

GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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[2020:
THE YEAR OF LIFE]

AMPLIFIED VOICES

Michelle Guitard and colleagues on how identity shapes our scientific experience

GREENOUGH'S WORLD

The bicentenary of the first crowd sourced geological map

ETHICAL INVESTING

Geoscience and the need for sustainable finance

ACADEMIC RICHES

Nina Morgan on a very geological love affair



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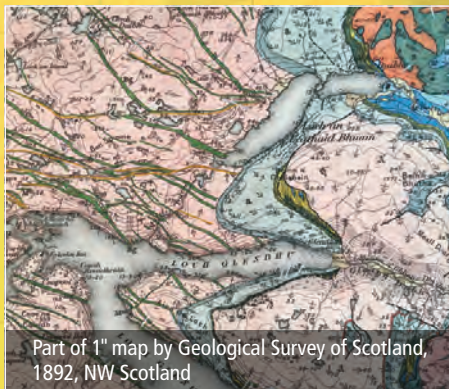
PETROLEUM GROUP

WILLIAM SMITH MEETING 2020

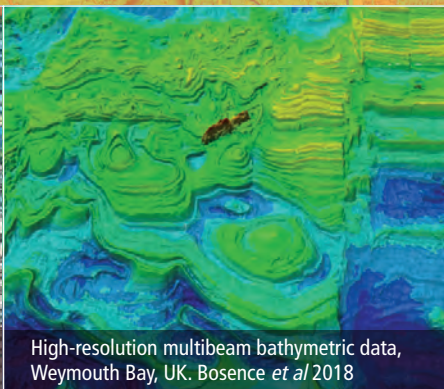
Geological mapping: of our world and others

6-8 October 2020

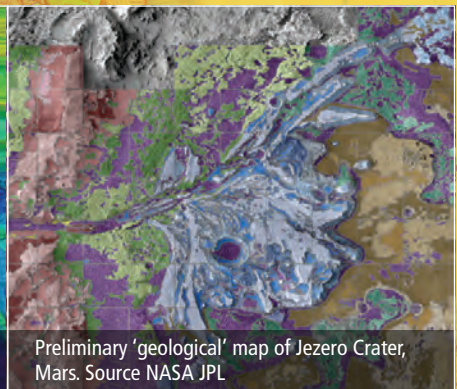
The Geological Society, Burlington House, London



Part of 1" map by Geological Survey of Scotland, 1892, NW Scotland



High-resolution multibeam bathymetric data, Weymouth Bay, UK. Boscence *et al* 2018



Preliminary 'geological' map of Jezero Crater, Mars. Source NASA JPL

Convenors

Lucy Williams (Rockhopper Exploration)
Rob Butler (Aberdeen University)
Mike Searle (University of Oxford)
Sanjeev Gupta (Imperial College)
David Schofield (BGS)

Further information

For further information about the conference please contact:

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

T: 0207 434 9944

E: conference@geolsoc.org.uk

Web: www.geolsoc.org.uk/wsmith20



Follow this event on Twitter:
#wsmith20

Map-making is a fundamental tool for developing geological knowledge. This 3-day conference is a celebration of geological mapping, its historical importance and future directions, and its use to deduce Earth and planetary evolution and processes in its wide context. The program seeks to explore Earth's surface to subsurface realms, and beyond to extra-terrestrial bodies.

Confirmed Keynote Speakers

Kathryn Stack (Jet Propulsion Laboratory, NASA)

Marc St-Onge (Geological Survey of Canada)

John Dewey (University College, Oxford)

Mike Daly (President-designate of the Geological Society)

Call for Abstracts

We invite oral and poster abstract submissions for the meeting, and these should be sent in a Word document to conference@geolsoc.org.uk by 30 April 2020. Abstracts should be approximately 250 words and include a title and acknowledgement of authors and their affiliations.



Geoscientist is the Fellowship magazine of the Geological Society of London

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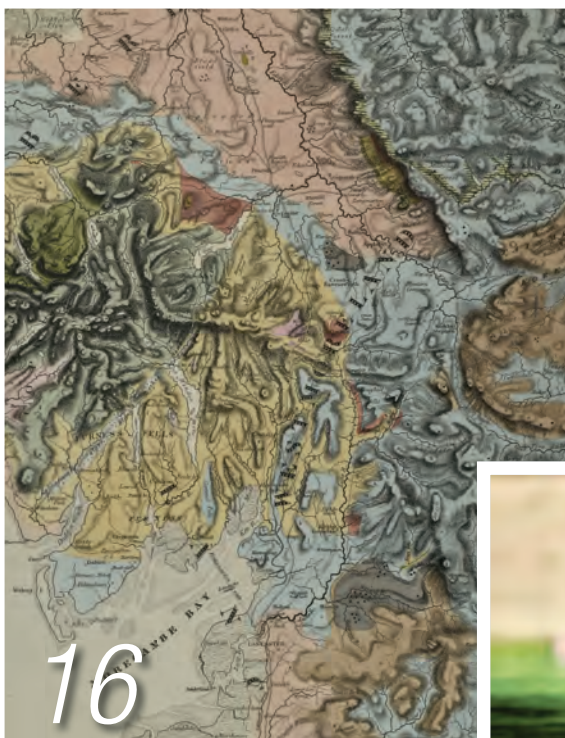
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New learning from exploration and development in the UKCS Atlantic Margin

20-22 May 2020
Robert Gordon University, Aberdeen



The UK Atlantic margin, including the West of Shetlands area, is the location of the UK's largest remaining hydrocarbon reserves, the largest recent field development investments and holds the greatest potential for future material discoveries in the UK.

In the 10 years since the last Geological Society conference on this region, great advances have been made in the understanding of its diverse plays, from fractured basement to Eocene coastal deposits, and everything in between.

This three day meeting gives a unique opportunity to learn about the geoscience of recent discoveries and field developments, as well as how technology is developing to meet the imaging and drilling challenges of the area. For a fully immersive experience, there is an opportunity to see the diverse range of reservoirs in outcrop on the Isle of Skye (15-17 May) and in core at the Iron Mountain facility at Dyce (19 May).

Associated events:

- Three day field trip to the Isle of Skye run by Nick Schofield (Aberdeen University) and Stuart Archer (Nautilus RFS)
- Guided core viewing day at Iron Mountain (Dyce)
- Social programme to include a conference dinner. (Nautilus RFS)

Conference themes:

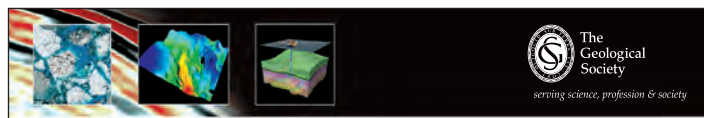
- Paleocene deep water reservoirs
- Mesozoic pre-, syn-, and post-rift plays
- Palaeozoic play (e.g. Carboniferous and Devonian at the Clair field)
- Non-clastic plays (e.g. fractured basement, volcanics, carbonates)
- Paleocene-Eocene volcanic-associated reservoirs
- Extra-UK Atlantic Margin
- Multidisciplinary technology session (e.g. advances in drilling techniques, sub-sill imaging, EOR)
- Geodynamics, basin modelling, thermal and uplift/subsidence history, migration routes
- What's next? The next 10 years for exploration and development in the region.

For further information please contact:
Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. Tel: +44 (0)20 7434 9944
Website: <https://www.geolsoc.org.uk/pg-atlantic-margins-2020>

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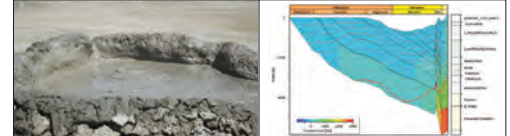
Geopressure 2020

Managing Uncertainty in Geopressure by Integrating Geoscience and Engineering

24-26 March 2020
Durham University, Durham UK

24 March 2020: Field trip Led by Richard Swarbrick and Jack Lee to North Yorkshire

25 and 26 March 2020: Conference Durham University, UK



The organisers invite contributions within any aspect of geopressure but are particularly interested in the various phases of pore fluid pressure prediction, modelling and overpressure evaluation to manage uncertainty during the life cycle of a well. Suggested themes and sessions include:

- Pore Pressure and stress, especially complex stress regimes
- Impact of machine learning on PPFPG
- Well engineering and PPFPG
- Injecting fluids underground (including CO2)
- Coupling of Pore Pressure and FG including depletion and closing the drilling window
- Seal capacity and relationship with PPFPG
- PPFPG issues in mature basins (including abandonment/decommissioning)
- Classic case studies, including Macondo and LUSI mud volcano
- Pore pressure as an exploration and prospectivity tool.
- Geopressure in mature basins – lessons learnt
- Pore pressure in active tectonic basins
- Unconventional stress regimes

Further Information or to Register:
For more information please contact sarah.woodcock@geolsoc.org.uk or visit the event website: www.geolsoc.org.uk/PG-Geopressure-2020

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Call for Abstracts – Deadline 29 February 2020

Development and Production Geology of Carbonate Reservoirs

28-29 October 2020
The Geological Society, Burlington House, Piccadilly, London



Carbonate reservoirs constitute some of the most important sources of global oil and gas production. They form the world's largest oil and gas accumulations, the world's highest-producing fields, and have some of the longest production histories. Significant new carbonate discoveries continue to be made, and carbonates are also a source of geothermal energy or may be utilised for gas storage.

Successful development of supergiant carbonate reservoirs can result in plateau production that may last for decades, giving high ultimate recovery factors. But, carbonate reservoirs can also be some of the most complex in terms of reservoir quality and heterogeneity. Many give disappointing ultimate recovery factors and some are deemed uncommercial with current technologies. Fundamental geological understanding, sufficient and appropriate geological and dynamic data, and the construction of effective models are the keys to optimising the exploitation of such reservoirs.

This conference will focus on how lessons learned from more than a century of discovery, appraisal and development of carbonate reservoirs may be applied to emerging discoveries. It will bring together the experiences of diverse operators with an objective of highlighting best practices for the geological characterization of carbonate reservoirs from appraisal to production.

Potential session themes:

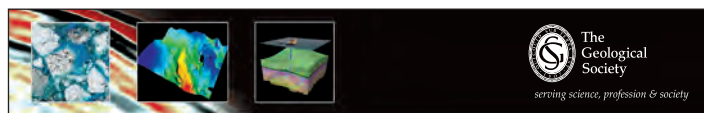
- Excess permeability – blessing or curse?
- Pores vs stratigraphy – what controls dynamic reservoir behaviour?
- Reservoir analogues – how useful are they?
- Static modelling of carbonate reservoirs – how predictive can we be?
- Multiscale/multidisciplinary dynamic reservoir characterization – how can we integrate geology effectively?
- Improving recovery/revitalising old carbonate fields – adding value through geological understanding.

Planned field trips:
The Carboniferous platforms of Derbyshire, led by Pete Gutteridge, Cambridge Carbonates.
Zechstein carbonates of the north-east of England, led by Geospatial Research Ltd.

Call for Abstracts:
Please submit talk or poster abstract to sarah.woodcock@geolsoc.org.uk by 29 February 2020.


For further information please contact:
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Core Values: the Role of Core in 21st Century Reservoir Characterisation

26-28 May 2020
The Geological Society, Burlington House, Piccadilly, London



Core has traditionally played a key role in the characterisation of conventional and unconventional hydrocarbon reservoirs, from exploration to mature production. It is the only means by which to observe and make measurements on actual reservoir rock. However, the recent oil industry downturn has driven many to question the value of taking core, due to the associated increased costs and potential risks to well operations. In tandem, advances in other reservoir visualisation techniques, such as seismic and borehole imaging, have been used to give weight to the contention that coring is an increasingly redundant means of characterising reservoirs.

Through four main themes this 3-day conference will aim to redress the balance in this debate by exploring the role core can, or should, play in the 21st century exploration to production cycle:

- Is core critical to sound commercial decision making?
- What are the challenges and benefits of integrating core-derived understanding across the geological, petrophysical and engineering spectrum?
- Integration of traditional core characterisation methods with new core, well and reservoir visualisation and mapping technologies - is the sum greater than its parts?
- How can the extensive network of global legacy core collections best be utilised to maximise their business and research worth?

Dedicated sessions will allow delegates to view core that has been central to addressing many key reservoir issues, under the direct guidance of those responsible for meeting such challenges. Speakers are thus invited to bring core to illustrate their presentation, and indicate if this is of interest when submitting an abstract.

