

GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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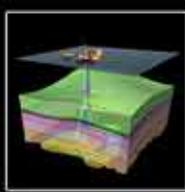
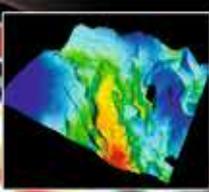
GAME OF DRONES

Adrian Wilkinson on point-cloud surveys captured from ground and air

TALE OF TWO MAGMAS
Ascension Island's zoned pyroclastic airfall deposits

ONLINE SPECIAL
Malcolm Hart on UNESCO's Global Geoparks conference

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Time to cast your ballots for President Elect and Council



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Subsurface sand remobilization and injection: implications for oil and gas exploration and development

22-23 March 2017

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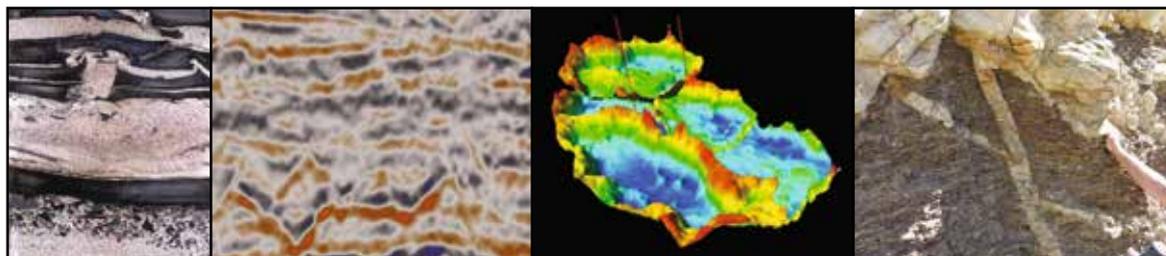
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Evidence of sand fluidization and injection as significant shallow crustal processes is increasingly common in outcrop and subsurface studies. Regionally-developed giant sand injection complexes develop in areas of 100's to 1000's km² and locally reservoir commercial volumes of hydrocarbons, act as fluid migration routes, compromise seals and record major periods of focused fluid flow. The non-stratiform character of sandstone intrusions requires original solutions for the successful quantitative modelling, drilling and completion of wells and accentuates the need for a better understanding of these often enigmatic features. Sand injection and fluidization occurs on many scales both within giant complexes and as small, discrete features. We invite presentations on the characterization and interpretation of sandstone intrusions and associated facies, from grain to basin scale. Presentations on process and reservoir modelling and other practical applications are also encouraged as we consolidate knowledge from improved subsurface imaging, exploration and development drilling and outcrop-based research and identify areas for future investigation.

For further information please contact:

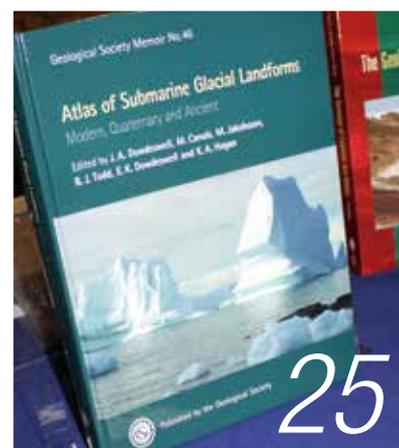
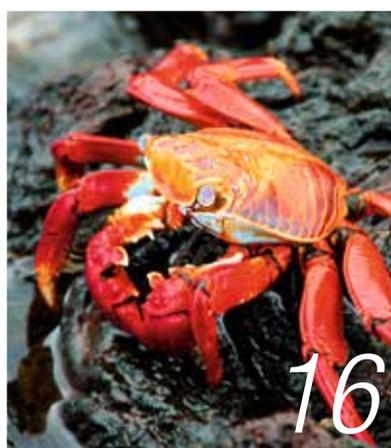
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SPECIAL**

MALCOLM HART
on **UNESCO's**
Global Geoparks conference



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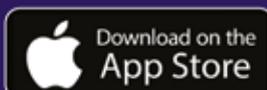
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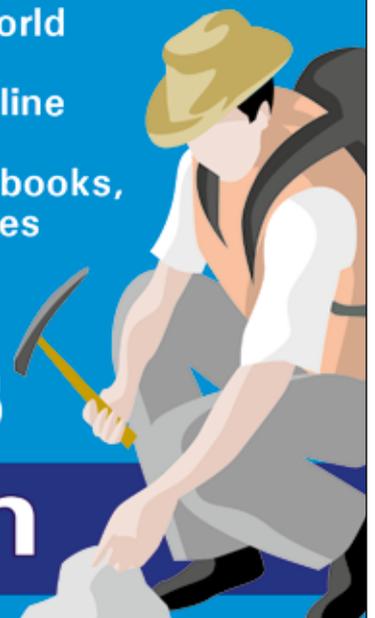


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“ **DESPITE WHAT J M BARRIE MIGHT HAVE CHILDREN THINK, BELIEVING FERVENTLY IN FAIRIES DOESN'T MAKE THEM REAL** ”

FROM THE EDITORS DESK:

Of belief and power

Belief – of the blind rather than the reasoned sort – enjoys an unwarrantedly high status in our supposedly modern culture. We are encouraged constantly, especially by wish-fulfilment dramas emanating from the dream factory, to subscribe to the notion that for a thing to become real, it is necessary only to believe strongly enough in it; and that failures of reality can always be ascribed to a failure of belief. If you build it, they will come, and all that. Yet, reality does not care what we believe. Despite what J M Barrie would have children think, believing - even fervently believing - in fairies doesn't make them real.

So, welcome to the new age of evidence-free belief. Welcome to conviction politics, where zealots no longer feel bound to acknowledge experts – those hated liberal élitists presumably defined as anyone who has voluntarily read a book. Welcome to the age in which one can even gain positive electoral advantage by admitting as much. Welcome to the age of Kellyanne Conway and her ‘alternative facts’.

At least the Trumpocene has one advantage over the Anthropocene: nobody will be in any doubt when it started. The White House website was gutted of references to many things

including climate change almost immediately after the inauguration. For the US Environmental Protection Agency and Department of Agriculture, it started on 24 January, when they were banned from talking to the press and posting social media updates. As the climate of fear grows, my colleagues in US magazines are reporting privately that even National Science Foundation staff are unsure to whom they can and cannot speak.

There is a quotation, much repeated, that goes: “In an age of universal deceit, telling the truth is a revolutionary act”. (There are variations.) Since 1982, it has been commonly attributed to George Orwell, though this is (according to experts) another ‘alternative fact’. Nobody has ever been able to trace it in the great man’s oeuvre. But leaving aside matters of attribution, the thought stands.

As more gagging orders are issued, and they will be, affecting more and more Federal agencies, scientists everywhere will have a stark choice to make. Truth-telling has always been revolutionary, because in the end truth will always trump belief. Because, as Richard Feynman famously said in his *Challenger* Disaster report: ‘Nature isn’t fooled’.

Vive la revolucion.

DR TED NIELD, EDITOR - TED.NIELD@GEOLSOC.ORG.UK @TedNield @geoscientistmag

SOCIETY NEWS

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



Elections to Council 2017-2018

The October issue of Geoscientist invited Fellows to nominate new members of Council for election to succeed those retiring at the Annual General Meeting on 7 June 2017. Nominations were also sought for the post of President-designate. Subsequent calls were made in the email newsletter.

Ten nominations have been received, one for President-designate and nine for the remaining four places. The Elections Committee had identified several potential candidates for President-designate, who were approached but who declined. It is permissible under Regulation R/G/11 to put

forward only one candidate, and Fellows are asked to indicate that they are content for the nomination to go forward to the formal vote at the Annual General Meeting.

All Fellows should already have received voting information either by email or post direct from Electoral Reform Services (ERS) who are managing the ballot for Council on behalf of the Society. If you have not heard from ERS, or have any other difficulties casting your vote, please contact Stephanie Jones (E: stephanie.jones@geolsoc.org.uk) at the Society.

It is important that Council is representative of the views and diversity of all the Fellowship so Fellows are urged to participate in the

preliminary ballot which will determine the list for the formal vote at the Annual General Meeting.

The process for the election of members of Council is set out at section 6 of the Bye-laws, and that for the election of Officers at clause 9.2.

Council elections are your opportunity to choose who should serve on Council to best represent the interests of all Fellows and to shape the future of the Society. Fellows may wish to have regard to the area of expertise of continuing members of Council (tables below). Biographies of members of Council are at www.geolsoc.org.uk/biographies.

Continuing members of Council 2017-2018

Name	Expertise	Background
Mr Rick Brassington	Hydrogeology	Industry
Mr Malcolm Brown	Petroleum Geology	Industry
Dr Jason Canning	Petroleum Geology	Industry
Miss Liv Carroll	Mining	Industry
Dr Marie Edmonds	Igneous Petrology, Volcanology, Geochemistry	Academe
Dr Sarah Gordon	Mining, Meteoritics, Risk	Industry
Mr Graham Goffey	Petroleum Geology	Industry
Mrs Tricia Henton	Environmental Geology	Retired
Ms Naomi Jordan	Sedimentology, Palaeontology, Palaeoenvironments	Academe
Dr Robert Larter	Marine Geophysics	Government
Dr Jennifer McKinley	Geographical Information Science and Geostatistics	Academe
Dr Colin North	Sedimentology	Academe
Dr Sheila Peacock	Geophysics	Government
Prof Christine Peirce	Marine Geophysics	Academe
Mr Nicholas Reynolds	Contaminated land, Geotechnical engineering	Industry
Dr Katherine Royse	Environmental Geology	Government
Mr Keith Seymour	Hydrogeology	Retired
Dr Alexander Whittaker	Tectonics and Landscape dynamics	Academe



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LONDON LECTURE SERIES

Palaeobiomechanics & the evolution of fossil vertebrates

Speaker: Prof. Emily Rayfield (University of Bristol)

Date: 15 March

Programme

◆ **Afternoon talk:** 14.30pm Tea & Coffee: 15.00 Lecture begins: 1600 Event ends.

◆ **Evening talk:** 1730 Tea & Coffee: 1800 Lecture begins: 1900 Reception.

Further Information

Please visit

www.geolsoc.org.uk/gsslondonlectures16.

Entry to each lecture is by ticket only. To obtain a ticket please contact the Society around four weeks before the talk. Due to the popularity of this lecture series, tickets are allocated in a monthly ballot and cannot be guaranteed.

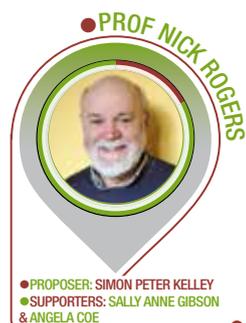
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London W1J 0BG, T: +44 (0) 20 7432 0981
E: receptionist@geolsoc.org.uk

Members of Council retiring at the Annual General Meeting on 7 June 2017

Name	Expertise	Background
Dr Nigel Cassidy	Geophysics	Academe
Mr Chris Eccles	Engineering Geology	Industry
Mr David Hopkins	Extractive Industries	Industry
Prof David Norbury	Engineering Geology	Industry
Mr Michael Young	Geophysics	Government/Industry

Elections to Council 2017-2018

► Prof Nick Rogers



I am professor of Earth Sciences at the Open University where I have spent virtually all my career. My research interests are in high temperature

geochemistry, igneous petrology and the composition and evolution of the mantle, but I have also engaged with many aspects of higher education that relate to the mission of the OU. I have been Head of Department and Science Programme Director, serving at Deanery Executive level in both posts.

I have been a Fellow of the Society for over 20 years and served on Council for six. For five years I was Publications Secretary in the run-up to and through the Bicentenary and was heavily involved in the establishment of Geoscience World and the Lyell Collection which are now core to the Society's publication output and a major source of income. I have subsequently served as a member, and latterly chair of the Education Committee, during which time we have successfully engaged with school curriculum consultations, developed the careers portal and facilitated the establishment of University Geoscience UK.

Having been involved with the development and drafting of the 2007 strategy, I am keen to see the renewed strategy established. The Society plays a key role in bridging the gaps between geoscience professions and education, research and policy, and should be a leading and authoritative voice for our science. I would bring to the role of President a sound knowledge of how the Society and its staff work and an enthusiasm to ensure that its role continues to develop along the lines it has been following for the past decade.

Proposer: **Simon Peter Kelley**

Supporters: **Sally Anne Gibson and Angela Coe**

Supporting statements - **Council nominees**

Note: **John Talbot (see Page 08) has agreed, if elected, to take on the role of Vice President, Chartership which becomes vacant on the retirement of Chris Eccles. His candidature is endorsed by Council.**

► Mr John Booth



I am Managing Director of Geotechnics Limited, one of the UK's largest independent geotechnical investigation specialists. I have 35 years' experience of engineering geology in the UK and overseas. I

hold a BSc in Geology (University of Liverpool, 1983), and an MSc in Engineering Geology (University of Leeds, 1991). I have been a Fellow of the Society and a Chartered Geologist since 1991, and a Chartered Scientist since 2005. I am a UK Registered Ground Engineering Adviser (RoGEP).

I have been committed to the Society and the wider geoscience community throughout my career. I am a former member of the Committee for the NW Regional Group (1993-96), and am an active CGeol Scrutineer. I have been involved in promoting career opportunities at schools and universities, and in mentoring colleagues as they approach Chartership.

