

GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

@geoscientistmag

[PLASTIC
PLANET]



BEHIND THE LENS

Step behind the camera of the pioneering documentary, *A Plastic Ocean*, with Joanna Ruxton & Jessica Hickie

HYDROSPHERE PLASTICS
An urgent problem requiring global action

SUSTAINABLE SITES
The need for a strategic approach to on-site sampling

PLASTIC & CLIMATE
The carbon footprint of our go-to material

RESPONSIBLE INVESTING in Natural Resources

7th – 8th October 2019

The Geological Society of London, Burlington House

What is responsible investing, how should we measure it and how can we shape its future? These are some of the questions that investors, operators, policy makers and NGOs will challenge and answer during this two day conference.

Responsible investment is currently driven primarily by the volume of carbon an organisation releases to the environment. This blanket approach can have unintended consequences for the extractives sectors and its customers. Responsible investment should encompass a broader and more balanced set of requirements, as suggested by the Sustainable Development Goals, thereby ensuring that those organisations who truly strive to operate in a more sustainable manner are actively supported by responsible investors.

If you are an investor, natural resources company such as mining or oil & gas, policy maker, industry body, regulator, NGO, insurer, analyst or interested party seeking to shape the future of responsible investment in the natural resources sector, we hope to see you at the conference.

For further information please contact:

Sarah Gordon, c/o Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG

T: +44 (0) 7815285466

E: conference@geolsoc.org.uk

Convenors:

Sarah Gordon (Satarla / The Geological Society)

David Bamford (Petromall)

Christopher Reeves (DIGBY WELLS)

Aldo Peninni (Satarla)

Ellen Casey (Satarla)

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The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T +44 (0)20 7434 9944
F +44 (0)20 7439 8975
E enquiries@geolsoc.org.uk (Not for Editorial - Please contact the Editor)

Publishing House

The Geological Society Publishing House, Unit 7, Brassmill Enterprise Centre, Brassmill Lane, Bath BA1 3JN
T 01225 445046
F 01225 442836

Library

T +44 (0)20 7432 0999
E library@geolsoc.org.uk

EDITOR-IN-CHIEF

Professor Andy Fleet

DEPUTY EDITOR-IN-CHIEF

Mr David Shilston

EDITOR

Dr Amy Whitchurch

E amy.whitchurch@geolsoc.org.uk

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Century One Publishing
 Alban Row, 27-31 Verulam Road, St Albans, AL3 4DG
T 01727 893 894
E enquiries@centuryonepublishing.uk

W www.centuryonepublishing.uk

ADVERTISING SALES

Alex Killen

T 01727 739 182

E alex@centuryonepublishing.uk

ART EDITOR

Peter Davies

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Corporate Supporters:

Call for Abstracts

Core Values: the Role of Core in 21st Century Reservoir Characterisation

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

Convenors:

Adrian Neal
Badley Ashton - Chair

Lucy Williams
Rockhopper

Mike Ashton
Ashton Geology

Steve Dee
BP

Cliff Lovelock
Shell

Emma Jude
BP

Anton Padin
Total

Keynote Speakers:

Mike Bowman
Manchester University

Patricio Desjardins
Shell UCs, Houston


Hakon Fossen
Bergen University

Bruce Levell
Oxford University

Anna Matthews
BP

Nordine Saboua
BHP, Houston

Kate Smout
Shell



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 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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www.geolsoc.org.uk/petroleum
#CoreValues20

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Corporate Supporters:

Call for Abstracts: Deadline 6 December 2019

Geopressure 2020

Managing Uncertainty in Geopressure by Integrating Geoscience and Engineering

24-26 March 2020
Durham University, Durham UK

Organising Committee:

Stuart Jones
Durham University

Nick Pierpoint
NWP Geosconsulting

Richard Swarbrick
Swarbrick GeoPressure Consultancy Limited and Durham University

Scientific Programme Coordinators:

Toby Harold
Repsol

Rick Lahann
Indiana University

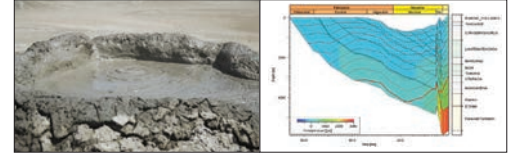
Stephans O'Connor
Global Geopressure Advice

Binh Nguyen
JX Nippon

Tom Sinclair
Shell

Beth Stump
Chevron

24 March 2020: Field trip **25 and 26 March 2020: Conference**
Led by Richard Swarbrick and Jack Lee 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 PFFG
- Well engineering and PFFG
- Injecting fluids underground (including CO₂)
- Coupling of Pore Pressure and FG including depletion and closing the drilling window
- Seal capacity and relationship with PFFG
- PFFG 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 and abstract submissions:
To submit an abstract please send it to abstracts@geolsoc.org.uk and copy to sarah.woodcock@geolsoc.org.uk.

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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Corporate Supporters:

Call for Abstracts – Deadline: 31 January 2020

New learning from exploration and development in the UKCS Atlantic Margin

20-22 May 2020
Robert Gordon University, Aberdeen

Convenors:

Noah Jaffey
Shell

Jamie Collins
BP

Clayton Grove
Siccar Point Energy

Olga Shukert
Western Geco

Christopher Bugg
Total

Douglas Watson
ExxonMobil



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 FPS)
- Guided core viewing day at Iron Mountain (Dyce)
- Social programme to include a conference dinner.

Conference themes:

- Paleocene deep water reservoirs
- Mesozoic pre-, syn-, and post-rift plays
- Paleozoic 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.

Call for Abstracts:
Please submit talk or poster abstract to sarah.woodcock@geolsoc.org.uk by 31 January 2020.

For further information please contact:
Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. Tel: +44 (0)20 7434 9944

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Corporate Supporters:

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

Convenors:

Alun Williams
Equinor

Andrew Barnett
Shell

Anna Matthews
BP

Björn Seyfang
Equinor

Ian Saikia
ExxonMobil

Jo Garland
Cambridge Carbonates

Paul Wright
National Museum of Wales and Consultant

Trevor Burchette
Royal Holloway, University of London and CRG Ltd



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:
Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. Tel: +44 (0)20 7434 9944

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“ TO HELP FIGHT OUR ‘PLASTIC PROBLEM’, GEOSCIENTISTS ARE NEEDED TO ASSESS THE FULL ENVIRONMENTAL IMPACTS OF PLASTICS, COMPARED TO ALTERNATIVE MATERIALS, AT EVERY STAGE OF THEIR LIFE CYCLE AND BEYOND ”

FROM THE EDITOR’S DESK:

Fossil plastics

Our planet is overwhelmed by plastic. This human-made material has infused our air and snowfall, invaded our rivers and coastlines, penetrated the depths of our oceans, and infiltrated our ecosystems and bodies. Our ‘zplastic problem’ has captured public interest, yet in terms of scientific understanding, we’ve only really scratched the surface. We need a better grasp of where our plastic waste is, the pathways it travels and its health impacts—points that are driven home in this special issue on plastic pollution.

While most research has focused on marine plastics, a report released earlier this year highlights a somewhat under-appreciated impact of plastic: climate change. *Plastics & Climate: The Hidden Costs of a Plastic Planet* reviews the climatic impacts of plastic over its entire life cycle. And the results paint a bleak picture.

Plastic is largely made from fossil fuels, so greenhouse gases are emitted at every step of the life cycle, from fossil fuel extraction and transport, through refining and manufacture, to end-of-life and beyond. Plastic production is highly emissions intensive, and whether plastic is landfilled, recycled, incinerated, or left unmanaged in the environment, it continues to give off greenhouse gases.

Particularly worrying is the impact on plankton. Phytoplankton contaminated by microplastics may have a reduced ability to fix carbon via photosynthesis, while microplastics may lessen zooplankton survival, reducing their ability to transfer carbon to the deep ocean. That plastics may interfere with the largest natural carbon sink on the planet should ring alarm bells.

The (conservative) emissions estimates given in the *Plastics & Climate* report make it clear that if we carry on producing plastic at the current rates, we jeopardise our ability to keep global temperature rise below 1.5°C. But the results are much worse than that. Petrochemical and plastic industries plan colossal expansion, in part fuelled by the availability of cheap natural gas from hydraulic fracturing (particularly in the US). The report estimates that by 2030, plastic production and incineration will add greenhouse gas emissions equivalent to 295 new 500-megawatt coal-fired power plants, and that number rises to 615 new plants by 2050.

We must be careful not to completely demonise plastic. This revolutionary material has brought many societal benefits.

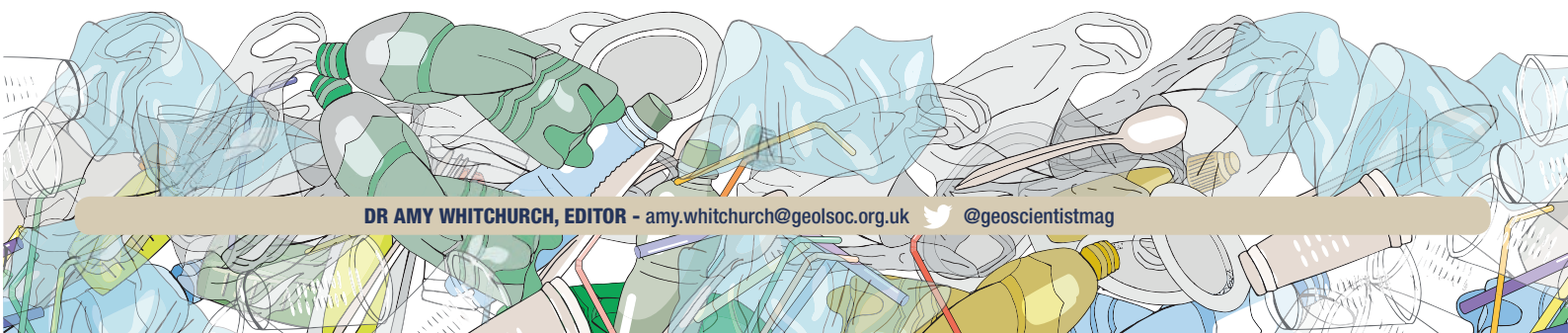
Engineered plastics allow for lighter vehicles with improved fuel efficiency and lower carbon emissions, they reduce food waste and spoilage, and have transformed the medical industry—many of our most innovative medical procedures, including pill casings, implants and prosthetics, depend on plastics.

One interesting alternative is bioplastics, such as those formed from plants or algae, because they have a lower carbon-footprint than petroleum-based plastics. CO₂ is sequestered from the atmosphere as the biomass grows and released back into the atmosphere as the plastics break down—there is no net increase in CO₂ emissions. But bioplastics are still problematic. A rise in their use could intensify pressure on arable land, fertiliser and water consumption, and increase monoculture cropping and pesticide use, thus contributing to the loss of habitats and biodiversity. Plus, while often labelled biodegradable, many bioplastics only do so under intensely high temperatures in industrial composting or recycling plants—most bioplastics lost to the environment pose the same threats as traditional plastics.

Bioplastics do have great potential. With the rise of genetic- and bio-engineering (and ethical considerations aside), they could one day be designed to have a vast range of applications and to be completely recyclable.

Our ‘plastic problem’ requires immediate action. Globally, we must ease our plastic dependency, especially single-use, and create alternative materials. Improved waste management and recycling infrastructures, particularly in developing nations, are urgently needed. Ramping up plastic production, as currently planned, is not an option. Rather, plastic producers should take greater responsibility, factoring reuse and recyclability into the design and committing to collect, reuse and recycle their products. Governments could enforce ambitious emissions targets and introduce levies on fossil hydrocarbon plastics, to make them less economically attractive than greener alternatives.

Geoscientists have an essential part to play. In addition to mapping and monitoring plastic pathways, geoscientists are needed to assess the full environmental impacts of plastics, compared to alternative products, over their entire life cycle. To have any hope of solving our plastic problem, we will require an integrated approach.