For further information or to register:
For more information, please contact Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. Tel: +44 (0)20 7434 9944, sarah.woodcock@geolsoc.org.uk

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SOCIETY NEWS

SOCIETY BUSINESS

YEAR OF LIFE

Amy Ball introduces the Society's theme for 2020

Welcome to 2020 and the Geological Society's Year of Life!

Throughout the year we will be running events, research conferences and other activities through our education and outreach programme exploring the theme of life. We will be covering everything from microbes and microfossils to evolution, biodiversity and mass extinctions past and present. Here's a brief overview of some of the highlights we're looking forward to in 2020.

Following on from our previous themed years, we will be hosting a number of public lectures throughout the year centred around the theme of life. As well as being delivered at the Geological Society in London, our Year of Life lectures will also be given as regional lectures across the UK. Our first Year of Life lecture, by Dr Stephan Lautenschlager, will be on 26 February on the topic of functional morphology and biomechanics in extinct vertebrates. We will also be running a joint public lecture with the Linnean Society on 23 June which will be given by Professor Daniela Schmidt on the subject of marine ecosystem responses to climate change and ocean acidification. All public lectures are free to attend and will be listed on our website:

www.geolsoc.org.uk/gslpubliclectures20.

As part of our conference programme we will be hosting a 'Plastics in the Environment' meeting on 14 May and a 'Sulphur in the Earth System' meeting later in the year.

Our Publishing House have put together a collection of Year of Life papers chosen by a group of early career researchers, which is accessible through the Lyell Collection: www.lyellcollection.org/content/collections. We are also developing a number of education resources throughout the year, including a Year of Life themed fossil set available for teachers and education groups to borrow, a set of infographics based on the geological timeline as well as other educational activities focussing on fossils, evolution and the history of life.

Finally, we are excited to announce that our Lower Library will be home to an exhibition by artist Melanie Ewar from 26 February for eight weeks. Melanie's artwork, inspired by her own Jurassic fossil finds, conveys geological time and ancient lifeforms through quilted work, mixed media canvases and wall hanging installations.

If you would like to propose an event or get involved with any of our Year of Life activities, you can find more information on our Year of Life webpage: www.geolsoc.org.uk/life20.



ELECTIONS TO COUNCIL 2020-2021

The October issue of Geoscientist invited Fellows to nominate new members of Council. A preliminary ballot will be conducted, the results of which will determine the list for the formal vote at this year's Annual General Meeting on 4 June.

Civica Election Services (CES - previously Electoral Reform Services) will administer this year's Council ballot. CES is the UK's leading independent ballot services provider, and has extensive experience of overseeing ballots for a wide range of organisations.

Those Fellows for whom we have an email address will receive an email from CES on or soon after 11 February with instructions how to vote online. If you have not heard by 22 February please check your spam emails before contacting the Society. Fellows for whom we do not have an email address will be sent a postal ballot pack.

The closing date for voting, online or postal, is 31 March 2020.

PUBLIC LECTURE SERIES

Public Lecture: Jurassic brain teasers - using modern technology to get inside the heads of dinosaurs (and other fossils)

Speaker: Stephan Lautenschlager, University of Birmingham

Location: Burlington House, London

Date: 26 February

Programme

- Afternoon talk: 14.30 Tea & Coffee; 15.00 Lecture begins; 16.00 Event ends.
- Evening talk: 17.30 Tea & Coffee; 18.00 Lecture begins; 19.00 Reception.

Further information

Please visit <https://www.geolsoc.org.uk/Events/Public-Lectures-2020>. Tickets are now available on Eventbrite.co.uk and will work on a first come first serve basis. The lectures will be available to watch livestreamed. To watch, please check the lecture webpage for the link.

Contact: The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: +44 (0) 20 7434 9944 E: conference@geolsoc.org.uk

What your society is doing
at home and abroad



POLICY UPDATE

THE FUTURE OF ENGLAND'S WATER ENVIRONMENT

Megan O'Donnell reports on the latest news from the policy team

Our latest consultation is seeking ideas on behalf of the Environment Agency about how to manage England's river basins from 2021 onwards. At the current rate of progress it will take over 200 years to reach the government's 25 Year Environment Plan target of at least 75% of waters to be close to their natural state. The Environment Agency urgently needs to find better, faster ways to encourage investment in our water environment.

Many of the topics they are consulting on could benefit from input from the geoscience community such as water contamination, changes to water levels and flows, climate and biodiversity, plastics, and the impact of physical modifications to the water environment.

If you have views, knowledge or expertise that are relevant to the ongoing and future management of the water environment in England, the Geological Society wants to hear from you!

Find out more: www.geolsoc.org.uk/consultations



USE YOUR EXPERTISE TO INFORM POLICY

The policy team at the Geological Society have made it easier than ever to get in touch and provide evidence and information to our upcoming policy responses and reports. Visit our new webpage (geolsoc.org.uk/policy) to meet the team, find out what we do, why we do it, and how you can get involved and keep up to date. You can join our brand-new database of expertise and be the first to hear about when relevant consultations and inquiries open for comment. Increase the impact of your profession, area of expertise or research by contributing to our series of policy briefing notes, helping to inform policymakers and Parliamentarians about geoscience information or simply find out a little more about what the policy team do for the geoscience community.

Join the database of expertise: www.geolsoc.org.uk/policy-database

FROM THE LIBRARY

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◆ **Visit the Library**

Fellows and Candidate Fellows can visit the Library at Burlington House between 9.30am and 5.30pm, Monday to Friday. You'll find comfortable and quiet study space, scanning and copying facilities, free Wi-Fi and all of the latest books and journals. The Library's professional, dedicated staff are on hand to answer any enquiries.

Geoscience, sustainability and ethical investing



To ensure finance and investment institutions create sustainable policies, geoscientists must have a seat at the table, argues **Matthew Pannett**

Environmental, social and governance (ESG) regulations are currently the number one topic for finance and investment institutions in the UK and continental Europe, and geoscientists have an important role to play in this agenda. The need for sustainable finance is largely being driven by a generation of people who are increasingly making investment decisions - from pensions to purchases - based on ethical considerations.

EU regulations and net zero

The link between geoscience and finance and investment is not immediately obvious, but dig a little deeper and the role of the geoscientist becomes clearer.

Recently, political agreement was reached on the EU's sustainable investment disclosure rules that will require companies to disclose, amongst other things, investment impacts on the environment. The EU is also examining how to integrate sustainability considerations into its financial policy framework in order to mobilise finance for sustainable growth while reducing pressures on the environment. These regulations are designed to support the EU's aspirations of a low-carbon, more resource-efficient and sustainable economy. Mark Carney, the outgoing governor of the Bank of England, has also spoken about the need for action to achieve net zero emissions and the potential failure of industries, sectors and firms that lag behind or do not adapt. The UK hosting the United Nations Climate Change Conference (COP26) later in 2020 and aspirations to be net zero by 2050 will only increase the focus on climate change and decarbonisation.

To be credible, ESG and sustainability need to be clearly defined, with standards and a

common language. Geoscientists have a deep understanding of Earth processes, including carbon cycles, water, resources and life on land, and can provide the necessary 'translation' of the Earth sciences into this language of sustainability. Consideration of sustainability criteria, such as benchmarking against the UN Sustainable Development Goals, or more specific metrics, such as carbon accounting, should now form part of our decision-making processes, whether it be resource extraction, re-use of aggregates, protection of soil or sustainable remediation.

Global economics

ESG will become increasingly important in global economics with central banks 'stress testing' climate change impacts on investment decisions. Emerging risks, which could include water and other resource scarcity, or changes in the behaviour of pollutants in the environment, are factors that will create stresses on economies. Clear understanding of these types of risks are needed to develop climate change resilience, an increasingly necessary measure to protect assets, investments and businesses.

Such decisions on sustainability cannot be made in isolation and all stakeholders need to be involved to create ESG and sustainable policies, and avoid 'greenwashing'. Geoscientists need a seat at the table and the ability to engage in this evolving arena where Earth and social sciences blend with economics and ethics.

Recent surveys show that climate change is the number one risk to business, and we need to be ready for this challenge. Now is the time for the geoscience community to become conversant in the language of sustainability.



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 sarah.day@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).

“RECENT SURVEYS SHOW THAT CLIMATE CHANGE IS THE NUMBER ONE RISK TO BUSINESS, AND WE NEED TO BE READY FOR THIS CHALLENGE”

MATTHEW PANNETT

Matthew Pannett (CGeol) is a Principal at Ramboll's London office

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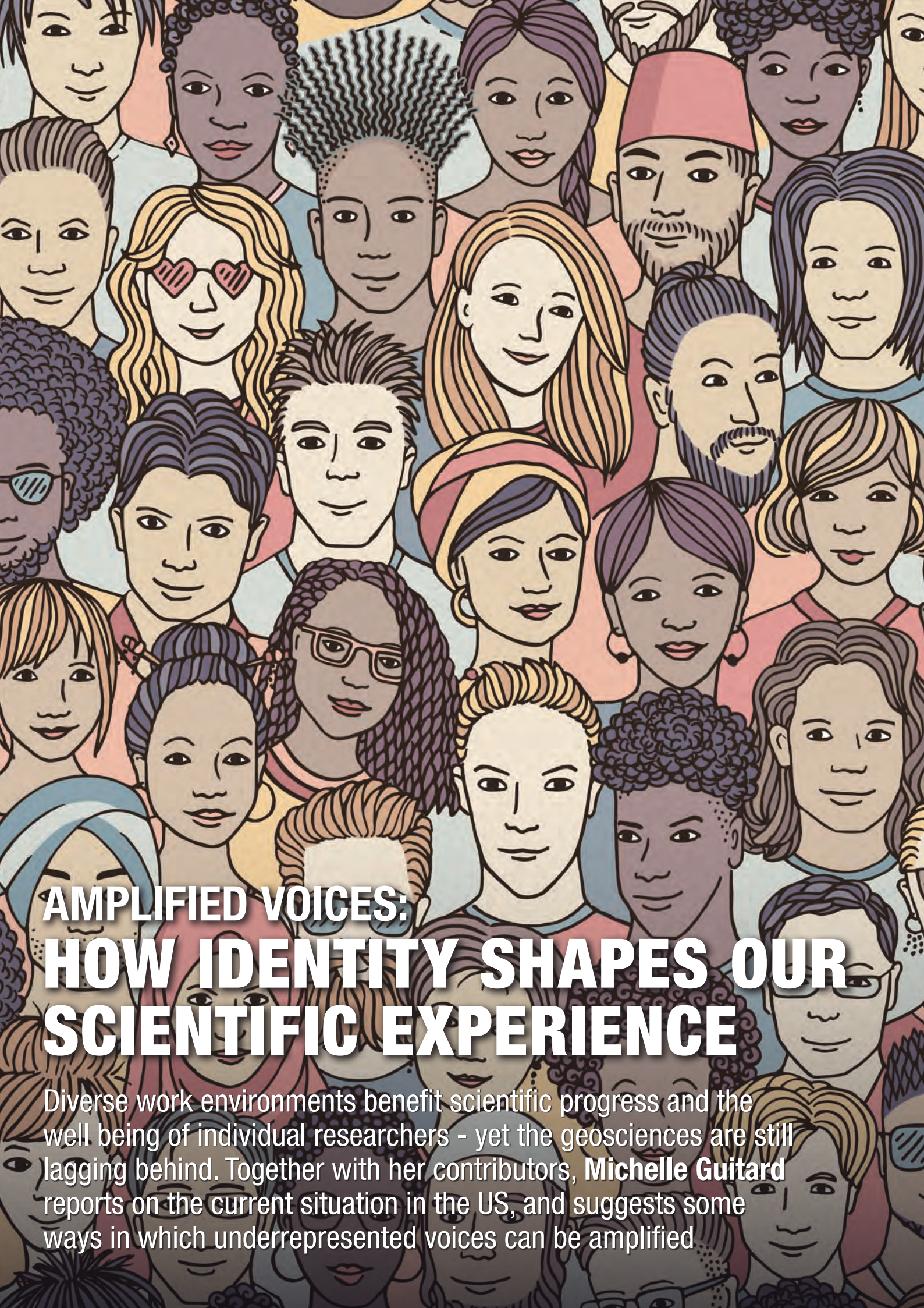
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Geological Society of London



AMPLIFIED VOICES: HOW IDENTITY SHAPES OUR SCIENTIFIC EXPERIENCE

Diverse work environments benefit scientific progress and the well being of individual researchers - yet the geosciences are still lagging behind. Together with her contributors, **Michelle Guitard** reports on the current situation in the US, and suggests some ways in which underrepresented voices can be amplified



The first time I heard about the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) I was reading a geological society's monthly bulletin. The article summarized the lack of diversity in geoscience professions and included SACNAS as an organization dedicated to fostering success for the above-mentioned groups. I immediately logged on to the SACNAS website and enrolled as a student member. I remember feeling happy and excited. Here was a scientific community that intersected my cultural identity, made up of members with shared experiences, but also those from whom I could learn new scientific and cultural perspectives.

