THE MAGAZINE OF THE GEOLOGICAL SOCIETY OF LONDON

GEOSCIENTIST

SPRING 2026

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Editors' welcome

Popularised following the Wall Street crash of 1929, the comment "When America sneezes, the world catches a cold" is becoming increasingly appropriate. The ripple effect of the dramatic US policy shifts, staff and funding cuts imposed over the past 16 months or so (p. 12), which have been devastating for many of our US colleagues, is slowing scientific progress, and increasing uncertainty globally. At a time when geoscience in the West already faces significant hurdles, with ongoing closures or restructures of university geoscience departments (p. 14), it is critically important to not only support existing colleagues, but also to shore up the future of our science by sharing the wonder and importance of our subject with new audiences.

> **"Geoscience is in almost every element of our lives"**

For geoscience does not live only in field notebooks, samples or technical reports; it is in almost every element of our lives, though we may not always see it. Architecture, for example, is literally grounded in geology. Where buildings are designed to work with the landscape, rather than flatten or conceal it, architecture can connect human and deep timescales and encourage people to engage with Earth processes (p. 20 & 28).

Geoscience seeps, often unexpectedly, into the wider culture around us: onto cinema screens and televisions, into museum galleries and podcasts, graphic novels and video games. Sometimes it is centre stage, other times it is background texture, but always encouraging us to ask questions about our planet.

Audio and visual storytelling offer particularly powerful entry points. A podcast or album can help us to explore complex concepts in unique ways compared to textbooks; a fictional volcano or earthquake movie can prompt real conversations about risk, resilience and responsibility; an exhibition can reframe deep time in ways that linger long after we leave the gallery. These encounters often shape how people first engage with geoscience — and how they continue to think about it.

That is why we want to hear from you. Many of you already encounter geoscience beyond the professional sphere, so if you have watched, listened to, visited or read something that made you think differently about Earth, we invite you to share it with us via geoscientist@geolsoc.org.uk in the form of a review for our Books and Arts section. By exploring these perspectives on geoscience encounters, we can broaden the conversation about where geoscience is found, who it speaks to, and how it resonates beyond our own community.

DR AMY WHITCHURCH
EXECUTIVE EDITOR

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The Geological Society

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Earth Science, Systems and Society is a fully open access journal publishing timely and topical research focused on the importance of the geosciences to society and sustainability.

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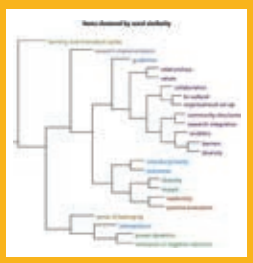

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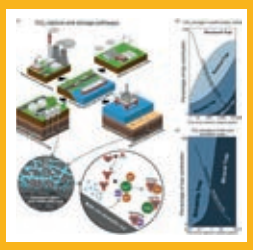

From carbon to climate action: harnessing basalt for geological carbon dioxide (CO_2) storage onshore and offshore

www.lyellcollection.org/doi/10.1144/esss2024-016

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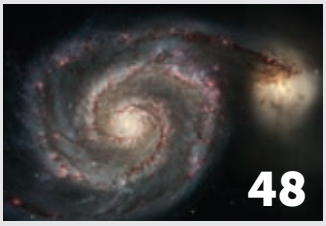
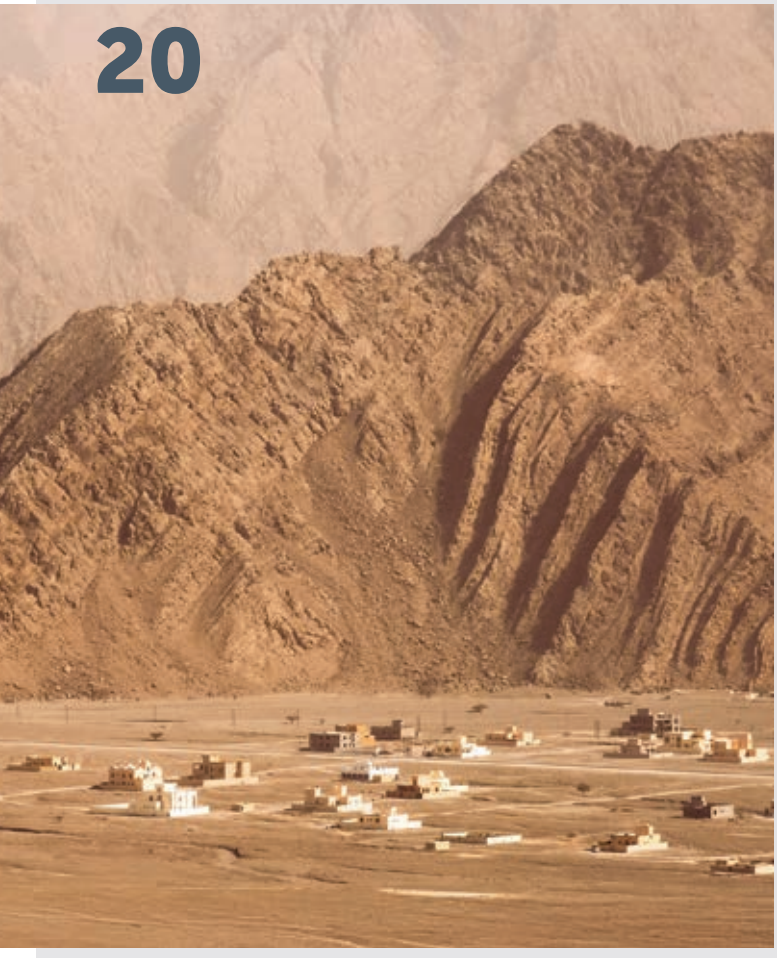
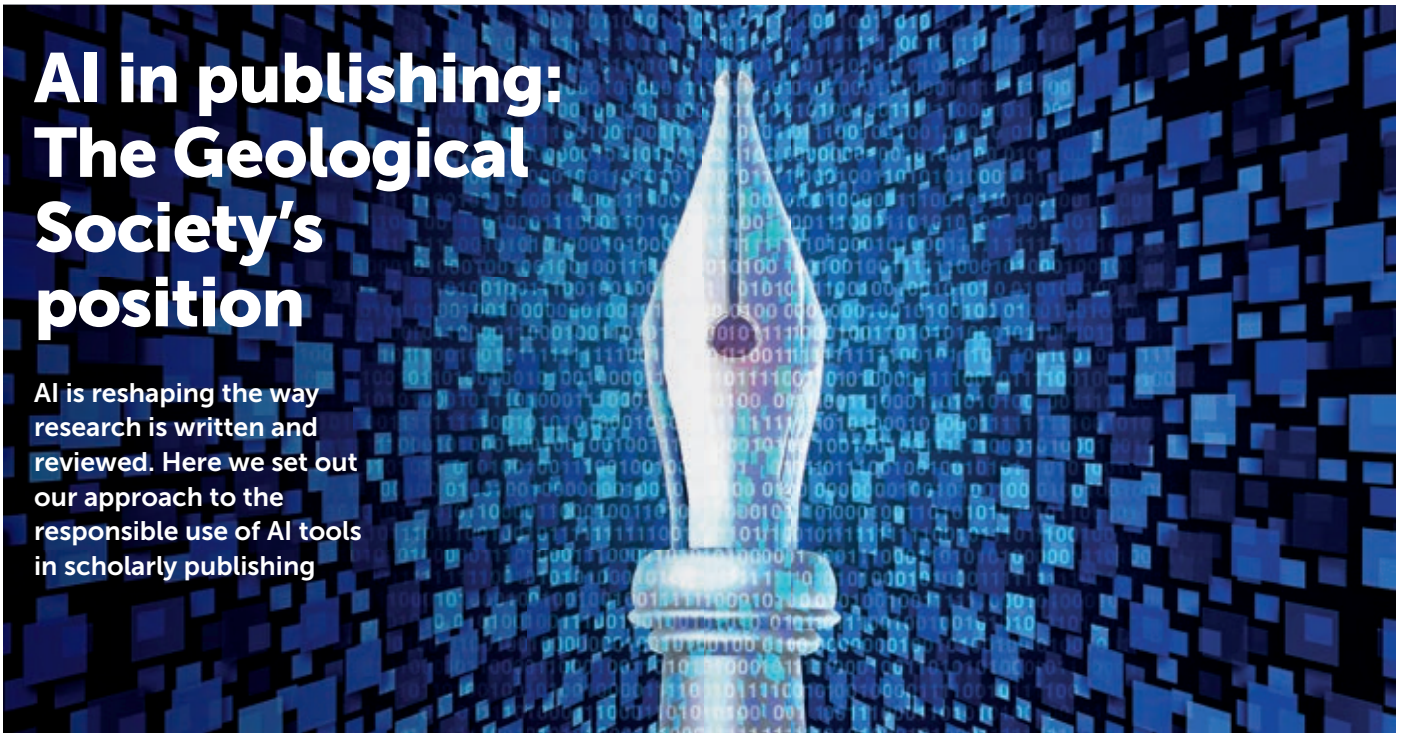




NEWS

SOCIETY AND COMMUNITY UPDATES

GEOSCIENTIST ARCHIVE
Access the *Geoscientist* archive back to 2009 at: geoscientist.online/issues



AI in publishing: The Geological Society's position

AI is reshaping the way research is written and reviewed. Here we set out our approach to the responsible use of AI tools in scholarly publishing

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THE APPLICATION OF artificial intelligence (AI) tools and techniques (such as ChatGPT and other Large Language Models; LLMs) for research and publishing is growing rapidly. The Society recognises both the opportunities and concerns surrounding the use of AI and supports its responsible use.

AI has the potential to accelerate the research and dissemination process and make it more accessible. However, it cannot replace human judgment or domain experience, and researchers should be alert to the risk of fabrications/hallucinations and confidentiality and copyright concerns.

Contributors using AI tools in the ideation, writing and reviewing of articles should refer to the Society's continually evolving guidelines and ethical policy for the latest advice on how best to adopt and communicate use.

AI FOR AUTHORS

Transparency in the use of AI tools can bring greater understanding and clarity for reviewers, readers and other researchers looking to build on the ideas communicated.

Where AI tools are used in the ideation and/or research process (such as collection or analysis of data) these should be disclosed in an appropriate section of the article (e.g. the Materials and Methods section) including a description of which tool was used and how.

If AI is used during article or book preparation (for writing, production of images or graphical elements of the article etc.), this may be declared in the Acknowledgments section, where appropriate.

AI does not replicate human thought or critical thinking and, in line with the principles set out by the independent organization the Committee on Publication Ethics (COPE; publicationethics.org), AI cannot be listed or cited as an author. During the article submission process, authors will be asked to confirm use or non-use of AI.

AI IN REVIEW

The Society does not prohibit the use of AI when creating a review of an article, but it should be used only as a supplemental tool (for example, providing grammatical editing for a reviewer report). AI-generated results intended for use in a final reviewer report should be checked fully and verified by the named reviewer and, as with authorship, an AI tool cannot be listed as a named reviewer.

Articles under review should not be

uploaded to LLMs, such as ChatGPT and others, because this risks violating copyright, privacy, security, and confidentiality obligations. When providing a review, reviewers are now asked to confirm that they have not uploaded the article under review to any LLM.

The development and usefulness of AI tools is progressing rapidly. The Society already employs enhanced research integrity checks and may adopt tools to support the review process. The priority is to maintain the quality and integrity of the process to allow our expert editors and reviewers to focus on the scientific rigour of a submission.

INTELLECTUAL PROPERTY

The Society reserves all rights across our copyrighted and exclusively licensed content, including those for the training and development of AI models. Authorisation for these activities can and must be sought from the Society in advance and licensed appropriately.

KEEPING PACE

Ultimately, authors and reviewers are fully responsible for the content of their articles and reviews, even those parts produced by an AI tool, and are thus liable for any breach of publication ethics.

The field of AI is evolving rapidly, as does the confidence in its integration in the publication process. We will continue to update and share our specific guidelines directly with contributors and in our Publishing Support Hub. For any queries or concerns, please correspond with the usual Publishing House contact for the relevant journal or book.