Engineering geology has a large role to play in developing our communities for the future, and is the direct link between the natural and the built environment. The availability and management of resources, water and energy, together with greater awareness of natural processes, floods and climate change are fundamental to safeguarding our World. An understanding of Geology and how we use and husband these vital reserves underpins the improvements we need in infrastructure, building our cities, and delivering improvements in health, education and wellbeing for an ever expanding population.

Proposer: **Bill Gaskarth**

Supporters: **David Cage and Paul Hayes**

► Dr Quentin Crowley



I am passionate about geoscience education and supporting the careers of the next generation of geoscientists. I am also a keen advocate of the Geological Society's role, particularly in maintaining high

standards in science and acknowledging those who have made significant contributions to our discipline.

I completed my BSc in Geology (1994) and PhD (1997), both at University College Galway, Ireland (now NUIG). I then moved to the UK for an exciting three and a half years as an EU-funded Post-Doctoral Research Fellow at Keele University, during which time I considerably extended my academic links across the UK and Europe. Subsequent to this, I was fortunate enough to gain employment as a NERC research scientist, at the Isotope Laboratories (NIGL) at BGS headquarters in Keyworth, Nottingham. In 2008, I returned to Ireland, this time to Trinity College Dublin, where I hold the position of Ussher Assistant Professor in Isotopes and the Environment.

I served as Subject Editor (2008-2011) and Chief Editor (2011-2016) for the Journal of the Geological Society, during which time I had the opportunity to work with a talented and diverse range of academic, industry and publishing house staff. During my tenure as Chief Editor, I sat on several committees (e.g. Publications and Information) and continue to sit on the Awards Committee.

Proposer: **Andrew Carter**

Supporters: **Robin Strachan and Iain Stewart**

► Ms Lesley Dunlop



I graduated from Durham University with a BSc Geology in 1985 and obtained an MSc in Crystallography from the London University in 1988. I have been a Fellow of the Society since

2006 and serve on the Geoconservation Committee. I work at Northumbria University and research interests relate to periglacial geomorphology using mainly geophysical techniques.

As Chair of the English Geodiversity Forum I was involved in the production and launch of the Geodiversity Charter for England. The Charter and Forum are aimed at highlighting the importance of geodiversity with the public, industry, government and professional organisations etc. I am Vice Chair of the Northern Group of the Geological Society and a Member of the Executive Committee of ProGeo, the European Association for the Conservation of Geoheritage.

I have an interest in outreach, education

Elections to Council 2017-2018

and public information and have taught at Northumbria and other universities, tutored A-Level and adult geology classes, including leading field visits. I have worked with organisations including the Natural History Museum, The Great North Museum, Geographical Association and GeoConservationUK. If elected I believe that I can bring a wide depth of interests and knowledge to Council and I am committed to enhancing the role of the Society.

Proposer: **Matthew Pound**
 Supporters: **Clive Edmonds and David Manning**

▶ Dr Neil Mitchell



A lifetime interest in submarine geomorphology commenced when I was first mesmerized watching the seabed revealed by sonars as part of my DPhil studies. Continuing that interest, I worked for a company in the early 1990s involved in offshore oil and gas, submarine cables and salvage (spending time offshore Brazil, Uruguay and Argentina). I have held research fellowships and later with academic positions at Lamont (New York), Fredericton (Canada), Durham, Oxford and Cardiff, developing a fascination for what geomorphology can tell us about the Earth.

Since my DPhil, my research interests have focused on mid-ocean ridges, equatorial Pacific sediments, seamounts, volcanic islands, continental slopes and coastal geology, maintaining links with the offshore industry. I have been a Geological Society fellow for more than 20 years and have previously served on the Marine Studies Group committee.

Now a Manchester University lecturer, in addition to expanding my research interests, I teach applied geophysics aiming to educate and prepare students for life after university. If elected I hope to engage in the education and chartership debate and contribute to the Society's remit of accrediting university degrees. Having experience of research council funding, I would also seek to contribute to strategy behind the Society's grants, aiming to ensure sustainable funding opportunities for young researchers, not otherwise supported through research

council or other bodies.

Proposer: **Stuart Jones**
 Supporters: **Katharine Brodie and Mike Burton**

▶ Miss Jessica Smith



As the Secretary of the Central Scotland Regional Group (CSRG) my key motivation for joining Council is to bring the voice of the Regions to the table. I believe that geographical

diversity plays a role in ensuring that the Society remains relevant to the membership and can have a positive influence on the engagement of Fellows.

I joined the Geological Society as a Candidate Fellow while studying my BSc in Earth Sciences at the University of Glasgow; upon graduating in 2004 I became a Fellow. Thereafter, the practical experience gained in work combined with my MSc in Engineering Geology at Imperial College London culminated in my obtaining Chartered Geologist status in 2014. Supporting and enabling others to achieve this career landmark is something I take great pride in through my work activities as well as my involvement with the CSRG.

In my current role as a Senior Engineering Geologist with Atkins I am privileged to be in a position where I can promote STEM careers to young people, and particularly to young women. It would be a great honour to continue do so as a Member of Council with the Geological Society.

Proposer: **Mike Winter**
 Supporters: **Stewart Lightbody and David Shilston**

▶ Dr Toby Strauss



I am an economic geologist with over 20 years' experience in exploration and mining, principally in the junior mining sector. I am today an independent geological consultant.

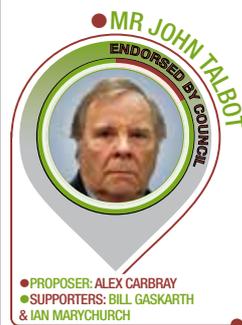
I have been a Fellow of the Society since graduating from Trinity

College Dublin over 20 years ago, and am also a Chartered Geologist and Euro Geologist. On completion of an MSc in Economic Geology at Rhodes University (1995), I moved to Finland working in mineral exploration for diamonds, gold and base metals. In one of the previous cyclical downturns affecting the mining industry I completed a PhD on a Finnish gold deposit (2003), before returning to industry.

The mining industry is once again in a major cyclical downturn, and again we face the prospect of losing many geoscientists to other industries. Many of these have a wealth of experience that as a profession we can ill afford to lose. I firmly believe that the Geological Society has a principal role, particularly through Chartership and CPD, in facilitating the retention of these skills and their transfer to future generations. As a member of Council I intend to play an active role in delivering practices that help to achieve these aims.

Proposer: **James Coppard**
 Supporters: **Graham Brown and David Pym**

▶ Mr John Talbot *Endorsed by Council*



I enjoyed and benefited from the extreme good fortune of being introduced to and taught geology and engineering geology for all three years of my degree course, at Newcastle upon Tyne by Professors

Bill Dearman and Duncan Murchison. Their infectious enthusiasm for geology instilled in me a lifelong passion for the subject. My first move on graduating was to seek Fellowship of the Society in 1970-71. Since then I gained an MSc in Geotechnical Engineering in 1981, followed by Chartered Geologist, Engineer, Environmentalist and Scientist. I am also a European Geologist and Engineer and a Fellow of the Institution of Civil Engineers.

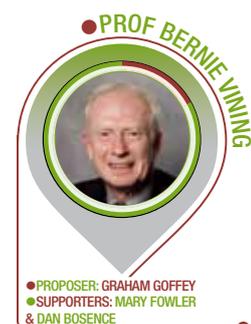
My pre-retirement career has been predominantly focused in engineering geology and geotechnical engineering, when I provided technical and financial project management and advice to a wide client base; in both the public and private sectors. I have technical expertise in all geotechnical aspects of site investigations; the analysis, design and provision of advice on shallow and deep foundations, maritime and inland waterfront structures, highways, slope stability and earth dams in the UK, Europe, Africa and SE Asia.

Elections to Council 2017-2018

Having been a scrutineer for over 20 years, and a reviewer and auditor for Chartered Geologist applications more recently, I would now like to give back yet more to the profession. Although I am currently Chairman of the Professional Accreditation Committee on behalf of the Society's Professional Committee, and was primarily responsible for the recent comprehensive review of our CPD recording system on behalf of the Chartership Committee, I am standing for election in the hope that I have the opportunity to make an even greater contribution to the affairs of the Society as a Council member, particularly in the areas of Chartership, CPD and governance.

Proposer: **Alex Carbray**
Supporters: **Bill Gaskarth and Ian Marychurch**

➤ Prof Bernie Vining



I would very much like to serve on Council and ask for your help to enable me to do so.

A strong Society is built on its membership.

I will contribute by developing the next generation of

geoscientists, a passion throughout my career in industry and in my role in academia.

As the oldest geological society in the world, the Society has a long-established reputation for scientific excellence. I will contribute by growing the Society's influence, "serving profession & society" both in the UK and on the global stage.

Success is combining talents. I will contribute by enhancing collaboration between industry and academia.

As background, my experience and expertise cover a broad range of geoscience. For example, I have explored many of the world's sedimentary basins in 30 years with Exxon in a variety of technical and managerial assignments. More recently, I was Vice President and Chief Geoscientist with Baker Hughes. I formed my own consultancy in 2015. I am a Fellow of Royal Holloway, University of London and a Visiting Professor in Petroleum Geoscience, being involved in both teaching and research.

I have enjoyed being involved with the Society over many years; convening conferences, editing publications. I am a former Chairperson of the Petroleum Group and currently a member of the External Relations Committee. As a Chartered Geologist, European Geologist, AAPG and SPEE member, I am a strong supporter of professional accreditation.

Thank you for your help in making this happen.

Proposer: **Graham Goffey**
Supporters: **Mary Fowler and Dan Bosence**

➤ Mr Alexander Yeadon



The Geological Society acts as a cornerstone for all geological sciences in the UK and beyond. Its role in education, professional development and as a bridge

between industry and academia is vital. The society's assets are unique and offer the members a world class resource. I would like to stand as a council member to ensure that the digital and physical assets of the society continue to serve the needs of the members and the wider public.

I have worked in the petroleum exploration business for the past 12 years and am currently a Senior Exploration Geologist. I studied my BSc in Geology and Physical Geography at The University of Edinburgh and then went to Imperial College for the Masters in Petroleum Geoscience. I have been a Fellow of the Society since 2004.

Proposer: **Simon Mann**
Supporters: **Neil Frewin and Adam Smith**

Society Awards 2017

Name	Expertise	Background
Prof Richard Alley	Pennsylvania State	Wollaston Medal
Prof Rosalind Rickaby	University of Oxford	Lyell Medal
Prof Tim Elliott	University of Bristol	Murchison Medal
Prof John Walsh	University College Dublin	William Smith Medal
Dr Mark Anderson	Plymouth University	Coke Medal
Prof Ian Fairchild	University of Birmingham	Coke Medal
Prof Caroline Lear	Cardiff University	Bigsby Medal
Prof Mott T Greene	University of Washington	Sue Tyler Friedman Medal
Dr Richard Hinton	University of Edinburgh	Distinguished Service Award
Mr Ian Kenyon	Retired	Distinguished Service Award
Rotunda – The William Smith		
Museum of Geology		R H Worth Prize
Dr Russell Garwood	University of Manchester	Wollaston Fund
Dr Susannah Maidment	University of Brighton	Lyell Fund
Dr Sami Mikhail	University of St Andrews	Murchison Fund
Dr Richard Walters	University of Durham	William Smith Fund
	TBA	President's Award
	TBA	President's Award

The Society is delighted to announce the names of the winners of its medals and funds and offers all its heartiest congratulations. The President's Award winners will be announced at a later date

FELLOWSHIP RENEWALS

Jonathan Silk, Director of Finance & Operations, writes: Every year at this time we remind Fellows to renew their Fellowship for the current year, or face being struck off – with the subsequent inconvenience of having to re-apply. For the Society, late payment results each year in additional costs and administration. In this economic climate we must ensure that optimum use is made of Society resources and we rely on the support of Fellows to achieve this.

7 June 2017

Time is running out for you to renew. To ensure that you continue to support and belong to your professional body, please renew today, preferably online via the website; or you can call Burlington House and ask for the Fellowship Department.

GAME OF DRONES



Photo: Alexander Kozlov/Shutterstock.com

Adrian Wilkinson* discusses point-cloud surveys captured by LiDAR and drones and how data capture is being adopted by the geoscientific professions

Above: Eye in the sky. Point-cloud surveys by drones and LiDAR are revolutionising our science

In an industry that requires regular topographical surveys for mineral royalty payments, geological face mapping for aggregate quality management and geotechnical measurements for quarry-face stability assessments, surveyors and geologists working in the quarrying industry frequently find themselves working in potentially hazardous environments.

Advancements in long-range high-definition terrestrial LiDAR systems (TLS) and unmanned aerial systems/vehicles (UAS / UAV's, commonly termed 'drones') coupled with falling costs has enabled remote and thus much safer surveying, geological and geotechnical mapping solutions to be adopted in the UK Quarrying Industry. This was recognised at the Mineral Products Association's National Safety Awards held at BAFTA in London in

November 2013.

However, the use of these integrated systems is not just limited to the UK Quarrying Industry. They are applicable to any geoscience application where access is difficult or hazardous, and they have been successfully used for surveying and mapping inaccessible coastlines, high alpine cliffs and sink-holes.

Mapping

Many features and comments in Geoscientist have expressed the continuing need for field mapping in the modern age and the importance of doing so. I could not agree more with those sentiments. However, the very nature of many of the mountainous and coastal cliffs that we need to map pose potentially serious hazards and an associated high risk to those collecting

“ THE MOUNTAINOUS AREAS AND COASTAL CLIFFS THAT WE MAP POSE SERIOUS HAZARDS AND HIGH RISK TO THOSE COLLECTING DATA ”



Top: Limestone coastal cliffs undergoing LiDAR survey



Bottom Left: Obtaining rock-mass data upon which to perform geotechnical assessments involves discontinuity mapping of near vertical and heavily fractured rock faces

data. This is especially true in the quarrying industry, where obtaining rock-mass data upon which to perform geotechnical assessments involves discontinuity mapping of near vertical and heavily fractured rock faces.