Anyone who has found the intersection between culture and career in a single organization can relate. But despite our best efforts in the geoscience community, this intersection is still hard to come by for geoscientists who belong to an underrepresented racial/ethnic group, or those who identify as LGBTQ+ and/or disabled. As a multi-faceted collection of sub-fields dedicated to understanding Earth, the geosciences' greatest strength is diversity of thought. Yet one of its greatest weaknesses, workplace diversity, is surely limiting our progress. A recent assessment of geoscience PhDs awarded to United States citizens and permanent residents at US institutions found that the proportion of degrees granted to underrepresented minorities (American Indian/Alaska Native, Black/African American, and Hispanic/Latinx groups) had ►

► remained stagnant, even while the number of geoscience PhDs earned and the US minority population had both risen over the last four decades (Bernard & Cooperdock, *Nature Geoscience*, 2018). The inability of geoscience programs to recruit and retain underrepresented scholars may have consequences for scientific progress, as there are measurable benefits to diverse laboratories, including greater collaboration and more impactful science (AlShebli et al., *Nature Communications*, 2018).

Besides the broader scientific implications, workplace diversity may also affect the well-being of individual researchers. In a study of workplace

satisfaction among lesbian, gay, bisexual, transgender and queer people (LGBTQ+) working in a science, technology, engineering, and mathematics (STEM) field within a US federal agency, LGBTQ+ employees reported lower workplace satisfaction compared to their non-LGBTQ+ counterparts; the population of LGBTQ+ employees surveyed was underrepresented compared to the US population (Cech & Pham, *Social Sciences*, 2017). Furthermore, STEM inclusion may be hindered by an individual's perception that a STEM career is not a viable option, as demonstrated by students with mobility impairments, who were less likely to report STEM career aspirations compared

to students without mobility impairments (Burgstahler & Chang, *Review of Disability Studies*, 2009).

Issues surrounding diversity, equity, and inclusion can arise because certain identities are at odds with the dominant STEM research culture, which often discounts personal identity in pursuit of scientific objectivity (Mattheis et al., *Journal of Homosexuality*, 2019). If this is the case, can we address these issues by reframing identity (e.g., cultural background, sexual orientation) as a lens through which we view scientific truth? Below are some insights and recommendations from geoscientists who identify as members of an underrepresented racial/ethnic group, as disabled and as LGBTQ+. This article aims to: 1) provide resources for those who identify with the above-mentioned groups, 2) foster an understanding of the issues faced by researchers underrepresented in STEM fields, and 3) highlight the benefits of viewing research through the lens of personal experience.

Dr. Claire Bailey

Claire is a recent graduate of the University of Texas at El Paso conducting research in sedimentology. On being a Black geoscientist, she says:

"I think about being Black in the geosciences, but I'm not sure if I've ever thought of what it means to be a Black geoscientist. I just recently started to think of myself as a geoscientist instead of someone who studies geoscience, which is weird considering I have three degrees in the subject. I think this speaks to how I battle with imposter syndrome; I know I'm not the only woman or black person or person who has this problem. Luckily, I have found a great group of friends and people with whom I can talk.

To me, being a Black geoscientist means being a part of an amazing group of intelligent people who have faced similar struggles but keep moving forward, and who work to make the geoscience community feel more inclusive. I've been lucky that one of my first mentors in geoscience was a black woman who did so many cool things. Seeing her active in the community definitely inspired me to step out of my comfort zone and explore the world of geology.



Claire Bailey participates in a geologic survey in the southwestern United States



Lydia Jennings collects soil samples for her PhD research © Julie Neilson

Claire has found support in a number of societies and meetings:

I think the number one society that supports Black geoscientists is the National Association of Black Geoscientists (NABG). NABG has a fall meeting every year with funding to support Black geoscience students from all over the country to come present their work. There are talks given by professionals from many different fields, including oil and gas, environmental, government, etc. This meeting has been a great place to network and meet other Black geoscientists. This community has been such a great space for me and other students to get advice and talk about what it is like to be a Black geoscientist. It is a space where I can connect with people who are at different stages within academia or in their careers. There is always someone who is willing to help you navigate a tough spot or search for great opportunities.

Becoming a more active member in NABG changed my life. The people I have met through this organization feel like family, and I feel so inspired by them. It's cool to see people grow and change, and it just inspires me to continue to work hard and to work through tough situations. I know I have this great network of empowering people I can reach out to for advice. This past meeting, we had a keynote speaker, Stacy Lusk of

Kuwait Energy, who gave the most inspiring keynote speech I have ever heard in my life. One of my favorite messages from her speech was, "You must decide, do you want to be liked or respected?" I think it inspired us to be who we are without fear.

Lydia Jennings

Lydia is a PhD candidate at the University of Arizona studying microbiology and soil science. She is a member of the Yaqui & Huichol tribes and is involved with a number of organizations and workshops that support Indigenous geoscientists and the integration of geoscience with Indigenous knowledge.

"In graduate school, I became involved in the American Indian Science and Engineering Society (AISES), which is a science organization and national conference geared towards helping Indigenous scientists develop their research and professional skills. AISES hosts workshops that feature scientists who are connecting traditional knowledge with standard scientific methods. The Geoscience Alliance also has powerful workshops that highlight Indigenous researchers and educators who bridge ways of knowing and recognize the cultural ceremony of research. There are talking circles to envision ways in which the

geosciences can honor our cultural identity. We also share the challenges we experience within geosciences and how we can address those challenges. It's a valuable place to brainstorm research projects, as well as a networking opportunity for graduate school and postdocs.

These spaces recognize identity as a core asset of research, and that Indigenous geoscientists face unique issues. In one workshop I attended, people discussed their community's observations of climate change. All groups mentioned traditional languages as a data source and as a place to identify solutions. This resonated with me because I am in the process of learning my own language. Language is inherent to who we are and understanding our cultural priorities, so I loved that it was recognized and respected among these scholars, especially because I have never felt supported in it before.

I love that these organizations recognize that a person of color in science has to be trans-disciplinary. Not only do we need to know scientific theories but also the impacts of colonization, data translation, and higher education statistics. As Indigenous scientists, we have a responsibility to share our research with our community and advocate for those who follow us.

Lydia stresses the need for institutions to honor Indigenous data sources and contributions, which are steeped in rich scientific tradition yet fall outside the dominant scientific paradigm.

Being part of an Indigenous geoscience community has helped me see my culture as an asset and grow my confidence as a researcher. My peers and I understand that our rich cultural heritages have an important legacy of knowledge; we recognize our communities have always been scientists. This has allowed me to think about how we can teach geoscience in a way that is inclusive of Indigenous scientific contributions, including recognizing when universities, cities, and public lands are on Indigenous lands, the importance of learning traditional place names, and supporting Indigenous land managers. We must also recognize that Indigenous scholarship includes being versed in dominant scientific thought, Indigenous studies, anthropology, sociology, and Indigenous language and culture. ►



Rocio Caballero-Gill analyses foraminifera under the microscope to get a paleoclimate perspective

► **Dr. Rocío Caballero-Gill**

Rocío is a Postdoctoral Fellow at George Mason University working in paleoceanography and paleoclimatology. She tells us what it means to be part of the Latinx geoscience community.

“I feel I represent, not only myself or my family but also my community; it means I have both the honor and responsibility of knowing what I do and how I do it could be scrutinized even more. The scrutiny could come from the scientific community looking at me as Latina, or the Latinx community looking at me as a community representative. This is not a bad thing necessarily; I like constructive feedback to learn and better myself. It’s only bad when impostor syndrome sets in or when the criticism comes from a destructive, rather than constructive, place. Being Latinx in geoscience also means it opens up “familiar” doors. It doesn’t matter which country we come from, we have a special connection and I immediately want to know more about a scientist. Who are they? How can I support them?”

To have the support of fellow Latinx in geoscience feels like I have cheerleaders in my corner. It’s like an extended family, which is important because as Latinx we pride ourselves on the strength of our family ties. Being part of this community is empowering, gives me a boost of energy, and makes me feel more useful. In my experience, the sense of community and belonging can be

critical to our path inside and outside of academia.

On the various organizations, groups, and meetings that support fellow Latinx in earth and planetary science, Rocío says:

Emotional and financial support is critical to our success. It took me seventeen years to know more than a handful of Latinas in my field. Recently, two colleagues and I co-founded a group dedicated to inspiring, supporting, and empowering Latinas in geoscience and planetary science (GeoLatinas). We provide a space to accomplish great things by practicing leadership, teamwork, and mindfulness. We inspire and support each other; it’s like a big virtual family working together for our better present and future. Collaborators include: The Mars Society Chile, Society of Latinx/Hispanic Earth and Space Scientists, and more. Other organizations include: The Leadership Alliance, Pathways to Science, Latino STEM Alliance, Latinas in STEM, and Society for the Advancement of Chicanos/Hispanics and Native Americans.

Efforts focused on recruiting and retaining scientists from underrepresented racial and ethnic backgrounds were a critical first step toward diversity, equity, and inclusion in the geosciences. Increasingly, the discussion is broadening further. Here, two scientists share perspectives from the

disabled and LGBTQ+ communities and provide feedback on efforts being made to increase representation for these groups.

Gabriela Serrato Marks

Gabriela is a PhD candidate in the Massachusetts Institute of Technology-Woods Hole Oceanographic Institute joint program specializing in paleoclimatology and geochronology. On navigating the geosciences with a disability and the importance of her community’s support, she says:

“It’s extremely frustrating when people assume that there is no way to make field trips accessible to disabled scientists. In reality, there are already plenty of STEM education and outreach activities by and for people with disabilities. One of my favorite organizations is the International Association for Geoscience Diversity (IAGD), a non-profit that advocates for disabled geoscientists. IAGD finally had a booth at the AGU Fall Meeting in 2018 despite being around for a long time. Another helpful organization/campaign is PhD Balance, which started as an Instagram account but has expanded to a full website where people can share their experiences with mental health and mental illness in academia. I have found a strong community online and now have friends with disabilities who are also



Gabriela Serrato Marks getting ready to do some analytical laboratory work (photo credit: Fatima Husain)



Benjamin Keisling (center) presents his research at the Out in STEM annual conference © Barbara Belmont, NOGLSTP

graduate students with whom I can commiserate and celebrate with from afar. Connections like this are so important because they de-stigmatize disability to build a more welcoming community.

The most important things I've learned since becoming part of the disabled community are the concepts of disabled pride and the social model of disability. Our bodies and minds are not the problem; deeply ingrained social barriers are the problem. There's value in difference. We should embrace a wide variety of abilities and not stigmatize anyone. I've learned a lot from other disabled scientists who share their experiences publicly or privately. It's powerful to realize that we have many a lot of common experiences, despite our different disabilities or health issues.

Dr. Benjamin Keisling

Benjamin is a Postdoctoral Fellow at Lamont-Doherty Earth Observatory studying glaciology and paleoclimatology. He shares what it means to have more visibility for LGBTQ+ scientists.

I have rarely seen my queerness reflected in my role models. I often hear about other LGBTQ+ scientists through clandestine whisper networks and don't feel free to discuss my personal life in professional spaces. In all the academic

spaces I've inhabited, there has been little discussion about how queerness impacts science. Although there is a rich and complicated history of LGBTQ+ scientists' contributions to STEM, a lot of it is still invisible.

We still lack visible LGBTQ+ role models, and I'm afraid this will cause bright researchers to pursue careers in other realms. I know there are queer scientists who have never spoken publicly about what it means to be a queer scientist because of historical and personal circumstances. I think that's a missed opportunity to encompass the full range of lived experiences of geoscientists. Being an LGBTQ+ geoscientist means advocating for members of the LGBTQ+ community who are still excluded, especially queer and transgender people of color.