RESOURCES

We encourage contributors to find out more via:

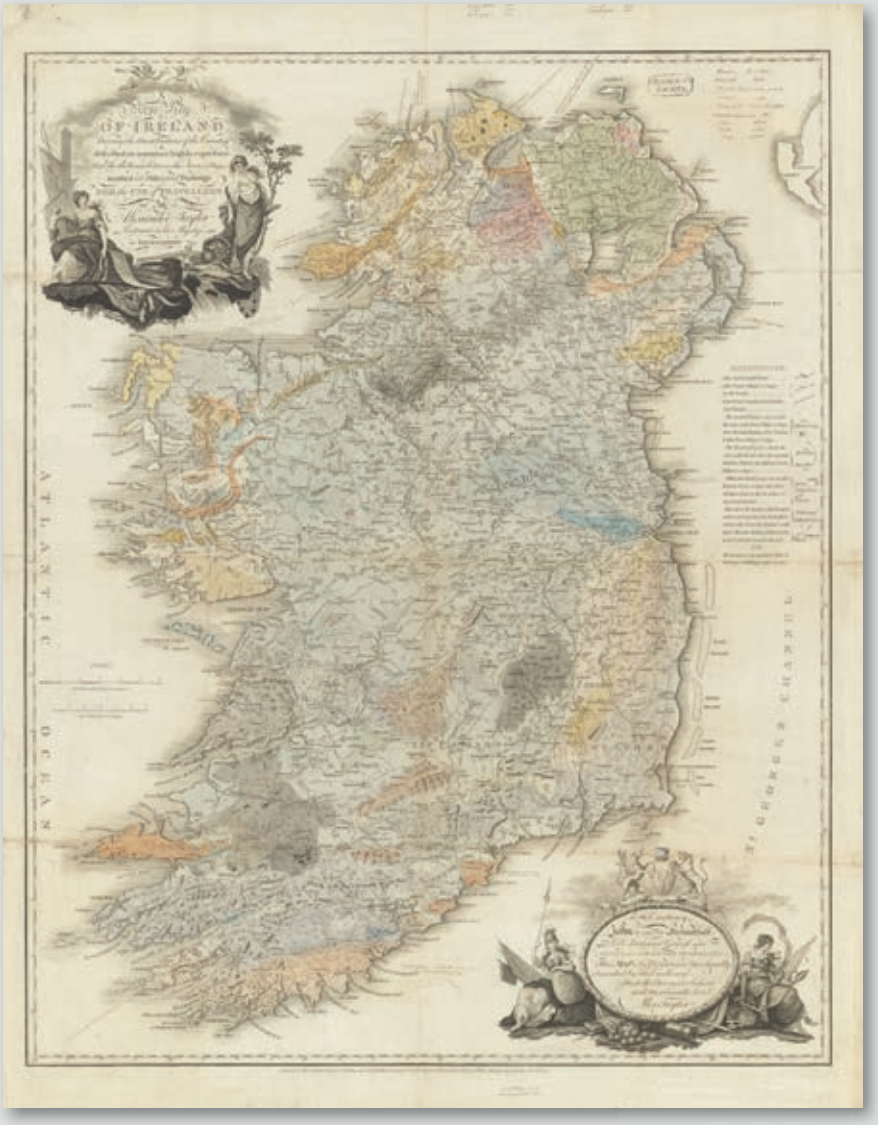
- The Geological Society Publishing Support Hub; lyellcollection.org/publishing-hub
- The Geological Society Code of Publishing Ethics; lyellcollection.org/publishing-hub/publishing-ethics#authors
- STEM Association (2025) Recommendations for a Classification of AI Use in Academic Manuscript Preparation. STM Association Task & Finish Group, September 2025; stm-assoc.org
- COPE. Promoting integrity in scholarly research and its publication; publicationethics.org

MAP FROM SOCIETY COLLECTIONS CONFIRMED AS IRELAND'S EARLIEST

A watercoloured manuscript map from our collections, which our Archivist suspected of being the earliest-known geological map of Ireland, has been confirmed as such in a paper in the *Irish Journal of Earth Sciences.* Patrick N. Wyse Jackson states that the map represents a collaborative trans-Irish Sea effort between Richard John Griffith and the Society's first President, George Bellas Greenough, to display Ireland's geological structure, and probably dates from 1814.

MORE INFORMATION

Find out more about this exciting discovery: **muse.jhu.edu/pub/423/article/971064**



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Geoscience skills at the heart of net zero

The Society has launched a new webinar series, exploring how geoscientists can contribute to and benefit from the global energy transition

LED BY THE SOCIETY'S Strategic Science Theme Lead for Energy Transition, Bas Spaargaren, *Opportunities for Geoscientists in the Energy Transition* brings together perspectives from industry, academia and emerging energy sectors to examine where geoscience expertise remains critical, and how established skills are being applied in new contexts.

FROM PRINCIPLE TO PRACTICE

The series builds on earlier Society initiatives, including a 2021 webinar programme and the 2022 *Energy & Material Transition Discussion Meeting*, which helped frame the scale and complexity of the transition challenge. The current programme shifts the emphasis from principle to practice, focusing on delivery: how geoscience underpins investable projects, supports risk reduction, and enables decision-making across a rapidly evolving energy landscape. Each session combines short expert presentations with moderated discussion, encouraging reflection on skills development, education and evolving career pathways.

The launch webinar in December 2025 introduced the scope of the series and the breadth of opportunity for geoscientists. Chaired by Bas, the session featured speakers from across the energy system, including Professor John Underhill (University of Aberdeen), Syrie Crouch (Energex CCS), Owain Jackson (H_2Au) and Karize Oudit (CNOOC International). Contributions highlighted how core geoscience capabilities, including subsurface characterisation, uncertainty management, data integration and systems thinking remain central as energy systems diversify and decarbonise.

A recurring theme was continuity rather than replacement. Skills developed in oil and gas, mining, engineering geology and environmental geoscience are increasingly being redeployed in carbon capture and storage (CCS), geothermal energy, hydrogen and helium, offshore wind infrastructure and critical mineral supply chains. Discussion also emphasised the growing importance of geoscientists who can operate across technical, commercial, financial and regulatory boundaries, particularly as projects move from concept selection through to permitting, final investment decision and deployment.

The second webinar, on 15 January 2026, focused on geothermal energy and its expanding role in the UK and Ireland, as well as internationally. Speakers included Rory Dunphy (Build Geothermal), Ellie MacInnes (WSP UK) and David Walls (TownRock Energy). The session examined deep and shallow geothermal systems, project delivery challenges and the role of public engagement in heat and power developments.

A STRATEGIC ENABLER

Across the full programme, ten more thematic webinars are planned, to also cover wind energy and subsea cables; hydrogen and helium; CCS; subsurface energy storage; nuclear siting and waste management; critical minerals; integrated energy; and the application of artificial intelligence and machine learning in subsurface analysis – areas where geological insight is central to managing risk, ensuring environmental integrity and delivering projects at scale. Taken together, the series positions geoscience not as a supporting discipline, but as a strategic enabler of the energy transition, reinforcing the profession's relevance in a net-zero future.

MORE INFORMATION

Catch up on past webinars and register for upcoming sessions free of charge via: **geolsoc.org.uk/science-and-policy/science-themes/energy-transition**

ES3's new Editor-in-Chief announced

Professor Gene Rankey (University of Kansas, USA) is the new Editor-in-Chief of the Geological Society's fully open access journal, *Earth Science, Systems and Society* (*ES3*). Gene joins an expert international Editorial Board, including Deputy Editors Dr Jen Roberts and Professor Iain Stewart, leading *ES3* in showcasing the relevance of the geosciences to society and sustainability.

"I am honoured to serve the Geological Society as the next Editor-in-Chief of *Earth Science, Systems and Society*," Gene says. "I appreciate the opportunity to lead the journal as it provides innovation, illumination and inspiration on the path between Earth sciences and a sustainable future that enriches our planet's communities."

To learn more about *ES3*, visit: lyellcollection.org/journal/esss.

NEW YEAR'S HONOURS LIST

Our heartfelt congratulations to the Fellows and geoscience colleagues recognised in the New Year's Honours list:

Professor Lorna Dawson, DBE (services to Innovations in Soil and Forensic Science)

Professor Gideon Henderson, CBE (services to Science)

Professor Tamsin Mather, OBE (services to Volcanology and to the Promotion of Science)

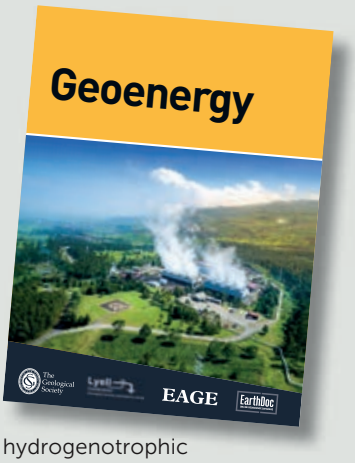
Professor John Rees, MBE (services to Multi-Hazard Science and Disaster Risk Reduction)

Professor Frances Wall, OBE (services to Geoscience and Sustainable Resource Development)

Polar Medal recipients: Nigel Blenkharn, Dr Samuel Doyle, Professor John Marshall, Craig Mathieson, Professor Colm O'Cofaigh, Professor David Roberts, Captain William Whatley, Professor John Woodward

MICROBIAL PROCESSES IN GEOENERGY SYSTEMS

Geoenergy is now welcoming field-based, experimental and modelling studies that advance our understanding of microbial processes in geoenergy systems



The transition to a low-carbon energy system increasingly depends on geoenergy applications in the (deep) subsurface. These include geothermal energy production, underground storage of energy carriers (hydrogen) and waste (carbon, radioactive waste) and mining of elements critical for building renewable energy technologies. In all of these settings, the presence and activity of microorganisms can strongly influence operational outcomes. Their impact can be negative, for instance by clogging geothermal wells through biofilm formation and bioprecipitation, or through the consumption of hydrogen by hydrogenotrophic microorganisms present in the subsurface reservoirs used for storage. On the upside, microorganisms can play key enabling roles, such as in the underground production of biogas (methane) through biomethanation, the extraction of metals from ores through (in situ) bioleaching, and the enhanced sealing of carbon storage reservoirs through microbially enhanced carbonate precipitation. **Submission deadline: 31 May 2026**.

COLLECTION CALL

To learn more/submit to the collection, visit: **lyellcollection.org/topic/collections/microbial**

Thank you for helping to shape our future

A big thank you to everyone who took the time to complete the *Geoscientist* readership survey!

Your feedback and insights are invaluable in helping us understand what matters most to you, from the topics you'd like to see explored to how you prefer to engage with our content.

The responses will directly inform the magazine's future trajectory, ensuring it continues to reflect and serve the needs of our diverse and dynamic community.

We're excited to put your ideas into action in the months ahead – stay tuned for updates.

Mapping the future

The Early Career Network as an integral part of the journey for anyone considering study or career paths in geoscience

AS THE WORLD FACES a growing number of challenges, geoscientists are more crucial than ever. Careers that help society understand and manage Earth's systems are both high-impact and increasingly sought-after, yet navigating these pathways can be challenging for early career professionals.

The Early Career Network (ECN) was established in 2019 as a place for early career geoscientists to develop multi-sector professional networks and support development in the widest sense. Since then, it has grown to over 1,200 members across the UK and internationally.

SERVING SCIENCE, PROFESSION AND SOCIETY

The ECN has the Society's key values at its heart and is a voice for early career geoscientists within the Society's Professional & Chartership Committee and Science Committee. It aims to facilitate collaboration and promote diversity and inclusion.

To achieve this, we have built strong foundations with the Chartership Office, Specialist Groups and Regional Groups of the Geological Society. We are working collaboratively to channel the 'Next Generation of Geoscientists' campaign, helping young people to learn more about studying and working in the geosciences, and are supporters of the 'This is Geoscience' campaign.

A CONGLOMERATE OF EXPERIENCE

The ECN is led by a volunteer committee of early career professionals, ranging from undergraduate and postgraduate students to graduate geoscientists and experienced Chartered members. The committee represents a broad spectrum of industry sectors, from engineering, exploration and hydrogeology to PhD students, geophysicists and sustainability experts (and more!), with over 50% female representation. Discover the committee at: geolsoc.org.uk/careers-and-training/early-career-network/meet-the-committee.

CELEBRATING EXCELLENCE

The ECN hosts the Early Career Geologist Award, which is held annually in May at Burlington House and is the highlight of our events calendar. Participation from all early career Fellows is warmly encouraged, offering the opportunity to present their work to a diverse, multi-sector audience, and learn effective science communication. Please connect with your local Regional Group to be nominated to participate in regional competitions, or keep an eye out for our 'Wildcard' entry. To find out more about the award, visit: geolsoc.org.uk/careers-and-training/early-career-network/early-career-geologist-award.

UPCOMING EVENTS

Our 2026 events calendar will be released shortly, but we continually review and adapt our schedule to reflect emerging interests and collaborations. Previous events included lectures, group walks, field trips, online discussion and Chartership guidance sessions. Consider early participation to make the most of these professional development opportunities. We welcome collaboration, so if you are planning a lecture, field trip, workshop, or other activity, we would be delighted to support and promote it within the ECN community. Do get in touch to discuss how we can work together to share knowledge and create engaging experiences for early career geoscientists.

DAN HOPE
Chair of ECN

RACHAEL SIMS
Vice Chair of ECN

JOCELYN BARKER
Publicity Officer

HOW TO GET INVOLVED

Whether you're a recent graduate, a mid-career switcher, or simply curious about what the ECN has to offer, we invite you to sign up to our mailing list via the QR code for updates, to attend an event, or volunteer your time.

PRESIDENT'S DAY AND SOCIETY AWARDS 2026

President's Day is on Wednesday 17 June. There will be an awards ceremony with the formal presentation of the Society's 2026 Medals, Awards and Funds by the President, followed by talks from the Wollaston, Lyell, Murchison and William Smith Medal recipients. Details on timings and how to register for President's Day are available at **geolsoc.org/events.**

COUNCIL MEETINGS AND AGM DATES

Council meetings 2026: 4 March, 13 May, 8 July, 14 October, 2 December
Council meetings 2027 (tentative): 3 March, 5 May, 7 July, 6 October, 1 December
Annual General Meeting 2026: 17 June 11:00-12:30 (GMT+1), with further details to be announced via the Society's e-newsletter, website and summer issue of *Geoscientist*.

VOTE IN THE 2026 BALLOT FOR TREASURER ELECT AND VICE PRESIDENT, FOREIGN & EXTERNAL AFFAIRS

The preliminary ballot for the roles will run from 2 to 31 March.

Information on the candidates and how to vote is available via **geolsoc.org.uk/about-us/governance/council/council-elections.**

Members eligible to vote will be contacted directly via an independent ballot provider with instructions for how to vote. If you do not receive an email, please check your spam email folder. Those without a registered email address will receive instructions on how to vote by post. If you do not receive your ballot by 9 March or have issues with casting your vote, please visit the ballot provider's direct link: **cesvotes.com/geosoc26.**

For further questions, contact **secretary@geolsoc.org.uk**

2026 SOCIETY AWARDS

We are delighted to announce the Geological Society's 2026 Medals, Awards and Funds winners and offer our utmost congratulations to this year's deserving recipients.

