

# Geoscientist

The Fellowship magazine of The Geological Society of London | [www.geolsoc.org.uk](http://www.geolsoc.org.uk) | Volume 22 No 9 | October 2012

## ETCHES CLOSER

New museum for Dorset?

## POLYGON PUZZLE

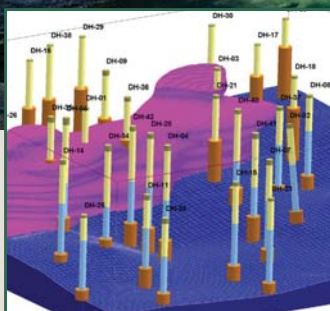
Polygons may point  
to wet Mars

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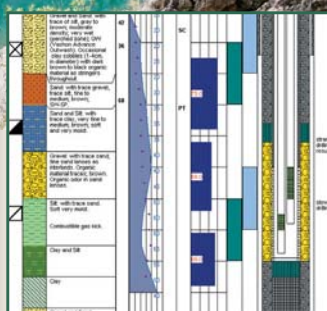


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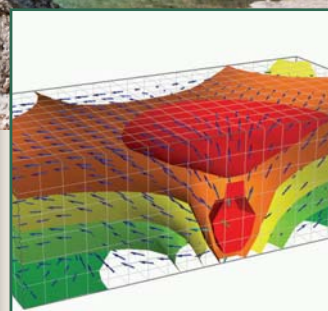


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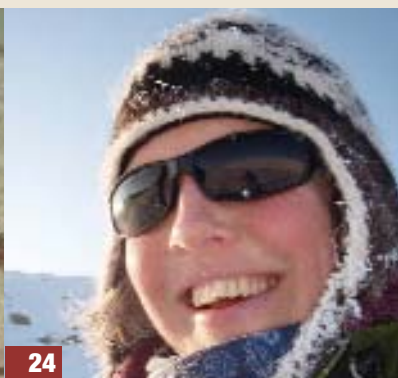
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# 'PILTDOWN: 100 YEARS ON'

Geological Society, Burlington House, Piccadilly, London



18 DECEMBER 2012

*A History Of Geology Group meeting to mark the centenary  
of the reading of the*

*Piltdown Man paper at the GSL on the 18th December 1912.*



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## Programme

### Morning: Guided Tours

10.00 -1.30: Tours of the Natural History Museum's "Piltdown Centenary Exhibition" of specimens, manuscripts and papers in the Library.

Three tours will be held at 10.00, 11.10 and 12.20. They will be led by Carolyn Schindler and Paul Cooper: each tour will be restricted to a maximum number of 15 delegates. See registration form.

12.00 13.30: Group viewings of the Piltdown painting at the GSL.

### Afternoon: Piltdown Centenary Meeting Geological Society

14.00 – 14.10	Welcome/Introduction
14.10 – 14.45	Anne O'Connor: " <i>Piltdown and the Geological Society</i> "
14.45 – 15.20	Dave Martill: " <i>Arthur Conan Doyle and the Piltdown Forgery</i> "
15.20 – 15.55	Miles Russell: " <i>Charles Dawson: a career fabricating prehistory</i> "
15.55 – 16.15	Tea/Posters
16.15 – 16.50	Christopher Dean: " <i>The Anatomy of the Forgery</i> "
16.50 – 17.30	Chris Stringer: " <i>The Piltdown forgery in context</i> "
17.30 – 18.00	Questions/discussion

Convenor: Professor Richard T. J. Moody  
rtj.moody@virgin.net



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## Registration Fees:

GSL Fellows, HOGG, GA and OUGS members:	£40.00*
Non Fellows nor members of above group	£50.00*
Students:	£25.00*
(* Reception included)	
NHM Piltdown Exhibition	£8.00
Piltdown Dinner	£45.00

“ALFRED WEGENER IN  
FIELD GEAR, GREENLAND.  
IT IS NOW 100 YEARS SINCE  
HIS VERSION OF CONTINENTAL  
DRIFT WAS PUBLISHED”

Front cover image: Alfred  
Wegener Institute

**Geoscientist is the  
Fellowship magazine of  
the Geological Society  
of London**

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London W1J 0BG  
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F +44 (0)20 7439 8975  
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(Not for Editorial)

#### **Publishing House**

The Geological Society  
Publishing House, Unit 7,  
Brassmill Enterprise Centre,  
Brassmill Lane, Bath  
BA1 3JN  
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London by  
**Century One Publishing**  
Alban Row, 27–31 Verulam  
Road, St Albans, Herts,  
AL3 4DG  
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number 210161.  
ISSN (print) 0961-5628  
ISSN (online) 2045-1784

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445046. Fax: 01225 442836. Email:  
sales@geolsoc.org.uk. The  
subscription price for Volume 22,  
2012 (11 issues) to institutions and  
non-members is £108 (UK) or £124 /  
US\$247 (Rest of World).

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## LEDGES LEGEND

Steve Etches - the legend of the  
Ledges - has been collecting,  
preparing and describing fossils  
from the Kimmeridge Clay for much  
of his life. He has now amassed a  
huge collection, which he keeps at  
his home in Kimmeridge and which  
is available by appointment to researchers and  
visitors. But this arrangement is far from ideal.  
For over 18 years Steve – possibly the most highly  
regarded amateur geologist in Britain today - has  
been trying to establish, in Dorset, a new home for  
his amazing and highly specific museum of  
Kimmeridgian life.

Make no mistake about it - the Etches Collection  
is renowned worldwide and has global scientific  
significance as the single largest collection of  
macrofossils from the Kimmeridge Clay Formation  
outside the Natural History Museum (which in  
many respects it greatly outstrips). Much of the  
material it contains is undescribed and completely  
new to science. It is a unique resource - not only to  
academics, but also to the County of Dorset, the  
Jurassic Coast World Heritage Site on which it sits,  
and the public.

Problem is, it remains a private museum in a  
converted garage - albeit one curated to the highest  
standards, with strict humidity control. For this  
material to be described, it needs to reside in a  
museum with Registered Museum status. For the  
public to appreciate it properly, in order for schools  
and universities to use the collection as part of  
their teaching, the collection has to be somewhere  
that can accommodate them.

There have been many disappointments along  
the way, but finally, it looks as though the Etches  
Collection is at last going to get the new,  
independent home it deserves.

A bid has been lodged with the Heritage  
Lottery Fund which, if successful, will set in  
train a series of events that will culminate in a  
newly built custom-designed museum on a  
donated greenfield site in the very village where  
Steve has made his home. The land is secure, the  
planning is secure; and there have been no  
objections from the local community, which  
supports the project 100%.

We cannot conceive of a project better prepared,  
with more powerful moral and matching financial  
support, or that is more worthwhile, or more  
eagerly anticipated than this. If the HLF were to  
fail at this late stage to back Steve's nigh-on 20-year  
fight for funding, this magazine at least would  
have to question what exactly that body thinks it is  
there to do.

**DR TED NIELD** EDITOR





# Point-counter point

BY HAYDON BAILEY

Haydon Bailey\* was co-author of May's *Soapbox* article, which gave rise to some stinging criticism of micropalaeontology. Here is his response



'Recently the self-promotion of micropalaeontology has figured large in *Geoscientist*', wrote Cornelia Kohler in the opening line of a letter that was starkly critical of this subject and its practitioners. I would respond that, as no-one else is promoting us, we have to promote ourselves.

Kohler continues: 'I agree that it is a disappearing core discipline and that it has important applications' – so far so good: 'But no one seems to ask why it is losing its significance. Unlike other disciplines, which are becoming more important especially in the petroleum industry, biostratigraphy has failed to enter the 21st Century.'

## SIGNIFICANT

I would respond that this discipline has not lost significance. If anything, it is as significant as ever – in fact, even more so. Other disciplines need increasingly sophisticated technology to generate their raw data and high-powered systems to manipulate them. While the latter is true also of biostratigraphy, it scores over other disciplines by the fact that generating its raw data involves using a well-trained pair of eyes with an agile brain behind them. These represent a system that very rarely breaks down, even when 21st Century tools do.

Kohler says she strongly believes that micropalaeo 'needs to reinvent itself and free itself from the past'. Here, I would echo comments by John Athersuch about such new techniques as 'biosteering' and the state-of-the-art software tools we now employ to marshal our data. Kohler complains of what she sees as merely 'saving' the 'old



ways'. Well, maybe – though that is not, I think, by any means 'all' we are saying. Sometimes "old ways" are there for a reason – they work, and reliably. At wellsite, for example, 21st Century technologies are more widely used than ever before, but they are not immune from breakdowns – nor are they, in the end, as intelligent as highly skilled people.

'By ignoring its shortcomings, as it has done for long time, this discipline will further lose importance and appeal' Kohler concludes. Well, if this were true I would agree but micropalaeontology has lost neither importance nor appeal – just its support within the broader geoscience community – hence our 'self-promotion'.

Kohler concludes: 'There are sadly very few pioneers left and these are usually heavily criticised. So, I plead to micropalaeontologists: stop patting each other on the back, stop thinking it is a perfect discipline and start reinventing yourselves – geology needs you!'

## BACK-PATting

I'm unsure about this point, who these 'pioneers' are and who is criticising them. But no-one has been doing any back-patting – quite the opposite. Micropalaeontology is probably one of the most competitive disciplines within geoscience. No-one thinks it a "perfect discipline"; if anything, we are constantly re-inventing the uses, applications and presentation of our data.

But on one thing I believe Claudia Kohler is, finally, correct, and on it we can conclude in a note of agreement. We are *needed*.

\* Haydon Bailey Network Stratigraphic Consulting Ltd., Harvest House, Cranborne Rd., Potters Bar, Hertfordshire EN63JF. Bailey and Jones's *Soapbox* piece was accompanied by an Online Special. E: [Haydon@network-stratigraphic.co.uk](mailto:Haydon@network-stratigraphic.co.uk). Cornelia Kohler's letter appeared in the July issue of *Geoscientist* (22.06). This correspondence is now closed.

## SOAPBOX CALLING!

Soapbox is open to contributions from all Fellows. You can always write a letter to the Editor, of course: but perhaps you feel you need more space?

If you can write it entertainingly in **500 words**, the Editor would like to hear from you.

Email your piece, and a self-portrait, to [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk). Copy can only be accepted electronically. No diagrams, tables or other illustrations please.

Pictures should be of print quality – as a rule of thumb, anything over a few hundred kilobytes should do.

Precedence will always be given to more topical contributions. Any one contributor may not appear more often than once per volume (once every 12 months).

“ MICRO-PALAEONTOLOGY HAS LOST NEITHER IMPORTANCE NOR APPEAL – JUST ITS SUPPORT WITHIN THE BROADER GEOSCIENCE COMMUNITY – HENCE OUR 'SELF-PROMOTION' ”

Haydon Bailey

# Polygon puzzle

Martian polygons formed under similar conditions to those on Earth, say scientists from the University of Texas, and lend support to 'wet Mars' hypotheses. **Kea Giles** reports

## PLANETARY GEOLOGY

Debate continues over the origin of large-scale Mars polygons hundreds of metres to kilometres in diameter, after decades of detailed observations. Similarity in geometric patterns on Mars and Earth has long captured the imagination. Geologists at the University of Texas at Austin examine these large-scale polygons and compare them to similar features on Earth's seafloor, which they believe may have formed via similar processes. Understanding these may in turn support the idea of ancient oceans on Mars.

Through examination of THEMIS, MOLA, Viking, and Mariner data and images, planetary scientists have found that areas on the northern plains of Mars are divided into large polygon-shaped portions. Sets of such polygons span extensive areas of the Martian surface.

Writing in *GSA Today*, Lorena Moscardelli and her colleagues from The University of Texas at Austin present a detailed comparison of the geometric features of these large Martian polygons and similar features found in deep-sea sediments here on Earth.

“UNDERSTANDING THESE POLYGONS MAY IN TURN SUPPORT THE IDEA OF ANCIENT OCEANS ON MARS”

## FINE-GRAINED

On Earth, polygon-shaped areas, their edges formed by faults, are common in fine-grained deep-sea sediments. Some of the best examples occur in the North Sea and the Norwegian Sea and have been imaged by 3D seismic surveys conducted in the search for offshore oil and gas deposits. These deep-water polygons tend also to be a kilometre or more across.