On organizations that support LGBTQ+ scientists and the need for continued support by the broader community, he says:

The professional society National Organization of Gay and Lesbian Scientists and Technical Professionals hosts national meetings, workshops at conferences, and a summit every other year. The organization Out in STEM has chapters all over the US and a few internationally as well. Another resource is 500 Queer Scientists. I'll add the American Geophysical Union (AGU) to the

list, too; since the 1980s, LGBTQ+ people at the AGU Fall Meeting have met up informally to network. The 2019 AGU Fall Meeting hosted an event or activity every day of the conference where LGBTQ+ geoscientists could gather.

There are lots of ways individuals can show support for LGBTQ+ geoscientists and encourage their professional organizations to do the same. In 2018, grassroots efforts to add pronouns to nametags accelerated AGU's own efforts to be more inclusive in that respect. However, we still have a long way to go; for example, having enough accessible gender-neutral bathrooms at meetings needs to be a future priority.

A shift in thought

A diverse set of perspectives is critical to elevating the geoscience community, but perspective extends beyond one's ethnic background or gender identity. It comes from our natural curiosity, our sense of duty to a community, and our concern for the planet. Who we are informs how we conduct ourselves in science; a scientist's perspective cannot exist without their culture, their values, or their abilities. Perhaps with this shift in thought, we can broaden our thinking and increase our problem-solving abilities to ultimately benefit our research and society.

Michelle Guitard is a PhD candidate at the University of South Florida, College of Marine Science

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GREENOUGH'S WORLD

Duncan Hawley and **Caroline Lam** on the bicentenary of the world's first crowd sourced geological map – and how you can get involved



Detail from George Bellas Greenough's 'Geological Map of England & Wales', first edition (1820)

The two earliest geological maps of England and Wales hang side-by-side in pride of place at the foot of the stairs in the Geological Society's apartments in Burlington House. Most people will be familiar with William Smith's map of 1815, but perhaps less so the other - the Geological Society's own map, issued five years later. Its chief architect was George Bellas Greenough, one of the founders of the Society and its first President.

Early life and adoption

George Bellas was born on 18th January 1778 in London. Orphaned at the age of six, he was adopted by his maternal grandfather Thomas Greenough, a prosperous, self-made apothecary. George Bellas first attended school in Slough and then, aged ten, went to Eton. But a year later in 1789 he transferred to Dr. Thompson's School in Kensington. Aged sixteen, his grandfather's death left him a considerable inheritance, with George adopting his surname 'Greenough' as part of the terms.

In 1795 he went up to Pembroke Hall, Cambridge to study law, attending nine terms. Ultimately he did not take his degree, through a principled choice of not accepting the required Church doctrines to graduate. In 1798 he went to the University of Göttingen to further his law studies, becoming friends with a group of English expatriate students, who included amongst their number the romantic poet Samuel Taylor Coleridge.

In Göttingen Greenough attended the natural history lectures of Johann Friedrich Blumenbach, encountering the mineralogy and geological ideas of the German tradition. He made at least two trips to the Harz Mountains during which he collected minerals and studied geological collections in the towns he visited. After further study at the University of Freiburg, he returned to Britain in 1801, now firmly converted to the natural sciences.

In addition to tours around Britain and the Continent, between 1801-1807 he was an active member of the Royal Institution, rubbing shoulders with contemporary scientists such as Humphry Davy and William Babington who were, like him, keen mineralogists. These men, along with ten others, would found the Geological Society on 13th November 1807.

The Society's map

Although accusations of plagiarism have been levelled at the Society's map, most notably in Simon Winchester's book 'The map that changed the world' (2001), the reality is more nuanced.

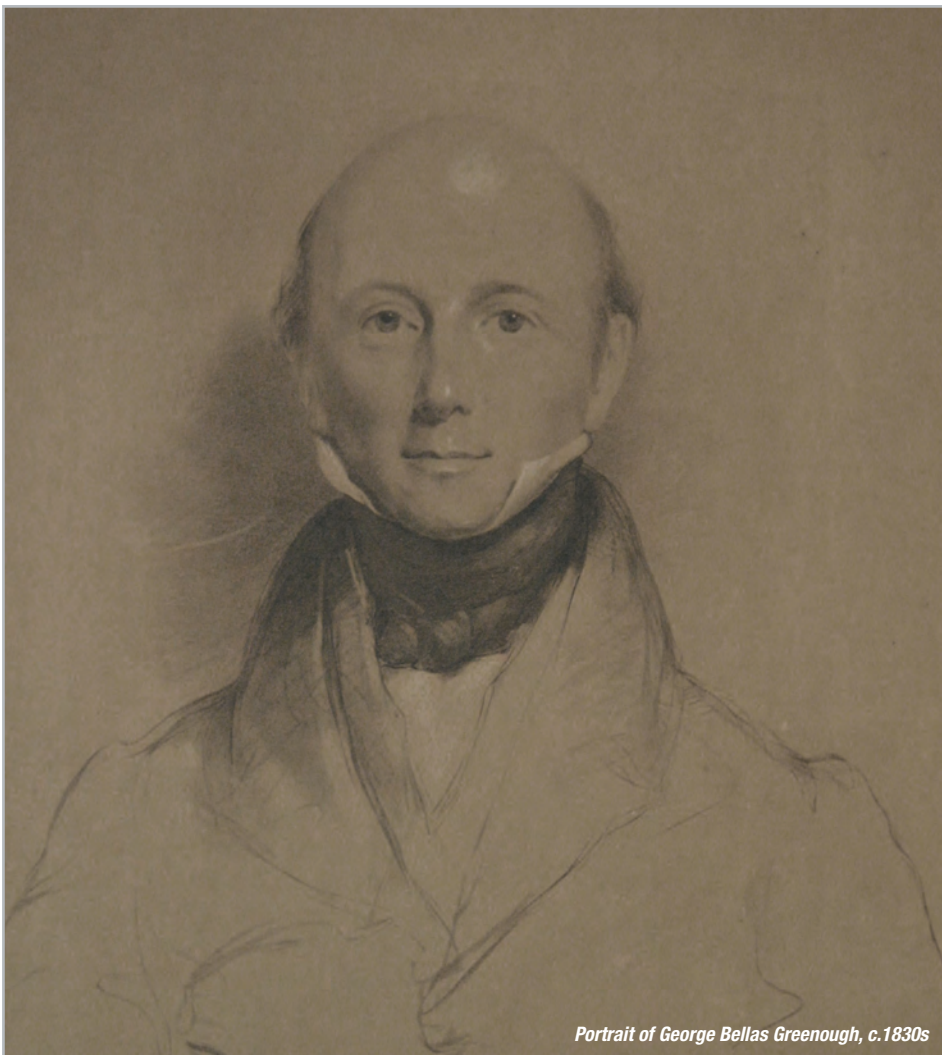
In fact the map was the culmination of a project set out in the Society's first publication 'Geological Inquiries', (1808). In 1809 a map committee was "appointed for the purpose of forming maps by consolidating and arranging all such topographic information they may be able to procure relative to the extent and boundary of the different formations of which the British Isles are composed." As progress on Smith's projected map had apparently stalled by this date, the most obvious solution for the Society was the preparation of its own geological map of England and Wales.

From the outset it was a collaborative effort. Greenough assumed the role of editor, gathering observations from Society Fellows, associate members and "persons in every situation in life" who had expert knowledge of the areas where they lived or frequented, and adding details from his own travels. In the map's accompanying memoir, Greenough acknowledged particular contributions from William Buckland, and noted help received from others including W.D. Conybeare, Henry Warburton, Arthur Aikin, Joseph Fryer, Henry De la Beche, John Farey and the Reverend John Hailstone.

A first draft of the map was ready by 1812 but publication was delayed in order to produce a base map that could accurately portray relations between ►



Photograph of the Entrance Hall, showing the two maps side by side (Greenough's map is on the left)



Portrait of George Bellas Greenough, c.1830s

► the topography and underlying strata. An outline version of the new base map, drawn by Thomas Webster at a scale of six miles to the inch, was complete by the end of 1814, but it took the engraver, Samuel Neele, a further five years to add the topographical and geological detail to Greenough's satisfaction. The first edition of Greenough's map is engraved with a date of November 1819, but actually wasn't issued until 1st May 1820.

Greenough's 'crowd sourced' approach resulted in the map being more geologically and topographically detailed and accurate than Smith's map of 1815. Records show 350 copies were produced, with a number presented to dignitaries, august societies and close collaborators. One was even presented to William Smith. A second revised edition was published in 1840 and a third (posthumous) edition appeared in 1865.

Reconstructing the Greenough map bequest

On his death on 2nd April 1855, Greenough's geological and geographical collections of books, maps and prints were bequeathed to the Geological and Royal Geographical Societies, respectively.

His book bequest forms a significant part of the Geological Society's Rare Book Collection but his geological maps were integrated into the existing map collection. Those which were his own manuscript, hand-coloured drafts have been transferred to the Society's Archives, but many others, with his own annotations, have remained scattered within the Society's Map Collection.

Greenough issued only three geological maps in his lifetime – 'Geological Map of England & Wales' (1st edition, 1820, and 2nd edition, 1840) and 'General sketch of the physical and geological features of British India' (1854) – yet his collection indicates that his mapping activities were far more extensive. For the Greenough Map Bicentenary in 2020, the map collection of our first President is being brought back together again to understand these activities more fully. Central Europe, especially the areas around Germany, features large in the collection but his maps cover much of the countries and continents of the world.

Crowdsourced conservation

Just over 330 maps survive, and most show the wear and tear of having being used and handled for over 160 years.

Conservation options are limited so, taking a lead from Greenough's crowd sourcing principles, the Library is launching a campaign entitled 'Greenough's World' to help preserve these maps for future generations. Individuals can choose to sponsor the digitisation of particular maps by selecting a country. Once a map's fundraising target has been met, it will be digitised and appear with contextual information on a special exhibition page

- building up a snapshot of Greenough's vision of geological knowledge in the first half of the 19th century.

1. Uncoloured proof of a section of Cornwall, from c. May 1818. Note that the mountain topography is still absent despite being with the engravers since 1815, as Greenough tinkered with the details

2. The final coloured map, showing the same area

3. Johann Friedrich Wilhelm von Charpentier's 'Petrographic map of Saxony and the Incorporated Lands', 1778. Oldest published geological map in the collection, thought to be the first geologically coloured map of Germany.

4. Draft geological map of Scotland probably by Greenough and Daniel Sharpe. The final map, commissioned by Council in 1851 to improve on John MacCulloch's 1836 map, has been attributed solely to Sharpe, however a number of drafts in the collection suggest Greenough's contribution."

Duncan Hawley is Chairperson of the Geological Society's History of Geology Group (historyofgeologygroup.co.uk)

Caroline Lam is the Geological Society's Archivist

GET INVOLVED

To celebrate the bicentenary of the publication of Greenough's map, a HOGG meeting will take place on Wednesday 6th May and Thursday 7th May 2020. Further information and registration details can be found the HOGG website (historyofgeologygroup.co.uk) For further details on the Library's 'Greenough's World' campaign, see www.geolsoc.org.uk/Greenoughsworld



A lower Carboniferous (Visean) tetrapod trackway represents the earliest record of an edopoid amphibian from the UK

By Hannah C. Bird, Angela C. Milner, Anthony P. Shillito and Richard J. Butler

The ichnological fossil record has previously provided key evidence for the diversification of land vertebrates (tetrapods) during the Carboniferous Period, following the invasion of the land. Within the UK, tetrapod ichnofossils from the late Carboniferous of the English Midlands are well documented, but few such fossils are known from earlier in the period. We present a rare ichnological insight into early Carboniferous tetrapod diversification in the United Kingdom based on a Visean-aged specimen collected from an interdistributary trough palaeoenvironment at Hardraw Scar, Wensleydale, North Yorkshire. This specimen represents the stratigraphically oldest known tetrapod trackway from the UK. We refer this specimen to *Palaeosauropus* sp., providing the earliest known occurrence of an edopoid temnospondyl.



► Read the full abstract and paper in the Lyell Collection

<https://jgs.lyellcollection.org/content/early/2019/11/08/jgs2019-149>



Port Askaig 2020

Cryogenian glaciation: the extraordinary Port Askaig record and its comparators

12-13 May 2020, University of St Andrews

www.portaskaig.org



International workshop presenting results of a long-term field campaign on the km-thick glacial succession focused on the extraordinarily complete exposures in the Garvellach Islands and Islay.