RECIPIENT	AFFILIATION	AWARD
Prof Rory Mortimore	ChalkRock Ltd / University of Brighton, UK	Wollaston Medal
Prof Margaret Collinson	Royal Holloway, University of London, UK	Lyell Medal
Prof Peter Cawood	Monash University, Australia	Murchison Medal
Dr Christopher Morley	Consultant, UK	William Smith Medal
Prof Andy Gale	University of Portsmouth, UK	Prestwich Medal
Prof David J A Evans	Durham University, UK	Dewey Medal
Ron Daniel	Lions Denergy, St. Lucia	Coke Medal
Prof Georg Zellmer	Universität Bonn, Germany	Coke Medal
Prof Silvia Peppoloni	Istituto Nazionale di Geofisica e Vulcanologia, Italy	Distinguished Service Award
Luisa Hendry	Scot Rock Walks – Scottish Geology Tours, UK	R H Worth Medal
Dr Jakob Vinther	University of Bristol, UK	Bigsby Medal
Dr Nemi Walding	Kelpie Geoscience Limited, UK	Wollaston Fund
Dr Elias Rugen	University of Southampton, UK	Lyell Fund
Dr Martin Li	Imperial College London, UK	William Smith Fund
Dr Alice Paine	University of Basel, Switzerland	President's Award
Dr Emma Watts	Swansea University, UK	President's Award

COUNCIL MEMBERS 2026-2027

Following the AGM and President's Day, Prof Jon Gluyas will be succeeded by the President Elect, Jessica T Smith, and he and Council members Prof Mark Anderson, Dr Anna Bird, Prof Sian Davies-Vollum, Dr David Giles, Martin Griffin, Dr Michael Kehinde, Ben Lepley and Liz Withington will stand down. We offer our heartfelt thanks for their service to the Society.

CONTINUING COUNCIL MEMBERS	EXPERTISE	SECTOR
John Davis	Geotechnical Engineering	Industry
Dr Andrew Dobrzański	Minerals and Mining	Industry
Hollie Fisher (Chair, Regional Groups)	Engineering Geology and Geomorphology	Industry
Dr Neil Frewin (Vice President, Professional)	Petroleum Geology	Industry
Dr Caroline Gill (nominee: Vice President, Foreign & External Affairs and EDIA Council Champion)	Petroleum Geology/EDIA	Industry
Leanne Hughes	Survey Geologist	Industry
Dr Ilias Karapanos	Hydrogeology	Industry
Prof Daniel Le Heron (Vice President, Publications)	Sedimentology	Academia
Louisa McAra	Geotechnical Engineering	Industry
Dr Keith Myers (Treasurer)	Petroleum Geology	Industry
Dr Chiara Maria Petrone (Vice President, Science)	Igneous Petrology, Petrography	Academia
Jessica T Smith (President)	Engineering Geology	Industry
Dr Kevin Stephen	Geoscience Education	Academia

VIEWPOINT

SEND YOUR LETTERS TO GEOSCIENTIST@GEOLSOC.ORG.UK
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COLUMN

Connection matters

Earth and space science have come under fire in the US, with global ramifications. Brandon Jones reflects on a challenging year, arguing that strong networks – national and international – are more essential now than ever

Growing up in Springfield, Ohio, I was a good 700 miles from the ocean, but one day that distance dramatically shrank. I was around seven years old when I first watched the documentary series *The Undersea World of Jacques Cousteau*. The vibrant corals and the other-worldly creatures from the deep sparked a wonder that connected to a curiosity, which ultimately led to a lifelong passion.

My journey from classroom to lab, from fieldwork to more than 20 years of service in US federal science, has been rooted in the dynamics of making connections – with mentors and colleagues. Connections like these built the powerhouse that is our global scientific enterprise, and it will be our connections that get us through the current challenges facing the Earth and space science community.

We can ensure resilience, stability and growth of geoscience in three fundamental ways: holding onto our connections; digging deeper into existing connections; and branching out to establish new ones.

An altered landscape

First, we must solidly link with our immediate community.

We are over a year into an altered landscape for global science. Through executive orders, withholding congressionally approved funding, and brazen, questionable personnel actions, the current US Administration has made its priorities regarding science abundantly clear.

Across federal agencies, the scientific workforce is being hollowed out by mass terminations, pressure-driven resignations, and early retirements, erasing generations of institutional knowledge and undermining future discovery and innovation. Research budgets across the full breadth of the geosciences, from planetary science and heliophysics to climate science and geohealth, are under continued threat of profound cuts at the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), United States Geological Survey (USGS), and National Science Foundation (NSF). At the same time, environmental protections are being systematically dismantled, and the communication of scientific evidence has become increasingly politicized – further weakening the ability of science to inform policy and protect the public.

As President of the American Geophysical Union (AGU), the world's largest association of Earth and space scientists, and a former Program Director at the NSF, I have seen this play out up close – and way too personal. In the fall of 2025, I made the very difficult decision to leave NSF and federal service to find other areas within the research enterprise to support science and undergird important initiatives for aspiring STEM professionals.

On one hand, I found myself linked with thousands of federal colleagues either let go or pushed out of their positions, and on the other, able to directly assist and support through a large association like AGU. I have never been a fan of the phrase *bully pulpit* to describe the special platform a certain position affords a certain occupant. I like to think of my role as AGU President more as *inspo instigation* – how one can motivate positive action.

In the face of the recent enormous challenges, AGU relied on the connections our members have with one another around the world. We collected and carefully listened to impact stories, drafted statements, increased policy trainings,

© Getty

created assistance programmes, and broadened our career guidance offerings.

These are crisis fundamentals and cannot be carried out in a "one and done" fashion. Over a year after stunning policy shifts, we must still be in constant contact with our colleagues to assess their needs and challenges.

Being there in support of the people – whether it is member societies, research teams, alumni groups or any kind of cohort – is still paramount to keeping our science community strong.

Dig deeper

Second, key relationship building does not stop at just being a dues-paying member. We can and should dig deeper into outer networks.

Our global scientific enterprise has an embarrassment of riches when it comes to organisations and associations. From AGU to the European Geosciences Union (EGU) and to the Japan Geoscience Union (JpGU), we sport a rich tapestry of international linkages in the geosciences. But if attention is not paid to expansion and reinforcement, then connective threads may become frayed and strained.

Shirley Chilsom, the first Black woman to run for president in the United States, famously said: "If they don't give you a seat at the table, bring a folding chair." With science under attack on so many fronts, colleagues around the world aren't just pulling up a chair; they are building their own tables.

Last summer, AGU joined with the American Meteorological Society (AMS) to create a new special collection on climate assessment research to continue the momentum of the now shuttered sixth National Climate Assessment.

In addition, we saw a whole new *ad hoc* organisation form. The US Academic Alliance for the Intergovernmental Panel on Climate Change (IPCC) opened a portal for experts, authors and review editors for the IPCC Seventh Assessment. With critical climate reports and readouts being cancelled by the current US Administration, this move represented a bold resetting and reframing for how scientists can organise and mobilise.

Branching out

The third and final component to science's connective power potential is how we boldly mature past traditional frames and operational structures. At AGU, we decided we needed to do more for the community on multiple fronts. As thousands of federal scientists were impacted by potentially unlawful firings engineered by the self-proclaimed, and now defunct, Department of Government Efficiency (DOGE), we engaged as co-plaintiffs with Democracy Forward (democracyforward.org) in multiple court cases to challenge these actions. It's been a rollercoaster of ups and downs as decisions have passed from circuits to appeals to, ultimately, the Supreme Court. This process is a long game, but we have made a decision to support our members and advance our mission over the long haul.

New alliances are increasingly being shaped not only by institutional partnerships, but by shared scientific needs. One of the most urgent is the preservation of data.

A stark example is NASA's Socioeconomic Data and Applications Center (SEDAC), which lost funding last year following the federal administration's decision to reduce support for Columbia University in New York, which hosts the center. SEDAC developed and maintained critical datasets and applications on land use, population, and climate impacts –resources that have been foundational to the socioeconomic components of IPCC assessments.

At the same time, actions by the current US administration to decommission or remove data pose far broader risks. These include terminating data collection for the Sea Ice Index, which tracks changes in polar sea ice, and removing online access to the US Global Change Research Program and National Climate Assessment reports. Together, these steps threaten data continuity and global scientific understanding, with consequences that extend far beyond the United States.

AGU and other global partners kicked off The Data Resilience Project addressing the governance and technical architecture needed for a more resilient global data network. These efforts are also being complemented by a special journals' collection. We are connecting over a vital issue with new substantive partners, a good reminder about keeping our networks fresh.

Threaded connections

Science is a never-ending cycle of ideas born and shared; theories developed and tested, research undertaken and expanded upon. And each step of the way, it is all threaded through connections. Connections made person to person, institution to institution, government to government. I urge all in our global community to be mindful of their immediate colleagues, to develop deeper, more complex ties within existing networks, and finally to cultivate new partnerships for strengthening the Earth and space sciences.

DR BRANDON JONES
President, American Geophysical Union, USA
agu.org

FURTHER READING

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

- fromtheprow.agu.org
- Weinberg, J. & Pflaumer, K. (2025) AGU and AMS join forces on special collection to maintain momentum of research supporting the U.S. National Climate assessment. AGU Press Release, 2 May; news.agu.org/press-release

COLUMN

Geology imperilled

There is a growing disconnect between the priorities of education and societal need, and those of today's university management, as epitomised by proposed closures at the University of Leicester, argues Jan Zalasiewicz

In recent years, universities across many western nations, including several in the UK, have closed Earth science courses and downsized their geology departments. The University of Leicester is the latest institution to fall foul of this trend. Following a strategic review to address financial pressures, the University of Leicester has proposed merging the School of Geography, Geology & the Environment with Chemistry to create a new School of Chemical, Earth and Environmental Sciences. Around half of the existing geology staff are expected to lose their jobs.

Geology provides vital scientific foundation for understanding how Earth's natural systems behave, especially when they are placed under stress, and provides key knowledge to help address climate and biosphere change and work towards a sustainable future. Those in university management positions seem not to grasp this, as they focus on running our universities as businesses.

Expectations exceeded

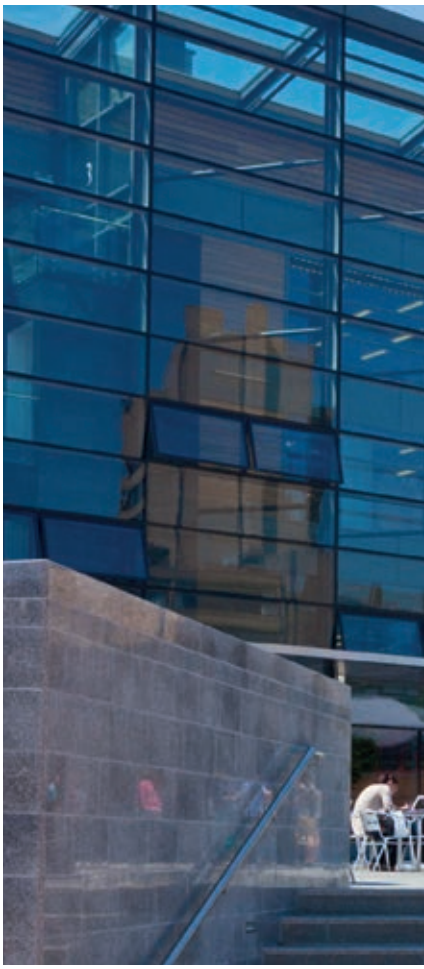
The teaching of geology at the University of Leicester goes back more than fifty years. During this time, the university has developed, and maintained, a superb reputation for teaching and research, punching far above its weight. Generations of students enjoyed the various degree courses in Earth science, in which the teaching of geological fieldwork long took a pride of place, and received an excellent all-round education. For student satisfaction, Leicester's geology course was long at or near the top of the UK rankings and was ranked first in 2025. That was an exceptional result given the unexpected and hasty evacuation, in the summer before, of the Bennett Building, the home of Geology and Geography for decades, as it was closed for renovation.

Leicester's research, too, is groundbreaking: in palaeontology, with the discovery of the 'Charnian' (now Ediacaran) fossils in the Precambrian, and key studies elucidating the evolution of life across deep time based on exceptionally preserved fossils; in global tectonics and geophysics (including establishing the UK's first Geophysics BSc degree), the science of catastrophic volcanic eruptions, mantle dynamics, mineralisation processes and, recently, in the big questions of climate change, loss of biodiversity, deforestation impacts, seeking new resources, and leading geological analysis of the Anthropocene concept. This is the kind of work that is needed now more than ever.

Geology misunderstood

Despite the critical importance of geology to our sustainable future, management at the University of Leicester has proposed that half or more of the geology staff will be made redundant, along with a similar proportion from geography (all human geographers are targeted), chemistry, history and all staff from modern languages and film studies (departments that will be closed). The remaining geologists, geographers and chemists are to be shoehorned into a new school combining these disciplines: most are on teaching-only contracts, and the only researchers to be maintained are those that broadly align with new 'research themes' chosen by the university management without consulting the scientists themselves.

In geology, the only remaining areas of research will be critical materials and satellite-based Earth observation: important areas, to be sure, but a ridiculously small span of the geological sciences. *All* palaeontologists – key strengths of Leicester geology past and present – are targeted for redundancy. The loss of palaeontology is absurd, not least because of the huge and growing importance of the deep-time record in providing analogues for a near-future Earth and its (increasingly difficult and dangerous) conditions of habitability. Leicester's palaeoclimatologists, who research climate change and biodiversity past, present and future, have essentially been forgotten by the narrow managerial reduction of



'climate and environmental futures' to remote sensing and sustainable mining.

Business trumps education

Extraordinarily, the university authorities plan to carry on teaching and advertising a geology degree together with palaeontology, even though their proposals imply it would in effect be taught by a skeleton (and therefore wholly unbalanced) crew of staff. Understandably, the students are distressed and furious, recognising that they would no longer receive the kind of education – informed by real knowledge, expertise and authority across the full range of disciplines – that they signed up for. There are post-graduate students too, who would lack supervisors, and research projects with post-doctoral workers already funded, with no-one to run them.