SOCIETY NEWS

CALL FOR NOMINATIONS TO SERVE ON COUNCIL

Would you consider standing for election to Council and contributing to the work of the Society, as a member of both Council and one or more of its committees?

Membership of Council enables you to influence the role of the Society in acting as a respected voice and serving science, the geoscience profession and society.

You will play an active role in the delivery of the Society's strategy, and help to facilitate the communication of science through engagement with policy makers, the media and the public, and the certification of best practice in the profession.

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

Council meets five times a year, usually on a Wednesday. Four of those meetings take place in the afternoon beginning at 14.00 and finishing at 17.00. In addition, there is a two-day residential meeting, usually in late September, to discuss major strategic issues.

All members of Council also serve on one of the standing committees (External Relations, Finance & Planning, Professional, Publications & Information and Science). Standing committees usually meet three or four times a year, mostly in person but

sometimes virtually. Council members are sometimes also asked to join other committees or short-term working groups. The typical time commitment is eight to ten days annually for ordinary members of Council.

Nominations from candidates with trustee experience are very welcome. Knowledge and experience of scholarly publishing and of fund-raising are also useful. Additionally, Graham Goffey, Treasurer, will stand down in June 2021 and candidates with suitable experience are particularly welcomed. The time commitment for this role will be greater.

As part of our commitment to ensuring a more diverse and inclusive Council, the Society particularly welcomes nominations from under-represented groups, allowing Council to better reflect the community it serves.

Details of the process are on the nomination forms, which can be downloaded from the Governance section of the website (<https://www.geolsoc.org.uk/about/governance/council-elections>). Here you can also see the names of those members of Council due to retire at the AGM in June 2020. You can also request a copy of the form from Stephanie Jones, Geological Society of London, Burlington House, Piccadilly, London W1J 0BG; email: Stephanie.jones@geolsoc.org.uk; Tel: 020 7432 0990.

Nominations must arrive no later than noon on **Friday, 3 January 2020**.

MEMBERSHIP RENEWALS 2020

Collection of membership renewal fees for 2020 has now started

We have sent an email communication to you at the address we have registered, with instructions on how to renew. If you do not have an email address registered with us or if you have requested paper billing, we have sent you a letter by post. Membership cards will be sent in January 2020 to all Fellows who have paid and renewed by December 2019.

For more information on membership subscription renewals for 2020 please visit www.geolsoc.org.uk/renewals

if you have not received any communication regarding your membership renewals, please contact the Fellowship office on membership@geolsoc.org.uk or call +44 (0)20 7434 9944.

We look forward to your continued membership and support of the Society.

**RENEWAL
REMINDER**

EARTH SCIENCE WEEK 2019



This year's Earth Science Week is taking place on 12-20 October, with the theme 'Geoscience is for everyone'.

There are plenty of events happening across the UK, from lectures and school activities to museum tours and geology fieldtrips. Just take look at our Earth Science Week calendar to find out what's going on near you (www.geolsoc.org.uk/earthscienceweek).

If you're one of our Geology STEM Ambassadors, Earth Science Week is a fantastic reason to get involved with a school visit or an outreach event. If you're a teacher, it's a great time to get some extra Earth science into your lessons or science clubs! If you do anything for Earth Science Week, please let us know by using the hashtag #EarthSciWeek on Twitter and Instagram (@geolsoc).

What your society is doing
at home and abroad



I'M AN EARTH SCIENTIST

To help promote and encourage under-represented groups in Earth Science, we would like Earth Scientists in academia, industry and other related jobs to join in with our 'I'm an Earth Scientist' outreach project.

To participate, all you need to do is submit an image of yourself holding a sign that reads 'I'm an Earth Scientist' in your work/study environment—be that in an office, library, quarry, laboratory, classroom, or up a mountain! We will collate these images into a video that aims to show the diversity of Earth Scientists working today across the world, with a focus on promoting underrepresented groups.

To join in with 'I'm an Earth Scientist' and for more information visit www.geolsoc.org.uk/im-an-earth-scientist. Please submit your images along with the image submission form to the Education Team (education@geolsoc.org.uk) by midnight on 25 November.



**I'M AN EARTH
SCIENTIST**

SOUTH WEST REGIONAL GROUP



Your regional group needs you! Sarah Boulton provides details.

The South West Regional Group is incredibly active, organising about eight talks, one fieldtrip and a one-day conference each year, in addition to taking part in the Schools and Early Careers competitions.

To continue, we need new general committee members to help organise events and keep the regional group relevant. In addition, we are looking for a new Treasurer (to start as soon as possible) and a new Chair to take over at the AGM in November, when the current Chair finishes her term. Please send expressions of interest to southwestrg@gmail.com

PUBLIC LECTURE SERIES

Public Lecture: Joint 'Year of Carbon' and 'International Year of the Periodic Table' lecture with the Royal Society of Chemistry

Speaker: Ros Rickaby, University of Oxford

Location: Burlington House, London

Date: 16 October

Programme

- Afternoon talk: 14.30 Tea & Coffee; 15.00 Lecture begins; 16.00 Event ends.
- Evening talk: Details and tickets available via the Royal Society of Chemistry

Further Information

Please visit <https://www.geolsoc.org.uk/Events/Public-Lectures-2019>. 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.

Regional Public Lecture: Quicquid sub terra est—Whatever is under the Earth

Speaker: Nick Rogers, President of the Geological Society

Location: Birmingham University

Date: 7 October

Programme

- Evening talk: 17.00 Lecture begins

Further Information

Please visit <https://www.geolsoc.org.uk/Events/Regional-Public-Lectures-2019>. Tickets are now available on Eventbrite.co.uk and will work on a first come first serve basis.

FROM THE LIBRARY

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www.geolsoc.org.uk/library

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Search the online catalogue of books, journals and maps held in the Geological Society Library. Fellows and Corporate Affiliate members can now login to the Library Catalogue to renew loans, view loan history, request items and create Favourite lists. www.geolsoc.org.uk/librarycatalogue

◆ E-Journals and e-books

Fellows of the Society can access over 100+ e-journals and e-books using Athens authentication. There is no charge to Fellows for this service. Visit www.geolsoc.org.uk/virtuallibrary to register.

◆ Literature searching

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

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If the item you want is not in our collection, we may be able to obtain it from another library. To find out more about this service, please email library@geolsoc.org.uk or call 020 7432 0999

◆ 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.

◆ Library newsletter

Subscribe to our bi-monthly newsletter to keep up-to-date with important Library news, electronic journal updates, online exhibitions, events and more—please email library@geolsoc.org.uk to be added to our circulation list

Latest news from the Publishing House

Geoscience and decarbonization: current status and future directions

By Michael H. Stephenson, Philip Ringrose, Sebastian Geiger, Michael Bridden & David Schofield

At the 2015 United Nations International Climate Change Conference in Paris (COP21), 197 national parties committed to limit global warming to well below 2°C. But current plans and pace of progress are still far from sufficient to achieve this objective. Here we review the role that geoscience and the subsurface could play in decarbonizing electricity production, industry, transport and heating to meet UK and international climate change targets, based on contributions to the 2019 Bryan Lovell meeting held at the Geological Society of London. Technologies discussed at the meeting involved decarbonization of electricity production via renewable sources of power generation, substitution of domestic heating using geothermal energy, use of carbon capture and storage (CCS), and more ambitious technologies such as bioenergy and carbon capture and storage (BECCS) that target negative emissions. It was noted also that growth in renewable energy supply will lead to increased demand for geological materials to sustain the electrification of the vehicle fleet and other low-carbon technologies. The overall conclusion reached at the 2019 Bryan Lovell meeting was that geoscience is critical to decarbonization, but that the geoscience community must influence decision-makers so that the value of the subsurface to decarbonization is understood.

➤ [Read the full abstract and paper in the Lyell Collection](http://pg.lyellcollection.org/content/early/2019/08/20/petgeo2019-084)

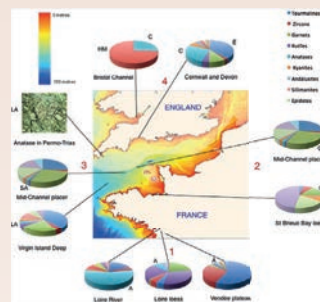
<http://pg.lyellcollection.org/content/early/2019/08/20/petgeo2019-084>



Transport of Late Pleistocene loess particles by katabatic winds during the lowstands of the English Channel

By Jean-Pierre Lefort, Jean-Laurent Monnier and Guzel Danukalova

Studies of the submerged Pleistocene conglomerate cored and dredged in the English Channel show that it resulted from the cementation of stony beaches under a loess blanket. Although the loess cover was later washed out by younger transgressions, the northern limit of the conglomerate corresponds to the original offshore extension of the loess deposits. Compilation of offshore and onshore altitudes of the limits of these deposits shows that loess was deposited by low-level wind fields never thicker than 200 m. Mapping surveys show that the present limits of loess are probably close to their original boundaries. The past proximity of the British Ice Sheet, the accumulation of dusty sediments coating north-facing cliffs of Brittany originating in the outwash of the British-Irish Ice Sheet and in the palaeo-rivers...continue reading in the Lyell Collection



➤ [Read the full abstract and paper in the Lyell Collection](http://pg.lyellcollection.org/content/early/2019/07/26/jgs2019-070)

<http://pg.lyellcollection.org/content/early/2019/07/26/jgs2019-070>

Plastic and sustainability on site

In the war on plastic, Geoff Faro argues for geoscientists to take a more strategic approach to on-site sampling



Unless you have been living under a rock (excuse the geology pun) for the past 5 years, the war on plastic is forefront in the media with people finding alternatives to single-use plastics and other disposable items. In our household (lead dutifully by Mrs Faro), we now proudly use bamboo toothbrushes, bamboo scourers, bamboo pot brushes, solid shampoo (looks like a bar of soap), metal reusable straws and reusable coffee cups. We choose food not wrapped in plastic and our daughter is the pride of the nursery sporting her finest re-useable nappies. All in all, we're left with a warm (and yes, probably self-righteous) fuzzy feeling that we do all, or at least a lot that we can.

Ethics on site

Although many of us promote our green ethics, undertake brownfield remediation and brand ourselves as 'Environmental' companies, the application of an eco-friendly approach at work, especially when undertaking environmental investigations is tricky. Recently, Geosphere Environmental undertook a small, client-scoped investigation using the Institution of Civil Engineers specification with site-specific amendments. The number of sample containers used was considerable. Overall, for four trial pits and two windowless sample holes, we used 90 plastic tubs, 104 glass jars (all with plastic lids), 20 bulk bags, 39 small bags for head space testing, a dozen plastic liners and a plastic bailer.

So, on site, as I smugly drink my coffee from my bamboo compostable mug, I can't help but think all good work that the Faro family and many others are undertaking at home to reduce single-use plastic, pales into insignificance when a few people on

site for one day can fill up a medium-sized van—and likely only a fraction of these samples will ever be tested.

Reduce, reuse, recycle

During a recent laboratory visit, we asked what happens to the samples and containers. It all goes to landfill as hazardous waste.

If this is the problem, what is the solution? We can't eliminate sampling.

Reusable containers? They don't exist as far as I'm aware and emptying and cleaning the containers isn't going to happen.

Recycling the containers? Maybe possible, but this is labour intensive, so incurs extra cost. With all the laboratories vying for business at competitive rates, recycling is unlikely to happen unless forced.

This leaves reducing. Can we reduce the number of samples we take instead of

the 'shotgun' approach often taken? Reduction could be achieved with a good desk-study or by having someone on site that is able to make an informed decision as to what will be tested, rather than a recent graduate instructed to blindly sample at half-metre depth intervals. One less tub is the same as one less

shampoo bottle and will assist with (but not solve) our reliance on plastic. In the end, every little helps. Of course, this approach isn't infallible—the environmental impact of returning to site if more samples were needed is significantly larger than a couple of pots—but we must at least try to reduce our industrial impacts wherever possible (so how about we stop sending out *Geoscientist* in a plastic wrapper?)