Meeting will include virtual field trips and will be webcast

Presenters include Roger Anderton, Doug Benn, Dave Chew, David Evans, Ian Fairchild, Mike Hambrey, Dan le Heron, Bruce Levell, Emrys Phillips, Catherine Rose (convener), Graham Shields, Anthony Spencer and Richard Waller.



GEOLOGICAL SOCIETY OF GLASGOW



1 October 2020

Activities Include:

- Geopoetry Walk past Dynamic Earth and on to Arthur's Seat (Geology and Poetry in the field) Yvonne Reddick (UCLances).
- Schools Geopoetry competition winners.
- Poets and Geologists telling their stories about rocks, poems and influences interspersed with readings (SPL) with contributions by Sarah Acton (Poet in Residence, Jurassic Coast), Michael McKimm (Geological Society) and Norman Bissell (Scottish Centre for Geopoetics).
- Geopoetry Workshop: individuals present poems for discussion and feedback.
- Edinburgh/Scottish Poets with geological gifts, Ken Cockburn (Edinburgh Poetry Tours), at Panmure House.

Organising Committee

Patrick Corbett, Heriot-Watt University (p.w.m.corbett@hw.ac.uk)
 Stuart Harker, Consultant
 Phil Ringrose, Equinox/NTNU, Norway
 Michael McKimm
 Bob Gatliff
 Asif Khan, Scottish Poetry Library
 Tom Kelly, Central Scotland Regional Group
 Carol Cotterill, BGS
 Dorrik Stow, Heriot-Watt University
 Lara Reid, Friends of Hugh Miller Society
 Norman Bissell, Scottish Centre for Geopoetics



GEOPOETRY 2020
 — Edinburgh —

The Scottish Poetry Library and its environs, Edinburgh

This event is to follow up the first Geological Society of London's GEOPOETRY day in 2011. Rocks have long inspired poets (refer to Burns' "O my Luve's like a red, red rose" poem of 1794):

"Till a' the seas gang dry, my dear,
 And the rocks melt wi' the sun"

To the present day poets are similarly inspired. Michael McKimm's *Fossil Sunshine* (2013) and "MAP, Poems after William Smith's Geological Map of 1815" (2015) showed how geological subject matter from Geopoetry 2011 could inspire poets: "...the poems here make Smith's map anew in moving and surprising ways." The Jurassic Coast Poems (2017) by Sarah Acton, the Jurassic Coast resident poet, shows continued inspiration:

"We hear the red rock
 Speak in ripples"

This gathering, to be held on National Poetry Day (1st October, 2020) is hosted by the Geological Society of London (in conjunction with the Central Scotland Group), The Scottish Poetry Library and the Edinburgh Geological Society and will bring together poets and geoscientists to further encourage the rocks to speak.

Proposed themes and activities

The organisers will be seeking contributions, which will form the basis of a programme of talks, walks, readings and workshops and ultimately a publication, in the following areas:

- **Geo-themes:** poetry about rocks, geologists, geological sites
- **Geo-images:** poetry that uses earth and ocean images
- **Geology and Society:** poetry drawn from earth and society interaction
- **Geoscience and the poetic form:** Geopoets' influences, inspirations, histories

These are to be submitted to the Geological Society by 1st March, 2020. English language translations must be provided for poems in different languages. More details on the submission process will be available in autumn of 2019.

www.geolsoc.org.uk/geopoetry20

**CAN'T FIND YOUR MEETING? VISIT
WWW.GEOLSOC.ORG.UK/LISTINGS
FULL, ACCURATE, UP-TO-DATE**

ENDORSED TRAINING/CPD AND EVENTS

| MEETING | DATE | VENUE AND DETAILS |
|---|-----------|---|
| Geocentrix: Decoding Eurocode 7 – Ground investigation and testing course | 4-18 Feb | Endorsed CPD course Venue: Accessed online over 5 sessions |
| Geological Society Discussion Group: February Meeting | 5 Feb | Evening meeting Venue: TBC |
| Engineering Group & British Geotechnical Association: The many faces of Q | 5 Feb | Evening lecture Venue: Institution of Civil Engineers, Westminster |
| Geology of England | 7-9 Feb | Endorsed CPD course Venue: Higham Hall College, Cumbria |
| WMRG: Provenance, the search for a source – using microfossils to track the origins of various items, from paintings to murderers | 11 Feb | Evening lecture Venue: St Martin in the Bull Ring, Birmingham |
| SWRG: School geoscience workshop and School Competitions 2020 | 12 Feb | Competition, workshop Venue: University of Plymouth |
| The Royal Society: Understanding earthquakes using the geological record | 17-18 Feb | Conference Venue: The Royal Society, London |
| TVRG: Source-to-sink – a holistic Earth system approach for understanding sedimentary systems and aiding natural resource exploration | 19 Feb | Evening lecture Venue: Halliburton, Milton, Abingdon |
| Geology of England | 24-28 Feb | Endorsed CPD course Venue: The Green Park Hotel, Perthshire |



Read the latest news in Geoscientist, when you join the GSL

BOOK REVIEWS

Fluvial Meanders and their Sedimentary Record



It is difficult to imagine a geoscientist who has not considered the nature of a meandering river, be it with a grain-size card and rock hammer, seismic data, or even clipboard and wellington boots. For many of us it will have been some time ago, and memories of secondary helical flow and lateral accretion surfaces may be rusty. This new volume provides an introduction to current ideas, a snapshot of active research, and pointers to future developments.

For example, it is now recognized that: (i) meandering rivers can migrate downstream as much as they migrate laterally, and that convex point bars may link to relatively mud-prone (concave) counterpoint bars as a result; (ii) mud-prone counterpoint bars and abandoned channel fills form stable buttresses against migrating channels and river patterns adjust accordingly; (iii) sandy meandering systems are likely to be common in the rock record, but can be difficult to distinguish from braided systems in the absence of rich palaeocurrent data or a clear view of plan form geometries; and (iv) not all river cut-offs are related to meander growth—some are caused by entrenchment of chute channels point across bars. Such insights are well-documented elsewhere in the sedimentological literature. This volume refines, reviews and extends them. As such it provides an excellent, high-quality resource for anyone new to the topic, and a benchmark for further detailed study of meandering river deposits.

The volume is focused on fluvial meanders, but like the earlier and more general compilation SEPM 97 “From River to Rock Record” (2011), it brings together sedimentologists, geomorphologists, engineers, and workers from industry. The nineteen papers are largely based on outcrop fieldwork and satellite photo analysis of modern rivers, but include numerical simulations, electrical resistivity profiling, doppler current profiling, ground-penetrating-radar data, well data, seismic

data and 3D models of ancient outcrops.

As for the active research, most of the papers address the facies architecture and shape of fluvial meanders. There is a snapshot of an ongoing debate on the evidence for pre-vegetation meandering rivers. Is plant stabilisation of river banks crucial for meandering patterns, and deep channels, or are they equally common in pre-Devonian rocks (they occur in modern unvegetated systems, and on extra-terrestrial surfaces)? The volume is strong in describing meander-bend cut-offs, with detailed analysis of the fill of abandoned sand-bed river channels, the first conceptual model of flow through neck cut-offs, and description of unsuccessful cut-off fills in ancient successions. There are also excellent insights in to how scroll-bar pattern variability can be used to predict lithological heterogeneity, and examples of mud-prone fluvial point-bar deposits.

The volume leans towards the zeitgeist in being relatively quantitative. Though not reaching the heights of “Big Data”, databases are used to place individual studies into context, and to derive general insights into the nature and controls on meandering systems. A gap, perhaps, is a modern exploration of the relationships between meandering channels and other river types; low-sinuosity, anastomosing and braided rivers, for example.

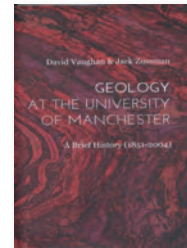
The editors point to paths for further research in the four main topics they recognise in the volume: channel-bend growth and related point-bar facies distribution, meander-bend cut-offs, meandering channels and vegetation cover, and geometries of meander belt sedimentary bodies. But most importantly they call for further work in unravelling the impact of man on meanders, noting a real need for “sedimentological models to assist with the management of rapidly evolving fluvial landscapes”.

Finally, the book is beautiful, particularly in its liberal use of coloured figures, and its technical content graces an already excellent series.

Reviewed by **Tony Reynolds**

FLUVIAL MEANDERS AND THEIR SEDIMENTARY RECORD by Massimiliano Ghinassi, Luca Colombera, Nigel P. Mountney & Arnold Jan H. Reesink (Eds) 2019. Special Publication Number 48 of the International Association of Sedimentologists. 592pp. (hbk) ISBN: 978-1-119-42446-8 List Price: £75.00
W: www.wiley.com

Geology at the University of Manchester: A Brief History (1851-2004)



One of the ‘big names’ of British university geology for decades, Manchester has led research in a number of fields, especially the ‘hard-rock’ side of

mineralogy, petrology, geochemistry etc. British geology departments are not great at historical retrospection - somehow it seems to go against the grain - but Geology at the University of Manchester sets a good example. David Vaughan and Jack Zussman are to be congratulated on producing this ‘Brief History’ of a department that has played a significant role in the development of geology in Britain.

The development of Manchester geology reflects the history of industrialization in Britain. Unplanned urbanisation in the first decades of the 19th century led to Manchester, nicknamed ‘cottonopolis’, becoming the world’s first great industrialised city. The best and the worst of its industrialisation was described by reforming industrialists, such as Friedrich Engels and John Owens. The latter left nearly 100,000 pounds in his will to found a college for non-sectarian education, which opened in 1851 and was modelled on educational principles established in Germany.

Geology, part of the curriculum from the start, was taught by the eminent naturalist and palaeobotanist W.C. Williamson FRS (1816-1895). He had been curator of Scarborough’s Rotunda Museum and his family had given a home to William Smith. In 1880, the college became the first affiliate of Victoria University, joined by University College Liverpool (1884) and Yorkshire College Leeds (1887), before separating again as independent universities in the early 1900s. Graduates of Owens College included the famous chemist Henry Roscoe and the physicist J.J. Thomson.

Vaughan and Zussman focus mostly on Manchester’s important role in the post-1950 boom in British geology, which was further strengthened by the 1991 formation of a Geoscience Research Institute (GRI) and the



merger in 2004 with the University of Manchester Institute of Science and Technology (UMIST). Manchester's graduates have not only entered all aspects of geology, at home and abroad, from industry and the survey to academe, but many have also become high achievers and their career movements have helped stimulate many other geology departments.

Hopefully other departments will follow Vaughan and Zussman's example and write up their history. Now that the 20th century is history, we need a clearer picture of what happened to British geology in recent decades, so that future generations can learn from it.

Reviewed by **Douglas Palmer**

GEOLOGY AT THE UNIVERSITY OF MANCHESTER: A BRIEF HISTORY (1851-2004)
by David Vaughan & Jack Zussman, 2019. Published by Matador 165 pp. ISBN 978 1789017 106 List price: £15.00 W: <https://www.troubador.co.uk/>

Reconstructing Archaeological Sites: Understanding the Geoarchaeological Matrix



In 1987, Michael Schiffer published a 364-page brainstorming volume, synthesizing his own and others' previous work, entitled *Formation Processes of the Archaeological*

Record. Schiffer himself admitted then that "the principles and techniques for identifying specific formation processes are not yet well developed" (1987:267), and he called for experimentation and refinement of techniques to monitor the multitudes of processes he identified. After 30 years, *Reconstructing Archaeological Sites* fills that gap for one aspect of geological (sedimentary) processes—and this volume's extensive bibliography provides a sampling of such work done on site formation processes in those intervening decades.

Karkanias and Goldberg are eminent geologists with extensive careers working on archaeological sites. They focus on the archaeological 'deposit', a three-dimensional

matrix primarily containing sediments and objects (artefacts, ecofacts) that were deposited penecontemporaneously (2019:11)—the exception being architectural structures that are filled later. They emphasize that the "sediments accumulated by a certain process, and it is this process that explains the patterning of the artefacts"—even when the sediments are gone (deflated deposits) (2019:12-13); to ignore the sediments is to vastly underestimate and possibly misunderstand the artefactual information. Thus, the volume is devoted to discussing the formation and depositional nature of both natural and anthropogenic sediments, and their remains in site stratigraphy, in non-architectural and architectural sites. They also offer various approaches to studying sediments in the field, such as drawing, photographing and sampling.