Why are the cuts to staff and expertise being made? The university's higher management cite financial difficulties and say these subject areas are not profitable enough, and so drastic measures are needed. A detailed, thoroughly worked proposal from staff in the School of Geography, Geology & the Environment for how earnings could be realistically increased and costs could be cut has been ignored. Positive change in the past two years that tremendously improved the financial position of the school has been overlooked by management. And, the protests of the students have also been ignored, going so far as to delete legitimate student comments from university social media posts, presumably on the grounds that this reflects poorly on the institution externally.

> **"The planned cuts fly in the face of academic reason. The university is lauding its climate change ambitions, yet proposing to cull its palaeobiological expertise, including research personnel at the forefront of the Anthropocene"**

The University of Leicester is set to cut half of all geology staff jobs as part of a departmental merger
© Alamy

The higher management do not, mind, say that these areas are unprofitable – simply that they wish to establish a financial buffer for the future. The real reasons thus may be sought in looking at where the money is going in a modern-day university, because it's no longer part of a nationally run, higher-education system aimed at providing the range of skills and knowledge needed for the nation (though that aim is formally what underpins a university's charitable status). Rather, it is what universities have become in the UK, in effect private companies supplying education to clients (formerly known as students), and competing fiercely with each other for business. Investment plans therefore are aimed primarily at increasing market share and profits, not to enhance the quality of education.

So, at Leicester some £500 million has been spent on large – indeed grandiose, if not hubristic – building programmes that include a glossy new student →

© Alamy

union, refurbishment of the management building, a prestigious Space Park at the edge of the city, as well as the expansion of degrees in China to bid for the foreign market. It seems that image at the levels of management trumps mere education: a few years ago, the university closed the (profitable and popular) university bookshop to clear room for more social space for the students (who were not impressed). Much of the money for these prestige projects is borrowed from banks, insurance funds and investment companies, many in the USA, as reported by Burrell and colleagues (2024). The results in practice seem not to have matched the grand management ambitions. There are now large debts that must be serviced, to the tune of millions of pounds a year. With this financial house of cards now at risk, it is the staff of geology (and geography, chemistry, languages, history and film studies) at Leicester that, management assert, need be sacrificed. There has, of course, been little or no suggestion that the university management team might be trimmed in this belt-tightening exercise.

It is a tragedy for the lecturing (and technical, and clerical) staff targeted, with the loss of careers, and mortgages and families to support. To keep the teaching, research and the ever-increasing administrative duties going, they have worked many more hours than they were contractually paid for, year after year, often working far into the night (I know, I was there). Redundancy is poor reward for all this effort. These staff really cared, and still do, and the students know this. The staff in Leicester are on strike in protest at these cuts, but the students are not criticising them for neglecting their teaching duties; indeed, they are turning out day by day on the picket lines and organising in support of the beleaguered staff.

Lend support

The planned cuts fly in the face of all academic reason. The university is lauding its climate change ambitions: it envisages a new school with the focus on chemistry, the Earth and environment. However, at the same time it is proposing to cull its palaeobiological expertise in the biosphere and climate change, including research personnel at the forefront of international focus on the interdisciplinary Anthropocene. To cast aside the biosphere, past and present, in any school of the environment shows naivety of interdisciplinary understanding at the very least and undercuts the eloquent message of Sir David Attenborough and others, which emphasises how human survival is directly linked to the health of the natural world. With no research expertise left in palaeontology, volcanology, stratigraphy, sedimentology and structural geology, and after ripping the heart out of the skills and expertise that Leicester once possessed, how can management expect geology degrees to still be taught and accredited?

SIGN PETITION

To sign the petition 'Save Geology at the University of Leicester', please visit: **change.org**

The university higher management – who, focused on financial engineering, have become almost wholly detached from how teaching and research function on the ground – seem at best to be ignorant of this problem, and unaware of the reputational damage that such casting away of international expertise would cause. There are alternative possibilities that should be listened to and are best developed in close meaningful consultation with the academic staff working at the coal face, making everybody part of the solution.

What can we do? In the case of Leicester, if you feel strongly that the once-thriving subject of geology should not be lost there, please do write to the Vice-Chancellor, Professor Nishan Canagarajah. Please also consider signing the petition 'Save Geology at the University of Leicester' available at change.org. The more voices that can be applied, from as many directions as possible, the better.

More widely, the University of Leicester is only one, if currently extreme, example of how geology is being squeezed out of education, because of ignorance about what geology means and what it can contribute daily at levels of decision-making that have real power and agency. The Geological Society is one organisation that can have a real voice in reaffirming its value, so that geology can thrive in the future – at Leicester and elsewhere.

PROF JAN ZALASIEWICZ
Emeritus Professor at the University of Leicester, UK

FURTHER READING

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

- Burrell, G. et al. (2024) Shaping for Mediocrity: The Cancellation of Critical Thinking at Our Universities. Zer0 Books. 256 pp.

LETTER

A revised approach

DEAR EDITORS,

Jonathan Turner's article on nuclear waste disposal in the Autumn 2025 edition (*Geoscientist* 35 (3), 18-19) raises interesting questions. I have no doubt that we need nuclear power for the future, since it is reliable in a way that wind is not, and we need to deal with the waste that will arise, and with legacy waste too. The UK is making remarkably slow 'progress'. When I was working on the Nirex project (a body set up by the UK nuclear industry to examine geological disposal of radioactive waste) in the 1990s, the target operation date was 2015 – the year I would retire. I've now been retired 10 years, and we are less far forward.

I agree with Dr Turner that the Borrowdale Volcanics near Sellafield are not very promising as a repository host, but the site investigated had the advantage that it is close to Sellafield, where most of the waste for disposal is currently stored. Many criteria must be considered: suitable geology is clearly essential, but transport and other logistics cannot be ignored, and cooperation from the host community is also necessary. The Eocene clays beneath north London might be a possible repository host formation, but I can't imagine this proving acceptable for many reasons.

> **"Many criteria must be considered: suitable geology is clearly essential, but transport and other logistics cannot be ignored"**

The search for a location could be made easier by taking a different approach to what is a suitable geological environment. The emphasis so far has been on low-permeability formations: evaporites, clays and igneous/metamorphic rocks. But the real need is for extremely low rates of groundwater flow, both to protect the containment materials and to minimise the flux of waste radionuclides into the accessible environment, and confidence that this will continue for the long term.

Long-term persistence of saline water with no support →

Sizewell in Suffolk, UK, hosts the Sizewell A and B nuclear power stations (pictured here); A is being decommissioned and a third, Sizewell C, is planned. Saline groundwater, expected to be present at depth in the Chalk under Sizewell, may provide suitable conditions for nuclear waste disposal, suggests John Heathcote. *© Shutterstock*

from evaporites is a good indicator of very low groundwater flow, whatever the permeability of the rock. I'm aware of such in the St Bees Sandstone beneath Sellafield (Bath et al., 1996), and at depth in the Chalk of East Anglia, proven at Trunch in Norfolk but probably present under Sizewell in Suffolk (Heathcote, 2024). My own preferred location, on geological grounds, would be near Sizewell in the lower part of the Chalk, which is characterised by very old saline groundwater, an area of likely glacial deposition rather than erosion, and long-term tectonic subsidence. Excavating tunnels in the Chalk beneath the water table is very well understood (e.g. the Channel Tunnel) and it's not necessary to go very deep.

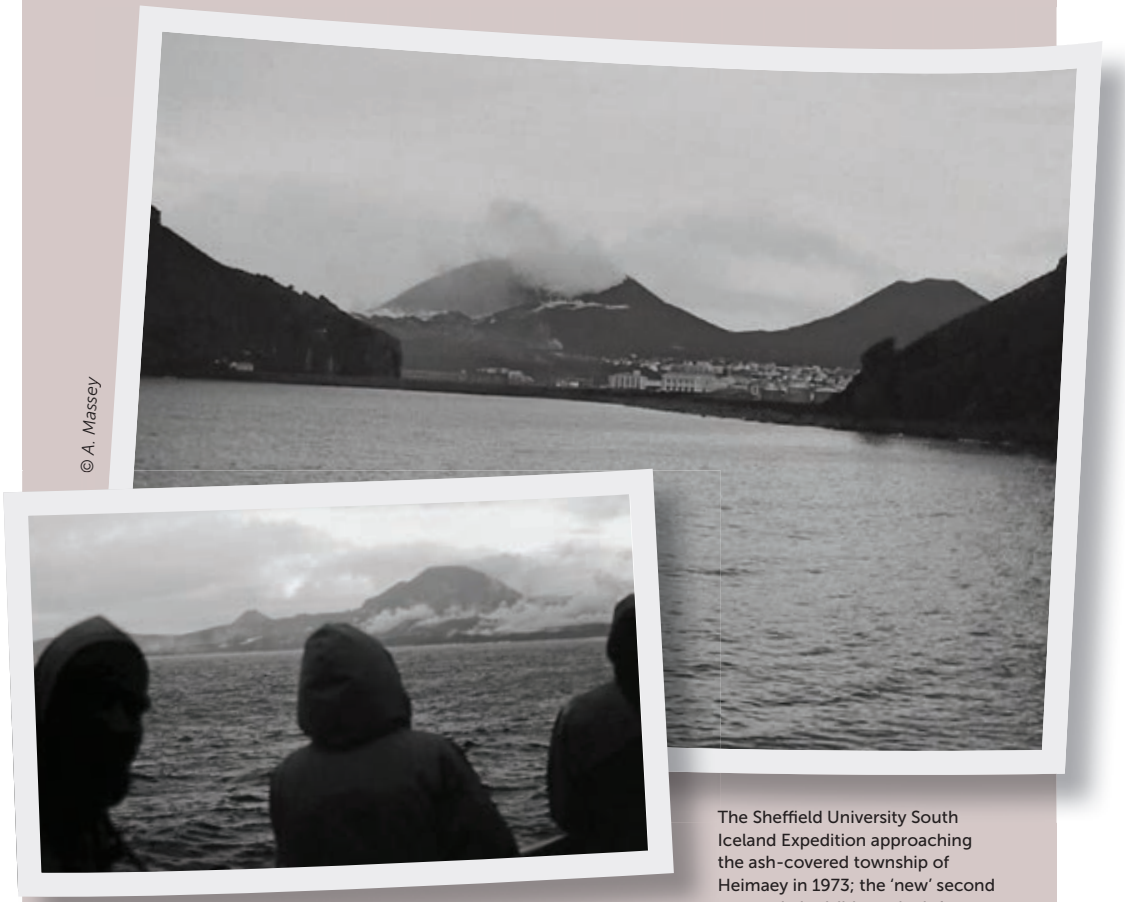
Local acceptance (not the same as volunteering) remains important, though. I appreciate the concept of 'acceptance', since where I live now in Scotland, a great deal of renewables electricity infrastructure is being foisted on us to meet needs in England, and it is meeting much opposition from host communities.

DR JOHN HEATHCOTE MA PHD CGEOL FGS
Director at John Heathcote Consulting Ltd.

FURTHER READING

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

- Bath,A.H. et al. (1996) QJEGH 29, S39 - S57
- Heathcote, J.A. (2024) QJEGH 58
- Turner, J. (2025) Geoscientist 35 (3), 18-19



The Sheffield University South Iceland Expedition approaching the ash-covered township of Heimaey in 1973; the 'new' second mountain is visible to the left

LETTER

Icelandic reminiscence

DEAR EDITORS,

In the Autumn 2025 edition, Dr Rhian Meara presents a lovely example of how working within the Earth sciences can lead to a range of careers, sometimes unthought of when setting out (*Geoscientist* 35 (3), 40-44).

Rhian describes her deep connection with the Icelandic island of Heimaey and how the impact of the 1973 eruption on the local community was a driver in altering her career towards the social sciences.

Her beautiful photographs reminded me of a cold overcast June day in 1973, when, as a member of the Sheffield University South Iceland Expedition, I had the good fortune to see Heimaey within months of the eruption.

We were on the MS *Gullfoss* ferry from Leith to Reykjavik when it dropped off supplies and passengers at Heimaey. It was a remarkable sight, especially for many in our team who had only just graduated as geologists. We sailed past the still hot and steaming lava front which had reduced the once wide harbour mouth to a channel barely wide enough for the ship to navigate.

A fellow passenger returning home to Heimaey after two years away told us that when he left there was only one mountain, now there were two!

ANDREW MASSEY, FGS
Retired Engineering Geologist, Brisbane, Australia

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THE ROCK AND I

MANUEL ALVAREZ DIESTRO PRESENTS A PHOTOGRAPHIC SERIES FROM THE MIDDLE EAST THAT DISTILS A LIFE SPENT WALKING AMONG ROCKS IN AN EFFORT TO UNDERSTAND THE RELATIONSHIP BETWEEN LANDSCAPE AND ARCHITECTURE – AND, IN SOME WAY, HIMSELF

Village against a rocky landscape in Northern Oman (Wadi Khab, Oman, seen from Jebel Harim, 2018 © *Manuel Alvarez Diestro*)

AS A PHOTOGRAPHER, my relationship with territory is profoundly physical and emotional. I not only have to walk long distances under an unrelenting sun but must also frame the relationship between architecture and landscape. My fascination with rocks began in childhood, watching western films shot in Almería, Spain – those CinemaScope images where small towns looked like scale models set within a stony landscape. Later I discovered that the volcanic landscapes of the Canary Islands, of Iceland, or the reddish surfaces of Wadi Rum are not simply settings for science fiction, but mirrors and companions to human desolation.

