis on glacial processes the textbook by Bennett and Glasser[34] is a good starting point; and for an account directed at the layperson there is the photography-based book by Hambrey and Alean[35]. A recent UNEP-sponsored report of the World Glacier Monitoring Service demonstrates clearly the response of glaciers to climate change worldwide, through a synthesises all the available data from mountain glaciers and ice caps[29]. In addition, the IPCC (2007)[30] report summarises the state of knowledge concerning the cryosphere and discusses the limitations of the data and uncertainties in considerable depth. The references cited by Ollier[1] are also worth reading, in particular to consider whether or not they are 'alarmist', as he states.

1. Ollier, C 2010. *Glaciers – science and nonsense*. Geoscientist, 20(3), 16-21
2. Rignot, E 2008. *Changes in West Antarctic ice stream dynamics observed with ALOS PALSAR data*. Geophysical Research Letters 35, L12505, doi:10.1029/2008GL033365.
3. Van den Broeke, M, Bamber, J, Ettema, J, Rignot, E, Schrama, E, van de Berg, W J, van Meijgaard, E, Velicogna, I, Wouters, B 2009. *Partitioning recent Greenland mass loss*. Science 326, 984-986.
4. Joughin, I, Das, S B, King, M A, Smith, B E, Howat, I M, Moon, T 2008. *Seasonal speedup along the western flank of the Greenland Ice Sheet*. Science 320, 781, doi: 10.1126/science.1153288.
5. van de Wal, R S W, Boot, W, van den Broeke, M R, Smeets, C, Reijmer, C H, Donker, J J A, Oerlemans, J 2008. *Large and rapid melt-induced velocity changes in the ablation zone of the Greenland Ice Sheet*. Science 321, 111-113.
6. Hubbard, A, Shepherd, A, Nienow, P, Joughin, I, King, M, McMillan, M, Box, J, Mair, D 2008. *Seasonal and diurnal melt-induced flow dynamics at a land terminating outlet of the Greenland Ice Sheet*. AGU abstract #C31C-0520, 2008AGUFM.C31C0520H
7. Shepherd, A, Hubbard, A, Nienow, P, King, M, McMillan, M, Joughin, I 2009. *Greenland ice sheet motion coupled with daily melting in late summer*. Geophysical Research Letters 36, doi:10.1029/2008GL035758.
8. Das, S B, Joughin, I, Behn, M D, Howat, I M, King, M A, Lizarralde, D, Bhatia, M P 2008. *Fracture propagation to the base of the Greenland Ice Sheet during supraglacial lake drainage*. Science 320, 778-781.
9. Scott, J T B, Gudmundsson, G H, Smith, A M, Bingham, R G, Pritchard, H D, *Increased rate of acceleration on Pine Island Glacier strongly coupled to changes in gravitational driving stress*, The Cryosphere, 3, 125–131, 2009.
10. Rignot, E, Kanagaratnam, P 2006. *Changes in the velocity structure of the Greenland ice sheet*, Science. 311, 986-990.
11. Howat I M, Joughin, I, Fahnestock, M, Smith, B E, Scambos, T A 2008. *Synchronous retreat and acceleration of southeast Greenland outlet glaciers 2000-06: ice dynamics and coupling to climate*. Journal of Glaciology 54, 646-660.
12. Holland, D M, Thomas, R H, de Young, B, Ribergaard, M H, Lyberth, B 2008. *Acceleration of Jakobshavn Isbrae triggered by warm subsurface ocean waters*. Nature Geoscience 1, 659-664.
13. Cook, A J, Vaughan, D G, 2010. *Overview of areal changes of the ice shelves on the Antarctic Peninsula over the past 50 years*. The Cryosphere 4, 77-98.
14. Rignot, E, Bamber, J, van den Broeke, R, Davis,C, Li, Y, van de Berg, W & van Meijgaard, E 2008. *Recent Antarctic ice mass loss from radar interferometry and regional climate modelling*. Nature Geoscience 1, 106 – 110, doi:10.1038/ngeo102
15. Pritchard, H D, Vaughan, D G 2007. *Widespread acceleration of tidewater glaciers on the Antarctic Peninsula*. Journal of Geophysical Research 112, F03S29, doi:10.1029/2006JF000597.