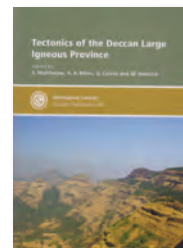
Most geologists will be familiar with the processes producing and the properties of natural sediments. However, the discussion of anthropogenic sediments will possibly open new doors for the identification of human presence in otherwise seemingly geological deposits, if finely excavated (a trampled path through a hunting ground? an intentionally burned landscape?). One aspect not dealt with herein is the potential for artefacts and sites themselves to yield data on geological processes. Schiffer noted that so-called 'soil-movement effects' can be detected from abrasion or microflaking of stone tools (1987:11), while the direction and impact traces of rocks on an archaeological site that were carried by a pyroclastic flow can reveal the exact direction and speed of the flow (see *TephroArchaeology* in the *North Pacific*, 2019:177).

Overall, this volume is a welcome guide to analyzing the sedimentary matrix of archaeological deposits, including artefacts as one element of matrix 'fabric'. The authors decry the continuing lack of archaeologists' sensitivity to sediments because without it, how else can one extract maximum information from the most common excavation product: 'dirt'?

Reviewed by **Gina L. Barnes**

RECONSTRUCTING ARCHAEOLOGICAL SITES: UNDERSTANDING THE GEOARCHAEOLOGICAL MATRIX by Panagiotis (Takis) Karkanias & Paul Goldberg, 2019. Published by: Wiley Blackwell 279pp (hbk) ISBN: 9781119016403 List price: £75.00. W: <https://www.wiley.com/>

Tectonics of the Deccan Large Igneous Province



The Deccan Traps of India are the product of the voluminous outpouring of basaltic lavas at the Cretaceous-Tertiary boundary and are among the best studied of all the world's

large igneous provinces (LIPs). These traps were an early focus for many petrologists who undertook seminal work on basalt geochemistry. They have been used to develop models of plateau uplift, the nature of mantle plumes and the effect of asteroid impacts, as well as the cause of the resulting mass extinctions. The well-known Geological Survey of India two-volume memoir on the Deccan Volcanic Province (1999) stood for two decades as the reference work. You may be forgiven for thinking that there was nothing new that could possibly be written on the geology of the Deccan LIPs.

You'd be wrong. Soumyajit Mukherjee and his co-editors have successfully compiled a book that provides fresh insights into an understanding of the tectonics of the Deccan LIP. The volume nicely brings together the results of modern fieldwork, offshore geophysical data with onshore seismic and gravity data, subsidence with uplift studies, and neotectonics. The book contains 13 original articles and an introduction by the editors.

India, Madagascar and the Seychelles were a single continental plate until the Late Cretaceous, when first Madagascar separated from India, followed by rifting of the Seychelles micro-continent and the Laxmi Ridge, at around 63 million years ago. This latter rifting event was coeval with Deccan flood volcanism and thus opens the continuing debate as to whether the cause of the Deccan LIP is a mantle plume or rifting processes.

The papers in this volume provide new insights into the tectonic evolution of the Deccan LIP. Kale et al. show that the traditional view of the Deccan as structurally simple is incorrect by demonstrating the presence of fault blocks with different uplift histories. Nemčok & Rybár beautifully illustrate the rift-drift break-up in the Gop Rift-Laxmi Basin that immediately predated the Deccan eruption and speculate on the role of the Réunion Plume in the tectonics of the LIP. Modern field ▶

BOOK REVIEWS

► structural mapping by Misra and Mukherjee documents the deformation histories of basaltic dykes to define a chronology of emplacement. Misra et al. record how post-rift subsidence on the ridges in the NW Arabian Sea drowned the Paleocene carbonates—important for offshore oil-and-gas exploration in both India and Pakistan.

This is a well-produced and edited volume effectively brings together diverse disciplines and topics. It will provide inspiration for future research on this geologically fascinating province, which I am sure has much still to reveal on the evolution of the Indian Ocean and LIPs.

Reviewed by **Stuart Burley**

TECTONICS OF THE DECCAN LARGE IGNEOUS PROVINCE by S. Mukherjee, A. A. Misra, G. Calves & M. Nemok (Eds) 2017. Geological Society of London SP 445, 363pp. (hbk). ISBN 978-1-78620-275-8
List Price: £110.00 Fellow's Price: £55.00 W:
<https://www.geolsoc.org.uk/SP445>

Science and Policy



The book has three sections that deal, respectively, with “understanding drought as a natural hazard” (4 papers), “vulnerability, risk and policy” (4), and “drought management

experiences and links to stakeholders” (5). All papers include numerous monochrome figures and around 40 of these are reproduced in a separate colour section. This is necessary but irritating. The monochrome figures, while clearly printed, are often inadequate, and concentration is lost while flicking back and forth to the colour section. Sadly, too, the opportunity to use the few blank pages—currently at the end—to enlarge some of the more complex figures, was missed.

Understanding drought begins with a paper full of the abbreviation soup that seems to be common to those involved in climate-change studies. Subsequent papers in the section are based more heavily than the first on actual records of drought over the centuries and, because of that, feel more genuine. Sixteenth century reports of and comments on drought might not be as precise, in modern terms, as could be wished, but the information in them is valuable and the droughts were obviously very real.

The papers on vulnerability, risk and policy are generally interesting, and include one about drought insurance. It helps that the set deals with real-world actions for real-world problems and that the principal assumptions underlying them are made explicit. (In fairness, there is one clear statement in the first section that potential evapotranspiration, PET, which is widely used in drought modelling, is likely to yield unrealistic and conservative results; it is equally true that finding a potentially better option is extremely difficult.)

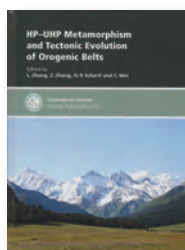
The final section comprises case studies from Europe, mostly from the Mediterranean region. The experience gained over the last several decades is set out, in each case, along with a resume of the lessons learnt and the resulting changes made. More value might have been added had the further lessons learnt from the most recent droughts been reported. Many issues relating to drought management and stakeholder links might seem intuitive, but all are worth appraising and discussing. The wisdom, for instance, of including stakeholders in both planning for drought and its subsequent management stands to reason. Stakeholders are, literally, at the receiving end, and are likely—individually and as a group—to be more aware more quickly of problems and difficulties as they arise during drought than even the best of managers.

Reviewed by **Jeremy Joseph**

DROUGHT: SCIENCE AND POLICY

by A. Iglesias, D. Assimakopoulos & H.A.J. Van Lanen (eds) 2019. Published by: Wiley Blackwell, Chichester, UK. ISBN: 978-1-119-01720-2 (hbk) 257 pp.
List Price: £100.00
W: www.wiley.com/wiley-blackwell

HP-UHP Metamorphism and Tectonic Evolution of Orogenic Belts



Where present, high pressure (HP) and ultrahigh-pressure (UHP) metamorphic rocks are fundamental indicators for deciphering the tectonic evolution of orogenic belts. UHP metamorphic belts are defined by containing rocks that have experienced pressure-temperature conditions (P-T) exceeding the lower limit of the Coesite stability field (Coesite is the very high

pressure polymorph of quartz). These rocks have typically experienced complex changes during subduction and exhumation processes (from recrystallization, deformation, element redistribution and fluid-rock interactions, often through to partial melting) and can retain a significant record of the evolving geodynamic systems in an orogenic belt. Globally, more than twenty UHP metamorphic belts have currently been identified and confirmed.

Based upon the outcomes of the 35th International Geological Congress (held in 2016 at Cape Town, South Africa) session on ‘HP-UHP metamorphism and tectonic evolution of orogenic belts’, this GSL Special Publication presents new and innovative studies from different geoscience disciplines that have been applied to develop a better understanding of the geodynamic evolution of these belts. The volume contains 15 papers in three thematic sections. Part one outlines recent developments in the determination of metamorphic P-T conditions and their timing, with part two containing overview papers of well-known HP-UHP metamorphic belts. The final part presents the latest research for some newly discovered (or less well characterised) HP-UHP belts.

The volume provides an excellent synthesis of current research efforts, successfully combining contributions from field-based studies and the application of modern micro-analytical, geochronological and tectonic modelling techniques. All sections are well-written and edited, concisely laid-out with clear and appropriate figures, photographs and datatables, all features that one has come to expect from the GSL Special Publication series. The inclusion of numerous annotated colour figures and photographs enhance the understanding of the textual details. The volume is particularly recommended to all researchers in crustal evolution, notably in metamorphic petrology, geochronology, orogenic tectonics and geodynamics, and is anticipated to be an essential reference source for many years to come. This is a comprehensive contemporary addition to this interdisciplinary field, and the editors and contributors are to be congratulated.

Reviewed by **Mark Griffin**

HP-UHP METAMORPHISM AND TECTONIC EVOLUTION OF OROGENIC BELTS

by Zhang, L., Zhang, Z., Schertl, H-P. and Wei, C. (editors). Geological Society of London Special Publication No 474, 2019. Geological Society of London. ISBN 978-1-78620-399-1. Hbk. 362pp. ISSN 0305-8719. List Price: £125.00, www.geolsoc.org.uk

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

UNREASONABLE DOUBT

Dear Editor, I agree with everything in Hugh Richard's recent Soapbox article (Richards, H., Face facts on fossil fuels. *Geoscientist* 29 (11), 9, 2019 <https://doi.org/doi:10.1144/geosci2019-059>) apart from the final sentence: "... if humanity is going to fail to avert 'Hothouse Earth', let it be primarily a failure of politics, not enabled in part by a failure of science communication."

As many climate science experts, such as James Hansen and Michael Mann, have pointed out, humanity's failure to take effective action to minimise the effects of burning fossil fuels - predicted over 125 years ago, well understood for over 50 years and identified 30 years ago - is primarily due to a multi-decadal, industry-funded campaign to discredit scientists, perpetuate unreasonable doubt and prevent governments from declaring that fossil fuels must be left in the ground. Therefore, I am sure that he will (have) upset the recalcitrant contrarians within the Society who are (or were) predominantly employed in the fossil fuel industry.

MARTIN LACK (FGS, CGEOL)

Face facts on fossil fuels

Inadequate science communication risks enabling failure to limit climate change, writes Hugh Richards



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, sarah.day@geolsoc.org.uk, or a self-posted to sarah.day@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 laptop 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).

“IF HUMANITY IS GOING TO FAIL TO AVERT 'HOTHOUSE EARTH', LET IT BE PRIMARILY A FAILURE OF POLITICS, NOT ENABLED IN PART BY A FAILURE OF SCIENCE COMMUNICATION”

HUGH RICHARDS



The UK geoscientific community about to miss a unique opportunity to make a substantive contribution to securing a stabilised Earth system with well below 2 °C of global heating? I refer to the heating in Glasgow in November 2020 of COP26 (arguably the most crucial UN climate summit thus far) and to the short time available for the UK to bring fresh thinking into what is currently a faltering process. The Paris Agreement reached at COP21 willed ends, but not sufficient means: COP26 must rectify this.

Inaccessible answers
The geoscientific community (working with other disciplines) should be able to give to several key questions. For example, how credible is it that once past about 2°C warming, the Earth system will transition to a highly inhospitable 'Hothouse Earth' state within a century or two as postulated by Steffen et al. (PNAS 2009)? In that context, how risky is it to allow global warming to exceed 1.5°C? How much fossil carbon can be extracted without putting the COP21 appointment between countries of such a carbon capture and storage (CCS)? Could a control of the extraction of fossil carbon be readily monitored?

As we approach the end of the Society's 'Year of Carbon', usable answers to these questions seem largely inaccessible. The field remains clear for narratives that lack meaningful quantitative constraints. One such example is John Whitburn's Soapbox article (*Geoscientist* 29 (8), 9, <https://doi.org/doi:10.1144/geosci2019-043>), which combines acceptance of the need for a 'transition from our fossil-fuel addicted lifestyle' with examples of only marginal reductions in CO₂ emissions, and

envisaging no prospect of an end to the world's insatiable thirst for a petroleum-based economy. At least this does implicitly deliver global decarbonisation: hence the need for control of supply and extraction.

Leadership
At the other extreme are the supporters of net zero emissions by 2025. Although it pains me to say so, if humanity wants to play an equitable role, the XR demand should perhaps already have the fossil carbon extraction industries substantially of action really would represent leadership on the international stage, and demonstrate what a LINGO treaty might involve. Do I think that such an outcome is likely? No, but if humanity is going to fail to avert 'Hothouse Earth', let it be primarily a failure of politics, not failure of science communication.