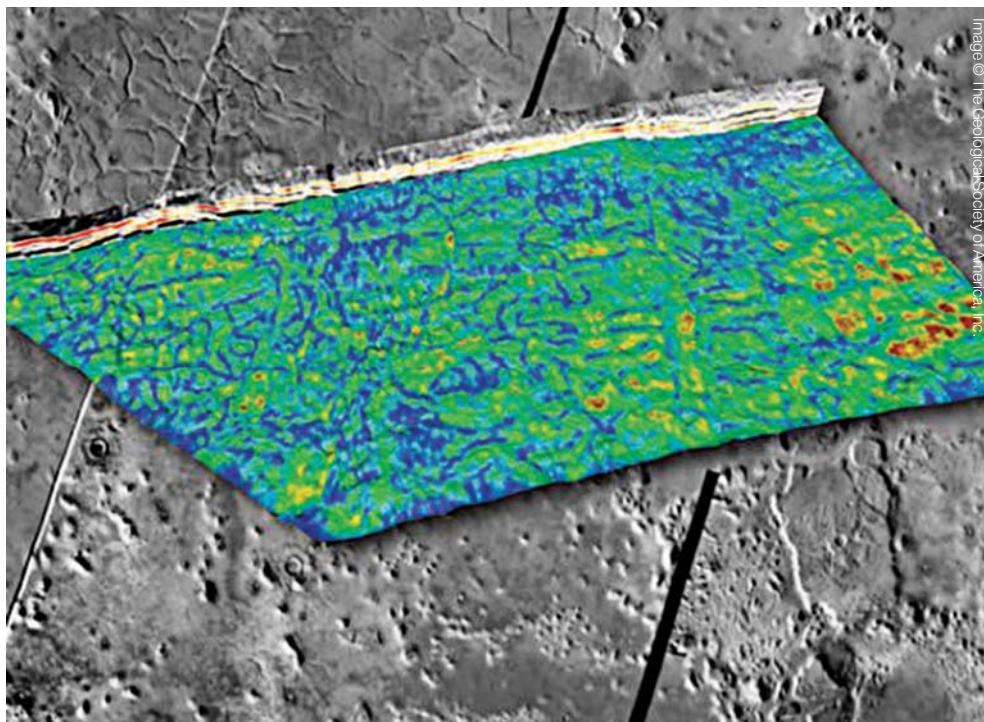
Moscardelli and her colleagues conclude that the majority of these polygons form in a common environment, when fine-grained clay sediment in ocean basins deeper than

500m are shallowly buried by younger sediments. Typically the physical mechanism of polygon formation requires the existence of a thick, wet, and mechanically weak sediment layer.

Moscardelli and colleagues believe that the angle of the sea-floor slope plays an important role in both the formation and preservation of polygons. Where the seafloor slope is gentle (less than half a degree), polygons have very regular shapes and sizes. In many locations where polygons have formed on top of buried topographic features, the shapes of the polygons were altered, and in some cases broken up and disrupted where the slopes were steepest. Both observations are consistent with deformation of soft marine sediments as they creep or flow down slope.

## NORTHERN PLAINS

On Mars's northern plains where the surface is basically flat, polygons have very regular shapes and sizes - remarkably similar to those found on Earth. In places where the topography on Mars is more varied, and where there may be evidence for other



**Above:** Terrestrial deep-water marine polygons (front, color image) are potential morphological and genetic analogs to large-scale Martian polygonal features (grayscale). **Front:** The terrestrial deep-water polygons are imaged using 3-D seismic-reflection data acquired by the oil and gas industry in offshore Norway (Brygge Fm.). **Background:** THEMIS imagery shows the character of large-scale Martian polygons in Acidalia Planitia (Vastitas Borealis Formation).

sediment-transport features on the surface, areas of deformed and disrupted polygons can be found – again, similar to disrupted polygons here on Earth.

On the basis of these striking similarities, the team argues that the Martian polygons were formed within a thick, wet, and weak layer of fine-grained sediments that were deposited in a deep-water setting, similar to the Earth polygons. Thus, these interesting geometric features may provide additional evidence for the existence of an ocean in the northern portion of Mars approximately three billion years ago.

## REFERENCES

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October 22nd-23rd, 2012

# Appreciating Physical Landscapes: Geotourism 1670–1970

## The Geological Society, London

Geotourism's burgeoning literature has tended to focus on descriptions and case studies of modern interpretative and promotional provision in protected areas and geoparks. The significant historical antecedents of modern geotourism in Britain and Europe are comparatively neglected in the literature. Whilst these antecedents can be traced back to the elite 17th century travellers who ventured into wild landscapes and visited caves and mines, early modern geotourism, with many of the features of its present-day provision, can be recognised if not so named from the opening of the 19th century. This latter period more than coincided with the emergence of modern scientific geology and the beginnings of excursion tourism; the organised publication of regional geology guide-books and geology field excursions followed from the first quarter of the nineteenth century. The conference's timeframe opens with the early reportage of elite travellers and the publication of the first travellers' guide-books and closes at the cusp of modern landscape and geoconservation measures, such as national parks, areas of outstanding natural beauty, national nature reserves, and the emergence of environmental interpretation and modern countryside leisure as forerunners to modern geopark provision.



*Lithograph of Käse-grottee at Bad Bertrich  
from Dr. August Goldfuss' Naturhistorischer Atlas, 1826*

### Summary Conference Information

The conference is split between: a

**Paper Reading Day** (22nd October) with 2 Keynote speakers, 12 paper presentations, and a poster session. Registration (including Abstracts Volume, refreshments and wine reception); costs from £45-£65

**Field-Excursion** (23rd October) to the Isle of Thanet (including rail fare, guide, snack luncheon, and afternoon tea); cost is £45

**For further information** about the conference please contact:

Conference Office, The Geological Society, Burlington House, Piccadilly, London, W1J 0BG

T: 020 7434 9944 F: 020 7494 0579

E: [naomi.newbold@geolsoc.org.uk](mailto:naomi.newbold@geolsoc.org.uk)

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### Conference Organiser:

**Tom Hose**, *University of Bristol, UK*  
[gltah@bristol.ac.uk](mailto:gltah@bristol.ac.uk)

**Follow this event on Twitter #apl12**



# Wreck of a medusoid?

Joe McCall describes an important new finding of Ediacaran fossils in peninsular India that may be the first palaeontological marker of the base of the Phanerozoic

## PALAEONTOLOGY

Chirananda De (Palaeontology Division, Geological Survey of India) has reported important new finds of Ediacara fossil assemblage associated with simple tubular trace fossils *Planolites*. The fossils come from purple biomat-bearing shales and siltstones of the Sonia Formation, Jodhpur Group, Marwar Supergroup, of Rajasthan, Western India<sup>1</sup>.

This discovery follows a similar one in the Vinhyans of Central India<sup>2,3</sup>, and much earlier discoveries in the Krol Formation of the lesser Himalaya<sup>4</sup>. Thus there are now three widely separated Neoproterozoic fossil localities in peninsular India,

consistent with the global distribution of these rare and unique soft-bodied fossils.

The fossils are all medusoids, similar to those found in NW Canada and S Wales<sup>5</sup>, there being no branching *Charnia*-like forms, which dominate in Newfoundland<sup>6</sup>. One Sonia medusoid is hexagonal, a novel peculiarity. Trace fossils *Cruziana* and *Rusophycus* are found higher up in the sequence, along with *Diplicnites*.

Trace fossils do occur in the Neoproterozoic<sup>5</sup>; but there are also possible trilobite body impressions on the same bed, and in continuation with *Cruziana* higher up<sup>6</sup>; so this succession appears to offer a more or less smooth transition into the

**Below: A 'medusoid' typical of the Ediacara fauna (not from India). Not all may be as it seems however. *Tateana inflata* (once known as '*Cyclomedusa radiata*') is now thought to be an attachment disk of unknown organism**

Tommotian. If this possibility is upheld by future work, it would represent the very first palaeontological delineation of the Precambrian/Cambrian boundary in peninsular India.

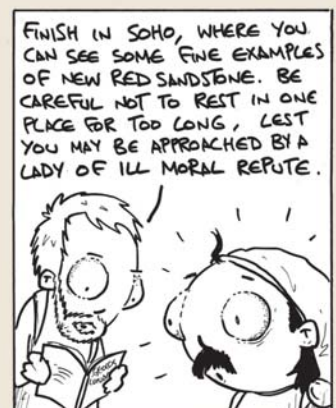
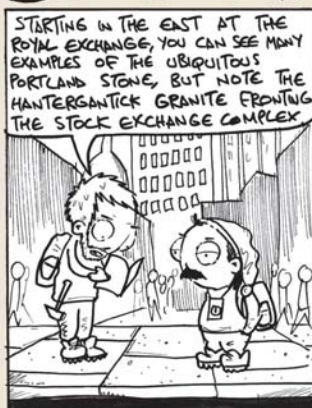
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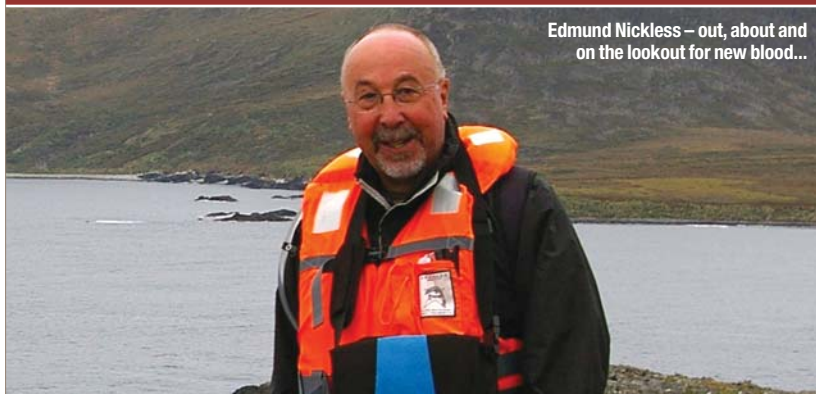


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# SOCIETY NEWS

## JOIN COUNCIL!



Edmund Nickless – out, about and on the lookout for new blood...

### Would you consider standing for election to Council? Executive Secretary Edmund Nickless issues the annual call for nominations

Are you willing to contribute to the work of the Society not only by becoming a member of Council and one of its standing committees but also by serving on working groups and undertaking particular tasks between meetings?

Whatever your background and expertise in the geosciences, membership of Council enables you to influence the role of the Society in acting as a respected voice serving society and the geoscience profession.

Each of the 23 members of Council is a trustee of the Society, accountable to the Fellows and to other stakeholders and regulators, such as the Charity Commission. Trustees' prime responsibility is to oversee the Society's affairs and act prudently in the management of its financial resources.

Council meets five times a year, usually on a Wednesday. Four take place in the afternoon (14.00-17.00). Papers are circulated a week in advance. There is also a two-day residential meeting (early February) beginning in the afternoon and finishing mid-afternoon, the next day. Its purpose is to allow Council to discuss issues such as strategy, business planning etc.

All Council members serve on a standing committee – External Relations, Information Management, Finance and Planning, Science, Professional or Publications Management (PMC). These usually meet quarterly; though recently the PMC has developed the practice of having one virtual and three actual meetings.

From time to time all standing committees may establish short-lived working groups which could impose a further call on the time of Council members but in agreeing to stand for Council you should think of a time commitment of 8 to 10 days annually for ordinary members of Council.

If elected to Council you will play an active role formulating and delivering the Society's scientific and professional strategy, facilitating the communication of new scientific findings, engaging with and translating knowledge and expert advice to society, policy makers and government, and in certifying good practice in the geoscience professions and teaching.

► This month's mailing contains **two nomination forms** - one for the election of new Council members and the other for President-designate. Details of the process may be found on the forms and also in the 'Governance' section of the website. The closing date for nominations is **4 January 2013** and nominations will NOT be valid unless they are fully completed, signed and accompanied by a statement by the nominees.

► Please return to **Professor Alan Lord**, c/o Executive Secretary, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.

## Geoscience Academy

**From geophysics to palaeontology, there are many options for geology undergraduates. But what about school? Joe Mears reports**

At school, geology is rarely taught as a specialist subject. Students are often introduced to the subject as part of other science lessons, by teachers whose specialism lies in other fields.

