Climate change in the geological record

26-27 May

What the geological record tells us about our present and future climate

By reconstructing past climate changes, we can better understand the dynamics of the climate system and hence the range of impacts possible under current warming. This symposium will address key questions about past climate change and what those past changes tell us about the future.

Register and submit your abstract at: www.geolsoc.org.uk/05-GSL-Climate-Change

Read the scientific statement at: www.geolsoc.org.uk/climaterecord

(c) Ingrid Demaerschalk
Welcome to the first edition of the new-look, quarterly Geoscientist magazine. We’ve had great fun putting the issue together, working with our new publishers, James Pembroke Media, and we hope you find it stimulating and entertaining. This issue takes us from volcanic peaks in enigmatic North Korea (p. 22), to the Californian and Australian gold rushes of the 19th Century (p. 40). It also touches on the critical issues of diversity, equality and inclusion, with reports and opinion pieces that highlight the immense and persistent barriers faced by many, including Black (p. 30) and LBGTQ+ (p. 16) geoscientists, as well as outlining the actions we can all take to help remove these barriers and make our community more inclusive.

Geoscientist magazine will continue to serve as a welcoming and inclusive forum

It is no secret that diversity is an issue both within the geoscience community and in our Society. Change is slow, but the Society is taking steps to rectify this. For example, Council recently asked for an evaluation of the Society’s historical links to slavery and colonialism, and our Archivist, Caroline Lam, reports the findings on page 36. The research will be used to determine Society policies and we will ensure that updates are provided in the future.

All of the articles in this issue are available online, via our newly launched and mobile-device friendly website www.Geoscientist. Online. The site features additional content, including more in-depth reports and letters, as well as videos linked to our science features.

We appreciate that some readers are disappointed to lose the monthly print issues and question whether they’ll engage as much digitally (p. 19). This was a difficult decision for us to make and was, of course, partly motivated by the need to make financial savings. Likewise, tough choices have had to be made across the Society as we face a period of considerable uncertainty (p. 6).

But there are also positive motives behind the change. Many of you have written to us with questions about the sustainability of print, and some have chosen to opt out of print entirely, in favour of a digital offering. We want to communicate afresh in print and digitally and, in doing so, retire our outdated and poorly functioning website, which was unloved and rarely used.

At a time when both Fellowship and geoscience student numbers are in decline, it is essential to widen our reach, and we truly believe that by focusing our efforts on both print and digital, we can place Geoscientist magazine – a showcase for the activities of the Society and of geoscientists – into more hands. Those readers may be people who have not found us before, those who perceive the Society as elitist and outdated, or those who view the field of geoscience as simply dirty and polluting, rather than a key part of the journey towards net zero.

We hope that by providing a range of options for accessing content, we will reach a more diverse audience, and that Geoscientist magazine will continue to serve as a welcoming and inclusive forum for both long-term and new readers.

Our new print and online offerings are works in progress, and we would love to hear your thoughts and suggestions – you can get in touch with us at geoscientist@geolsoc.org.uk or via Twitter @geoscientistmag.
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Society’s Burlington House tenure remains uncertain

Steeply rising rent threatens our tenure at Burlington House. Two initiatives are underway to ensure a long, sustainable and relevant future for our Society, writes Richard Hughes, Executive Secretary

IN LATE JANUARY 2021 the President, Mike Daly, updated the Fellowship on behalf of Council on the situation regarding the Society’s future occupancy of Burlington House. Fellows will be aware that since then a public awareness and political engagement campaign has been underway in an effort to persuade Government to reconsider its position. In parallel, a project has also begun to look at potential alternative options for the Society, should it have to relocate.

A summary of the background to the situation is provided below. Further details are available at www.geolsoc.org.uk/burlingtonhouse.

The root cause of the uncertainty surrounding the Society’s future occupancy of Burlington House is unaffordability due to steeply rising rents. The Burlington House Learned Societies (the LS: the Geological Society, Royal Society of Chemistry, Royal Astronomical Society, Linnean Society, and the Society of Antiquaries) entered an arbitration process with the landlord in 2014-15, and since then several avenues have been pursued to secure our future at Burlington House on an affordable long-term basis. The avenues pursued by the LS include:

• Renegotiation of the current unsatisfactory lease and rent escalation formula;
• The pursuit of a political solution that might provide for a long lease with concessionary rent (as granted to the Royal Academy of Arts > 150 years ago); and
• The acquisition by the Society of a long lease or virtual freehold arrangement either through purchase or on the basis of a government grant reflecting the considerable societal value of the LS.

Communications with the landlord (the Ministry of Housing, Communities and Local Government, MHCLG) continue. However, an affordable solution that would allow the Society to remain at Burlington House for the long-term remains out of reach. Discussions have led only to the offer of a lease on the same terms as the current one, with a rate of rent increase fixed at 8% per annum for the first five years of the term. To illustrate the effects of an 8% annual rent increase, Burlington House-related costs in 2020 (excluding Covid impacts) total £570k, of which £217k is rent. Total costs are forecast to increase to £710k in 2025 and £900k in 2030, the rent components of which are £320k in 2025 and £470k in 2030.

The enquiry into the purchase of a long lease was rebuffed by the landlord, who saw ‘no scope’ for entering such discussions. It should be noted that on the basis of recent valuations the cost of a long lease for the Society’s premises with no rights to sub-let would be in the region of £17.6m. The landlord also ruled out payment ‘in kind’, that is through transfer title of collections.

The Geological Society is self-financing and a financially neutral outcome is forecast for 2021. An 8% or greater escalation of our already significant annual rent will turn neutrality into an escalating annual loss over the coming years. Despite the current rent being approximately 1/3 of the landlord’s targeted market rent levels, the large footprint (almost 14,000 sq. ft.) and substantial other facilities-related costs mean that our occupation accounts for almost 10% of the Society’s annual costs.

If you have a query relating to the lease, please email burlingtonhouse@geolsoc.org.uk
income. In addition, the Society forecasts falling revenues in the medium term due to a substantial Open Access-driven reduction in publishing income. Falling Fellowship numbers of between 1-3% per annum since 2017 are expected to continue, given the reduction in the national oil industry and falling numbers of students choosing to study Earth sciences. These challenges have forced the Society, for the first time, to reduce its staffing levels, in part through a redundancy programme, to achieve a neutral out-turn in 2021.

With no further realistic options available for negotiation with the landlord, Council discussed the situation in August 2020. Three conclusions were forthcoming from the discussion:

1. The escalating rents are an unsustainable burden on the Society’s finances, and continued residence at Burlington House threatens its future existence.
2. The time has come to face up to the long-standing lease issue, with us since 2005, and consider seriously the options for alternative premises and our relocation.
3. The Society should launch a final campaign to gain Government support to remain at Burlington House. Should Government be unwilling to re-consider their stance we would seek their assistance in supporting a move.

Council has directed the commencement of two initiatives. Firstly, a public awareness and political engagement campaign, managed by www.april6.com. The primary objective of this campaign is to influence Her Majesty’s Government to achieve an equitable outcome that extends the Society’s future at Burlington House on affordable rent terms and under a new lease that gives the Society freedom to pursue its strategic and business objectives. Secondly, a project to examine the Society’s options for relocation from Burlington House began in January, chaired by past-President David Shilston.

While many Fellows have a strong attachment to the building where the Society has enjoyed continuous occupation since 1874, a large number of Fellows feel little or no attachment to it. Whatever the outcome, the Fellowship can be assured that Council is committed to seeking the best possible solution to guarantee a long, sustainable and relevant future for our Society.

**MORE ONLINE**

Keep up-to-date with the latest news and discussion, and view additional geoscience-related reports, videos and more at [www.Geoscientist.Online](http://www.Geoscientist.Online)

**President’s Day Awards**

The Awards will be presented on President’s Day on 25 June 2021. It is likely that some restrictions will be in place in June, so we are planning a virtual event. Further updates on President’s Day will follow in newsletters and on the website, so please keep an eye out. On the day, talks will be given by some of the senior medallists, which Fellows will be able to attend virtually.

**RENEWALS REMINDER**

RICHARD HUGHES, Executive Secretary, writes: I would like to remind Fellows who have not yet done so to renew their Fellowship for the current year. Non-renewal may result in the discontinuation of your Fellowship with the subsequent inconvenience of having to then re-apply. Moreover, late payments result in additional costs and administration for the Society. To continue your support, please renew your Fellowship today, preferably online via the website. Note that you now have the option of a monthly or quarterly direct debit to spread your payments. If you wish to discuss any aspect of your renewal, please call the Fellowship Department.
Fellowship categories and benefits review project

An in-depth review of the current fellowship categories, fee structure, and membership benefits is underway, writes Richard Hughes, Executive Secretary.

Our current, largely age-based structure is complex compared to other learned societies/professional bodies, and seen by some as divisive and discriminatory. The Society needs a simpler, more appealing structure that enables it to more successfully attract and retain members from all parts of our community, especially underrepresented groups. Any new structure will need to be broadly cost-neutral so as not to adversely impact the Society’s overall financial position, and its important policy, outreach, education, communications and advocacy work on behalf of the profession.

Any new proposed fellowship categories, fees, and membership benefits will need the approval of the Society’s Professional & Chartership and Finance & Planning Committees before being considered by our governing Council in April 2021. Under the Society’s bye-laws, any proposals to change fees must also be approved at our Annual General Meeting, scheduled for late June 2021. Any changes will therefore not come into effect until the 2022 renewal cycle, which will start in the autumn of 2021.

Fellows’ views were sought in an online survey published in December 2020, and I am very grateful to those who took the time to respond. Further information will be made available before the Annual General Meeting.

Society Awards

The Society is delighted to announce the names of the winners of its medals and funds and offers all its wholehearted congratulations.

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<tr>
<th>NAME</th>
<th>AFFILIATION</th>
<th>AWARD</th>
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<tr>
<td>Prof David Pollard</td>
<td>Stanford University</td>
<td>Wollaston Medal</td>
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<tr>
<td>Prof Nicholas White</td>
<td>University of Cambridge</td>
<td>Lyell Medal</td>
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<td>Prof Graham Pearson</td>
<td>University of Alberta</td>
<td>Murchison Medal</td>
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<td>Dr Phil Christie</td>
<td>Schlumberger Cambridge Research</td>
<td>William Smith Medal</td>
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<td>Prof Sanjeev Gupta</td>
<td>Imperial College London</td>
<td>Prestwich Medal</td>
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<td>Prof Kenneth McCaffrey</td>
<td>University of Durham</td>
<td>Dewey Medal</td>
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<td>Prof Chris Jackson</td>
<td>Imperial College London</td>
<td>Coke Medal</td>
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<td>Dr Helen Reeves</td>
<td>Jacobs</td>
<td>Coke Medal</td>
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<td>Dr Sheila Peacock</td>
<td>Blacknest (AWE)</td>
<td>Distinguished Service Award</td>
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<td>Dr Anjana Khatwa</td>
<td>Wessex Museums, UK</td>
<td>R H Worth Medal</td>
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<td>Prof Marie Edmonds</td>
<td>University of Cambridge</td>
<td>Bigsby Medal</td>
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<td>Dr Caroline Gill</td>
<td>Shell U.K., Limited</td>
<td>Aberconway Medal</td>
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<td>Dr Emma Liu</td>
<td>University College London</td>
<td>Wollaston Fund</td>
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<td>Dr Luke Parry</td>
<td>University of Oxford</td>
<td>Lyell Fund</td>
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<td>Dr Andrew Thomson</td>
<td>University College London</td>
<td>Murchison Fund</td>
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<td>Dr Fabian Wadworth</td>
<td>University of Durham</td>
<td>William Smith Fund</td>
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<td>Dr Finnigan Illsley-Kemp</td>
<td>Victoria University of Wellington</td>
<td>President’s Award</td>
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<td>Dr Scarlett Jazmin</td>
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<td>President’s Award</td>
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Dr Malcolm Butler, Chair of the UK Onshore Geophysical Library, was awarded an OBE for services to education, research and development, and Dr Alison Monaghan, Principal Geologist at the British Geological Survey was awarded an MBE for services to geology. The Society offers both our sincere congratulations.

ELECTIONS TO COUNCIL 2021-2022

GEOSCIENTIST’S OCTOBER issue and subsequent email newsletters invited Fellows to nominate new members of Council to succeed those who will be retiring at the Annual General Meeting on 25 June 2021.

One nomination was received for the post of President Designate and a further 14 nominations for the seven remaining vacancies. The process for the election of members of Council is set out at section 6 of the Bye-laws and the process for the election of President is set out at section 7.

The preliminary ballot is in progress, the results of which will determine the list for the formal vote at this year’s Annual General Meeting on Friday 25 June 2021. As in past years, Civica Election Services (CES) is administering this year’s Council ballot on behalf of the Society. CES is the UK’s leading independent ballot services provider and has an extensive experience of overseeing ballots for a wide range of organisations.

In February, Fellows should have received an email from CES with instructions for how to vote online. If you have not heard to date, please check your spam emails before contacting the Society. Fellows for whom we do not have an email address will have received a postal ballot pack. If you have not heard from CES via email or post, or would prefer to receive a postal ballot pack, or have any other difficulties casting your vote, please contact Christina Marron (christina.marron@geolsoc.org.uk) at the Society.

The Council elections are your opportunity to choose who should serve on Council to best represent the interests of all Fellows and to shape the future of the Society. Fellows may wish to make their choices having regard to the area of expertise of the continuing and retiring members of Council that are shown on the tables on page 53. Their biographies are at www.geolsoc.org.uk/biographies. Council is particularly keen to strengthen representation from experienced academics.

It is important that Council is representative of the views and diversity of all the Fellowship, so Fellows are urged to participate in the preliminary ballot, which will determine the list for the formal vote at the Annual General Meeting. The closing date for voting, online or postal, is 23.59 on Wednesday 31 March 2021. Postal ballot forms must be sent to CES (not to the Society) and must arrive by Wednesday 31 March.

Graham Goffey, Treasurer, is retiring from Council and Keith Myers was co-opted by Council in April 2020 as Treasurer-designate. His nomination for election is endorsed by Council. See page 50 for supporting statements of the Council nominees.

Queen’s New Year Honours List 2021

Dr Malcolm Butler, Chair of the UK Onshore Geophysical Library, was awarded an OBE for services to education, research and development, and Dr Alison Monaghan, Principal Geologist at the British Geological Survey was awarded an MBE for services to geology. The Society offers both our sincere congratulations.
Launch of Earth Science, Systems and Society journal

In January, the Geological Society officially launched its first fully gold open access journal, *Earth Science, Systems and Society* (ES³), writes David Boyt, Head of Editorial Development.

