

Geoscientist

The Fellowship magazine of The Geological Society of London | www.geolsoc.org.uk | Volume 23 No 10 | November 2013

MOVING EXPERIENCE

Can tectonic stress affect the way humans behave?

MAPPING FUTURES

Fellows flock to the defence of student mapping

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STORY BOARDING

Helen Quinn on how TV documentaries like *Rise of the Continents* are commissioned and made

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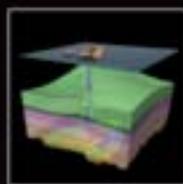
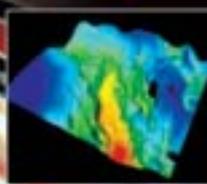
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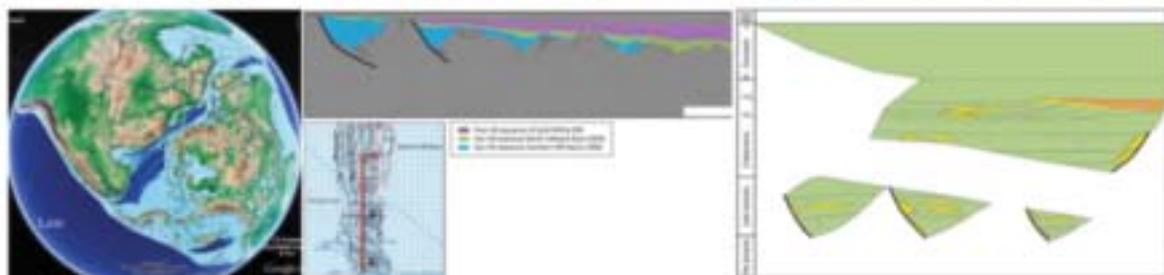
An Evening in the Falkland Islands

19 November 2013, 6pm

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Malcolm Brown
BG Group



REGISTRATION NOW OPEN

Speakers

Fiona MacAulay - Rockhopper Exploration

Colin More - Falkland Oil and Gas Limited

The lecture will be followed by a question and answer session and refreshments in the Lower Library at Burlington House. Nominal registration fee of £30 fellows and £40 non fellows.

For further information and registration, please visit the conference webpage www.geolsoc.org.uk/falklands or contact: Laura Griffiths, Event Co-ordinator: tel: +44 (0)20 7432 0980 or email: laura.griffiths@geolsoc.org.uk



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“HELEN QUINN, WHO WORKED WITH PROF. IAIN STEWART HON FGS ON THE BBC SERIES *RISE OF THE CONTINENTS*, DESCRIBES HOW IT'S DONE”

Front cover image

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OUT OF LOVE?

August's *Soapbox* (*Geoscientist* 23.07) has kicked up a merry storm over the suggestion that the traditional undergraduate field mapping project might have had its day (see *Letters* p.21, *Soapbox*, p.9). Academics have protested, and industry geologists queued up to affirm that experience in the field is any geologist's most prized possession, and that far from watering it down, universities should be doing all they can to beef it up.

Concern over the fieldwork content of undergraduate courses, and of the quality of the contact hours spent in the field, underpins the Society's highly successful accreditation scheme. Some might say that it was that scheme's *primum mobile*, and remains an important reason why any student who emerges qualified from such a course need answer no more questions about his or her education when applying for Chartership. But, more viscerally, I struggle to understand why someone would want *not* to map.

I recently paid a nostalgic visit to the Isle of Man (the southern third of which I mapped for my degree). This experience revealed several things. First, mapping for nine weeks during the glorious summer of 1976 was simply my happiest time. This may explain why what I learned there stuck: I could still recall those three phases of folding, to a level of detail in outcrop that amazed me. The pleasure of being able to predict what I would find on a mountainside, if my structural model was correct, gave me a satisfaction I have rarely equalled. I remember *pitying* – not too strong a word – students whose courses did not allow them the chance to immerse themselves in their subject so completely.

But here's the thing. The *subject* may want fieldwork, but do students? In my time, love of the countryside drew us to geology in the first place. We were all *outdoorsy*; we already had the boots and most of us were hikers or climbers. We knew how to conduct ourselves. We tended not to fall over and break limbs. We had been stung by bees long ago, but didn't make a habit of it, rarely suffered from allergies and never went into anaphylactic shock.

I look askance, and even suffer occasional *Daily Mail* moments, over what I suspect is a pallid, indoors generation that we are breeding. I worry that geology is moving out of its true laboratory and into a virtual fairyland. But I worry most that the young may be falling out of love with nature; and if they are, whether they will ever want to study geology at all.

DR TED NIELD EDITOR



SOCIETY NEWS

ELECTION – FELLOWS

The following names are put forward for election to fellowship at the OGM 27 November 2013.

ABRAHAMS Mark John; **ADRIASOLA MUNOZ** Yvonne; **ASHWORTH** Kevan Lynton; **BARNES** Barry; **BHATIA** Rehema; **BOCCIOLI** Stephen; **BOOTH** Melanie Jo; **BOYD** Sarah Louise; **BRADFORD** Paul; **BRANNEN** Scott David; **BROWN** Henry; **BRYANT** Ros; **CAMPBELL** Michael David; **CISSE** Mouawiyah Amadou; **CHAMBERLAIN** Claire Mary; **CHAN** Hin Wai; **CHAN** Kam San; **CHAUDHRY** Tahir Mehmood; **CHENG** Jessica; **CHIN** Melissa Frances; **CHUM** Chun Yip; **COETSEE** Sharla Anne; **COLLINS** Philip Edward Fenmore; **CONNOLLY** Naimh; **COOKSON** Alexandra; **COOPER** Gerald Gettys; **CORBIN** George Richard; **COSTELLO** Lynette Mary; **COTTERILL** James Edward; **COWELL** Ellie; **CRAIG** Findlay; **CROLLA** Sebastian Anthony; **DAILY** Martin Ian; **DANIELS** Stella; **DEGEN** Christian Peter; **DEVONSHIRE** Robert Lawrence; **DHIR** Ravindra Kumar; **DIGGS** Timothy; **DUCKERING** Josh; **EDWARDS** Alexander Philip; **ELLEN** Rachael; **ELLIOTT** Thomas Paul; **ENTWISTLE** James; **ERZHANOV** Ruslan; **FAIRLIE** Andrew Paul; **FARDELL** Anna Elizabeth; **FOSTER** Peter; **FROST** Christopher; **FYVIE** Richard Michael; **GARDINER** Nicholas John; **GATER** Robert David; **GILBERT** Andrew; **GILBERT** Carl; **GRANADOS GOMEZ** Jose; **GREEN** Damon Antony; **GREEN** David Edward; **GRIFFITHS** Elin; **HANDLEY** Matthew; **HO** John K; **HODELL** David; **HOGG** Samuel; **HOWE** George Warrick; **HUGHES** Charles Edward David; **IU** Teddy; **JEFFREYS** Joanne Emma; **JENNINGS** Keenan; **JOHNSTONE** David James; **JONES** Mervyn; **JOSEPH** Nicholas Eli; **KEMP** Nikki Hannah; **KENNEDY** Hilary Anne; **KING** Thomas George; **KREVER** Samuel; **KRUEGER** Scott; **LAI** Cheuk Yiu; **LEWIS** Robert Matthew; **LLOYD** David Tomasz; **MACLEOD** Cecilia Louise; **MARSHALL** Iain; **MARTIN** Jessica Lily; **MARTIN** Rita Lara Rose; **MASON** Rachel Deborah; **MCMAHON** Christopher; **MCQUILLAN** John Henry; **MEARNS** Leanne; **MELETIADOU** Souzana; **MELROSE** James; **MOSAWY** Raad Nouri; **MOSS** Andrew James; **MUGUWE** Julias; **MURPHY** Breandan David; **NEVILLE** Jonathan; **NIVEN** Jennifer; **NKWUNONWO** Ugonna Chimnonyerem; **OGUZ** Egemen; **ORME** Richard Henry; **ORMEROD** David Scott; **OYO-ITA** Daniel; **PALMER** Ben; **PARSONS** Ewan; **PRESCOTT** Edward John; **PUNTORNO** Michael; **PURVINS** Martin Elliott; **REILLY** Monica; **RILEY-JONES** Gary; **RITCHIE** Leo Matthew Leppanen; **ROWLAND** Dennis; **SCOTT** Peter; **SELDON** Benjamin John; **SMITH** Dominic; **STEPAN** Clare; **STOTT** Greg; **TAYLOR** Alan Laurence; **TEASDALE** Derek Antony; **THOMAS** Allison Jane; **THOMAS** Hope Elizabeth; **THOMAS** James William; **THORNE** Rowan John; **TOMLINSON** David Ian; **TRACEY** Michael Rudolf; **TYLER** Andrew David James; **TYNAN** Patricia; **UTILI** Stefano; **VON STEHT** Markus; **WARKE** Matthew Rober; **WATTS** Andrew Benjamin; **WHITE** Aime-Dawn; **WILLIAMS** Brian Shearman; **WILLIAMS** Liam Nathan; **WRIGHT** Huw Tomas; **WRONA** Thilo; **YOUNG** Eileen; **ZAPATA SUAREZ** Luz Helena

CHRISTMAS AND NEW YEAR CLOSURE

The Society (London and Bath) will be closed from 24 December – 1 January inclusive, re-opening on Thursday 2 January 2014.



Ensure that you keep receiving your *Geoscientist*!

Renew your Fellowship

Fellowship renewals for 2014 fall due this month. *Graeme Etheridge*

Renewing your fellowship and subscriptions not only ensures that you keep receiving your *Geoscientist* and chosen subscriptions, but also helps your Society to promote both science and profession.

▶ Renewing couldn't be easier! Simply log in on www.geolsoc.org.uk, and follow the links under Fellowship

Geofacets-GSL Millennium Edition

The autumn programme of webinars on the Geofacets-GSL Millennium Edition is well underway, writes *Anne Davenport*.

Geofacets, the new web-based map search tool, provides individual Fellows with the full range of Geofacets functionality and enables you to retrieve over 24,000 maps published in the Lyell Collection. Each map search result links to the article from which it is derived (full-text for those titles to which you have access rights), and can be downloaded and integrated into a personal secure geological software analysis system for personal use. You may add this new research tool to your membership for 2014 for only £35.00.

▶ See back cover. There are only three webinar sessions left, so sign up today on www.geolsoc.org.uk or go to www.info.geofacets.com for more information

Research Funds open for bids

The 2014 round of Society Research Funds is now open for applications. Applications for support from any of the Society funds must be made on the form which can be downloaded from www.geolsoc.org.uk/About/Awards-Grants-and-Bursaries. Alternatively, visit the longer online version of this story, and follow the link there.

Chartership news



Accreditation officer **Bill Gaskarth** hails record numbers of applications and validations.

A record number of 37 fellows were validated as CGeol at the September meeting of Council, along with four Chartered Scientists (CSci) of whom one also attained CGeol and another was a retrospective application (following CGeol). In addition to this 11 CGeols, who had been previously validated, became EurGeols.

Applications remain buoyant, with 40 received to date for this month's (November) interviews in Glasgow and London.

This puts increased load on the present panel of Scrutineers, and experienced CGeols are invited to apply to join the panel (www.geolsoc.org.uk/scrutineers).

The new application route for Fellows with 20+ years' experience is proving popular and some 15 becoming Chartered to date with a further six applications received. The applications have come from a variety of sectors of the profession – Oil and Gas, Mineral Exploration, Academia, Engineering Geology. These senior geologists will be role models for early career geologists in their workplace and will help the Society promote the professional titles of CGeol and CSci.

MSC ACCREDITATION

The Petroleum Geology MSc at Imperial College is the latest course to be accredited. Students graduating from this course will be eligible to apply for CGeol after four years' professional experience.

Accreditation of the University of Derby's MSc in Applied Petroleum Geoscience was reported in the previous issue. The University has since press-released the achievement, saying that recognition by an 'independent body of academics and industrialists' will be reassuring to students, and advertising the fact that an accredited degree is the first stage towards professional qualifications. More applications for MSc course accreditation are expected shortly.

COMPANY TRAINING SCHEMES

We have received an application for accreditation URS for its Training Scheme. At present schemes from RPS Energy, RSK and CH2MHill (Halcrow) are under review by the Professional Committee, and others are invited. Such accreditation fosters partnership between company and Society, and helps early career geologists prepare for Chartership.

NEED A MENTOR?

Jana Horak (National Museum of Wales) writes: Could you benefit from the experience of a mentor in preparing for chartership? The Society is re-launching its Mentoring Scheme to support chartership candidates for both CGeol and CSci. This service will particularly valuable to those embarking on chartership who do not have access to a mentor through work.

A mentor can help you evaluate your development needs to fulfil the chartership requirements and work with you to draft an effective Development Plan. The mentoring process underpins submission of strong chartership applications, based on adequate and appropriate skills, knowledge and experience to demonstrate the required competencies. There are also benefits in becoming a mentor, as it provides the opportunity to share knowledge and experience to help others develop and progress. Mentoring is a recognised form of CPD.