Anyway, rant over, I'm off to entice the drillers away from their single-use coffee cups.



Geoff Faro is a Principal Engineering Geologist at Geosphere Environmental; e-mail: geoff@geosphere-environmental.co.uk

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).

“ WE ASKED WHAT HAPPENS TO THE SAMPLES AND CONTAINERS. IT ALL GOES TO LANDFILL AS HAZARDOUS WASTE ”

GEOFF FARO



A PLASTIC OCEAN: **BEHIND THE LENS**

While making the ground-breaking documentary 'A Plastic Ocean', **Joanna Ruxton** and **Jessica Hickie** came to the dark realisation that plastic pollution has infiltrated our food chain



The 2017 documentary, *A Plastic Ocean*, features a journalist, Craig Leeson, a freediver, Tanya Streeter, and an international team of scientists as they travelled around the globe investigating the causes and consequences of plastic pollution. Over four years of exploration, the team came to realise the startling extent of plastic pollution in our fragile oceans and ecosystems. Here, documentary producer, Jo Ruxton, and scientist, Jessica Hickie, provide a behind-the-camera peek at this game-changing documentary.

Engaging audiences

Jo: Back in 2009, when I decided to make a film about the problem of plastic waste in the ocean, my perspective of the issue was limited to the effects of plastic on marine life, with entanglement and ingestion being the focus. I had also heard stories of a giant floating island of trash, the so-called, 'Great Pacific Garbage Patch' in the centre of the Pacific Ocean. The very thought of that was horrifying, but I was soon to learn that the reality of it was worse and I was unsure how to document these horrors in a way that would engage audiences.

I had been making underwater natural history films with the BBC for 12 years previously and although I wanted to include environmental messages in these, I was constantly told that no one is interested in bad news; we just had to entertain our audiences. I knew that to make a success of an environmental film, I would have a better chance if there were a positive ending and, for *A Plastic Ocean*, I was given the perfect scenario. A fleet of decommissioned fishing boats was destined to head out to the centre of the Pacific Ocean accompanied by a 'mothership' containing a plastic-to- ►

Cameraman, Doug Allen, filming plastic on the surface where the Blue Whales fed. Location: offshore Sri Lanka, Indian Ocean (© David Jones)



► fuel plant. The aim was to happily collect plastic from the ocean and use it to fuel the expedition. It all sounded too good to be true and, of course, it was.

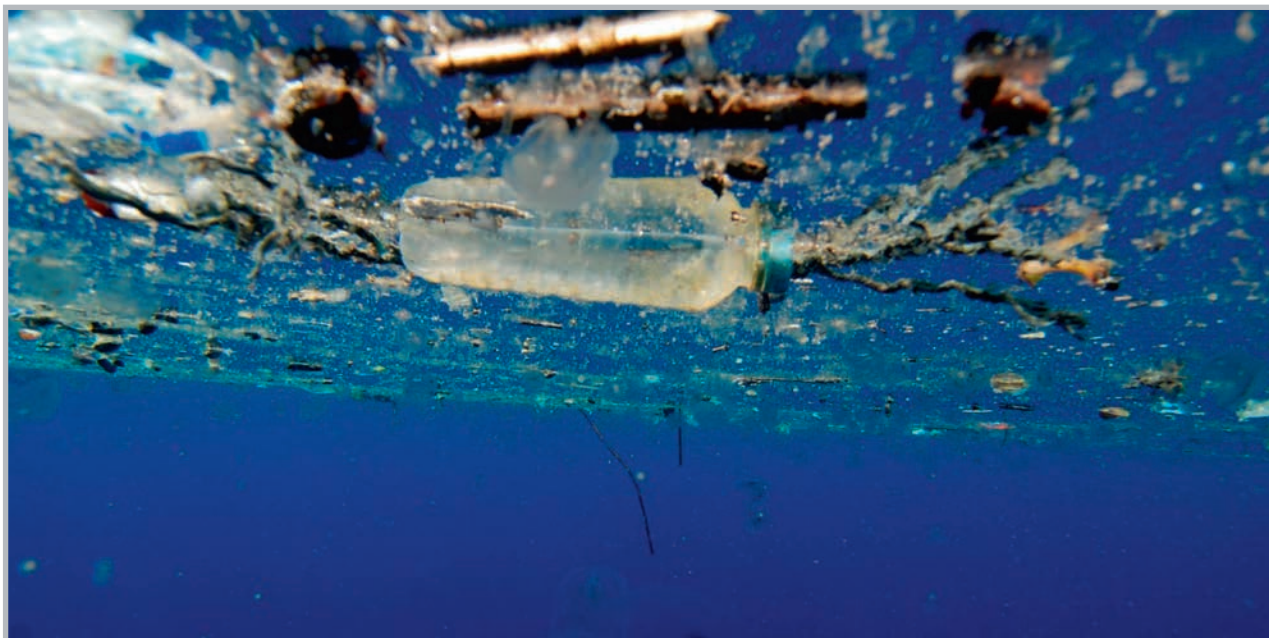
Invisible threat

Jo: I joined an expedition out to the North Pacific with a group of scientists and volunteers. At the centre of the ocean the whole focus of the film took a sharp turn—and I even questioned continuing with it. We planned to film the massive ‘continent of plastic’ using overhead camera cranes (at a time before everyone had drones) and subsurface cameramen below, looking up through the creaking, moving mass with shafts of light shining through. However, the truth revealed itself in a very different way.

There is hardly any visible floating plastic out there. Yes, there are occasional crates, bottles and tiny specs of polystyrene on the surface but apart from that, the ocean centre looks clear, blue and inviting. Where was all the plastic? It was there that I learned the insidious truth about this ‘garbage patch’: most of it is invisible from the surface.

Our scientists used fine-mesh plankton nets to trawl the surface for microplastics. They began 400 miles west of San Francisco and continued each day on our way to the ocean centre. I was horrified to see even tiny fragments of plastic revealed—but they were nothing. The closer we travelled toward the ocean

Floating plastic (© David Jones)



centre, the more plastic accumulated in the plankton nets until, at the heart of the ocean, every net deployed came up choked with plastic fragments that were invisible from the surface. Our lead scientist on the expedition, Dr. Andrea Neale, estimated a 26:1 ratio of plastic to plankton out there.

As a filmmaker, this revelation presented a problem because the story had taken a sudden turn. It was clear that plastic wasn't just entangling marine creatures, micro-plastics were entering the marine food chain at the very lowest level—what might this mean for top predators? We sit at the very summit of that food chain and millions of people around the world rely on fish as their main source of protein. Visually, the film idea faced a challenge: as interesting as the story had become, what could we actually show? Even an audience of dedicated marine scientists would soon tire of images of plastic-filled sieves—I toyed with the idea of making a radio programme instead.

At the same time, new science was emerging that would add a critical new dimension to the story.

Stark realisation

Jessica: When I was asked to research some storylines around micro-plastics and human health, it came as a bit of a surprise. This was in 2010, when most didn't give a second thought to using single-use plastic before throwing it in the bin and images of entanglement and starving whales were rare, let alone any mention of tiny pieces of plastics.

I started reading the scientific literature published at the time and talking to the relatively few scientists working in this field. As my research continued, I struggled to find published work directly linking our plastics-obsession with a health risk and the developing storyline was more of a joining-the-dots exercise. I found papers that told different parts of the story: the increasing prevalence of micro-plastics in our environment; the effects of chemical additives such as Bisphenol A, Phthalates and flame retardants on endocrine systems, foetal development and cancer risk; the hydrophobic properties of plastics leading to adsorption of extra toxins from the surrounding waters increasing the concentration; and the potential for

bioaccumulation through animal tissues, up the food chain. In an Erin Brockovich-like moment, I connected the dots all the way up to humans as top predators and made a phone call.

Jo: With this newfound knowledge pouring in, I realized that the film was quickly becoming more than just a documentary about plastics. It was about everyone. I began to search for ways to highlight the issue to a much wider audience, but needed to draw them in before covering the scary science. I decided that whales might serve us best to carry and open the film. Who can resist a Blue Whale? They tick all of the charisma boxes after all! And so, the documentary begins with Craig searching for blue whales in what was expected to be pristine ocean.

A long journey

Jo: It was an 8-year process from deciding to make the film to its release in January 2017 and much of the delay was due to the difficulty of raising funds. It took 2-years of fundraising and research before we even ventured out to the Indian Ocean for our Blue Whale shoot and that one was far from easy. ▶



Our vessel at the centre of the 'Great Pacific Garbage Patch' (© Joanna Ruxton)

► Three days into the shoot with nothing to show but a few topside shots, the Japanese Tsunami happened and, I can only assume, the whales detected something in the oceanic response to far-off movements of the vast tectonic plates and they left the area all together. Then in true natural history filming form, it all happened on the last day. Huge slicks of plastic waste floating on the surface allowed us to capture important footage for our film. Flights home loomed, so we started to head back to the port. As we dismantled the cameras and began to pack up, our cetacean biologist, Dr. Lindsay Porter, yelled from the flying bridge, “Whales—seven of them!” And, doing the boating equivalent of a handbrake turn, we steamed back and captured all the footage we needed in the last two hours of our two-week shoot.

Human connection

Jo: The toxin-related health story weaves throughout the film. We show animals in desperate situations and the underlying threat is obvious, but the effect on humans is harder to connect, simply because it is not possible to ‘experiment’ on humans with hazardous chemicals. The best we can say is that plastic carries

“ IT WAS CLEAR THAT PLASTIC WASN'T JUST ENTANGLING MARINE CREATURES, MICRO-PLASTICS WERE ENTERING THE MARINE FOOD CHAIN AT THE VERY LOWEST LEVEL—WHAT MIGHT THIS MEAN FOR TOP PREDATORS? ”

and leaches chemicals and, in the lab, these have been linked to critical disease in other mammals. However, for me the story that really brought this message home in a powerful way was filming on the Polynesian islands of Tuvalu. Even now when I watch that sequence, it is enough to make me well up.

Tuvalu is a tiny island archipelago in the South Pacific Ocean. Once part of Kiribati, it gained independence in the late 1970s. From that point onwards, the sustainable natural lifestyle of the inhabitants began to change. They began importing goods from Asia and whatever they imported came packaged in plastic. Over the years, the plastic waste began to take over the islands. The lagoon on the main island filled up with it and poisoned

the fish. Fish are no longer on the menu, but they are still fed to the pigs. Plastic is burned perpetually and even cooking stoves are started by melting plastic bags. The sickness we encountered within the family group we filmed was overwhelming.

The family comprised 30 people, of whom six had cancer and two had died of it in the previous 18 months. The kids were coughing all the time, but with so few toys to play with, many amused themselves by melting plastic in bonfires. Sadly, so many island nations are heading the same way.

I wish I could say that the remaining shoots were trouble-free and that funding was the only obstacle, but we were plagued by bad weather and rough seas throughout. Now, 10 years after it all began, we are proud of the result and quite overwhelmed at the reception the film has received throughout the world. It has picked up 15 awards and been described by Sir David Attenborough as ‘The most important film of our time’. It was the inspiration for including plastics in the *Blue Planet II* series and was available on Netflix in 60 countries with subtitles in 15 different languages. It can now be seen on Amazon, iTunes and via the film’s distribution website



The islands of Tuvalu. Since importing plastic, there has been a rise in the number of incidents of illness associated with the additives in plastic
(© Joanna Ruxton)



Tuvalu village where filming of the extended family took place
(© Joanna Ruxton)

www.aplasticocean.movie.

We continue to deliver our message through our global education programme, our work in sustainability and our support of scientific research.