**ES³ covers** the spectrum of Earth science, with a particular focus on interfacing, cross-disciplinary research related to sustainability in society. In addition to publishing high-calibre research, the journal aims to encourage inclusivity and diversity in publishing, engage directly with early career researchers, and embody principles of openness and transparency in science.

The journal’s Chief Editor, Dr Kathryn Goodenough (British Geological Survey; see ‘Five minutes with…’, page 54), heads an international Editorial Board of researchers and professionals representing a broad range of subject knowledge and experience.

Under the journal’s open access (OA) publishing model, all accepted articles will be subject to an article processing charge (APC), which supports the costs associated with publication. The Society has established ES³ as a not-for-profit publishing endeavour. Any surplus will be used to support a programme of discounts and waivers aimed at increasing access for those without funding. Standard APC discounts are available for Fellows of the Geological Society and authors from developing countries.

As the Society’s first fully OA journal, ES³ builds on the hybrid open-access options available via the Society’s existing journals and Special Publications to provide authors with a dedicated route to open-access publication, which aims to be compliant with mandates from the key funders and institutions, both now and in the future.

ES³ is owned and published by the Geological Society, using the systems and services of Frontiers Media.

- **ES³** is live online and welcomes submissions at www.EScubed.org
- Authors can also choose to submit work to one of the journal’s three live Special Issues, which include ‘Earth Sciences and the Race to Net Zero’.
- For any queries, please contact: david.boyt@geolsoc.org.uk

**Special Publications launched**

The Geological Society’s Publishing House is happy to announce the publication of two new books in early 2021:

*Celebrating 100 Years of Female Fellowship of the Geological Society: Discovering Forgotten Histories*

Due to be published in March 2021, this Special Publication celebrates the centenary of the first female Fellows elected to the Society – 112 years after its formation. It presents the often-untold stories of pioneering women geoscientists from across the world who navigated male-dominated academia and learned societies, and it uncovers important female role models in the history of science.


*Geoethics: Status and Future Perspectives*

This book is a significant step forward in the development of geoethical thinking, its theoretical foundations and practical applications. Geoethics is now ready to be introduced outside the geoscience community as a platform for global ethics, addressing anthropogenic changes and the responsible interaction between humans and the Earth system.

Available online at https://sp.lyellcollection.org/online-first/508 and via the Special Publications series from April.
2020 statement on climate change in the geological record

The Geological Society has published an updated scientific statement, writes Alicia Newton, Director of Science & Communications.

THE GEOLOGICAL SOCIETY published its first statement on the geological record of climate change in 2010, followed by an addendum in 2013. Because this is a fast-moving field of science, in 2018 the Society and the UK Paleoclimate Society jointly convened a panel of experts to review the Geological Society’s existing statements and to create a revised version that reflects the current state of scientific research. The resulting paper is published in the Journal of the Geological Society (Lear et al. (2020) J. Geol. Soc. 178(1): jgs2020-239; https://doi.org/10.1144/jgs2020-239).

As part of their process, the expert panel reviewed nearly 200 peer-reviewed publications, as well as white papers and international climate assessments. They also received questions raised by Fellows following the Society’s Annual General Meeting in 2019. This information was distilled into a comprehensive publication that documents four billion years of Earth history, and explores how previous episodes of greenhouse gas-induced warming can inform our understanding of Earth’s future.

A related conference will be held 26–27 May. Visit www.geolsoc.org.uk/05-GSL-Climate-Change for more information.

Mary Anning Rocks campaign

The Geological Society honours Mary Anning by supporting statue campaign

THE GEOLOGICAL Society has become an official supporter of the campaign to acknowledge the life and work of Mary Anning (1799 - 1847) through a statue to be erected in her honour on the Jurassic Coast. Aiming to commemorate Mary’s contribution and inspire future fossil-hunters with her unique story, this support is in line with the Society’s goal to promote Earth science education and awareness.

Mary Anning was a fossil hunter and collector, who made many incredible discoveries in her home town of Lyme Regis, becoming renowned throughout the scientific world in the early 19th century. Mary’s work was groundbreaking within palaeontology, however because Mary was a woman and from a working-class background, she didn’t receive the recognition she deserved during her life. Regrettably, Mary was never able to join the Society because women were not considered for Fellowship until 1919. However, the foundations to our science were laid by countless dedicated and passionate geologists, just like Mary, who deserve to be remembered and celebrated.

Mary Anning was a fossil enthusiast Evie Swire sparked the campaign when she asked her mother, ‘Why isn’t there a statue to Mary, Mummy?’

The Mary Anning Rocks campaign coordinator says, “We see the statue as an inspirational presence in the landscape where she worked.”

To find out more about the campaign, visit www.maryanningrocks.co.uk/

Visit our online exhibition: www.geolsoc.org.uk/Library-and-Information-Services/Exhibitions/Women-and-Geology/Mary-Anning

Download our KS3 factsheet: www.geolsoc.org.uk/~/media/shared/documents/education%20and%20careers/Resources/FactSheets/Mary%20Anning%20factsheet.pdf?la=en
The Discussion Group fosters wide-ranging scientific discussion in a social setting on a variety of geoscience topics. It has roots in the Geological Society Dining Club, which dates back to 1824, becoming a formal part of the Society as one of the Specialist Groups in 2016. Since 2018, a summary of the meetings has been available on the Society’s website, with topics ranging from masonry repairs, the critically stressed Earth, deep continental subduction, and how life began on Earth, to the future of the Society itself.

Traditionally, meetings take place in the evening at a range of venues in London, when a topical subject is raised by an invited speaker and debated over dinner. However, events in 2020 have been held with equal success by Zoom, without travelling and with a convivial glass of wine to hand from the comfort of your own home!

Meetings are open to all – Fellows, their guests and non-Fellows. To make a reservation, contact Becky.Goddard@geolsoc.org.uk

The programme for 2021, including talks related to the Society’s ‘Year of Space’ theme, includes:
- 14 Apr. Stac Fada impact deposit. Dr Ken Amor, University of Oxford
- 14 Jul. Summer outing. Gilbert White Museum, Selborne

Fellows are invited to join the Discussion Group as part of the annual membership renewal process. For more information, please contact John Bennett (Honorary Secretary) via the website: www.geolsoc.org.uk/Groups-and-Networks/Specialist-Groups/Geological-Society-Discussion-Group/

JOIN THE DEBATE
Has a news item got you thinking? We welcome readers’ letters and feedback. Share your views by emailing geoscientist@geolsoc.org.uk

PARTNERSHIP WITH THE JP MORGAN FORCE FOR GOOD PROGRAMME
Building a community platform to connect geoscience educators and practitioners

We recently announced that the Geological Society is launching the Geoscience Education and Outreach Network (GEON), an online platform for sharing education initiatives and discussion across the geoscience community. We are thrilled to have been chosen as a recipient of the prestigious JP Morgan Force for Good programme. Through the programme, JP Morgan will provide pro bono technical support to develop the online platform. GEON will represent a significant opportunity to increase collaboration and best practice across the geoscience community. The ultimate aim will be to inspire a skilled and diverse community of future geoscientists. To find out more and register your interest, please get in touch: GEON@geolsoc.org.uk
Conferences & Events

GSL EVENTS

Plastics in the Environment
15 March 2021
Reg open
https://www.geolsoc.org.uk/plastics2021

GSL Training – Geohazards
March – June
Registration open
https://www.geolsoc.org.uk/CPD-Geohazards-events-2021

Public Lectures
March – June
https://www.geolsoc.org.uk/Events/Public-lectures-2021

ENERGY GROUP EVENTS:

Geopressure 2021: Managing Uncertainty in Geopressure by Integrating Geoscience and Engineering
23-26 March 2021
https://www.geolsoc.org.uk/03-rescheduled-pg-geopressure-2021

Core Values: the Role of Core in 21st Century Reservoir Characterisation
3-7 May 2021
https://www.geolsoc.org.uk/05-rescheduled-pg-core-values-2021

New Learning From Exploration and Development in the UKCS Atlantic Margin
19-21 May 2021
https://www.geolsoc.org.uk/05-rescheduled-pg-atlantic-margins-2021

For more information, please contact conference@geolsoc.org.uk

Image: Laminated sandstones on Gullane beach © Milena Farajewicz
23-25 NOVEMBER 2021
BUSINESS DESIGN CENTRE LONDON
petex.pesgb.org.uk | #PETEX2021
The Shift to a low/neutral carbon economy, which is essential to tackle climate change, is now a pressing international effort. November 2021 marks the UK-co-hosted United Nations Climate Change summit (COP26), which is expected to drive new international agreements for decarbonisation.

Geosciences will play a pivotal role in enabling the increasingly urgent energy transition. Earth resource stewardship will also be critical to the development of circular economies, reducing waste and environmental impact, driving innovation, and supporting business. Geological solutions will underpin responsible resource and waste management, new innovative technologies for both storage (H and He) and capture (CO₂, radioactive waste), and geothermal energy production. Geological knowledge will allow the sourcing of essential raw materials, in particular critical metal resources, to support new technologies in energy storage and transmission, transportation, construction, and engineering.

Geoscientists are therefore uniquely placed to support policy makers, stakeholders and industry in the management of Earth resources that are fundamental to the energy transition. The Society’s Energy Transition Theme will champion this goal, support communication between academia, business, government and public communities, and aim to inspire a new generation of geoscientists.

Energy Transition Theme events and activities

A number of events and activities are planned for 2021-22, to support and align with the Energy Transition Theme.

2021 Webinar Series:
- 13 April (13.00-16.30) Geosciences and the Energy Transition: How can the Geosciences contribute to the Energy Transition?
- 7-8 June (13.00-16.30) Geosciences and the Energy Transition: Energy Transfer, Injection and Storage
- 6-7 September (provisional) Geosciences and the Energy Transition: Mineral Supplies on a Finite Planet

These seminars are being coordinated by Prof. Jon Glayas (Durham University), Prof. Stuart Haszeldine OBE (University of Edinburgh), Prof. Rob Knipe (University of Leeds), Dr David Reiner (University of Cambridge), Prof. Frances Wall (University of Exeter), Jo Coleman OBE (Shell), Dr Nick Gardiner (University of St Andrews and Theme Leader), Dr Jen Roberts (University of Strathclyde) and Prof. Mike Stephenson (British Geological Survey).

Hydrogen Storage in Caverns Meeting (12 April 2021, virtual event)

This meeting is being organised in collaboration with Energy Research Accelerator. If you would like to contribute, participate or help shape how the event might proceed, please email Seamus.Garvey@nottingham.ac.uk or mhste@bgs.ac.uk with the title ‘About Hydrogen storage in caverns meeting’. For more information visit: www.geolsoc.org.uk/Hydrogen-Storage-in-Caverns

Energy Transition Discussion Meeting (April 2022)

A multi-day conference in Burlington House, London, in April 2022 will bring together geoscientists, the energy transition communities, and policymakers, with an aim of assessing the on-going directions and priority roles for the geosciences in the energy transition, following the COP26 meeting.

Decarbonisation Working Group

The Decarbonisation Working Group, chaired by Prof. Mike Stephenson, continues to work on key issues at the interface of geoscience and public policy, developing resources and initiatives to highlight and communicate key enabling decarbonisation technologies to policymakers and the wider public. More information about their work can be found at www.geolsoc.org.uk/Policy-and-Media/issues/decarbonisation/working-group

Special issue of ES3: Earth Sciences and the Race to Net Zero

The Geological Society’s new OA journal, Earth Science, Systems and Society (ES3, see page 10) will publish a special issue on the theme of Earth Sciences and the Race to Net Zero. Submissions are welcomed on all aspects of this topic: www.escubed.org/research-topics/2/earth-sciences-and-the-race-to-net-zero

In addition, a number of outreach events will be planned throughout 2021 and 2022 aligned with the theme. Further information can be found at www.geolsoc.org.uk/ET and www.geolsoc.org.uk/events
“Some barriers are invisible”

Fieldwork is important, but we must recognise the manifest risk it poses to LGBTQ+ people, argues Prof. Chris Jackson

As the old saying goes, “the best geologist has seen the most rocks!” This statement superficially makes sense; if you’ve seen many rocks, you can draw on those experiences to... erm... identify and interpret more rocks. But geoscientists rely on numerous skills to determine the structure, composition, and evolution of Earth and other planets – skills that span a bewildering range of disciplines and scales.

Fieldwork is undoubtedly important and is a core element of many Earth science courses. There are, however, numerous barriers to fieldwork. Some are obvious, such as those related to coping with the sheer physicality of fieldwork. Many more are less obvious, such as the requirement for safe conditions under which to change sanitary protection. And some barriers are perhaps invisible, such as sexual orientation and gender identity.

Why might sexual orientation be a barrier to fieldwork? Queer people are as able to deal with cold weather and boulder-strewn slopes as non-queer people, aren’t they? I’m not questioning this, but rather highlighting that there are still about 70 countries where being gay, lesbian, bisexual, and/or transgender is illegal, and many more with minimal protections against discrimination towards LGBTQ+ people. This is nothing to do with having sex; this discrimination exists simply for being (or perceived as being) a member of the LGBTQ+ community.

For example, in 2014 a British tourist was arrested in Morocco after authorities searched his phone and found images used to prosecute him, while the arrest, torture, exile to Canada, and eventual suicide in 2020 of activist Sarah Hegazi was triggered by her waving a rainbow flag in Egypt. The stress felt by LGBTQ+ people in these locations is not conducive to teaching and learning, presenting further barriers. Holding field courses in such countries presents an unnecessary risk. In most cases, other suitable field locations exist that support attainment of the learning objectives. We must select such alternatives to promote an inclusive learning environment, to the benefit of an individual course and the wider community that our graduates will join. Deciding not to hold a field course in a location that is unsafe for LGBTQ+ geoscientists is not a political or value statement on a country or its citizens. We have a duty of care to our colleagues and students. Additionally, universities or staff in the field may not be able to immediately assist or repatriate employees or students who run into trouble overseas. Such restrictions highlight the fact that many institutions do not have field-course risk assessments explicitly covering LGBTQ+-specific risks; even where such assessments and related evacuation policies are in place, they remain untested.

Like many geoscientists, I do not see a future where fieldwork is not a core element of the geoscience toolkit. However, we must be aware of and work to remove the barriers to fieldwork placed in front of all members of the geoscience community.

Prof. Chris Jackson
Chair in Sustainable Geoscience, University of Manchester
Reverse the decline

DEAR EDITORS,

Geology’s popularity is in decline for many reasons. A big one is that, as a community, we have allowed it to become widely regarded as just the study of some dusty old rocks. Geologists know it is far more than that – it is Earth Science. Another reason is the name change to Earth sciences or geoscience – this only creates confusion and dilutes our message. The Geological Society urgently needs to be more proactive in encouraging extra mural courses and spreading the word.