▶ If you are interested in obtaining or becoming a mentor, please contact **Janine Benn** E: janine.benn@geolsoc.org.uk T: 020 7434 9944

[LECTURES]

Shell London Lecture Series



Image: iurl/Shutterstock.com

Shearwater: Geology Under Pressure

Speaker: Caroline Gill, Senior Production Geologist (Shell)

20 November 2013

■ **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/shellondonlectures13. Entry to each lecture is by ticket only. To obtain a ticket please contact us 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



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FUTURE MEETINGS

Dates for meetings of Council and Ordinary General Meetings until June 2014 shall be as follows:

- **2013:** 27 November
- **2014:** 5 February; 9 April

SOCIETYNEWS...

New E-journals and E-books

Online access to e-books & additional e-journals published by Springer has been arranged for Fellows of the Geological Society using Athens logins until the end of the year. We will be using data from these trials to enhance the development of our collections.

Visit our Virtual Library for details of publications available and how to get an Athens login.



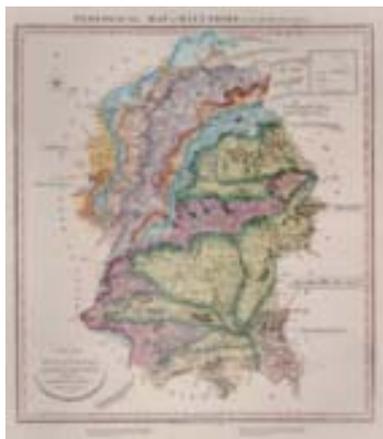
William Smith maps for sale

William Smith's county maps have been photographed in high resolution.

The Library has had its complete atlas of William Smith's County Maps photographed - which means that we can now supply high-quality prints of any of the 21 counties whose geological maps Smith published between 1819 and 1824. These were a follow-up to his famous 1815 map of

Britain, and were produced in conjunction with John Cary whose 'New and Correct English Atlas' of topographic county maps had been selling well since the 1780s.

All the maps can now be viewed on www.geolsoc.org.uk under 'Library and Information Services'. Here you will also find a brief history of the maps and details of both the cost and how to order prints. *Paul Johnson*



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>

LITERATURE SEARCHING

Not enough time or struggling to find the information you need? We can search a wide range of resources on your behalf and send you the results directly to your inbox. To find out more about this service, please email library@geolsoc.org.uk

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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, or at another venue, to be confirmed nearer the date. Once a year there is also a buffet dinner at Burlington House. New diners are always welcome, especially from among younger Fellows. Dinner costs £55 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.

2013: Please note that the Club does not meet in November, its place being taken by the Founders' Day Dinner on November 13. **2014:** 5 February (Burlington House); 5 March (Ath); 14 May; 24 September; 15 October. Fellows wishing to dine or requesting further information about the Geological Society Club, please email **Cally Oldershaw** (Hon Sec) at cally.oldershaw@btopenworld.com or **T: 07796 942361**. DR



Bring back real mapping!

BY **STUART HARKER**

Far from scrapping the undergraduate mapping exercise, industry needs universities to beef it up, says **Stuart Harker** *



In Mark Brodie (*Geoscientist* 23.07 August 2013) used this column to issue a plea to change the university teaching of undergraduate geology to include more relevant and up to date vocational training. In principle, this is a proposal that I wholeheartedly support. Indeed the inclusion of geophysical logging in the curriculum gets my vote. However, the old adage that, all other things being equal 'the best geologist is the one who has seen the most rocks' still applies in industry employment as well as academia.

SKILLS

Geological mapping is the hands-on way that geologists get to hone their skills in structural understanding in 3D. In addition, these geologists become familiar with scales from micro to megascopic, the variety of lithologies and depositional environments, lithological contacts and their relationships in geological evolution of the area and difficulties in sampling and measuring sections. A picture may be worth a thousand words in the classroom to pass an exam, but to see, measure and touch the outcrops in the field will be remembered for a lifetime.

Reduction of the mapping component in the undergraduate degree has been going on for the 25 years or so, largely due to cost constraints, legislation changes and health and safety issues. As a result we now see new recruits to industry who may know the theory, but not the practice of how to evaluate and represent their interpretation



Her smile will be even broader when she does field mapping and puts a hard hat on

of Earth history. The need to think in 3D is essential to all of this work.

Without mapping skills the geologist becomes reliant on computer applications to produce a map. Unfortunately computers can only produce what they have been programmed to do. Computers do not yet have the ability to visualise and interpret data as we humans can. For producing valid structural interpretations and thickness (isopach) or parameter distribution maps, the geologists must first use their experience to determine what the relevant map should look like in their heads, before pushing the "Nintendo" solution. Otherwise it's the familiar "Garbage In, Garbage Out" (GIGO) scenario. Validation by structural and correlation sections is also a part of this process. Cross sections are merely vertically oriented maps after all. There is no substitute for learning your mapping skills in the field, even though you may never go out on a field mapping exercise in your industry career.

REALITY CHECK

I have been fortunate throughout my industry career to have been able to maintain geological field work activity, which puts the geologist back in touch with the reality of nature. Accurate and geologically realistic mapping is the foundation-stone of success in exploration. I have also taught prospect generation and evaluation on a Masters course and there invoked a hands-on mapping exercise. I now use this exercise as a simple pencil and paper test to prospective employees to see how (or even if) the candidate can think in 3D. Unfortunately, most today cannot. This is a very sad state of affairs and I put out a plea for universities to reinstate mapping as a compulsory part of the undergraduate geology course.

▶ Read more on this topic in Letters, p 21. *Editor*

* **Stuart Harker** is VP Geology at Circle Oil Plc and a former VP Regions of the AAPG

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. 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).

“ WE NOW SEE NEW RECRUITS TO INDUSTRY WHO MAY KNOW THE THEORY, BUT NOT THE PRACTICE OF HOW TO EVALUATE AND REPRESENT THEIR INTERPRETATION OF EARTH HISTORY. THE NEED TO THINK IN 3D IS ESSENTIAL TO ALL OF THIS WORK ”
Stuart Harker

Reports of 'unusual animal behaviour' before earthquakes became common during and after the 1960s - snakes coming unseasonally out of hibernation, dogs deserting their kennels, birds sensing impending quakes and, most recently, insects not resting. But, as anyone who has lived with animals will know, animals 'behave strangely' all the time; which means evidence of this kind suffers from a huge and possibly unresolvable 'false positive' problem. The trouble is, nobody bothers to record animals' 'normal' behaviour. And even if you do watch them all the time, the quality of their behaviour is extremely tricky to quantify.

Humans, though are different. We have the media. I believe that comparing news reports with seismicity data provides compelling evidence that we humans may be responding to the effects of seismicity shortly before earthquakes.

Having observed what seemed to me to be an unusually large number of instances of riot and disorder shortly before reported earthquakes, I compiled a database of riots and obtained permission from the British Geological Survey (BGS) to use their comprehensive earthquake lists to make statistical comparisons.

The resulting statistically significant correlations are grounded in a simple comparison of one list with another. My intention in this article is to summarise the facts about the relative timing of earthquakes and riot, and let

you make your own mind up.

We all know the adage about correlation not necessarily meaning causation; but the first step must be to determine whether there is at least a correlation there. I believe the statistics show there is. The results could, I believe, be telling us something about the Earth and human behaviour, and may be worth pursuing further.

BISHOP'S CASTLE

On 1 April 1990 a disturbance broke out at Strangeways Prison, Manchester and quickly developed into a widespread insurrection. The riot and rooftop protest continued until 25 April, making it the longest incident of its kind in UK penal history.

My ideas about human behaviour being influenced by geological processes began to develop on the day after the Strangeways riots began. I was nearly knocked off the edge of my chair (and I don't mean metaphorically - I was sitting on the 6th floor of a Gwent office block), when the Bishop's Castle earthquake struck. This earthquake was at M5.1, occurring at only a little over 14km depth, and was caused (it is believed) by movement along the Pontesford Linley fault.

But why should there be any connection between a riot in Manchester one day, and a (for the UK) major earthquake in Shropshire the next? Why should the two occurrences be nothing more than an unrelated coincidence? I believe that by a close and rigorous application of statistics we may be able to detect a pattern. ►

GRAVITY & MIND

Is there a human response to tectonic stress?
Alan Watson* thinks so, and is about to publish a book about it. We asked him to share his evidence...





Rioting breaks out during the G20 Summit, London, April 2009. Could there be a correlation with tectonic stress?

► I believe it may be telling us something about how underlying processes, occurring deep within the rocks below our feet, may create a human response - a response that expresses itself in unrest or disorder in the period before earthquakes actually strike.

NEW GEOPHYSICS

Conventional ‘sub-critical’ geophysics had never been able to explain satisfactorily how tectonic stress can accumulate over large lateral distances before high magnitude earthquakes without breaking out into multiple, low magnitude shocks. However, the ‘New Geophysics’ as suggested by Crampin and others (albeit controversially and with significant opposition)³, has recently suggested a mechanism whereby, prior to earthquakes, strain may be spread out thinly over large volumes of rock without initiating low magnitude earthquakes.

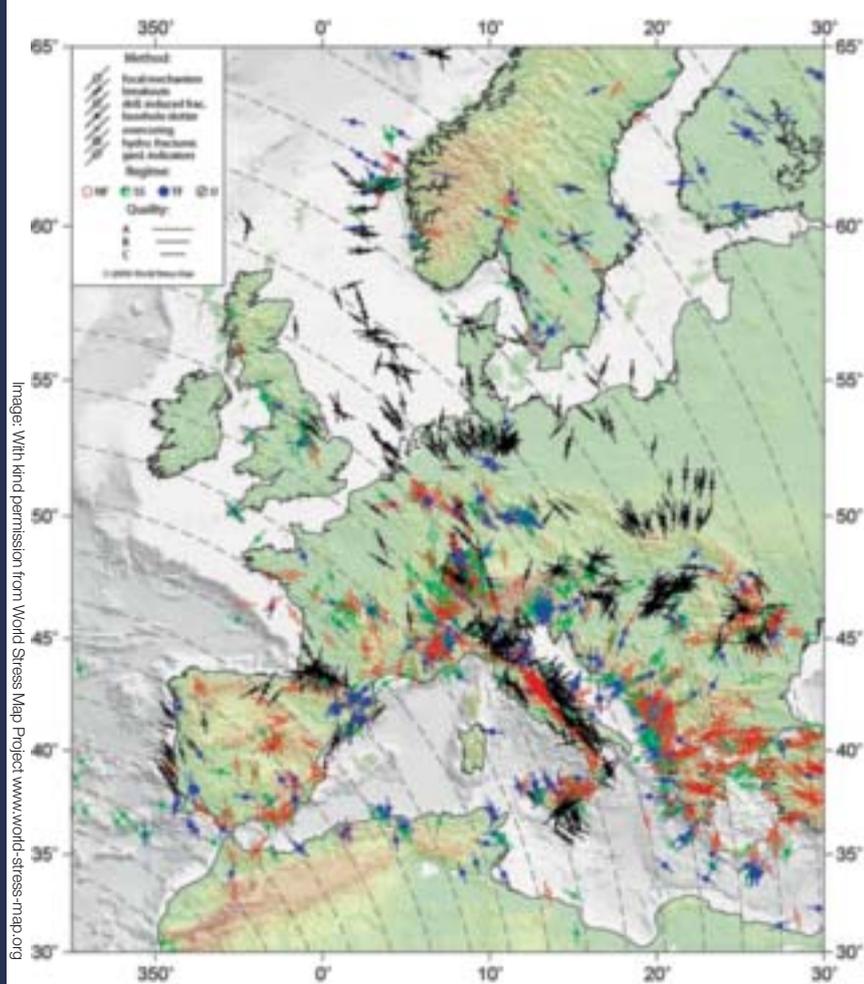
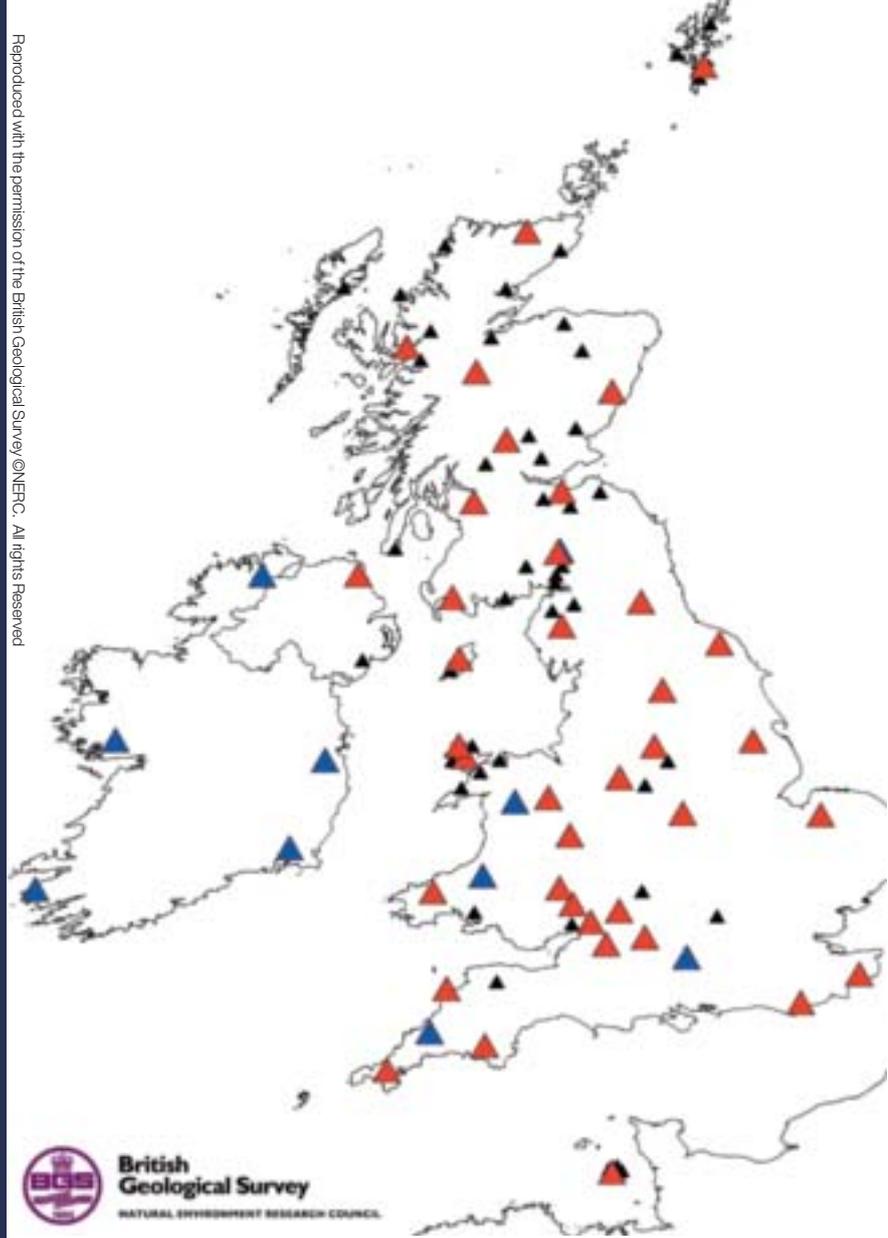
The geographical distribution of earthquakes in the UK is well documented in data gathered since 1970 by BGS from their nationwide seismograph network. This provides an ample database against which to assess the potential for any link between rioting and seismicity. England and Wales is a suitable site for comparing the incidence of earthquakes and riots as tectonic conditions are somewhat consistent within this land area, as shown by the prevailing stress regimes. Armed with a full dataset of earthquakes for the chosen period and a reliable list of widely reported riots, the statistical correlations that emerge are, I believe, strikingly clear.