With the help of BP, the Geoscience Education Academy (GEA) was launched by the Geological Society in 2010, to equip teachers with specialist tools for teaching geoscience as part of their science lessons.

"When I was at school, geology wasn't taught" says BP Director of Geology Nev Jones. "I had a teacher who saw something in me and helped me study it. There must still be hundreds of students out there like me, who need to be pointed in the direction of geoscience."

### RESIDENTIAL

The five-day residential course aims to provide teachers with a variety of tools for communicating geoscience, as well as an understanding of the careers available. Though places are limited, the learning material is designed to be passed on to other teachers, and support continues long after the GEA is over thanks to the Society's Schools Affiliate Scheme, Schools Geology Competition and Earth Science Week. In this way, the GEA has reached a staggering number of students across the UK.

As well as financial support, BP provides a chance for teachers to experience first-hand what goes on behind the scenes at the company. At BP's Sunbury offices, they learn the complexities of how oil is found, handle core samples and meet geoscience graduates at the beginnings of their careers.

Participants also visit the Natural History Museum to see the same equipment used in a very different way, find out about research careers, and handle incredible specimens. All this builds a picture of where their own students can fit into the future of the geosciences.

"The visits were an eye-opener to me" says James Salmon, a biology teacher who attended GEA 2011. "The ambience of the course was wonderful; fast-paced, demanding and provoking."

### BOOK NOW

The next GEA is on 19 – 24 October, and forms part of the Society's continued efforts to develop and expand its educational activities.

► See online for a longer version of this report. The theme of this year's Earth Science Week (15 - 19 October) is 'Careers in Geoscience', and will culminate with the third annual GEA. For further information: **E: joanna.mears@geolsoc.org.uk**.



[LECTURES]

## Shell London Lecture Series



### Pollutants and Human Health in the Age of Man

Speaker – Professor Jane Plant

**10 October 2012**

Between 160,000 and 200,000 years ago a biological change took place that would disrupt the natural equilibrium of the Earth that had existed for the previous 4.5 billion years - the evolution of *Homo sapiens*. From about 70,000 years humans spread around the Earth. At first we made little impact but from about 9000 years ago settled agriculture saw the first anthropogenic changes to chemicals in the environment. That process has continued and now, new substances, such as engineered nano-materials, have begun to be released. Politicians are battling to deal with just one of the chemical impacts of these changes - the accumulation of greenhouse gases in the atmosphere. But there are many other serious chemical threats to the Earth as a planet capable of sustaining human life.

Jane Plant is Anglo American Professor of Geochemistry at Imperial College London. For over 30 years she worked at the NERC British Geological Survey, where she rose to become Chief Scientist. Jane is a world expert on environmental geochemistry and has played a key role in raising public awareness of geochemistry and health, from element deficiency studies in Africa and Asia, to linkages between diet and such illnesses as osteoporosis and cancer. Her best-known book – *Your life in your hands* – has sold several million copies worldwide and been translated into 20 languages.

■ **Programme** – Afternoon talk: 1430 Tea & Coffee: 1500 Lecture begins: 1600 Event ends.

■ **Programme** – Evening talk: 1730 Tea & Coffee: 1800 Lecture begins: 1900 Reception.

### FURTHER INFORMATION

Please visit [www.geolsoc.org.uk/shelllondonlectures12](http://www.geolsoc.org.uk/shelllondonlectures12). Entry to each lecture is by ticket only. To obtain a ticket please contact the Society around four weeks before the talk. Due to the popularity of this lecture series, tickets are allocated in a monthly ballot and cannot be guaranteed.

► Contact: **Naomi Newbold**, The Geological Society, Burlington House, Piccadilly, London W1J 0BG, T: +44 (0) 20 7432 0981 E: [Naomi.newbold@geolsoc.org.uk](mailto:Naomi.newbold@geolsoc.org.uk)



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## FROM THE LIBRARY

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

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

## The Long View Reflected

### A Burlington House Lecture for the general public

Chris Orr, Royal Academician, painter, printmaker and writer's engaging and often humorous drawings and prints of cities (including New York, Nagasaki, Dresden and London) explore the deep DNA of urban centres to understand their cycles of perpetual renewal and creative energy. His work about London centres on the River Thames, with which he has been familiar all his life. Recently he has been mostly working from a penthouse with a view of Bankside. In this lecture he will discuss his own

art, and that of other artists including James Whistler, J M W Turner, Oscar Kokoshka, Canaletto, Claude Monet, Walter Greaves, Stanley Spencer and Wencelous Hollar whose 1647 'The Long View of London from Southwark' inspired Orr's recent work.

■ Tea/coffee from 17.30. Lecture starts at 1800, Reception 1900.

### ► REGISTRATION

Admission is free but by ticket only available from the Conference Office, Geological Society on **020 7434 9944** or email: [registrations@geolsoc.org.uk](mailto:registrations@geolsoc.org.uk).  
W: [www.burlingtonhouse.org](http://www.burlingtonhouse.org)



## The Geological Society Club

The Geological Society Club, successor to the body that gave birth to the Society in 1807, meets monthly (except over the field season!) at 18.30 for 19.00 in the Athenaeum Club, Pall Mall. Once a year there is also a special dinner at Burlington House. New diners are always welcome, especially from among younger Fellows. Dinner costs £52 for a four-course meal, including coffee and port. (The Founders' Dinner, in November, has its own price structure.) There is a cash bar for the purchase of aperitifs and wine.

■ **2012:** 12 September; 17 October

■ **2013:** 16 January; 20 February; 13 March; 10 April (Burlington House); 15 May.

► Fellows of the Society wishing to dine should send cheques, payable to 'Geological Society Club', to: **Cally Oldershaw**, c/o Shashu Lalji, Department of Earth Sciences, Natural History Museum, Cromwell Road, London SW7 5BD. E: [cally.oldershaw@btopenworld.com](mailto:cally.oldershaw@btopenworld.com) DR

### FUTURE MEETINGS

Dates for meetings of Council and Ordinary General Meetings until June 2013 shall be as follows:

- **2012:** 28 November
- **2013:** 6 February (1500); 10 April



**O**ne hundred years ago, in the German city of Frankfurt, a young man who at Marburg University worked as a physicist and meteorologist told a meeting of the recently founded *Geologische Vereinigung* (GV) how the Earth functions. He shocked the meeting of eminent geologists with an outrageous idea – that since the Late Palaeozoic the continents and oceans were not fixed – and that they had once been grouped together in one vast supercontinent, Pangaea, and one even larger ocean. The continent had fragmented and the fragments drifted apart, five modern oceans forming between them.

Alfred Wegener and his ideas were not welcomed and his ideas were rejected furiously by most geologists. However, he was convinced that his unorthodox interpretation explained a wealth of many puzzling observations better than other theories – and in a manner that definitely called for further tests. In the same year, 1912, his ideas were published in an important geographical journal, *Petermann's Geographische Mitteilungen* (PGM). Geographers seemed less hostile to his ideas, which Emile Argand (University of Lausanne) and an early convert, later referred to as 'mobilism'.

Early in the 20th Century, Earth science was making great strides. Was there a general unifying theory, such as cooling and shrinking, that could embrace all the new discoveries? Influential geologist Eduard Suess suggested that contraction caused episodic sagging of the Earth's surface, as former continents foundered. But many thought that continents and oceans were permanent. Little was known about the

seafloor then, and the concept of geological time was vague and relative. Lord Kelvin's estimate of the Earth's cooling time provided millions of years, but uniformitarianism, combined with estimates of the rates of various processes, seemed to demand much longer than that and certainly more than the paltry millennia of biblical creation. Palaeontologists envisaged 'infinite' epochs of evolution. Radioactivity had been discovered, but was not yet convincingly applied to absolute dating. Earth evolution was the subject of many speculative 'geotectonic hypotheses'.

## MATCH

Wegener had not hitherto been involved in the debate – surely an advantage – but he was probably aware of it. This was in his character; although focused on meteorology and the study of the atmosphere, he was curious about the Earth as a whole and often looked at globes and wondered about patterns of land and sea. His fiancée, Else Köppen, in her 1960 biography of Alfred, quotes from a letter of January 1911:

"My roommate ... got *Andree's Handatlas* (Scobel, 1910) as a Christmas gift.

For hours we admired the magnificent maps. A thought occurred to me: ...

Does not the east coast of South America fit the west coast of Africa as though they had been contiguous in the past?

Even better is the fit seen on the bathymetric map of the Atlantic when comparing ... the break-off into the deep sea. I must follow this up". So we can date the spark that led to Wegener's revolutionary mobilist ideas precisely to Christmas 1910.

Others had noted the match – Bacon, 1620; Osmond Fisher, 1889; George ►

# ALFRED WEGENER

## 100 YEARS OF MOBILISM

**Wolfgang R. Jacoby\*** celebrates the centenary of Alfred Wegener's first publication on continental drift, the greatest revolution in Earth science since James Hutton



Alfred Wegener on board of  
the ship "Godthaab", before  
crossing Greenland in 1912/13



► Darwin, 1898; William Pickering, 1907; Frank Taylor, 1910; Alexander von Humboldt, 1801. Wegener was not then aware of them, and none of them had thought of continental drift in quite the way he had. In 1910, Taylor attempted to explain Mesozoic to Recent orogeny on a global scale by suggesting large changes in planetary oblateness. Wegener remarked: "It does not appear that Taylor has realised the immense consequences of such large displacements of continents. As he did not investigate the implications despite their contradiction of traditional views, his suggestion has probably been met mostly with scepticism. For my work this was not the starting point ... I learnt about it later."

Wegener began to look in earnest for evidence in the geological literature (not in those days the huge flood it is today!). It was then that he came across earlier allusions to the fit of coastlines, and the palaeontological literature on 'land bridges'.

He was alert to Theodor Arldt's 1907 book: *Die Entwicklung der Kontinente und ihrer Lebenswelt* [The evolution of continents and their living beings], an analysis of what some 20 palaeontologists had to say about trends in the evolution of species on landmasses now facing one another across wide oceans. Between Africa and Brazil, for example, he found that divergence began in late Early-Cretaceous, providing strong support for their former contiguity. On the basis of Arldt's analysis, in 1921 he plotted the evidence for both convergence and divergence against stratigraphic time to illustrate initial contact and later separation of continents.

## CONNECTION

Another persuasive argument was the connection of geological structures, such as coal-bearing Carboniferous formations, across oceans like the Atlantic. He clearly saw the climatic argument provided by evidence of Permian glaciation on continents now far distant from one another. By reassembling continents Wegener found that a wealth of geological and geophysical phenomena fell into place, which increasingly convinced him that continental drift was a reality.