Point-cloud surveys collected by long-range high-resolution LiDAR and by photogrammetric techniques from either terrestrial set-ups (tripods, fixed stations or vehicle mounted) or mounted from aircraft provide exceptionally high quality 3D models from which topographic, geological and geotechnical information can be extracted without the need to approach the rock-face. As well as being collected more safely, a permanent record of the feature being mapped is made available for further interpretation at a later date, should further corroborative data be obtained.

Point-cloud surveys

Both photogrammetric modelling and LiDAR laser scanning produce a survey or 3D model comprising many thousands or even millions of data points. These models are commonly referred to as 'point clouds'.

Both systems can be either obtained terrestrially from upon the Earth's surface or from aircraft. In the case of the aerially mounted systems the use of 'Drones' are becoming increasingly frequent with several 'Drones' being able to carry LiDAR scanners as well as high quality digital cameras.

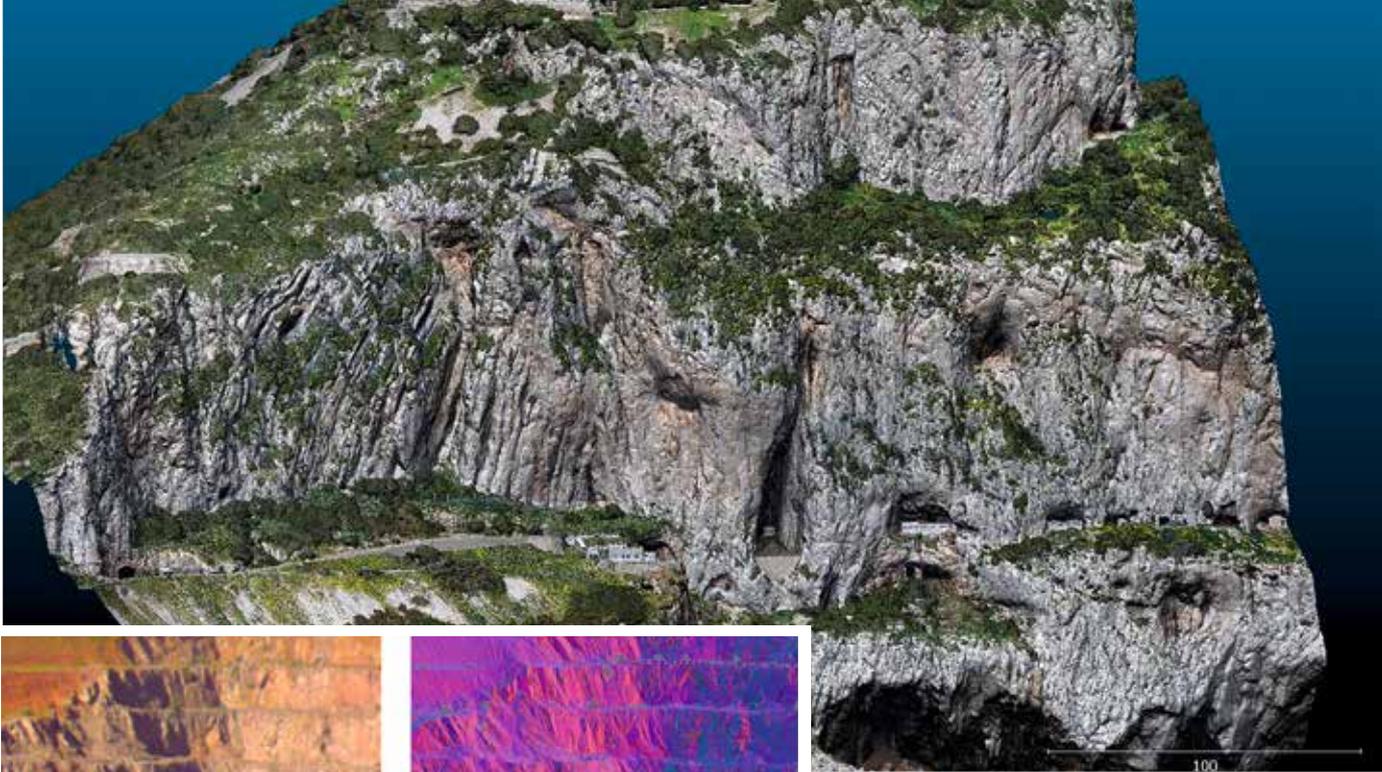
Photogrammetric surveys comprise a series of data points that can be georeferenced into real world coordinates and attributed a colour from the overlapping photographs generating an XYZ RGB point-cloud.

LiDAR scanners generate

point-clouds that can be similarly georeferenced into real-world coordinates. Cheaper LiDAR scanners simply record the flight-time and bearing of the photons and provide a monochrome XYZ point-cloud. However more expensive scanners will also record the reflectance intensity of the photon being returned; and if also equipped with a digital camera, then an RGB value can be ascribed to the point in the resultant point-cloud. This generates a similar 3D model, as a photogrammetrically derived point-cloud.

However, adding reflectance intensity adds another dimension useful to a geologist – because harder brighter materials (buildings and granites, for example) reflect more than softer duller materials (vegetation and clays) do. Distance also affects

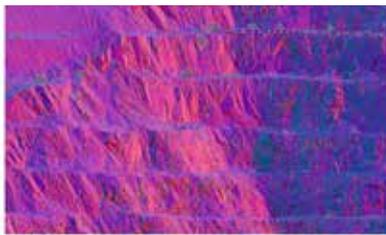
Photogrammetric surveys comprise a series of data points that can be georeferenced into real world coordinates and attributed a colour from the overlapping photographs generating an XYZ RGB point-cloud



A LiDAR point-cloud as captured in RGB and Reflectance Intensity (left) and post processed into Inclination and Confidence (right)



Colour LiDAR point cloud (RGB from internal camera)



Inclination processed LiDAR point cloud



Reflectance Intensity LiDAR point cloud



Confidence processed LiDAR point cloud

▶ reflectance intensity – because the further the photon has to travel, the weaker its eventual received response will be.

Software is available that can compensate for distance-based variations in intensity and can also calculate the angle of incidence of the photon striking the object being scanned. This enables points with a similar orientation to be coloured with similar RGB values and makes the identification of joint planes easier to identify.

By comparing the distance-compensated reflectance intensity with the angle of incidence of the reflected photon, a “confidence” value can be ascribed to the point. Low reflectance and tangential angles of incidence are ascribed lower confidence values than those with high reflectance, striking the feature perpendicularly. Manipulation of the point-cloud in this manner generally enables block-edges to be more readily identified. In general terrestrial systems obtain a better model of sub-vertical features and aerial systems obtain a better model of sub-horizontal features (pictures).

Drones

Laws governing the use of drones are awash with anachronisms and abbreviations, such as: ‘Unmanned Aerial Vehicles’ (UAV), ‘Unmanned Aerial System’ (UAS), ‘Small Unmanned Aerial System’ (SUAS) and ‘Remotely Piloted Aircraft System’ (RPAS). In general, if it is carrying a payload (such as a camera, LiDAR, etc.) then it is a ‘system’.

Composite of terrestrial LiDAR data merged with UAS photogrammetric data from the Limestone coastal cliffs shown in the photograph (previous page)



The drone shown has the LUASSTM registration number GUAU-0180 – see text



Otherwise, it's a simple 'vehicle'. Stringent legal requirements must be adhered to when operating a drone, in the UK and in many other national airspaces around the world. We have had experience in the UK, Republic of Ireland, Gibraltar, France and are currently seeking permission in Canada.

In the UK, the first requirement is that the Operator (whether 'Sole Trader' or 'Company') must possess a "Permit to Undertake Aerial Work" issued by the Civil Aviation Authority (CAA). In order for such a permit to be issued, the operator must have an Operations Manual, detailing all the equipment being used and the capabilities of the staff operating it. To that end, all pilots must be able to demonstrate a recognisable level of knowledge of aviation law and aircraft handling competence. In most cases this will involve the pilot, who has passed the BNUC (Basic National UAS Certificate) ground course and practical flight examination, actually using the equipment they wish to fly.

The drone itself also needs to be independently assessed (usually, at the same time as the flight test) and be issued with a LUASSTM (Light UAS Scheme) Registration Number. The drone shown in the picture, for example, has the registration number GUAV-0180.

Finally, the operator needs to have an acceptable level of Third Party Liability Insurance cover. Once all of these conditions have been met, the Operator can legally undertake aerial work. Following the issue of a permit, UAS Pilots are also required to log their flights and keep a log of the battery discharge and recharge (in effect, the equivalent of an engine maintenance log). These records are submitted annually to EuroUSC, the body which administers the examination and documentation on behalf of the CAA.

In terms of the practicalities of flying, most UAS Operators fly under Visual Line of Sight (VLOS) criteria - being a 'cylinder' of airspace with a radius of 500m and a height above take-off of 400 feet (~120m) while retaining a clear line of sight to the drone. This can make planning flights a challenging process, especially in areas of great vertical relief.

For example, it took two pilots six hours to plan the four flights necessary to scan the sea cliffs shown in the picture. An example of flight planning is shown in the accompanying picture. It shows that the UAS had a planned flight height of 60m and air speed of six metres per second (12knots) and flew a total length of 2788 linear metres in eight minutes and 21 seconds, covering a section of coastline 800m long and 200m wide.

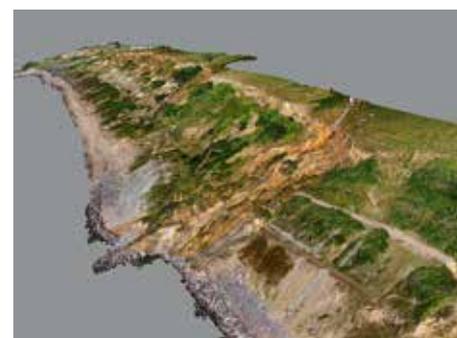
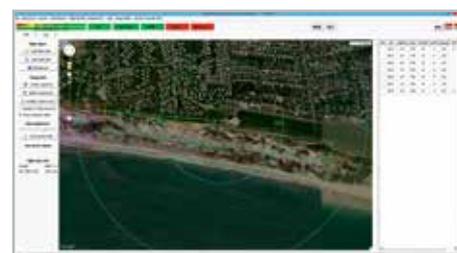
Mapping the sea cliffs shown in the picture would have been a difficult, laborious and potentially hazardous process without the resultant point-cloud 3D model obtained by the UAS. In a similar manner, surveying and undertaking geomorphological mapping of the saturated clays failing along the coastline shown in the picture would also have been difficult using traditional terrestrial-based surveying and mapping techniques. The safety element, coupled with the acquisition-time benefit, is immediately apparent.

Application

Our surveyor recently joked that he now pushes his mouse harder than his legs since we started obtaining, processing and analysing point-cloud surveys. I am sure he exaggerates - but I can appreciate his sentiment! Where a traditional survey would have entailed several days in the field (and maybe a day processing), we frequently find that up to a day is spent planning a survey, less than a day actually doing it - followed by several days processing the data on a high powered PC running 256GB of RAM.

However, the resultant 3D models are invaluable. The picture shows a point-cloud model of the coastal erosion survey shown in earlier photos. It comprises 730,445,364 points each with an XYZ RGB value. From this model, geomorphological mapping can be undertaken, and cross-sections obtained, upon which to base slope-stability analyses. By comparing successive surveys, rates of retreat along any part of the slope can be determined - either toe erosion by the sea or crest break-back as the toe erodes and the slope fails.

Other examples of geo-hazards being mapped in this way are crown



Above: An example of flight planning for one of the four flights over the coastal erosion site featured in earlier pictures
Middle: Point-cloud model of the coastal erosion survey shown in earlier pictures
Below: A fixed survey station on the edge of a quarry

“ MAPPING THE SEA CLIFFS SHOWN IN THE FIRST PICTURE WOULD HAVE BEEN DIFFICULT, LABORIOUS AND HAZARDOUS PROCESS WITHOUT THE RESULTANT POINT-CLOUD 3D MODEL OBTAINED BY THE UAS ”

► holes, sink holes and old lead rakes, all being mapped using the UAS derived photogrammetric techniques.

Mass movement (such as the coastal erosion described above) can be monitored using UAS-derived photogrammetry; but where smaller movements are expected, terrestrial LiDAR mounted on fixed survey stations enables finer monitoring to be undertaken.

In the pictures you can see a fixed survey station on the edge of a quarry, and monitoring of a failure using LiDAR from a similar fixed station. This failure occurred several years ago during a particularly wet winter. Swelling of the mudstones caused the retaining veneer of limestone to fail. Since then, the failure has been monitored quarterly and the rates of movement calculated.

In recent months, the rates have been shown to be declining (fewer colour changes in the lower image than the upper image). The scanner is able to obtain survey points 34mm apart at a range of 1700m and at the range of the monitoring example (approximately 350m) changes as low as 21mm can be determined and has proved that further deformation of the limestone veneer

is not occurring but has picked up isolated small rock-fall events.