STATISTICAL COMPARISONS

My first hypothesis might be stated thus: ‘That there is a significantly higher incidence of riot and disorder shortly before earthquakes, compared with the same period afterwards.’ An inspection of instances of riot and their causes can never be complete without a proper appraisal of the periods of peace and quiet. The two lists provide strong evidence that significant rioting is rarer during seismically quiescent periods.

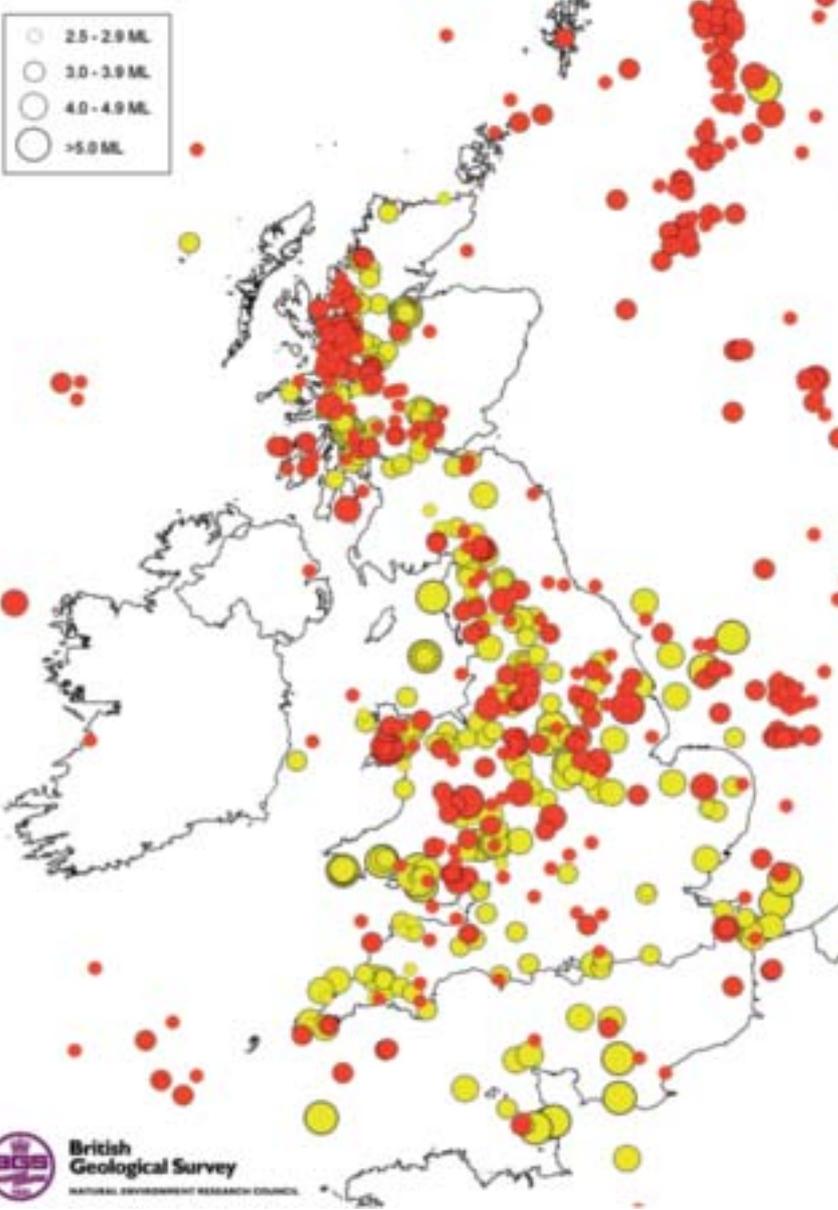
A second hypothesis for testing then arises, namely: ‘That there is a significantly lower incidence of riots and disorder after more than 140 days has passed since the last most recent earthquake of 2.5ML or greater, compared with the incidence that would be expected by chance.’

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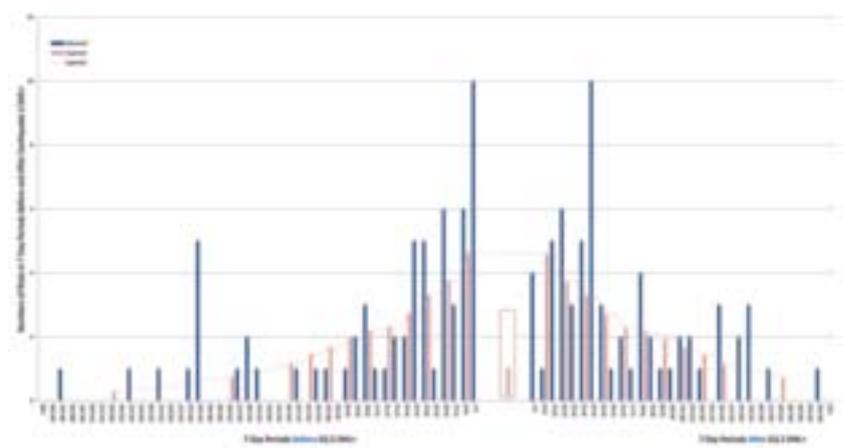


Images: With kind permission from World Stress Map Project www.world-stress-map.org

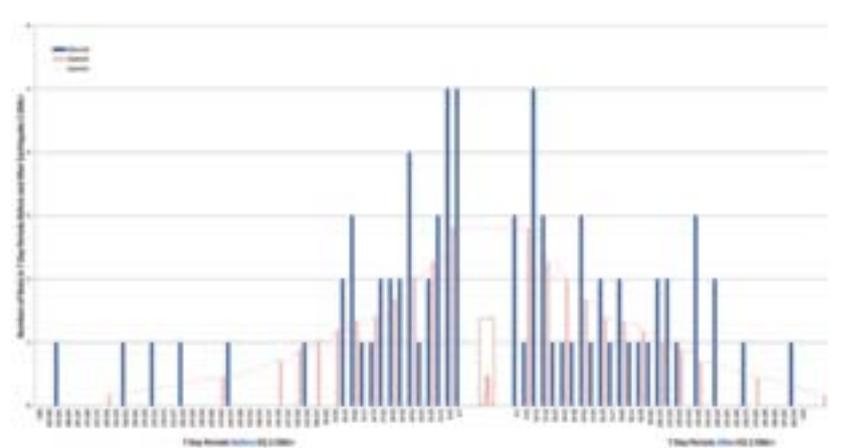
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Distribution of Earthquakes in the UK. Red dots represent instrumented records obtained in recent years, while the yellow dots are historical events known through contemporary reports of the after effects



Expected and Observed Frequency of Riots With Tails of Clusters in 7 Day Periods Before and After Earthquakes 2.5ML+



Numbers of Riots Without Tails of Clusters in 7 Day Periods Before and After Earthquakes 2.5ML+

Statistical tests have found probabilities of less than 1% that these two hypotheses are untrue. These probabilities are very low and contrast sharply with the usual perception – call it the default assumption - that there is no association between the incidence of riots and earthquakes.

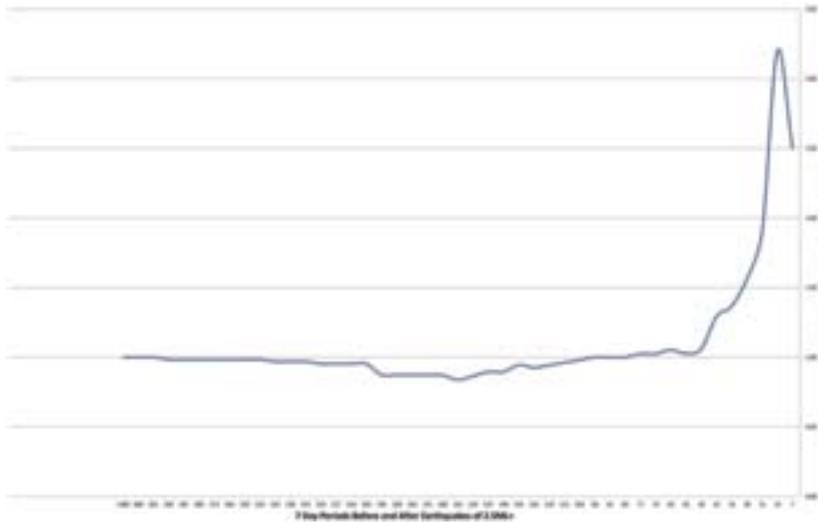
A substantial number of cases of riot appear in clusters with a common initial cause. My dual studies have therefore included both a full appraisal of these cases, including ‘tails’ of clusters as well as excluding them. One would imagine that copy-cat rioting in these tails of riot clusters would be influenced to a lesser extent by seismicity than might be the case for the initial onset of violence. The dual study therefore removes the uncertainties resulting from such potentially contaminating ‘sociological’ effects.

I also had to decide where to draw the line between what is and is not a ‘significant’ riot in this context. The compiled riot list, a selection from which is included in the table, is by no means a comprehensive catalogue of every mass disturbance that has occurred in England and Wales during the study period. Substantial instances of disorder occurred in many geographical areas at the time of the clusters in both 1981 and 2011; but some involved low numbers of arrests or limited injuries or damage to property. This contrasts with other cases where the substantial damage or large numbers of arrests to my mind justify inclusion in the list.

CONCERNS

Naturally, this selection process is somewhat subjective, and might lay me open to an accusation of cherry-picking my data to suit my case. To allay such concerns, I have applied statistical sensitivity tests to assess the effect of including or excluding certain events. Ultimately, I intend to make the database of riots available on a dedicated website, with the opportunity for the public at large to suggest additions for verification, should gaps in the list be identified.