And so, as we mentioned above, on 6 January 1912, at a meeting of the *Geologische Vereinigung* (GV) in Frankfurt, he went public for the first time, with a lecture entitled *Die*

Wegener launching a meteorological balloon



Photo: Alfred Wegener Institut

Alfred Wegener 1930  
Far right: Wladimir Peter Köppen (1846-1940), Climatologist and Wegener's father-in-law

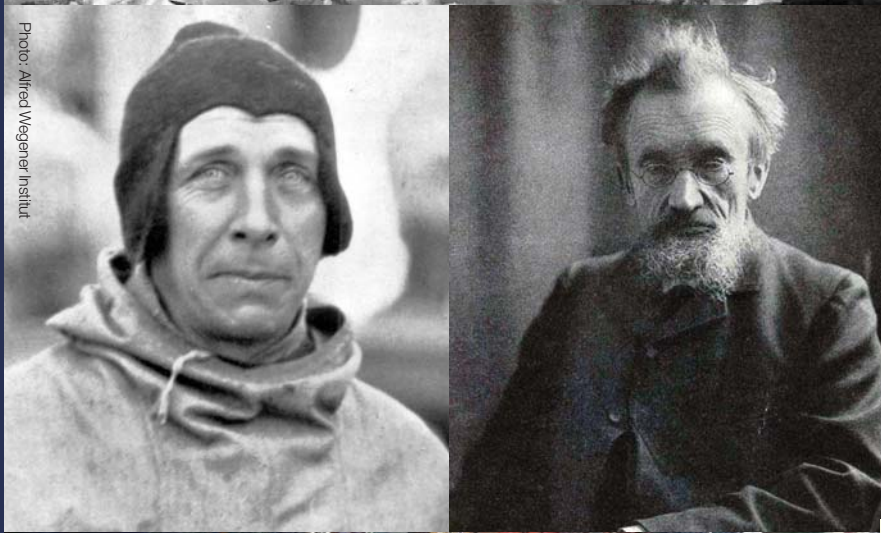


Photo: Alfred Wegener Institut

The Alfred Wegener Institute of Polar and Marine Research in Bremerhaven, Germany. Building near the Old Port in the city

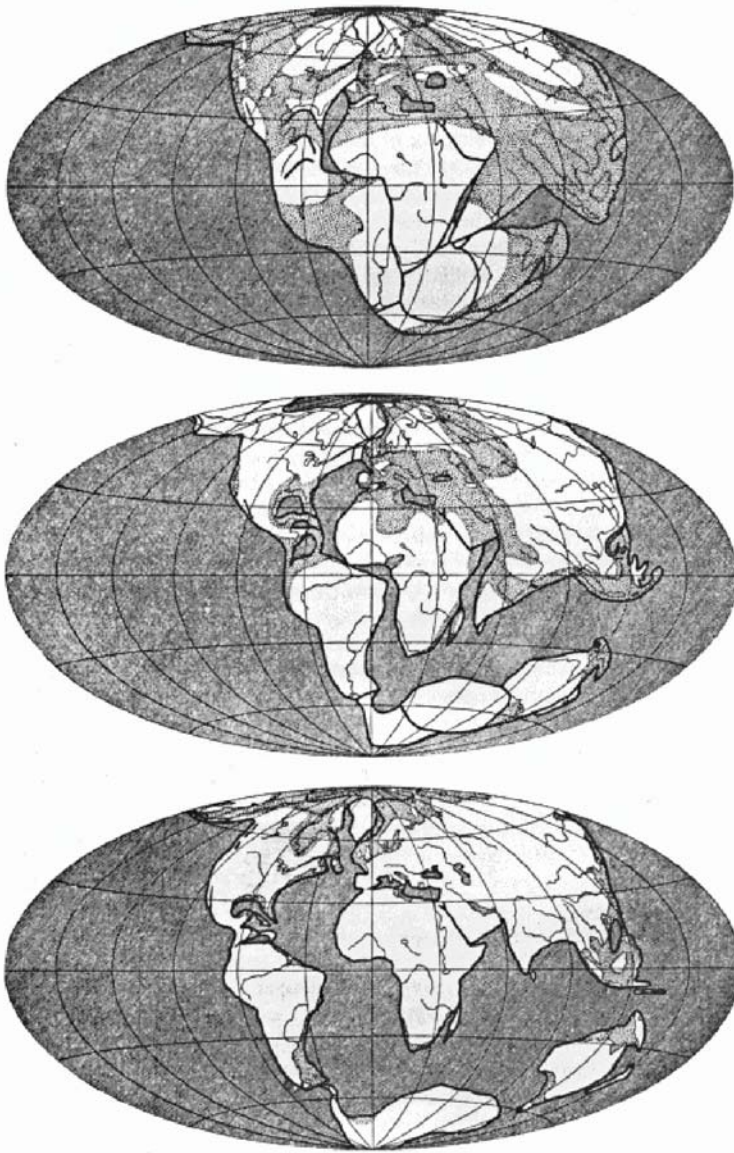


Photo: Alfred Wegener Institut

Dragon's Back (Elkhorn Scarp) in the Carrizo Plain – the trace of the San Andreas Fault







Wegener's iconic diagram of post Pangaea continental drift



Image: Royal Society

FIGURE 8. Fit of all the continents around the Atlantic at the 100 fm. contour, transverse Mercator projection.

The Bullard Fit – from 'The Fit of the Continents Around the Atlantic', co-authored by Sir Edward Bullard, 1965

*Herausbildung der Großformen der Erdrinde (Kontinente und Ozeane) auf geophysikalischer Grundlage* [Building Earth's main crustal structures (continents and oceans) on a geophysical basis]. This was later published in GV's journal, *Geologische Rundschau*. We have noted that geological audience's negative reaction; but a few days later, speaking on 'Horizontal Drift of the Continents' to the Marburg Society for the Advancement of Science, he enjoyed a more positive reception and immediately afterwards began work on the extended version 'PGM12', which he finished in a few months. Six months later he boarded a ship for Greenland and Iceland.

## COLLEAGUES

Wegener's Marburg colleagues helped greatly by searching the literature and bringing him references: "The geologists recover everything I need and bring it to me, saving nine tenths of my time. Otherwise it would have taken months...". Young geology professor Hans Cloos remained sceptical but constructive, and Wegener updated his paper with new results and arguments. Wegener wrote: "Such a large number of surprising simplifications and interrelationships become visible after only a preliminary scanning of the main geological and geophysical results, and for that reason alone I consider it justified, even necessary, to replace the old hypothesis of sunken continents by the new one, because it appears to be more successful. The old hypothesis [land bridges] has been demonstrated inadequate by its antithesis of the permanence of the oceans. In spite of its broad foundation I call the new idea a working hypothesis and I wish it to be taken as such, at least until it has been possible to prove by astronomical positioning with undoubtable accuracy that the horizontal displacements continue to the present day."

So what made Wegener so sure he was on the right track? Else Wegener quotes from a letter he wrote in 1911 to her father Vladimir Köppen, who had advised his young protégé against allowing himself to be 'side-tracked'. Wegener responded: "I think you consider my original continent [Pangaea] more fantastic than it is, and you do not see that it is but an interpretation of observations. ... We must assume a land connection, e.g., between South America and Africa, which ended at a certain time. It may ▶



► have happened in two ways: (1) by the collapse of a connecting continent or (2) by the widening of a great rift. ... The first one contradicts the modern concept of isostasy and our physical understanding. A continent cannot sink, for it is lighter than that on what it floats. Considering the second hypothesis, we find a wealth of simplifications making more sense in the whole geological history; should we not throw the old hypothesis overboard?"

In the early decades of the 20th Century geographical research was closer to geology than it is today and geographers were less inhibited by geotectonic doctrines. The editor of *PGM*, Professor Langhans, accepted Wegener's manuscript for publication unabridged, in three parts. The article caused great excitement, and not all of it negative. Its arguments ought to have made objective geologists think; but first reactions were inevitably rather subjective. Many renowned geologists ridiculed the idea.

Strong opposition from geologists and (especially) geophysicists persisted for decades worldwide, especially in Germany and America, even into the 1960s. In contrast, several geodesists, especially the director of the Geodetic Institute Potsdam, Friedrich Robert Helmert, considered drift a serious hypothesis. Unfortunately, in the 1930s geodetic observations were too inaccurate for adequate tests to be conducted. By the time I was a student, in the late 60s, the tide was turning; but most of my teachers were still very sceptical.

## PALAEOCLIMATE

After World War I, Alfred Wegener worked in Hamburg; he and Else were married and moved in with her parents. Close cooperation developed between Wegener and his father-in-law. Else wrote that her father first opposed the new ideas but as he became more involved became convinced that the idea provided 'paths through the labyrinth of palaeoclimates'. Else wrote: "Often my father waited impatiently for Alfred to come home and to discuss new arguments". Wegener himself wrote of how he enjoyed: "...a daily exchange of ideas with Köppen, and I had the satisfaction that he, initially cool and doubtful, increasingly warmed to drift theory, and finally convinced himself that here the 'red thread' through the labyrinth of palaeoclimatology had been found. Several chapters were written in such close exchange of ideas that the bounds of intellectual ownership can no

longer be decided".

Four years of criticisms, support and hard work resulted in their book *Die Klimate der geologischen Vorzeit* [*The climates of the geological past*] (1924). One positive voice came from Milutin Milankovitch, who wrote: "I am impressed by your splendid concise and concentrated presentation. I am easily convinced by such a material of facts woven into a common idea."

Wegener thought a lot about the mechanism of drift. However, his priority in 'PGM12' was to describe the phenomenon. Explanations could wait. After discussing isostasy and plasticity at length and describing geosynclines in a quite modern way (as an isostatic response to sediment loading of continental margins) Wegener wrote: "...what forces cause horizontal drift, is an obvious question ... but premature. It is first ... necessary to exactly realise the reality and nature of the movements before we can hope to understand their causes." He discussed polar wander, and thought of it as a consequence, not a cause, of mass-changing redistribution related to drift. He considered tidal forces a more likely cause. "Possibly for the time being, it is best to consider continental drift the consequence of accidental currents inside Earth. Hopefully it will be possible in the future to separate the accidental aspects from the tendency toward equilibrium in rotation."

Interestingly, at first Wegener envisioned a phenomenon akin to 'seafloor spreading'. In 'PGM12' this idea is expressed twice, most significantly on page 305: "... we now seem able to explain the different ocean depths. Since for large areas we will have to assume isostatic compensation of the seafloor, the difference means that the seafloor we believe to be old is also denser than that believed to be young. Moreover, it seems undeniable that freshly exposed sima ... will for a long time maintain ... higher temperatures (perhaps 100°C in the uppermost 100km on average) than old, largely cooled seafloor. ... The depth variation appears also to suggest that the Mid-Atlantic Ridge should be regarded as the zone in which the floor of the Atlantic, as it keeps spreading, is continuously tearing open and making space for fresh, relatively fluid and hot sima from depth."

## WORLD WAR ONE

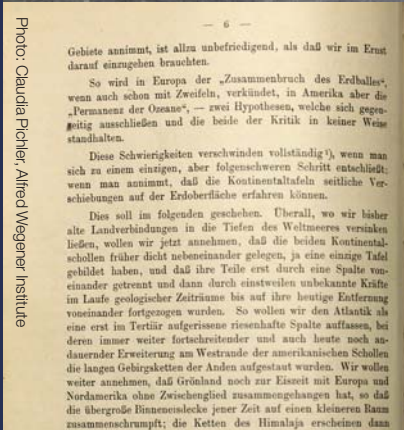
Wegener was wounded early in the war, and it was while convalescing in Marburg that he wrote the first version of his 1915 classic text *Die Entstehung der Kontinente*

Wladimir Köppen in his obituary of Alfred Wegener 1931, wrote: 'His great silence, willing to make sacrifices and friendly justice made him to a qualified leader of expedition.'

One of the last, if not the last picture: Wegener with Rasmus Villumsen, whose body was never found

Memorial plaque, Alfred Lothar Wegener, Georg-Wilhelm-Str 20, Berlin-Halensee, Germany

Alfred Wegener's copy of the first edition of 'Die Entstehung der Kontinente und Ozeane', filled with his handwritten notes





HAUSE LEBTE  
BIS 1909  
YSIKER UND  
FORSCHER  
WEGENER  
KONTINENTAL-  
NGSTHEORIE  
30 IN BERLIN  
EN 1930 IM  
EN INLANDEIS

Alfred Wegener (1875-1930) war ein deutscher Geophysiker und Meteorologe. Er ist bekannt für seine Theorie der Kontinentalverschiebung, die er in seinem Buch 'Die Entstehung der Kontinente und Ozeane' (1915) darlegte. Wegener war ein vielseitiger Wissenschaftler, der auch in den Bereichen Polarforschung und Klimawandel tätig war. Er starb im Jahr 1930 in Grönland, während einer Expedition.

und Ozeane [The Origin of Continents and Oceans], in which he replaced his earlier 'sea-floor spreading' idea with a model involving continental 'rafts' floating through viscous sima. Why did he do this? Perhaps it was an arctic explorer's experience of ice as a flowing, solid 'rock'.

Three more editions followed, the second (1920) written mostly in Marburg, the third (1922) in Hamburg, and the fourth in Graz (1929). The subject of seafloor spreading was never taken up again. In parts his formulations became somewhat defensive, but although the driving mechanism still went unexplained, his conviction remained unshaken that the 'mobilist' view of Earth better explained Earth history and structure than fixist hypotheses could. In the fourth edition, Wegener wrote: "Relative continental movements have been determined by purely empirical means. ... So were the planetary movements of free fall. Then came Newton and derived the laws of gravitation. ... The Newton of continental drift has not yet appeared."