Clearly, we must embrace diversity and inclusivity, while eliminating racism, but we cannot give in to those clamouring to remove traditional fieldwork requirements. It should be crystal clear why it is ridiculous to think the personal experience gained through fieldwork is not absolutely essential, and it worries me that anyone could think they can become a real ‘geologist’ without it.

Virtual field trips are great for inclusivity, but I am concerned that these will largely become point-and-see exercises that do not instil sound recording techniques or stimulate the kind of mind that seeks out answers.

Safety and inclusivity in the field are vital, but difficult issues. Thankfully many classic localities already have suitable access and it wouldn’t take much work to improve many more field locations. Some sites even offer for hire off-road mobility scooters. Would the Geological Society be interested in helping to set up a database of such places and help raise funding to improve matters?

True geologists are like forensic detectives. They must think across disciplines to understand the complexities of Earth’s natural processes and its many human-made problems. The combination of a less outdoorsy generation and geology’s toxic association with destructive and polluting extractive industries are major barriers to be overcome if geology’s popularity is to be improved. With so little coverage of accurate geology in the media, and little or no specific mention of the term geology in schools, is it any wonder that many are unaware of the tremendous opportunity geology offers for employment, intellectual challenge and personal fulfilment, as well as its key role in locating essential resources and helping Earth’s environment?

A hard task lies ahead, but we must hurry to fully convince the public that first-class geologists are, and always will be, absolutely vital.

RICHARD ARTHUR

George Jameson, Diversity and Inclusion Project Lead, Geological Society of London, writes in response: The Society is acutely aware of the decline in the popularity of geology over recent years. This is most noticeable in the drop in student numbers applying for and studying geology at undergraduate level, something we are genuinely concerned by.

Ideally, we want every person to be familiar with geology as an area of study and aware of the applications of geology to our everyday lives. However, this ideal is nuanced. There are old-fashioned perceptions of what geology is and what geologists do, as you rightly point out, especially around geology’s association with the extractive industries.

This complex problem is not one the Society can fix alone. We are therefore partnering with a number of other organisations and stakeholders to widen the appeal of geology. Two notable organisations are:

• University Geoscience UK, the subject association of geoscience departments based within British universities. We co-organised the June 2020 student enrolment summit, which led to the development of a strategy and a plan of action is currently being pursued to increase interest.

• Diversity in Geoscience UK, a recently established charity looking at ways to improve diversity and inclusion for all within the community. They are currently assessing potential projects and fundraising opportunities, and we can work together with them to improve access to field locations throughout the country.

Our goals may not be realised overnight, but they will go some way to dusting off the perception of geology as just the study of old rocks. Given the gravity of the situation, it is essential for the community to address this task together and we welcome additional support.

To anyone who wishes to continue this conversation, please get in touch by emailing diversity@geolsoc.org.uk
Geology (and all its incredible subfields) is an amazing science to learn. The integral importance of geoscience and the minerals industry to global economies should make it a strong choice for developing future careers. So, why does it not attract more Black students and why are there so few Black geoscientists and corporate leaders?

The scarcity of Black geoscientists is not a function of Black students finding geoscience and careers in the minerals industry uninteresting, it is a function of over 40 years of white geoscientists and corporate leaders happily content with the status quo.

Even though most of us, who are white, have rarely met Black geoscience students, professors, geoscientists and corporate leaders, we have rarely voiced concern, and mostly accepted the lack of diversity as something normal.

It should not have taken the horrific murder of George Floyd to create the unprecedented global change in corporate attitudes. But the minerals industry, to a large extent, has stood silent. Silence is a form of complicity, and the minerals industry gives the impression that it does not care. Why? Because it does not understand nor feel connected to the Black community and its predominantly white boardrooms are an echo chamber insulating them from reality. This should shame us all.

The industry’s Black underrepresentation starts with the education system that has not yet stepped up to changing its predominantly white complexion. This is a major global issue, especially in primarily white countries where colonial attitudes and systemic racism are still ingrained, and where Black underrepresentation is not seen as an issue.

It is time for us to do more than speak up. We must go beyond wearing t-shirts, using hashtags and glossy Corporate Social Responsibility reports. We need to take action to create truly diverse and welcoming workplaces in academia and the minerals industry. This will not happen overnight, but we can make a start through open dialogue on inclusivity, equity, and breaking down barriers. We need to create intern programmes, more scholarships and bursaries, and mentorship and outreach programmes to attract Black high-school students into geoscience. We need to encourage them to continue in academic research and work in the minerals industry. How can we do this? By creating a paradigm shift in culture and attitude, celebrating Black role models, recognising Black student’s abilities and achievements, encouraging them to become leaders, accepting them for who they are, and nurturing their desires to succeed.

• This opinion piece links to the feature ‘Waiting for a paradigm shift: Black underrepresentation in geoscience and the minerals Industry’, available at www.Geoscientist.Online
• See also feature, page 30.

Visit Geoscientist.Online to read the latest discussions in full.

Dr Andrew P.G. Abraham
An independent consultant who serves as volunteer Director External Engagement for the Canadian Federation of Earth Sciences
Quarterly dismay

DEAR EDITORS,

We write, as a former President, Professional Secretary, Editor-in-Chief and Editor of Geoscientist, to express our sadness and dismay that this fine magazine is to become a quarterly, with promises of an enhanced online presence.

You attempt to put a brave face on it, but beyond that – and some questionable greenwash – we detect two real motives: saving money, and stifling dissent. In the right circumstances in these straitened times, we approve of reduction of real expenditure. We are sure that the new quarterly will be a thing of beauty; but quarterlies cannot be topical. High production values and long intervals lead to blandness and inconsequentiality. One knows there will never be anything piquant in these organs – even in Letters, assuming there are any.

So where will Fellows, in the last resort, go to voice any objections to the way Trustees and staff or others are mishandling the Society’s business? They will go online, we are told. Result! For where is the danger in that? The power of print is that ‘it comes to you’, so you read it. Online letters, as now, hide in plain sight, free for all the world to read if they can be bothered – and cynically put there in the full knowledge that nobody will. They will go as unread in future as they do now, and for the same reason – one that no amount of web design can ever overcome.

PROF. EMER. PETER STYLES, DR TED NIELD

DEAR EDITORS,

I am saddened to hear the society is reducing the number of magazine issues per year. From my perspective, all this will mean is that I engage less with the magazine and the Society, as I already receive a torrent of digital communications and offerings – getting the print magazine cuts through this and means I actually read it.

A move towards digital provision will result in less of my attention, I’m afraid.

CHRIS JACK

> Prof. Andy Fleet, Editor-in-Chief; David Shilston, Deputy Editor-in-Chief; Dr Amy Whitchurch, Editor; Sarah Day, Editor, Geoscientist magazine, write in response: In making changes to Geoscientist, we are trying to provide the best service to the full spectrum of Fellows that we can, given the resources available to us, and improve how we provide news and debate in exciting, varied and timely ways.

As Peter and Ted highlight, money was a key factor in making the changes. Like all Society activities, Geoscientist has to be affordable, particularly in these difficult times, and staff were tasked with finding ways to become more sustainable. The editorial team drew up a variety of options for the production of Geoscientist. These detailed options were assessed by the Finance and Planning Committee and agreed by Council, which decided on enhanced online presence and quarterly publication. This decision reflected both costs and the best use of the time of the editors and others producing Geoscientist.

Peter and Ted forcefully argue that having letters initially and immediately online will ‘hide objections and dissent’ in plain sight’. This may be true for some cohorts of Fellows, but others will doubtless be far more at home finding or expressing views online. We hope that putting more resources into timely online news and debate will serve a broad range of the Fellowship and help attract new Fellows.

Geoscientist continues to be ‘by and for the Fellows’ and, as ever, we encourage our community to voice any concerns and share their opinions – email your letters to geoscientist@geolsoc.org.uk. Indeed, our problems are usually that we do not hear from all sides of a debate, especially those who agree rather than dissent, and in hearing a variety of views rather than the same argument repeated.

Dare we end by saying that we have published a fuller response on Geoscientist Online?
DEAR EDITORS,
I read Melvyn Giles’ article about The Scottish Geology Trust (Geoscientist 30(10), 28-29, 2020) with great sympathy for the cause – that public interest in dramatic Scottish landscapes is not matched by investment in our geoparks.

There is a perception that the public is unwilling to engage with lengthy explanations. TV documentaries often open with sequences on plate tectonics, floods or icecaps, before rapidly giving way to the urge to feed public interest in animal behaviour. Many film directors seem to believe the physical world is merely a setting for the organisms that inhabit it.

Would education help increase public awareness and thereby funding of geoparks? In pre-university science, geology is incorporated as a minor component, though perhaps too fleetingly to impress young minds. We should instead exploit the geography curriculum, but here the window might be closing – even geomorphology may be fighting a rear-guard action to preserve its long-standing space as relative newcomers such as climate change and environmental despoliation crowd out the time available.

PROF. EMERITUS, IAN REID

DEAR EDITORS,
I am most concerned by recent articles citing the decline in the teaching of geology, its adverse impact on the profession which, in my view, is to the detriment of society.

A geological degree gives one a wonderful start to a career. In my school, geology was not taught, but it seemed an obvious degree choice, given it combined the subjects I studied at A Level: physics, chemistry, botany and zoology. I went on to enjoy a career in civil engineering, not in geotechnics, but as a maritime civil engineer.

Geology as a subject has developed and continues to do so. It has much to contribute to our future, including tackling major issues like climate change and geohazards. The profession has always changed as it moved forward, not only for the few, but for the many. Indeed, the comment from the Editor’s desk in the October issue that “Geology has a way of capturing the imagination, whatever level of detailed understanding you reach” should be exploited to its full potential.

The profession must reach out beyond the known world of geology and be more proactive. Perhaps the slogan for universities should be ‘Kick Start your Career with a Geology Degree’, reinforcing the view that geology is a broad church.

DR ROGER MADDRELL
Dear Editors,

To my delight the Société Géologique de France sent me their geologically themed face coverings (€5 each or €15 for all four, and around €3 postage to the UK). Designed for non-medical use they can be worn for four hours and are machine washable at 60° C.

Designs include a pair of cream on black illustrations of the ammonite laevigatus (James Sowerby) from southern England.

David Nowell

Dear Editors,

With respect to your editorial piece in October’s issue (Geoscientist 30(9), October 2020), what is a geologist anyway? You’ve met the requirements to be a Fellow of our Society, so I think you are. I did my first degree at Cambridge, in Natural Sciences, which is also modular. Earth science was 1/4 of the first year, 2/3 of the second year, and full time only in the last year (this adds up to a little less than two years). But my last year contained no palaeontology whatsoever (my choice) and I concluded correctly that I could avoid answering any exam questions about sandstone.

The chemistry, physics and maths that took up the rest of the teaching time have been very useful in a commercial career as a hydrogeologist, before broadening out into the contaminated land aspects of nuclear decommissioning, and even some of the finer points of reactor dismantling.

Being able to communicate is a rare skill too, something that my English master at school stressed.

So I’d recommend a broad first degree – you don’t know at that stage where your career might take you.

John Heathcote
A dormant volcano, Mount Paektu, marks the frontier between North Korea and China. James Hammond, Amy Donovan and Clive Oppenheimer discuss how a unique collaboration is providing insights into this enigmatic, restless giant.
MOUNT PAEKTU (known as Changbaishan in China) was responsible for one of the largest eruptions in history, known as the Millennium Eruption. This cataclysm, dated through a combination of radiocarbon and ice core evidence to late 946 CE, likely formed the 5-km-wide caldera that truncates the summit of the volcano. Enclosed below this rampart lie the tranquil waters of Chonji (Tianchi in Chinese), or ‘Heaven Lake’.

This landscape is not only testament to dramatic volcanic events, it is, for Koreans, a place of great mythological significance. And, particularly for those living north of the Korean Demilitarized Zone, it is the ‘sacred mountain of the revolution’. Visitors to Pyongyang will see it depicted in giant murals in the subway, at grand monuments, and as the background behind TV newscasters.

An episode of volcanic unrest between 2002 and 2005 (see box, ‘Volcanic Unrest’) reignited scientific interest in the volcano, not to mention the attention of government administrations, on both sides of the international border, concerned with the possibility of renewed activity. Additionally, Mount Paektu defies our conventional ideas that explain where volcanoes exist – it lies more than a thousand kilometres from the Pacific Plate boundary. Geoscientists from the Democratic People’s Republic of Korea (DPRK) have largely worked in isolation from the international community, but thanks in part to Mount Paektu’s emblematic cultural, scientific and political status, we have been able to initiate and build a unique collaboration involving geologists and seismologists from the UK, US, China and the DPRK.

**Science and diplomacy**

Our key scientific aims are to understand the origins, geological history and underlying structure of the volcano. The particular situation demands an approach that combines science and diplomacy in order to navigate the complexities and constraints of the regional and international geopolitics. Our collaboration has led to several achievements: the deployment of the first array of broadband seismometers in the DPRK; the first cross-border geophysical study; and secure dating of the Millennium Eruption, whose age was previously only known imprecisely. These achievements demonstrate that geoscience collaboration can be successful and durable even under circumstances and impositions of severe political strain.

Our work continues, with new projects including a Covid-19-delayed installation of a larger seismic network in the DPRK to complement China-led deployments across the border. An aim of this study is to understand the origins of the volcano, but the project is also an opportunity to investigate the volcanic history of the region beyond Mount Paektu. To facilitate management of this survey and build a platform for wider geoscience and environmental research in the DPRK, we have established the Mount Paektu Research Centre (MPRC) at Birkbeck, University of London. Through this, we hope to use our networks and experience to assist other teams interested in initiating research with DPRK scientists.

**Mount Paektu**

Mount Paektu is an intraplate volcano whose origins are enigmatic. The volcano is situated around 1,000 km north–west of the Japan Trench, and it belongs to a wider collection of volcanic centres on the Korean Peninsula and north-east China (Fig.1).

These volcanoes are most commonly associated with the subducted Pacific Plate that has stalled at the base of the upper mantle. The so-called ‘big mantle wedge’ model proposes that water released at these depths drives mantle circulation and subsequent generation of partial melt. However, lower mantle upwellings or shallow processes have also been proposed.
to explain volcanism in this part of northeast Asia. What is clear is that the region has a relatively long history of volcanism, with Mount Paektu representing the latest of a series of volcanoes constructed over the last 20 million years. Early volcanism in the region is linked to the opening of the East/Japan Sea, with extensive basalt eruptions across the region.