The relative timing of earthquakes has been studied in order to determine the number of riots that would be expected to occur by chance. The expected average frequency of riots will increase anyway in the period leading up to earthquakes due to the effect of ‘overlap’ in the time periods. The total number of days in T day periods ▶



Ratio of Frequency of Riots (With Tails) Before to After Earthquakes 2.5ML



Poll Tax Protesters in Trafalgar Square, March 1990

► immediately prior to N earthquakes is somewhat less than $T \times N$ because some earthquakes occur less than T days apart. This effect is lessened nearer to earthquakes as T approaches zero and overlap is less likely, meaning that the chance of a riot in any given 14-day period increases nearer to the shocks. One diagram shows the expected and observed frequency of riots (with tails) in England and Wales 1980-2012 and another shows a similar pattern without the tails of riot clusters (see diagrams on P13).

In 14-day periods starting 70 days before all earthquakes in the study period, only 7% of riots would be expected to occur. This example has allowed for the effects of 'overlap' where earthquakes occur within 70 days of each other. If no association existed between the incidence of earthquakes and riots then about 14% of riots would be expected in the 14 days immediately before earthquakes. Statistical tests have compared the expected incidence with what is observed. In fact, as many as 25% of riots actually occur in the 14 days immediately preceding earthquakes.

Equally, if no association existed between earthquakes and riots, then about 14% of riots would also be expected in the 14 days immediately following earthquakes. In fact, as few as 8% of riots are observed to occur immediately after earthquakes. On this basis, we can say that there appear to be around three times as many riots in the 14 days before earthquakes compared with the 14 days after them. Naturally, the same number in both periods would be expected to occur by chance alone.

RATIO

The variation in the ratio between numbers of riots before and after earthquakes is presented graphically (see top left of page). Interestingly, the average ratio reaches a peak of 3.2 within 14 days of earthquakes and then falls off to 2.5 within seven days. Is this indicative of the stress accumulation followed by relaxation described over large lateral distances by the 'new geophysics'? The next diagram

TABLE 1

No.	Date			Riot Location	Days before next EQ	Magnitude of next EQ (ML)	EQ Epicentre	Days after previous EQ	Days between next EQ & subsequent riot
	Year	Month	Day						
7	1981	July	27-28th	Toxteth	9	2.8	Talke Area	45	978
8	1984	April	9th	Cresswell	6	3.3	Felindre, Powys	18	44
9	1984	April	9th	Babbington	6	3.3	Felindre, Powys	18	44
10	1984	May	29th	Orgreave	6	3.0	Selby, N Yorks	44	94
14	1985	May	11th	Birmingham	21	2.6	Nr Scunthorpe	210	100
22	1990	March	31st	Trafalgar Square	2	5.1	Bishop's Castle	27	514
23	1990	April	1st	Strangeways Prison	1	5.1	Bishop's Castle	28	514
31	1992	July	16-18th	Hartcliffe	13	3.5	Caernarvon Bay	150	1047
32	1992	July	22-26th	Burnley	7	3.5	Caernarvon Bay	156	1047
33	1992	July	22-23rd	Huddersfield	7	3.5	Caernarvon Bay	156	1047
34	1992	July	23-24th	Blackburn	6	3.5	Caernarvon Bay	157	1047
41	2001	May	26th	Oldham	5	3.6	Hartland Point, Devon	69	5
45	2004	June	24th	Boston	11	2.6	Driffield, Humberside	116	79
49	2008	May	14th	Manchester	14	2.5	Penrith, Cumbria	39	297
50	2009	March	21st	Stoke on Trent	21	3.0	Goxhill, N Lincs	18	43
51	2009	April	1-2nd	London	10	3.0	Goxhill, N Lincs	29	43
52	2009	May	24th	Luton	12	2.9	Maesteg, Bridgend	26	64
56	2010	Dec	1st	Birmingham	20	3.5	Coniston, Cumbria	124	11
57	2011	Jan	1st	Ford Prison	2	3.6	Ripon, N Yorks	11	108

Table 1: Riots Shortly Before Earthquakes : England and Wales : 1980 to 2012

shows a similar trend for the case disregarding the 'tails' of riot clusters.

On average, the compiled list shows that riots occur roughly every 189 days, while earthquakes of 2.5ML or greater occur, on average, every 78 days. This should put into perspective how small a 'window' the 14-day period before earthquakes represents.

These observations suggest to me that there may be something in the idea that seismic influences may draw the incidence of riots towards periods of generally higher stress prior to its impending release.

I have also studied the periods of seismic quiet since 1980. The retrospective classification of a 'quiet' period starts 140 days after the last most recent earthquake of 2.5ML or greater, and ends 14 days before the next earthquake. If there were no association between earthquakes and riots then about 22% of riots would be expected to occur in these periods. The observed incidence is that fewer than 5% of riots actually occur during quiescent intervals.

This to me seems even more striking, and is at least as significant for this project, because it shows that not only are riots *more* likely to occur shortly before earthquakes, but they are far *less* likely to occur during periods of low seismicity than would be expected by chance.

HUMAN RESPONSE

So, could these statistics really be indicating a human response to tectonic stress? If so, how could changes in stress within rocks result in variations in riot distribution?

Seismicity can manifest itself in other indirect phenomena such as electromagnetic variations, changes in hydro-geochemistry, atmospheric conditions, ground gas emissions and gravitational potential. Perhaps we should look to these effects for an explanation.

We should not expect this correlation, if it exists, to be confined to the United Kingdom. Indeed, evidence exists worldwide for instances of riot and unrest occurring prior to earthquakes, but

a full statistical appraisal of other regions or countries lies beyond the scope of this current project. Nevertheless, this would almost certainly form a basis for future research, and one chapter of my book describes examples from India, Australia, China, Italy and USA among others, including a recent example from Turkey where the onset of widespread recent rioting was followed by a series of low magnitude earthquakes.

SUMMARY

I believe my figures justify the following statements.

1. There is a significantly higher incidence of rioting and disorder in the 14 day periods prior to earthquakes compared with the 14 day periods after earthquakes.
2. The ratio of riot frequency before to after earthquakes falls off from a peak of 3.2 (with tails and 2.5 without) within 14 days to a lower ratio of 2.5 (with tails and 1.67 without) within 7 days of the shocks.
3. There are substantially fewer instances of rioting and disorder when more than 140 days have passed since the last most recent earthquake of at least 2.5ML.
4. These findings will provide support to other earth science studies about interactions between the biosphere and the lithosphere. There have been reports of unusual behaviour exhibited by birds, snakes and insects, among other species, prior to earthquakes. This project widens the scope

of influence between the lithosphere and biosphere and asks the question: are humans influenced by the behaviour of the lithosphere in ways not yet understood?

5. The statistics of riot and earthquake incidence serve to re-affirm seismology research known as 'the new geophysics' that tectonic stress may vary on a regional scale prior to earthquakes.
6. The occurrence of riots, in certain circumstances, may provide one further factor to consider, when assessing the risk of an impending earthquake.

If proved, could this science have predictive value and be of service to society? There have been calls for investment in a global ground-stress monitoring network in order to improve our ability to stress-forecast earthquakes. If this investment were to go ahead, it might also provide an opportunity to re-evaluate security risks and perhaps indicate a need for heightened security in prisons, or during protest marches.

I feel there must be some rational explanation for the observations I have described. I do not believe I have cherry-picked my data and I do not think I have allowed myself to be bamboozled by statistics! I hope that this article will generate some interest among geophysicists. The full story, in *Gravity and Mind – Human Response to Tectonic Stress* is now available in e-book form. ■

FURTHER READING

- 1 British Geological Survey List of Earthquakes of >2.5ML 1980 to 2012
- 2 Crampin, S., S. Chastin, and Y. Gao (2003). Shear-wave splitting in a critical crust: III – preliminary report of multi-variable measurements in active tectonics. *Journal of Applied Geophysics* 54, special issue 265–277.
- 3 Crampin, S., and Y. Gao (2013). The New Geophysics. *Terra Nova* 25.3, pp173-180.
- 4 Baptie B (British Geological Survey). Seismogenesis and state of stress in the UK. *Tectonophysics* (2010) p150-159.
- 5 Crampin S., Yuan Gao & Angelo De Santis, 'A few earthquake conundra resolved' December 2011 – intended for publication in *J. Asian Earth sci.*
- 6 Friedemann T Freund, Akihiro Takeuchi, Bobby W S Lau : Electric currents streaming out of stressed igneous rocks – A step towards understanding pre-earthquake low frequency electromagnetic emissions. *Physics and Chemistry of the Earth* 31 (2006) 389-396.
- 7 Friedemann T Freund : Toward a unified solid state theory for pre-earthquake signals. *Acta Geophysica*, Volume 58, October 2010, Issue 5, p 719-766.

* Alan Watson BSc (Eng) CEnv CEng MICE is a Ground Investigation specialist and writer. He is a Chartered Civil Engineer and a Chartered Environmentalist



GEOLOGY & OTHER STORIES

Producer and geologist **Helen Quinn** considers how the theory of plate tectonics has helped put geoscience on TV



“**W**hy is it relevant?” This is the question we, as TV producers, get asked most often when

pitching new ideas to programme commissioners. Having previously completed a PhD in science and dipped my toe into the world of geological research, I used to find this question difficult. *Of course* it's relevant, I was thinking: science is everywhere, science is how the world works. Of course this story needs to be told! But with a little more experience of working on science documentaries, I have come to understand that this is actually the most important question - and it is my job to find a way of answering it.

After completing my PhD I decided to step out of research and into science communication. What I didn't realise was what I wanted to do was tell stories.

Storytelling is something we all do, a way of communication unique to humans, it has allowed us to convey events and ideas throughout history in an understandable and entertaining way. Stories are our way of making sense of the world, of finding our place within it. But some stories can be harder to tell than others, and geology, with its vast, unimaginable timescales often finds its way into this difficult category. But, when the 50th anniversary of Vine and Matthews's momentous publication on sea floor spreading and the theory of plate tectonics came around, BBC programme commissioners believed geological stories could make interesting television and thus *The Rise of the Continents* was born.

UNASHAMED

The series was completely and unashamedly a geological story with its roots in the theory of plate tectonics. It was broadcast earlier this year on BBC 2, presented by the University of Plymouth geologist, Professor Iain Stewart. It aimed to tell the story of how our continents came to be as they are today, and the journeys they made to get there. From the time of the last giant supercontinent Pangaea,



Above: Filming active volcanoes in South America, visual clue to the subduction process

Left (clockwise from top): Iain Stewart in South America, in front of an extinct volcano, the largest single source of silver on the planet

Filming the alligator sequence

American alligators are related to the reptiles that walked Pangaea

it told how continental movements have helped build the world around us, contributed to our shared human history and influenced the plants and animals with whom we share our planet.

Its underlying story was how all this was brought together under the grand unifying theory of plate tectonics. The theory, as significant as the discovery of DNA in the biological sciences, brought together years of research allowing almost every geological phenomenon to be explained and connected. For us, half a century later, the theory had the added bonus of helping us build a narrative for our documentaries. The theory of plate tectonics allowed us to navigate a simplified and understandable pathway through the science. And because it was so momentous in the history of geosciences, parts of this theory are now recognisable to non-experts.

The fact that the continents look like parts of a giant jigsaw whose pieces have been strewn across the globe, resonates with many people, and for us this was a good starting point. Each programme in the series covered a major continental landmass or groupings of major landmasses - Africa, The Americas, Australasia and Eurasia - and in terms of

practicality we assigned a separate team to each. Initially, a director and a producer would get up to speed with the geology, making contact with experts and discovering new research. One of our biggest challenges was to get our heads around over 300 million years of geological history and think about how this could be condensed into an understandable and interesting, but also (crucially) visual hour of television.

PERSONAL

Early on, we decided we wanted Iain to take a more personal role in the documentary. We wanted the audience to buy into the idea that a geologist sees the world in a unique way. As Series Producer, Zoe Heron explains: “We were aiming to translate what Iain was seeing when he looked at landscapes. As a geologist he didn't just see a layer of rock in front of him, he saw a whole history open up before his eyes, his eyes took us away from the present and into a different world”. Through Iain we wanted to translate this geologist's view of the world to our audience.

To do this visually we created moments in the film where we used quick cuts and flashes of symbols or geological clues that helped decode the landscape that Iain was looking at. The aim was ▶

► to convey the feeling of being inside a geologist's mind, seeing the landscape through geological eyes and understanding how the micro structures made the macro structures.

As well as style, the content of each film needed to be carefully considered. With so much science to fit in, we were wary about overloading each film. We chose eight key moments in the history of each landmass, all of which moved us a little closer to answering our main question about how the continents came to be as they are today. We wanted things on the other side of the world to feel relevant to wherever you were, in the way in which the theory of plate tectonic brought everything together. (One of our more surprising connections was made at an alligator farm in Southern Colorado.)