The use of the LiDAR has enabled rock-fall predictions (see diagram) to be carried out on a particularly well-known film set in a dormant UK quarry (pictured). While Mance Rayder and his army of Wildlings and Giants add to the hazards of manning 'Castle Black', rock-fall was one hazard that was decidedly not acceptable. The risk was ameliorated by designing a rock-trap into the rear of the Castle, against the rock face. Subsequent annual LiDAR rock-fall monitoring has been undertaken to ensure the efficacy of the rock-trap design and to calculate the volumes of rock-fall occurring (picture). (For the uninitiated, who have been mystified by my references, the film-set is for HBO's hugely popular *Game of Thrones* series.)

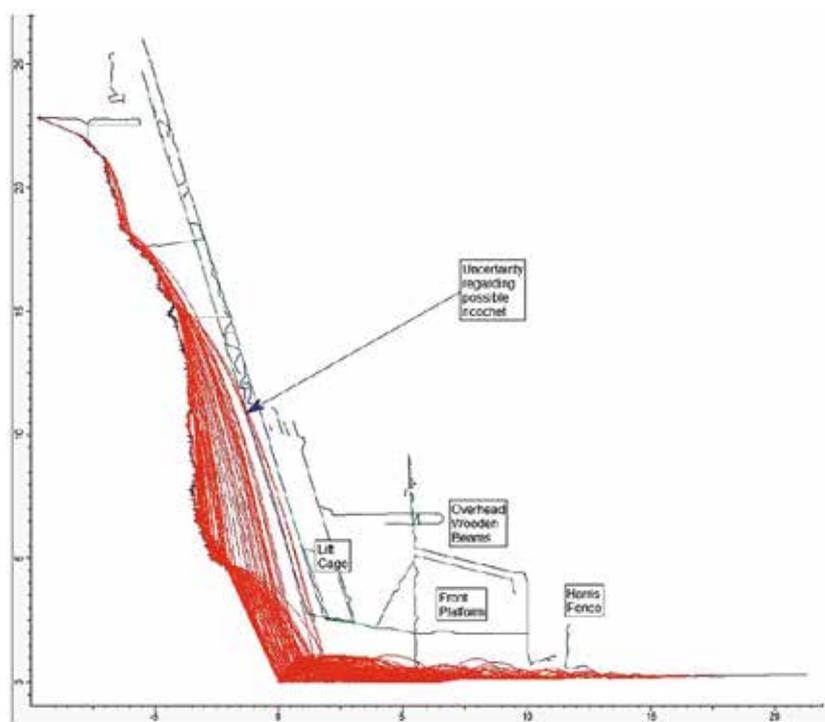
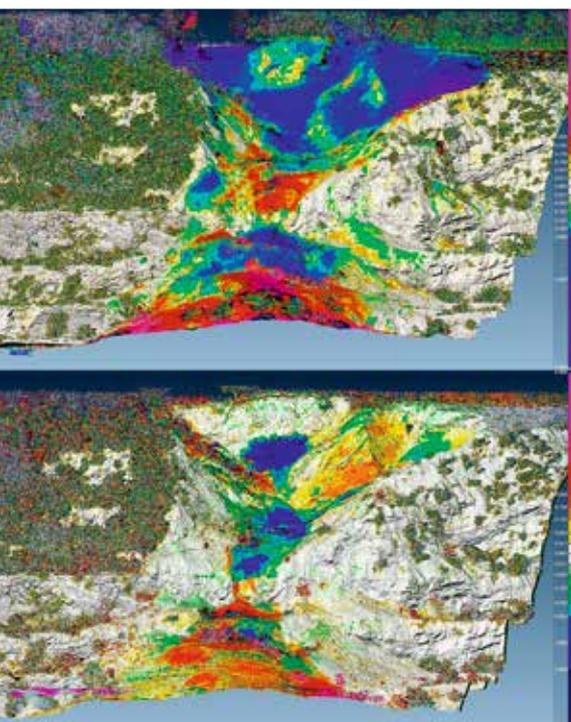
Keeping with the theme of engineering geology, discontinuity data (dip, and dip direction) and extrapolation of those discontinuities as planes, can all be undertaken on a point-cloud survey. Numerous software packages enable Dip / Dip Direction data to be automatically determined or individually digitised

and calculated.

The final pair of pictures show: a series of joint planes being digitised and the joint orientations determined on an "inclination" processed LiDAR point-cloud, and extrapolation of this failure plane and of two joint planes forming a wedge failure at another quarry location. The real advantage in this type of discontinuity-analysis is plain to see: not only is the dip and dip-direction recorded, but so is its geographic location within the point-cloud survey.

Point-cloud surveys provide a safely-acquired 3D model, upon which subsequent geological and geotechnical mapping can be undertaken. While no remote mapping can wholly substitute the 'Mk.1 eyeball', they do provide valuable data in a form that can be re-interrogated again later, and can provide data in areas difficult or hazardous to access. ♦

***Adrian Wilkinson** is Geotechnical Director at Land and Minerals Consulting Limited based in Clevedon, North Somerset, UK. All information correct at time of writing, but under constant legislative review

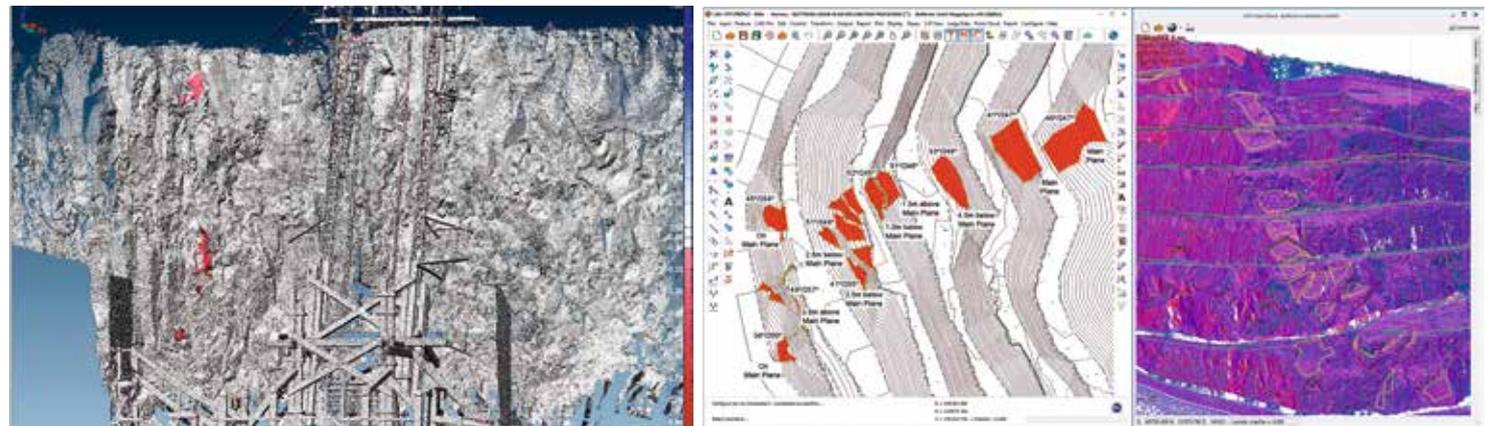


Monitoring a failure using LiDAR from a similar fixed station. Changes as low as 21mm can be determined. These have proved that further deformation of the limestone veneer is not taking place. Isolated small rock-fall events have been detected

Rock fall predictions for the quarry shown above



A well-known (to devotees of Game of Thrones) film set in a dormant UK quarry



	Shale			Sandstone					
Intensity Gate	0 - 31	32 - 63	64 - 95	96 - 127	128 - 159	160 - 191	192 - 223	224 - 255	TOTAL
Number of Points	1,721	20,302	31,401	31,966	24,303	18,931	13,628	25,718	167,970
% of Total	1	12	19	19	14	11	8	15	100
	32%			68%					

Middle Left: Annual LiDAR rock-fall monitoring has been undertaken to ensure the efficacy of the rock-trap design and to calculate the volumes of rock-fall occurring

Middle Right: A series of joint planes being digitised and joint orientations determined on an "inclination" processed LiDAR point-cloud

A TALE OF TWO MAGMAS



Katy J Chamberlain* is investigating zoned pyroclastic airfall deposits on Ascension Island with help from a Society Fieldwork Grant

Ocean island volcanoes, unrelated to clear tectonic boundaries such as rifts or subduction zones, are intriguing examples of 'intraplate volcanism'. While magmatic sources and plumbing systems on 'classic' ocean island volcanoes like Hawaii, Iceland and Tenerife are relatively well understood, they also highlight the surprising range of mantle sources - and magmatic evolution processes - that can be detected in these isolated locations.

Understanding ocean-island volcanic processes is important, not only to help forecast and potentially mitigate hazards from future eruptions, but as a test-bed for viable mechanisms whereby felsic continental crust can be generated on thin, mafic ocean crust.

Ascension Island is a small (12km diameter) ocean island volcano in the tropical South Atlantic, 90km west of the Mid Atlantic Ridge, with a population of c.800. The island is a unique place, accessible only by taking one of the 10 civilian seats on a twice-weekly Air Tanker flight from RAF Brize Norton to the Falkland Islands. This flight stops at Ascension to change flight-crew and deposit supplies for the RAF base.

Unique

Volcanologically, the island is unique, with almost every type of volcanic deposit present in its 96 square kilometres. While most Ascension residents live on the lower mafic lava fields dotted with scoria cones in the western areas of the island, higher ground in the central and eastern areas boast felsic lava flows, domes, scoria fall, pumice fall, pyroclastic flow and debris avalanche deposits - with a complete range in magma compositions from mafic olivine-basalts through to felsic trachytes and rhyolites. Previous work on the island has focused on geochemistry, resulting in reasonably detailed geological maps which display units based on their composition rather than stratigraphic relationships.

We undertook a field trip to Ascension Island during July 2014 with the aim of quantifying the range of eruption styles and sampling their deposits. But during

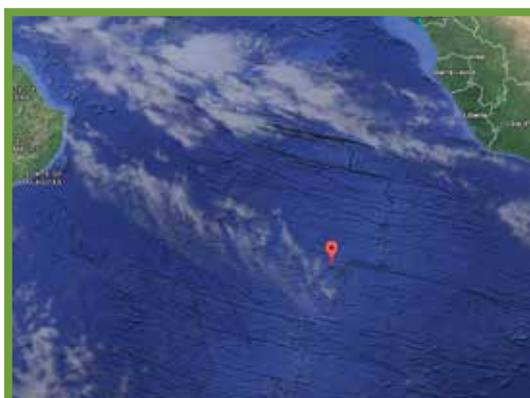
this work two unusual zoned fall deposits were identified, showing variation between scoria and pumice during the course of a single eruption. These two fall deposits vary in the way that they change from pumice to scoria, potentially representing different modes of formation.

We have chosen to investigate these deposits in detail because there is a chance that the preservation of the scoria-pumice transition has captured a magmatic process that has not yet reached completion (unlike in the other, unzoned pumice-fall deposits). We therefore applied for a Geological Society Fieldwork Grant to return to Ascension to carry out detailed observations of these two deposits, and to sample them fully in order to understand the geochemical processes responsible for felsic magma genesis at Ascension Island.

2015 field season

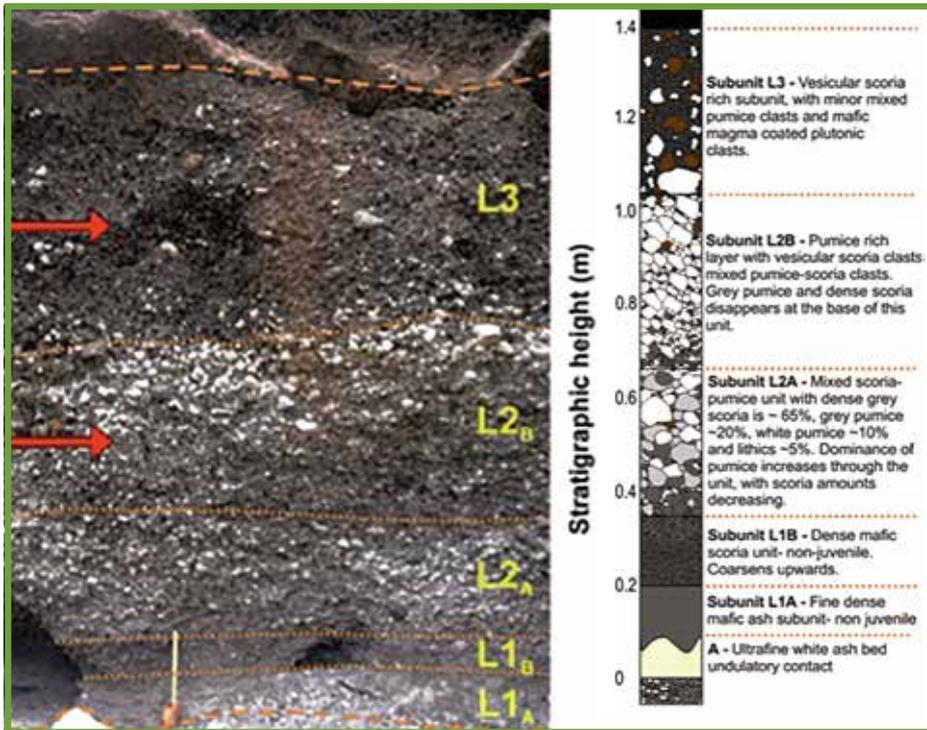
We undertook ten days of intensive fieldwork in mid-2015, to place these zoned fall units in stratigraphic context with all the other eruptive units on the island. We also took detailed, centimetre-scale stratigraphic logs through the units, to capture compositional and textural variations, variations in maximum juvenile and lithic clast sizes (with both stratigraphic height and lateral variations), unit thickness, and the nature of bounding stratigraphic units. This allowed the variation within subunit thickness, and maximum pumice and lithic sizes, to be measured and compared across a wide area.