16. Pritchard, H D, Arthern, R J, Vaughan, D G, Edwards, L A 2009. *Extensive dynamic thinning on the margins of the Greenland and Antarctic ice sheets*. Nature 461, 971-975
17. Rignot, E, Casassa, G, Gogineni, P, Krabill, W, Rivera, A, Thomas, R 2004. *Accelerated ice discharge from the Antarctic Peninsula following the collapse of the Larsen B Ice Shelf*. Geophysical Research Letters, 31, L18401. (doi:10.1029/2004GL020697).
18. Scambos, T A, Bohlander, J A, Shuman, C A, Skvarca, P 2004. *Glacier acceleration and thinning after ice shelf collapse in the Larsen B embayment, Antarctica*. Geophysical Research Letters, 31, L18402. (doi:10.1029/2004GL020670).
19. St. John, K E K, Krissek, L A 2002. *The late Miocene to Pleistocene ice-rafting history of southeast Greenland*. Boreas 31, 28-35.
20. Kopp, R E, Simons, F J, Mitrovica, J X, Maloof, A C, Oppenheimer, M 2009. *Probabilistic assessment of sea level during the last interglacial stage*. Nature 462, 863-867.
21. Naish, T, Powell, R, Levy, R and 53 others 2009. *Obliquity-paced Pliocene West Antarctic ice Sheet oscillations*. Nature 458, 322-328.
22. Turcotte, D L, Schubert, G 2002. *Geodynamics, 2nd edition*. Cambridge University Press, Cambridge, 472 pp.
23. Molnia, B F 2007. *Late nineteenth to early twenty-first century behaviour of Alaskan glaciers as indicators of changing regional climate*. Global and Planetary Change 56, 23-56.
24. Davis, C H, Li, Y, McConnell, J R, Frey, M M, Hanna, E 2005. Snow-driven growth in East Antarctica ice-sheet mitigates recent sea level rise. Science 308, 1898-1901.
25. Bamber, J L, Riva, R E M, Vermeersen, B L A, LeBrocq, A M 2009. *Reassessment of the Potential Sea-Level Rise from a Collapse of the West Antarctic Ice Sheet*. Science 324, 901-903.10.1029/2007GL029703.
26. Stroeve, J, Holland, M, Meier, W, Scambos,T, Serreze, M 2007. *Arctic sea ice decline: faster than forecast*. Geophysical Research Letters 34, L09501, doi:
27. Hanna, E, Huybrechts, P, STeffan, K, Cappelen, J, Huff, R, Shuman, C, Irvine-Flynn, T, Wise, S, Griffiths, M 2008. *Increased runoff from melt from the Greenland Ice Sheet: a response to global warming*. Journal of Climate 21, 331-341.
28. Cruz, R V, Harasawa, H, Lal, M, Wu, S, Anokhin, Y, Punsalmaa, B, Honda, Y, Jafari, M, Li, C, Huu Ninh, N. 2007. *Asia. Climate Change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In* Parry, M L, Canziani, O F, Palutikof, J P, van der Linden, P J, Hanson, C E (Eds.), Cambridge University Press, Cambridge, pp. 469-506.
29. Zemp, M, van Woerden, J (eds.) 2009. *Global glacier changes: facts and figures*. The United Nations Environment Programme and World Glacier Monitoring Service, Zurich, 88 pp.
30. IPCC 2007. *Climate change: the physical science basis*. Cambridge University Press, Cambridge, 1054pp.
31. Grinsted, A, Moore, J C, Jevrejeva, S 2010. *Reconstructing sea level from paleo and projected temperatures 200 to 2100 AD*. Climate Dynamics 34, 461-472.
32. Chapman, W L, Walsh, J E 2007. *Simulations of Arctic temperature and pressure by global coupled models*. Journal of Climate 20, 609-632.
33. Paterson, W S.B 1994. *The Physics of Glaciers, Third Edition*. Pergamon, Oxfod, 480pp.
34. Bennett, M R, Glasser, N F 2009. *Glacial geology: ice sheets and landforms, 2nd edition*. John Wiley & Sons, Chichester, 385 pp.
35. Hambrey, M J, Alean, J 2004. *Glaciers, 2nd edition*. Cambridge University Press, Cambridge, 345pp.
36. Barrett, P J 2003. *Cooling a continent*. Nature, 421, 221-223.