SUPERCONTINENT

As part of the story of the American continent, we set out to describe when the continents very gradually transformed from the coal swamps characteristic of the Carboniferous, to the dry deserts

Below left: Iain Stewart with an alligator, telling the story of how supercontinent Pangaea catalysed evolutionary change

Below right: Relaxing with alligators after a tough few days' filming

of the Permian as the supercontinent Pangaea took shape. Amphibians could no longer thrive in this new landscape because of the very limited wetland areas in which to lay their eggs. Reptiles, ancestors of the crocodylian, began to dominate in Pangaea's deserts, largely because of one key adaptation - internal fertilisation. Environmental change, brought about as a result of continental movement, became the catalyst for evolutionary change.

As director Arif Nurmohamed recalls: "Internal fertilisation was a key turning point in our narrative and I wanted to tell this story with an energy that would illustrate this momentous change. Seeing these prehistoric-looking creatures in Colorado and realising that the way we reproduce as humans is linked back to Pangaea and the ancestors of those gators was incredible." This story of environmental change, caused by huge continental movement over 200 million years ago linked geology into an evolutionary change and suddenly became very relevant to us.

EXCITE & INSPIRE

In producing a series of geological films, our role was to excite and inspire people about the world around us and the science within it. Vine and Matthews' theory certainly influenced the way we were able to tell our story. Because it so clearly brought everything together, explaining past and present geological activity and highlighting our connections around the world, I believe it helped us get that original commission to put geology on television.

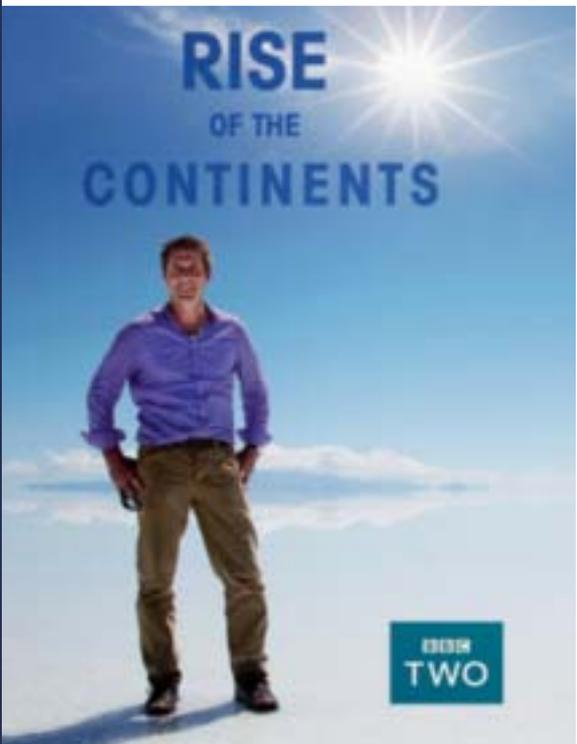
I hope we got people talking about geology, and maybe even looking at the world with new eyes. Our films needed to resonate with the audience, while keeping a clear view of the science, we needed to entice, inform and entertain. By using the unifying theory of plate tectonics as our subject we were able to build a narrative through the science. And for us, even with geology, it all comes back to telling stories. ■

* **Helen Quinn** works in the science department at the BBC





Filming with llamas. Llamas, guanacos and vicuñas evolved in South America but ended up confined there largely as a result of continental movement



Right: Poster boy – Iain Stewart in the publicity shot for *Rise of the Continents*

Far right: Filming on Salar de Uyuni, Bolivia, the world's largest salt flat



The Salar de Uyuni was created as a result of the growth of the Andean chain



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MAPPING STILL RELEVANT



Image: djls / Shutterstock.com

The sun must not set on field mapping training

MAPS FUNDAMENTAL

Sir, Mark Brodie (*Soapbox*, *Geoscientist* 23.07 August 2013) is a good example of why an individual mapping project should be an essential part of an undergraduate course in Earth science. Mark did not see the point of it. But it is the first, and for some geologists perhaps the only occasion on which he or she has to gather data in the field and make a three-dimensional interpretation of it.

I do agree with Mark that the interpretation of geophysical borehole logs should also be taught – having had occasion to use borehole logs and having had to teach myself. The basic principles are not difficult to understand and it would not take very long. And how about seismic interpretation, now much more sophisticated than in my early days?

However, in mapping, the chief fount of expertise in the art has always been the British Geological Survey (BGS). Their geologists have mapped all of England and Wales and much of Scotland on a scale of 1:10 000, new recruits being trained by their experienced colleagues. Over much of lowland Britain, where you hardly ever see a natural rock exposure, this is a skill not to be sneezed at, and far superior to what can be acquired during a student project. But do we need it any more? The last BGS printed catalogue (2010) shows coverage of England and Wales complete at the 1:50 000 scale, except for 21 sheets (out of 356) only available at 1 inch to the mile, and nine which are, I suspect, unavailable.

Six-inch maps, (later 1:10 000 revisions) were begun more than a century ago and

are, I believe, virtually complete. Quality of work no doubt varies but information on local geology based on large scale mapping is generally available. The six-inch originals can be examined at BGS offices. So do we still need to know how to do it?

It can be argued that revision of the national mapping can never be 'finished'. The question is, should we pursue this chimaera nonetheless? A recent example is provided by the Chalk. For most of the 20th Century three divisions were mapped: Lower, Middle and Upper Chalk, and these were used, for example, in a partial six-inch revision of the Shaftesbury (313) One-Inch sheet in 1923. Towards the end of the Century the area was again revised, and 'it was found that the Chalk could be divided into nine mappable units ... in the Shaftesbury and adjacent districts.' (Bristow *et al.* 1995, 111). These were shown in the 1993 map. Similar refinements may be found in other groups. And what about the vast areas of Triassic mudstones, showing no faults because they could not be mapped, or faults shown on the Dorset coast which are not continued inland? In any case some of the earlier six-inch revisions are certainly capable of improvement.

I doubt this is the present philosophy of BGS. Mapping becomes ever more time-consuming and expensive, though aerial photography and satellite imagery can help, as in the Shaftesbury case. A new revision is surely something that any public servant would view with horror.

Desmond Donovan

INDUSTRY NEEDS MAPPERS

Sir, Mark Brodie's *Soapbox* article is scary and ignorant of the needs of industry. Mark suggests that, at the expense of field mapping, universities should teach wire-line logging because it is relevant to the small part of an industry he has experienced.

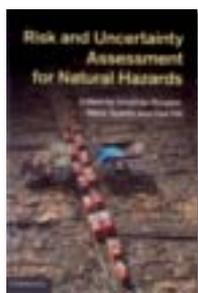
He is totally wrong because:

1. Most if not all geological data are spatially coordinated; they sit on a map, or its modern variant, a computer 3D image.
2. A significant number of industry geologists map for a living. For instance, a grade-control geo on a gold mine will daily record structure, alteration and lithology in the underground heading, and mineral geologists always map exploration tenements.
3. While some geologists do not 'map' as a part of their industry job, all use maps, cross-sections and 3D models. The ability to read an unconformity or on-lapping stratigraphic sequence is enhanced when the geo has mapping experience of that phenomenon.
4. Industry needs universities to teach those topics which it cannot. This includes the basics exemplified by geological mapping.

A challenge for industry is to find staff with quality field skills. Today, the better universities are still teaching good field mapping despite the pressure from budgets and protocol safety. They are successful because they are finding ways to integrate mapping with modern technologies in a changing environment. Industry will always need their graduates.

Julian Vearncombe





Risk and Uncertainty Assessment for Natural Hazards

The editors, affiliated with the Bristol Environmental Risk Research Centre, have led a NERC scoping study on the analysis, propagation and communication of probability, uncertainty and risk. The aim was to provide scientific advice and recommendations to NERC to help develop a research programme in uncertainty and risk, culminating in a workshop from which this book evolved.

The study focused on understanding risk and uncertainty with respect to natural hazards: how they are assessed and quantified, how they are communicated, to what extent current practices meet the needs of stakeholders, and how the current situation can be improved, with reference to practice in other areas. This was achieved by involvement of an expert panel of specialists in natural hazards, in statistics, in risk perception and communication, and in insurance and policy.

This book is not about geology or geohazards, nor is it concerned with teaching how to undertake an assessment. It is more concerned with policy and perception than the needs of the practitioner. Of the 16 chapters just three are concerned with types of geological hazard (earthquakes, landslides and volcanoes); the remainder cover a broad range of topics (including hydrometeorology, flood risk, tsunami hazard, wildfires and ecotoxicology), reflecting the wide range of backgrounds of the contributors, only 10% of whom are from Earth science institutions (30% from university geography departments). The coverage is not comprehensive, omitting such geohazards as shrinking soils, karstic solution, and mining. However, the book emphasises the need to communicate the potential occurrence of a hazard including the degree of uncertainty and risk to non-specialists, and in this the book focuses with effect.

Each chapter is a stand-alone

contribution. Whereas this tends to make the coverage somewhat disconnected, it nevertheless provides an overview of the context and alerts the reader to broader societal concerns. Those wishing to identify an appropriate methodology for undertaking an assessment for each topic can use the useful bibliographies concluding each chapter.

Assessment of risk and its concomitant uncertainty form the common thread in the context of economic activity and the adverse impact of hazard events. An integrated approach has been adopted, reflected by an absence of mathematical abstractions and bearing in mind the needs of the decision-making process concerned with prediction and dealing with aftermath.

This is a somewhat expensive volume for the student, but a useful acquisition for the library of an institution concerned with risk assessment and management, and the development of natural hazards policy.

Reviewed by Mike Rosenbaum

RISK AND UNCERTAINTY ASSESSMENT FOR NATURAL HAZARDS

JONATHAN ROUGIER, STEVE SPARKS AND LISA HILL (EDS)
Published by: Cambridge University Press 2013 ISBN: 978 1 107 00619 5 (hbk) 574pp **List price: £90.00**



Geology and Hydrocarbon Potential of Neoproterozoic-Cambrian Basins in Asia

The Neoproterozoic-Cambrian succession is of undoubted global importance from the petroleum point of view. Oil and gas are produced commercially from Neoproterozoic basins in Oman, Siberia and China, and there have been successful tests in North America, North Africa, India, Pakistan, Australia and elsewhere. This book concentrates on the potential in Asia, and is therefore a welcome follow-up to Special Publication 326 (Craig *et al.*, 2009), which dealt largely with North Africa.

Of the 15 papers that comprise the book, seven deal specifically with the Neoproterozoic of India, two with Pakistan, and one each with Oman, Siberia and China. The remainder include an introduction and two papers comparing India, Pakistan and Oman.

The seven papers on India and the two on Pakistan deal comprehensively with the depositional history and the petroleum potential of the various Neoproterozoic basins. In India, the Bikaner-Nagaur and Vindhyan Basins have tested oil and wet gas respectively to surface. The other basins in India are still undrilled but surface geological mapping has proven the presence of source rocks and likely reservoirs. In Pakistan, minor oil production has been achieved from the Potwar Basin, while numerous oil and gas shows have been recorded on the Punjab Platform. The scope of the papers varies from generalised regional synthesis to details of proven and potential source rocks, reservoirs, balanced structural cross-sections and descriptions of individual fossils.

The two papers comparing the Neoproterozoic of India, Pakistan and Oman provide further details of plate tectonic history, sedimentology, reservoir quality and source rock geochemistry. The paper by Smith claims that the Ara Formation of Oman hosts the world's oldest commercial oil. There are tests from older reservoirs in Australia (live oil, 1.4 Ga) and in India (wet gas, 1.7 Ga, possibly even older), but these have not reached commercial production.

The single papers on the productive Lena-Tunguska Province of Siberia and the NW Tarim Basin of China are particularly clear and well written. The NW Tarim paper is unusual in a volume of this kind in that its author concludes that although all the key elements for a hydrocarbon play are present, they are risky, and a prolific Neoproterozoic hydrocarbon play is unlikely to exist.

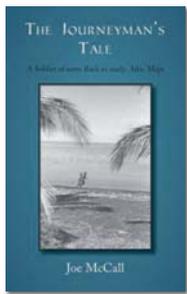
The book is profusely illustrated, though some of the figures suffer from a reduction in size to the point that pieces of text and numbers in particular are illegible. There is a very comprehensive index.

Reviewed by Pete Webb

GEOLOGY AND HYDROCARBON POTENTIAL OF NEOPROTEROZOIC-CAMBRIAN BASINS IN ASIA.

G M BHAT *et al.* (Eds). Published by: The Geological Society 2012 ISBN: 978-1-86239-346-2.
List price: £110/\$200; Geological Society £50/\$100; other qualifying societies £60/\$120 312 pp
www.geolsoc.org.uk/bookshop

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The Journeyman's Tale

The late Joe McCall had an exceptionally long career and was much involved with the Society. This is the third volume of his family history and autobiography. I remember being with Joe in a Strasbourg restaurant in the 1980s when he suddenly said loudly "I am one of the few English men still around who has actually FOUGHT THE FRENCH!"