Fieldwork on Ascension Island comes with its own unique challenges, not least being its isolation. St Helena is the nearest landmass to Ascension Island, and that is still nearly 1300km away! The island has only 40km of roads, so most of our fieldwork involved wandering across the trackless terrain on foot. Luckily no animals more dangerous than the ever-present land crabs are hiding in the undergrowth. We spent many hours discussing the possibility of teaching these land crabs to use their claws for good - and pre-crush some pumice for us. Sadly, neither of us dared get close enough to ▶



Above: Katy Chamberlain (l) and Holly Connolly (field assistant, r) on the lava fields of Ascension
Above middle: Location of Ascension Island (GoogleEarth)
Lower middle: Land crabs at NE Bay
Below: The compositionally zoned fall deposit at North East Bay outcropping underneath a thick trachytic lava flow

Left: The ubiquitous Ascension land crab, *Johngarthia lagostoma*



The mingled fall deposit, showing the bimodal clast type present in the deposit; red arrows indicate sampling horizons

► assess whether the full force of their (up to 40-year old) pincers might be sufficient for the task.

Fractionation?

The compositionally-zoned fall is found only in the north eastern, younger, areas of the island, and is the best preserved eruption in all of Ascension Island's history. Previous studies have dated the overlying trachyte lava to be 163,000 years old¹, so we expect this eruption to be of about the same age, but a little older. While it is the best-preserved eruption deposit on the island, the geographic area of outcrop meant that no meaningful isopachs could be drawn, and therefore, no eruptive volumes estimated.

Luckily, while exploring the coastal areas, we were able to identify the vent site for the compositionally-zoned fall by noting the presence of a fissure with bomb-sized clasts of the deposit in its walls (picture). The logs through the compositionally-zoned fall deposit show a systematic gradation - from more-evolved, creamy pumice at the base through to slightly less-evolved, light brown pumice in the middle of the unit, to the least-evolved brown scoria at the top.

Chemical analyses of samples collected have revealed that the whole-rock compositions change systematically with

stratigraphic height, but with no evidence in their crystal chemistry for multiple magma compositions. Therefore, this fall deposit is thought to be the result of the evacuation of a chemically-zoned magma chamber, which became more felsic in composition by closed-system fractionation.

Magma mixing

In contrast to this compositionally-zoned fall, the much older mingled fall (picture) is not found to crop out in many locations, and is restricted to the island's central area. The mingled fall changes rapidly from pumice to scoria over a sharp boundary, with no transitional clasts identified. Although this deposit is not found in many places on the island (and thus we could not draw isopach maps to locate the vent site, or calculate the volume of magma erupted), we did derive insights into the origins of the mingled fall.

We discovered multiple lines of evidence for mixing between the felsic, pumice-producing magma, and much less-evolved mafic, scoria-producing magma: including mixed clasts, bimodal crystal and melt inclusion compositions, and chemical zoning on the felsic-sourced crystals. We therefore interpret this deposit as the result of a late-stage, potentially eruption-triggering, magma



Fissure vent for the compositionally-zoned fall deposit, overlain by a younger trachyte lava flow at the head of the fissure

mixing event between a felsic and a mafic magma.

Future work

These contrasting, well preserved zoned fall deposits on Ascension highlight the contrasting magmatic processes responsible for generating felsic magmas, and their interaction with mafic lavas also common on the island. The apparently closed-system evolution of the compositionally-zoned fall raises the question of whether more felsic fall deposits on Ascension are compositionally-zoned, but do not cross the pumice-scoria textural boundary. Further work is required to understand how the magmatic processes, identified in the zoned deposits, relate to texturally unzoned deposits on the island.

The role of the closed-system crystal fractionation is unusual for an ocean island, where commonly, multiple magma types are known to interact. Yet, Ascension Island is known to have a relatively low magmatic flux² compared with other classic ocean islands, and it is possible that this has an effect on the types and timescales of the magmatic processes responsible for felsic magma generation, and therefore potentially significant implications for the genesis of continental crust. ♦

*Dr. Katy J. Chamberlain, Postdoctoral Research Associate, Department of Earth Sciences, University of Durham, Durham, DH1 3LE, UK
E: katy.chamberlain@durham.ac.uk. If you would like to apply for fieldwork support money from the Society, please go to W: www.geolsoc.org.uk/grants

► References may be viewed in the Online version of this article.
Editor



Chartered or Professional?

Martin Shepley CGeol PGeo compares and contrasts the two postnominals. Is it time for the UK to 'go legal'?

In the last few years there has been a fair bit of debate in Geoscientist on the role of chartership and professional accreditation (see July 2014; June, August & December, 2015). In 2010, I moved across to Canada, a country where geoscience is a regulated profession (i.e. with parliamentary acts and regulations). After six years of practice as a hydrogeologist in Canada I may have something to contribute.

Registered

To call yourself a geoscientist in almost all Canadian provinces and territories, you have by law to be registered with one of the provincial and/or territorial regulatory associations: i.e. be a 'Professional Geoscientist' (PGeo).

The origin of the regulatory associations is described in the Canadian Professional Engineering and Geoscience (CPEG) book by Andrews (2009 – see Further reading). In this book some of the most prominent events related to Canadian geoscientific practice that led to this professional regulation are described. Possibly the most infamous example is the 1997 Bre-X scandal, when gold reserves were fraudulently overestimated by more than 100 million ounces, with an estimated investor-loss of six billion Canadian Dollars - the subject of the 2016 film 'Gold'. The move to geoscience regulation in Canada has followed a familiar and well-worn path where something going wrong has needed to be fixed.

Differences

The differences between becoming a CGeol and a PGeo are not that great in terms of experience required and qualifications. However, where CGeol has the 'professional interview', PGeo has the Professional Practice Exam (PPE). The PPE is not a doddle. To pass you need to know your ethics - the law and regulations affecting geoscience practice. Much of this is contained within the CPEG book.

Do you know the differences between the four main theories on ethics (Mill's utilitarianism, Locke's rights-based ethics, Kant's duty-based ethics, Aristotle's virtue-based ethics) or the ethics of whistle-blowing (truly a last resort when all other avenues

have been exhausted, not some personal publicity stunt)? Maybe not. The CPEG book explains it all, with some real examples. Fortunately, despite much of its material being a bit dry, this book is simply an excellent read, in fact the only textbook I have ever read cover to cover.

So what does it mean in practice? Are there any differences between how geoscientists do their work in Canada compared to the UK? In Canada there is, in my opinion, a greater awareness of conflicts of interest and a more guarded and measured approach to providing professional opinion and advice. PGeo's are encouraged not to stray from their specific expertise. As the Canadian provincial and territorial professional geoscience acts are mostly still relatively young of course there are individuals (they are by law not geoscientists) who still practise without being registered. Many are caught when advertising their skills on LinkedIn.

Nevertheless, organisations that contract an unregistered 'geoscientist' do so at their peril, because their reports, without being stamped (i.e. at the minimum reviewed and approved) by a PGeo, may be of little value if challenged, particularly if the judiciary is involved.

In the present 'Post Truth' age the public is now exposed to unprecedented quantities of dubious information through the Internet. As geoscientists we need to be perhaps a bit more circumspect about how geoscience information reaches the public. Canada's move to a regulated geoscience profession provides some salient lessons that are worthy of consideration.

➤ Further reading

Andrews, G C 2009: Canadian Professional Engineering and Geoscience, Practice and Ethics. 4th Edition, Nelson Education, Toronto, 429 pp. (NB: The 5th Edition was published in 2013; author passed his PPE in 2010.)

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.

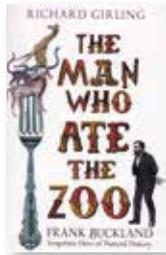
Pictures should be of print quality – please take photographs on the largest setting on your camera, with a plain background.

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).

“ THE MOVE TO GEOSCIENCE REGULATION IN CANADA HAS FOLLOWED A WELL-WORN PATH WHERE SOMETHING GOING WRONG HAS NEEDED TO BE FIXED ”

MARTIN SHEPLEY

The Man who Ate the Zoo



The Rev. William Buckland, father of the subject of this highly entertaining book by environmental journalist Richard Girling (who recently gave us *The Hunt for the Golden Mole*),

would also fit the description in its title (though perhaps he is less 'forgotten' today). Son Frank was more than a chip off the old bonkers Buckland block – a childlike man who revered his great father and sought all his life to emulate him – including his zoophagous habits.

Although solemn scientists regarded him as a gadfly, he became, if anything, more famous than dad: a sort of Victorian cross between David Bellamy and Brian Blessed who, as well as entertaining audiences and readers with his boundless enthusiasm for natural history, rose from being a military medic to Inspector of Her Majesty's Fisheries (in which post he was succeeded by none other than Thomas Huxley).

Frank was a barrel of a boy who got larger as he aged but never really grew up. Even as a man, he was likely to produce slow-worms from his pockets or wade into icy waters to see what it really felt like to be a salmon, or defend his views with the incontrovertible but specious logic of a 10 year-old. (He approved of poor children not wearing shoes, explaining that shoe leather gets thinner as you wear it. Human leather gets thicker. QED.)

So why 'forgotten' today? Frank made two career 'mistakes'. First, he maintained the creationist views of his father, long after 1859. As a result, his popular books dated quickly and condemned him a stuckist. Second, he committed the unforgivable sin of having fun, and being popular. Today he poses the biographer a difficult and unusual problem, namely the sheer volume of his writings, much of which were either wholly or semi-autobiographical.

He also hoarded personal papers, many of which are preserved. Add to this the fact that innumerable anecdotes from his short, packed and highly colourful career have been retailed by many other authors, and we have *un véritable embarras de richesse*.

Girling skilfully marshals this material into a coherent timeline that manages to recount not only Frank's life but the story of his discovery of it, while encompassing the anecdotes in a way that doesn't fall into the other trap – for Frank's misadventurous life does indeed read like something out of the Beano, or Richmal Crompton.

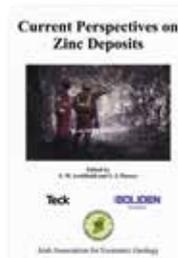
In passing, Girling even manages to throw light on the father. Did you know, for example, that Buckland *père's* occiput and cervical vertebrae were donated to, and still survive under glass at, the Royal College of Surgeons? Neither did I.

Reviewed by: **Ted Nield**

THE MAN WHO ATE THE ZOO – FRANK BUCKLAND FORGOTTEN HERO OF NATURAL HISTORY

by RICHARD GIRLING 2016 Published by: Chatto & Windus ISBN: 9781784740405; 392pp, hbk. List Price: £17.00

Current Perspectives on Zinc Deposits 2015



The Irish Association for Economic Geology is an active association in organizing conferences. Each decade or so it also contributes

publications focused on an issue of importance to the Irish or European mining sector. This new publication is a departure from this in that there is much more of a global approach taken focused on a single commodity, in this case Zinc.

The papers in this volume arise out of a conference in 2010 (ZINC2010) held in Cork, Ireland, and is a compilation of papers presented there by selected authors. Zinc is a pertinent commodity for Ireland that has a large number of world-class zinc deposits, some of which are covered by papers in this volume.

The volume contains papers by the keynote speakers as full papers (7) or extended abstracts (5) as well as 17 other extended abstracts by other authors. In addition a further previously published paper is included in the appendix.

An impressive array of topics is covered by the 29 articles, ranging from regional studies to detailed case studies with an excellent overview paper by Huston *et al.* on all zinc deposit types. The papers contain both original research on the formation of zinc deposits, such as the paper by Piercey *et al* on VMS deposits discussing controls on the formation of zinc-rich deposits, to laboratory studies such as one by Boyce *et al.* on zinc geochemistry and the formation of sphalerite to excellent review papers such as the one by Wilkinson and Hitzman reviewing the key processes responsible for formation of the Irish orefields.

Probably my favourite paper in the volume is an overview by Borg on non-sulfide zinc deposits focusing on the supergene geochemistry that can give rise to such potentially economic deposits. A nice feature of the article is the use of hand specimen photographs and photographs of ore exposure in open pits, particularly from Angouran in Iran and explanation of the exploration method of 'zinczap' solution, appropriately illustrated with suitable photographs.

Overall the volume adds significantly to this important but often overlooked commodity. The volume seems relatively free of errors and the editors and authors have done an excellent job of completing the publication. If there is one small criticism it is that for many of the articles, presumably submitted in 2010, the references are less than current and only a few of the keynote papers appear to have been revised to include relevant more recent papers post 2010. But this is a small gripe and in no way diminishes the relevance of the volume not just to those working in the zinc industry but economic geology in general and particularly useful as a reference source for students and researchers.

Reviewed by: **Rob Bowell**

CURRENT PERSPECTIVES ON ZINC DEPOSITS

2015 by S M ARCHIBALD AND S J PIERCEY (Eds) Published by: Irish Association for Economic Geology 251pp, sbk. ISBN: 0950989452, 9780950989457. List Price: €50.00 + p&p.



Strata and Time: Probing the Gaps in Our Understanding



I often think of the sedimentary record as a quasi-reliable record of past events, although as someone who works ancient glacial successions I am always mindful of how much time is really preserved in the rocks, and how much is missing. Can this missing amount be quantified?