Hugh Richards makes his last UK coal number announcement in a letter to the Editor. (The full version of this article and an accompanying graphic appear online, page 9)

A PRECAUTIONARY APPROACH

Dear Editor, Hugh Richards makes some interesting points in his Soapbox article in the December issue. He asks some questions that scientists might be expected to answer. I suspect that the answer to most of them is that we don't really know. What we do know is that humanity is extracting geological reduced carbon and transforming it into atmospheric oxidised carbon at an unprecedented rate, that the atmospheric concentration of carbon dioxide is increasing, ocean pH is decreasing, and there is evidence of climate warming.

Since there is a suggestion that the consequences will be really bad, such that we and much other life may not survive, a precautionary approach seems to be well justified. I would therefore suggest that the 'politics' is more important than detailed science, but I agree that science communication is critically important.

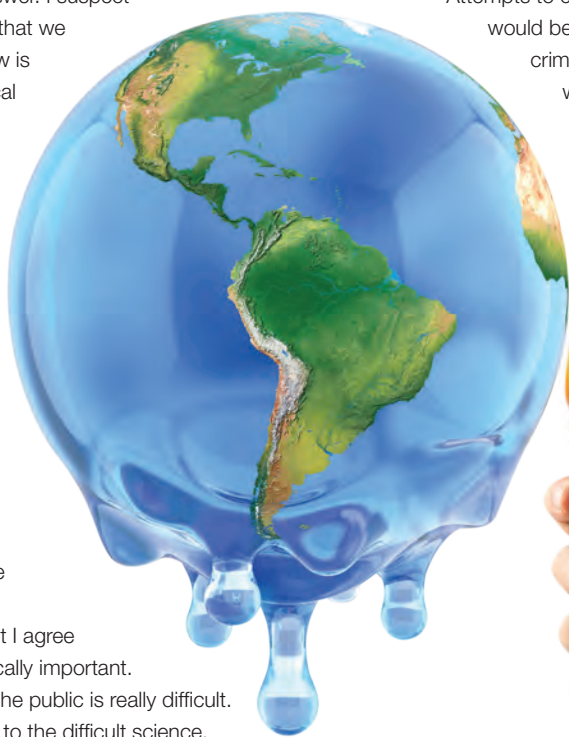
Communication of bad news to the public is really difficult. I think that politicians need to listen to the difficult science, and then persuade us public that using hydrocarbons is unacceptable, probably through a structured taxation process. Government also has a role to play in reducing the carbon content of current lifestyles, and in improving the insulation standards of UK housing stock. It's not just a

matter of demonstrating and school strikes, but real change in lifestyle that we all have to do together. No more long-haul holidays!

Attempts to control hydrocarbons by leaving them in the ground would be difficult and would probably only encourage criminal cheating. Monitoring would be difficult. What would be easier to monitor is distribution - tankers and big pipelines are readily visible. However, preventing distribution could be very unfair - some countries do not have much in the way of native energy sources.

A final thought: if fossil fuel use is so bad for the planet (I think that it is), is it ethical for geologists to be involved in exploration and production of said fossil fuels?

JOHN HEATHCOTE (FGS)



DISTANT THUNDER

Marriage of true minds

Geologist and science writer Nina Morgan describes a surprise double wedding

She was a talented botanist who went on to study botany and geology in 1903 at University College London – ‘The Godless Place in Gower Street’ – under the supervision of the botanist Francis W. Oliver [1864 – 1951] and the geologist, Thomas George Bonney [1833 – 1924]. He was a palaeobotanist, appointed by Professor Thomas McKenny Hughes [1832 – 1917] in 1899 to a demonstratorship in the Woodwardian (later Sedgwick) Museum in Cambridge.

The pair, Edward Alexander Newell Arber [1870 – 1918] and Agnes Robertson [1878 – 1960], met while she was an undergraduate at Newnham College, Cambridge. They fell in love, and became engaged in 1906.

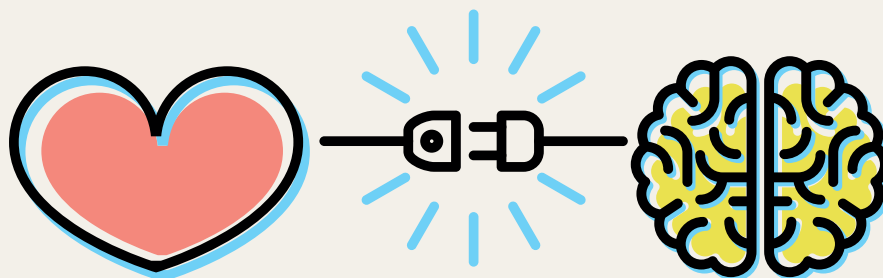
The absent-minded professor

They were married in Cambridge in 1909. Thanks to Bonney, who was also an ordained minister, their union was ‘doubly blessed’. As their daughter, Muriel Arber [1913 – 2004] described it:

“Professor Bonney returned to Cambridge, and as a friend of both my parents he officiated at their wedding. Indeed he married them with great thoroughness, for not being in the habit of conducting the service, he accidentally went back instead of forward after the vows, so that my father twice endowed my mother with all his worldly goods as she for the second time promised to love, honour and obey him... Professor Bonney then gave a charming little address in which he said that the happiest marriages the he knew were those in which the man and woman remained lovers.” Bonny, himself, never married.

The wedding gifts, too, were unusual:

“I still have the wedding present that the Curator of the [Sedgwick] Museum, Henry Keeping, then aged 82, gave to



my parents: it is a box containing some excellent fossil specimens of his own collecting, lying on pink cotton wool: *Belemnites oweni*, split to show the phragmacone, together with a pair of interlaced crayfish from the Wealden, and a fine palatine tooth of a Cretaceous fish. Pasted on a piece of cardboard was a little poem on love cut out of the Daily Chronicle.”

Academic riches

Demonstrators were poorly paid, and in the early days of the marriage money was tight. It was, Muriel recalls, “only [Newell’s] consulting fees that made the marriage in 1909 possible... I owe my own existence to the Kent Coalfield later on.”

But in the academic sense, the Arbers were very rich. Before his early death, Newell wrote more than 6 monographs on palaeobotany and geology, published the book, *The Natural History of Coal*, and more than 90 papers and articles. He later became well known for his studies of the geomorphology of the Devon coast described in his book, *The Coast Scenery of North Devon*, published in 1911, which inspired Muriel’s own research on geomorphology.

Her mother went on to become a plant morphologist and anatomist, as well as a historian and philosopher of botany. She was elected a Fellow of the Royal Society in 1946, the first female botanist and only the third woman to receive that honour.

Muriel graduated from Newnham College, Cambridge in Geology (BA 1935, MA 1938), and from 1942 – 1973 taught at The King’s School in Ely. She played a

central role in the Geologists’ Association, where she served as President from 1972 – 1974, and was a key architect of the GA Code for Geological Fieldwork. She also carried out research on fossil brachiopods and published a series of papers on the geomorphology, with special reference to sea-level change, cliff profiles and active land slipping on the coasts of South Devon and Dorset.

Love affair

In 1922 Muriel fell in love with Lyme Regis where she “found the key to the whole future of my life.” Though Cambridge-based she visited Lyme often. She was, said the late John Fowles, ‘the genius of the place’ who provided the geological background for his novel, *The French Lieutenant’s Woman*. But an even higher accolade came from the local newspaper, which towards the end of her life dubbed her ‘Lyme’s Oldest Tourist’!

End notes: Sources for this vignette include: Papers of Edward Alexander Newell Arber at <https://archiveshub.jisc.ac.uk/data/gb590-arbr> ; Obituary of E.A. Arber, *Geol. Mag*, **5**, 426 – 431, 1918; Obituary of Muriel Agnes Arber by Eric Robinson, *Proc. Geol. Assoc.* **116**, 61 – 63, 2000; Early Memories of the Sedgwick by Muriel Arber, *GeoCam*, **7**, 5 – 7, 2003 and personal memories provided by Eric Robinson.

* **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



Mineralogical Society of Great Britain & Ireland backs Geological Society of London statements on climate change

The Mineralogical Society issued a press release in late November, lending its formal support to the Geological Society's statements on climate change, and thanking its representatives 'for their efforts in bringing together the specifically geological evidence contrasting present-day climate change with such changes in the recent geological past.'

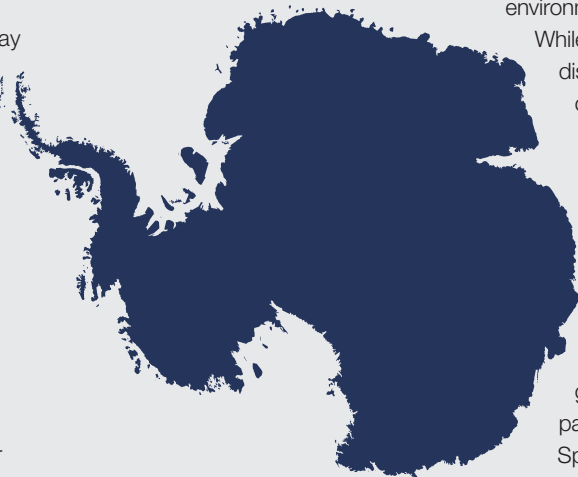
The Geological Society first published 'Climate Change: Evidence from the Geological Record' in November 2010, with a subsequent addendum in October 2013. Intended for non-specialists and Fellows, the statement focuses specifically on the geological evidence. Subsequently, in the run up to the United Nations Climate Change Conference COP 21 in 2015, the Geological Society was a signatory to a communiqué signed by 24 academic institutions calling on national governments to take immediate action if they want to avert the serious risks posed by

climate change.

In a press release, the Mineralogical Society Council stated that it 'formally noted the strong public concern regarding anthropogenic climate change and welcomed the growing public appreciation of the environmental sciences...

While most public discussion has focused on climate models, we are aware that the recent geological and geochemical records also provide detailed evidence for climate change in the context of the geologically recent past.'

Speaking after a Council meeting on 14 November, the Mineralogical Society's President, Prof. Bruce Yardley, stated that 'the Mineralogical Society supports the efforts of the Geological Society to place such geological evidence in the public domain and has offered its assistance to the Geological Society in any future revisions of its briefing documents where its members have appropriate expertise.'



The Society notes with sadness the passing of:

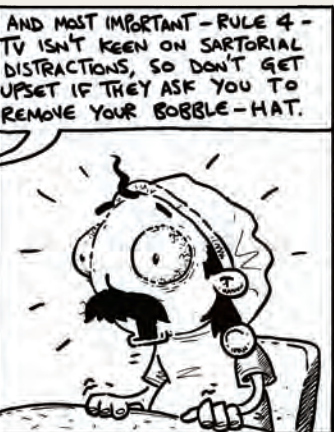
- Almond, David
- Ashworth, Kevan*
- Bentley, Peter*
- Buist, David Stuart
- Chambers, Henry***
- Chew, Kenneth
- Glennie, Ken
- Higginbottom, Ian
- Hunt, Albin Digby***
- Laughton, Anthony *
- Lumsden, Alastair
- Marriott, Derek Leslie *
- McCann, David Michael
- Parvizi, Fereydoun *
- Potter, John F**
- Reading, Howard
- Talbot, Christopher J
- Urquhart, Elspeth
- Williamson, Iain**

In the interests of recording its Fellows' work for posterity, the Society publishes obituaries online, and in Geoscientist. Bold, recent additions to the list; * Fellows for whom no obituarist has been commissioned; § biographical material lodged with the Society.

If you would like to contribute an obituary, please email sarah.day@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.