Jessica: The time spent working on the film and the effect it has had on the public has highlighted to me the

importance of communicating environmental issues to a wider audience. I have continued my work on public engagement in plastics and sustainability for the Environment Agency, managing a team that works tirelessly to make plastic pollution a thing of the past. ♦

Note: Guidelines for boat traffic and interactions with whales were strictly adhered to at all times.

Joanna Ruxton, CEO, Plastic Oceans UK
 @joruxton @plasticoceans @plasticoceansuk
www.plasticoceans.uk

Jessica Hickie, Programme Manager, Plastics and Sustainability Team, Environment Agency
 @jessicahickie

Crew looking for blue whales
 (© Joanna Ruxton)



FURTHER READING

Plastic Oceans UK: www.plasticoceans.uk

The Environment Agency: www.gov.uk/government/organisations/environment-agency

A peer-reviewed document 'The Science Behind the Film' is available at plasticoceans.uk/programmes/science/the-science-behind-the-film/

Fact sheets and scientific papers are available at plasticoceans.uk/the-facts-plastic-pollution/fact-sheets-scientific-papers/

A trailer for the documentary is available on YouTube at www.youtube.com/watch?v=6zrn4-FfbXw

The film can currently be watched on Amazon, iTunes and via the film's distribution website www.aplasticocean.movie



One of the little girls from the Tuvalu village family
 (© Joanna Ruxton)



The
Geological
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THE UNIVERSITY of EDINBURGH
School of GeoSciences

The Geological Society Career and Industry Days 2019/20

Wednesday 6 November 2019

Venue: BGS, Keyworth, Nottingham, UK

Wednesday 4 December 2019

Venue: Our Dynamic Earth, Edinburgh, UK

Wednesday 19 February 2020

Venue: The Geological Society of London,
Burlington House, London, UK

[www.geolsoc.org.uk/Education-and-Careers/
Careers-Information/Careers-Days](http://www.geolsoc.org.uk/Education-and-Careers/Careers-Information/Careers-Days)

The Geological Society Career & Industry Day is an essential meeting place for geoscience students and the geoscience industry, and is the most recognised geoscience careers focused forum in the country.

The day will include short career and industry presentations covering different areas of geology and academia, and there will be an exhibition consisting of industry and professional bodies, and higher education institutions promoting MSc and PhD programmes. There will also be a CV and careers workshop running alongside the talks.

Registration

This event is free to attend but there are limited numbers so pre-booking is recommended. Delegates will be required to pre-register to receive a student manual, free packed lunch and free drink at the drinks reception.

Contact Information

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

T: 0207 434 9944

E: conference@geolsoc.org.uk

Follow these events on Twitter: #GSLcareers19
#GSLcareers20



Background Image: Stepping Stones © Nigel Bell

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AN END TO PLASTIC WRAP?

Dear Editor, I am becoming increasingly irritated by the constant use of 'single-use plastic bags' in the delivery of my *Geoscientist* and *Petroleum Geoscience* magazines. As an institute, I feel you should be leading the way and pioneering compostable packaging, instead of pandering to market forces and using plastic bags that go to landfill and may eventually find their way to pollute our oceans.

Single-use plastics are a bane on the environment and should be phased out immediately, and I expect the Geological Society to be leaders in showing the world how to be environmentally aware.

MICHAEL MCCULLOUGH

AN END TO PLASTIC WRAP? - REPLY

Dear Michael, Thank you for your letter. We share your frustration and concerns (as do many of our Fellows), and we whole-heartedly agree that the Geological Society of London should help lead the way in terms of environmental awareness.

We have been investigating alternatives to single-use plastic, including the possibility of using compostable plastic wrap for *Geoscientist* delivery for more than a year now. Sadly, the cost

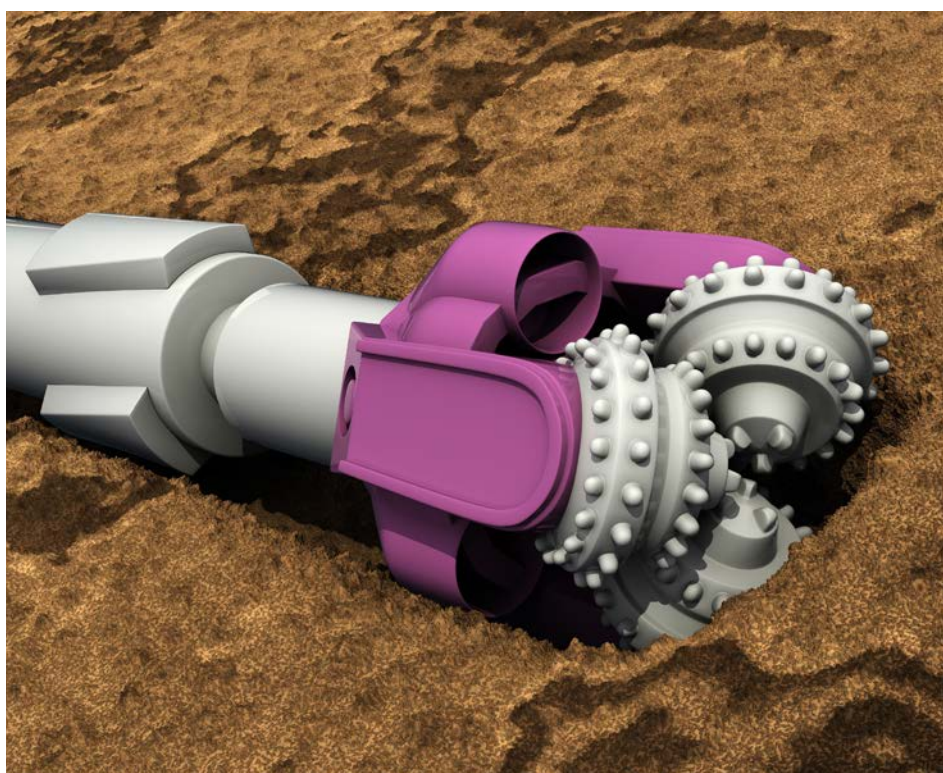
of this relatively new product (associated with the need for new materials and technologies in the automated wrapping process) has, to date, simply been prohibitive. However, we will refresh our publishing contract in the new year and aim to banish the offending plastic wrap.

AMY WHITCHURCH (EDITOR, *GEOSCIENTIST*)

Advancing deep geothermal

Dear Editor, John Beswick, Director of the Marriott Drilling Group, in his Soapbox article (De-risking UK geology. *Geoscientist* 29 (2), March 2019) questioned how we can de-risk UK geology for deep geothermal. He suggested that many geologists are faint hearted in their desire to sample the deep geology of the UK. Nothing could be further from the truth. The thirst for new data to ground truth indirect methods and models has never been greater; the problem is high drilling costs and unavailability of funding for such multi-million-pound boreholes. The main research funding body for Earth sciences research is the Natural Environment Research Council and they have competing demands, a research agenda based on science excellence and limited funding. As such, distribution of funding via a peer-review process is always going to leave a strategic proposal to confirm the stratigraphy at the starting gate. The UK Government has, over the last decades, also shied away from funding deep boreholes; the last being the geothermal boreholes at Marchwood, Southampton, Cleethorpes and Larne, drilled in the 1980s.

However, there may be a glimmer of hope for de-risking deep drilling for geothermal. If the UK Government were to introduce a

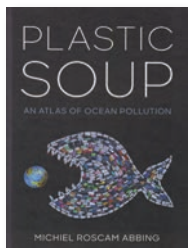


geothermal insurance scheme, as currently exists in many European countries, then many deep geothermal projects could get under way. The scheme would ensure that drilling risks (i.e. geological risks of less production than forecasted), which currently sit solely with the scheme owner/client, is underwritten by the government. If anyone

has any doubts about the effectiveness of such risk-sharing schemes, then just look to the Netherlands—they have seen a transformation in deep geothermal since the introduction of their government guarantee scheme in the mid 2000's.

JON BUSBY (FGS) & CORINNA ABESSER (FGS)

Plastic Soup: An Atlas of Ocean Pollution



The potential usefulness of plastics (synthetic materials derived from petrochemicals) was first shown over 150 years ago, when Alexander Parkes demonstrated Parkesine—an organic plastic made from cellulose that, when heated, becomes malleable—at the 1862 Great International Exhibition, London. In *Plastic Soup*, Abbing documents how plastics have since come to dominate our lives, their properties (lightweight, easily moulded, strong, waterproof) being revolutionary.

In this lavishly but disturbingly illustrated book, topics ranging from plastic production (“Plastic Fantastic”), through pollution, to legislative means of combatting challenges associated with plastics (“Turning The Tide”) are each described in two pages of text and pictures. The evenly-handed text documents both the benefits and problems (especially in the oceans) associated with plastics. Abbing notes how they barely react with other substances, giving myriad applications. Many traditional substances (glass, wool, cotton, earthenware, metals) have been replaced with plastics. At first glance, this has environmental benefits. Plastic production, for example, releases less greenhouse gases, and uses less water and energy, than does paper manufacture. Plastic-wrapped foods have longer shelf lives, while plastic-wrapped goods (recall the fun-filled bubble wrap) are protected during transport.

There are two classes of plastics: Thermosets like Bakelite become hard on cooling and are used in rigid products (e.g. electrical plugs, aircraft), while Thermoplastics like polyethylene (polythene) soften when heated and have the potential to be melted and re-shaped many times. However, the ease of plastics production and their low cost has led to many plastic products being seen as disposable, single-use items. Abbing tells us that 2.5 million plastic bottles are thrown away hourly in the USA alone, where each person disposes of about 85 kg of plastic annually. On average, a plastic bag is used for just 12 minutes.

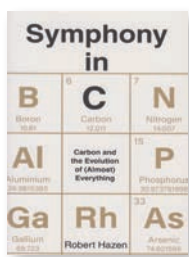
While plastics barely react chemically with other substances, once in the wider environment they are broken physically into ever smaller pieces, ranging down to nanoplastics < 0.1 μm in size. The 3% of plastic delivered to the seas has now formed a plastic soup so dense that there is an ocean-wide plastisphere. This is ingested by some organisms, traps others, smothers some shorelines, and provides a habitat for potentially toxic bacteria—factors that this reviewer notes to render challenging the geoscientists’ practice of using the present as the key to the past.

One wonders, how can geoscientists contribute their skills to combatting the problems from plastics? I recommend this book to those concerned about this issue, that they might help identify solutions.

Reviewed by: **Brent Wilson**

PLASTIC SOUP: AN ATLAS OF OCEAN POLLUTION by Michiel Roscam Abbing, 2019. Published (and translated from Dutch into English) by: Island Press, Center for Resource Economics, Washington, D.C., USA, 144 pp. ISBN-10: 1642830089, ISBN-13: 978-1642830088 List Price: £20.00 W: <https://islandpress.org/books/plastic-soup>

Symphony in C: Carbon and the Evolution of (Almost) Everything



At school we learnt that carbon is element 6 in the periodic table, has two allotropes, diamond and graphite (now more), is the base of organic chemistry, has many chemical combinations and molecular shapes and, as salts, such as carbonates, forms beautiful crystals. In truth, carbon is everywhere—in Earth’s core, the sea, atmosphere, materials and us. There is thus a much wider story concerning carbon and Robert Hazen in *Symphony in C* gives it. Hazen is a carbon scientist, currently the Executive Director of the Deep Carbon Observatory (DCO), which is a large global community dedicated to understanding the origins of carbon, its forms, movement and quantities inside Earth. So, who better

to tell this story?