My training in art history reinforced that obsession. In the Leonardo da Vinci paintings projected by my professor in Boston, USA, I understood that geology could become a spiritual structure; in the works of Joaquín Patinir, master of the Northern Renaissance, I saw how mountains reduced the human figure to something almost symbolic, shifting the protagonism toward the landscape. I then understood that rock, beyond its tectonic dimension, is also a symbolic, emotional, and narrative element. →

When architecture invades

My personal story was built far from my home in Spain. I spent many years in the Middle East, where I lived with rock during my territorial explorations: camera in hand, litres of bottled water on my back, and always a cap to protect myself from the sun. I climbed the Alborz Mountains in Iran countless times to photograph the Eocene pyroclastic formations rising abruptly beside the megalopolis of Tehran. I crossed the Strait of Hormuz to navigate the Mesozoic limestone rias (drowned river valleys) of Musandam, a Martian-looking karst landscape where dolphins cut through the turquoise waters to remind you that you are still on planet Earth. In Egypt, I crossed the deserts around Greater Cairo, where the fractured limestones of Mokattam seem to lament the great urban botch job advancing over them with no sensitivity or dialogue.

I often touched the rocks, trying to understand their excess of beauty: their sharp edges, their fractures, their geometry. I asked myself what happens when architecture invades that space – whether it is a dialogue, an imposition, or an accident. I encountered multiple scenes: cubic buildings that seemed to have landed from another planet; constructions attempting to assimilate by incorporating local materials; or dwellings directly excavated into the rock. In these landscapes, I understood that the ultimate symbiosis between rock and human beings can appear in the most unexpected places.

> **“Symbiosis between rock and human beings can appear in the most unexpected places”**

Living landscape

My relationship with the territory begins even before stepping on it. From the airplane window during the approach to the destination, I identify possible places to photograph. Landing in Khasab, in Northern Oman, is already an experience itself: the pilot traverses limestone mountains before fitting the aircraft onto a runway wedged between massive rocks. Excitement and adrenaline take over your body. Then I rent a car and cross long distances looking for isolated buildings scattered among vast valleys flanked by seemingly infinite rock walls. The questions then arise: how do those people who sleep just a few metres from those stone walls live? Do they feel what I feel? Have they ever climbed the rocks? What does rock mean in their lives? Are rocks an obstacle, or an element that helps people reconnect with themselves?

One of the phenomena that most fascinates me is the self-destruction of rock: constant erosion, the fragments that break off, the debris rolling down the slopes and dangerously coexisting with human dwellings. Geology redefines vital space far more than we usually perceive, and walking among these processes reveals to me a living landscape in perpetual transformation.

During these journeys I rarely encounter people. I prefer it this way: in my photographs, human absence allows architecture and landscape to speak for us. The human figure appears through its imprint, its scale, or its constructive errors – not through its direct presence. That distance interests me deeply, and provides the opportunity to find myself alone with the rock.

The experience of crossing these Middle Eastern geographies, of finding constructions that resemble anticipated ruins, inevitably leads me to surrealism, particularly to the dreamlike landscapes of Salvador Dalí depicting the rocks of northeastern Spain’s Costa Brava in his native Girona. Photographing such scenes demands absolute attention. I risk getting lost, but in that exercise, I find beauty and the sublime. In the most absolute solitude, I can release my emotions and, why not, shout into the open sky out of sheer happiness. I remember so many occasions when the unbearable heat made my sweat burn my eyes, not knowing whether I was crying from irritation or from the emotion of witnessing such landscapes. Photographing far from my roots becomes a method of personal relocation: understanding who I am in relation to a landscape that is not part of my childhood memories in Northern Spain. These aesthetic raptures, difficult to explain, transport me →

New residential developments under construction in Egypt’s desert (New Cairo, Egypt, 2012 © *Manuel Alvarez Diestro*)

Unfinished residential tower outside Tehran (Pardis, Iran, 2018 © *Manuel Alvarez Diestro*)

“Are rocks an obstacle, or an element that helps people reconnect with themselves?”

Rocks overlooking the endless metropolis of Tehran (Tehran from the Alborz Mountain Range, 2017 © *Manuel Alvarez Diestro*)

> “I generate a sense of merging between the construction and the rock, leaving the image flat, where the human presence fuses with stone”

to another world where, for me, life becomes absolutely wonderful and full of meaning.

Photographic dance

When I descend a rocky mountain and find an isolated building in the middle of nowhere, the photographic dance begins. I circle the structure, attentive to every angle, following Swiss-French architect Le Corbusier’s concept of ‘promenade architecturale’, but rather than perceiving space through movement, here the dialogue is between architecture and geology. I observe how the building embeds itself in the terrain, identify strata, slopes, shadows projected onto limestone or basalt. Then I move away to contextualise it. Finally, I seek height, climbing a nearby rock to obtain a polyhedral, almost cubist view and take the photograph. At that moment, I often use a telephoto lens to generate a sense of merging between the construction and the rock, leaving the image flat, where the human presence fuses with stone.

As in the films of Werner Herzog and Akira Kurosawa, I seek to show human fragility: although I cannot film rolling rocks, I can photograph those that seem on the verge of falling. In the Alborz, many rocks appear to watch Tehran with dangerous patience, reminding the city’s inhabitants of its precariousness – here, the threat is constant.

I have seen that geology is seldom integrated into architecture. In Egypt, where I lived for years, I saw new urban developments destroying native rock with no consideration for the environment. That rock could have been integrated sensitively, generating an organic dialogue and creating contextual architecture. In Cairo’s Zabbaleen district, at the foot of the Mokattam Plateau, informal dwellings cling to the hillside, establishing a duel in which the precarious →

constructions are doomed to lose. From above, on the great rock, the visual drama is exceptional: the history of humanity compressed into a single panorama where pyramids, medieval mosques, the City of the Dead, colonial expansions, and 21st-century skyscrapers coexist in this great architectural genesis.

Walking man

I am aware of my limitations in the field of geology. I cannot scientifically explain the origin of these formations, but I can relate to them from vulnerability. In the erosion of rock, I perceive the erosion of the human soul. The Swiss artist Giacometti expressed this condition in his elongated figures, eroded inside and out, in constant movement. In some way, I too am that walking man: a minimal and fragile body in an immense landscape, aware of its smallness and yet compelled to move forward. Walking on rock is accepting the real scale of the world.

A Cairo neighbourhood interacts with rock (Zabaleen district seen from Mokattam, Cairo, Egypt 2021 © *Manuel Alvarez Diestro)*

I have no geological training, but many years spent walking through arid territories have taught me to recognise essential patterns: the alternation of lithologies, the distinctive limestones, the sandstones that redden at sunset, the basalts that scar the hillsides, the fractures announcing future rockfalls, the aeolian erosion, the thermal weathering. In Beirut, Lebanon, I began to apply geological logic to urban collapse: bombed buildings whose folded slabs resembled fragile strata subjected to extreme pressures.

Photography is my intuitive way of understanding deep time. Each image captures an instant that nonetheless belongs to a territory that continues to change. Between that instant and that geological time opens the space where I try to situate my photographic work.

In the end, understanding rock is not a scientific matter for me, but one of presence. Each landscape reminds me that we are brief visitors in territories that took millions of years to form. Rock teaches me my own physical and temporal limitations. Erosion speaks of our existential wear but also of our possibility to continue. And architecture reveals our need to dialogue with something greater than ourselves.

MANUEL ALVAREZ DIESTRO
Filmmaker and photographer based between Toulouse, France, and Madrid, Spain

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THE GROUNDS OF ARCHITECTURE

AS HUMAN CONSTRUCTION RAPIDLY RESHAPES EARTH'S SURFACE, PAUL DOBRASZCZYK DISCUSSES THE WAYS IN WHICH ARCHITECTURE CAN CONNECT PEOPLE WITH GEOLOGY AND THE DEEP HISTORY OF OUR PLANET

IN 2020, EMILY ELHACHAM and colleagues published an article in *Nature* which argued that, for the first time in history, the mass of everything made by humans exceeded that of all living biomass (the latter being approximately 1.1 tera tonnes; Elhacham et al., 2020). The team also demonstrated that the growth in the total mass of human-made artefacts was exponential, doubling every twenty years or so.

Just a century ago, less than 3 per cent of the planet was human made; it crossed the 50 per cent threshold in the 2010s. Following this trajectory, we would have ample reason to believe that, sometime in the 22nd century, the entire planet will be one great mass of metals, asphalt, plastic, bricks, aggregates and concrete. A planet like Trantor in *Foundation*, a series of science fiction novels by American author Isaac Asimov where a single conurbation covers every available surface on the globe. That prospect is undoubtedly far-fetched, but it flags up the extraordinary speed at which humans are now altering the very material fabric of Earth's crust itself, a process that has, or more precisely will have, significant geological implications.

The Anthropocene

We are now living in what some call the Anthropocene, a new geological epoch in which humans are the principal planet-changing force. A key buzzword for social scientists over the past two decades, the term firmly entered the public realm in 2024 when the International Union of Geological Sciences formally rejected the Anthropocene as a successor to the Holocene, the geological epoch that began at the end of the last Ice Age some 11,700 years ago, and which was only accepted by the scientific community in the 1990s (IUGS, 2024).

Despite broad agreement on humanity's unprecedented impact on Earth (and its recentness) and plenty of material evidence to support this, the formal rejection of the Anthropocene by geologists was due, in large part, to the short period of time under consideration — the last seventy years or so. Geologists, and particularly stratigraphers, generally deal with periods of time that extend into tens, if not hundreds, of millions of years. They look to the distant pre-human past to discern changes in the geological record. While there is no doubt that the sheer amount of anthropogenic mass is already affecting and contributing to Earth's strata, there is simply no formal geological framework for investigating what might happen in the deep future, as opposed to the deep past. Neither is there a framework for the sheer speed at which humans are →

15 Clerkenwell Close. Designed by architect Amin Taha and built in 2017, this six-storey office building in Clerkenwell, London, has a rough-hewn limestone façade with visible fossils and textures that express the geological origins of the building material *© Paul Dobraszczyk*

generating the materials that will still be there in the distant future (Zalasiewicz, 2008).

What debates about the Anthropocene do flag up is the central role that human construction plays in the alteration of Earth's fabric. As of 2023, the global construction industry accounted for nearly 40 per cent of carbon emissions worldwide, mostly a consequence of the manufacture of concrete and steel in colossal quantities (Dyson, 2023). But construction, and particularly architecture, always has a reciprocal relationship with Earth. On the one hand, construction consumes the planet's resources by turning raw materials into things we can use; on the other, it also has the potential to draw us into an awareness of Earth and deep time.

15 Clerkenwell Close

In 2017, the appearance of a new six-storey office building in Clerkenwell in London generated intense debate that keyed into architecture's reciprocal relationship with Earth. Designed by architect Amin Taha, 15 Clerkenwell Close has an exposed structural façade made of rough-hewn limestone, rather than polished stone cladding, with visible fossils and textures that express the geological origins of the building material. Taha sourced the stone from the famous Caen quarry in Normandy — a decision inspired by the 11th-century abbey that used to stand on the same site as the new building. This Jurassic Period limestone was used to build many of England's medieval cathedrals and other ecclesiastical buildings; and it is rich in fossils from this period in Earth's history.

The building faced significant opposition from the borough council, heritage groups and some locals. The controversy was so fierce that the building received two demolition orders (one in mid-2017 that was withdrawn and another in 2018 that was later overturned). Fortunately, the building survived this furore and seems safe for now. The planning officer's ire centred on the architect's decision to use raw quarried limestone for the building's structural frame. According to the local council, the untreated limestone wasn't specified in the original planning application. Taha thought otherwise: for him, it was the appearance of the building that caused such offence. It looked unfinished, an uncomfortable reminder that what we generally appreciate in architecture is the erasure of any signs of its origin in the natural materials of Earth.

A fallen Ionic capital placed directly outside 15 Clerkenwell Close (designed by Amin Taha) refers to the beginnings of classical architecture © *Alamy*

When I visited the building after the planning furore had died down, I noticed something that many of its detractors had missed: a fragment of stone at the base of the façade that displays a knowing reference to architecture's oldest recognized theorist, the Roman writer Vitruvius, whose *De Architectura* (normally translated as *Ten Books on Architecture*) was written between 20 and 30 BCE. In this treatise, Vitruvius speculated about the origins of architecture itself, arguing that human construction must have been inspired by examples already set by nature. These included birds' nests, tree branches and caves — each natural architecture producing a human equivalent over time.

In the fragment of stone placed outside the Clerkenwell office building we see a reference to the beginnings of classical architecture: an Ionic capital, picked out in gold paint, seems to emerge from the otherwise untreated stone. The ivy that half concealed the stone when I visited only added to its symbolic power. For me, this artful fragment and the rough-hewn façade behind it questioned the origins of architecture itself. Does architecture begin in the quarry or in the transformation of natural stone into art?

> **“The artifice of architecture can make geology meaningful to humans”**

If the Anthropocene requires us to look into the far future, it also means looking back, too, to the point where the gargantuan juggernaut of human construction we know today first began — the moment when geology was turned into architecture. Perhaps the emotive charge of Taha's building lies in this provocation — the unfinished aesthetic suggesting that, in the Anthropocene, far bigger things are up for question than the niceties of planning legislation.

Reciprocal landscapes

Quarries are part of architecture's 'reciprocal landscapes', in the words of landscape architect Jane Hutton: places where the materials used to build with are extracted from Earth.

Hutton's 2020 book, *Reciprocal Landscapes*, highlights the hidden connections between designed sites and the distant places that supply their materials, urging us to see landscape architecture as a web of mutual — and often unequal — exchanges between people, materials, and ecosystems.