Following the cessation of rifting around 15 Ma, alkali basalt volcanism intensified and focused into the wider Paektu/Changbaishan region. Since 4.5 Ma, volcanism at Paektu/Changbaishan has largely gone through three stages, from basaltic eruptions forming a shield-like plateau to more silicic magmas (with some intermediate products) forming large volcanic centres with the most recent stage being dominated by explosive silicic eruptions, but with some small basaltic eruptions continuing throughout.

A remarkable feature of the landscape of Mount Paektu on the DPRK-side of the border is its tundra-like appearance. Above the treeline, there are expanses of pumice that accumulated during the Millennium Eruption. Subfossil larch and pine trees, killed by the paroxysm in 946 CE, poke out of the pyroclastic deposits.

VOLCANIC UNREST

In 2002, the volcano observatories in DPRK and China recorded increased seismicity, along with ground deformation and changes in volcanic gas emissions (Fig. 3). Earthquake event rates increased by two orders of magnitude with hypocentres located in the shallow crust. Modelling of ground deformation suggested a source of inflation at 2-6 km depth beneath the summit. Increases in helium and hydrogen abundances in hydrothermal discharge rose sharply in 2003 and remained elevated. These were accompanied by an increase in the proportion of primordial helium, interpreted as a signature of magmatic contribution. In China, the alert level was raised and there was considerable public anxiety. Despite a return to baseline activity in 2005, operational surveillance of Mount Paektu continues and it remains a focus of volcanic risk assessment and management in both China and DPRK.
either side of the road leading up to the summit, which is a site of pilgrimage for North Koreans (Fig. 2). Historical texts and reports have been interpreted to indicate that the volcano erupted subsequently, in 1668, 1702 and 1903 CE, but these suggested episodes have not been clearly corroborated by the geological record.

International collaboration
In the summer of 2011, DPRK scientists extended an invitation (via a journalist with the American Association for the Advancement of Science (AAAS) and an NGO, the Environmental Education Media Project, both based in Beijing), for volcanologists to visit DPRK to discuss monitoring of Mount Paektu. Two of us (CO and JH) responded, and travelled to Pyongyang in September 2011. We were told that we were the first western scientists to visit the volcano observatories. Our hosts gave us an overview of their monitoring efforts, as well as a digest of past observations and the results of many summer field campaigns. We also enjoyed geological excursions on and around Mount Paektu that gave us a feel for the scale of the Millennium Eruption and the stratigraphy of its deposits. From this encounter, a day of presentations and many intense discussions emerged a set of critical questions concerning Mount Paektu (see box, ‘Mount Paektu: Critical Questions’).

With the enthusiasm of our new colleagues from Pyongyang to connect with the wider volcanological community, and the immense cultural significance of the volcano, we came to recognise an extraordinary opportunity for engagement with the DPRK in the domain of geoscience. A cornerstone of our approach would be dialogue and joint elaboration of the scientific research agenda. Accordingly, we sought and obtained the support of the AAAS, the Richard Lounsbery Foundation, and the Royal Society of London. All three organisations take an interest in science diplomacy. We also secured the loan of a set of broadband seismometers by SEIS-UK, one of three nodes of the Natural Environment Research Council’s Geophysical Equipment Facility.

Since 2011, the Korean Peninsula has experienced considerable geopolitical flux. There have been changes in leadership of almost all countries in the region, multiple nuclear and missile tests, an increase in Republic of Korea–US military exercises and numerous summit meetings between leaders of the DPRK, the US, Republic of Korea and China, among others. This dynamic situation has been accompanied by policy shifts and tightening of international sanctions imposed on the DPRK.

A joined-up approach
Working with the Royal Society of London and the AAAS provided channels to communicate our aims and objectives to relevant departments in the UK and US government administrations. Additionally, partnering with the Environmental Education Media Project in Beijing and the Pyongyang International Information New Technology and Economy Centre based in the DPRK capital enabled communication with colleagues in the Korean Earthquake Bureau, the State Academy of Sciences, and universities in Pyongyang. After a year and a half of discussion and negotiation, we obtained the export licenses necessary to bring the seismic equipment into the DPRK and to conduct field campaigns. These took place in the consecutive summers of 2013, 2014 and 2015. On the last of these missions, we decommissioned the seismic array and arranged for the return of the seismometers to the UK. We also brought the renowned film director Werner Herzog along with a film crew into the country for production of the 2016 Netflix film Into The Inferno.

With new projects underway, we continue to negotiate changing sanctions frameworks, and even to influence policy. For example, in 2016, new sanctions were imposed by the United Nations that stated ‘all Member States shall suspend scientific cooperation involving persons or groups officially sponsored by the DPRK’. This implied that our research should cease. However, through discussions with the Foreign, Commonwealth and Development Office in London, we obtained exemptions from the United Nations, which allowed our project to continue. This emphasises a critical dimension to our practice of science diplomacy – the necessity to test and proactively respond to evolving regulatory frameworks in the service of scientific knowledge production.

We believe our approach and multi-actor engagement, with its cornerstone of a jointly agreed scientific agenda, underpins the durability and success of our collaboration. The DPRK continues to encourage international collaboration in environmental and other matters; a key aim of the MPRC is to share our experience with others who may be interested in scientific engagement with the country.

Lessons learnt
The field campaigns from 2013 to 2015 allowed us to collect two years of digital seismograms (now publicly available on the Incorporated Research Institutions for Seismology database; www.iris.edu) and more than 100 geological samples of Millennium Eruption tephra, as well as older pyroclastic rocks and lavas.

The seismic survey was designed to image the magmatic system beneath the volcano. Initially, we performed this using the DPRK data alone – work led by Ri Kyong-Song from the Earthquake Administration in Pyongyang during research visits to the UK. However, we recognised our interpretations were susceptible to spatial bias →
Photo of Mount Paektu/Changbaishan taken from the International Space Station.

Image credit: NASA/JSC
the international border cuts right across the summit caldera of Mount Paektu and thus we only had observations from one segment of the volcano. More recently, thanks to a data-sharing agreement between MPRC and the China Earthquake Administration, we have carried out a wider survey. This yielded evidence for an extensive trans-crustal magmatic system with different storage regions throughout the crust that extends some 20 km laterally from the volcano.

Analysis of the geological samples has led to new work on the volatile budget of the Millennium Eruption and on the pre-eruptive storage conditions of the magma. This indicates that the comenditic magma was relatively shallow and cool, and that its eruption may have been triggered by an injection of trachytic melt from depth. Petrological work in progress further suggests a critical role played by a more mafic melt in the eruption, and is illuminating the magma mixing processes that occurred. Combined, the seismic and petrological data are allowing us to develop, test and refine a conceptual model of the magmatic system (Fig. 4).

**Dating the Millennium Eruption**

A further highlight of the project has been to date the Millennium Eruption precisely. Previously, many groups had used radiocarbon and varve dating to calculate the age of this colossal event. These estimates spanned at least the 10th century (Fig. 5), with the most precise dates pointing to eruption sometime between the 920s and 950s CE. These were based on ‘wiggle matching’, where 14C measurements made for multiple rings from an individual sample are matched to an international calibration curve (that is largely anchored in time by dendrochronology).

However, the discovery that an intense burst of cosmic radiation occurred in 774 CE (probably a solar proton event, whose magnitude would wreak havoc as ‘space weather’ today), suggested a means to date the eruption to the year. Colleagues at the China Earthquake Administration had collected a larch tree stem that was 264 years old when it was killed by pyroclastic flows during the Millennium Eruption. We realised it likely was alive at the time of the 774 event, and that annual-resolution radiocarbon measurements of the rings should indicate an anomaly due to the excess production of 14C in the atmosphere during the cosmic ray burst. We struck lucky and, by counting rings to the bark, determined the tree was killed after the end of the growing season in 946 CE, but before the growing season of the following year. Inspection of a Greenland ice core record of sulfur and chlorine deposition enabled us to refine the dating. Miniscule ash particles from the Millennium Eruption had already been identified in the core along with the associated sulfate aerosol fallout. The timing of this anomaly in relation to the seasonal pattern of sea-salt deposition recorded in the ice narrowed the eruption window down to the last months of 946 CE.

With this information to hand, two historical texts now stood out, corroborating the date. The first is from the Koryŏsa (history of the Koryŏ dynasty), and relates to the year 946 CE:

> “That year the sky rumbled and cried out, there was an amnesty.”

This was clearly a remarkable and unusual event to have been recorded and is suggestive of the explosive detonations associated with the eruption that were likely audible over a range of 1,000 km or more. The second text is from the Heungboksas

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scientists from the DPRK, China, Republic of Korea, UK, US and the EU. In 2021 we intend to run workshops on disaster risk reduction to develop understanding of the risks associated with geological hazards in DPRK. Geological hazards do not suddenly dissipate at international borders. While this presents numerous challenges for operational monitoring, hazard and risk assessment and fundamental research, our project demonstrates that international dimensions to geohazard assessments, and in this case geo-heritage, create a new space for collaboration. Robust evaluations of geohazards and effective management of their associated risks is in everyone’s interest – this requires a joined-up and interdisciplinary approach that pools scientific resources between countries.

Figure 5: Left, radiocarbon (blue) and varve-based (yellow) age estimates for the Millennium Eruption. Red line indicates 946 CE. Right, Cross-section of sampled trunk showing selected ring numbers. Ring 172 contains evidence of the solar proton event dating Ring 1 to 946 CE. (Figure modified from Oppenheimer et al. (2017) Quat. Sci. Rev. 158, 164-171; https://doi.org/10.1016/j.quascirev.2016.12.024. Published under CC-BY licence)

The urgency of understanding geohazards and risks presents opportunities for engagement in the face of severe intergovernmental strain, as well as a chance to build trust and understanding, and to test local and international regulations so that future, more sensitive projects can benefit and serve populations – even in some of the most politically sensitive corners of the Earth.

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Further Reading
A full list of further reading is available at geoscientist.online


Temple History (Nara, Japan) and is particularly interesting as it may exactly pinpoint the date of the eruption:

"White ash fell gently like snow.” [on 3 November, 946 CE]

Millennium Eruption ash has been identified in cores taken from the bed of Lake Suigetsu, not far from Nara, which is not so close to the active volcanoes of Japan. Nor are any eruptions of Japanese volcanoes recorded at this time. It is entirely conceivable that this simple entry records the fallout from the Millennium Eruption – allowing for around 24 hours for the ash cloud to be transported above Nara, the eruption may have taken place on 2 November, 946 CE.
WHERE ARE THE BLACK GEOSCIENTISTS?

Black geoscientists exist in the UK – the first #BlackInGeoscienceWeek campaign showed it. Munira Raji and Hendratta Ali ask why Black geoscientists are less visible in the geoscience community and workforce, and discuss grassroots initiatives that aim to confront this invisibility.

Published data that document the exact number of Black geoscientists in the UK geoscience workforce are scarce. We therefore have to rely on our own personal experiences, communications and interactions to educate and address the difficulties that Black geoscientists encounter.

The high visibility of a few might wrongly give the impression that numerous Black geoscientists are employed in the discipline. Our experiences suggest otherwise. Of more than 50 UK-based Black geoscience graduates in one network, less than 10% of them are currently employed as geoscientists, two of whom are the only Black geoscience professors in the entire UK. Instead, many UK-trained Black geoscientists are either unemployed or working at jobs unrelated to their geoscience training and professional credentials.

Access to the profession
Low employment numbers begin with and are exacerbated by limited recruitment into the pipeline and a lack of opportunity for trained Black (and other minoritised) geoscientists. Exposure in secondary schools is low, retention at university level is poor, and access to resources during postgraduate research is limited. Highly skilled Black geoscientists are also under-employed in the workforce, leading to involuntary attrition. As a consequence, many Black students and scholars do not see the geosciences as a viable career pathway.

We, Black geoscientists, want this trend to change. To increase visibility and showcase the expertise of Black geoscientists, we organised a grassroots initiative on social media, #BlackInGeoscienceWeek, to connect and celebrate Black geoscientists across the globe. Organised in Summer 2020, this event was inspired by the #BlackInXWeeks online initiative that started after the #BlackBirdersWeek, which highlighted Black nature enthusiasts following the Central Park bird-watching incident in New York City. During this incident, a confrontation between a Black man and white woman walking an unleashed dog led to the woman telling the police an African American man was threatening her life.

Later, during the #BlackInGeoscienceWeek we attracted close to seven million Twitter engagements, with participation from Antarctica to Oceania. During this event, Black geoscientists, including many from the UK, sought to amplify their voices, showcase their work, and create
a community network of mentors and collaborators. An important aspiration was to find and connect with other Black geoscientists.

**Underrepresentation**

Recent studies confirm that the representation of Black geoscientists, in communities outside the continent of Africa, is low. For example, Bernard and Cooperdock (2018) show that over the past 40 years, there has been little change in the ethnic and racial diversity of people earning geoscience doctorates in the US. Similarly, a lack of representation exists in the UK. Dowey and colleagues (2020) report that over the past five years only 1.4% of postgraduate geology researchers were Black people, compared to 3.8% of 18-to-24-year-olds in the general population. Dowey and colleagues also report poor retention rates of Black geoscientists in postgraduate studies. They indicate that the enrolment of Black, Asian, Mixed or other Ethnicities (BAME) in undergraduate and postgraduate geology was 10.1% and 10.4%, respectively, for the 2018 to 2019 academic year.

Underrepresentation persists, despite promises from institutions and organisations to implement strategies that improve recruitment and retention in all sectors, from education to research and employment. The Black geoscience community has not experienced any substantial change, at least, not for the better. Black geoscientists are still under-employed in academia, industry and other geoscience organisations. They constantly face harassment and discrimination — microaggressions, bullying and racism — and their professional research and technical expertise are often undervalued or dismissed. Many of these harrowing experiences are documented with the #BlackInTheIvory hashtag on Twitter. These negative experiences lead to attrition and further increase underrepresentation. Our geoscience community must pivot in the right direction toward equity and inclusion for all.

**The power of inclusion**

If inclusion is resolved, diversity will increase. Many geoscience institutions and organisations monitor the diversity of their members and fellows, have diversity committees, and publicly comment about their commitment to diversity, equality and inclusion (DEI). This has to translate to something concrete for Black and other marginalised geoscientists, such as improved experiences in the scientific community. Diversity data and public declarations of commitment to DEI are a good start; however, by themselves, they do not solve the underlying problems that lead to underrepresentation in geoscience. Being one of the most exclusive communities suggests a fundamental flaw in our approach to diversity. In addition to public statements, organisations and institutions must actively ensure that their plans are implemented by a leadership and workforce that is truly diverse. We must shift our focus from performing diversity to enacting inclusive change.

Black and other marginalised geoscientists are as passionate about their discipline as any other group. They too, want to inspire and encourage the next generation of geoscientists and create a vibrant community that is representative.
Pass on something wonderful!