Symphony in C enthusiastically discusses many of the topics in suitably grouped chapters. Hazen starts by introducing the DCO and how this book was motivated. Essentially, as he is a symphony musician (trumpet) his appreciation of musical compositions inspired him to write this book as a symphony, but in words not music. As with a musical symphony, *Symphony in C* has four movements (chapters). Movement I, ‘Earth’, begins with the ‘Big Bang’, (about 14 billion years ago) and how atoms of carbon were forged from smaller atomic bits. Then at 4.5 billion years ago, planet Earth formed. The chapter progresses to discussing rocks and minerals and the beauty of crystalline carbon compounds. Movement II, ‘Air’, examines first the origin of Earth and its atmosphere, then the whole carbon cycle, as carbon moves through Earth’s interior via the mantle, oceans, volcanoes and atmosphere, and finishes with climate change via carbon dioxide and methane. Movement III, ‘Fire’, shows how carbon pervades every aspect of our lives (stuff), including energy, polymers, rubber, glue, nanotubes, graphene, food, clothes and plastics, useful or otherwise. Finally, Movement IV, ‘Water’, explores how carbon is essential for the element of life, its origins and evolution (biological processes), and predicts (p245) that Earth will go on no matter what injuries we do to it. There is, though, much more.

Hazen has an enthusiastic approach in clear language. A recent sample of his style is his special public lecture, <https://www.geolsoc.org.uk/GSL-Special-Lecture-Feb>. He often makes his point through a human story by tying the topic to a particular research person. However, although the style is easy, appreciation of some of the content needs a science background. There is no index, but the notes give many sources.

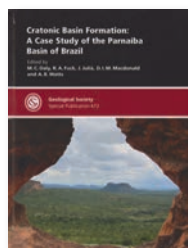
I enjoyed expanding my learning of the magnificence of carbon. *Symphony in C* could be a bedtime read, a passing of a long journey or otherwise a dip.

Reviewed by: **Richard Dawe**

SYMPHONY IN C: CARBON AND THE EVOLUTION OF (ALMOST) EVERYTHING by Robert Hazen, 2019. Published by: William Collins, London. 268pp. (hbk) ISBN: 9780008292386 List price: £20.00 W: www.harpercollins.co.uk



Cratonic Basin Formation: A Case Study of the Parnaíba Basin of Brazil



Cratonic basins are one of the great unsolved mysteries of global tectonics. Why do they form and what drives their subsidence? Cratonic basins have defied satisfactory explanation, despite covering about 10% of the world's land area and housing significant petroleum and mineral resources.

Cratonic basins have been extensively studied, but the data are often very specific. Deep information is scant, not least because basins of this type are characterized by thick lithosphere, but also because such data have not been considered commercially relevant.

Daly and colleagues tackle this problem head-on by assembling a consortium consisting of BP and several Brazilian and British universities, with the intention of dissecting Brazil's Parnaíba Basin systematically from top to bottom. The result is a collection of 20 papers with comprehensive coverage, including deep lithospheric imaging and modelling, sedimentary history and architecture, magmatic history and petroleum systems. All topics are skilfully woven together in a useful introduction by the editors.

Many of the papers make comparisons with other global cratonic basins in the search for common factors. It turns out there are many. Generally, the basins are geographically extensive, bowl-shaped, contain modest sedimentary thicknesses and seem to have formed and subsided in the Palaeozoic, during or just after continental consolidation. The relationship of these basins to supercontinent formation is a recurring theme; one I believe will be built upon in the coming years.

The modelling of Parnaíba and related basins provides insights into potential formation mechanisms, while leaving tantalizing loose threads. Basin evolution seems to mimic a classic thermal subsidence profile—yet there is little evidence of the preceding lithospheric

extension needed to start the process. Several basins show evidence of a dense, presumably magmatic body in the lower crust or upper mantle. Such a body could also trigger subsidence, but emplacement would have to just precede subsidence, and that doesn't usually seem to be the case. The circular shape and intracontinental position of cratonic basins points towards a mantle upwelling origin. Unfortunately, the corroborating evidence isn't there or the timing is wrong.

The Parnaíba Basin is highly magmatic, as documented in the volume by field evidence, seismic interpretation and some stunning magnetotelluric work. The main igneous pulses, of Early Jurassic and Early Cretaceous age, are interpreted as part of more widespread large igneous provinces. While these episodes post-dated basin formation, and thus cannot throw light on the underlying mechanism, they are highly interesting in their own right.

Cratonic basins are going to intrigue and confound us for a while yet, but this book is a substantial step in the right direction. Importantly, it also brings these somewhat neglected basins into the geological limelight. I don't think there is another collection remotely like this one. There are other works on specific cratonic basins, but none as generic, well-integrated and comprehensive.

Reviewed by: **Tony Doré**

(The full original version of this review appears online. *Editor*.)

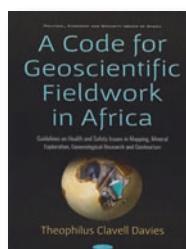
CRATONIC BASIN FORMATION: A CASE STUDY OF THE PARNAÍBA BASIN OF BRAZIL

by M. C. Daly, R. A. Fuck, J. Juliã, D. I. M. Macdonald & A. B. Watts (eds) 2018. Geological Society of London SP 472, 384 pp. ISBN: 9781786203960 (hbk.)

List price: £120.00 Fellow's price: £60.00

W: <https://www.geolsoc.org.uk/SP472>

A Code for Geoscientific Fieldwork in Africa



Fieldwork has always been an important part of a good geological education. For most in the UK, this has involved visits (usually in less than ideal weather) to the western islands of Scotland, the Lake

District, Pembrokeshire and South West England. But, in an age of cheap travel, more exotic locations can be planned.

Africa has long held fascination for those with a sense of adventure. So it is that Theo Davies has written a book not just for student field trips, but also to cover research and geotourism.

The book is laid out in a clear, logical fashion and covers very practical issues of safety and conduct in the field, as well as perils more specific to Africa such as travel, personal health and safety, accommodation and catering, insurance requirements, legal considerations and a section on ethical conditions and behaviour. Overall, the book is a useful guide to those planning a trip to Africa, especially with students.

The breadth of the topics addressed is over whelming and, sadly, this has led to variable levels of coverage. In some cases, important aspects are given scant comment, for example, road traffic accidents, whilst others such as the use of a compass, are given in pain-staking detail—quite unnecessary in the context of the book. Even then, the topic is not dealt with particularly well, illustrated only by a photograph of a standard Brunton compass-clinometer. This is a pity because most students in Africa will only have seen a Silva style compass-clinometer.

Other frustrating sections include one on drilling that really does provide much information, but is unlikely to form part of student fieldwork or geotourism. I found the case histories unhelpful, and the illustrations and photographs in the book are generally of poor quality. Hopefully, in a second edition the case histories can be removed and replaced with better illustrations, while more careful editing could remove the scattered spelling errors.

Overall, the volume is useful. I enjoyed reading the book and found it to be a novel and informative publication. Certainly a must for anyone who is likely to do fieldwork in Africa.

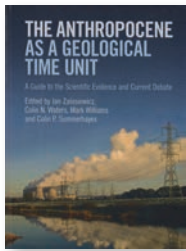
Reviewed by: **Rob Bowell**

A CODE FOR GEOSCIENTIFIC FIELDWORK IN NIGERIA AND AFRICA: GUIDELINES ON HEALTH AND SAFETY ISSUES IN MAPPING, MINERAL EXPLORATION, GEOECOLOGICAL RESEARCH AND GEOTOURISM

by Theophilus Clavell Davies 2018, Published by: Nova Science Publishers Inc., 305pp., ISBN: 978-1-53613-033-1 (hbk.) List price: List Price: \$230.00 W: <https://novapublishers.com/>

BOOKS & ARTS

The Anthropocene as a Geological Unit: A Guide to the Scientific Evidence and Current Debate



This is a book with a purpose, to inform the process of producing a formal proposal for the Anthropocene as a geological time unit. It is no easy read, but a detailed resource over the issues involved in the setting up of a geological unit that reflects our impact on the environment. Such a motivation is new in the context of the geological record, and it has been the subject of much debate across the natural and social sciences.

As a geological time unit, the Anthropocene would be a unit of Earth history, analogous to the Silurian, the Miocene or the Holocene, and not, for example, a diachronous unit of human cultural history, like the Iron Age or even the Renaissance. A key issue is how the beginning and end of such time units are best recognized, and fossils, and often mass extinctions, have been widely used. Should the onset of the Anthropocene therefore be based on the recognition of human impact, or on when sufficient change has taken place to warrant a new geological time unit? Ideally it needs to be global, and to be a time horizon, and it would be helpful to have a boundary that can be recognized in the field, and not just on the basis of some sophisticated laboratory measurement.

Most of the editors and authors are members of the Anthropocene Working Group, and the approach and the material discussed reflect their discussions and the journey this far. The book charts the history and development of the Anthropocene as a stratigraphic concept, and some of its stratigraphic signatures. The role of synthetic minerals and rocks, fly ash, plastics and refuse, mine wastes and the debris of war, metal pollution and changes in sedimentation rates, are discussed together with changes in chemostratigraphy in response to environmental and climate change, and those associated with species invasion and extinctions. Some appear more useful than others, but the discussion

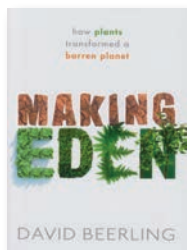
usefully highlights the nature of stratigraphic units in a contemporary context.

The figures are black and white, although some are then reproduced in colour plates in the centre of the book. Many are detailed, consistent with the tenor of the book, with the risk that they may be mostly studied by those who know what they are looking for. Nonetheless this is a welcome documentation of the details of the debate about whether the time is right to formulate a new geological time unit, what the term Anthropocene has meant to different communities, and how it might be best defined in materials that will survive in the geological record. It is a valuable resource for graduate students and researchers across scientific, social science and humanities disciplines, written by the group that has led the way to establish the Anthropocene as a stratigraphic geological time unit. Perhaps it should be on all our book shelves as we grapple with current and future environmental change.

Reviewed by: **Chris Hawkesworth**

THE ANTHROPOCENE AS A GEOLOGICAL UNIT: A GUIDE TO THE SCIENTIFIC EVIDENCE AND CURRENT DEBATE by Jan Zalasiewicz, Colin N. Waters, Mark Williams & Colin P. Summerhayes (eds) 2019. Published by: Cambridge University Press, 361 pp. (hbk) List Price: £44.95
W: <https://www.cambridge.org/>

Making Eden: How Plants Transformed a Barren Planet



Many readers will be aware of the popular 2012 BBC series *How To Grow A Planet*, which presented the natural history of plants, and their effects upon the planet, atmosphere, and ultimately human civilisation. Fewer will be aware that the three-part TV production was based upon *The Emerald Planet* (2007), the engaging previous book by David Beerling on this subject.

Twelve years after *The Emerald Planet* was released, comes *Making Eden*, the preface to which indicates that it “can be regarded as the prequel to [the] previous book... which actually had rather little to

say about how plant life on land got going and sustains the diversity of life there”. To fill in these details then, is the main purpose of *Making Eden*, and the focus is clearly shifted to the development and progression of early plant life. Relatively complex subjects within the field of planet genetics are presented in detail, yet in an accessible writing style that should appeal to non-specialists. However, be aware of the weighting towards early plant biology, and away from interactions with the lithosphere and atmosphere; for example, it is not until the penultimate chapter when the effects and feedbacks of trees upon climate are discussed. Readers who are more interested in these areas of research are better served by the previous book.

Making Eden highlights the problem of “plant blindness”, described by the author as the tendency for society to overlook and under-appreciate the presence and contribution of plant life within the natural system. We are reminded of the truly high value of plants from opening chapter “All flesh is grass”, which serves to amplify the dangers of species loss presented in the concluding chapter. It is sobering to learn that by the year 2100, at least 18% of plant species are projected to become extinct due to habitat depletion, a figure that would rise to an estimated 40% if high-diversity hotspots remain poorly-protected. Additional significant losses related to general climatic warming are predicted, and the likely pressures this will apply to society are unrelentingly described. These challenges will doubtless be familiar to the popular-science target audience, but that does not detract from the importance of the message.