Stone, along with timber, may be some of architecture's oldest building materials, but these have long been eclipsed by materials that humans rather than Earth or its living biomass fabricate. Such human-made materials include concrete, iron and steel, brick and plastic, to name only the most common. Many view quarries as sites of violence meted out on the planet, with raw materials only given meaning as they are shaped into buildings and other things we can use. These sites are generally shunned as places of pollution, noise and

ugliness — connecting architecture to these places is discomforting. It is commonplace to assume that for a work of architecture to attain value, it must transform its 'mere' material basis in nature into art. Put another way, the artifice of architecture is the very thing that can make geology meaningful to humans. That is why a piece of natural stone is not usually called architecture: it has to be shaped by human hands (or our machines) and made useful for it to possess any architectural meaning.

Utility

Utility — *utilitas* in Vitruvius's treatise — is often seen as one of the cardinal virtues of architecture, even more so in the modern period, when it became something of a religious tenet for leading modernist architects like the Swiss-French architectural designer Le Corbusier [1887 – 1965]. Yet the very idea of utility comes with enormous historical baggage, especially when applied to geology.

In her provocative book *A Billion Black Anthropocenes or None* (2018), geographer Kathryn Yusoff traces the origins of the science of geology to the advent of colonialism and the widespread instigation of slavery. Yusoff's argument is that the early science of geology was intimately tied up with the Eurocentric empires that began at the end of the fifteenth century after the first voyage of Christopher Columbus. For colonisation was predicated on the exploitation of natural resources — the materials of Earth — and geological investigation was closely allied to the sourcing and extracting of these resources. Surveying the ground and investigating rocks showed the colonisers what was available for their use. In Yusoff's estimation this led directly to the enslavement of millions of Black Africans, because seeing Earth as inert paved the way for seeing other people in the same light. Thus, any idea of the usefulness of resources — whether rocks or people — is tied up with the ways in which we construct knowledge about those resources. In short, things/people are made useful by first being described as such. There's nothing natural about utility; indeed, it is loaded with political and social meaning from the start.

Yusoff's thesis is extremely disquieting. She questions whether definitions of the Anthropocene are yet more evidence of humans' (here meaning colonialist humans) unwillingness to treat Earth and each other with respect, particularly when it comes to the still-thorny issue of racial difference. Even if we don't agree with Yusoff's conclusion that the science of geology and slavery are closely aligned, there's a wider point here about the tendency of certain human ideas of utility to render all things, including people, as subservient to our needs.

Stories of stone

What I see in the rough-hewn stone of Taha's building in Clerkenwell is an assertion of other ways of being in the world. The stone in that building, freshly extracted from the ground, forces awareness of the life of stone in the world, the way in which it has its own places of origin, its own stories of becoming and its own futures. Just because the stories of stone are indifferent to and immensely longer than our own doesn't mean that they are of any less value.

MORE INFORMATION

Paul Dobraszczyk's book, *The Matter of Architecture*, will be published by Reaktion in 2026

Does architecture begin in the quarry or in the transformation of natural stone into art? Here, limestone building blocks are cut from a quarry on Gozo, Republic of Malta © *Alamy*

PAUL DOBRASZCZYK
Architectural writer, photographer and artist, and lecturer at the Bartlett School of Architecture, London, UK

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CORE KNOWLEDGE: VALUING THE UK'S GEOLOGICAL ARCHIVE

WITH THE UK'S NATIONAL GEOLOGICAL REPOSITORY REACHING CAPACITY, DANIEL CONDON AND EMMA BEE EXPLORE THE CRITICAL ROLE OF THIS VAST LIBRARY OF RAW GEOLOGICAL DATA AND HIGHLIGHT THE NEED TO FURTHER UNLOCK ITS POTENTIAL

THE UK'S NATIONAL GEOLOGICAL REPOSITORY (NGR) is a flagship science facility run by the British Geological Survey (BGS) in Keyworth, Nottinghamshire. Composed of three warehouses totalling approximately 3,000 m^2 of climate-controlled storage space, the NGR contains over 600 km of core, millions of rock and fossil specimens collected over centuries, and decades-worth of subsurface data. The NGR is the nation's largest curated collection of subsurface geological samples and related information, and represents the collective efforts of industry, academia, BGS and many affiliated organisations, past and present.

But the NGR is far more than a collection of rocks and records (Howe, 2023); it's a national asset that underpins science, innovation, industry and policy — past, present and future. Like a library, its contents are accessible to a broad community of users seeking authoritative information about the UK's subsurface environment.

However, the NGR currently faces some critical challenges. Nearing its physical limits for storage capacity, the

BGS © UKRI

INSIDE THE NATIONAL GEOLOGICAL REPOSITORY – A TREASURE TROVE OF UK GEOSCIENCE

CORE COLLECTIONS
- Onshore: 250+ km of drill core from over 15,000 boreholes
- Offshore: Over 350 km of drill core and other samples from approximately 800 wells

FOSSIL COLLECTIONS
- Type and stratigraphic fossils: Approximately 250,000 specimens
- Microfossils: Approximately 250,000 slides
- Locality-based fossils: Approximately 2.5 million specimens

ROCK & MINERAL COLLECTIONS
- Systematic British Rock Collection: Over 300,000 samples
- Thin sections: Over 200,000
- National soil and sediment survey samples

GEOSCIENCE RECORDS & ARCHIVES
- Over 20 km of records, including:
  - Field records, maps and borehole logs
  - Coal data and mine plans (approximately 20,000)
  - Seismic, geophysical, and geochemical data
  - Seismograms (approximately 100,000)
  - Magnetograms (22,000)
  - Marine and hydrogeological data

The NGR also houses important collections from other organisations, including the British Antarctic Survey, Natural History Museum, and Maritime and Coastguard Agency.

NGR has invoked a series of temporary closures for accepting new donations and is contending with decreased public funding. Yet, as the UK navigates the challenges of decarbonisation, resource security and climate resilience, the NGR's role in providing trusted subsurface data has never been more critical. How do we convey the economic, scientific and societal value of the NGR to decision makers and investors? And what role do foundational analogue collections play in our digitally enabled future?

Economic value

Anyone who works on UK geology will immediately understand the value of the collection, for both their research and for the nation's long-term benefit. Core and other samples, with their associated metadata, provide the rawest form of foundational data underpinning geological knowledge; they are quite literally the ground-truth. But how do we quantify the value of the NGR and ensure that others, who are less familiar with the significance of geology, understand its value *and* importance, and the need to invest in it? Together with colleagues at the BGS, we worked with a team of economic consultants at the firm Human Economics to not only tell the story of the value of the NGR to the nation but also to put some economic figures to it.

Whilst the question of economic value seems simple, answering it with compelling evidence is a challenge. We could think about the costs incurred in collecting the samples. For example, the NGR contains material from about 8,000 offshore wells collected over five decades. Using £25 million as the typical cost for an offshore well (NSTA, 2022; 2023) gives a total of £200 billion, underscoring the immense costs involved with acquiring the materials. But what are the materials worth after they have been used for their primary purpose, when they are curated and made available for wider use by the NGR? →

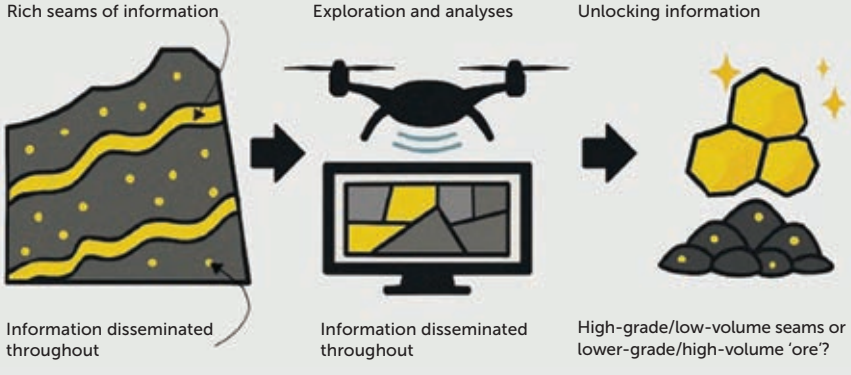
This study used a case-studies approach, choosing four recent and ongoing case studies that cover historical, current and future uses, and operate across a range of timescales: shale gas exploration, geological disposal of radioactive waste, carbon capture and storage (CCS) and geological energy storage. We could have used many other examples, including oil and gas exploration in the 1960s, groundwater security, mineral exploration, climate change adaptation or infrastructure engineering (such as tunnels), but time and resources were limited.

For each case study, the team worked with subject matter experts to understand the role the NGR collections played in each sector. How many cores were examined? Were they offshore or onshore? How useful was the derived information (nice to have vs. essential)? A critical question was the counter-factual, hypothetical scenario: if the NGR did not exist, what would need to be done to attain the same level of knowledge to underpin the development of that topic? Starting investigations from scratch, the experts estimated that about 30% of the number of wells would be required if their sample collection was planned/optimised, allowing us to assign a value to the information obtained.

The economists used this approach to determine a benefit-cost ratio (BCR) for the NGR that complied with the Government Green Book and Guidance. A BCR is a tool used in cost-benefit analyses to assess the value for money of a project or facility and is calculated by dividing a project's total benefits by the total costs. Based on just four case studies, the BCR for the NGR was estimated to be about 36, that is, a return of up to £36 for every £1 invested (BGS, 2025; Human Economics, 2025). Such a BCR is considered high for economic assessments. Yet, the quantified inputs were conservative, so as not to over-inflate the BCR, and independent testing by other economists confirms the estimate is robust. The value reflects the intrinsically high costs of acquiring core from under the North Sea, costs that are primarily borne by industry and are not incurred by the NGR.

Beyond economics

Beyond the headline financial figures, the report highlights several important narrative themes. Chief among them is that the collections are somewhat independent from their original purposes and can (and will) be continually repurposed as needs, opportunities and national priorities evolve. Examples of repurposing include materials gathered during hydrocarbon exploration that now play a vital role in advancing CCS, as well as coal mine samples that are now used for shallow geothermal energy.



Gold mine or prospect? | Is the NGR a gold mine with rich seams of information or a deposit with value disseminated throughout — or a combination of both? *(BGS © UKRI)*

Whilst the financial valuation of the NGR is important, its broader societal value is equally significant. The NGR serves as a vital resource for students and early-career geoscientists, offering hands-on access to real-world geological materials and key reference collections that span a wide range of UK geology, supporting teaching and research projects. Like a national library or other national archive (such as the UK BioBank or the Millenium Seed Bank), the NGR safeguards irreplaceable records of the UK's geological history that are a resource to support research, innovation and application.

The repository also underpins public policy, environmental protection and infrastructure planning. It supports the work of BGS as well as a wide network of partners engaged in UK geoscience, from academics and consultants to planners and regulators. Importantly, the collection is agnostic of end use and has proven invaluable when unexpected demands on the subsurface arise. Examples include the recent shale gas 'boom', the growth of CCS, the development of geological energy storage, research into critical minerals and the emerging interest in natural hydrogen – activities that are likely to continue to be NGR use cases for the coming decades. Archived materials can suddenly become critical to new sectors, allowing the NGR to support different stages of subsurface technology development, from early appraisal through to implementation. The NGR's value lies in its ability to support exploration of the known and unknown, over decades.

Digitisation: Unlocking potential

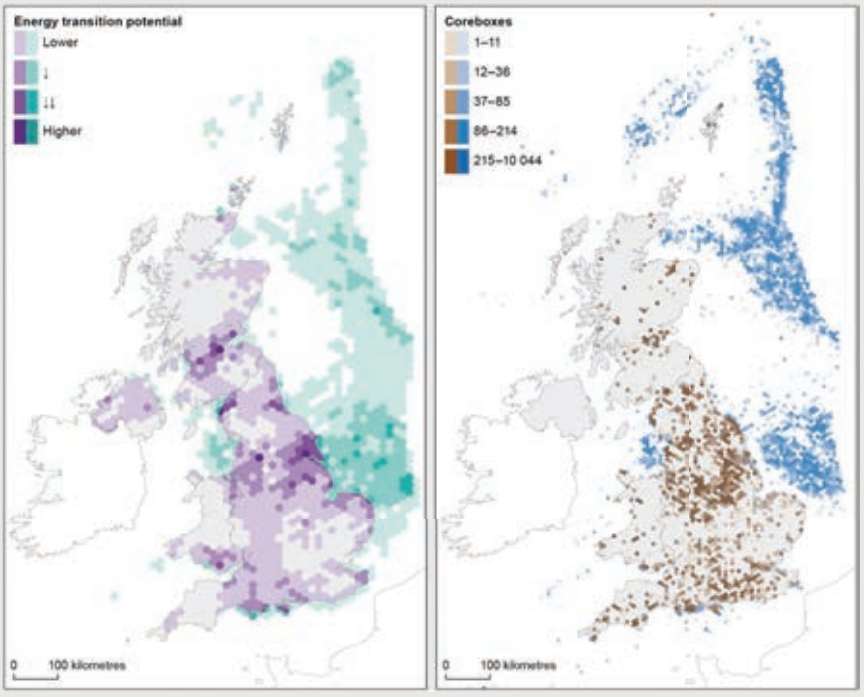
New opportunities lie in unlocking the value embedded in the NGR physical collections through digitisation. We are on the cusp of revolution driven by the increasing application of artificial intelligence (AI), so the question of digitisation is primary. At present, physical access is mostly required to extract information from the collection (although some key datasets are already digitally available, including an extensive range of high-resolution core photographs), but what outcomes might AI and high-performance

computing offer once the physical assets are scanned and made digitally available?

'Digitisation' means different things to different people and sectors. Photographing is a form of digital capture, but it has limited 'actionability'. Digitising a human can range from a simple photograph to advanced imaging, like X-rays or MRI scans, and even biological sampling, such as blood tests. The same applies to NGR collections, where digitisation could range from photography through to core scanning using X-rays for imaging, and geochemical analyses, to sample analyses to quantify porosity, age, composition, etc. Each method reveals different levels of detail, collectively forming a digital representation of the analogue sample.