For further information, please contact Jenny Boland, Head of Development on +44 (0)20 7434 9944 or email jenny.boland@geolsoc.org.uk

The Geological Society of London is a registered charity, number: 210161
People in marginalised communities bear the brunt of environmental catastrophes, and geoscience expertise is central to resolving many of the problems our planet faces, such as natural hazards, pollution and climate change, including conversations about the nature of research, policies, mitigation plans, best implementation practices, kind of regulation and, importantly, stakeholder buy-in.

To spur action, recent calls such as ‘The Call for a Robust Anti-racism Plan for the Geosciences’ (Ali et al. 2020; change.org) and ‘No Time For Silence’ (notimeforsilence.org), suggest steps that organisations can enact to combat racism and increase the inclusion of marginalised communities in the geosciences. Other calls outline actions to tackle geoscience-related activities specifically, such as safety during fieldwork (e.g., Anadu et al., 2020) and inclusive anti-racist laboratories (Chaudhary & Berhe, 2020).

In addition to these detailed plans, the majority of individuals in the geoscience community can take personal steps to facilitate inclusion in their spaces (see box, below left), from simple actions to more elaborate plans. To be effective, self-reflection, including asking yourself uncomfortable questions, is essential. For example, how many minoritised geoscientists have I interacted with in the last week, month, or term? How many are Black geoscientists? Why, or why not? What have I done to make my community inclusive? Where are my biases? How can I work to minimise them?

Allies, sponsors and accomplices

To implement changes that will lead to improved DEI in the geosciences, more allies, sponsors and accomplices (ASA, see box, above right) need to step up and take action, to work with marginalised geoscientists in order to facilitate access to resources such as the hidden curriculum, the unwritten rules, and fair compensation. ASA may, for example, advocate that minoritised individuals get appropriate and fair compensation for the time and labour put into helping institutions or organisations achieve their diversity quota, or demand that Black and other minoritised people are allowed the same access to resources and opportunities as their peers from the over-represented group. Whatever the challenge, there is always something an ASA can do.

For example, the reach of #BlackInGeoscienceWeek was amplified by the support and collaboration of individuals and groups of ASA from both the over-represented community and other marginalised groups. Some examples are the Geolatinas, the Earth Science Women’s Network, 500 Women Scientists, the International Association for Geoscience Diversity, the Association for Women Geoscientists and Women in Mining, UK.

These groups, as well as other ASA, supported the #BlackInGeoscienceWeek events in different ways. For example, retweeting to their large groups of followers, thereby amplifying tweets on their platforms, sponsoring and coordinating DEI events for greater reach, or using their skills to design and create event fliers. For example, the Association for Women Geoscientists provided access to their meeting platform for live panels, and the Earth Science Women’s Network and 500 Women Scientists co-sponsored the Blackingeoscience.org website.

Because individuals from Black and other minoritised groups do not typically have the same network reach as their peers in the majority group, the work of ASA is essential to introduce and enact change that can lead to larger networks, greater safety, equity and inclusion of minoritised individuals. Thus, as an ASA, you can support minoritised individuals by being an active bystander, an advocate for equity, and/or a sponsor of opportunities.

A virtual community

Visibility matters. Social media has provided many marginalised individuals, including Black geoscientists, who are otherwise isolated in their physical communities, the opportunity to reach a larger network of peers. Finding an online community means there is less gatekeeping – when used strategically, social media can provide global access to potential mentors, collaborators, and special interest groups.

Sometimes, social media is not only supportive and encouraging, it is vital for members of minoritised groups. The Twitter account of @BlkinGeoscience gained over 8,000 followers within two weeks and is now a frequent tag for geoscience academic recruiters seeking to attract students or staff from minoritised groups.

Virtual communities like Black In Geoscience and others demonstrate that intentional actions, such as organising an online event or creating a website, can
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- Mike Stephenson (BGS)
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The world can see that Black geoscientists exist. Invite them into your network and communities, and allow them access to the same opportunities.

Diverse role models and mentors must exist to attract a diverse talent pool into the geosciences, and to guide aspiring geoscientists to attainment. This is salient because geology is not taught in most primary and secondary schools.

Appointing Black and other minoritised geoscientists in leadership and decision-making roles can help define more appropriate procedures that are adaptable to minoritised communities. This will lead to better collaboration between the broader UK geoscience community and the Black or other minoritised communities. Such collaboration could take the form of geoscience outreach programmes that are targeted at schools with predominantly Black and other minoritised pupils, then incentivise and compensate Black or other minoritised geoscientists to conduct these outreach programmes.

For example, in December 2020, Black in Geoscience also piloted a successful secondary school outreach event, to introduce students at the Sacred Heart Catholic School, Camberwell, London to professional and active Black geoscientists. This model of Black geoscience ambassadors could be used to recruit, sponsor and actively promote geoscience in communities with underrepresentation. For many in the Black community, it is important for their professional careers that they have visible role models and mentors with similar cultural and ethnic backgrounds from whom they can seek general life and career advice.

Ambassadors can engage in science communication with the general public and schools to help foster a sense of inclusion and belonging in the communities, thereby inspiring the next generation of Black geoscientists in the UK.

Looking ahead

We want #BlackInGeoscience to offer a meaningful increase in representation for aspiring geoscientists. The world can see that Black geoscientists exist. Invite them into your network and communities, and allow them access to the same opportunities.

Institutions insist that diversity and representation is important and has value. Yet, the message has not translated into actions, opportunities and adequate compensation for equal work.

Know that Black scientists are capable. Capable of keynotes, seminars, lectures, panel discussions, fieldwork or research. We can serve on committees, councils, and editorial boards. Black geoscientists demand space to contribute their talents to help create a more diverse geoscience workforce.

Acknowledgements

We thank all the organisers and supporters of #BlackInGeoscienceWeek for making it a success. A sincere thanks to our anonymous colleagues for proofreading the article.

Further information

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In Summer 2020, Council requested an assessment of the Geological Society of London’s historical links to slavery and colonialism. The Society’s Archivist, Caroline Lam, researched those links and reports the findings here.

**Decolonising**

**THE HARROWING** deaths of George Floyd and Breonna Taylor in the United States, and the subsequent rise of the Black Lives Matter movement profoundly affected much of society last summer. One of the most notable outcomes has been organisations, such as our own, investigating the extent of links to imperialism, slavery and racism in their past.

The evidence for many of these connections is usually found by surveying institutions’ historical collections, and curators, archivists and librarians are at the forefront of the movement to ‘decolonise’ the more problematic material. ‘Decolonise’ is a catch-all term to indicate attempts to negate centuries of colonial or imperialistic origins and attitudes that are manifested in historical academic studies and collections.

Although the geographical scope of the Society’s collection is wide, there is a distinct lack of diversity in the individuals who created them. The Society’s membership from the first was not diverse. After decades of campaigning, women were finally allowed to join in May 1919 but, as was found in the 2020 Geological Society of London Strategic Options project, the science and ergo the membership to this day continues to display a lack of diversity. The collections are a reflection of this.

**Colonial links**

Most of the collections cover the geology of Britain and Europe, but there is much coverage farther afield, including material derived as a result of European colonialist practices of the 19th and 20th centuries.

Britain was, of course, at the forefront of imperialist expansion and, while Fellows of the Society participated in these activities, for instance as surveyors on an expedition or colonial survey, the Geological Society (unlike, say, the Royal Geographical Society) as a body was not involved in the organisation or funding of these. However, as experts in the field, the Society was frequently asked for recommendations on geological appointments. Employing a geologist would enable exploratory expeditions to survey areas for mineral wealth to be exploited by the imperialist agency’s home nation.

The Society’s collection of maps and images are rare records of areas before they were obscured or destroyed by colonial construction and industrialisation, much of which do not survive elsewhere. Traditionally there has been a tendency to describe these regions as having been ‘discovered’ by a member of a colonial exploration trip. Of course, the indigenous populace of a country would know all too well of an area’s existence and may have, in many cases, acted as guides.

Artist and colonial surveyor Charles Heaphy (1820-1881) arrived in New Zealand in 1839 as part of a scientific expedition to study the geology and of the country’s flora and fauna. Heaphy’s work was instrumental in the establishment of the New Zealand Geological Survey.

In 1840, Heaphy and his team undertook a series of surveys in the Wellington region, charting the coastline and cataloguing the geological formations. Their work was crucial in the development of New Zealand’s geological maps and in understanding the geological history of the region.

Heaphy’s maps and notes were instrumental in the development of New Zealand’s geological survey, and his work helped to establish the country’s geological future. His contributions to the field of geology were significant and his legacy continues to be felt today.

In 1853, Heaphy was appointed as the first director of the New Zealand Geological Survey, a position he held for the next 21 years. Under his leadership, the survey grew to become one of the most important in the world, with a workforce of over 300 scientists and surveyors.

Heaphy’s work was crucial in the development of New Zealand’s geological survey, and his legacy continues to be felt today. His contributions to the field of geology were significant and his work helped to establish the country’s geological future.
Zealand in August 1839, initially as draughtsman in the employ of the New Zealand Company. This was a commercial enterprise whose remit was to systematically (and socially engineer) the colonisation of New Zealand. Heaphy’s role was to produce idyllic images of the landscape to tempt Europeans to emigrate (Fig. 1). In his exploration of the country, Heaphy is known to have employed Maori guides, two of whom, Kehu and Tau, saved his group from starvation during a trip down the west coast in 1846.

Colonial era images frequently depict the land as empty. The invisibility of the indigenous population and their culture to modern eyes seems shocking, but it is a stark illustration of the nature of imperialistic land acquisition that continues to this day.

Slavery
Slavery was abolished in Britain in 1807.
the same year that the Geological Society of London was founded. This significant milestone is largely credited to the vociferous campaign led by the Quakers. Three of the founders of the Geological Society were Quakers – the brothers William Phillips (1773-1828) and Richard Phillips (1778-1851), whose father James helped establish the Society for the Abolition of the Slave Trade in 1787, and the chemist William Allen (1770-1843), who devoted much of his later life attempting to abolish slavery worldwide.

Yet, slavery was only outlawed on British soil. It continued elsewhere in the Empire, notably in the colonial outpost of the British West Indies. One of the most prominent early Geological Society members with holdings there was Sir Henry De la Beche (1796-1855; Fig. 2) who later became the first Director of the British Geological Survey. De la Beche had inherited slave (sugar) plantations in Clarendon, Jamaica, from his father, but falling revenue due to the frequent slave revolts in the region led him to travel there between 1823 and 1824. It was during this trip that he undertook the research for the first geological map of Jamaica (Fig. 3).

In 1825, De la Beche published a pamphlet, *Notes on the Present Condition of the Negroes*, which was issued as part of the pro/anti abolitionist literature and debates that were circulating during this time. Despite being a slave owner, De la Beche held anti-slavery views, but his income was entirely reliant on his Jamaican estate. The volume is essentially an account of his attempt at a compromise, that is to institute a more ‘humane’ approach to the treatment of the slaves on his plantations.

The almost pastoral view of the conditions of the enslaved populace of Jamaica depicted in the publication was clearly at odds with the reality as unrest on the island continued. The ‘Great Jamaican Slave Revolt’ of 1831-1832 was its culmination. This major rebellion and its brutal fall out accelerated the British Government’s decision to abolish slavery in the British West Indies in 1833. The British Government paid compensation, not to the slaves but to the plantation owners, but by this time De la Beche had mortgaged his properties to the Hibbert family who received the money instead.

De la Beche was by no means the only Fellow whose economic situation was bound up with Britain’s nationally sponsored slave trade. Sir Roderick Murchison’s (1792-1871) maternal family had slave holdings in the West Indies, as did the father and brother of the physician Richard Bright (1789-1858). Even the staunch abolitionist Adam Sedgwick (1785-1873) appears to have benefited financially through a bequest from a slave-owning neighbour in Dent, Yorkshire. Within the historical Fellowship lists are likely to be more, including those with connections to the East India Company. This organisation was not only involved in the slave trade in Africa, but with the imperial invasion of India and the opium trade with China.

**FURTHER READING**
A full list of further reading is available at geoscientist.online.

- Centre for the Study of the Legacies of British Slave-ownership database, University College London; www.ucl.ac.uk/lbs
Racism and prejudice

As to be expected with a long-standing organisation such as the Geological Society of London, there will be a number of individuals in their history whose actions, beliefs or writings are viewed as being abhorrent to present sensibilities. Much of this will be because the supremacist attitudes that enabled imperial expansion and slavery to flourish were also embedded into many of the academic studies of the period.

For example, in Europe the Swiss naturalist Louis Agassiz (1807-1873; Fig. 4) is lauded for his influential palaeontological and glacial studies. However, after moving to the US in 1846, he became a leading spokesman for the racist theory of polygeny. Polygeny is the concept that different races are effectively a different and lesser taxonomical species than the white race. It developed against a background of slavery and the expulsion of the Native Americans from their lands to give academic credence and justification for the inherent prejudices and mistreatments of the age.

Polygeny was one of a number of prejudicial pseudosciences that developed across Europe and the US in the 19th century. Pseudosciences are studies that appear to have academic merit, but are based on superficial evidence to provide proof of a pre-established opinion. In polygeny’s case, it charted the visual differences between the ‘ideal’ body of the white male scientist and those of his inferior subject, based on concepts of western beauty. Agassiz held particular racist views on Black people and commissioned degrading photographs of slaves, yet polygeny and its ilk were not only applied to other races, but to women, children, Jewish people, immigrants, the poorer classes and disabled people.

The advent of female higher education at the end of the 19th century also saw women taking part in prejudicial studies. One of our early women members, the palaeobotanist Marie Stopes (1880-1958), is now viewed as a feminist champion of female reproductive rights. However, her motivation for offering contraception was the practice of her firmly held eugenic principles (Fig. 5). The aim of eugenics was to ‘improve the human race’, by removing its supposed degenerative elements. Stopes’ methodology was to restrict the reproduction of the poorer classes whom she considered ‘unfit’. Eugenics and much of the other prejudicial academia only fell out of mainstream view due to their association with the Holocaust in the Second World War.

Why now?

All people are products of their time. The attitudes and actions developed by those growing up in an era when, say, colonialism, slavery and racism were embedded into society is useful in understanding historic events. The issue is that in many cases these contextual explanations are never given in any great detail, resulting in a tendency to project only a white-washed, heroic narrative of history because it doesn’t mention the problematic bits.

The decolonising process seeks to add more contextual information, but striking a balance between acknowledging the importance of historical works with an openness on the attitudes and actions of their creators will not be easy or quick, and missteps are likely in this period of reflection while curatorial staff are finding their feet.