Authors

[1]Centre for Glaciology, Aberystwyth University
[2] Bristol Glaciology Centre, Bristol University
[3] Scott Polar Research Institute, University of Cambridge
[4] British Antarctic Survey, Cambridge

Society Business

Library Review – 'Town Hall' meeting

Nic Bilham writes: Thank you to all Fellows who have helped with the ongoing library review by completing questionnaires and library slips. (See 'From Gutenberg to Google', *Geoscientist* March 2010). All are welcome to come and hear what progress has been made and discuss the review group's emerging findings, at a meeting at Burlington House at 11am on Monday 12 July. To register, contact nic.bilham@geolsoc.org.uk.

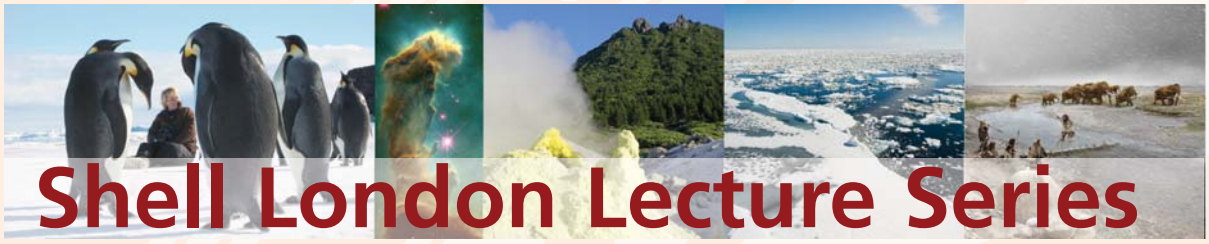
Society & Publishing House closure

The Publishing House in Bath and the Society's apartments in Burlington House will remain closed to business on **Wednesday June 30** for staff training.

Future meetings

OGMs:
16 June 2010; 29 September 2010; 24 November 2010; 27 January 2011; 13 April 2011.

Council:
16 June 2010; 29 September 2010; 24 November 2010; 26/27 Janyuary 2011; (residential); 13 April 2011.



Shell London Lecture Series

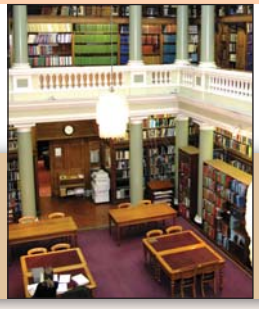
The remainder of the programme for the 2010 Shell London lectures is listed below. Entry to lectures is free and open to all, but by ticket only. To obtain a ticket please contact the Conference Office using the contact details below. Tickets will be allocated on a monthly ballot basis and we will not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

Each talk will appear online shortly after the talk has been given. To view the presentations please visit the individual talk's event page, accessed via www.geolsoc.org.uk/shelllondonlectures10

DATE	SPEAKER	TITLE
Weds 9 June	**Derek Vance (Bristol University)**	**The chemistry of the oceans: Past, present & future**
Weds 8 September	**Marie Edmonds (Cambridge University)**	**A lot of hot air: Degassing and volcanic eruptions**
Weds 13 October	**Jay Melosh (Purdue University)**	**Impacts**
Weds 10 November	**Rob Kleibergen (Shell)**	**Half empty or half full: How much oil and gas can we recover from our fields?**
Weds 8 December	**Martin Culshaw**	**Geological hazards: How safe is Britain?**

Further information
To be added to the mailing list, or to request a ticket, please contact the Conference Office at the Geological Society.
To view abstracts and biographies, and to view films of past talks, please visit our website.
T: +44 (0) 20 7432 0981; E: events@geolsoc.org.uk
W: www.geolsoc.org.uk/shelllondonlectures10.

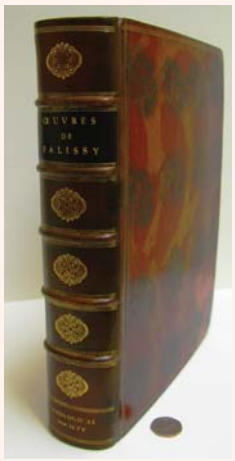
In association with



From the Library

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

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



Rare book of the month!

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

Oeuvres de Bernard Palissy, revues sur les exemplaires de la bibliothèque du Roi, Bernard Palissy, with notes by Barthélemy Faujas de Saint Fond and Nicolas Gobet (1777 edition)

Should you venture to the Wallace Collection in London, a visit to the basement floor is recommended, for there sits an exquisite earthenware basin with a dark blue glaze over which a snake slithers between water grasses, fish, lizards and frogs, and a generous scattering of shells and shellfish. It is a fine example of the ceramic art invented by Bernard Palissy (1510-1590), who used real plants and animals to make moulds, creating a look as close to nature as possible.

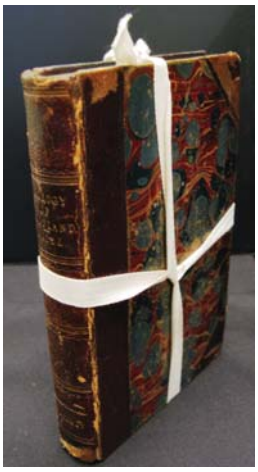
As you might expect, Palissy was keenly interested in geography and geology. His search for new ideas for his pottery in rivers, lakeshores and mountains led him to examine his landscape in the same way the Geological Society's founders would centuries later. Perhaps the most famous section in *Oeuvres de Palissy*, presented to the Society by G.B. Greenough, is 'L'Art de Terre', which describes the stresses involved in mastering the art of firing clays. There are also, however, fascinating writings on metals and alchemy, salts, Natural History, and a chapter called 'On Rocks', in which he writes, 'I have always comforted myself with the idea that science has no greater enemy than ignorance'.