He discussed mantle convection as a possible driving mechanism, but wrote cautiously: "If the theoretical foundations prove reliable ... , which is not yet clear, convection will have to be taken into account as an agent shaping Earth's surface." Summarising: "It must be taken for sure: the forces which move the continents are the same as those that form the great fold mountain belts. Continental drift, divergence and convergence, earthquakes, volcanism, transgressions and polar wander are interconnected in a grand causative scheme. ... Which is cause and which effect, the future will show." At much the same time, Arthur Holmes (1928) proposed the existence of mantle convection resulting from radiogenic heat. In his revised edition of *Principles of Physical Geology* (1965), Holmes treated many aspects of the present essay.

## DEATH ON THE ICE

Wegener did not live to see his last edition in print. He was away in Greenland, where he died in 1930 - shortly after his 50th birthday, returning from the central station on the ice-cap to the western main station. He had intended to bring desperately needed supplies and had to return on skis with only the one Greenlandic, Rasmus Villumsen - who buried him in

his tent dug into ice, marking the grave by his skis. Their radio did not work. The following spring, a search party found the grave. Wegener probably died of heart failure. Rasmus had taken his diaries - but himself never reached the west station. His body was never recovered.

So what prepared Wegener to become the researcher who, a century ago, introduced continental drift as a general theme in Earth history, explaining in such an engaging manner a much wider variety of terrestrial phenomena than any previous theory had done, and who, over the following decades, inspired others to go out and test his ideas? We read of his very early interest in nature, encouraged by his parents - especially his mother. His father was religious, but not dogmatic. Alfred and his brothers and sisters were allowed great freedom. There were arguments between son and father; but in the end, Alfred followed his own interests - which broadened as he grew older. Skilled at seeing connections, he was able to formulate ideas that explained them lucidly. On a global basis he assiduously collected observations and, after reviewing them critically, boldly accepted their consequences. He became courageous and was unafraid of debate and argument.

All these things are probably significant; but in the end we must take Wegener as the true 'Newton of continental drift' - the man who made mobilists of us all. ■

\* Wolfgang Jakob is Professor Emeritus of Geophysics at the University of Mainz

## ACKNOWLEDGEMENTS

I owe the opportunity to write this essay to the Editor of *Geoscientist* and his Editorial Board.

Ted Irving contributed insights into palaeoclimatology in untangling continental drift and polar wander, and the cooperation between Köppen and Wegener. I thank him for reviewing my draft, many clarifying comments and corrections. Exchange with numerous colleagues over the years has helped me better understand Wegener the man, and his science. Finally, I am grateful to Alfred Wegener himself for the inspiration and encouragement that his life and work have given me.

## FURTHER READING

For an extensive list of references and further reading, please consult the online version of this article.





# KIMMERIDGE LEGEND

**Ted Nield** visits the private museum of a palaeontological pioneer as he nears what he hopes will be the end of a 20-year quest





**T**hose who once perused the introduction to British Mesozoic Fossils, the British Museum (Natural History)'s essential – and once ubiquitous – fossil-hunter's guide, may remember the following line from its introduction: "The Kimmeridge Clay is probably the least attractive to the fossil collector of all the British Jurassic formations".

Fossilist extraordinaire Steve Etches would beg to differ. He has amassed a lifetime's collection of thousands of exquisitely preserved and prepared specimens, many completely new to science, that say otherwise. Next month, he should hear if his 20-year battle to have it displayed in a registered museum with proper access for public and researchers, is finally over. "If it is," he told me, "I am going to have that quote carved over the front door!"

Walking into Steve's house, in the almost impossibly picturesque Dorset village of Kimmeridge, neatly demonstrated the two sides of his life. On the drive were parked two vans marked "Webber & Etches Ltd., plumbing and heating engineers". Inside, after being ushered through kitchen and lounge, I found myself in a windowless outbuilding where, as the lights flickered on, I saw was lined with exquisite fossils – Steve's over-riding passion – together with the framed accolades he has garnered from the world of geology. The Palaeontological Association's Award to Amateur Palaeontologists came first, in 1993; followed by the R H Worth Prize of the Geological Society (1994), the Mary Anning Award of the Palaeontological Association (2005) and most recently, the Geologists' Association's Halstead Medal (2006). That Steve has had to sacrifice the wall space needed to put them on display, suggests how much they mean to him.

## FIRST FOSSIL

Steve was five when he collected his first fossil – an echinoid flint cast, which he put into his



**Above:** Steve Etches shows off his collection to Professor Chris Wilson

**Left (clockwise from top):** Steve Etches: "It's the collection that's important – and it's important that it should be held in a Recognised Museum."

**A Plaster cast of a very rare fish in the Kimmeridgian called *Asthenocormus* sp. Generally thought to be a filter feeder**

**One of the most complete *Lepidotes* from the Kimmeridge Clay, fin perfect**

**Still in preparation and not completed a complete new species of Ichthyosaur from the Upper Kimmeridge Clay**

mother's button box for safe keeping. Fourth of five children, he accompanied his father on his work as a commercial and industrial photographer, and if they finished work early they would go together to remote beaches, collecting anything of interest.

"I spent most of my early childhood searching for things" says Steve: "birds' nests, badger holes, dropped coins, spent gun cartridges – anything. I was not really interested in most subjects taught at school. I saw no point in sport and hated team games. I was always a loner and liked nothing better than to go off on my own. At the seaside I didn't sunbathe – I found it very dull – and so went and investigated the rocks." Steve's enthusiasm for his collection is, and by his own account always was, infectious – his first convert being his own father.

It is easy to understand why. Steve is not a collector of any and all spectacular fossils. His cabinet of curiosities consists solely of "anything that lived in, on, or swam or flew above the Kimmeridgian sea", and his interest in his specimens lies not just in their beauty as objects, or even in the thrill of finding and

revealing something new to science, but for what they can tell us about life and death in the Kimmeridgian. It is this enthusiasm for the fossils as once living objects, and their post-mortem history, that makes Steve a truly inspiring guide to his material.

The first thing I noticed was a huge sauropod humerus centre stage, but as Steve flitted from specimen to specimen, hardly knowing where to begin, I began to see the exquisite *lagerstätte*-like preservation – of cartilaginous material in the fossil sharks, the world-beating quantity and quality of his pterosaur specimens, the insects – dragonfly wings ('delicate filmed as new spun silk' as Hardy might have said); the teuthids with soft parts preserved, the lobsters, barnacles, and the first ammonite egg-cases ever discovered.

## RESOURCE

Steve has always seen his collection as a learning resource for public and researchers; but making it happen has been a long and arduous job. Almost 20 years ago there was a project to build a new museum in Swanage – which was strangled by red tape. Others offered attractive venues, but at ►



► unsustainable rents. A quarry owner once offered a free building, only for the Council to refuse planning permission. A projected museum *cum* tea room seemed poised to draw down then-available rural development grants for the restoration of disused rural buildings - but foundered when it was discovered that the disused barn in question was listed. Cooperation with Lulworth Heritage Centre - where Steve currently has an exhibition based on the striking evidence of predation between species in the Kimmeridgian - has been valuable experience; but the location is obscure and the Centre has to charge entry.

Things began to look up, however, when local landlord Dr Philip Mansel proposed making a greenfield site in Kimmeridge village available for a combined Museum of Jurassic Marine Life and village hall. This proposal, now going under the general heading of 'The Kimmeridge

Project' has met with universal local approval (surely itself a first in rural planning history) and garnered pledges of funding from a green energy firm, the landfill tax credit scheme and a US hospital trust.

At the suggestion of the Heritage Lottery Fund Steve showed his collection to John Woodward, former Director of Bovington Tank Museum, for whose recent revamp he raised £25m, much from the HLF. Woodward took one look and immediately offered his services as a project manager - advising that only the HLF could really do the project justice. Next month, they will hear whether the resulting bid has been successful - that they are finally on track to the £2m that the Project needs.

Steve's mood is upbeat, but he has known too much disappointment to count chickens yet. There's a glint of steel; just as he would never sell his collection, he won't 'sell out', either. He's no

**Below:** A fore fin of *Opthalmosaurus* from the Lower Kimmeridge Clay, Small Mouth Sands, Weymouth

pushover; he wants things the way he wants them, and that's that. "What's the point otherwise?" he says. He also has very definite ideas about museums, and how the material should be presented. He no more wants 'dumbing down' than screeds of minute, learned text. Nor does he want people goggling ignorantly at things they don't understand, too afraid to question, or unable to find someone to ask. He wants all guided, ideally in-person, tours - pre-recorded, failing that - so that people actually do learn about what they are seeing.

## RECOGNISED MUSEUM

That glint of inner steel shines off Steve's absolute (and entirely justified) confidence in the worth of his collection. "We have the world's finest ichthyosaur material from the Kimmeridge. The NHM may have the best fish collection, but for the Kimmeridge, ours is far superior. For pterosaurs, there's no-one to beat us. I know what I've got. I know it can't be replicated anywhere else..." though lest this sound like personal grandstanding, he quickly adds: "But it's the collection that's important - and that it should be held in a Recognised Museum."

Steve has been overwhelmed by pledges of support for the Kimmeridge Project from university and museum academics, and expert individuals in the UK and abroad. He quotes Professor Desmond Donovan, who recently sighed, with a shake of the head: "I've worked on these things all my life, and yet you are showing me stuff I have never seen before."

If all goes well, we shall soon all be able to see stuff we've never seen before - and could never see anywhere else. ■

### FURTHER INFORMATION

To find out more about the Kimmeridge Project: [www.kimmeridgeproject.org](http://www.kimmeridgeproject.org)

### FURTHER READING

You can obtain a copy of Steve's book (written with Jane Clark), *Life in Jurassic Seas - the autobiography of a fossil collector*, by emailing Steve directly at [steveetches@hotmail.com](mailto:steveetches@hotmail.com). The book is privately printed, has no ISBN and is not available retail or online.







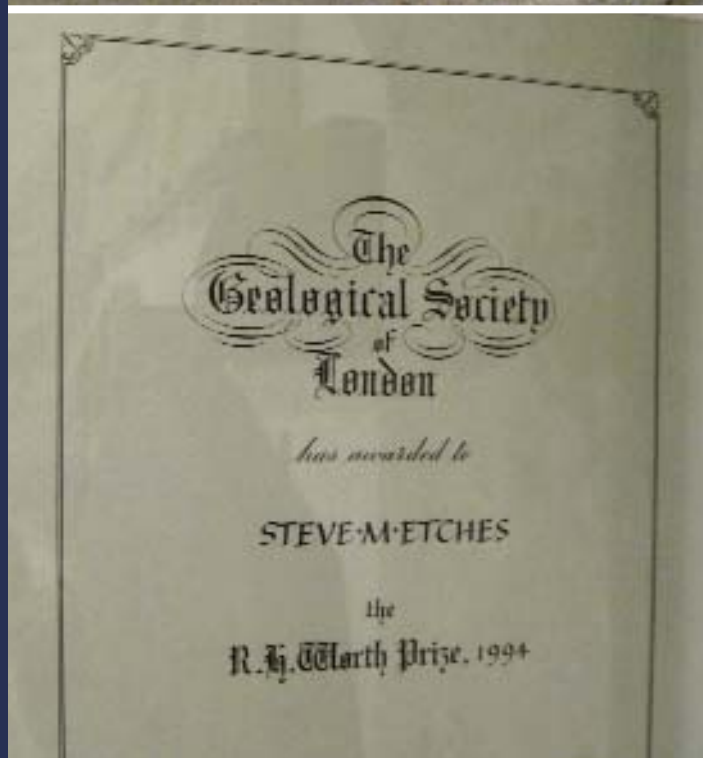
Steve Etches and (left) some of his unique collection of fossil teuthids

Far right: Parked vans in Kimmeridge provide a clue to Steve's other life



Ammonite egg cases... the first ever discovered

Far right: Upper specimens in the image are *Pectinatites* sp. Lower specimens of *Gravesia* sp



Steve's R H Worth Prize from the Society

Far right: The green field site earmarked for the Kimmeridge Project building, if funding is forthcoming Inset: Plan of the proposed museum cum new village hall for Kimmeridge





# READERS' LETTERS

**Geoscientist** welcomes readers' letters. These are published as promptly as possible in *Geoscientist Online* and a selection printed each month. Please submit your letter (300 words or fewer, by email only please) to [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk). Letters will be edited. For references cited in these letters, please see the full versions at [www.geolsoc.org.uk/letters](http://www.geolsoc.org.uk/letters)

## WAGER AND EVEREST

Sir, Geoff Glasby (*Geoscientist* July 2012) speculates that Jack Longland may have been mistaken when he stated (in *Everest - the best writing and pictures of seventy years of human endeavour*: Ed Peter Gilman) that three climbers reached 8565m on Everest in 1933. Dr Glasby bases this on the fact that Lawrence Wager, subsequently Professor of Geology at Durham, then Oxford and doyen of Skaergaard intrusion studies) reached this height alone. Not so.