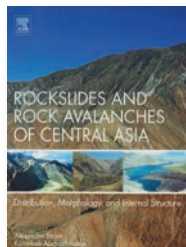
Thoroughly researched, content-heavy, and scattered with anecdotes and examples from Beerling’s own career, *Making Eden* overall probably does not achieve the ‘essential reading’ status of its predecessor, but nonetheless remains an informative and highly relevant read.

Reviewed by: **David Vaughan**

MAKING EDEN: HOW PLANTS TRANSFORMED A BARREN PLANET by David Beerling, 2019. Published by: Oxford University Press 272 pp. (hbk.) ISBN: 9780198798309. List price: £20.00 W: <https://global.oup.com/academic/product/making-eden-9780198798309>



Rockslides and Rock Avalanches of Central Asia



The mountain ranges of Central Asia, encompassing the Pamir, Tien Shan and Dzungaria have a fascinating history including events

that have shaped human civilisation from the Alexander the Great, the spread of Islam and the formation of new republics following the collapse of the Soviet Union. This richness of heritage extends to geology and, as is apparent from the new book by Strom and Adrakhmatov, rockslides (bedrock landslides) in particular. The book focuses on regions where previous research has primarily been published in Russian or Chinese and presents a summary of the region's large-scale, deep-seated landslides for readers in English.

Fifteen chapters are divided into three main sections. The first provides a history of landslide studies, an overview of the study region and discussion of landslide identification and classification. The second section, and main content of the book at around 200 pages, provides a detailed description of landslide scars and deposits ordered geographically. The final section presents an analysis of the landslide database, including morphological (e.g. fall height/run-out distance, H/L; runout vs volume) and sedimentological analysis, as well as consideration of emplacement mechanisms.

The book is highly informative and the authors' passion for the subject is clear. However, the main descriptive section is somewhat repetitive, and it is easy to become bogged down in the succession of landslide descriptions, many of which are rather similar. Landslide features are given geographical locations, morphological and geological descriptions, and are accompanied by a figure. These are normally a Google Earth 3D image. In the best cases these figures work well and show the features clearly. In other

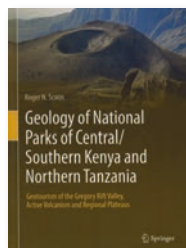
instances, lower resolution and varying colour schemes reduce clarity. Occasional use of digital elevation models breaks this pattern and is welcome, as are the photographs of features including rockslide dams, outcrops and trimlines. This main descriptive section would benefit from more regional maps showing the location of the myriad landslides described. Readers should be aware that the landslide database is only included with the online version.

These criticisms aside, the book will provide researchers and practitioners an extremely valuable resource of large, Central Asian landslides. Indeed, for those without access to Russian language literature, this reference may be the only available source for many of the features described within.

Reviewed by: **Matthew Owen**

ROCKSLIDES AND ROCK AVALANCHES OF CENTRAL ASIA by A. Strom & K. Adrakhmatov, 2018. Published by: Elsevier 458 pp. (hbk.) ISBN: 9780128032046 List Price: £138.00
W: www.elsevier.com/books/

Geology of National Parks of Central/Southern Kenya and Northern Tanzania



The East African Rift Valley contains some of the most stunning landscapes, mountains and, of course, active volcanoes, including the only known carbonatite volcanoes.

In this book, Scoon presents a description of the spectacular geology of this region and the national parks. With descriptions of the geological formations and characterization of this area, he provides an understanding of the interrelationship between the geology and the existing geomorphology, including glaciers, alkaline lakes and, of course, the magnificent wildlife of this unique part of Africa.

In all this, the author succeeds

extremely well. The volume provides the reader with a better understanding of the formation and modern management of the region, emphasising the importance of geology for sustaining the landscape, flora and fauna of this unique area.

The volume is extremely well illustrated, with excellent photographs and clear illustrative diagrams. As far as this reviewer can see, it is free of publishing errors or spelling mistakes. Anyone interested in East Africa, the geology of volcanoes, or the relationships between geology, geomorphology or wildlife should consider purchasing this volume.

Reviewed by: **Rob Bowell**

GEOLOGY OF NATIONAL PARKS OF CENTRAL/SOUTHERN KENYA AND NORTHERN TANZANIA: GEOTOURISM OF THE GREGORY RIFT VALLEY, ACTIVE VOLCANISM AND REGIONAL PLATEAUS by Roger Scoon, 2018. Published by: Springer, 221 pp., ISBN 978-3-319-73784-3, (hbk.) List Price: £34.99
W: <https://www.springer.com/>

BOOKS FOR REVIEW

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

- ◆ **NEW! The Rocking Book of Rocks**, by Amy Ball & Florence Bullough, Quarto Publishing 201995 pp. hbk.
- ◆ **NEW! Groundwater in Fractured Bedrock Environments: Managing Catchment and Subsurface Resources** by U. Offerdinger et al. (eds), Geological Society of London SP 479 2019, 250 pp. hbk
- ◆ **NEW! Mining in Zimbabwe: From the 6th to the 21st Centuries**, by Martin Prendergast & John Hollaway (eds), The Chamber of Mines of Zimbabwe 2019, 645 pp. hbk.
- ◆ **NEW! Paleozoic-Mesozoic Geology of South Island, New Zealand: Subduction-related Processes Adjacent to SE Gondwana**, by A.H.F. Robertson (ed), Geological Society Memoir No. 49 2019, 378 pp. hbk
- ◆ **Hydromagmatic Processes and Platinum-Group Element Deposits in Layered Intrusions**, by Alan Boudreau, Cambridge University Press 2019, 275 pp. hbk
- ◆ **Paleozoic Plays of NW Europe**, A.A. Monaghan et al. (eds), Geological Society of London SP 471 2019, 398 pp. hbk
- ◆ **Development of Volcanic Gas Reservoirs: The Theory, Key Technologies and Practice of Hydrocarbon Development**, by Qiquan Ran, Dong Ren & Yongjun Wang, Elsevier (Petroleum Industry Press, Gulf Professional Publishing) 2019, 1066 pp. Pbk.

Plastics in the hydrosphere

*Jessica Hickie and Fiona Tovey
report on an urgent problem
requiring global action*

Plastic pollution is recognised as one of the most serious problems facing our planet. Global production, use and ultimately disposal of plastics continues to soar, posing an increasing threat to our environment. There is an urgent need for global action, backed by sound scientific understanding. With these issues in mind, the Environment Agency convened a session at the European Geosciences Union (EGU) in April 2019 (<https://meetingorganizer.copernicus.org/EGU2019/session/30244>). The aim was to bring to the attention of some of the 16,000 scientists and policy makers in attendance, the need to focus more research on the impact of plastics on our land, rivers and oceans.

Research on plastic, until recently, has mostly centred on the marine environment, and this was reflected in the conference session, with the initial talks largely discussing the oceans. However, a key point that came from the session is the need to focus research upstream. As Jo Ruxton, a film director, put it “The ocean is the final casualty, but the rivers are like the arteries that feed it”. We must investigate the sources, pathways and effects of plastics on their journey to the sea. And we can’t approach the problem from a purely physical science perspective.

The plastics crisis is also a social problem and it is essential that geoscientists engage with those in various sectors, including social scientists, those working in industry, policy makers, campaigners and the public, to create positive behaviour change.

Six speakers—most of whom were not geoscientists—each brought a unique perspective to the session, and together helped to tell the whole story of plastics and us—a story that influences on a global scale.

Where is all the plastic?

The main problem with plastic is that it was designed not to disappear, which is why it breaks up and not down, and persists in the natural world as microplastics. As emphasised by Jo Ruxton, we know that plastic production is increasing. In the 1950s and 60s, we were producing less plastic globally than what enters the oceans now. So, where is it all going?

Dr Erik van Sebille (Utrecht University, Netherlands), an oceanographer and climate scientist, investigates the time scales and pathways of the global ocean circulation. He told us that plastic is now

found everywhere—in the water column, ocean floor, sediment and in organisms. However, currently we can only account for 1% of the plastic that we know is in our environment. So where is the missing 99%? Two pieces of plastic that start close together can end up hundreds of miles apart, so at some point you have no idea where the plastic has been.

Numerical models and simulations help us create maps to estimate how much plastic is floating around in the ocean, where it is floating and where it congregates. High concentrations are found in South East Asia, the Mediterranean and the mid-latitude areas called “garbage patches”. However, it is not enough to know where the plastic is; we need to know where the animals and interactions with plastic are.

By combining the maps of plastic distribution with those of where seabirds feed, we are able to identify the locations where seabirds are most at risk. And this turns out to be the Southern Ocean. The same approach can be used for other animals, such as turtles, where the risk of plastic ingestion is highest in their foraging locations, mostly relatively close to shore.

Erik emphasised that we need to “Be careful not to make plastic the enemy. If we



go too far then it can be detrimental to the environment.” That is, environmental risk stems not just from how *much* plastic there is, but from where it is distributed. Only by establishing this risk can we truly understand the ecological impacts.

Turning the tide

While research into plastic distribution continues, we should remember that the ‘plastic problem’ has only become a focus for the public relatively recently. Jo Ruxton began her journey into plastics following a career with the BBC, working with Sir David Attenborough on series such as *Blue Planet*. Jo noticed that they tended to film the beauty of the natural world and not the negatives, such as plastic pollution, and felt the need to show the world, through film, what impact our addiction to plastic was having on the oceans. Over eight years, Jo produced the multi-award-winning film, *A Plastic Ocean* (see page 10).

Jo talked about the challenge of finding funding for the film because, at the time, few people believed the topic would be of general interest. However, her passion drove her on and the film, which shows strong images of birds with stomachs full of plastics, as well as island nations devastated by single-use plastics, has had a major impact.

Jo is also now full of hope for the next generation, having witnessed inspirational changes in behaviour from children while visiting their schools.

Indeed, the tide has now turned. As Hugo Tagholm (Chief Executive of the charity Surfers Against Sewage) pointed out, of the seven hours of *Blue Planet II* documentary, only 14 minutes was dedicated to plastic pollution, yet this changed how government, industry, NGOs and individuals responded to plastics in a way that has never been seen before.

For example, Surfers Against Sewage mobilises over 75,000 beach clean volunteers annually and works closely with government and industry to reduce plastic pollution. Their most successful initiative, Plastic Free Communities, brings together businesses, the public and schools to tackle plastic pollution. Within two years of launch, there were 500 communities representing 30 million people, from Hackney in London to the Highlands in Scotland. The charity’s projects demonstrate how environmental issues can be tackled by individuals working together.

Personal connection

This intense public response to plastics is largely due to people being able to see and connect with the problem. As a poignant example of this, Lucy Siegle, an independent writer and journalist who specialises in communicating Earth science and telling environmental narratives, projected onto the conference screen a photograph of a shrink-wrapped coconut. The image of single-use plastic replacing a perfectly natural outer skin instantly highlighted our unnecessary and excessive use of this material. Lucy explained that “We have to have a diverse way of telling the story so people will connect”. People react to things differently because they have different cognition and cultural experiences or fears, so they express things in a very different way. That is, as scientists, we must socialise our science.

The importance of a personal connection was stressed by Hanli Prinsloo, founder of the I AM WATER foundation, which focuses on ocean conservation through human experience. The competitive free diver pushed the audience to connect with ocean health on a personal level by asking them to take several deep breaths together. In thinking about why we should care how well our oceans are doing, Hanli told us that more than 50% of oxygen in our atmosphere comes from the ocean, so at least every second breath we take is thanks to the ocean. And Hanli emphasised that it’s not just that our survival depends on the ocean. What would we be if we didn’t protect this great wilderness? What does it say about us as a species if we ►



► cannot take care of 70% of our planet? Our bodies are about 70% water, so there is a great connection!