Figure 4: Carte de visite portrait of Louis Agassiz by unknown photographer [1860s]. (Archive ref: GSL/POR/SS/01-2; reproduced courtesy of the Geological Society of London)

Figure 5: Notes on the petrology of coal [c.1935], written by Marie Stopes on the reverse of Annual General Meeting notices for The Society and Clinic for Constructive Birth Control and Racial Progress, 1931. Stopes set up the Constructive Birth Control (CBC) in 1921. (Archive ref: LDGSL/63; reproduced courtesy of the Geological Society of London)

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HEN GOLD was discovered in 1848 at Sutter’s Mill on the American River at Coloma, over 80,000 would-be miners from all over the word descended on northern California in the hopes of striking it rich. Although a few of these ‘49ers’ did make their fortunes, for most, gold fever turned out to be a fatal disease. Nevertheless, the ‘infection’ soon spread to other parts of the world.

One who did strike lucky was Edmond Hammond Hargraves [1816-1891], who travelled to California in 1849 from his adopted country, Australia. Although he didn’t find much gold there, he gained a valuable knowledge of prospecting. Recognising that there were geological similarities between California and New South Wales, Hargraves returned to Australia in January 1851 hoping to make his fortune by claiming a government reward for the discovery of a payable goldfield. A few weeks later, in February 1851, while working with John Lister, Hargraves found specks of gold in Lewis Ponds Creek in New South Wales. He revealed his find in a letter to the Sydney Morning Herald, and within two weeks 300 men were at work at what became known as the Ophir goldfield, and an Australian Gold Rush took off. Prospectors also flocked to other areas, including Castlemaine and Forest Creek in Victoria, to dig for placer, or alluvial, gold.

Although Hargraves had exaggerated and falsified his finds, the government awarded him £10,000 and from 1877 he received an annual pension of £250. He was also showered with testimonials, and valuable trophies. In 1851, he became a commissioner of crown lands for the gold districts and a justice of the peace.

One of the unlucky ones
But most who joined the Australian Gold Rush found gold mining to be hard and unprofitable work. Writing from Melbourne in 1853 to his brother-in-law in England, Thomas Spencer Niblock [1820-1853], who travelled to Australia to try his luck in the gold fields of Castlemaine and Forest Creek, described the process:

“Having selected the spot and marked the hole – oblong or circular, but generally circular for a deep hole, and about 4ft diameter, [miners] set to work by turns with pick and shovel until about 8ft down when they can throw up no earth more conveniently. They then erect a crude windlass over the hole and draw up the
earth in a bucket – and do not suppose (like I and most new hands) that all this earth is gold dust more or less. No such thing – none of it will pay for washing it until the ‘washing-stuff’ is reached – in some places 3ft, in others 90ft below the surface...

“Having reached this washing stuff and carefully tried a few handfuls of it by washing it and picked out what nuggets are visible, the earth is carefully laid by itself (and the rock well scraped as there the gold lies) and then well ‘puddled’ with water in a tub and then washed by hand in a large dish exactly the same as a large shallow milk pan or in a ‘cradle’ which does it much quicker so it is amazing what gold is sometimes found in a pail of earth, which to an unpractised hand would appear valueless.

“As each man has a right to a plot of ground 12ft square, when he gets to the bottom he undermines so far – should the hole prove worth proceeding with; and often if it proves rich, one man will trespass and undermine for yards under his neighbours’ who perhaps have not yet got to the bottom.”

A sad end

Alas, Niblock never reached pay dirt: “After six weeks steady application the result has been nothing – we have not even made our living and our party has separated and returned to Melbourne one by one.”

By April 1853, Niblock too had given up, and rejoined his wife and child in Melbourne. But he found conditions weren’t much better there. Although his wife had “made many strenuous efforts to obtain some employment or situation... [these were] in vain, for Melbourne is crowded with single females looking for employment.” And unable to find a job himself, Niblock was reduced to selling his “long cherished ‘old’ books” to put food on the table and a roof over his family’s heads.

Hoping to find a means of making a living, in May 1853 the family took a passage to Sydney on the American-built single screw steamer, Monumental City. On Sunday 15 May 1853, the vessel ran aground in calm weather off Tullaberga Island, Victoria, and 37 people, including Niblock and his family, were drowned.

The legacy lives on

But the Niblock gold mining legacy lives on. One hundred and forty years later, his great, great, great nephew, Jeremy Burton [b. 1952] having earned a degree in geology, tried his luck in 1993 in a placer mine in California.

“We had to drill and blast our way into a mountain to reach a supposedly gold-rich palaeo-channel,” Burton recalls. “But in spite of our state-of-the-art equipment, we were about as unsuccessful in our search for gold as Uncle Tom was in his!” Happily, Burton has lived on to succeed in other ways and is now enjoying a bit of metal detecting in rural Oxfordshire, where he still hopes to make a fortune by discovering a large hoard of gold coins!

Acknowledgements

I thank Jeremy Burton for information and references about gold mining, and providing me with pictures and a transcript of ‘Uncle Tom’s’ letter.

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Post-doctoral research can be rewarding, but also short term and often involve moving locations. Melanie Leng and Joe Emmings advise those weighing up whether to sign up to a post-doc

CONGRATULATIONS, you just passed your PhD viva! So what’s next? A post-doc is one route available to you, and is a good option if you’d like to pursue a career in research. A post-doc gives you the chance to enrich your expertise, boost your CV and experience new research environments, but it’s not right for everyone. Post-docs can be great opportunities, but as with any job, take care to consider whether a post-doc is right for you, think carefully about the projects you apply for and the people you will be working with.

What is a post-doc?
A post-doc refers both to the researcher who is working on a research project, often following completion of their PhD (they are called a ‘post-doctoral researcher’), and the project itself. Post-doc positions are almost always fixed-term (usually one to three years) and offer an opportunity for early career researchers to develop their research ideas, learn new skills and gain experience in an advanced research environment.

Most post-docs are positions in universities and research institutes, and occasionally in industry (or sponsored by industrial partners). There are two distinct styles of post-doctoral research position: 1) project-specific, where post-docs are typically funded as part of a larger, overarching research grant and are part of a team of researchers; and 2) thematic, where the post-doc research objectives are less constrained, in order to encourage new thinking and discovery. In reality most

TIPS WHEN APPLYING
If there is a formal application process, make sure you read the guidance carefully. Tailor your application and cover letter to the position and research in question. A generic application is usually easy to spot.

Do your homework on the principal investigator and their research team. Take questions to the interview about the department or company, and explore all of your questions (in case the position isn’t for you). Once offered the role (and before accepting it), you will be in the best negotiation position to discuss expectations, roles and responsibilities.
post-docs are on the spectrum between these two end-members.

Post-docs generally have minimal supervision, and they are expected to gather and interpret their data, present their research at conferences and publish peer-reviewed papers in academic journals.

Why do a post-doc?
Post-docs are usually taken up after a PhD and offer a pathway to a career in academia or industry. Post-docs present an opportunity to help establish your independence, develop your critical thinking, leadership, mentoring, and project and people management skills, as well as expand your technical knowledge. Unlike a PhD, a post-doc is not ‘defended’ at the end of the position, but key research outputs are expected within a timeframe that is agreed with your supervisor and the wider research group.

A post-doc position is generally associated with less supervision and more responsibility, compared to being a PhD researcher. Post-docs are almost always expected to publish peer-review papers, but innovation, outreach and public engagement are becoming increasingly important.

At the start of your first post-doc after your PhD, many people face a dilemma: to double-down on your PhD research and expertise, for example by expanding the types of analysis for rocks you have already characterised, and fostering existing partnerships, or to strike out in a new direction, perhaps by embracing entirely new techniques, method development and building new collaborations. There is no right answer to this, and it will often depend on your post-doc objectives and long-term research aspirations.

“ You can also approach researchers directly to enquire about future opportunities ”

How to choose a post-doc
Post-docs are expected to largely know what they are doing (or to find out), so think about what a post-doc outside of your immediate specialism will involve. Post-docs are almost always required to deliver the outcomes as described in the job advert, the grant or by the funder – be assured you can deliver.

Think about your supervisor, the principal investigator. It may be a fantastic project, but it’s important to know who you will be working with. After securing an interview or meeting, do some research. Look up the potential principal investigator(s) and their laboratory or research group via their websites and online presence. Do they appear interesting and are they doing research that genuinely interests you? Look at how many PhD students and other post-docs they have in their group, and take time to consider the diversity of the research group. Do they look like a dynamic and diverse research group that you would want to feel part of? You may also want to find out if any of your network is in the same field. If so, ask if they know anything about the research group you may be joining.

How to find a post-doc
Most PhD students start thinking about post-docs in their final year. There are many websites and information can be easily found through search engines. In the UK, one of the biggest websites for academic jobs is jobs.ac.uk, which lists different types of academic jobs both in the UK and overseas. Many of our major geoscience publications advertise post-docs including New Scientist magazine and Science magazine, and there are jobs boards on the websites of the Times Higher Educational Supplement and the Guardian. University websites are also a good source for information.

You can also approach researchers directly to enquire about future opportunities. Make use of contacts made through networking. Fellowships are a useful source of funding for post-doctoral research and there are many, including the Research Councils, Royal Society, Marie Curie, Anne McLaren, and institutional fellowship programmes.

UPSIDES AND DOWNSIDES
Like any job, the merits of a post-doc are influenced by the role and environment. The post-doc might be a fantastic project, but it’s important to consider who you will be working with.

Probably the main downside to post-docs is their fixed-term nature, it is not unusual for early career researchers to do multiple post-docs before attaining a permanent position. Perhaps as a result, a much lower percentage of women move from post-docs to academia; this might relate to family demands, self-confidence, and inability to travel due to dependants or caring responsibilities and wanting to be more settled.

Post-doc salaries vary, some can be lower than those on offer for industry positions. Post-doc positions can also require you to be mobile (e.g., visiting other labs, fieldwork, conferences); for some the prospect of travel is appealing.

Post-docs are an opportunity for you to do your research and have fun; your abilities will be stretched, you will gain a mass of experience through exposure to different environments, and you will make new friends.
Recently Published by The Geological Society

The Changing Role of Geological Surveys
Edited by P.R. Hill, D. Lebel, M. Hitzman, M. Smelror and H. Thorleifson

Senior managers and Heads of Geological Survey Organizations (GSOs) from around the world have contributed a collection of papers to provide a benchmark on how GSOs are responding to national and international needs in a rapidly changing world.

www.geolsoc.org.uk/SP499

Archean Granitoids of India: Windows into Early Earth Tectonics
Edited by S. Dey and J.-F. Moyen

Granitoids form the bulk of the Archean continental crust and preserve key information on early Earth evolution. India hosts five main Archean cratonic blocks (Aravalli, Bundelkhand, Singhbhum, Bastar and Dharwar).

www.geolsoc.org.uk/SP489

Pannotia to Pangaea: Neoproterozoic and Paleozoic Orogenic Cycles in the Circum-Atlantic Region
Edited by B. Murphy, R.A. Strachan, C. Quesada

Special Publication 503 celebrates the career of R. Damian Nance. It features 27 articles, with more than 110 authors based in 18 different countries.

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INTRODUCING HYDROGEOLOGY

DETAILS

REVIEWED BY ROB BOWELL
Introducing Hydrogeology is another addition to the ‘Introducing Earth and Environmental Sciences’ series, which focuses on providing elementary understanding of the sub-disciplines in the Earth and Environmental Sciences. Hydrogeology is a critical part of applied geology and deals with the distribution and movement of water in Earth’s crust. Groundwater transport is an important part of the overall hydrological cycle, in which water is transferred by evaporation from the oceans and seas into the atmosphere. This cycles back to the ground through precipitation and some percolates underground to become groundwater. This process imprints distinct chemical signatures on the water, dependent on the rock type the water contacts, and migration can occur over a period of a few weeks to tens of thousands of years.

Hydrogeology intersects a variety of disciplines that do not strictly fall within geology, including hydrology, climatology and socioeconomics. Therefore, this guide describes the base concepts of groundwater flow analysis in simple language and avoids jargon or detailed analysis of the topic (there is also a glossary). The book describes all facets of the science, physical and chemical, together with topical issues, including climate change and our insatiable demand for water. It also covers subjects including aquifers, groundwater flow and numerical analysis, boreholes and testing, the management and quality of groundwater (including pollution and protection), flood, drought and subsidence.

The book will appeal to Earth scientists and engineers unfamiliar with the topic, as well as students and non-scientists looking for a basic text on the subject. The book’s emphasis is the underlying measure of the importance of hydrogeology to society, and this is communicated through example topics such as climate change impact, water scarcity, nuclear waste repositories and oil shale fracking.

Nicholas Robins worked for much of his career as a hydrogeologist with the British Geological Survey, in the UK and overseas, and has also been involved with research into radioactive waste disposal. As current Editor-in-Chief for the International Association of Hydrogeologists, he is well placed to review contemporary literature in the field.

A definition I was once given of an expert is not how much they can write on a topic, but rather how well they can explain that topic in a few words. By this definition, Nicholas Robins is an expert in hydrogeology and succeeds in providing a readable introduction to hydrogeology in a slim volume. I strongly recommend this book to those interested in pursuing hydrogeology as a discipline.

BEACHES AND COASTS

DETAILS

REVIEWED BY BRENT WILSON
The world’s coastlines are of geologically recent origin, most of their geomorphic features (other than a few relict ones) having arisen since the transgression at the end of the Pleistocene. Seaboards are as diverse as any geological setting on Earth, and of great importance to humans, with many people gaining their livelihoods from them. Davis and Fitzgerald have, in this revised edition of Beaches and Coasts, risen to the challenge of publishing a concise and informative book that summarises the nature of Earth’s different coastlines. It also describes the various processes that formed these coastlines, and the many factors (climate change, sea-level rise, urban development) that make maintaining the integrity of coastlines challenging.

The authors take a novel approach, such that their book’s title belies its full scope. Prior to describing shoreline systems (deltas, estuaries, tidal flats and so on), they provide an overview of plate tectonics and then classify coastlines according to their plate tectonic settings. They group coasts into three categories: collision types, trailing edge types and marginal seas. These differ in part in the scale of the rivers draining them, collision coasts having short rivers and trailing edge coasts having long ones. They differ also in the nature of the continental shelves, which are narrow on collision coasts, wide on trailing edge coasts, and bordered by offshore island arcs along marginal seas. Trailing edge coasts are subdivided into Neo-types (geologically <30 million years old) resulting from continental rifting, Afro-types around continents lacking opposing collision- and trailing-type coastlines, and Amero-types along passive, Atlantic-type margins.

Superimposed on this classification are the effects of modern climates, weather systems such as hurricanes, wave types and their propagation, and tides. A brief description of sediments and rocks is presented, but the mineralogical component is kept to a minimum, shoreline sediments containing primarily four mineral types: feldspars, quartz, clay minerals and carbonates.