We looked around nervously, thinking that might not have been a good thing to say in that place. He was referring to his participation in the May 1942 invasion of Vichy-held Madagascar. About half of the book deals with the vagaries of his army training and that campaign. When he went to the Royal School of Mines (RSM) after the war, he was one of only six students reading pure geology, but they included Roy Elwell (later of Kings College) and David Holt (later of Freeman Fox and Partners). They were taught by formidable geologists such as H H Read, Alan Wood and Robert Shackleton.

Joe received a PhD for work on the Dalradian of Donegal alongside Wally Pitcher and Derek Flynn among others. His behind the scenes anecdotes bring out the human side of that great generation of geologists, as well as the social side of the RSM and of mapping in Ireland. In 1951, Joe joined the Colonial Geological Survey as a hydrogeologist in the Public Works Department in Nairobi; but after working in Western Kenya for a couple of years he transferred to the Kenya Geological Survey. He mainly undertook field mapping in western Kenya including early work on carbonatite volcanics, during which he became acquainted with Louis Leakey, but also carried out a pioneering gravimetric survey of part of the Rift Valley. He describes the rigours of working in the bush which seem redolent of 19th Century exploration.

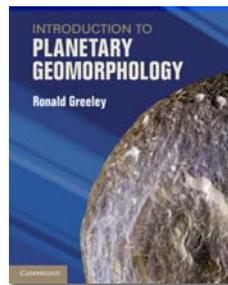
In 1960, Joe was tipped off by John Sutton of an advertised senior lectureship at the University of Western Australia. Joe secured the job and the book closes with him about to depart to Perth. Joe intended a fourth volume to be

published this summer. I hope he was able to complete it. This well-presented paperback is a good read, loaded with Joe's great sense of humour.

Reviewed by Brian Marker

THE JOURNEYMAN'S TALE

G J H MCCALL. Published by: Bright Pen Books (Sandy, Bedfordshire) 2013. 233pp ISBN 978-0-7552-1532-4 or as an e-book from www.authorsonline.co.uk



Introduction to Planetary Geomorphology

The data returned to Earth by spacecraft orbiting or flying by the planets and their satellites contain images of astonishing beauty and great geological importance. This excellent book by the late Ron Greeley introduces laypeople and geologists alike not just to geomorphology on other planets, but to the techniques of image manipulation and interpretation as applied to planetary surfaces.

Greeley, originally a carbonate palaeontologist, mused that he gained entry into the NASA *Apollo* program when someone possibly misunderstood his PhD thesis title, on "lunulitiform bryozoans", as being somehow related to the Moon! Nevertheless, he went on to forge a successful career in comparative geomorphology, planetary imaging and analysis, and was instrumental in many of the missions detailed in this volume.

An introduction to the planets of the Solar System and how flight projects move from the drawing board to launch pad is followed by a useful chapter discussing image processing. It provides an overview of how data are acquired by different methods and sensors, downloaded to Earth and then dispersed to a variety of repositories, processed, analysed and published. A final general chapter provides an overview of the four processes which influence the shape of planetary surfaces: tectonism, volcanism, impact cratering, and gradation. Examples of the Earth's landforms resulting from these process are provided, although mostly

from the Western Hemisphere, and almost exclusively from the USA.

Seven prodigiously illustrated chapters then follow, discussing seminal landforms on Earth's Moon, Mercury, Venus, Mars, and the satellites of Jupiter, Saturn, and Uranus and Neptune. A final chapter covers the upcoming missions to Jupiter and Pluto and the prospects for further missions. Images and discussions are up-to-date and include those from the MESSENGER project to Mercury in 2011.

Unfortunately it shares with other recent books on planetary geology the fact that all images are monochrome, in some cases robbing the reader of both the beauty of false- or true-colour images, and of useful information. However, the pictures are often iconic, and have been selected to illustrate the best example of each landform type clearly. Every chapter is followed by assignments for students, new terms are shown in bold type and defined on their first use, critical references are sparingly mentioned in the text and listed fully in a bibliography, and the index is comprehensive, making the book a useful textbook as well as a pleasure to read. It can be recommended for professional geologists and educated laypeople with an interest in planetary geology, and for undergraduate students. This book was submitted for publication by Greeley just one month before his sudden death, and stands as a fitting tribute.

Reviewed by Lewis McCaffrey

INTRODUCTION TO PLANETARY GEOMORPHOLOGY

RONALD GREELEY. Published by: Cambridge University Press, 2013 ISBN: 978-0-521-86711-5 (hbk) 252pp. List price: **US\$85**

REVIEWS: COPIES AVAILABLE

Please contact ted.nield@geolsoc.org.uk if you would like to supply a review. For a full up to date list go to www.geolsoc.org.uk/reviews

- **NEW! Magnetic Methods and the timing of geological Processes** by L Jouvane et al. (Eds) 2013. Geological Society of London Special Publication 373. 402pp hbk.
- **NEW! Life Beyond Earth – the search for habitable worlds in the universe** by Athena Coustenis and Therese Encrenaz. Cambridge University Press 2013 287pp hbk
- **NEW! The Earth as a Cradle for Life: the origin, evolution and future of the environment** by Frank Stacey and Jane Hodgkinson. World Scientific Publishing 213 285pp hbk
- **NEW! Addressing Tipping Points for a Precarious Future** by Tim O'Riordan and Tim Lenton (Eds) British Academy Paperback 2013 347pp pbk

PEOPLE

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

DISTANT THUNDER

Keep calm and carry on

As Remembrance Sunday approaches, geologist and science writer Nina Morgan remembers geologists who served

Although potential military applications of geology had been recognised since the end of the 18th Century, it was not until World War I that geological expertise was deployed specifically on the battlefield. Of the 14 geologists from the Geological Survey, who joined the British forces in 1914, 13 were also Fellows of the Geological Society. Two of these – Lieutenant (later Captain) W B R [Bill] King (1889-1963), and Major (later Lieutenant-Colonel) Tannat William Edgeworth David (1858-1934) – are especially remembered for their geological contributions to the Allied victory.

King employed his geological expertise to guide the emplacement of at least 470 British military water supply boreholes and produced maps that assisted the development of a water supply infrastructure in areas occupied by the British Army. Engineering geology maps compiled by Edgeworth David played a key role in the placing of the tunnels and mines beneath German positions and made it possible to set off a massive explosion – felt as far away as Lille, 20km distant. This devastated German troops and enabled the capture of Messines-Whyschaete Ridge (*Geoscientist* 22.11 Dec/Jan 2013).

DINING CLUB

Meanwhile, on the home front, Fellows of the Geological Society were not idle. The members of the Society dining club continued to meet. Handwritten notes on Dining Club menu cards preserved in the Geological Society archives provide an insight into of how the war

progressed – and chronicle how the domestic geological army kept calm, carried on and continued to march on its stomach:

"[4 November 1914] ...

The first dinner after the war began. No difference in price.

[20 January 1915] ... The first effect of the War on these dinners was the stoppage of German wines. The better class hock has been finished and a cheaper brand was supplied.

[23 June 1915] After more than 18 months of war there is no reduction in food, and no increase in prices, but the German hocks gave out and French white wines were substituted on May 12 1915

[19 January 1916] The fishing boats were often raided by the German destroyers so that fish became more scarce and dearer. We had to drop the fish course. The price of fish has become so high that for the first time we had only 1 fish course.

[20 December 1916] ... The first club dinner with restricted menu ..

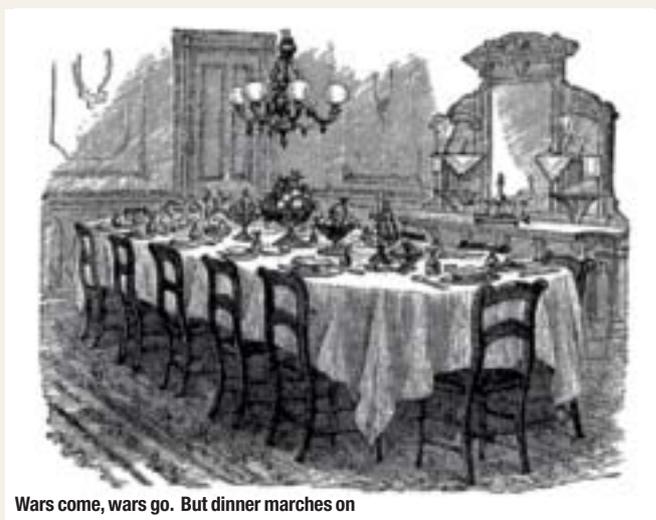
[7 February 1917] 3 course dinner 5/6, no soup but two meat courses... The wine became poor in quality. It gradually got so bad that several members drank whiskey in place of wine.

[14 March 1917] A bottle of whiskey used in place of bad wine due to [the] Criterion [restaurant] being in the hands of the receiver.

[6 June 1917] The wine was not only bad. The price was raised.

[20 June 1917] The last dinner held at the Criterion restaurant. "

Following the closure of the



Wars come, wars go. But dinner marches on

Criterion, the diners moved to Oddenino's Imperial restaurant, a venue recommended by their dining colleagues at the Royal Geographical Society.

"[17 November 1917] The first dinner held by the Club at Oddenino's restaurant.

[20 March 1918] The meat being rationed it was decided to have meatless dinners and this was the first series of meatless [meals]. (The menu included: Hors d'oeuvre, crème germinal, turbot sauce capris, timbale de macaroni a la Jules Verne, omelette chasseur, fromage)."

And the diners also faced higher prices.

"[6 November 1918]: French wines now more in price and were 50/- dearer than when the war began. The last War Dinner. The Armistice signed after the 11th. The change of tone between this and the previous dinner was wonderful. The end came very rapidly and once the Germans were got on the 'run'.

[21 November 1918] The price of everything being so high the

restaurant refused to allow coffee free, and it was paid for out of Club funds."

But towards the end of 1918 thankfully things began to look up, at least on the drinks front.

"[5 December 1918] The wines began to rise in price but they were distinctly good [underlining sic]"

All's well that ends well!

ACKNOWLEDGEMENT

Thanks to the staff at the Geological Society Library for alerting me to the existence of the menu cards, and to Caroline Lam, archivist at the Geological Society for showing them to me. Other sources of information for this vignette include Chapter 7 of *Whatever is under the Earth* by Gordon Herries Davies; and the feature article *Officers with maps* by Ted Rose, which appeared in the April 2012 issue of *Geoscientist*

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



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.

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

Bestow, Trevor *	Million, Ronald *
Blackburn, James Kirk *	Moffatt, William Stewart *
Bowler, Christopher Michael Lance *	Robson, Geoffrey Robert *
Chapman, W T *	Spencer, Peter Murray *
Holroyd, J D *	Spurr, Arthur M M*
Hudson, Neal F C *	Vincent, E A ('David')*
Jacqué, Maurice *	Williams, Colin L *
Jones, Brian Lloyd *	
Kellaway, Geoffrey Arthur	
Middleton, John *	
Miller, James *	

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 to be commissioned. You can read the guidance for authors at www.geolsoc.org.uk/obituaries. To save yourself unnecessary work, please do not write anything until you have received a commissioning letter.

Deceased Fellows for whom no obituary is forthcoming have their names and dates recorded in a Roll of Honour at www.geolsoc.org.uk/obituaries.



STICKS AND STONES

Dalston and Gibbet are in the field. They return next month, assuming they work out how to open the gate

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- The Society offers two pathways to chartership: Chartered Geologist and Chartered Scientist. Equivalent in status, each requires high standards of knowledge, competence and professionalism.
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- Be informed about the progress of cutting edge science. Engage in the development and debate of GSL policy and position papers.

Explore

- The Geological Society houses one of the most important libraries in the world, with over 300,000 volumes of books and serials, remote online access to over 60 subscribed journals and a collection of over 40,000 maps. The library's collection can be searched from anywhere in the world through the online catalogue. Items can be posted anywhere in the UK and photocopies can be sent to Fellows overseas.
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- As a Fellow you will be assigned to one of our Regional Groups and have the opportunity to sign up to a Specialist Group.

There is an appropriate grade of membership for each career stage, from student to retirement. Fees are graduated according to age, so that membership is made accessible to younger and older geoscientists. For further information www.geolsoc.org.uk/apply

For more information or to download an application form visit www.geolsoc.org.uk/join

OBITUARY



JONATHAN PATRICK CHESTERMAN 1952-2012

Oil explorationist with a taste for adventure who worked in major plays worldwide

Paddy Chesterman was an explorer. He exemplified the best qualities of a geologist, not least in the time he devoted to studying rocks in the field all over the world. Explorers can be fidgety, even isolated at times; Paddy was a great traveller but also knew how to be calm. He had an enviable capacity for sharing his enthusiasms with family and friends - rocks, trees, mountains and music leading the way.