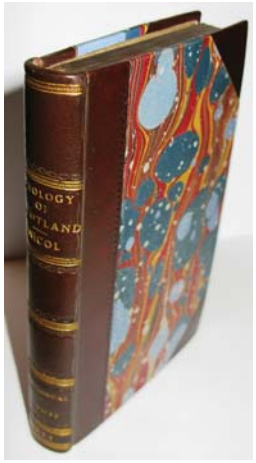
Showcasing the genius of a Renaissance thinker on the merging of arts and natural sciences, this volume, conserved last year as part of the Sponsor-A-Book Appeal, is a highlight of the Society's collection.

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

Sponsor-a-Book update

The Library would like to thank the Donations Committee of Maersk Oil North Sea UK Ltd for their generous donation which has allowed us to restore James Nicol's *Guide to the geology of Scotland* (1844). Its covers are re-fixed and spine delicately retooled, and its many loose and torn pages have been repaired.



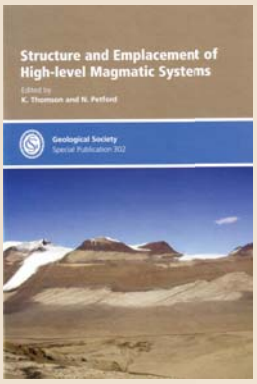


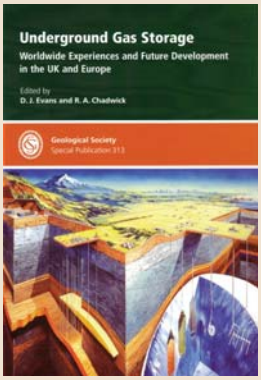
Archivist appointed

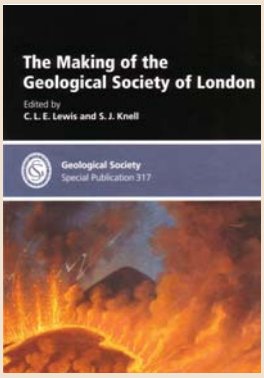
The Society has appointed Caroline Lam as Archivist/Records Manager. Caroline is responsible for managing the Society's archives, implementing records management procedures for the Society's administrative records, and provision of an archive reference and enquiry service.

Make your Publication *Special!*

Jonathan Turner, Angharad Hills, Neal Marriott and Robert Pankhurst have a list of good reasons why you should publish in the Society's prestigious Special Publications Series.







A glance at most Earth scientists' burgeoning bookshelves will usually reveal a selection of distinctively colour-banded spines signifying the Special Publications series – the "SPs". Now in their 46th year, the strength of the Special Publications brand has helped to establish the Geological Society as one of the world's foremost Earth science publishers. SPs have achieved an unrivalled reputation for scientific excellence, clear layout and high-quality production. Librarians consider them essential acquisitions. This year, the Geological Society Publishing House will deliver some 23 new volumes, taking us to volume 346 and making it one of the most extensive geoscience book series ever published.

SPs cover an eclectic mix of Earth science topics, including world-class thematic sets in such diverse fields as petroleum geoscience, hydrogeology, tectonics and structural geology, igneous petrology, history of geology, and many more. Since 2007 the complete series has been available online via the Society's *Lyell Collection*, the success of which has meant that the breadth of audience to which the SPs are exposed has increased massively. Online SP abstracts were accessed nearly half a million times in 2009 through the *Lyell Collection*, and about 250,000 full papers were downloaded - exceeding the hit-rates of many Earth science journals. The Society offers substantial discounts to its own Fellows, as well as members of some of the main geoscience societies, making these books very affordable.

SP editors and contributors are supported by a Society-appointed Books Editor and the dedicated Publishing House staff. Once final manuscripts for a book are received, we aim to publish within seven months. All surpluses are used to enhance the Society's support and promotion of interest in Earth sciences.

But times are changing, for publishing especially. To ensure SPs' future vitality, several new initiatives are being rolled out, designed to encourage would-be editors and authors to publish in them.

- **Free colour.** For all new proposals, authors can have up to three free colour figures in their printed paper (all colour illustrations are free in the online version).
- **Citation data.** From late 2010, citation data for SPs from 2005 onward will be available from the ISI Web of Knowledge; citation data can also be obtained from Scopus.
- **Online submission and review.** The entire peer review process is now handled online using the AllenTrack software (similar to that employed by AGU and *Nature*) which means greater efficiency for authors and editors, particularly when they live in several different countries, and a much improved project planning - avoiding production bottlenecks and delivering faster service.
- **Electronic marketing.** The shift in emphasis from print-based to highly focused electronic promotion of new titles is providing the series with exposure to new markets.
- **Conference and publication planning.** New collaborative relations are being developed between the Society's Conference Office and its Science and Publications Management Committees so that conveners of meetings can receive free assistance with organising the promotion and logistics of their conference, and in planning from the outset for an eventual Special Publication.