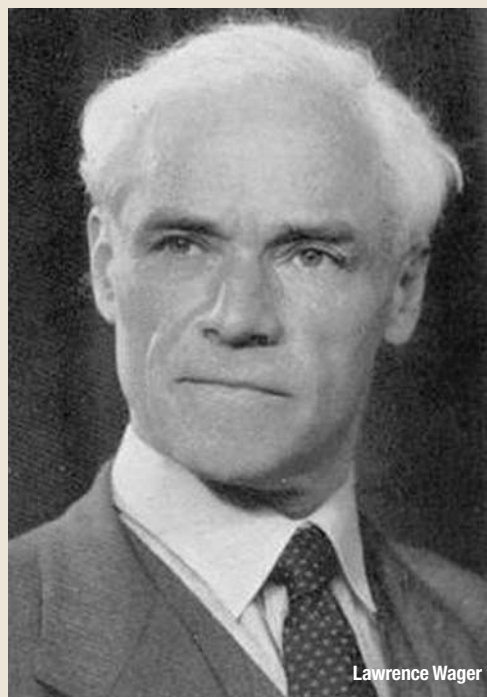
As with most early expeditions, there were two summit attempts, each consisting of a pair of climbers. Lawrence Wager climbing with Percy Wyn Harris on 30 May reached this altitude, equalling that achieved by Edward Norton in 1924. They turned back due to dangerous conditions and the lateness of the hour. It was during this attempt that Wyn Harris found 'Mallory's ice axe' (it may equally have been Irvine's) after it had been lost nine

years earlier when the two disappeared on the upper part of the mountain.

Two days later Frank Smythe turned back at much the same height, climbing alone after Eric Shipton had been unable to continue. Notably, of all these, only Mallory and Irvine were using supplemental oxygen.

Longland's own heroism occurred on 29 May when he led eight sherpas from Camp Six to Camp Four through a severe blizzard, at a time when 'sahibs' were expected to guide sherpas, rather than the reverse. He went on to become a visionary Chief Education Officer for Derbyshire, established White Hall, the Britain's first specialist outdoor education centre, and is justifiably viewed as the father of outdoor education in the UK. Wager shares with Noel Odell, a great tradition of geologists on the early Everest expeditions.

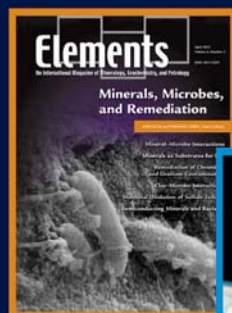
Andrew Heald



Lawrence Wager

# Elements

An International Magazine of Mineralogy, Geochemistry, and Petrology



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To keep abreast of the latest developments in mineralogy, geochemistry, and petrology

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Daniel J. Condon and Mark Schmitz
- **APRIL - SERPENTINITES**  
Stéphane Guillot and Keiko Hattori
- **JUNE - THE MINERAL-WATER INTERFACE: WHERE MINERALS REACT WITH THE ENVIRONMENT**  
Christine V. Putnis and Encarnación Ruiz-Agudo
- **AUGUST - CONTINENTAL CRUST AT MANTLE DEPTHS**  
Jane A. Gilotti
- **OCTOBER - NITROGEN IN THE GEOSPHERE**  
Gray Bebout, Marilyn Fogel, and Pierre Cartigny
- **DECEMBER - GARNET: COMMON MINERAL, UNCOMMONLY USEFUL**  
Ethan Baxter, Mark Caddick, and Jay Ague

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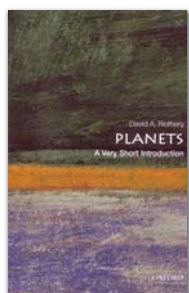
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*Elements* is available online at [www.elementsmagazine.org](http://www.elementsmagazine.org) and [www.elementsgeoscienceworld.org](http://www.elementsgeoscienceworld.org)



## Planets: A Very Short Introduction

This belongs to a series of 'very short introductions'. The first chapter - Solar Systems - is very condensed writing, full of facts: then come chapters on Rocky Planets; Giant Planets; Giant planets' satellites and rings, and Asteroids. I found the last named particularly interesting, because we are now really establishing known facts about their nature, on account of actual sampling and close imagery, backing up the earlier reliance on spectrography.

Chapter Six covers Trans-Neptune objects: here we are by contrast groping our way towards a reasonable understanding of these assorted plutoids, which can be Plutinos, Kuiper belt objects or Scattered Disk Objects, and of course also satellites such as Charon. There seems to be a rash of classification at a very early stage of knowledge (dare one say that NASA is rather too keen on classification?). More will be known about these objects when the 'New Horizons' mission reaches Pluto (now a Plutino or dwarf planet) in 2015.

Chapter Seven is equally fascinating, covering Exoplanets, of which some 500 or so are now known from our galaxy, despite the fact that the Kepler telescopic mission is covering only a small wedge of it. Rothery estimates that there are 10,000,000,000 exoplanets in our galaxy, of which 100 million may be habitable; but it is anyone's guess. The mind boggles at the potential population of planets in further galaxies. Exoplanet discovery dates from only 1995, and relies on variations in starlight, transits and even direct observation. A warning here: NASA scientists have defined the 'habitable zone' in multiplanet exoplanet systems in which life could exist (based on physical conditions), but so far there has been little consideration of the nature and history of evolution, which is partly controlled by external factors such as planetary development through time, nature of 'suns' and configuration of planets. Each planet surely will have its own evolutionary development, *sui generis*,

and none will be like matches of ours?<sup>1</sup>

This is an excellent introduction, but not faultless: Figure 10 (Mars) shows an 'impact crater' (Rothery's term) with a surround of a flow of some sort (now lava or slurry?) which must be genetically related to the crater and a similar, older feature, behind. These are not ice sheets. I think a volcanic explanation is more likely. But this just shows what a wealth of material still awaits specialist interpretation in these fascinating images.

*Reviewed by Joe McCall*

**Reference:** available online

### PLANETS: A VERY SHORT INTRODUCTION

DAVID ROTHERY, Published by Oxford University Press  
2010 ISBN: 978-0-19-957350-9 135 (pbk)  
**List Price £7.99 RRP \$11.95 USA**



## Geological Map of Italy

This most welcome geological map of Italy at one to a million is extremely well drafted so that it packs in an incredible amount of information. The excellent base map is clear to read, including offshore bathymetry highlighting the submerged morphology of the waters surrounding the Apennine peninsula, along with Sicily, Sardinia and Corsica, which is part of the varying overlap with neighbouring countries.

Even if the geological presentation is slightly overwhelming, this comprehensive coverage is beautifully executed, rendering it possible to assimilate fine detail within a unified stratigraphic framework. The captions for both keys are in both Italian & English, and the insert, with the tectonostratigraphic units, are defined in terms of the crust they were derived from during the Hercynian and then Alpine orogenies.

While it is easy for those of us lucky enough to have grown up speaking the international language of science to become complacent, it is a pity that this translation - including the useful bilingual pamphlet explaining the authors' approach to their work - was not read over by an

English-speaking geologist. That said, the text provides an invaluable insight into the complexities of synthesising such varied geology into one coherent overview.

The map itself is divided into over one hundred units, including superficial deposits covering extensive areas, most notably the Po Valley, which clearly displays a number of underlying thrusts in red. Such faults riddle much of the geological detail and yet somehow avoid becoming overwhelming. Given that this map was compiled at 1:500,000 it can only be hoped that it could be used as the basis for a regional series. It will be a long time before many areas receive more detailed coverage, as 1:10,000 surveying was halted a decade ago.

Many of those areas which have been completed have yet to be printed at 1:50,000 and can only be previewed online at [www.isprambiente.gov.it/Media/carg/index.html](http://www.isprambiente.gov.it/Media/carg/index.html). From here, click on a region to see an index map, where red sheets have been published and orange in press awaiting publication can be selected for interactive viewing, with a 'zoom' and 'explore' system. This includes satellite imagery, location of boreholes and sinkholes, 1:50,000 sheet lines, and both Bouguer gravity contours and shading.

A discussion of the wider implications of ceasing classical 1:10,000 mapping - both in Italy and now in Britain - can be found online in a longer version of this review.

*Reviewed by David Nowell*

### 1:1,000,000 CARTA GEOLOGICA D'ITALIA 5TH EDN.

B. COMPAGNONI AND F. GALLUZZO ET AL., Published by: Servizio Geologico d'Italia (Geological Survey of Italy)  
Publication date: 2011

**List Price unstated, c. €10 (cf. national gravity map), folded only.** <http://sgi.isprambiente.it/geoportale/catalog/main/home.page>

## REVIEWS: COPIES AVAILABLE

We have received the following books. Please contact [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk) if you would like to supply a review. You will be invited to keep the review copy. See Geoscientist Online for a full up-to-date version of this list.

■ **NEW! The Million Death Quake - the science of predicting Earth's deadliest natural disaster** Roger Musson. October 2012 Palgrave Macmillan 250pp ISBN 978-0-230-11941-3 pre-pub softback.

■ **NEW! Natural Hazards of Jamaica** Parris Lyew-Ayee Jr & Rafi Ahmad (University of West Indies Press, Mona Geoinformatics Institute). ISBN: 9789766402594. 150pp Large format, colour.



# PEOPLE

Geoscientists in the news  
and on the move in the UK,  
Europe and worldwide

## CAROUSEL

All fellows of the Society are entitled to entries in this column. Please email [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk), quoting your Fellowship number.

### PETER COOK



Peter Cook CBE, former BGS Director, has been honoured with the launch of the Peter Cook

Centre for Carbon Capture and Storage Research by the Hon. Michael O'Brien, Victorian Minister for Resources and Energy. The Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) will direct research at the new Centre, which has been sponsored by Rio Tinto with \$3 million in funding over three years. A further \$3 million in Rio Tinto funding over three years will support the CO2CRC Otway Project, Australia's first demonstration of geological carbon dioxide storage, as a field site for carbon storage research. **E:** [pjcook@co2crc.com.au](mailto:pjcook@co2crc.com.au); **W:** [www.co2crc.com.au](http://www.co2crc.com.au)

### EDMUND NICKLESS



Edmund Nickless, Executive Secretary of the Society, has been elected a Fellow of the

Geological Society of America. His citation highlights the many ways in which Mr Nickless has advanced the geological sciences - as a researcher, Assistant Director of BGS, and as Executive Secretary - and praises his fostering of international links with societies in the United States and across the world.

Dr Karen Darke



## Paralympian

*Dawne Riddle writes:* Fellows who watched the Paralympics may well be interested to know more about geologist Dr Karen Darke ([www.karendarke.com](http://www.karendarke.com)), who first entered the Paracycling World Cup in 2009. She formed part of the British Cycling team in the road race on a hand-cycle. Darke has been paralysed from the waist down since a climbing accident 20 years ago, when she was 21. By then she had already climbed Mont Blanc and the Matterhorn, but has since climbed El Capitan (Yosemite), kayaked the Alaska coastline and skied across Greenland. Next year she will attempt to reach the South pole. She has written two books about her life, the second of which is out shortly and is called *Boundless*.

## Earth Heritage magazine

*Colin MacFadyen (SNH) writes:*

Earth Heritage is the UK geological and landscape conservation magazine, produced by the nature conservation agencies - Natural England (NE), Scottish Natural Heritage (SNH) and the Countryside Council for Wales (CCW), in partnership with the Geologists' Association.

Published online twice a year, the magazine is an eclectic mix of articles on geodiversity conservation initiatives and interpretation, often with international input.

To download current and previous issues, and to subscribe free, visit [www.earthheritage.org.uk](http://www.earthheritage.org.uk).