EXPEDITIONS

By the time Paddy was born on 2 May 1952, his parents

(my uncle and aunt) had already led his older cousin irretrievably into geology by mounting impromptu expeditions at any hour and any season into the hills of Derbyshire and along the Dorset coast. In 1961 Paddy's father Deryck, a pioneer in the development of sonar technology for seabed mapping, became Professor of Physics in Hong Kong. From there the family travelled widely, creating in Paddy an ease with both travel and unfamiliarity that was a feature of his attitude to work all his life.

Following the family's return to England, Paddy graduated in Geology from

Exeter in 1973, worked as a mudlogger in Singapore for a couple of years, then took the MSc in petroleum geology at Imperial College in 1976. In 1980 he married Linda, and they moved to Calgary, a fine base for them and children Julian and Melanie, as father set about finding oil across the world.

“PADDY UNDERSTOOD A LOT ABOUT ROCKS AND PUT THEM IN A BROADER CONTEXT, UNDERPINNED BY FUNDAMENTAL PRINCIPLES RATHER THAN BY MODELS”

COMPANIES

The list of companies for which Paddy worked tells two stories. The likes of Core Labs, Occidental, Dome, Bow Valley, Devon, Canargo and Carmanah, are interspersed with J P Chesterman Proprietorship and Chesterco Inc. That first story is of corporate jostling as oil prices moved up and down, a familiar tale to petroleum geologists caught in the action. The second is personal: an able geologist determined to pursue his passion for applying geology to finding oil, while remaining his own man. Paddy was perfectly

happy to run his own companies if others were losing their nerve.

The list of countries from which that search was conducted includes most of the usual suspects – such as Indonesia, Argentina, Georgia and Bahrain. Paddy operated happily in settings that would have had others yearning for familiar comforts: the taste for adventure, sharpened in childhood, never left him.

TRIBUTES

Tributes from colleagues and friends consistently focus on two characteristics not necessarily prominent in the same person: enthusiasm and personal engagement. Some great enthusiasts may fail to respond to the more subtle signals from those around them, but not so Paddy. Those heartfelt tributes refer consistently to his real friendship and consideration, especially his encouragement of those seeking to follow his adventurous path.

On his travels from Exmouth to Exshaw, Paddy understood a lot about rocks and put them in a broader context, underpinned by fundamental principles rather than by models. Through his great enthusiasm he helped the rest of us keep our eyes on the hills, and on that larger picture. He died on 14 September 2012.

► By Bryan Lovell



ENDORSED TRAINING/CPD

Course	Date	Venue and details
Aqueous Geochemistry	4-8 November	Newcastle University School of Engineering and Geosciences. Presented by Dr Neil Gray (Course Leader). £1125. Fellows' discount. See website for details & booking.
Soil & Rock Description and Site Investigation	11-15 November	University of Sussex, Sussex House, Brighton. Leader – Prof. David Norbury. £1229. Fellows' Discount. See website for details & booking.
Soil and Rock Logging Course	12 November	Organised by: First Steps Ltd. Venue: EM Drilling, Bath. £265 + VAT. Fellows' discount. See website for details & booking.
Lapworth's Logs	n/a	'Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. Contact: info@lapworthslogs.com. Lapworth's Logs is produced by Michael de Freitas and Andrew Thompson.

DIARY OF MEETINGS NOVEMBER 2013

Meeting	Date	Venue and details
What's New in Hydrogeology, Hydrogeological Group, IAH, Earth Surface Science Institute	6 November	Venue: University of Leeds. See website for abstract submission, registration fees and details. Fellows and members discounts apply. Contact: Chris Jackson E: crja@bgs.ac.uk
Postgraduate Research in Marine and Earth Science 2013. Marine Research Group, Geological Society, Marine Geosciences Group, NOC	6-7 November	Venue: NOC, Southampton. See website for abstract submission, registration fees and details. Contact: Dr Tim Le Bas T: +44(0)23 8059 6557 E: tlb@noc.ac.uk.
Museums Association Conference & Exhibition 2013 Museums Association	11-12 November	Venue: BT Convention Centre, Liverpool, UK. See website for registration and further details. Contact: Lorraine at Museums Association, 42 Clerkenwell Close, London EC1R 0AZ T: 020 7566 7840 E: lorraine@museumassociation.org
Incoming! Or why we should stop worrying and learn to love the meteorite. Western Regional	12 November	Venue: SH Reynolds Lecture Theatre, University of Bristol. Speaker: Dr Ted Nield Time: 18.00 for 18.30. Contact E: wrg@uk.environmentcorp.com
Geophysics in Identifying Cavity and Marble on Site Hong Kong Regional	12 November	Venue: Mariners' Club, TST. Speaker: Frank Collar. Time: 18.30. Contact: Kitty Chan E: kitty.chan@arup.com
Helpston Groundwater Remediation Project West Midlands Regional	12 November	Venue: University of Wolverhampton, Telford Campus. Speaker: Leon Warrington - Hydrogeologist, Hydrock Consultants. Time: 18.00 for 18.30. Contact: Daniel Welch E: geolsoc_wmrg@live.co.uk
Founders' Day Lecture and Dinner 2013 Geological Society, Sponsored by Afren	13 November	Venue: Burlington House & Le Meridien, Piccadilly. Speaker: Dr Cherry Lewis. See website for fees and registration. Contact: Naomi Newbold. T: 020 7432 0981 F: 020 7494 0579 E: Naomi.newbold@geolsoc.org.uk.
The 17th Annual Glossop Award and the 14th Glossop Medal Lecture, Engineering Group	13 November	Venue: The Royal Geographical Society, 1 Kensington Gore. For further information see website or contact Tom Casey T: +44 (0)113 242 8498 E: tom.casey@arup.com
Credit due to the few: British Military Geologists and Hydrogeologists of World War II, South Wales Regional	14 November	Venue: Main Building, Cardiff University, Park Place. Speaker: Prof. Ted Rose. Time: 17.30 for 18.00. Contact E: swales.rg@geolsoc.org.uk
Geoscience, Engineering & Environmental Careers Evening. South Wales Regional, CIWEM, ICE Ground Engineering Group	14 November	Venue: Main Building, Cardiff University, Park Place. Time: 17.30 for 18.00 Contact E: swales.rg@geolsoc.org.uk
Gypsum geohazards and road construction East Midlands Regional	18 November	Venue: De La Beche Conference Suite, BGS. Speaker: Dr Tony Cooper. Time: 18.30 for 19.00. Contact: David Bailey E: deba@bgs.ac.uk
Frontiers Meeting Hong Kong Regional	18 November	Venue: HKU, Pok Fu Lam. Time: 08.30- 17.50 Speakers: Bob Sas & Raymond Sung. Contact: Kitty Chan E: kitty.chan@arup.com
AGM and Presentation of the Frederick Sherrell Award 2013. South West Regional	20 November	Venue: Dolphin Hotel, Bovey Tracey. Time: 18.30 for 19.00. Frederick Sherrell Award for 2013 goes to Dr John Grimes (John Grimes Partnership Ltd). Contact: Jonathan King E: southwestrg@gmail.com
Careers Day 2013 Geological Society	20 November	Venue: BGS, Keyworth. See website for details. Contact: Naomi Newbold. T: 020 7432 0981 F: 020 7494 0579 E: Naomi.newbold@geolsoc.org.uk.
Our Hidden Geology and Geomorphology: Sea Bed Mapping in the 21st Century. Marine Studies, MAREMAP partners	21 November	Venue: Royal Society of Edinburgh. See website for registration & details. Contact: Alan Stevenson T: +44 (0)131 667 1000 E: agst@bgs.ac.uk
Assessment and Design Mitigation for Rockfalls in Quarries. North West Regional	21 November (TBC)	Venue: Williamson Lecture Theatre, Manchester University. Speaker: Thomas Clifford. Contact: Nik Reynolds E: geologicalsociety.northwest@gmail.com. Time: tbc. Please check website.
European water policy: challenges for Hydrologists European Federation of Geologists	22-23 November	Venue: Royal Belgian Institute of Natural Sciences, Brussels. See website for registration and details.
Annual Dinner Hong Kong regional	22 November	Venue: Hong Kong Football Club, Causeway Bay. Time: 18.30 – 23.30. Features address by the President of the Geological Society, David Shilston, and Bill Gaskarth. Contact: Kitty Chan E: kitty.chan@arup.com

For more meetings in November, please see website www.geolsoc.org.uk/listings

OBITUARY



DAVID ALFRED GRAY 1925-2013

Hydrogeologist and Assistant Director of the Survey, who headed its Geophysics and Hydrogeology Division

David Gray, a Fellow for 64 years, died 18 March 2013. Born at Chelmsford, Essex, on 4 September 1925, he went to school in Colchester and Brentwood before joining the Royal Naval Volunteer Reserve in 1943. Commissioned as midshipman, he served in motor torpedo boats in UK waters as well as spending a year in West Africa and contracting malaria, which was to affect him periodically throughout his life.

MAPPING

Following demobilisation, and a geology degree at University College London, he joined the Geological Survey, beginning his career

mapping in Kent. Preferring more applied work, he requested a transfer to the Water Department where he spent the next 24 years. He joined as interest in groundwater was beginning to blossom, dealing with enquiries and work associated with the implementation of the 1945 Water Act. He also carried out the first systematic investigations of saline intrusion into coastal aquifers in the UK and began to apply geophysical methods to hydrogeological problems.

In 1965 seven staff from the Water Department were transferred to the newly formed Water Resources Board. Those remaining formed the core of a new Hydrogeological Department

and David was appointed Chief Hydrogeologist. His remit was to convert the Department from a service to a research organisation and to provide hydrogeological support to the Overseas Division of the newly named Institute of Geological Sciences. He was a progressive manager at a time when management in some parts of the organisation stifled innovation. By the time he left the Department, it had been entirely reborn as a centre for applied hydrogeological research, with an international reputation.

“THOSE WHO WORKED WITH HIM WILL REMEMBER A DETERMINED AND COMMITTED PROFESSIONAL WHO NEVER LOST HIS INTEREST IN SCIENCE AND GAVE HIS STAFF OUTSTANDING SUPPORT”

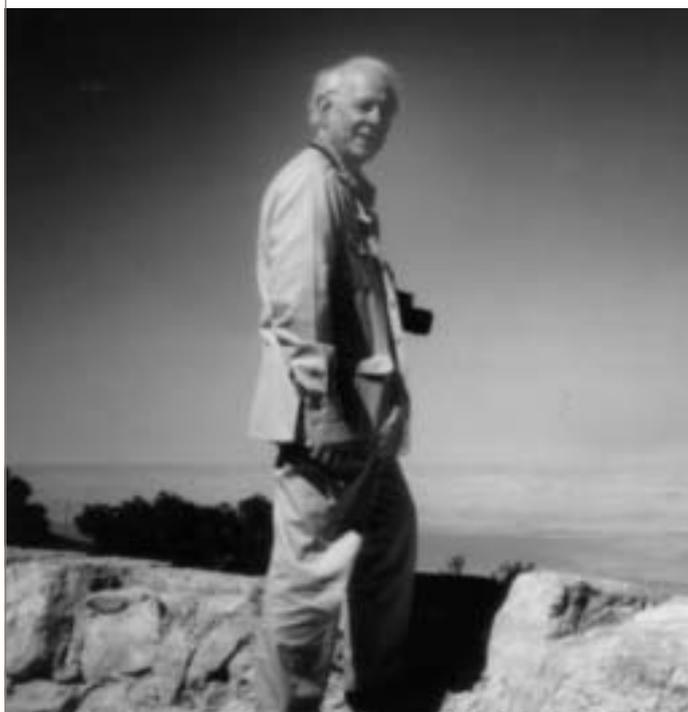
ACTRESS

Promoted an Assistant Director in 1974, initially in charge of the Special Services Division, three years later he was happy to take charge of a new Geophysics and Hydrogeology Division where there was a large component of commissioned

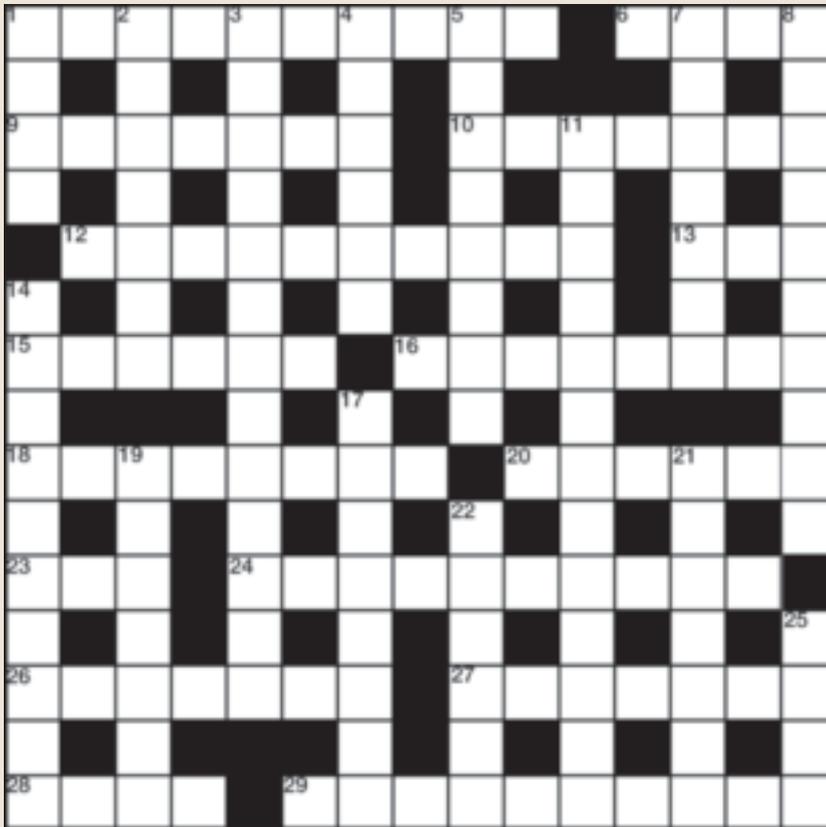
and fundamental research. Here he played a major role in the setting up of task forces to look at the potential of geothermal energy in the UK and the disposal of radioactive wastes. These were new, politically sensitive fields of research, and his personal commitment was instrumental to their success. Those who worked with him will remember a determined and committed professional who never lost his interest in science and gave his staff outstanding support. The award of a CBE in the 1986 New Year's Honours crowned his career. Retiring in 1985, he advised civil engineers on water-inflow problems associated with tunnelling and the European Community on their Geothermal Programme.