Furthermore, we are planning a "publish-ahead-of-print" process whereby individual articles are posted to the Special Publications site on the *Lyell Collection* within one month of acceptance, before the full book is collated for printing.

The SP series continues to flourish in an intensely competitive environment. Their continued success relies on a steady flow of scientifically exciting new proposals to the Books Editorial Committee. From the pleasure of having used SPs, most of us will, we trust, agree that they provide a permanent record of our very best scientific endeavours. Moreover, the new initiatives listed above will ensure that SPs retain their edge in the worlds of fundamental and applied geoscience.

So, next time you are deciding where to publish – whether the work arises out of a conference you convened or participated in, or indeed any other thematic set of papers - please give SPs serious consideration. You will be supporting the Society in its task of furthering Earth science research and communication. We are confident that you will be delighted with the result.

- To find out more about publishing in the Special Publications, please contact the Commissioning Editor, Angharad Hills: E: angharad.hills@geolsoc.org.uk; T: +44 (0)1225 476402.

From the Geological Society Publishing House

The Geological Society

July Online Bookshop Sale

Friday 2nd July - Friday 9th July 2010

35 publications will be reduced to
£25.00 each
for the duration of the sale

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 1st July.** Once registered, you will receive an email at the start of the sale detailing the publications on offer.

SUBJECT CATEGORIES FEATURED IN THE SALE:

- Engineering
- Environmental
- Geochemistry
- Geohazards
- History of Geology
- Hydrogeology
- Magmatic Studies
- Marine Studies
- Museums and Collections
- Palaeontology
- Petroleum
- Quaternary Geology
- Regional Geology
- Stratigraphy / Sedimentology
- Structural Geology
- Tectonics

www.geolsoc.org.uk/bookshop

Sale 2 July - 9 July 2010

Mt Everest from base camp by Martin Lack

Continuing Professional Development (CPD) Courses

•2-4 June *Natural Attenuation of Pollutants.* Venue: Sheffield. For those who would like an introduction to the fundamental ideas and processes involved in the application of natural attenuation to the remediation of contaminated sites. A valuable opportunity to meet the course tutors, leading academics and practitioners, as well as your professional peers tackling similar problems. Contact: Pat Rayner. T: 0114 222 5758 E: p.rayner@shef.ac.uk W: www.shef.ac.uk/civil/shortcourses/

•8-10 June *Surpac Foundation & Geology Workshop.* Venue: Coalville. The Surpac Foundation and Geology Workshop is an amalgamation of both the Foundation course and the Geology course. A comprehensive three-day workshop designed for new users of Surpac regardless of discipline and geologists new to Surpac's geology toolset. GSL Members receive a 15% discount! Please mention this when registering. To register, or for more information: E: sales-eu@gemcomsoftware.com. T: +44 1530 835554 W: www.gemcomsoftware.com.

•16 June *Groundwater Levels and Dataloggers.* The requirements of the Water Framework Directive have given a new emphasis to the need for groundwater level monitoring, and for obtaining reliable data. Highly practical, designed to improve delegates' understanding of loggers and build confidence in their use. Contact: Julie Rose T: 0121 733 3533 E: Julie.rose@waterrauk.com W: www.waterrauk.com/Pages/general/training.asp

•21-25 June *Minex Foundation & Geology Workshop Organiser:* Gemcom Venue: Coalville.Detailed five-day course designed for new Minex users. Main core features of Minex and detailed procedures to generate seam models. E: sales-eu@gemcomsoftware.com. T: +44 1530 835554 W: www.gemcomsoftware.com.

•25 June *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

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.*

•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. **Contact:** Leila Taleb T: 020 7432 0981 F: 020 7494 0579 E: events@geolsoc.org.uk

•3-4 June *Modelling Sedimentary Basins and their Petroleum Systems.* Advances in modelling of basin formation, fill and fluids. Details and registration – see Website. Re-scheduled from 22-23 April, when the conference was cancelled due to volcanic ash disruption of air travel. All bookings made for April will be transferred to the June event. If you have booked a place and are now **unable** to attend, please contact Steve Whalley. Venue: Burlington House. **Contact:** Steve Whalley, Events Co-ordinator: T: +44 (0)20 7432 0980 E: steve.whalley@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:** Leila Taleb T: 020 7432 0981 F: 020 7494 0579 E: leila.taleb@geolsoc.org.uk.