Emerging from the 2012 William Smith flagship meeting, this book is an excellent resumé of the problems associated with incompleteness in the sedimentary record, how much time is missing (e.g. in shale: paper by Tabucho-Alexandre, and in karst landscapes: Plotnick *et al.*). The publication year - 2015 - was an auspicious one, falling 200 years exactly after the publication of 'Strata Smith's' map.

The tome is sensibly organised into sets of papers dealing with (i) continuity, completeness and the Geological Time Scale, (ii) gaps, fractals and scaling, (iii) stratal hierarchies and cycles and (iv) strata and time in the field and subsurface. The volume thus generally evolves from the theoretical and modelling based realm to real world examples. Rocks themselves only appear in 15 photos in the first 240 pages, with the latter part of the book becoming much more enriched with photographic material. That's not to say that the earlier part of the book does not contain excellent visuals: it does, with graphs and maps more common.

Many of the chapters are highly provocative either in title or in content: the first major paper by Miall, for example, asks whether uniformitarianism requires updating or whether it is, instead, a series of "frozen accidents". The book also contains one of the most entertaining yet potent abstracts I have ever seen, reproduced herein in full: "Ths wht th fn-grnd mrine sdmtry rcrd rllly lks like".

The book also has chapters which help the non-specialist to understand how the science of stratigraphy is really done. Take the Alan Smith *et al.* paper, which reads as a grand introduction to how global boundary stratotype section and point (GSSPs) are established, with lots of useful guiding principles in the process.

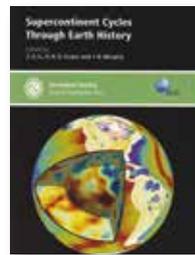
To my mind, the book is an essential remedial stratigraphic read for any geologist, capturing the state of the art and best practice in the same volume. It may make for slightly uncomfortable reading in places for fans of uniformitarianism or who subscribe to the idea of near-continuous sedimentation in deep water environments. Two hundred and one years after the publication of his seminal map, what would William Smith have thought about it?

Reviewed by: **Daniel LeHeron**

STRATA & TIME: PROBING THE GAPS IN OUR UNDERSTANDING

Edited by D G SMITH, R J BAILEY, P M BURGESS AND A J FRASER. Geological Society Special Publication #404 2015. ISBN 978-1-86239-655-5. 325pp.
List Price: £120.00. Fellows Price: £60.00.
W: <https://www.geolsoc.org.uk/SP404>

Supercontinent Cycles through Earth History



Geoscientist readers who viewed the recently repeated BBC4 broadcast of Iain Stewart's series 'The Rise of the Continents', were provided with an eminently watchable, informative and

accessible introduction to the evolutionary cycling of Earth's continents and supercontinents.

This GSL Special Publication presents the geoscientific research underpinning the subject, reporting current developments in numerical and theoretical modelling, source data acquisition used in continental reconstructions and the spatial / temporal correlations between global geodynamic events, plate kinematics and palaeoenvironmental histories. Investigating how supercontinent cycles interact with the deep mantle is fundamental to understanding how the Earth's tectonic 'engine' operates.

The supercontinent-cycle model assigns episodic global-scale tectonic events to an essentially self-regulating system of mantle convection, controlled by the relative buoyancy of continental lithosphere that 'opposes' subduction during the closure of existing ocean basins, with the consequent reorganisation of mantle convection cells leading to the opening of new ocean basins. Cycle timescales are each typically

of 500 – 700 ma duration. The proposed spatial patterns (or kinematic styles) of supercontinental tectonic cyclicity range from the hemispheric ('introversion') to antipodal ('extroversion'), with other cycles incorporating characteristics transitional ('orthoversion') between these end-member conditions.

Written in the established GSL Special Publications series format, the volume is introduced with a contextual overview paper and contains 11 research contributions on the four identified (or hypothesised) palaeogeographic – kinematic supercontinent cycles. Presented chronologically within the framework of the three-fold geodynamic models, the cycles are - cycle 1: Kenorland to Nuna, cycle 2: Nuna to Rodinia, cycle 3: Rodinia to Pannotia / Gondwana and cycle 4: Gondwana / Pangea to Amasia. (Kenorland is the title given to the postulated supercontinent at the Archean – Palaeoproterozoic transition).

Current and continuing research from the related disciplines of mantle convection cell and plume dynamics, palaeomagnetism, geochronology, geochemistry, metallogenesis and tectonostratigraphy have all combined to provide valuable new insights.

All contributions are well written and edited, concisely laid-out with clear and appropriate figures, photographs and data-tables. Many are presented in colour and enhance the understanding of the textual details. The volume is a comprehensive contribution to this interdisciplinary field, and the editors are to be congratulated. A recommended read and authoritative reference work.

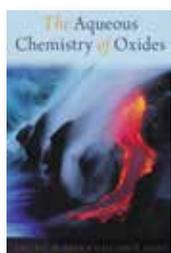
Reviewed by: **Mark Griffin**

SUPERCONTINENT CYCLES THROUGH EARTH HISTORY

by LI, Z X, EVANS D A D AND MURPHY J B (eds)
Geological Society of London Special Publication #424. 2016. ISBN 978-1-86239-733-0. (hbk).
297pp. ISSN 0305-8719.
List Price: £110.00,
W: www.geolsoc.org.uk/sp424

The Aqueous Chemistry of Oxides

The Earth is composed principally of oxides, and so the study and understanding of these materials is relevant to almost every branch of the Earth sciences. This book aims to provide a comprehensive overview of



the principle aspects of the interaction of aqueous solutions and oxides, and to act as a reference for those interested in this subject. The book is principally focused

on oxides in the environment but this is a broad-ranging text, and is not purely concerned with Earth system processes. Included content also includes such subjects as glass dissolution and metal corrosion.

The book is primarily a technical text, covering numerous aspects of inorganic aqueous chemistry, and as such a reasonable comprehension of physical chemistry is required to elicit maximum value from its pages. However, it is worth noting that as although a technical text, it is written in a very readable and relatively informal manner and provides an engaging overview of its subject matter.

The book is illustrated with numerous black and white figures throughout, with key illustrations included within a 27 colour plate insert in the text. The selection of figures to be included as colour plates does not always appear to be logical, with many useful figures that would benefit from colour only given in black and white, and a number of colour plates produced of photographs that add little of scientific value. However, this is a relatively minor quibble and illustrations are generally well used.

The book is arranged into seven sections, with several chapters within each section, covering distinct thematic areas of the subject - as well as a general introduction to oxides and oxide chemistry. The layout ensures that navigation on the basis of subject area is straightforward, further aided by comprehensive substance and subject indexes.

Much of the content could be regarded as general reference material for most Earth scientists, to be dipped in an out of as required. Other sections however, such as those on 'fundamental oxide reactions in aqueous solutions' and 'the environmental geochemistry of oxides' should be considered for reading in their entirety as they contain much useful information, particularly on the subject of oxide

weathering.

Overall this is a book with much to recommend it, but with a list price of £97 is likely to be a carefully considered purchase for most readers.

Reviewed by: **John Heneghan**

THE AQUEOUS CHEMISTRY OF OXIDES

BRUCE C BUNKER & WILLIAM H CASEY, 2016.
Published by: Oxford University Press 604pp (hbk) ISBN: 9780199384259 List Price: £97.00.
W: <https://global.oup.com/academic/product/the-aqueous-chemistry-of-oxides-9780199384259?q=9780199384259&lang=en&cc=gb>

Mineral Resources Economics and the Environment



While it superficially it has the look and heft of a standard student text, this book provides rather more engaging content and topical diversity than might be expected.

It covers topics

across the full range of its title, taking the reader on a journey from mineral resource formation and geochemistry, exploration and production to the economic and legal settings in which the minerals industry operates. As an updated and revised edition, it includes additional contemporary context to issues discussed, and provides some timely overviews of relatively recent developments in mineral demand, extraction and applications.

One area in which this text excels is in providing a lot more practical and applied content (and context, for that matter) than many standard textbooks. Frequent asides in text-boxes provide particularly useful expansions and insights into the more contemporary social, economic and political challenges surrounding mineral resources - particularly in the context of sustainability and sometimes playfully, as in 'The Global Footprint of a Smartphone'.

From geochemical reservoirs and reserve estimates to the assessment and treatment of pollution; from processing to mineral law and land-access rights, the introductory materials cover a truly massive swathe of concerns. For mineral

resources themselves, the authors have chosen to disaggregate those covered into 'groups': such as energy, technology elements, agricultural, and construction and industrial minerals, which all helps draw out the relevance of each in the context of economic, environmental and social challenges. It also provides a contextual framework in which to consider minerals in society, aside from their more esoteric natures as Earth materials.

As is often the case, broad topical coverage takes place at the expense of significant depth; however this large and comprehensive text is useful as a basic, core textbook for college, undergraduate and masters level students, and a worthwhile advanced reference to have to hand. It covers a lot of basic background information that may be of benefit to a non-specialist audience, but which the more experienced reader may feel free to 'take as read'. This is a collection of interesting material, well illustrated with images and examples and presented in logically and consistently. Colour plates are limited, but are very helpful in supporting and enriching the text, as are the extensive appendices and glossaries.

Reviewed by: **Carla Leanne Washbourne**

MINERAL RESOURCES, ECONOMICS AND THE ENVIRONMENT

by HAAKON FOSSEN, 2016.
Published by Cambridge University Press.
524pp (hbk) ISBN-13: 978-1107057647
List Price: £50. W: <http://folk.uib.no/nglthe/>

BOOKS FOR REVIEW

Please contact ted.nield@geolsoc.org.uk if you would like to supply a review. You will be invited to keep the review copy. See a full up-to-date list at www.geolsoc.org.uk/reviews

- ◆ **NEW! Integrated Environmental modelling to Solve Real World Problems.** Geol Soc Spec pub #408, 2017 by Riddick et al (eds)
- ◆ **NEW! Petroleum Geoscience of the West Africa Margin.** Geol Soc Spec. pub. #438, 2017 by Sabato Ceraldi et al (eds)
- ◆ **NEW! Atlas of Submarine Glacial Landforms: modern, Quaternary and Ancient Geological Society Memoir #46** by Dowdeswell et al
- ◆ **NEW! Waves, Particles and Storms in Geospace** by Balasis et al. 2016 Oxford University Press 448pp hbk
- ◆ **NEW! Lake Pavin - history, geology, biogeochemistry and sedimentology of a deep meromictic maar lake,** by Sime-Ngando et al., (Eds) 2016 Springer. 421pp, hbk



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Image: Giants Causeway at Dusk ©Sarah Boulton

PEOPLE NEWS

CAROUSEL

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

◆ Richard Hughes



has been appointed Executive Secretary of the Society. Dr Hughes is currently Director of Business Development at the Coal Authority, prior to which he was Director of Information at BGS. He will take up the position in early May. Dr Hughes is a Fellow, has served on Council and has been a Chartered Geologist since 2001. An interview will appear in the May issue.

NEW YEAR'S HONOURS

◆ Jane Francis,



Director of the British Antarctic Survey, has received a DCMG for her services to UK polar science and diplomacy from the Foreign and Commonwealth Office. As well as her research, Professor Francis has been closely involved with the Antarctic Treaty, and in 2014 received the Geological Society's Coke Medal in recognition of her extensive work in both science and policy.

◆ Edmund Nickless



has received an MBE (Member of the Order of the British Empire) for services to geology. Mr Nickless was the Geological Society's Executive Secretary for 18 years, retiring in 2015, and currently serves on the Executive Committee of the International Union of Geological Sciences (IUGS). In 2016 he was awarded the Geological Society's Distinguished Service Award.

◆ Willy Aspinall



was awarded a CMG for services to the Government and community in Montserrat. Currently Cabot Professor in Natural Hazards and Risk Science at the University of Bristol, Professor Aspinall travelled to Montserrat in 1995 as scientific advisor following a major eruption, and spent the next 20 years advising the Montserrat and British governments on protecting communities from eruptions. He received the Geological Society's William Smith Medal in 2012.

IN MEMORIAM WWW.GEOLSOC.ORG.UK/OBITUARIES

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

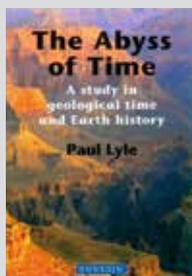
Absalom, Sydney Stuart *
Armitage, John *
Ayers-Morgan, Christopher *
Boyd, David Murray *
Davis, Robert Vincent *
Drysdall, Alan Roy *
Geddes, James D*§
Jenner-Clarke, Hugh Clifford David *
Morgan, Daniel *

Palmer, Stephen J *
Piffaretti, Joseph*
Pipes, Kenneth P *
Rawcliffe, Eric *
Roberts, John Cole
Saunders, John Baverstock
Smith, Robert L *
Stokes, David R *
Wright, Ernest *

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

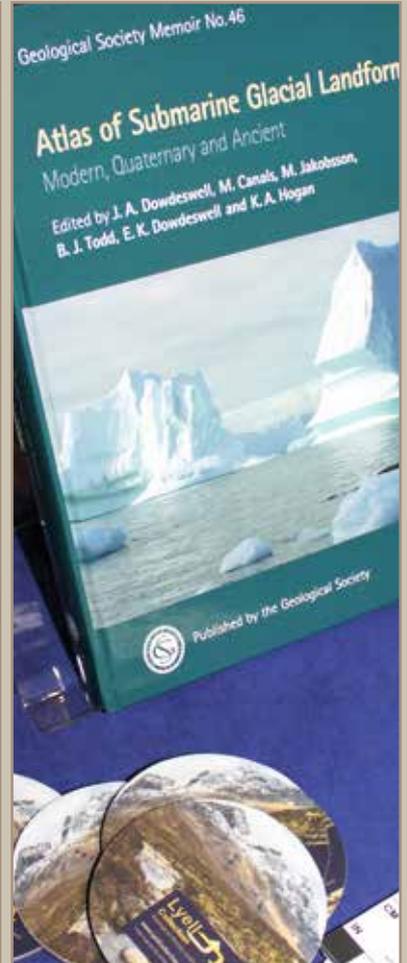


◆ **Paul Lyle's** book *The Abyss of Time* (see *Geoscientist* 26.10, November 2016) has won the book award at the annual conference of the Association for Science Education. The award is designed to celebrate science writing that educates and inspires science learners of all ages. A panel of independent reviewers from different sectors of science education considered 15 books, out of which three were shortlisted. Paul's book was overall winner.