## IN MEMORIAM [WWW.GEOLSOC.ORG.UK/OBITUARIES](http://WWW.GEOLSOC.ORG.UK/OBITUARIES)

### THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

**Bowler, Christopher Michael Lance \***  
Chappell, Bruce \*

Chapman, W T \*  
Hooper, Peter Ralph

King, Bruce \*  
Middleton, John \*

MacLean, Ronald G \*  
Williams, Colin L \*

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 shown in bold. Fellows for whom no obituarist has yet been commissioned are marked with an asterisk (\*). The symbol § indicates that biographical material has been lodged with the Society. If you would like to contribute an obituary, please email [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk) to be commissioned.

You can read the guidance for authors at [www.geolsoc.org.uk/obituaries](http://www.geolsoc.org.uk/obituaries). To save yourself unnecessary work, please do not write anything until you have received a commissioning letter. Deceased Fellows for whom no obituary is forthcoming have their names and dates recorded in a Roll of Honour at [www.geolsoc.org.uk/obituaries](http://www.geolsoc.org.uk/obituaries).



## HELP YOUR OBITUARIST

The Society operates a scheme for Fellows to deposit biographical material. The object is to assist obituarists by providing contacts, dates and other information, and thus 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

## Climate Change

**Nina Morgan speculates on the role of uniformitarianism in international relations**

Charles Lyell's *Principles of Geology* was arguably one of the most influential geology books ever written. First published in three volumes between 1830-1833, it ran to 12 editions, the last published posthumously. In his autobiography Charles Darwin described Lyell's book as 'of the highest service to me in many ways' and the first volume served as Darwin's 'Desert Island' book on the *Beagle*. But Lyell's observational powers and keen sense of reasoning extended well beyond the realms of rocks and Earth processes. He also appeared to delight in amateur anthropology.

### SPURRED

In *A second visit to the United States of North America*, Lyell recalls how, spurred on by a remark by a Boston resident that 'We ought to be happier than the English, although we do not look so' [Lyell's italics], he was moved to speculate on the origins of national characteristics.

"I suspect," Lyell wrote, "that the principal cause of the different aspect of the Anglo-Saxon race in England and America is the climate. During both our tours through the United States, my wife and I enjoyed excellent health. But, he notes, "we were told that, if we stayed a second year, we should feel less vigorous..."

The reason, he conjectures is the weather. "English travellers often ascribe the more delicate health of the inhabitants here [in the United States] to their in-door habits and want of exercise. But it is natural that they should shrink from exposing themselves to the severe frosts and long-



Charles Lyell – from the Society's portrait collection

continued snows of winter, and to the intense heat of the summer's sun. An Englishman is usually recognised at once in a party, by a more robust look, and a greater clearness and ruddiness of complexion; and it is surprising how distinguishable he is even from persons born of English parents in the United States. It is also a curious fact, which seems generally admitted, that the native Anglo-Australians bear a considerable resemblance to the Anglo-Americans in look and manner of speaking, which is a mystery, for there is certainly in that case no analogy between the climates of

the two countries."

But, since the Anglo-Saxon 'invasions' of America and Australia are, relatively speaking, comparatively recent, perhaps uniformitarianism had not yet progressed as far in these regions. If that is the case, one wonders what Lyell might have written had he lived long enough to publish a 13th edition of his most famous work.

### ACKNOWLEDGEMENT

Sources for this vignette include: *A second visit to the United States of North America*, by Charles Lyell, published in two volumes by John Murray in

1849; and the chapter covering the voyage of the *Beagle* in Charles Darwin's *Autobiography*.

► 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: [www.geolsoc.org.uk/hogg](http://www.geolsoc.org.uk/hogg), where the programme and abstracts from the Conference on Geological Collectors and Collecting are available as a pdf file free to download.

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



## OBITUARY



## STEPHEN JOHN MILLS 1942-2012

Oil geologist with encyclopaedic knowledge of the world's basins and a pioneer in applying plate tectonic theory

**S**tephen John Mills died peacefully on Saturday 7 January, 2012 in Calgary, Canada after a long and courageous battle against Parkinson's Disease. Steve was well known to many people internationally in the E&P industry. During his time in London he was a regular attendee at courses and symposia organised by the Society as well as a regular visitor to the Library.

Steve was born on 20 November 1942 in Gosforth, England and educated at St Bees School, Cumbria (1956-61). He graduated from Durham University with a BSc (Hons) in Geology (1964) and later an MSc in micropalaontology from London University (1965).

### BURMAH OIL

His first job was with Burmah Oil Company (Ecuador, 1965). He worked

in general exploration geology, including fieldwork in the Santa Elena Peninsula and later in the Oriente Basin.

In 1972 Steve was transferred to Burmah's Perth office (W. Australia). Burmah's giant Northwest Shelf gas/condensate discoveries made these exciting times. He was later appointed District Geologist in the Bonaparte Gulf Basin and his work resulted in the multi-TCF gas/condensate discoveries at Sunrise, Troubadour and Kelp. He was later involved in fieldwork in Indonesia and Portuguese Timor. Following Burmah's sale of Australian assets Steve was transferred to London, where he became responsible for exploration in Burmah's Central North Sea assets. He later moved to BNOC (Glasgow).

While in Ecuador and Australia Steve became excited by global plate tectonics and applied these

concepts to his basin analysis of the NW Shelf of Australia, and the North Sea. At BNOC he became much admired for his skill in being able to condense a play - its plate tectonic setting and prospectivity attributes - into a single diagram.

In 1979 he moved to Hudbay Oil International (Calgary) as Manager of Geology worldwide. He developed an attractive and well-balanced portfolio of assets at Hudbay, adding to already existing assets there and acquiring new ones throughout Southeast Asia, Europe, Latin America and Africa. Steve was well liked and highly regarded by the management and board of the parent company.

### AMAZING DETAIL

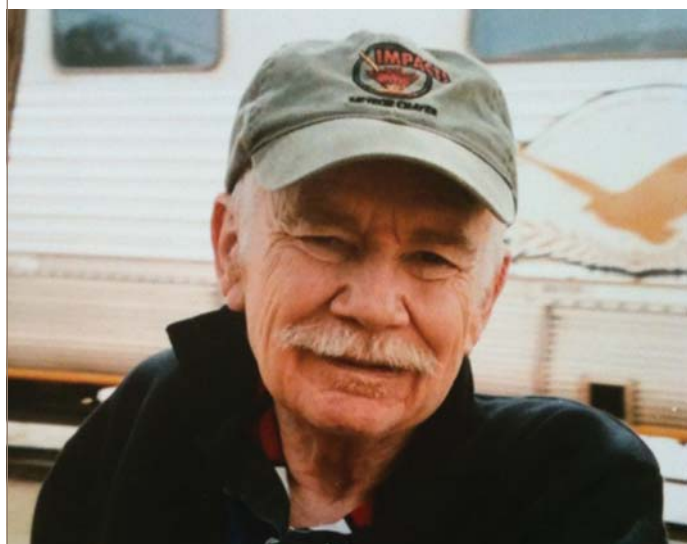
In 1981 Hudson's Bay Oil and Gas was acquired by Dome Petroleum, which then sold its international assets to Lasmo. Steve thus moved back to London (early 1983), assuming the position of International Geology Manager worldwide at Lasmo. Throughout his seven years with Lasmo he filled various senior exploration management and international new venture roles, impressing all with his ability to talk knowledgeably yet modestly about any sedimentary basin in the world. His phenomenal memory could recall conversations, discussions, meetings and reports in amazing detail.

He was a perfectionist and brought this trait into all recommendations and decisions in which he participated. Steve was a good manager, always supportive of his staff. Despite an affable manner his standards were extremely high and he demanded the same from his team.

In late 1990 CanadianOxy offered him the position of International Exploration Vice President in Calgary, which he accepted. At that time the company was expanding and the international new venture group was an exciting place to work. Steve inspired all with his quiet competence and extraordinary global knowledge. In 1996 he left CanadianOxy to pursue a consultancy career. By 2000 Steve decided to discontinue this and redirected his energy towards military history.

Steve will be remembered as a gentleman, an excellent geologist, a military historian and above all as a loyal and trusted friend. He was erudite, broadly read, a linguist and a wonderful raconteur. His great spirit and firm determination were amply demonstrated during his long illness.

► By **Robert W Duke** and **J Bruce Blanche**, with contributions from **Phil Wright**, **Dave Boote**, **Brian Hodgson**, **Dave Powell**, **John Hogan**, **Don Poynton** and **Jenny Miles**





## ENDORSED TRAINING/CPD

Course	Date	Venue and details
Field Observation & Geomorphological Mapping	1-5 October	University of Sussex, Brighton. This week-long field course provides professional training in field observation, geomorphological mapping and dGPS surveying skills. Fees, - discount for Fellows – apply. See website.
Structural Modelling and Analysis Using MOVE	2-4 October	The 3-day course in our Glasgow office is an ideal hands-on introduction to the Move software suite and also covers the geological theory behind Move. Fees apply. See website.
2, 3 or 5 Day Introductory & Advanced Geochemistry Courses	8-12 October	Rougemont Hotel, Exeter, Devon. Introductory Geochemistry course aimed at people in the petroleum industry. See website. Fees apply.
Introduction to Micromine	9-10 October	Burlington House. This course is being held over 2 days and includes Introduction to Micromine (Day 1) and Introduction to Exploration (Day 2). Fees Apply. See website.
3-Day Basin Modelling Course	10-12 October	IGI Ltd, Hallsannery, Bideford, Devon. Aimed at petroleum geoscientists who wish to begin using basin modelling software in their work. Fees Apply. See website.
Cone Penetration Testing	19 October	Nottingham. FUGRO. Free. Introductory course and technology update on Cone Penetration Testing theory and application. See website for other dates. Will also run on 14 December (Wallingford), and 23 November (Exeter). E: s.poulter@fes.co.uk W: www.fes.co.uk
Terrain Analysis & Digital Mapping	22-26 October	University of Sussex, Brighton. Visualisation, interpretation and synthesis of spatial datasets is an essential requirement of geological and geomorphological assessment. Fees Apply. See website.
Lapworth's Logs	n/a	'Lapworth's Logs' are a series of e-courses involving practical exercises of increasing complexity. 'Lapworth's Logs' provide training in applied geology for civil engineers, engineering geologists, environmental engineers, hydrogeologists, and anyone interested in ground modelling. Contact: info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson. Price dependent on number of users/duration of licence.

## DIARY OF MEETINGS OCTOBER 2012

Meeting	Date	Venue and details
Deep-Water Continental Margins: Final Exploration Frontier? Geological Society	1-2 October	Burlington House. Bringing together geologists, geophysicists, mathematical and physical modellers seeking to understand the evolution of continental margins and their economic importance. See Website for details and registration. Office contact: Steve Whalley T: 020 7434 9944 F:020 7494 0579 E: steve.whalley@geolsoc.org.uk
Brofiscin Quarry - Securing Remediation Through Part IIa, Southern Wales	3 October	Room 1.25, Earth Sciences, Main Building, Cardiff University. Speakers: Trystan James (EA) Peter Stanley (EA) Ewan Thomas (Geotechnology). 1730 for 1800.
Hot Deserts Engineering Group	4 October	Burlington House. See Website for details and flyer. Fees apply. Office contact: Steve Whalley T: 020 7434 9944 F:020 7494 0579 E: steve.whalley@geolsoc.org.uk
Operations Geology Workshop Petroleum Group	5 October	Kings College Conference Centre, University of Aberdeen. Fees apply. See website to register. Office contact: Laura Hayward T: 020 7432 0983 F: 020 7494 0579 E: laura.hayward@geolsoc.org.uk
Pollutants and Human Health in the Age of Man, Geological Society, Shell	10 October	Burlington House. A Shell London Lecture - see p.11
The Long View Reflected Burlington House Lecture	16 October	Geological Society, Burlington House. See p.11
Military Applications of Geology for the Cross-Channel Invasion, Solent	17 October	University of Portsmouth. Speaker: Ted Rose. Evening meeting. Contact: Karen Allso (Secretary) E: karen.allso@ramboll.co.uk
Appreciating Physical Landscapes: Geotourism 1670 – 1970 History of Geology Group	22-23 October	Burlington House. The significant historical antecedents of modern geotourism in Britain and Europe. Fees apply - see website for details and registration. Office contact: Naomi Newbold T: 020 7434 9944 F: 020 7494 0579 E: naomi.newbold@geolsoc.org.uk
East Africa – Petroleum Province of the 21st Century? Petroleum Group	24-26 October	Burlington House. Fees apply – see website for details and registration. Office contact: Steve Whalley T: 020 7434 9944 F: 020 7494 0579 E: steve.whalley@geolsoc.org.uk

## OBITUARY



# GEORGE RICHARD ORME 1931 - 2012

Carbonate sedimentologist who transferred his interest from Waulsortian mounds to modern, living reefs

**R**ichard Orme was a student of the Sheffield University Geology Department, graduating with Honours in 1955. Richard was quiet and studious, with a good sense of humour (the Goon Show was a particular favourite) coupled with a natural organizational flair that he put to good use as President of the student geological society. His attention to detail also showed when he won the Fearnside prize for his undergraduate field project. Born in Worksop, Nottinghamshire on 19 May 1931, Richard passed away peacefully on 16 January 2012 in Brisbane, Australia leaving his widow, Awen.