Hanli feels that we are given the opportunity to share our environment with so many species, yet we are not being very good friends at this time: “It is not a human planet, it is a shared planet. It is arrogant to call us the custodians of it”. This sentiment was echoed by Hugo Tagholm: “We can’t knowingly carry on creating plastic whilst our animals carry on suffering and dying”. Hanli stressed the intelligence of the creatures we share this planet with, saying that if there’s one thing that makes humans unique, it is that we have choices and our choices matter. This blue is truly our last wilderness and there is so much left to fight for.

Addressing the scientific audience in front of her, Hanli urged us to communicate not just the facts and statistics, but the need to *care*. Only then will we see true behavioural change—a change for the oceans and the good of ourselves.

Giving plastic new life

Following intense media coverage, plastics are now firmly on the agenda. But, what’s next? The ‘plastics problem’ is not simply an environmental issue. As Ed Mitchell (Director of Environment & Sustainability at Pennon Group Plc. and Wastewater Operations Director at South West Water) put it, “We have a legal and moral responsibility to protect our environment. Society and the economy rely on it.” He reminded the audience that plastic is an incredible resource to be valued in a circular economy.

Ed told us that businesses are starting to see plastic as a resource, rather than waste, through innovation. By using recycled plastic, manufacturers can reduce the need to create virgin polymers from oil, saving CO₂ and energy. Substituting a tonne of virgin polypropylene (PP), such as that used in yoghurt pots, with recycled PP would save nearly 1,200kg of CO₂—equivalent to driving the material from London to Milan in a standard lorry.

Ed also explained Government’s influence in changing our approach to plastics. In 2018, the UK Government announced it is considering introducing a new tax on the production and import of plastic packaging with less than 30% recycled content. This creates an incentive for companies like the Pennon Group to invest in new recycling



The six inspirational speakers, from left to right: Ed Mitchell, Lucy Siegle, Jo Ruxton, Hanli Prinsloo, Hugo Tagholm and Erik van Sebille

infrastructure in the UK, therefore reducing the export of plastics.

The ‘plastics problem’ is caused by too much of the wrong waste in the wrong place. Ed feels that the focus needs to be on removing unnecessary and poorly designed packaging and products, alongside boosting investment in recycling.

Barrier or gateway?

Some have questioned whether the recent intense focus on plastics is drawing attention away from other important environmental issues, such as climate change. However, Lucy Siegle, who hosted a weekly segment on BBC1 dedicated to turning the tide on plastic, highlighted that plastic is also a very important touch stone for people who are not ready to talk about climate change, linked through carbon.

Carbon emissions from the plastics industry are vast and growing. Currently, 6% of global oil demand fuels plastic production, but by 2050 (as other parts of the economy decarbonise) plastics may well be responsible for 15% of all greenhouse gas emissions. So, the ‘plastics problem’ provides an opportunity to educate people on less obvious carbon footprints associated with human activity.

System change

The conference session was incredibly well attended—over 1,000 delegates witnessed the four-hour session. The speakers were inspirational and completely engaged an audience of geoscientists who perhaps had not considered playing a part in solving

the plastics crisis.

Dr David Todd at HR Wallingford commented, “It was incredible to see such a big venue at standing room only—an exceptional achievement—filled with some of the world’s leading geoscientists, who witnessed a set of incredible, inspiring, moving talks on plastic waste—what it is, what it means, and what we can do about it. Such brilliant speakers could not fail to move an audience to action.”

There is not an easy solution to the plastic crisis we have created. Many people and organisations are doing lots of great things, but to really make a difference requires system change. The whole industry must work together—from the creation of new materials and thinking about a product’s ‘end of life’ at the ‘beginning of life’, through to manufacturing, marketing, consumer disposal, collection, facilities, policies and legislation.

Geoscientists have an important role to play in this collaboration. In addition to carrying out research to fill in any gaps in understanding or evidence, we must also work with government and business to communicate our science in a way that all audiences understand. Only by working across disciplinary boundaries can we bring about sustainable change for the good of all life on Earth.

Jessica Hickie, Programme Manager for the Environment Agency’s Plastics and Sustainability Team

Fiona Tovey, Project Manager for the Environment Agency’s Plastics and Sustainability Team

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ENDORSED TRAINING/CPD AND EVENTS

MEETING	DATE	VENUE AND DETAILS
Early Career Network Micromine Course	3-4 Oct	Endorsed CPD Course Venue: Burlington House, London
Responsible Investment in Natural Resources	7-8 Oct	Conference Venue: Burlington House, London
A review of advances in shallow seismic investigation for managing ground risk	9 Oct	Evening Meeting, Lecture Venue: Fugro GeoServices Ltd, Wallingford, Oxfordshire
WMRG Oxford University Museum of Natural History trip	19 Oct	Museum visit Venue: Oxford University Museum of Natural History
Decoding Eurocode 7 – Ground investigation and testing course	21 Oct-7 Nov	Endorsed CPD Course Venue: Accessed online over 5 sessions of 1.5 hours
An introduction to rocks, minerals and fossils	24-27 Oct	Endorsed CPD Course, Field Trip Venue: Higham Hall College, Cumbria
Joint QRA / GLWG Field Meeting to Glen Clova and Strathmore, eastern Scotland	24 Oct	Conference Venue: Glen Clova and Strathmore
Salt Tectonics: Understanding Rocks that Flow	29-31 Oct	Conference Venue: Burlington House, London

STICKS AND STONES



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DISTANT THUNDER

Get the picture?

Geologist and science writer Nina Morgan hears of a formidable force in palaeobotany

Passionate about palaeobotany, and a pioneer in the study of coal geology, Marie Stopes [1880-1958] is best known to the public at large as a sex symbol for her enthusiastic promotion of birth control and best-selling books such as *Married Love*, first published in 1918. Blessed with a formidable intellect, as well as a flamboyant and determined nature, she was nothing if not controversial.

In 1902, at a time when few women attended universities, Stopes obtained a double honours degree in botany and geology from University College London (UCL) after just two years of study. She went on to become the first woman to obtain a PhD in botany from the Botanical Institute in Munich, where university rules had to be altered to allow her to graduate. In 1904, she was appointed Demonstrator in Palaeobotany at Manchester University, overcoming opposition from some in the Senate who opposed the idea of a young woman teaching men. In 1905, she became the youngest Doctor of Science in Britain, and in 1907 she travelled to Japan to spend two years carrying out palaeobotanical research. Along the way she prepared museum catalogues, participated in international discussions, went down coal mines and carried out pioneering work on Carboniferous calcite-rich concretions known as coal-balls.

Strong minded

In 1910, Stopes was elected a Fellow of UCL and, for the rest of her life, made regular appearances in the geology department. As a young Assistant Lecturer at UCL during the 1950s, Eric Robinson [born 1929] recalls how he was delegated to receive her when she visited the department because the then professor, Sydney Hollingworth [1899-1966], chose not to meet her. "It was the forceful aspects of her personality and



Marie Stopes (taken in 1904) [Author unknown; Public domain]

her strongly held views that were the problem", he explains. "She was an old lady by then, but very active. She used to come into the department, bringing copies of her publications. She had a running campaign with the press, and she didn't suffer fools lightly. Her life was marked by an uncompromising drive, and bruising personal contacts with people who were in the same fields of research, including superiors who often seem to have conceded for their own peace of mind and life."

Vanity fair?

In later life, Stopes also exhibited a streak of vanity. "She was a lady with a rather strong profile", Robinson remembers, "and when she was quite old, she had her portrait painted. It was designed to present her best face. I went off with Professor Hollingworth to look at the result, and we were joined by a professor at the Slade School of Fine Art at UCL. He judged the painting to be 'a bit thin'. His suggestion was to save the expense of getting it repainted, and just paint something else on top of the canvas".

Stopes, it turned out, had other ideas. Years later, when Robinson went into the main common room at UCL, he was surprised to find that "there was this portrait. Marie had had it repainted. Then I found out she had had five copies made and given to various institutions, including the University of Manchester and the Asiatic Society."

The portrait in question is probably the one Stopes commissioned from Sir Gerald Kelly [1879-1972] in 1953—just five years before her death—which depicts her against a black background wearing the flowing crimson and cream UCL academic robes. Kelly himself pronounced the portrait "strikingly like her", and it is now on display at the National Portrait Gallery in London. Stopes was apparently a great admirer of Kelly's work, which included portraits of Elizabeth, the Queen Mother, and King George VI among others. The feeling seems to have been mutual. Kelly described Stopes as the "most remarkable woman, whose fame will outlive so many". If Robinson's account is to be believed—that's certainly one way of putting it!

End notes: Sources for this vignette include Marie Stopes: passionate about palaeobotany by Hugh Falcon-Lang, *Geology Today*, 24/4, pp. 132-136; Back to the past by Eric Robinson, *Geology Today*, 24/6, p. 208; the 2004 DNB entry for Marie Stopes by Lesley A. Hall; and an interview with Eric Robinson recorded in July 2019. The portrait can be viewed at <https://www.npg.org.uk/collections/search/portrait/mw06069/Marie-Stopes>

* 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



It's a 10 from Len!

September 9th to 15th was national *Remember a Charity Week*—an important cause that encourages people to leave a gift in their Will to charity, after they've taken care of friends and family.

Thank you to all of our Fellows who got in touch to find out more about leaving a legacy gift to the Society. Your generous support will have a huge

impact on our future sustainability.

The poster-man of the *Remember a Charity Week* campaign was none other than *Strictly Come Dancing's* head judge, Len Goodman. After a busy week of promoting giving in Wills, here's Len putting his feet up with some good reading material!



Len Goodman (for Remember a Charity Week; www.rememberacharity.org.uk)



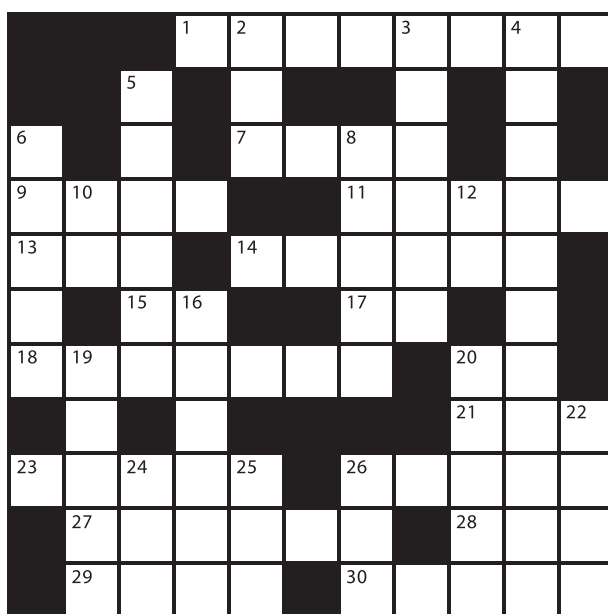
The Society notes with sadness the passing of:

- Almond, David*
- Bentley, Peter***
- Black, John Henry
- Buist, David Stuart**
- Chew, Kenneth ***
- Higginbottom, Ian**
- Lumsden, Alastair
- Marriott, Derek Leslie *
- McCann, David Michael
- Nutt, Michael John Crossley *
- Osmaston, Miles *
- Rocha, Rogerio *
- Simpson, Peter Robert *
- Talbot, Christopher J

In the interests of recording 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.