During his time as a naval officer in north Kent he met and subsequently married a young actress, Bunty Leaton. The union between the rather reserved David and the vivacious Bunty was predicted to be a short one by many colleagues, but endured happily for over 50 years until her death in 2006. They made their home in Harrow where their two sons, Richard and James were born. Although joints were beginning to wear out, he was active until the end, and his death was sudden and unexpected.

► By John Mather



CROSSWORD NO. 174 SET BY PLATYPUS



ACROSS

- 1** Mineral group of mostly green, brown or spotted minerals, formed by the hydration of ultramafics (10)
- 6** Hydrated magnesium silicate with perfect basal cleavage commonly found in amipits (4)
- 9** In the chamber (7)
- 10** Long wave in a harbour, literally (7)
- 12** Originating within (10)
- 13** North country river famous for its miller (3)
- 15** To slip away, especially of time (6)
- 16** In tune with the climatic changes of the annual cycle (8)
- 18** Ynys Môn, famously mapped by Greenly (8)
- 20** Hopkins's Windhover (6)
- 23** 20a's underneath-him-steady (3)
- 24** Palaeontologically, covered in keels, sulci, tubercles and other curcliques (10)
- 26** Unbeliever (7)
- 27** Canadian province rich in oil (5)
- 28** Prelapsarian garden (4)
- 29** Lacking repetitive similarity across planes or along axes (10)

DOWN

- 1** Unwell (4)
- 2** EU country bordering the Black Sea, first mentioned by Herodotus and known to the Romans as the mineral-rich province of Dacia (7)
- 3** Discoid or cushion-like echinoderm type, extinct since the end of the Permian (13)
- 4** Father of the H-Bomb (6)
- 5** Commonest atmospheric element (8)
- 7** Leave behind, like a meander that becomes an ox-bow lake (7)
- 8** Etching into rock with repeated blows from a steel spike (10)
- 11** Incapable of being permanently maintained (13)
- 14** Rock formed as a result of the metamorphism of basic igneous rock (10)
- 17** This guy's number is a dimensionless expression of the ratio of inertial and viscous forces in a flowing fluid (8)
- 19** Tallest terrestrial mammal most commonly found in textbook explanations of evolution (7)
- 21** Less obscure (7)
- 22** To preserve human remains in a lifelike condition (6)
- 25** Secular, of the people (4)

WIN A SPECIAL PUBLICATION

The winner of the September Crossword puzzle prize draw was **Geoffrey Jago** of Nottingham.

All correct solutions will be placed in the draw, and the winner's name printed in the February 2014 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - Friday 10 January.**

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

Name

Membership number

Address for correspondence

Postcode

SOLUTIONS SEPTEMBER

ACROSS:

- 1** Resin **4** Germanium **9** Transform **10** Under
- 11** Onomatopoesis **14** Road **15** Signboards
- 18** Dielectric **19** Lode **21** Christianised **24** Tenet
- 25** Elevation **27** Aversions **28** Style

DOWN:

- 1** Retrograde **2** Sea **3** Nosean **4** Geologist
- 5** Romeo **6** Avulsion **7** Industrious **8** Marl
- 12** Opalescence **13** Ascendance
- 16** Noisiness **17** Detritus **20** Uncaps
- 22** Steno **23** Etna **26** Ivy

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Founders' Day

LECTURE & DINNER 2013



THE GEOLOGICAL SOCIETY WAS INAUGURATED ON FRIDAY 13 NOVEMBER 1807 BY THIRTEEN GENTLEMEN OVER DINNER AT THE FREEMASONS' TAVERN, COVENT GARDEN.

TO CELEBRATE THE SOCIETY'S INAUGURATION, WE WILL BE HOLDING OUR ANNUAL FOUNDERS' DAY LECTURE AND DINNER ON WEDNESDAY 13TH NOVEMBER 2013.

Founders' Day Lecture

James Parkinson and the Founding of the Geological Society
 Speaker: Dr Cherry Lewis, University of Bristol

At the age of 16, James Parkinson (1755-1824) was apprenticed to his father to learn the 'art and mystery' of being an apothecary. Living all his life in Hoxton, then a village on the outskirts of London, his pioneering work in medicine led to him identifying the Shaking Palsy as a distinct medical condition, which eventually became known as Parkinson's disease. His favourite past time, however, was collecting fossils. This talk will review Parkinson's remarkable life, including his involvement in a plot to kill King George III, how he put the study of fossils on the scientific map of Britain through his three volume work *Organic Remains of a Former World*, and how his expertise as the country's only 'fossilist' led to him becoming one of the 13 founders of the Geological Society.

Contact details:

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 T: 0207 432 0981
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 W: www.geolsoc.org.uk/founders13

Founders' Day Dinner

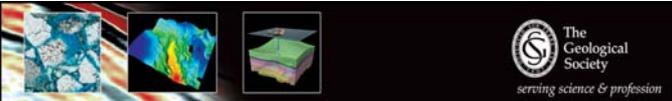
Venue: Le Meridien, Piccadilly - Dress: Black Tie - Ticket price: £80

After dinner speaker: TBC

Timings:

17:30 Tea & coffee served, Burlington House
 18:00 Lecture by Dr Cherry Lewis
 19:00 Drinks reception at Le Meridien (sponsored by AFREN)
 19:45 Presentation of The Netflix Earth Model Award
 20:00 Dinner served
 21:30 After dinner speaker
 24:00 Carriages

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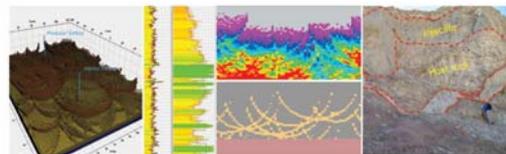
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Registration Now Open

Capturing uncertainty in geomodels: Best practices and pitfalls

11-12 December, 2013
 Elphinstone Hall, University of Aberdeen



Over recent years, the static description of hydrocarbon fields has increasingly been undertaken via construction of 3D cellular geomodels. The model builder's toolkit is now extensive, incorporating sophisticated structural framework building capabilities, numerous gridding technologies and an ever-expanding, complex geostatistical data modelling resource. However, as we develop hydrocarbon fields and not the geomodels that are built to describe them, we must ask whether the modelling paradigm is robust and whether the models illuminate or hide uncertainty.

This two-day conference will explore how geomodelling tools should be used to best effect, and when such tools mislead or do not add value. The focus will be on methods and workflows for capturing uncertainty throughout the geomodelling process, and on how to carry this uncertainty into the dynamic modelling realm. Each of four sessions will be headed by a keynote speaker who, together with a further nineteen presenters, will make for a topical and thought-provoking conference. The full programme is available on the conference webpage.

For further information please visit www.geolsoc.org.uk/geomodelling13 or contact:
 Laura Griffiths, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.
 T: 020 7434 9944 F: 020 7494 0579 E: laura.griffiths@geolsoc.org.uk

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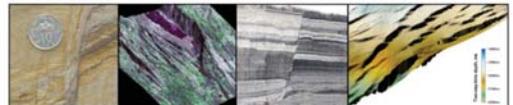


Call for Abstracts - 29 November 2013

Geometry and Growth of Normal Faults

23 -25 June 2014

The Geological Society, Burlington House, Piccadilly, London



The past few decades have seen major advances in our understanding of many aspects of the kinematics of normal fault systems. The analysis of high quality 3D seismic datasets of faulted volumes and detailed outcrop studies, combined with complementary geomechanical modelling, have provided much improved constraints on both the nature and growth of faults and associated fault zones. Recent research progress has benefited from the importance of faulting in a variety of application areas, such as the groundwater, minerals and petroleum industries. In a conference convened on the 25th anniversary of the Geological Society's 1989 'Geometry of Normal Faults' conference, it is intended that the full range of technical issues associated with the growth of normal faults, together with their practical applications, will be covered. The conference is in memory of Juan Watterson, one of the pre-eminent scientists in the field of 3-D fault analysis and modelling.

Contributions are invited on all aspects of normal faults including:

- 3D geometry and kinematics of normal faults
- Internal structure and growth of fault zones
- Deformation within the volume surrounding normal faults
- Fault growth on earthquake through to geological time scales
- Links between the ductile and brittle expression of faults
- Stress- and strain-based methods for analyzing normal fault systems
- Numerical modelling of the geometry and growth of normal fault systems
- Practical application of fault analysis techniques

Confirmed Invited Speakers:

Joe Cartwright - University of Oxford
 David Ferrill - Southwest Research Institute, Texas
 Haakon Fossen - University of Bergen
 James Jackson - University of Cambridge
 Andy Nicol - GNS Science, Wellington
 David Sanderson - University of Southampton
 Janos Urai - RWTH Aachen University
 Scott Wilkins - Anadarko

A fieldtrip to the Bristol Channel will follow the meeting (26th-27th June).

Instructions for abstract submission are provided on the conference page of the Geological Society website: www.geolsoc.org.uk/Geometry-and-Growth-of-Normal-Faults. Abstracts should be sent to laura.griffiths@geolsoc.org.uk and copied to conrad.childs@ucd.ie by 29 November.

For further information please contact: Laura Griffiths,
 The Geological Society, Burlington House, Piccadilly, London W1J 0BG.
 T: 020 7432 0980 or email: laura.griffiths@geolsoc.org.uk

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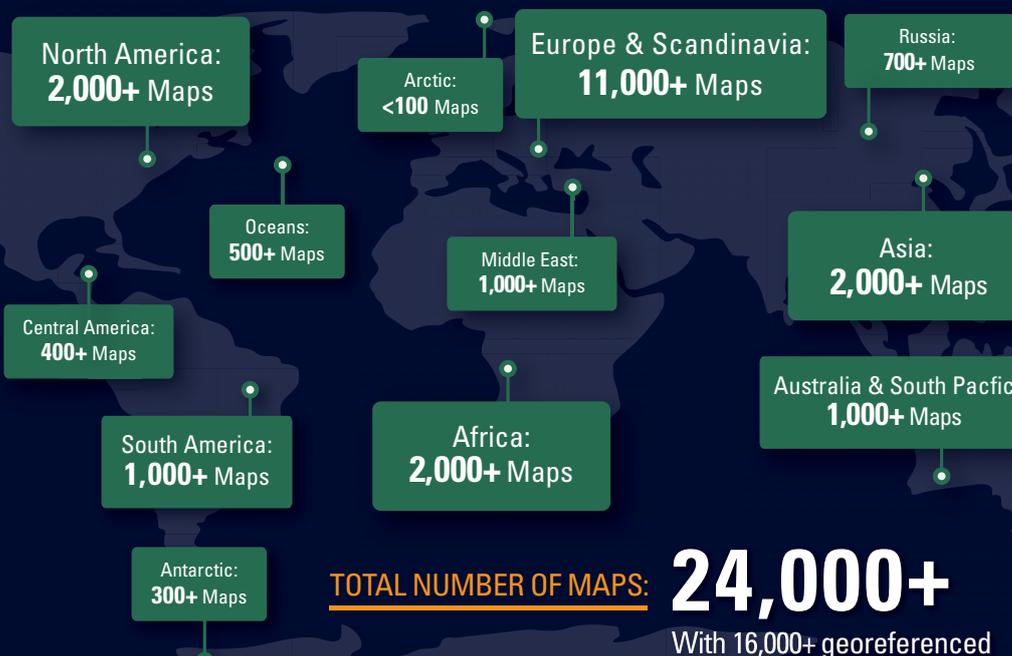


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