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



Memoir 46 published

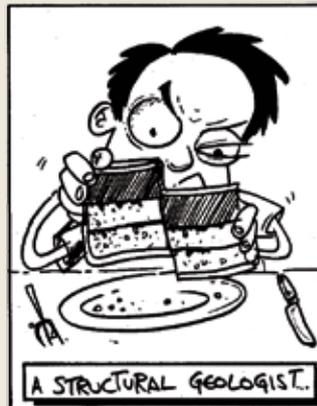


L-R: Dr Brian Todd (Canadian Geological Survey, editor), Evelyn Dowdeswell (Scott Polar Research Institute, Cambridge, editor), Prof. Julian Dowdeswell (Scott Polar Research Institute, editor-in-chief), and His Excellency Snr. Rolando Drago Rodriguez (Chilean Ambassador to the UK)

The volume, sponsored by BP, ENI, Kongsberg and Det norske, contains over 180 contributions

Mr Malcolm Brown, GSL President, welcomed the Chilean Ambassador to the UK, editors, authors and sponsors of 'Atlas of Submarine Glacial Landforms' on 23 January 2017. Three years in the making, this magnificent £140 volume is available to Fellows at 50% discount. Go to www.geolsoc.org.uk/M0046 to secure your copy! At time of writing, a copy was also available for review.

STICKS AND STONES



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DISTANT THUNDER

Geologist and science writer Nina Morgan* discovers the lesser known talents of Benjamin Peach

Best known for his work on the complex stratigraphy and tectonics of the Southern Uplands and the Northwest Highlands of Scotland, Benjamin Peach [1842 – 1926] owed his entry into geology to his father's talent for finding fossils. Although born in Cornwall, Benjamin grew up from the age of 7 in Scotland where his father, Charles, a coastguard officer and amateur naturalist and geologist, was posted. Charles's discovery of important fossils at Durness, caught the attention of Sir Roderick Murchison [1792 – 1871].

Murchison, noticing the ability of the younger Peach, arranged for Benjamin to study in London at the Royal School of Mines. Benjamin joined the Geological Survey in 1862, where his first task was to assist in the determination of fossils in the London office, before moving to the Scottish branch to map glacial deposits, and where he discovered his great love and talent for field work.

In 1867, Peach was entrusted with the training of a new recruit, John Horne [1848 – 1928], and the rest, as they say, is history. The pair worked together for nearly 60 years and became known for their legendary work on unravelling the complex Scottish geology and the geological formation of the Highlands.



Fossils and fish



Ben Peach (right) with John Horne at Inchnadamph

Song of praise

But along with his talent for field mapping, Peach was also known among his colleagues for his great skill in fishing, a talent recorded in song in the notebook of another young Survey geologist, Henry Cadell [1860 – 1934].

D'ye ken Ben Peach with his shoulders broad
His dimpled cheeks and smiling nod?
D'ye ken Ben Peach with his reel and rod
As he starts for the loch in the morning

Yes I ken Ben Peach and Jock Scott too
The mallard wind and black Tulu [sic]
You should see him at sport in Kylesku
With a whale on his line in the morning

He lived at Durness for many a day
With old Robert Sutherland at Sango Bay
And was once nearly killed in a furious fray
With a Frenchman at one in the morning

He tried camp life near Achamore
But the rain came down in a steady pour
So all he could do was to lie and snore
Till seventeen o'clock in the morning

Then here's to Ben Peach and his sunny smile
As he comes home at night from a day on the kyle
May the fish aye rise in a splendid style
To Peach-flavoured flies in the morning

For the ricket of his reel brought the fish from their bed
And the swish of his line high over his head
They hurried up in shoals to be all struck dead
By a wave of his wand in the morning

When Peach died on 29 January 1926, he was the subject a number of glowing obituaries in the geological press highlighting his amiable personality and mapping and artistic skills. But surprisingly, there seems to have been no mention of his death in *Fishing News*, aka 'the voice of the industry since 1913'.

Acknowledgement

The verses about Peach are quoted in: *The Highlands Controversy: Constructing Geological Knowledge through Field Work in Nineteenth Century Britain*, by David Oldroyd, Chicago University Press, 1990. Other sources for this vignette include the entry for Benjamin Peach by David Oldroyd in the Dictionary of National Biography, and the obituary of Benjamin Neeve Peach by E B Bailey, which appeared in the *Geological Magazine*, 1926, pp. 187 – 190.

* Nina Morgan is a geologist and science writer based near Oxford. Her latest book, *The Geology of Oxford Gravestones*, is available via www.gravestonegeology.uk



ENDORSED TRAINING/CPD

COURSE	DATE	VENUE AND DETAILS
Introduction to Micromine (Subsidised)	7-8 March	Micromine, 36 Whitefriars Street, London EC4Y 8BQ. Fees: £110. E: mmuk@micromine.com
Resource Estimation in Micromine	9-10 March	Micromine, 36 Whitefriars Street, London EC4Y 8BQ. Fees: £500. E: mmuk@micromine.com
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 2017

PLEASE NOTE THAT THERE ARE MANY MORE MEETINGS FOR WHICH WE DO NOT HAVE SPACE. ALWAYS CHECK WITH WWW.GEOLSOC.ORG.UK/LISTINGS

COURSE	DATE	VENUE AND DETAILS
School Geology Challenge 2017 South Wales Regional	1 March	Venue: Coleg Sir Gâr, Llanelli. Time: 1700. Free to schools. Contact: Paul Maliphant E: swales.rg@geolsoc.org.uk
Schools Geoscience Workshop and Competition 2017 South West Regional	1 March	Venue: Fitzroy Building, Plymouth University Drake Circus, Plymouth, Devon. PL4 8AA. Time: 1500. Contact: Gordon Neighbour E: gneighbour@tggsacademy.org
Lyll Meeting 2017: Sticking Together - microbes and their role in forming sediments	7 March	Venue: Burlington House. Fees and discounts apply. For details and registration, see website. Contact: Naomi Newbold E: naomi.newbold@geolsoc.org.uk
Geological Society, Micropalaeontological Society, Palaeontographical Society, Palaeontological Association	7 March	Venue: LT 1.40 Cardiff University, Main Building, CF10 3AT. Time: 1730 for 1800 finish at 1900. Free. Contact Simon Hughes E: swales.rg@geolsoc.org.uk
Tip management in South Wales Southern Wales Regional	8 March	Venue: Burlington House. Speakers from Fugro. Time: 1730 for 1800. Contact: E: engineering.group@geolsoc.org.uk
Glacial Ground Models from Offshore Ground Investigations Engineering Group	21 March	Venue: See website. Speaker: Jens Holtvoeth - Bristol University. Time: Evening meeting. See website. Contact E: westernregionalgroup@gmail.com
Subsurface Sand Remobilization and Injection Petroleum Group	22-23 March	Venue: Burlington House. For details, fees and registration see website. Contact Sarah Woodcock E: sarah.woodcock@geolsoc.org.uk
Pioneering Female Geologists North West Regional	23 March	Venue: Chester university. Speaker: Cynthia Burek. Time: See website. Contact E: geologicalsociety.northwest@gmail.com
A joint lecture with the NI Geotechnical Group Northern Ireland Regional	27 March	Venue: See website. Speaker: Dr Tony Waltham. Time 1830. Contact E: GeolSocNI@gmail.com
Earth's Climate Evolution - a New (Geological) Perspective Central Scotland Regional Royal Scottish Geog. Soc.	28 March	Venue: Royal Overseas League, Edinburgh. Time: 1800 for 1830. Speaker: Colin Summerhayes. Fees apply for non-members. Book at W: https://earth-climate-evolution.eventbrite.co.uk
Contaminated Land: Perspectives on Land Contamination Year of Risk Contaminated Land Group	29 March	Venue: Burlington House. Time: 13.30. Register with Sarah Hey at E: slh@ivyhouseenv.co.uk Contact E: dave.jones@naturalresourceswales.gov.uk

OBITUARY Alfred Brian Hawkins 1934-2016

Brian Hawkins came into engineering geology via geography and a keen interest in the Quaternary. He studied at Bristol University between 1952 and 1956 before taking a teaching qualification and joining the staff at Bristol's first comprehensive school. Although he always loved teaching, he continued his own research, eventually returning to the University where he was awarded a PhD in 1970. He was an active academic, supervising over 30 PhDs, publishing more than 120 papers, for which he was awarded a Readership in 1979 and DSc in 1989.

Research Unit

Under his leadership, a strong engineering geological research unit was created that concentrated on such topics as slope stability in soils and weak rocks, engineering geochemistry of sulphates in the ground, and the remediation of historic mines and tunnels. He was hugely active in applied research, but it was his unique and engaging teaching skills that set him apart from others.

While on the staff at Bristol University, he discovered that his skills were in demand in the outside world. So, despite being appointed Reader in Engineering Geology in 1979, Brian found time to work as a consultant to the construction sector. This unique combination of high level consultancy and academic work meant that his civil engineering

Engineering geologist and former Chair of the Engineering Group hugely respected as researcher, teacher and consultant



“**BRIAN HAD A VERY ACTIVE RESEARCH CAREER FOCUSING ON THE TECTONIC AND GEOCHEMICAL EVOLUTION OF GNEISS COMPLEXES**”

and geology undergraduates and his PhD students gained huge benefit from his experience on projects around the world.

Right to the end he maintained a personal interest in all aspects of the work of his

firm, which was not allowed to grow to the detriment of his involvement, and which employed a number of his former research students.

Active roles

Brian Hawkins was also extremely active in the profession at large. At first, he operated in the arena of the Geological Society, taking a series of active roles in the Engineering Group where he was at one time Secretary (1972-4) and later Chairman (1982-4), having earlier contributed greatly to the success of the regional

conference on slope stability held at Bristol in 1972, the papers from which were published the following year in QJEGH. He edited QJEGH (1990-3), having published in the journal on several occasions previously. He was at one stage on the Géotechnique advisory panel.

Subsequently, he served as Vice President for Europe for the International Association for Engineering Geology and the Environment (IAEG) (1995-8) and assisted by his partner Marian, was Editor-in-Chief of the Bulletin of Engineering Geology and the Environment for 15 years (1998-2012). He narrowly missed being elected President of IAEG in 1998, but was the first recipient of the Marcel Arnould Medal, presented at the 2014 IAEG Congress in Torino “in recognition of people of significant repute within the IAEG and who have made a major contribution to the Association” (picture).

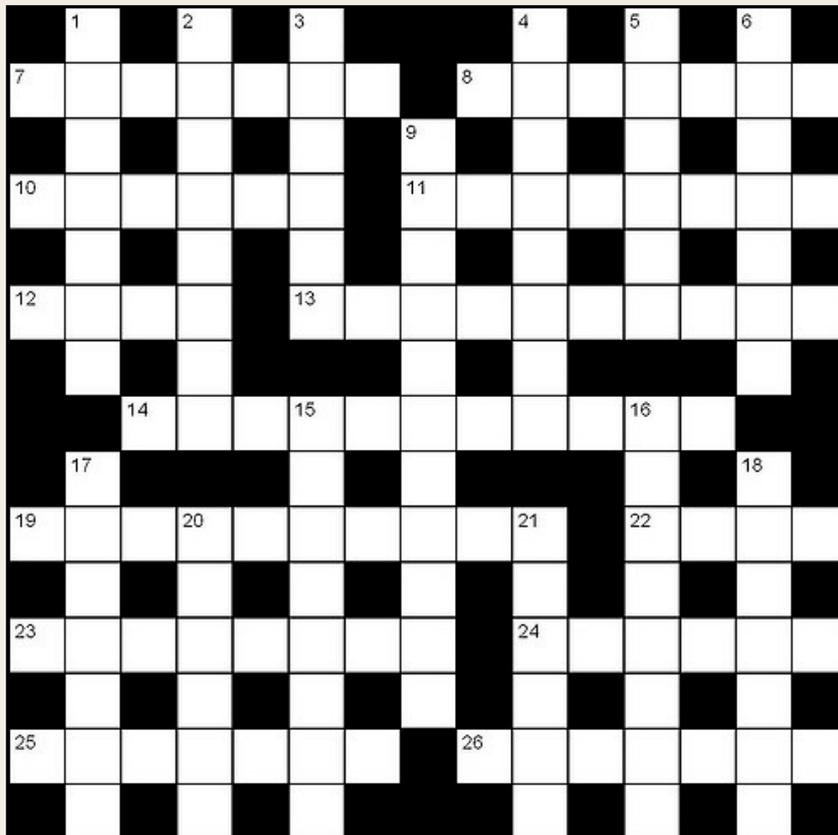
Brian died suddenly in January 2016 aged 81. That day he and Marian had visited a site, instructed the drillers, spent the evening at a local hotel. His last day was spent doing exactly what he loved doing and with Marian by his side.... Way to go.