## AVONIAN

Richard Orme's career in carbonate sedimentology followed his doctorate research *On the stratigraphy*

*and petrology of the normal and reef facies of the Avonian limestone, Derbyshire* in the late 1950s under Prof Leslie Moore, then Head of Geology at Sheffield. For this research Richard received his PhD in 1960. Sheffield's local Carboniferous geology supported an active research centre at the University, and the excellent outcrops and large commercial quarries of the Peak District provided Richard with his training. His research on limestones was further developed through a year's assignment to the Geology Department of Aberystwyth under Prof Wood, where he met his future wife Awen.

## FOSSIL REEFS

Having studied fossil reefs, the move to recent ones was a logical step, facilitated through a scholarship to Columbia University, New York (1960-62) where, under the tutorage of Norman

Newell and John Imbrie he studied the reefs of Bimini Island in the Bahamas. A short return to Sheffield followed when in 1962 Richard was offered a NATO scholarship to work in the Sheffield Department. The offer of an Assistant Lectureship (1963) provided the security for Richard and Awen to marry, and they remained in Sheffield until January 1967 when Richard took up an appointment as Senior Lecturer in the Department of Geology and Mineralogy in the University of Brisbane, Queensland, Australia. Here he rose to become Associate Professor and Head of Department, and remained until his retirement in 1996.

Through his knowledge of reefs, Richard became a member of the Great Barrier Reef Committee concerned with the running of Heron Island. He also joined Rhodes Fairbridge on an



expedition to reefs off Eastern New Guinea and took part in a Japanese submarine dive off the Great Barrier Reef. His main interests, however, were with the Northern Great Barrier Reef Province (North of Corktown, Lloyd Bay area).

Richard once invited me over to Brisbane to sample his cellar of French wines; sadly I was never able to take up his offer.

► Compiled by **Ray Bate** with much help from **Awen Orme**



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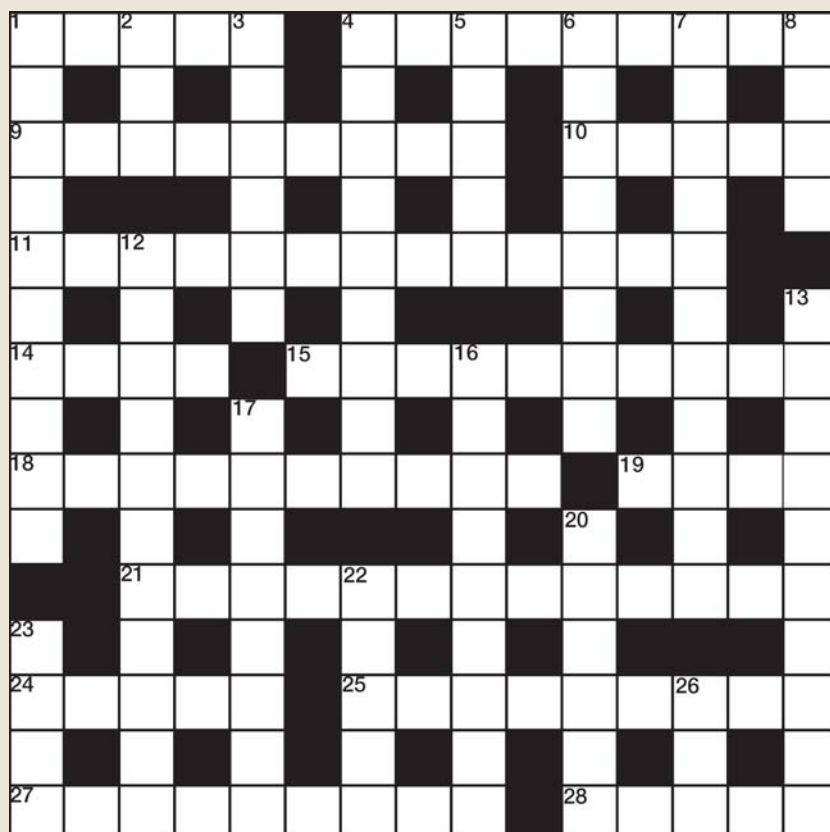
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## CROSSWORD NO. 162 SET BY PLATYPUS



## ACROSS

- 1 Subvertical discordant sheet intrusions (5)  
 4 Weathering along surface-parallel planes creating onion-skin effect (9)  
 9 Southern Australian desert, famous among meteorite hunters (9)  
 10 Mountain kingdom of the Himalaya (5)  
 11 Palaeontological object eroded from one formation and deposited in another (7, 6)  
 14 Lunar-induced oscillation (4)  
 15 Chronometers (10)  
 18 Cancer expert (10)  
 19 Jetty (4)  
 21 Involving many sovereign states (13)  
 24 London lecture sponsor (5)  
 25 Liable to nab an electron (9)  
 27 Rameses, Amenhotep, Hatshepsut, Nefertiti and co. (9)  
 28 French love, usually observed cleanly in England (5)

## DOWN

- 1 Long-term wearing away of Earth's surface and reduction of relief (10)  
 2 London university institution discovers potassium chloride (3)  
 3 Extreme diet (6)  
 4 Enclosing an object within a solid substrate (9)  
 5 Iron-containing mineralogical chemical prefix (5)  
 6 Ground failure (8)  
 7 North American caledonide mountains (11)  
 8 Slippery swimmers, rendered more so in London by 4-downing in jelly (4)  
 12 Arguing in a way common in science, by which one object or concept is explained in terms of another at a lower level. (11)  
 13 Non-scientific interpreter of the heavens (10)  
 16 Milton, pursuing melancholy, asks a 'pealing organ' to dissolve him into these (9)  
 17 Blood-clotting factors in mammals (8)  
 20 Most common continental oxide (6)  
 22 Northern Spanish wine province (5)  
 23 Man, Wight, Scilly, Portland etc (4)  
 26 Same, Greekly (3)

## WIN A SPECIAL PUBLICATION

The winner of the August Crossword puzzle prize draw was **Nicola Watson** of **Chester-le-Street**.

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

The competition is open to all Fellows, Candidate Fellows and Friends 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 scan the signed form and email it as a PDF to [ted.nield@geolsoc.org.uk](mailto:ted.nield@geolsoc.org.uk)

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## SOLUTIONS AUGUST

## ACROSS:

6 Gypcrete 8 Inlier 10 Temper 11 Lava Tube  
 12 Alsations 13 Inca 15 Hogback 17 Arsenic  
 20 Elmo 21 Decompose 23 Efferent 25 Nelson  
 27 Anomie 28 Treatise

## DOWN:

1 Gyre 2 Scopes 3 Aeolian 4 Sieves 5 Verb  
 7 Erratic 9 Lattice 12 Atoll 14 Chine 16 Bioherm  
 18 Rumanie 19 Acetate 21 Diesel 22 Oolith  
 24 Fens 26 Ouse

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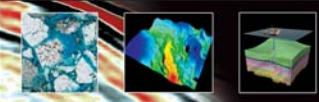

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**Call for Abstracts - Deadline: 17 September 2012**

## Industrial Structural Geology:

### *Principles, Techniques and Integration*

## 28 - 30 November 2012

The Geological Society, Burlington House, Piccadilly, London



**CALL FOR ABSTRACTS**

Structural geology is a crucial element in the Petroleum and Mineral Industries. It provides the framework within which we explore, appraise and develop assets, with a critical influence on their commercial success. Industrial activity provides a wealth of structural data to advance fundamental science, which allows theories to be tested through constantly evolving techniques. Ultimately structural geology is a key pillar in supporting the profitable generation of society's energy and mineral requirements, requiring research funding and offering rewarding careers to future geoscientists.

This conference provides an opportunity to review current best practices in structural geology as well as explore and define the relationships between industry and academic practitioners. In a commercial climate, where declining resources, the environment and safety are all fundamental issues, defining future trends and developments through better collaboration will help prepare us for the challenges that lie ahead.

This three-day conference will combine presentation, discussion and workshop formats. We invite contributions covering all practical aspects of structural geology with a commercial application, including: mapping and fault validation; fault seal, trapping and compartmentalisation; regional geology, including restorations and plate-scale reconstruction; risk, uncertainty and volumetric assessment; geomechanics, fracture prediction and (HPHT) production behaviour; unconventional resources; carbon storage; application of analogues; salt tectonics; data collection, synthesis and integration.

**Confirmed Keynote Speakers:**

Tom Blenkinsop (James Cook University)	Dave Sanderson (University of Southampton)
Joe Cartwright (Oxford University)	Richard Swarbrick (Icon Science/Geopressure Technology)
John Cosgrove (Imperial College)	John Underhill (University of Edinburgh)
Martin Jackson (AGL, BEG, University of Texas)	John Walsh (Fault Analysis Group, UCD)
Steve Jolley (Shell)	Nicky White (University of Cambridge)
Paul MacKay (Shale Petroleum Ltd)	Graham Yielding (Badleys Geoscience)

For further information and registration, please contact:  
Steve Whalley, Event Co-ordinator: +44 (0)20 7432 0980 or email: [steve.whalley@geolsoc.org.uk](mailto:steve.whalley@geolsoc.org.uk)

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Friday November 23rd 2012 - Exeter

Friday December 14th 2012 - Wallingford, Oxon

\*endorsed by The Geological Society







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# Founders' Day

L E C T U R E   &   D I N N E R



Thursday 15 November 2012

## Founders' Day Lecture

Geology at the end of the Earth: exploring  
Antarctica's green history

Speaker: Professor Jane Francis,  
*University of Leeds*

## Founders' Day Dinner

Venue: Le Meridien, Piccadilly

After dinner speaker: Dr Rory Mortimore,  
*President, Geologists' Association*

Dress: Black Tie

Ticket price: £80

Timings:

18.00 Tea & coffee served, Burlington House

18.30 Lecture by Professor Jane Francis

19.30 Drinks reception at Le Meridien

20.30 Dinner served

22.00 After dinner speaker

24.00 Carriages

### Contact details:

Naomi Newbold,  
The Geological Society, Burlington House,  
Piccadilly, London W1J 0BG

T: 0207 432 0981

E: [naomi.newbold@geolsoc.org.uk](mailto:naomi.newbold@geolsoc.org.uk)

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# Careers Day 2012

Wednesday 7 November 2012

British Geological Survey, Nottingham

## The Geological Society

Careers Day is the essential meeting place for geoscience students and the geoscience industry, where university undergraduates and postgraduates will have the chance to find out about the latest career options and talk to industry leaders about how they might gain entry into that sector.

The day will run from 10am – 4pm and will include presentations on careers, a CV writing workshop, an interview techniques workshop and an exhibition fair. The day will end with a beer reception.

### Registration

This event is free to attend and covers all delegate material, lunch and a beer at the reception, but you must register for the event and the workshops must be pre-booked.

### Contact Information

Naomi Newbold

**Tel:** 0207 432 0981

**Email:** [naomi.newbold@geolsoc.org.uk](mailto:naomi.newbold@geolsoc.org.uk)

**Web:** [www.geolsoc.org.uk/careersday12](http://www.geolsoc.org.uk/careersday12)