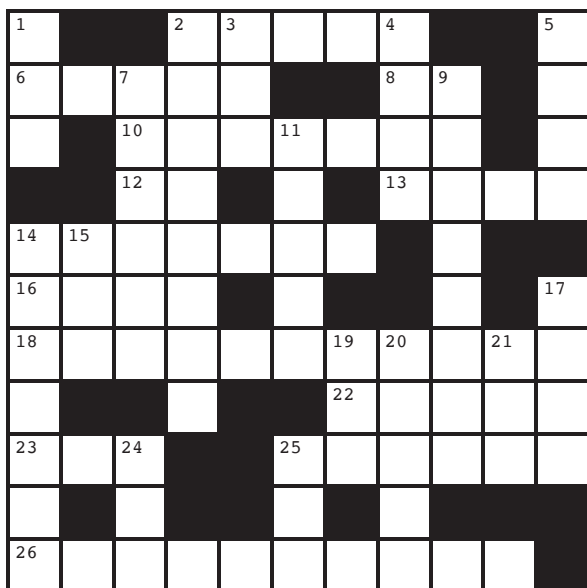
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By Bindweed



Crossword

Across

- 2/5** Metallurgical material often used as aggregate (5,4)
- 6** Collected maxims of a sage (5)
- 8** A type of quark (2)
- 10/2D** Material occurring in 4d as tetrahedral and octahedral sheets (15)
- 12** Metal used in Nobel Prize winning batteries (2)
- 13** Crushed brick for example (4)
- 14** Reduce at high temperature (7)
- 16** Continent east of Europe (4)
- 18** Place of learning (7, 4)
- 22** Sail named after a city in Liguria (5)
- 23** International Olympic Commission (3)
- 25** With affection (6)
- 26** Landform erupting sludge, water and gas (3, 7)

Down

- 1** Was 17d until the 1960s (3)
- 2** See 10 Across
- 3** Short-lived negatively charged lepton (3)
- 4** Organ of respiration (4)
- 5** See 2 Across
- 7** French acid? (6)
- 9** Stone used in Cardiff City Hall (8)
- 11** One of the folk who dig rock (5)
- 14** This 10ac/2d is the end member anorthite (7)
- 15** Suffix denoting an enzyme (3)
- 17** In ISO 14688, a sediment with a particle size smaller than 2 micron (4)
- 19** The conscious self (3)
- 20** Pigment prepared from Lawsonia inermis (5)
- 21** Laugh out loud (3)
- 24** Longest running Indian TV series (3)
- 25** Cornish river whose estuary is a ria (3)

Solutions December | Across: 1/1D dust devil **5/6D** ice cap **7** ohm m **9** RT **11** aviso **13** ayah **14** -opia **16** epimer **18** DCI **20** nuns **21** pyrite **23/15** Siba **24/18D** planetary dynamo **27** Urga **28** IR **29** See 26 Down **31** moon **Down: 1** See 1 Across **2** SOS **3** tholeiitic **4** grabens **6** See 5 Across **8** Mariner **10** Tharsis **12** -ia **14** Olympus **17** See 30 Down **18** See 24 Across **19** CRE **21** Pag **22** tarry **25** Lr **26/29Ac** Yuty Crater **30/17D** rimu

Latest news from the Publishing House

An integrated approach for fractured basement characterization: the Lancaster Field, a case study in the UK

By Daniel A. Bonter and Robert Trice

To date, naturally fractured crystalline basement reservoirs ('basement') in the UK Continental Shelf (UKCS) have been underexplored and underexploited. Over the last 12 years, Hurricane Energy have explored and evaluated the potential of the basement play, West of Shetland. Data acquired by Hurricane Energy through drilling and drill stem testing of five wells on the Lancaster Field has provided sufficient insight into the reservoir properties of the basement reservoir that Hurricane is now progressing Lancaster towards the first UK basement full-field development.

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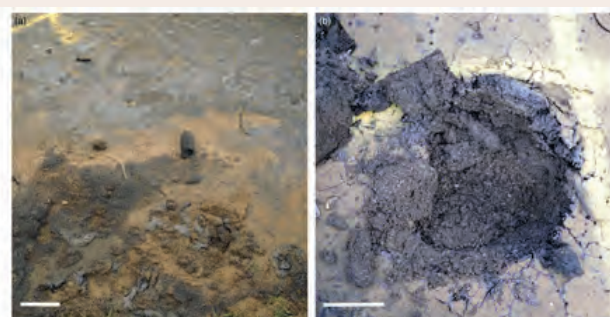


Heavy hydrocarbon fate and transport in the environment

By David M. Brown, Matthijs Bonte, Richard Gill, James Dawick and Peter J. Boogaard

Heavy hydrocarbons are a heterogeneous mixture of compounds consisting mainly of alkylated cyclics, resins and asphaltenes and, depending on the source, can form a significant proportion of crude oil. Their prevalence is expected to increase in the future as heavy oil reserves are increasingly exploited for growing worldwide energy demands. Despite their growing use, heavy hydrocarbons are generally overlooked when assessing the risk of hydrocarbons to human health, ecology and water reserves.

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OBITUARY**Andrew Gordon Whitham (1960-2019)**

Andrew was born in Birmingham. His father, Gordon Whitham, lectured in organic chemistry at the university. His mother was born Mary Gordon, hence Andy's middle name! Gordon moved to Oxford University with the family in 1965, where Andy and his sisters, Sarah and Emma, grew up. Educated initially at Magdalen College School, Oxford (1971-1978), he read Geology at Durham University (1978-1981). There at Van Mildert College he met Julie Gray. They married in 1990, setting up home appropriately off Oxford Road, Cambridge.

University of Cambridge

In 1981, Andy started his PhD on subaqueous pyroclastic rocks at the interface between volcanology and sedimentology, supervised by Steve Sparks. Andy's geological adventures took him to the Caribbean, USA and Italy. His brilliant experimental study of sinking and floating pumice resulted in the widely cited "Pumice", the shortest titled volcanology article. His engaging, humorous and warm personality created a positive atmosphere in the research group. His supervisor's only concern was that Andy always beat him at squash.

British Antarctic Survey

Andy's first job was as sedimentologist to the British

Arctic and Antarctic sedimentologist, Chief Geologist and Managing Director of CASP

Antarctic Survey (1985-1990) studying the backarc basin of the Antarctic Peninsula in two 5-month field seasons, contributing to the study of shallow marine siliciclastic rocks, deep marine anoxia, vitrinite reflectance and basin analyses. His research was augmented by field work in Barbados and examination of oceanic black shales in South Atlantic boreholes at the Lamont Doherty Geological Observatory, USA.

CASP

In 1990, Andy joined CASP (formerly the Cambridge Arctic Shelf Program). There he worked for the rest of his life, rising to become its Chief Geologist in 2003, which was combined with Managing Director from 2014.

He set up the East Greenland Project, one of CASP's flagship enterprises, leading 27 expeditions from 1990 to 2018. He was involved in a wide variety of studies that have been paramount to understanding the hydrocarbon-rich Norwegian sector of the North Atlantic, as well as other projects in Arctic Canada and Libya.

When seeking a new chief geologist at CASP, Brian Harland once advised Peter Friend, chairman of the Trustees to 'find someone using Andy Whitham as a yardstick'! Under his able management, CASP has weathered the current hydrocarbon industry low. His enthusiasm, positive leadership and skilled negotiating abilities helped the

various CASP projects maintain the interest of the subscribing companies. Andy also served as editor for the Geological Magazine from 2008 and 2017.

Andy's pathway crossed mine many times from his Cambridge student days, through BAS and to CASP. We worked in both the Arctic and Antarctic, in some of the world's most beautiful yet most challenging areas of frontier geology. Together in Greenland, we faced stormy seas in small boats, crossed treacherous crevassed ice-fields and raging torrents, had campsites destroyed around us, survived temperatures down to -40°C, and looked polar bears straight in the eye. None compared with him for companionship and leadership in the field. Without him our world is a much poorer place.

Andy was awarded the Polar Medal in 1995. His name and CASP are commemorated in the Greenland Cretaceous bivalve, *Caspiconcha whithami*. In Antarctica, Whitham Bluffs was most appropriately named! His publication record stands as the memorial to his geological skills.

Andy suddenly became acutely unwell at home early on 31 January 2019 and died in hospital later that morning. He leaves his loving wife, Julie, and children, Joseph and Rachel.

By Simon R.A. Kelly

➤ (The full version of this obituary appears online. *Editor.*)

OBITUARY**Reginald Bradshaw (1924-2019)**

Reginald was born in West Butterfield, Lincolnshire on 21st September 1924 and attended Scunthorpe Grammar School. He joined the RAF in 1943, becoming a photographer and then a meteorologist, serving in France, the UK and Hong Kong, and ending as a Flight Lieutenant. He graduated in 1950 with a First in Geology and, in 1952, with an MSc in X-ray Crystallography under Kathleen Lonsdale FRS, both from University College London. Reginald then became a Lecturer in Geology there, with a sabbatical spell in 1955 in British Guinea, until 1958 when he became Lecturer in Mineralogy at Bristol University and remained there until retirement in 1989.

Connemara & Norway

Reg, as he was known, was a mineralogist and petrologist who mapped the Oughterard area of Connemara, western Ireland and established the Oughterard Granite as being later than the Connemara antiform. Also in the 1950s, he mapped around Sørfinnset, Glomfjord, northern Norway. In Bristol, he worked with Coles Phillips on X-ray studies of petrofabrics and most of all, he turned his attention to the local geology. As a gemmologist he became an expert on 'Bristol diamonds' (anhydrite nodules replaced by quartz), but is best known in the Mendips for drawing attention in 1970 to the now named 'Bradshaw's Cave' west of Nunny. He became Senior Lecturer in 1970 and in

Mineralogist and petrologist whose outstanding contributions to amateur geology were recognised by the Society with the R.H. Worth award



“ REG'S MAIN CONTRIBUTIONS WERE IN YEARS OF POPULAR UNDERGRADUATE TEACHING AND SUPERB TUTORING, ATTESTED TO BY MANY TUTEES, PLUS EXTRAMURAL EVENING AND WEEKEND TEACHING OF GEOLOGY, ESPECIALLY TO AMATEUR GEOLOGISTS, SUSTAINED OVER DECADES ”

1973 obtained his Bristol PhD from submitted publications.

Brilliant teacher

Reg's main contributions were in years of popular undergraduate teaching and superb tutoring, attested to by many tutees, plus extramural evening and weekend teaching of geology, especially to amateur geologists, sustained over decades. Typically he taught between seven and ten courses a year, even for years after 'retiring', with numerous day excursions to observe local geology, as well as longer trips to Iceland, Brittany, Cyprus, Massif Central and Norway. He long supported the Bristol Naturalists' Society, being Librarian (1959-1972), President of the Geological Section

(1963-1964), and President of the Society (1968-1969). Reg's outstanding service to amateur geology was recognised by the Geological Society in 1995 with the award of the R. H. Worth Prize, by which time he had retired to Wedmore, Somerset. He was a Fellow for 71 years and for ~60 years a member of the Geologists' Association (GA), being Librarian (1953-1958), Chairman (1984-1985; 1990-1993) and then President of the West of England GA. He was President of the Earth Science Teachers' Association (1984-86).

Stamps

He collected world postage stamps depicting geological features such as volcanoes and gave very popular illustrated lectures on the subject, as well as on the geological works of Leonardo da Vinci.

Reg and his wife, Gwyneth (who died in 2010), met in Hong Kong and were married in 1947 for 63 years. They were staunch Methodists and much of their outreach, as well as Reg's exceptionally affable, helpful and empathetic nature, certainly sprang from an amalgam of his Christian beliefs and his natural twinkle in the eye and love of a leg-pull. He died on February 13th 2019 leaving three children, Rhiannon, Alison and Martin, eight grandchildren and twelve great grandchildren.

By Bernard Elgey Leake

➤ (The full version of this obituary appears online. *Editor.*)



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14 May 2020

Plastics in the Environment

The Geological Society, Burlington House, London

Primary Convenors

Wes Fraser (Oxford Brookes University)

Gordon Inglis (University of Southampton)

Further information

For further information about the conference please contact:

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

T: 0207 434 9944

E: conference@geolsoc.org.uk

Web:

www.geolsoc.org.uk/plastics2020



Follow this event on Twitter:
[#plastics2020](https://twitter.com/plastics2020)

The accumulation of plastic debris in the environment is a global problem which may have detrimental impacts on ecosystem health. Plastics are now widely enough distributed that they may also act as an anthropogenic marker horizon in the future rock record. However, there are still many outstanding questions regarding the: 1) source, 2) transfer, 3) degradation, 4) persistence and 5) measurement of plastics in the environment.

This one-day meeting will bring together researchers from a diverse range of disciplines (e.g. hydrology, sedimentology, geochemistry, earth science, biology) to discuss the fate of plastics in terrestrial, freshwater and marine environments.

This meeting seeks to foster conversation between these different communities to facilitate a more holistic approach towards understanding plastic in the environment.

Call for Abstracts

We invite oral and poster abstract submissions for the meeting, and these should be sent in a Word document to conference@geolsoc.org.uk by Friday 7 February 2020. Abstracts should be approximately 250-350 words and include a title and acknowledgement of authors and their affiliations.





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