The end use dictates the 'depth' of digitisation required and each sector is likely to have a common set of minimum requirements, which could vary with time. There is a trade-off between breadth/coverage and depth/detail, which need to be balanced to find a sweet spot. One size does not fit all, so an adaptive infrastructure is required. Digitisation that creates actionable, 'research-ready' data providing sufficient information for most needs should include high-resolution images, georeferencing and structured metadata. Digitising information such as core scans, key physical property measurements, and other standard geological analyses would provide actionable data that can support a wide range of applications, from CCS to groundwater management.

It is exciting to consider the suite of technologies now available for deployment. Digitisation of text records using optical character recognition and natural language processing allows for intelligent searches, pattern recognition and integration across datasets that can transform static archives into dynamic, queryable resources. Physical samples can be digitised through high-resolution scanning, hyperspectral imaging and X-ray fluorescence. Thin sections can be fully scanned and digitised to reveal mineralogical and structural details, enabling remote analysis and cross-comparison. The application of machine learning to data will enable data processing at rates and scales far beyond what is currently limiting, opening new areas of geodata processing and analyses.



Mapping the NGR to national needs | The correlation between energy transition potential (the capacity or opportunity of a region to shift from fossil fuels to low-carbon energy sources) and the geographical distribution of core held in the NGR is high. Such mapping highlights how NGR collections can be mapped to high-priority geology using an intelligence-led approach that maximises the benefits of digitisation. *(BGS © UKRI)*

> **“New opportunities lie in digitisation”**

Advances in machine learning and AI will drive a step change in how we interact with geoscience data and information, and digital readiness is key for the discipline (Bergen et al., 2019). Together, these technologies and this approach form the backbone of 'NGR+', a vision to be collectively developed for a digitally accessible, research-ready NGR that contributes to underpinning UK geoscience in the digital age. This transformation will not only preserve the UK's geological heritage but also unlock its potential for current and future generations.

To realise this digital future requires a strategic and agile approach that aligns with evolving national priorities, uses emerging technologies and builds upon ongoing investments. It's easy to think of the NGR as a gold mine with 'value' in every part of the collection, but perhaps we are better off approaching it as a prospect, a resource that requires evaluation, careful consideration of worth to stakeholders and development of suitable extraction and delivery strategies. Are there rich seams of valuable information that can be mapped out and unlocked through targeted digitisation, or is the value distributed equally throughout? Must we consider some form of wholesale digitisation? Perhaps there will also be lots of secondary value in the 'tailings', the metadata and records. To link any effort to realise value from an asset, we need to balance public- →

good needs and economic prudence with operational resilience. The NGR must be resourced not only to maintain its collections but to adapt, digitise and serve the evolving needs of the UK's geoscience community.

Infrastructure delivers

The NGR is at capacity, prompting a strategic reappraisal and rationalisation of collections to optimise space. However, the growing demand for new insights from geological data, driven by emerging sectors like CCS, geothermal energy and hydrogen exploration, means that additional storage and digitisation infrastructure are essential. Investment in expanded facilities and digital platforms will ensure the NGR remains fit for purpose in the decades ahead.

TAKE A VIRTUAL TOUR

Tour the NGR at **bgs.ac.uk/geological-data/national-geological-repository/ngr-tour**

The rationale for ensuring the NGR's sustainability is clear. National needs, from clean growth and the energy transition through to environmental resilience, and new technologies and industries, require subsurface data. Such data are critical to addressing challenges including CCS, geothermal energy, safe disposal of radioactive waste, groundwater security, critical minerals and major infrastructure development. The NGR supports cutting-edge science across academia, government and industry. Further unlocking its contents will enable new discoveries and accelerate innovation. It does not provide all the answers but is a very efficient way to access data and information that can de-risk projects and reduce costs, in both discovery research and the applied sectors. The NGR is a foundational asset for national infrastructure and environmental stewardship, and a catalyst for geoscience research, innovation and impact.

Where should we start? We know where the major uses of the subsurface will likely occur because this is dictated by both the geology and existing infrastructure, such as offshore pipeline networks. As such, it is possible to develop an 'intelligence-led' approach to digitisation, where each sector could develop a bespoke approach to unlocking the value of the NGR for their sector, within the underpinning infrastructure of the NGR. Developing a strategic and co-designed approach, with input from government departments, regulatory bodies, industry and academia to investment in digitisation should ensure that efforts are focused where they are most needed, that value for money is maximised over time.

Just as libraries have evolved from physical books to digital platforms, enabling remote access, searchability and integration with other systems, the NGR must undergo a similar transformation. Digitisation will allow researchers, regulators and industry to 'order' geological information as easily as downloading an ebook, unlocking new efficiencies and insights. Imagine being able to download entire collections for a region or geology of interest and read or interact with that collection using machine-learning tools, at a scale not previously possible. Where this analogy with libraries breaks down is that the materials in the NGR are not 2D surfaces with text and images: they are varied and heterogenous 3D objects and digitisation will never create a true facsimile. Thus, the case for disposing of core once scanned is limited because the samples may one day be required for additional testing.

The NGR's estimated BCR of 36 provides compelling evidence that past investments have yielded substantial returns. This historical performance is a strong predictor of future value, especially as national priorities shift toward decarbonisation, resilience and sustainable development. Although the economics of decarbonisation industries using the subsurface will differ from other subsurface activities, it is almost certain that the future BCR of the NGR will be greater than one! Other ways of valuing the NGR will also emerge, including de-risking projects, helping smaller companies explore new areas, supporting regulation, and providing timely guidance to industry and government on new technologies.

The NGR is a prime example of national data sharing at its best, with numerous companies contributing and sharing information for the long-term collective benefit of the nation.

Geological legacy

The NGR is not just a repository; it is a dynamic, national asset that underpins science, innovation and policy. Its curated collections offer irreplaceable insights into the UK's subsurface, and its adaptability ensures relevance in a changing world. To unlock the NGR's full potential, we must invest in digitisation, infrastructure and sustainable stewardship. The time to act is now, so that future generations can continue to benefit from this geological legacy. Investing in the NGR is not just about preserving the past; it's about enabling the future.

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The British Geological Survey is a part of UK Research and Innovation (UKRI) and a research centre under the Natural Environment Research Council (NERC)

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

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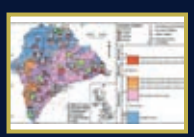

Special Publications

Mesozoic and Cenozoic oceanic gateway evolution and global tectonics: paleoceanographic and sedimentary implications

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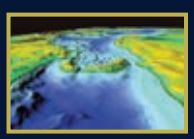

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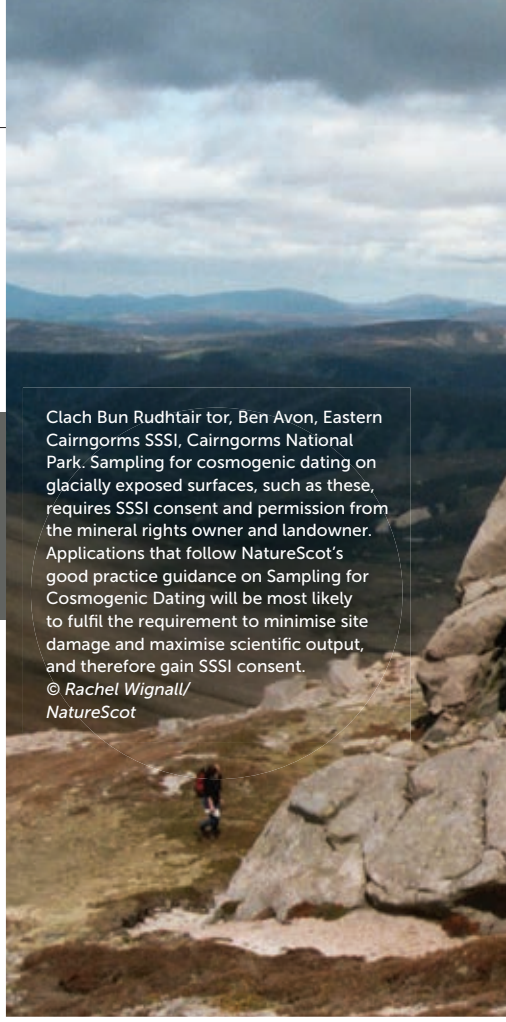
UNEARTHED

Who do I ask?

Responsible geological sampling requires careful planning. Rachel Wignall discusses permissions, site protection, and best practice for effective research and sample collecting in Scotland



Clach Bun Rudhtair tor, Ben Avon, Eastern Cairngorms SSSI, Cairngorms National Park. Sampling for cosmogenic dating on glacially exposed surfaces, such as these, requires SSSI consent and permission from the mineral rights owner and landowner. Applications that follow NatureScot's good practice guidance on Sampling for Cosmogenic Dating will be most likely to fulfil the requirement to minimise site damage and maximise scientific output, and therefore gain SSSI consent. *© Rachel Wignall/ NatureScot*

SCOTLAND'S RICH GEODIVERSITY has been studied for over 200 years, yielding significant advances in understanding of our science. Fortunately, many geoscience researchers are still enthusiastic to study Scotland's geodiversity, carrying out field studies and fieldwork in Scotland. If you are one of these researchers, contributing to our knowledge of Scotland's geodiversity, your research may require you to collect geological samples for lab analysis. Before you do so, it is important to consider whether your proposed sampling is legal, what permissions you will need and whom you should ask.

These questions should be on the mind of every geologist undertaking fieldwork and collecting samples – whether in Scotland or elsewhere. However, the answers are often not easy to find. Legislation differs between countries, even between the nations of the UK, and may change over time, as may the process of applying for permission. Legislation exists relating to ownership, access rights, areas protected for nature conservation, and historic monuments, so it can be difficult to know where to start.

The process of applying for nature conservation protected areas consents in Scotland changed in 2025, so now is a good time to report on what you'll need to know if you are planning to collect geological samples in Scotland for research work.

Ownership and permission

Geological sample collecting includes all methods used to collect rock, mineral, fossil, sediment and soil samples, including peat. Good practice guidelines (see box 'Resources') should be followed for all sample collecting, but it is also important to be aware of the laws that apply to your activities.

Scotland has arguably some of the best outdoor access legislation in the world, which is set out within the Land Reform (Scotland) Act 2003 and the Scottish Outdoor Access Code. However, fieldwork that includes sample collecting is not covered by access rights under this legislation. You must therefore obtain landowner/occupier permission before you access any site to remove samples, regardless of whether it is in a protected area.

Traditionally small geological specimens are collected without permission and hindrance. However, lawfully the right thing to do is to obtain permission to extract, collect and retain geological specimens and samples. Under Scots law, geological samples are 'minerals'. You must therefore identify and gain permission from the mineral rights owner (usually, though not always, the landowner) before collecting samples from any site whether it is a protected area or not. Collecting without permission may be regarded as theft. A phone call to the mineral rights owner or a knock on their door before you access the site, may be sufficient to avoid an irate owner. However, if you come to accession your samples (the process of formally recording and taking an item into a collection) into an accredited museum

Rock core sampling that does not follow best practice guidelines in the Scottish Core Code, such as this rash of holes at Glas Eilean to Mingary Pier GCR site, Ardnamurchan SSSI (which pre-date effective SSSI legislation), impacts the visual value of the geosite. Such examples of bad practice will effectively last forever and can reduce the amenity value of the site by compromising the perceived naturalness and wildness of our outdoor spaces. *© Jenny Rees/NatureScot*

collection, within your own research institute or elsewhere, you may need to show proof of ownership. Written permission from the mineral rights owner – to both collect and take ownership of geological samples – may be required.

Nature conservation

Nationally and internationally important sites for geoscience research in Britain are identified in the Geological Conservation Review (GCR) and many are protected under the Nature Conservation (Scotland) Act 2004 as Sites of Special Scientific Interest (SSSIs).

Geoconservation in Scotland aims to ensure that future generations can enjoy and learn from our remarkable geodiversity while safeguarding key sites for geoscience research and public enjoyment. Geosites are designated primarily for their scientific value and an important purpose of geoconservation is to conserve and maximise this value. Therefore, geoconservation is pre-disposed to support scientific research. However, sample collecting in a protected geosite presents a potential conflict between conserving material *in situ* and removing it for scientific study.

In Scotland, it is an offence for any person to intentionally or recklessly damage the protected natural features of an SSSI, and this includes unauthorised sample collecting. If you collect samples from an SSSI without the appropriate consent, you may be considered to be intentionally or recklessly damaging the protected natural features of the SSSI and thus committing an offence. Police Scotland are responsible for prosecuting cases of damage to SSSIs, and categorises this damage, including damage to geological SSSI features, as wildlife crime.

You can check whether your proposed field site is in an SSSI or a GCR site using NatureScot's Open Data Hub website (under 'Protected Areas'), which also has links to further SSSI information. Further information on GCR sites and collated information on Local Geodiversity Sites is available through the Scottish Geology Trust's excellent Geosites project website (geosites.scottishgeologytrust.org).

Additional permissions

Additional permission may be required to collect samples from one of Scotland's National Nature Reserves (NNR). If the reserve is owned by NatureScot, an application for SSSI consent should trigger an application for appropriate NNR permission.

You are also responsible for checking whether the site has any other protected status that requires additional permissions (such as scheduled monuments – those monuments with national or international importance relating to human settlement), and to obtain these permissions from the organisation responsible for regulating activities on such sites. Local Authorities may also have lists of protected local sites, such as Local Biodiversity Sites and Local Geodiversity Sites, which you should consider.