North West Regional

15 June *Oil Exploration: Unlocking Value by Technical Innovation.* Evening Meeting. Venue: The Centre Lecture Theatre, Warrington. Tea, coffee & biscuits served 1800 for 1830. Speaker: Mike Bowman (BP Exploration) **Contact:** Gillian Hurworth E: Gillian_Hurworth@coffey.com

•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.

Southern Wales Regional

•19 June *Field Trip.* Venue: Main Building, Cardiff University. Further details to follow. Speaker TBA. **Contact:** Margaret McBride E: margaret.mcbride@jacobs.com.

Western Regional

•19 June. *A Geological Background for Applied Geology in Gloucestershire.* Field trip. Venue: Robinswood Hill Country Park. Leader: Dr Nick Chidlaw. Time: 0900-1700. Of interest to Society members working in a variety of professions including ground engineering, petroleum geology, hydrogeology and education. Register by 11 June. **Contact:** Francesca Ryan. E: Francesca.ryan@area2.bbmm.co.uk

South West Regional

•25 June *Field Trip to Meeth Clay Works.* Venue: Meet at the Bull and Dragon Pub, Meeth, (01837 810325) from 1230 for 1330 access to the site. Participants must provide a high-viz jacket and safety helmet. Stout work or wellington boots will be needed for 3-4km walk through mud. The event must be pre-booked. **Contact:** Jonathan King E: jonathan.kingeo@yahoo.co.uk

Palaeontographical Society

•30 June *Lyell Meeting 2010: Comparing the geological and fossil records: implications for biodiversity studies* Venue: Flett Lecture Theatre, Natural History Museum. 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. Registration – see website. **Contact:** Andrew Smith, Natural History Museum, Exhibition Road, London SW7 5BD E: a.smith@nhm.ac.uk.

A·A·P·G

The Geological Society

International Conference:

The Geology of Unconventional Gas Plays

4 - 7 October 2010

The Geological Society, Burlington House, Piccadilly, London

REGISTRATION NOW OPEN

It is generally recognised that unconventional gas resources will make up a major part of our future energy needs. In recent years there has been a marked increase in interest in these resources from industry and especially amongst the major western oil and gas companies. Many of the technical issues surrounding unconventional gas plays revolve around the complex engineering solutions required to commercially exploit them. The aim of this conference however is to specifically address the geoscience issues related to their exploration and exploitation.
We invite oral and poster presentations on the following themes:

- **Overviews of Unconventional Gas Plays**
- **Shale Gas**
- **Tight Gas Reservoirs**
- **Coalbed Methane**
- **Gas Hydrates**

Within each theme we welcome contributions that address any relevant geoscience issue, such as petroleum system analysis, reservoir geology, geophysical evaluation, structural geology and fracture prediction as well as case studies on particular plays, basins or fields.

We aim to bring together key figures in industry and academia active in both established unconventional gas plays of North America and emerging plays of Europe, plus other plays around the globe.
The following speakers have agreed to deliver keynote talks:

- **Richard Chuchla (ExxonMobil) - Unconventional Gas Resources: An Integrated Global Perspective**
- **Ken Chew (IHS & Morenish Mews, UK) - European Unconventional Gas Plays**
- **Prof. Terry Engelder (Penn. State Univ.) - Shale Gas**
- **Prof. Dan Jarvie (Texas C.U./IFP) - Shale Gas**
- **Prof. Brian Horsfield (GFZ Potsdam) - Shale Gas**
- **Steve Cumella (Bill Barrett Corp.) - Tight Gas Sandstones**
- **Andrew Scott (Consultant) - Coal Bed Methane**
- **Tim Collett (USGS) - Gas Hydrates**
- **Prof. Graham Westbrook (Univ. Birmingham) - Gas Hydrates**

Please send all abstracts and sponsorship enquires to Paul Doubleday at doubled@statoil.com

Convenors:
Paul Doubleday (Statoil)
Stephen Laubach (The University of Texas)
Lois Atterton (Statoil)
Jaquie Bond (ExxonMobil)

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

PETROLEUM GROUP

At the forefront of petroleum geoscience

www.geolsoc.org.uk/petroleum

GeoRisk Solutions

Engineering Geologists, Hong Kong

GeoRisk Solutions Ltd. (GRS) is an engineering geology consultancy based in Hong Kong. Due to our increasing work load we are seeking motivated Engineering Geologists at all levels.

Applicants should have a first degree in Geology and preferably an MSc in Engineering Geology. Applicants for senior positions should be Chartered or near Chartered, be capable of producing high quality technical reports and managing/leading field teams. All applicants should have strong geological mapping skills, ideally with experience in landslide hazard assessments. Experience in the design of landslide mitigation works, such as flexible barriers, would be advantageous. Considerable field work in Hong Kong's sub-tropical climate would be involved at all levels.