With this background in place, the authors describe the many shoreline...
systems, noting in which plate tectonic setting they primarily occur. The emphasis is on depositional features, but one chapter is devoted to rocky coasts. In addition to diagrams showing systems’ evolution, photographs from worldwide settings are provided to illustrate them. Boxed case studies add depth; I particularly enjoyed one describing historic car races at Daytona Beach, Florida.

This book is designed for introductory students, bibliographic references being kept to a minimum. However, it has much to offer to those in more advanced courses and those working in coastal management.

**THE MUSEUM BUILDING OF TRINITY COLLEGE DUBLIN: A MODEL OF VICTORIAN CRAFTSMANSHIP**

**DETAILS**


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**REVIEWED BY JULIAN INGRAM**

This book presents a series of essays exploring the most influential Victorian building in the city of Dublin. In the 1850s, the Museum Building of Trinity College was built to showcase the potential of Irish stone at the start of a golden age of Ireland’s decorative stone industry.

Those familiar with the building will know it is an Irish geology lesson in itself. The experience that a visitor would have translates into the book very well. Colour photos capture the sumptuous polychromy and present the detail of the carved ornament of the building, while descriptions make for a fascinating geological tour.

The book explores the sources of the stone and the pivotal role the museum played. The story of the development of Ireland’s stone industry is a well-researched highlight. This looks at the extraction and marketing of Ireland’s coloured limestones and serpentinites. Interesting research is presented on the evolution of granite quarrying techniques, transport and roads, which led to the migration of the Wicklow quarrying communities. And, of course, no story of Irish stone is complete without the Kilkenny Marble. The challenges in transporting the stone and how it compared with native and continental competitors in the Victorian period is fascinating.

We meet the builder and carvers responsible for the construction of the Museum Building in later chapters. The theme of Ireland’s natural resources follows through into the depiction of native Irish plants and animals in the building’s remarkable carvings. The final section looks at the current conservation of the building by considering the weathering of the exterior and recent cleaning techniques.

This is an entertaining book, representing an inspired and thorough research project. The crucial relationship between architecture and geology is made clear throughout. This is much more than a book about a building and will appeal to any geologist with an interest in Ireland’s geology and architecture.

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**INTRODUCING LARGE RIVERS**

**DETAILS**


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**REVIEWED BY JEREMY JOSEPH**

Rivers are drains — lines connecting the topographic points of lowest potential in a catchment and, thus, along which water flows to get away. In doing so, they remove the weathering and erosion products. The basic model, followed by all rivers, has three zones where sediments are generated, transferred and deposited, respectively. There really are no surprises: water flows downhill.

The difference between large rivers and the others is that, because of their relative length and huge drainage areas, they can function in more modes. The underlying geology is a major controller of mode changes. While these basic issues come through in the book, the presentation and development of the deeper detail seem confusing. In part that might be because large rivers are very diverse and so inherently hard to deal with as a group.

The book is intended to help readers new to the field and covers a range of disciplines including geomorphology, hydrology, ecology and the anthropogenic environment. Most chapters end with questions to help readers reflect on the content of the chapter concerned.

Much of the information given is qualitative rather than quantitative, so it is unfortunate that some quantitative errors have got through the editing. The nominal capacity of Lake Mead is given numerical values that differ by three orders of magnitude — 98 million and billion m$^3$, respectively. More concerning is that the official (notional) capacity is actually around 32 billion m$^3$, so the significant itself is wrong. There are similar issues elsewhere. It is unlikely, for instance, that the capacity of a reservoir on the Missouri approaches 29,500 km$^3$, exceeding that of Lake Baikal. The book also needs a glossary, which should include the ‘local’ names in the text. Not all readers will know that the Chinese name for the Yangtze transliterates as Chang Jiang, for example.
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NORMAN SNELLING, who died peacefully on 12 January 2020, was a pioneer in the application of potassium-argon (K-Ar) geochronology. He graduated from the University of Manchester in 1951 and won a scholarship to the Australian National University at Canberra. His PhD, published in the Quarterly Journal of the Geological Society in 1960, was on the petrology and mineralogy of the Palaeozoic granites of the Murrumbidgee batholith – in his own words, a “wonderful country, virtually uninhabited, just bush, forest and mountains ranges (plus the usual kangaroos and snakes”).

Isotope analysis
In Canberra, John Richards introduced Norman to the isotope analysis of gases. Together they built an early version of the equipment necessary to date rocks from the radioactive decay of natural potassium to an isotope of argon. This defined the course of Norman’s subsequent career, starting with postdoctoral work on K-Ar dating at the Geological Survey of Canada.

His role in the emerging science of geochronology was recognised in 1959 when he was recruited to lead a small rock-dating unit for the UK Directorate of Overseas Geological Surveys (OGS). This was based at Oxford University, where Lawrence Wager had assembled a team of experts to establish what became an internationally recognised geochronology laboratory.

The symbiotic relationship lasted until 1969 when the survey unit was taken in-house in London. Under Norman’s direction for the next 19 years, it grew in size and scope of the methods used.

Travel and publications
In 1965, OGS was absorbed into the Institute of Geological Sciences, by which time Norman had already conducted projects worldwide, working with survey and university geologists and students. He travelled widely and sent members of his group to continue detailed studies, and indeed to develop their own careers. He was widely appreciated for his role in technology transfer, giving advice and help in setting up autonomous K-Ar dating equipment.


Retirement
In 1988, Norman retired from what had become the British Geological Survey. He was then instrumental in launching the Journal of South American Earth Sciences where he was co-chief editor for four years, returning as chief editor in 1996 to rescue it at a critical stage of management difficulties. In the meantime, he assisted with a new geochronology laboratory at Universidad Complutense, Madrid, where in 1991 he was given a full professorship that lasted until his final retirement in 1996.

Norman is remembered as kind and generous by his colleagues. Despite his global travelling he was a devoted family man and is greatly missed by his second wife, Carmen, two children by his first wife, Anne, three stepchildren, grandchildren and great grandchildren.
Peter Fookes began his career in the 1950s in chemistry, but soon changed to geology and, after graduation, entered the world of civil engineering as a young geologist. Under the influence of Professor Skempton, Peter studied for a PhD at Queen Mary College, London, which led to a lectureship at Imperial College London in the developing Engineering Geology Group. From there he never looked back, using his commercial experience to build up the first MSc programme in Engineering Geology, before developing his consultancy in 1971.

Peter became a pioneer in the application of geology to civil engineering and, using his chemistry background, in the influence of desert materials on concrete durability. He has been affectionately called the “father of engineering geology”, but he was also a pioneering advocate of the use of geomorphology on engineering projects. He never lost his links to academia, continuing to lecture, lead field courses and initiate ground-breaking research, while playing a leading role in the Engineering Group of the Geological Society of London.

Influence
Peter was a prolific writer, publishing some 200 papers and 10 books, including many seminal works. His contributions spanned the full range of geological application and resulted in awards in many disciplines, including the Glossop Medal (engineering geology), Honorary Fellow of the Royal Geographical Society (engineering geomorphology), Fellow of the Royal Academy of Engineering (civil engineering), as well as Honorary Fellow of the Institute of Concrete Technology (concrete). Peter held several visiting professorships, was awarded Doctor of Science (Engineering) from Imperial College London and was a recipient of the William Smith Medal of the Geological Society of London.

If anything sums up Peter’s approach to the worlds of geology and engineering it is the ground model, which so logically brings the two disciplines together. His approach was to characterise a site by considering its historical development from the original depositional environment, through global tectonic changes to the geomorphological processes that have most recently shaped the near-surface landscape.

From the 1970s, economic expansion in the Middle East provided many opportunities for European and American engineers with little experience of engineering in hot, dry climates. Peter identified inadequacies in the aggregates used in the concrete, pioneered the concept of salt attack resulting from high rates of evaporation and was at the forefront of developing guidelines for good practice that now embody regional standards.

“Peter’s charisma was huge. He brought many of his colleagues and students into his extended family, providing them with continuous support.”

The person
Peter Fookes died in September 2020 after a long illness. He is survived by his wife and soulmate Edna, five children and 12 grandchildren. Peter was passionate about steam trains, and was a fan of West Ham United football club, as well as the television soap Neighbours – even ending his field trips in time for the 5.30pm episode.

Peter’s charisma was huge. He brought many of his colleagues and students into his extended family, providing them with continuous support. Uncannily, Peter’s theories, which initially seemed far-fetched, often became the key to the successful progress of a project. It is this knack, the logical way Peter engaged the client and, above all, his friendship that I will remember. He will be sorely missed.

Contact
If you would like to contribute an obituary, please email the editor geoscientist@geolsoc.org.uk

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

Peter George Fookes 1933-2020

A pioneer in the application of geology to civil engineering

By John Charman

Pictured, above: Peter’s work was pivotal in establishing good practice in engineering standards in the Middle East (Photo by Mark Lee, 2010)
Elections to Council 2021-2022

Find out more about this year’s nominees

Supporting statement for the post of President Designate

**RUTH ALLINGTON**

If elected, I would work energetically with Council, staff and all the Geological Society’s communities and stakeholders to ensure that the study and practice of geoscience is recognised as the essential basis of solutions for a sustainable planet.

Now semi-retired, I would bring to the role 39 years’ experience as a consulting engineering geologist in the minerals industry, as a professional mediator and expert witness, and many years of active contribution to the Society and the wider geoscience community. I am passionate about promoting effective inter-disciplinary collaboration and high professional practice standards within and beyond geoscience; these underpin sustainable solutions and public confidence.

My vision for the Society is that it delivers value and support for our diverse Fellowship whilst being true to its aims to improve knowledge and understanding of the Earth, to promote Earth science education and awareness, and to promote professional excellence and ethical standards in the work of Earth scientists, for the public good.

A Fellow for 39 years, I hold CGeol and EurGeol titles. I joined the Engineering Group in 1981, serving as Hon Secretary, Vice-Chair and Chair between 1985 and 2000, and was awarded the Glossop Medal in 2012. I have served on the Editorial Board of Quarterly Journal of Engineering Geology & Hydrogeology (QJEGH) and have been a member of Pan-European Reserves & Resources Reporting Committee (PERC) for 15 years.

A member of Council from 2000 until 2005, I served as both Vice-President and Professional Secretary. For more than ten years, I represented the Society on the Council of the European Federation of Geologists, including four years as President.

**Proposer:** Prof Iain Stewart

**Supporters:** Dr Sarah Gordon  
Nic Bilham

**Supporting statements for Council nominees**

**PROF MARK ALLEN**

I am standing for Council to use my experience of research, industry and education to help the Geological Society serve its members and society. My current role is Professor in Tectonics in the Earth Sciences Department at Durham University, where I have worked since 2005. Active research projects and teaching cover a range of subjects, including continental deformation and magmatism, seismic hazards and climate change. I interact with the UK’s research councils, including two years as Director of the Natural Environment Research Council (NERC) Lapetus Doctoral Training Partnership. My previous employment was at the Cambridge Arctic Shelf Programme, working on hydrocarbon industry-funded projects across Eurasia and North Africa (1993-2004).

With this background, I hope to encourage more communication between different sectors of the geosciences, and to promote the subject to prospective students. I have been a Fellow of the Geological Society since 1993, served as a member of the Petroleum Group, acted as Secretary of the Northern Regional Group, and been on the editorial board of Petroleum Geoscience. I have convened several conferences for the Society, and am an active member of its Tectonic Studies Group. It would be a privilege to be on Council and serve the Society.

**Proposer:** Prof Robert Holdsworth  
**Supporters:** Prof Jonathan Gordon Gluyas  
Dr Alex Whittaker

**ANDREW DOBRZANSKI**

I have been a committed member of the Society since studying A-Level Geology and have previously served on the Society’s Information Management Committee. My research background is in igneous petrology, gemmology, and ore-deposit geology at Liverpool, Durham and Edinburgh universities. I currently co-manage the Joyce Institute facilities for materials science research at Cambridge University, and I am particularly interested in materials and metal supply chains, and the reuse of waste materials.

I believe the Society must play a key expert role in guiding future UK climate, infrastructure and resource policy. As Secretary of the Royal Chartered Newcastle Mining Institute, I am well versed in charity, tenancy and lease law and dealing with legal issues under Royal Charters. I have promoted professional geological opportunities to students in the North East and have organised annual Geological Society events in Newcastle.

If elected I will: work with the regional groups to deliver more local events to change the Society’s perceived London-centric image; work to attract and retain new Fellows in a post-COVID economy; further develop the professional training and support offered by the Society to university student societies and postgraduate students; and further champion the expansion of the Society’s international geodevelopment partnerships.

**Proposer:** Prof Daniel Clark-Lowes  
**Supporters:** Dr Lesley Dunlop  
Dr John Bennett

**DR NEIL FREWIN**

I have 27 years of industry experience as a geoscientist, much of that time with Shell, but also periods with Hess UK Ltd and BG Group. Although igniting my passion as a research geochemist in the Netherlands, I have spent much of my career in asset management and new business development. I am currently leading a regional geology team with Shell in London, a role that has a global basin and play remit.

I believe that stronger collaboration between professional societies will be key to survival and further growth. In that regard, I was recently President of the Petroleum Exploration Society of Great Britain (PESGB) and have played a substantive role in their strategic reshaping. The role of geoscience in society and the use of Earth’s resources is also changing, and
I co-founded the “Exploring the Energy Transition” special interest group to address these trends. I have a passion for public outreach and am a Trustee and Company Secretary of The Etches Collection – a museum in Dorset. Here I fulfil specific roles with respect to fundraising and digital engagement to support the charity.

I am a Chartered Geologist and an editorial board member for the journal Petroleum Geoscience.

**Proposer:** H A Wilson  
**Supporters:** Philip Thomson, Lucy Williams

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**DR TIM GOOD**

The Earth sciences face major challenges related to the energy transition and environmental changes at a time of declining student numbers and Geological Society membership, as well as mixed public perceptions of the resource industries. If elected, I hope these are themes I can help the Council address through strengthening industry-academia collaboration and delivery of a high-quality technical programme.

I have worked in both industry and academia. My undergraduate training (Hull) was followed by a NERC-funded sedimentology PhD (Reading) interpreting clastic depositional systems in the UK and Canadian Arctic. My industry career with BP and ExxonMobil (current employer) has included exploration, research and commercial roles and specialist assignments in sedimentology and geological modelling in the UK and overseas. As an academic at Heriot-Watt University, I led an industry-funded reservoir characterisation research team on large-scale outcrops in Europe and North America and taught field and classroom courses for students and industry.