Crossword



Across

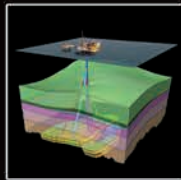
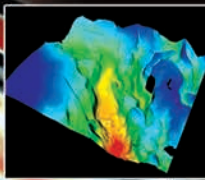
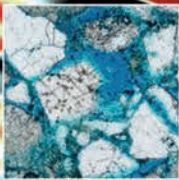
- 1 Beachwear for Atlantic islands? (8)
- 7 Chain of rocks at or near the surface (4)
- 9 How the Beatles got from Miami Beach (4)
- 11 Hindu ascetic (5)
- 13 Stumped, caught, bowled etc. (3)
- 14 Beachwear of a Pacific Island? (6)
- 15 An alien (2)
- 17 Where 16d might be undertaken (2)
- 18 Type of offshore 7ac (7)
- 20 Plural of 'I' (2)
- 21 Ernie, The Big Easy (3)
- 23 Marine invertebrate of the class Anthozoa (5)
- 26 '...water', structure dissipating the power of waves (5)
- 27 Water body within a 19d, for example (6)
- 28 Professional Golfers' Association (3)
- 29 German lyric song (4)
- 30 Flat-topped underwater mountain (5)

Down

- 2 To do this is human (3)
- 3 Not just (6)
- 4 1ac for example (11)
- 5 A hat to reach 1 or 14ac? (6)
- 6 Device devastating 14ac 19d (1-4)
- 8 Ridge of gravel, say (5)
- 10 Worldwide university founded in 1969 (2)
- 12 Point group of which the snowflake is number 6 (2)
- 16 Selection of casualties for treatment (6)
- 19 Oceanic structure lacking a central island (5)
- 20 Prone to tears (5)
- 22 Animal droppings (4)
- 24 Style of North African music (3)
- 25 Limit of Detection (3)
- 26 British National Grid (3)

By Bindweed

Solutions September | **Across:** 1/8 Mount 3 ridges 7 Mn 8 See 1 9 caoutchouc 11 GUI 12 kettle holes 15/27 erne 16 Munro 17 bears 20 sandar 21 Sweden 25 yellow rain 28/10 ice age **Down:** 1 Mac 2 Inuit 3/7 roche moutonnee 4 duomo 5 gnu 6 etc 7 See 3 10 See 28ac 12 kames 13 lead 14 erratic 17 BA 18 en 19 sr 20 snow 22 Wye 23 DL 24 EI 26 AI 27 See 15ac



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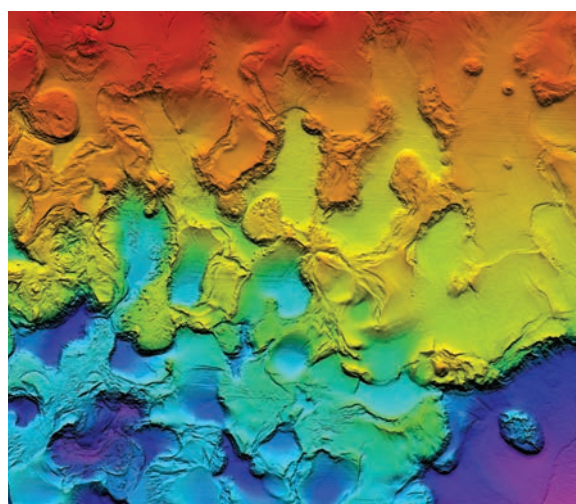
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- Analytical methods of interpreting salt in seismic data
- Physical and numerical modelling of salt tectonics
- Implications of salt tectonics for hydrocarbon exploration.

For further information please contact:

Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.
Tel: +44 (0)20 7434 9944



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OBITUARY**Herbert Basil Sutton Cooke (1915-2018)**

Herbert Basil Sutton Cooke, passed away peacefully on 3 May 2018 at 102 years of age. Born in Johannesburg on 17 October 1915, Basil was the last surviving member of a group of pioneering African palaeontologists, which included Robert Broom, Raymond Dart, John Robinson and Phillip Tobias in South Africa, as well as Louis Leakey in East Africa.

Educated at King Edward VII School, Johannesburg, Cambridge University (B.A. [Hons] Geology and M.A., 1936-1940), and the University of the Witwatersrand (M.Sc. and D.Sc., 1940-1947), he went on to teach at the University of the Witwatersrand from 1938-1947. From 1941-1945, he also served with the South African Air Force during the Second World War as observer and meteorologist, and held the rank of Captain.

In 1953, following a stint as a private Consulting Geologist, he returned to Witwatersrand University as a Senior Lecturer, and between 1958 and 1961 held the title of Reader in Stratigraphic Geology. In 1961 he moved to Halifax, Nova Scotia, Canada, where he was professor of Geology at Dalhousie University, holding the Carnegie Professorship from 1969 onwards and acting as Dean of the Faculty of Arts and Science for five years. He retired in 1981 and, together with his wife Dorette, moved to White Rock, British Columbia.

Research

Academic communities around the world knew Basil best as one of the pioneering African palaeontologists. He took a keen

A geoscientist of international repute with strong links to South Africa and the Quaternary Geology of the African continent



interest in Hominid Evolution and played a significant role in understanding the geology of the famous Sterkfontein Caves site (Maropeng). Although he was a geological 'all-rounder', his personal specialty was Quaternary Geology and he made notable contributions in a series of papers on the alluvial terraces of the lower Vaal River, famous for the Stone Age artefacts and vertebrate fossils revealed in pits excavated by scores of diamond diggers. He made major contributions working on fossil African pigs, as well as Hominin

environments in the East African Pliocene.

In later years, Basil was drawn into the work of the International Union for Quaternary Research where, as a member of their policy-setting body—the Commission on Stratigraphy—he made telling inputs, which led to the defining of the present geological boundary between the Pliocene and Pleistocene epochs.

Accolades

In 2018, Basil celebrated the 68th anniversary of his election, at an exceptionally

young age, to Fellowship of the Royal Society of South Africa. He was also a Fellow of the Geological Society of South Africa, an Honorary Member of the Palaeontological Society of Southern Africa, Past President and Member of both the South African Geographical and Archaeological societies, and a Past Vice-president of the South African Association for the Advancement of Science. In Canada, Basil was made an Honorary Member of the Nova Scotian Institute of Science and the Canadian Association for Physical Anthropology. He was awarded the Canadian Centennial Medal (1967) and Queen's Golden Jubilee Medal (2002) for his contributions to education.

His awards over the years have been many and varied, including an LL.D. *honoris causa* by Dalhousie University in 1982 and a D.Sc. *honoris causa* by his alma mater, the University of the Witwatersrand, in 1998.

Basil was predeceased by Dorette, his wife of more than 60 years. He leaves behind two sons, Christopher (Sharron) and Patrick (Phyllis), and three grandsons, Brandon, Christian, and Justin.

► By Carl R. Anhaeusser

(This obituary is modified from the original version by Carl R. Anhaeusser, reprinted with kind permission from the Geological Society of South Africa, *Geobulletin*, June 2018; The full original version of this piece appears on page 27 of the *GSSA Geobulletin*, June 2018 here: https://gssa.pub/gb/content/2018/gb_v61n2_june-2018_archive.pdf. Editor.)

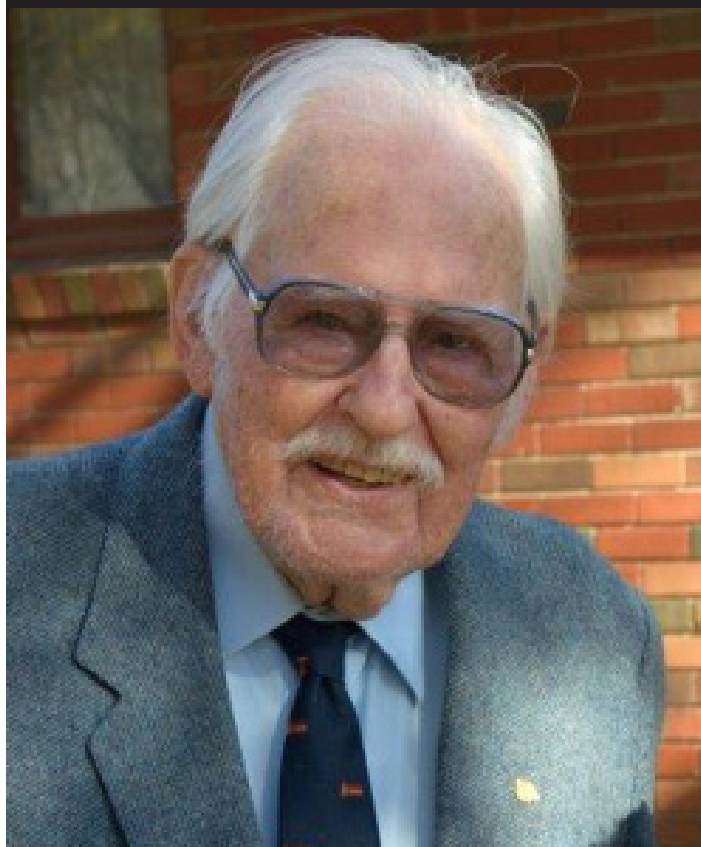
OBITUARY**Daniel Francis Merriam (1927-2017)**

Daniel (Dan) Francis Merriam, an American geologist best known as the 'Father of Mathematical Geology' for fostering the development of quantitative modelling in geology after the advent of digital computers, passed away on 26 April 2017 at the age of 90 in Lawrence, Kansas. He had been suffering for a few years with failing memory and was slowly declining into dementia.

Born in Nebraska to parents of Swedish ancestry, Dan was adopted, and raised by the Merriam family. After a varied early career which included distinguished service with the US Navy in the Pacific during WWII, Dan graduated in Geology at the University of Kansas and then spent two years with the Union Oil Company before joining the Kansas Geological Survey (KGS) in 1953.

Mathematical geology

The arrival of the first computer at the University of Kansas in the early 1960s sparked off his seminal work on computer applications in geology, further stimulated by a semester as Visiting Research Scientist at Stanford University and a year's Fulbright-Hayes Senior Fellowship at Leicester University. Recognising the enormous potential of computing, Dan's career and international profile leapt ahead.

Pioneer of mathematical geology and an authority on the geology of the mid-continental United States

Under Dan's management (1963-1971), the Research Section of the KGS emerged as the international leaders in quantitative studies in the Earth Sciences.

He is quite rightly known as the 'Father of Mathematical Geology' as he has long been associated with the development of the subject and probably did more to promote the growth and success of the field than any other person. He helped found the International Association for Mathematical Geology (IAMG) during the dramatic

events of the Prague Spring in 1968.

In 1971, he became the Jessie Page Heroy Professor of Geology at Syracuse University. Arising from Dan's increasing national and international involvement in a fast-growing field, Syracuse became recognised as a leading centre for quantitative studies in the geosciences. Dan moved to Wichita State University in 1981 to become Endowment Association Distinguished Professor of the Natural Sciences—a post he held

until 1991—and as Emeritus Professor after that. His career turned full circle when he became affiliated with the KGS in Lawrence, Kansas, firstly as Senior Research Scientist from 1991 to 1997, then as an Emeritus Scientist.

He published more than 300 books, scientific articles and notes mostly on the stratigraphy, structure, tectonic evolution and hydrocarbon potential of Kansas and the application of computational methods to the geosciences.

Honours

Dan Merriam was an international scientist of the highest repute and received countless honours and awards such as the IAMG's prestigious Krumbein Medal in 1981 and the Geological Society's William Smith Medal in 1992.

His memory lives on through his wife of 71 years, Annie Merriam, their children Beth Ann, John, Anita, James and Judith, 10 of his 12 grandchildren, three great-grandchildren, five of six half-sisters and one of three half-brothers, along with the numerous friends, colleagues and students.

He was truly an inspiration to those who walked in his light, and will be sorely missed by so many.

► By John Cubitt

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

HELP YOUR OBITUARIST The Society operates a scheme for Fellows to deposit biographical material. The object is to assist obituarists by providing contacts, dates and other information, and thus ensure that Fellows' lives are accorded appropriate and accurate commemoration. Please send your CV and a photograph to Sarah Day at the Society.

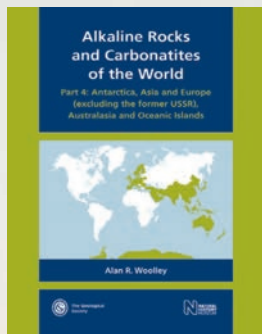


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