We offer attractive salaries and comprehensive medical insurance.

Additional details of GRS can be found on our web site **www.georisksolutions.com**

Applications should be made by email to **GRS@georisksolutions.com** and should include a CV, current salary, and the names of at least two referees.

United Kingdom

UKGE limited

Geologists Equipment

www.ukge.co.uk

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

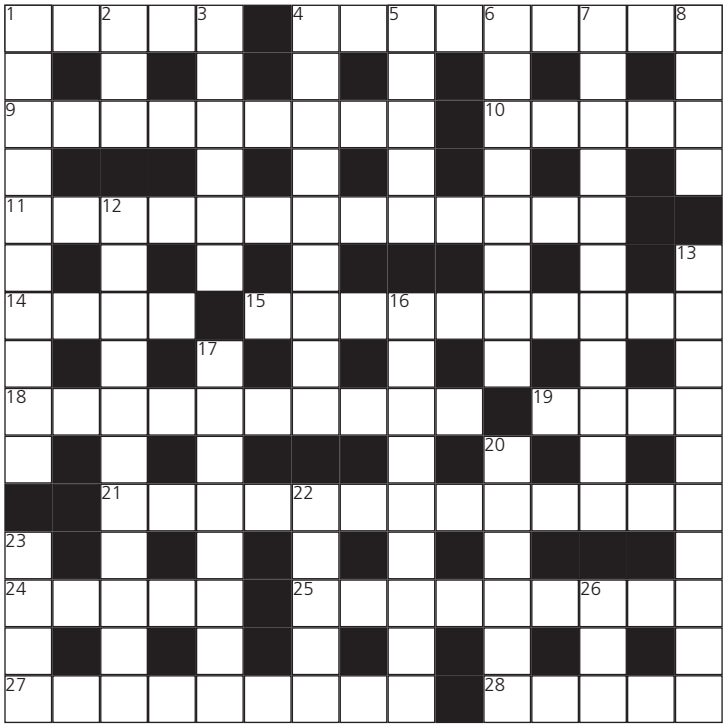
Offering over 10,100 tools, field equipment, maps and books for the professional geologist online

- 0800 0336 002 -

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

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

Crossword no. 136 set by Platypus



Solutions: April

Across: **1** Sinter **4** Topset **9** Barb **10** Ornamented **11** Attach **12** Equities **13** Granulite **15** Soda **16** Brow **17** Eggshells **21** Cryostat **22** Nicene **24** Auriferous **25** Lath **26** Annoys **27** Escape

Down: **1** Spatter **2** Nubia **3** Epochal **5** Osmium **6** Sunstronke **7** Theresa **8** Investigation **14** Neocomian **16** Bermuda **18** Sinuses **19** Lunette **20** Steely **23** Cilia

Win a Special Publication of your choice!

The winner of the April Crossword puzzle prize draw was Joan Walsh of Glasgow.

All correct solutions will be placed in the draw, and the winner's name printed in the August issue. The Editor's decision is final and no correspondence will be entered into. Closing date – June 17.

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

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

Name .....

Fellowship Number .....

Address for correspondence .....

.....

.....

.....

.....

.....

.....Postcode .....

Across

1 Stratigraphic marker, allegedly golden (4)
4 Wetting agent (9)
9 Inactive rift, partially or completely filled with sediment (9)
10 Arabic owner, or proprietor (5)
11 Process of determining the location of a point by measuring angles from known points (13)
14 Security device, frequently raped by Pope (4)
15 Seaside promenades (10)
18 Falkland Island Mount, bloodily recaptured in 1982 (10)
19 ad libitum, or gratis - it's all the same in English (4)
21 Charged, perhaps inappropriately, with feeling (13)
24 Last Greek letter (5)
25 Beautifier of the dear departed (9)
27 There is (or rather was, to judge by the archaic spelling) a little yellow idol on the road to here (9)
28 The only drum that might also catch a rabbit (5)

Down

1 Soft grain deformed during burial (10)
2 Unwell (3)
3 Dawn of the recent (6)
4 With all magnetization removed (9)
5 Friendly Islands (5)
6 Black Sobranies, ethnically (8)
7 Cambrian to recent deuterostomes characterised by 5-rayed symmetry (11)
8 Sumatran supervolcano (4)
12 Units that cannot deform without flowing (11)
13 Dominating influence (10)
16 Typical Munich style beer, and evidently the preferred beverage of a top predator (9)
17 Redundant expression: "Most unkindest cut of all", for example. (8)
20 Non-solid states of matter (6)
22 Was John ever free? Not after he played Mr Humphreys. (5)
23 Swine flesh (4)
26 The other Gershwin (3)