I have been a Fellow of the Society for 35 years and have served on the Petroleum Group Committee, as a conference convenor and editor of Geological Society Special Publications on the application of outcrop analogues to subsurface problems (SP 387, 436). I have participated in British Sedimentological Research Group activities over my entire career.

**Proposer:** Dr James Maynard  
**Supporters:** Dr Jonathan Wilson, Prof John Underhill

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**MARTIN GRIFFIN**

I am a Principal Geotechnical Engineer with COWI. I am dyslexic, dyspraxic, autistic and partially sighted. These are the conditions that have shaped me, but don't define who I am. I am a workplace Equality Diversity Inclusion (EDI) Officer and have advocated for disability awareness in our sector. I have 20-plus years' professional experience with consultancies, working on national and international projects.

I am standing for Council to advance equality, celebrate diversity and stand up for people who are from underrepresented groups. If elected, I aim to represent perspectives of those who are on the periphery of the geoscience community and be a positive and proactive voice for such people in decision-making at the Geological Society.


Currently, I am Geological Society Scrutineer, journal peer reviewer for QJEGH and International Association for Engineering Geology and the Environment (IAEG), STEM Ambassador and a Ground Forum Mentor.

**Proposer:** Jackie Skipper  
**Supporters:** Chris Jack, Tom Backhouse

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**BEN LEPLEY**

My primary goal of being on the Council is to assist with improving the perception of geology and the geosciences in the public eye, particularly with the aim of encouraging more students to study geoscience subjects. I would like to see more active public engagement and make geoscience enticing for young environmentally conscious people.

I have worked for SRK Consulting as a mineral resource geologist for 12 years, since graduating from Cardiff University. I have been a Fellow since 2008 and served on the Southern Wales Geological Society Committee between 2009 and 2011. I gained Chartered Geologist status in 2014. I have also given talks and contributed to conferences arranged by the Mineral Deposits Studies Group, along with being part of the FutureGeo Group.

As part of my role as co-chair of the Public Perception of Mining Committee with the Critical Minerals Association, I engage with a number of organisations, including school and university education, academia, exploration and the mining industry. I feel I can contribute to the committee with ideas on industry-academia collaboration, multidisciplinary thinking and public outreach. Thank you for considering my application.

**Proposer:** Dr Mike Armitage  
**Supporters:** Martin Pittuck, Robert Goddard
DR DAVID MCNAMARA

I would like to engage with the Geological Society at the Council level to help the Society progress its efforts in two specific arenas. Firstly, I aim to contribute to the Society’s efforts to improve support for the diverse geoscience community it represents. This includes raising community awareness of issues diverse geologists face with respect to fieldwork, developing international careers, and progressing academic careers, and designing best practices that the geological community can adopt and enact. I have experience with this at national levels when I represented early career researchers on the Royal Society of New Zealand’s (RSNZ) Council, founded the RSNZ Early Career Researcher Forum, and chaired the National University of Ireland Galway LGBT+ Staff Network.

Secondly, I am passionate about helping communicate the incredible role geology plays in decarbonising our energy sector, contributing to climate change mitigation, and geologists’ unsung role in the manufacturing supply chain. I contribute to such efforts professionally as an Energy Group Committee Member, an IGI Energy Geoscientists Group committee member, external examiner for University of Edinburgh’s GeoEnergy MSc, and publicly as an invited panellist in the 2021 Tectonic Studies Group Plenary ‘Geology in a Changing World’.

I would like to see the Geological Society succeed and flourish. By serving on Council I would bring an early career perspective to these vital issues and champion the importance of attracting the new Fellows who will ensure the Society’s long-term success. I am currently a NERC Independent Research Fellow at the University of Manchester. I became a Fellow in 2013 and I chair the local organising committee of the Volcanic and Magmatic Studies Group’s 2022 meeting. In addition to serving on Council, I am thus eager to contribute to the Society’s scientific programme across the UK through the Science Committee.

Proposer: Prof Marie Edmonds
Supporters: Dr Kathryn Goodenough Prof Ernest Rutter

STUART MILLIS

I am a Chartered Geologist with over 20 years’ experience as a practising engineering geological consultant. I am based in Hong Kong and have predominantly operated throughout the Asia region during my career. I have been highly active with the Geological Society, having been the Chair of the Hong Kong Regional Group (HKRG) between 2013 and 2016 and HKRG Secretary from 2005 until 2009 and 2010 until 2011. During my time as HKRG Chair, I also sat on both the Professional Committee and the Chartership Committee of the Geological Society.

In addition to these roles, I have also been an Editorial Board Member of the QJEGH since 2016, taking up the role of Assistant Scientific Editor (Geotechnics) since 2019. My long-standing involvement in Geological Society activities, as well as my location outside of the UK, place me in an ideal position to represent other Fellows located outside of the UK and give the Council a more international perspective to the way it operates.

Proposer: Kevin Ashley Styles
Supporters: Richard Martin Samuel Kc Ng

DR KEITH MYERS, (Endorsed by Council)

I would like to serve on the Council to help the Geological Society through the challenge that faces geoscience in maintaining relevance and growing its influence in a rapidly changing world. My current role is Head of Research for Westwood Global Energy Group, responsible for research output across the Group from Petroleum Geoscience through to the Energy Transition. Post PhD, I have worked in industry, first in a large oil company and subsequently as the founder and managing director of several service companies.

I have managed businesses of a similar scale to the Society and I am keen to make that experience available to the Society to ensure it continues to be financially robust and makes best use of its resources. I have been a Fellow of the Society since graduating in 1984 and have contributed papers to many Society Conferences and Special Publications. I am also a member of the Advisory Council for the Natural Resource Governance Institute.

Proposer: Malcolm Brown
Supporters: Prof John Underhill Alyson Harding

DR DAVID NEAVE

Geoscientists will play a central role in confronting societal challenges over the coming years, whether by helping to achieve net zero, mitigating the effects of climate change or improving the sustainability of resource extraction. However, public perceptions of geoscience are mixed, and student recruitment remains alarmingly low. Fortunately, the Society’s integration of academic, industrial and government expertise means that it is well placed to advocate for geoscience, now and in the future. I believe that key topics to ensure the Society’s continuing relevance and accessibility in the years ahead will include degree accreditation reform, improving the inclusivity and affordability of Fellowship, and ensuring the openness and sustainability of publishing activities.

By serving on Council I would bring an early career perspective to these vital issues and champion the importance of attracting the new Fellows who will ensure the Society’s long-term success. I am currently a NERC Independent Research Fellow at the University of Manchester. I became a Fellow in 2013 and I chair the local organising committee of the Volcanic and Magmatic Studies Group’s 2022 meeting. In addition to serving on Council, I am thus eager to contribute to the Society’s scientific programme across the UK through the Science Committee.

Proposer: Prof Marie Edmonds
Supporters: Dr Kathryn Goodenough Prof Ernest Rutter

DR AMANDA OWEN

I became a Fellow while studying in London (2012). I hugely benefitted from my membership during this period, including access to Burlington House, guest lectures and networking opportunities. However, upon moving to Scotland (2014) I allowed my membership to lapse because I felt that I was not benefiting from my membership in the same way. I have since become a Fellow again (2020) because I want to see the Geological Society succeed and flourish.

I am an academic at the University of Glasgow teaching on a variety geoscience programmes and leading outreach efforts (e.g. Girls into Geoscience Scotland). I believe I have experience that will allow valuable insights into the current state of play of student opinion and recruitment challenges that universities currently face. I am not currently a member of any of the Society’s committees or specialist groups, but believe this puts me in a position to...
voice opinions and experiences of those who are not closely involved with the Society. I am particularly motivated and interested in how the Society can have a wider reach across different demographics, which will ultimately build upon the work to increase the Society’s diversity and inclusion policies and practices.

Proposer: Dr Gary Nichols
Supporters: Dr Catherine Isnerwood
Andrew Cunningham

LUCY THOMAS
I became a Fellow of the Geological Society in 1995, whilst undertaking my BSc in Applied Environmental Geology at Portsmouth University. I am a Chartered Geologist, a Specialist in Land Condition and Suitably Qualified Person. My career commenced at a structural engineering practice where I undertook site investigation to facilitate brownfield development. I loved transforming disused manufacturing sites into beneficial use and consolidated my skills in risk-based remediation. I am now RSK’s Chief Scientist and the Managing Director of RSK’s African businesses; a challenging and rewarding role that enables me to increase diversity in our industry, promote the latest science in our operations and engage with stakeholders. I am an active member of the North West Regional subgroup, having spoken at career and evening events. I was Chair of the Society of Brownfield Risk Assessment and of the National Brownfield Land Forum. Now is an exciting time for geoscientists. We are instrumental to delivery of the United Nations Sustainable Development Goals and with COP26 in Glasgow we must capitalise on this opportunity to promote our science and inspire the next generation of geoscientists. I would love to help deliver these opportunities using my collaboration, facilitation and international business skills.

Proposer: Dr Paul Nathanial
Supporters: Nicola Harries
Prof George Tuckwell

DR PAUL WINROW
Although my professional career has been spent in audit and accountancy, I have held a lifelong interest in geology, having studied geology at all levels from O Level to PhD. After graduating from Durham in the early 1990s and obtaining a Masters from Aberystwyth, I returned to study some years later and completed a part-time PhD in palaeontology in 2015. I have been a Fellow of the Geological Society since April 2017. I am currently Technical Partner at a large accountancy firm, having spent nearly 30 years in the audit profession. I have recently become involved in the audit of major international mining companies, including gold, zinc and iron. I have spent the last ten years as Trustee and Treasurer of the Palaeontological Association and am now looking for a fresh challenge. I would dearly love the opportunity to bring my professional and personal experience to the Council for the benefit of the Society as a whole. I believe that I will bring a different perspective and skillset to the Council, as well as extensive experience operating at Board/Council level.

Proposer: Prof Paul Smith
Supporters: Dr John Argent
Dr Adam Law

CONTINUING MEMBERS OF COUNCIL 2021-2022:

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<th>NAME</th>
<th>EXPERTISE</th>
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<tr>
<td>Joanna Alexander</td>
<td>Geoscience, communications, culture change</td>
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<tr>
<td>Dr Michael C Daly</td>
<td>Continental Tectonics and Resources</td>
<td>Academe/Industry</td>
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<tr>
<td>Dr Jennie Gilbert</td>
<td>Volcanology</td>
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<td>Dr Joel Gill</td>
<td>Social geology, disaster risk reduction, sustainable development</td>
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<tr>
<td>Dr Kathryn Goodenough</td>
<td>Mineral Resources, igneous petrology, crustal evolution</td>
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<td>Prof James Griffiths</td>
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<td>Dr Michael Keinde</td>
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<td>Andrew Moore</td>
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<td>Dr John Perry</td>
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<td>Sarah Scott</td>
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<td>Gemma Sherwood</td>
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<td>Jessica Smith</td>
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<td>Prof Robin Strachan</td>
<td>Tectonics, geochronology</td>
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<tr>
<td>Dr Alexander Whittaker</td>
<td>Tectonics and Landscape Dynamics</td>
<td>Academe</td>
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<tr>
<td>Lucy Williams</td>
<td>Petroleum geology</td>
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MEMBERS OF COUNCIL RETIRING AT THE ANNUAL GENERAL MEETING ON 25 JUNE 2021:

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<td>Tom Backhouse</td>
<td>Risk / environmental &amp; geological hazards</td>
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<td>Dr Andrew Bloodworth</td>
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<td>John Booth</td>
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<td>Graham Goffey</td>
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<td>Prof Chris King</td>
<td>Geoscience educator</td>
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<td>Prof Bryne Ngwenya</td>
<td>Microbial geochemistry</td>
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<tr>
<td>Nik Reynolds</td>
<td>Contaminated land, Geotechnical engineering</td>
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<tr>
<td>Dr Helen Smyth</td>
<td>Petroleum geology</td>
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“Getting hands-on experience is vital”

→ **KATHRYN GOODENOUGH** is a Principal Geologist with the British Geological Survey (BGS) in Edinburgh. A member of the Geological Society’s Council, she is Chief Editor of the Society’s new Open Access journal, *Earth Science, Systems and Society (ES3)*.

What’s a typical day for you?
Before the COVID-19 pandemic, I had no such thing as a typical day. I might be in a meeting room in Brussels, a conference hall in Vancouver, an office in Freetown, or a mine in Zimbabwe — or, occasionally, at my desk in Edinburgh. The pandemic has changed all that, and now a typical day is spent at my laptop on the dining table at home, with an excursion out to walk, run or cycle in the Pentland Hills most days.

My work is still very varied though! My research focuses on the critical raw materials that are essential for low-carbon technology, and although field and analytical work aren’t possible right now, we have a lot of data already collected, so I’m spending plenty of time writing science papers and proposals, and preparing talks for a range of audiences. We’ve just started a new NERC-funded project (LiFT: Lithium for Future Technology) on lithium resources in the crust, and I’m working with the team to get that up and running.

Within BGS, I also have a role in developing international projects, and working with partners in geological surveys around the world. All of this, along with a range of external roles, project and people management, and an enormous number of Zoom meetings and emails, keeps me very busy indeed!

Tell us more about ES3
*ES3* is a new Geological Society journal, for which I am Chief Editor. It’s Gold Open Access, which means that authors do have to pay an Article Processing Charge (APC), but the APCs are being kept as low as possible and the Society is making absolutely no profit. The APCs cover the costs of the editorial system, paper production and online hosting, plus other journal costs such as waivers for authors in lower income countries. The journal will cover the broad range of the Earth sciences, but in particular it will be a home for interdisciplinary papers, especially on subjects where Earth science has a role to play in addressing major societal challenges, such as geohazards and the race to net zero.

What one piece of advice would you give to someone hoping to work in your field?
I am still a great believer in the importance of building up practical knowledge. For me, that has been particularly focused around fieldwork, but fieldwork isn’t accessible to everyone, and there are plenty of other ways for geoscientists to acquire practical knowledge — logging core, working in labs, investigating microscopic features through a scanning electron microscope, building 3D models...

Whatever approach you take, getting hands-on experience is vital. Collecting and working with your own data will help you to understand the uncertainty associated with those data, and how they could have been interpreted differently. Every bit of practical experience we gain as Earth scientists helps us to understand the incredible complexity of the Earth system, and, indeed, how it impacts on wider society!
JOIN TODAY!

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Membership brings many benefits, including professional recognition. Fellows are entitled to the letters FGS after their name and can apply to become a Chartered Geologist, European Geologist and/or Chartered Scientist.

All Fellows receive our quarterly magazine, Geoscientist, a choice of free access to Society journals from the Lyell Collection, discounted publications and meeting fees, as well as access to our world-class geological library. In addition, all Fellows have access to our online Continuing Professional Development scheme.

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