Alfred Brian Hawkins PhD, DSc, FICE, FIMMM, FCIHT, CEng, CGeol, EurIng. 10 October 1934 to 22 January 2016

► By **Eddie Bromhead and Brian McConnell**
A longer version of this obituary may be read on the website.
Editor

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.

CROSSWORD NO.211 SET BY PLATYPUS



ACROSS

DOWN

- 7** The irregular recurrence of the same expression within a verse or successive verses of scripture (7)
- 8** Great Ape (7)
- 10** Fractional shape-change or internal rearrangement due to tectonic activity (6)
- 11** Slightly salty (8)
- 12** Mineralised body formed by infilling of a rock fracture (4)
- 13** Limit above which, under stress, elastic behaviour ceases (5,5)
- 14** Risk-taking or excitement-seeking personality (11)
- 19** Stellar explosions that briefly outshine an entire galaxy (10)
- 22** 'Slight amount', though actually 10, and the ninth letter of the Greek alphabet (4)
- 23** Variable resistor (8)
- 24** Berber ethnic confederation of nomad pastoralists, principally inhabiting the Sahara desert (6)
- 25** French work? More a form of onerous heavy labour (7)
- 26** Chipped nodule, formerly imagined to have been primitive tools (7)

- 1** Agglutinated masses of primary ejecta, bigger than lapilli (7)
- 2** Got hold of, or alternatively, prevailed (8)
- 3** Like 26a, hard, having properties of cryptocrystalline quartz (6)
- 4** Orange stuck with cloves (8)
- 5** living fossil tree (Permian - present) (6)
- 6** Non-agreement or opposition to a prevailing idea (7)
- 9** Scientific philosophy eliminating biases, assumptions, emotions etc. (11)
- 15** Albert of the Special and General (8)
- 16** Sidnie M grouped under this name the Onychophora, Hexapoda and Myriapoda (8)
- 17** Uncontrolled releases of crude oil under natural pressure (7)
- 18** Dutch city where a famous Union treaty was signed in 1579 (7)
- 20** Undergo incremental change through time (6)
- 21** Effect due to changes in perceived gravitational force resulting from eastbound or westbound velocity (6)

WIN A SPECIAL PUBLICATION!

The winner of the November Crossword puzzle prize draw was **David Williamson of Dungannon**.

All correct solutions will be placed in the draw, and the winner's name printed in the May 2017 issue. The Editor's decision is final and no correspondence will be entered into. **Closing date - March 13.**

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 DECEMBER/JANUARY

Across:

- 7 Deposit 8 Echinidna 10 Escort
- 11 Polarity 12 Fiji 13 Meandering
- 14 Thousandths 19 Chlorophyl(l) (Platypus apologises for laying this egg)
- 22 Rune 23 Foramina 24 Teflon
- 25 Halibut 26 Diploid

Down:

- 1 Seismic 2 Lopolith 3 Diatom 4 Occluded
- 5 Mirror 6 Instant 9 Appalachian
- 15 Uxorious 16 Hornfels 17 Chloral
- 18 Anionic 20 Oxalic 21 Lithic

Ground Related Risk to Transportation Infrastructure

26-27 October 2017 The Geological Society, Burlington House, London



We are pleased to announce a conference for the Society's chosen scientific theme in 2017 (Year of Risk). The meeting will focus on best practice for managing geotechnical infrastructure and is supported by the UK Geotechnical Asset Owners Forum. The conference will provide an opportunity to showcase innovative, industry leading approaches to holistic and tactical risk management across geotechnical infrastructure.

Themes include:

- Strategic management of risk for portfolios of geotechnical assets, including policy development, application and use within regulated industries,
- Identification, assessment and management of ground-related hazards to transportation infrastructure,
- Identification, assessment and management of hazards relating to natural slopes and hazards from third party land in proximity to transportation infrastructure,
- Assessment and management of changing risk during asset deterioration, including monitoring procedures and methods,
- Operational responses to geotechnical asset failures impacting on transportation infrastructure,
- Assessment of Whole Life Cost and Value, including modelling, development of input data and validation of outputs,
- Current state of thinking in assessing climate change and dynamic weather events that impact on geotechnical infrastructure.

Convenors

Simon Abbott (Network Rail)	Clare Brint (Network Rail)
Chris Power (Mott MacDonald)	Tom Berry (Arup)
Fiona Todd (The Coal Authority)	Jonathan Chambers (BGS)
Ken Gavin (Technical Uni Delft)	Verity Smith (Atkins)

Further information

For further information please contact:
Georgina Worrall, Conference Office,
The Geological Society, Burlington House,
Piccadilly, London W1J 0BG
T: 0207 434 9944
E: georgina.worrall@geolsoc.org.uk
Web: www.geolsoc.org.uk/infrastructure17
Follow this event on Twitter:
#GeoRiskTransport17

Call for Papers

We particularly welcome abstracts for oral and poster presentations from geoscientists specialising in geohazards, engineering geology, geotechnics, hydrogeology as well as science communicators, risk assessors and risk managers. An important aspect of the meeting will be to explore case studies and to consider what insights and understanding can be shared across sectors and applications. Abstracts should be no more than 500 words and should be emailed to georgina.worrall@geolsoc.org.uk, as a Word document.
Deadline: Friday 26 May 2017



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GEOSCIENCE JOBS



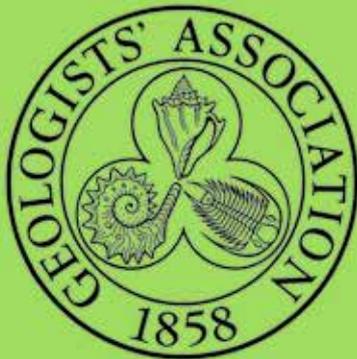
Geoscience Jobs is the official jobs platform for the Geological Society. Whether you are searching for a new role, or in a managerial position keen to advertise a new vacancy, you will be able to access and use jobs.geolsoc.org.uk knowing it is tailored to a broad spectrum of specialist earth science professions. Managed by the Geological Society of London, Geoscience Jobs is an essential resource for any earth science professional looking for the next step in their career.

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Geologists' Association Student Symposium

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Geology and societal change: What difference does your research make?

SUGGESTED THEMES:

- Geohazards
- Exploration
- Geological engineering
- Climate change



Prizes will be awarded for the best oral and poster presentations.



Confirmed keynote speaker:
Professor Iain Stewart
(Director of the Sustainable Earth Institute, Plymouth University)

Further Information:

The Geologists' Association

@GeolAssoc #GASS2017

gass@geologistsassociation.org.uk

Conference registration opens:

January 2017

Deadline for abstract submission:

31st March 2017

19th of May 2017

Burlington House, Piccadilly,
London; W1J 0BG

GASS 2017



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William Smith Meeting 2017

Plate Tectonics at 50

3-5 October 2017

The Geological Society, Burlington House

INVITED SPEAKERS

Nick Christie-Blick, Lamont-Doherty Earth Observatory, Columbia University, USA
John Dewey, University of Oxford, UK
Tony Dorá, Statoil, UK
Cindy Ebinger, University of Rochester, USA
Hank Frankel, University of Missouri, Kansas City, USA
Catherine Johnson, University of British Columbia, Canada
Peter van Keken, Carnegie Institution for Science, Washington DC, USA
Mike Kendall, University of Bristol, UK
Xavier Le Pichon, Collège de France
Peter Molnar, University of Colorado, Boulder, USA
Jason Morgan, Harvard University, USA
Donna Shillington Lamont-Doherty, Earth Observatory of Columbia University, USA

Opening remarks by

Tony Watts, University of Oxford, UK

Closing remarks and introduction of the

William Smith lecturer

James Jackson, University of Cambridge, UK

William Smith lecturer

Dan McKenzie, University of Cambridge, UK

Convenors

Rob Butler, University of Aberdeen, UK

Mike Daly, University of Oxford, UK

Gareth Roberts, Imperial College London, UK

Jonathan Turner, formerly BG Group

Tony Watts, University of Oxford, UK

Call for Papers

On the 50th anniversary of the advent of the plate tectonics paradigm, this three day meeting is convened to examine the state of the art and scope out new directions. This Call for Papers is for contributions that complement the array of invited speakers – reporting recent research on any aspect of tectonics and the associated disciplines that together feed into understanding the plate system and processes.

We can accept contributions for talks and posters.

Registration and abstract submission forms are available via the conference web-site. The deadline for abstract submission is **31st May 2017** but we encourage submission and registration as early as possible to avoid disappointment.

The conference will be drawn to a close by the 2017 William Smith lecture, delivered by Dan McKenzie.



Further information

For further information about the conference please contact:

Naomi Newbold, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: 0207 434 9944 E: naomi.newbold@geolsoc.org.uk
Web: www.geolsoc.org.uk/wsmith17

Follow this event on Twitter: #wsmith17



servicing science & profession



Lyell Meeting 2017

Sticking Together: microbes and their role in forming sediments

7 March 2017

The Geological Society, Burlington House



Convenors:

Daniel Parsons (University of Hull, UK)

Mike Rogerson (University of Hull, UK)

Concha Arenas Abad (University of Zaragoza, Spain)

Gernot Arp (University of Göttingen, Germany)

Jaco Baas (University of Bangor, UK)

Confirmed Keynote Speaker:

Christophe Dupraz (University of Stockholm, Sweden) – *Biofilms and Sediment: a 'Geobiological Tango'*

Further information:

For further information about the conference please contact:

Naomi Newbold, Conference Office,

The Geological Society, Burlington House,

Piccadilly, London W1J 0BG

T: 0207 434 9944

E: naomi.newbold@geolsoc.org.uk

Web: www.geolsoc.org.uk/lyell17

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Sedimentology and geomorphology have traditionally been seen as fields in which physical, and sometimes chemical, processes dominate completely. Even in settings where biological processes have long been recognised, for example in marine carbonates, focus has been almost entirely on metazoans. This is curious, because microbial communities since the Pre-Cambrian, have suffused all sedimentary environments on Earth, and at least half global biomass is prokaryotic. Are all these microbes simply bystanders? Recent research has hinted that they are key agents in controlling an impressive range of processes and products in sedimentology, bringing the fields of microbe palaeontology and bio-sedimentology into intimate alignment. The implications are fundamental, and pose the question “are large-scale sedimentological features actually microbial trace fossils?”.

This meeting will put the majority of life on earth back into its proper place within the sedimentary geosciences. It will shed new light on the important roles that microbial life plays in controlling how sediments erode, transport, precipitate, deposit and cement. We will explore whether microbial processes can leave signatures in sedimentary deposits that prove life was there, despite the fact that the majority of global biomass has nearly zero preservation potential. Ultimately, we will lift the lid on the exciting field of sedimentary geobiology as we collectively work towards a new paradigm of microbial sedimentology.



Why Dinosaurs Matter

With Professor Ken Lacovara, *Rowan University*

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TOUR DATES

SATURDAY 8 APRIL

Kimmeridge Bay &
Lulworth Cove Family Field Trip
FREE but registration required

The Etches Collection Museum
Talk & Reception
FREE but registration required

SUNDAY 9 APRIL

Lecture
Lyme Regis Baptist Church
FREE but registration required

MONDAY 10 APRIL

Lecture
Natural History Museum, London
FREE but registration required

TUESDAY 11 APRIL

Stoneley Lecture & Reception
Cavendish Centre, London
£15, includes drinks reception

WEDNESDAY 12 APRIL

Keith Palmer Lecture & Reception
University of Birmingham School
FREE but registration required

FRIDAY 14 APRIL

Fun family activities throughout the day
TED talk screenings & Q&A
Aberdeen Science Centre, Aberdeen
Registration not required, venue entry fees apply

Stoneley Lecture & Reception
Aberdeen Science Centre, Aberdeen
£10, includes drinks reception

SATURDAY 15 APRIL

Lecture
National Museum of Scotland
Part of the Edinburgh Science Festival
Registration coming soon

Lacovara enjoys sharing the wonders of science and his dinosaur discovery with audiences around the world. He has appeared in numerous television documentaries on American TV networks, as well as on the BBC, and was voted as one of the best TED speakers in 2016



Why study the ancient past? Because it gives us perspective and humility. It's the past that gives our world context. And it's the past that gives us foresight.

Dinosaurs were tiny, and huge. They were skittish and ferocious. Fast and slow. Runners, walkers, climbers, flyers, and sometimes swimmers. They were solitary and gregarious. Nocturnal and diurnal. Meat-eaters and plant-eaters. Hunters, scavengers, grazers, and browsers. They were drab, colorful, scaled and feathered. But, most of all, they were astoundingly adaptable. Dinosaurs dominated every continent and were thriving the day before their demise. Snuffed out by an asteroid, along with 75% of species on the planet, their sudden extinction emphasizes the contingent nature of Earth history. Over geological time, improbable, nearly impossible events do occur. By studying the ancient past, we begin to see ourselves as part of nature, connected across deep time to all other living things.

After 165 million years, the dinosaurs died in the world's fifth mass extinction, wiped out in a cosmic accident, through no fault of their own. They didn't see it coming and they didn't have a choice. We, on the other hand, do have a choice and the nature of the fossil record tells us that our place in this world is both precarious and potentially fleeting. Right now, our species is propagating an environmental disaster of geological proportions that is so broad and so severe, that it can rightly be called the sixth extinction. But, unlike the dinosaurs, we can see it coming. And, unlike the dinosaurs, we can do something about it. That choice is ours.