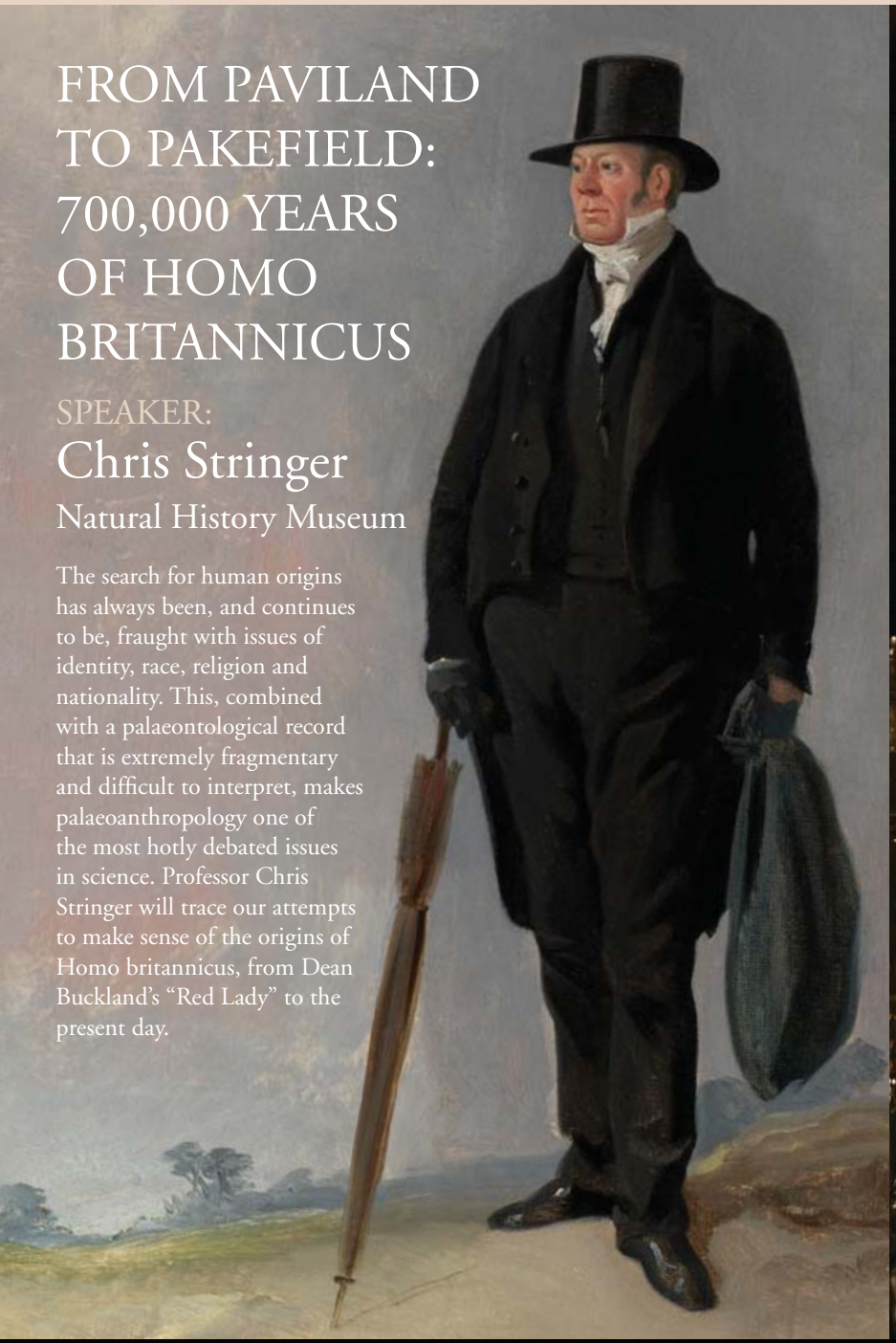
Subscriptions: All correspondence relating to trade subscriptions should be addressed to the Journals Subscription Department, Geological Society Publishing House, Unit 7 Brassmill Enterprise Centre, Brassmill Lane, Bath BA1 3JN, UK. Tel: 01225 445046. Fax: 01225 442836. The subscription price for 2010 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

FOUNDERS' DAY LECTURE AND DINNER

Thursday 11 November 2010

Tickets are limited



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

SPEAKER:

Chris Stringer

Natural History Museum

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

And afterwards at Le Meridien, Piccadilly

Dress: Black Tie

Ticket price: £70

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

Dining with dinosaurs

CONTACT DETAILS

For further details contact: Georgina Worrell, The Geological Society, Burlington House, Piccadilly, London, W1J 0BG
Tel: 020 7432 0983 Email: georgina.worrall@geolsoc.org.uk Web: www.geolsoc.org.uk/founders10