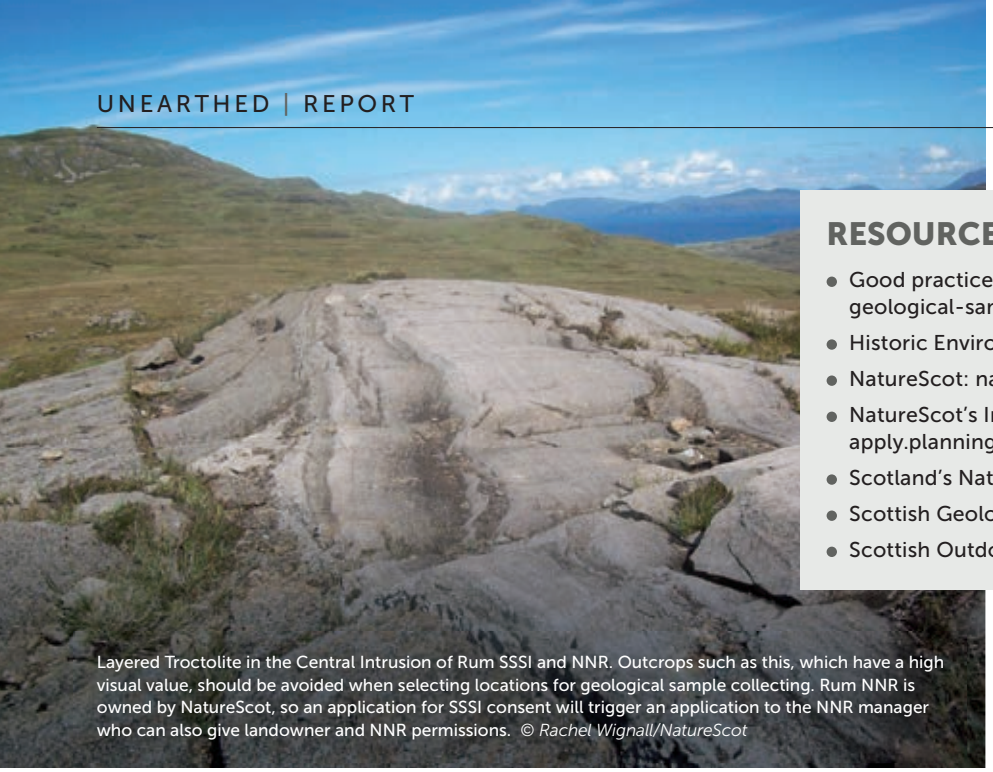
You are acting within the law if you obtain permission to collect samples. But permission from one body or person does not imply permission from anyone else. For example, consent from NatureScot does not imply permission from the mineral rights owner or any other body.

SSSI consent from NatureScot

Where geological sample collecting is required for a civil engineering, geoenvironmental or similar project regulated by the planning system, the system requires the planning authority to consult NatureScot for consent where appropriate. However, for activities such as geological sample collecting for scientific research, which are not regulated by the planning system, there are two pathways by which NatureScot may grant SSSI consent:

- Directly to a Public Body (including government-funded bodies and educational institutes) or its representative.
- To the landowner or occupier to permit the activity to be carried out.

If you represent an organisation that may be considered a public body, such as a government-funded body or an educational institution, you can apply directly to NatureScot for permission →



Layered Troctolite in the Central Intrusion of Rum SSSI and NNR. Outcrops such as this, which have a high visual value, should be avoided when selecting locations for geological sample collecting. Rum NNR is owned by NatureScot, so an application for SSSI consent will trigger an application to the NNR manager who can also give landowner and NNR permissions. *© Rachel Wignall/NatureScot*

RESOURCES

- Good practice guidance: scottishgeologytrust.org/geology/geological-sample-collecting
- Historic Environment Scotland: historicenvironment.scot
- NatureScot: nature.scot
- NatureScot's InformedDECISION™: apply.planning.nature.scot
- Scotland's National Nature Reserves: nnr.scot
- Scottish Geology Trust: scottishgeologytrust.org
- Scottish Outdoor Access Code: outdooraccess-scotland.scot

to collect samples from an SSSI. If you do not represent an organisation that may be considered a public body, you need to ask the landowner, occupier or manager of the SSSI to apply to NatureScot for permission for you to collect samples. The landowner, occupier or manager will need information about your proposed activities so that they can apply to NatureScot.

In 2025, NatureScot launched a new online service called InformedDECISION™ to enable the submission of applications, including applications to collect geological samples from Sites of Special Scientific Interest. Guidance on applying for consent to collect geological samples in Scotland is available through the NatureScot website. The form 'Public body and SSSI owner geological sample collecting application' should be completed and uploaded with your InformedDECISION™ application. Note that this form is only for use by public bodies and the owners, occupiers and managers of the site(s) from which samples are to be taken.

Our role at NatureScot is to balance safeguarding a protected area's geodiversity for future generations with fostering thriving research and geoscience education. Requesting permission and outlining your planned research helps us understand how and when geosites are being used for their primary role as scientific resources. It also provides the information we need to assess your proposal and to document

> **"Geoconservation focuses on conserving the scientific resource"**

authorised research for future site-condition monitoring. If you come across research samples that were inadvertently collected without SSSI consent, please contact NatureScot and we can make a retrospective assessment for those samples.

The scientific value of a geological SSSI is the sum of the existing scientific data from the site, and the potential scientific information remaining within the site. Removing geological samples decreases the store of remaining information and is usually considered irreversible damage to the SSSI feature. However, in some circumstances, the loss of resource may be off-set, or balanced, by the scientific information gained from the samples taken, allowing an overall assessment of no loss of scientific value for the SSSI.

Research projects are most likely to generate scientific benefits that offset any loss of *in situ* geosite material when they:

- minimise the loss of *in situ* scientific study potential, including minimising damage to the visual value of the site,
- maximise the scientific knowledge gained from collected samples, including through *in situ* study and recording before removal, and
- avoid long-term impacts on natural processes at active process geosites.

NatureScot may refuse consent for a variety of reasons, such as a resource being extremely limited, or a site being particularly vulnerable to damage and loss. We may ask for further details about your proposal if we have concerns about damage to the site. It is also important that we understand how any remaining samples will be stored and curated after the research is completed, to ensure that maximum scientific and educational benefit is gained from samples, and that the minimum number of samples are taken over time.

Further guidance on best practice for minimising loss of *in situ* scientific study potential and maximising knowledge derived from geological samples is provided in our online guidance notes. If you have any questions, please do ask, as we are keen to engage with researchers who are studying Scotland's amazing geosites.

DR RACHEL WIGNALL
Geology Adviser, NatureScot, Scotland, UK
Rachel.Wignall@nature.scot

FURTHER READING

A full list of further reading and resources are available at geoscientist.online.

- Ellis, N.V. et al. (1996) Geological Conservation Review Series No. 1. Joint Nature Conserv. Commit. Peterborough
- MacFadyen, C.C.J. (2024) In: Smith, M. & Strachan, R.A. (eds) The Geology of Scotland. 5th edn. Geological Society of London 654 pp.
- Nature Conservation (Scotland) Act (2004); legislation.gov.uk

The Geological Society

Conferences

~~£345~~
£205 for members

AI in the Geosciences Conference

Date: 4-5 June 2026

Location: Burlington House, London, Piccadilly, UK - virtual options available

Registration:
www.geolsoc.org.uk/events/ai-in-the-geosciences

Conference convenors:

- Dr David Hodgetts - VRGeoscience Ltd
- Prof Paul Cleverly - Infoscience Technologies Ltd
- Prof Cedric John - Digital Science Research Institute (DERI)
- Dr Silvia Peppoloni - National Institute of Geophysics and Volcanology (INGV)
- Dr Giuseppe di Capua - National Institute of Geophysics and Volcanology (INGV)

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FABRIQ

What is the 'AI in the Geosciences' conference?

The inaugural AI in the Geosciences conference is a new hybrid event exploring how artificial intelligence, machine learning and big data are transforming the geosciences, while also addressing the challenges that come with these technologies.

Key themes include:

- Developments and opportunities within AI and machine learning
- Data integration, interpretation and automation using AI tools
- Open data and collaborative development of AI tools
- Considering ethics, bias and transparency in implementing AI and machine learning
- Policy considerations for future AI development
- Importance / use of AI in geoscience education

Interested in this topic?

We are also hosting a new in-person course on 14-16 April, as part of our 'Digital Geoscience' science theme.

'*An Introduction to Machine Learning for Geoscientists*' will provide a hands-on introduction to the principles, tools and workflows of modern machine learning.

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www.geolsoc.org.uk/science-and-policy/science-themes/digital-geoscience/an-introduction-to-machine-learning-for-geoscientists

Joining the watery dots

How do we fix a national skills shortage in a profession most people never learn exists? Rhiannon Marchi-Smith reports on career pathways in hydrogeology – a profession at the heart of resilience

WE TALK A LOT about national resilience: drought, flooding, water quality, and the energy transition. We talk less about the people who make resilience possible. Hydrogeologists sit quietly at the centre of it all, translating between the unseen subsurface, the policies, data, and infrastructure.

Reconnecting with our geological story

Hydrogeology as a discipline grew alongside civil and environmental engineering, shaped by practical questions about the ground: water supply, dewatering, contamination, and foundations and ground stability. This heritage gave the field strength in hydraulics, mechanics, and modelling – tools essential to understanding how water moves through the ground.

But deeper roots lie in geology. The best hydrogeologists read the ground as a story: the rhythm of sediments, traces of ancient rivers and buried landscapes, the way Quaternary deposits record water's path through time. These aren't just details in a borehole log; they're narrative threads explaining how aquifers behave and why water moves the way it does.

Geology is our storybook, a record of shifting rivers, glacial tills, fractured bedrock, and permeable pathways still controlling groundwater flow today. Understanding the ground goes beyond technical knowledge; it's storytelling: making sense of how the subsurface connects to surface processes, climate, and people.

As we face new challenges around drought, flooding, and contamination, reconnecting the analytical precision of engineering and the interpretive insights of geology is vital. By teaching hydrogeology as both science and story, we remind students that understanding water starts with understanding the ground beneath their feet. A robust education and career pipeline strengthens our capacity to respond to the challenges we collectively face.

The Streetly report

In 2023, the committee for the Geological Society Hydrogeological Group published *Access to Careers in UK Hydrogeology* (authored by Mike Streetly). It confirmed what many in the profession already sensed: the growing demand for hydrogeological skills is outpacing the declining supply of hydrogeologists.

The report identified familiar challenges – declining MSc enrolments, reduced teaching capacity, an ageing professional workforce – but it also highlighted new opportunities. As the oil and gas sector restructures, experienced subsurface specialists are looking to reskill. With the right bridging support, they could help meet the growing need for expertise in groundwater, mine-water, and energy transition projects.

Survey responses revealed something else. Employees wanted more training in communication, policy, and stakeholder engagement, but these areas weren't emphasised in MSc curricula or employer-development plans. The skills that make hydrogeologists effective are as much translation as calculation: communicating uncertainty, framing risk, and connecting science with decision-making.

There are signs the geology/ geoscience sector is responding. The Level 6 Geoscience Apprenticeship (a professional qualification equivalent to a Bachelor's degree combining on-the-job training with academic study) is becoming established, collaborations between professional institutions are strengthening, and outreach initiatives such as the Geological Society's 'This is Geoscience' are widening the conversation. Discussions about opening the Environment Agency's in-house geoscience training scheme to external participants are underway. This could provide a structured route for early-career professionals to gain the practical experience sought by employers. Such initiatives illustrate the potential value in treating the skills pipeline as a shared resource rather than the responsibility of others.

The Streetly report is a timely reminder that improving access is not only about the number of people entering the field, but about how effectively they can connect hydrogeology to the systems it serves.

Pipeline as a system

I asked a secondary school geography teacher whether pupils learn about groundwater. The answer was a pause, then: "Not really." The school curriculum includes the water cycle eight times, but groundwater only appears as a thin blue line on a hydrograph.

Pupils learn the observable symptoms of hydrogeology – floods, droughts, river flow – but not the system beneath. They know rain falls, rivers rise, but not how and where the water hides, travels, or reappears.

At school, geology remains niche and hydrogeology almost invisible. At university, it's buried in a hydraulics module, valuable but detached from stories of people, place, and policy.

The Level 6 (Batchelor's degree) Geoscience Apprenticeship has opened an alternative route, yet progress slows at the next step. A Level 7 (MSc) Hydrogeology Apprenticeship, which would bridge academic depth and professional practice, is in development but struggles for cross-sector support.

> **"Collaboration between professional bodies is strengthening. These are genuine steps forward"**

There are signs of progress. Professional bodies including the Geological Society's Hydrogeological Group, the Chartered Institution of Water and Environmental Management and the Institute of Materials, Minerals and Mining are exploring shared events and conversations around skills and resilience. These are small steps, but they matter. Collaboration starts through relationships. Informal coordination can begin to build the systems thinking needed.

Capacity in academia

Some universities no longer have staff to teach hydrogeology. Those that do rely on staff who juggle heavy workloads or short contracts. It's not lack of interest, but lack of capacity.

Practising hydrogeologists work in industry, not academia. Consequently, although students learn about groundwater, they do not do so from those who manage it day-to-day. This weakens mentoring, making it harder for students to picture themselves in the profession.

Mature students and career changers are often left out of outreach and recruitment discussions. They bring experience, perspective, practical thinking – exactly the qualities the sector needs.

Professionals leaving the oil and gas industry and looking to reskill already understand the subsurface, project delivery, and risk. With the right bridging courses and mentoring, their skills translate directly into groundwater, mine water, and energy transition work.

The talent pipeline is an ecosystem. The above types of people aren't side streams but essential tributaries. We need to build a feedback loop between education and practice so knowledge can move both ways. This doesn't mean pulling people out of industry and into universities; it means creating new teaching models: practitioner-led modules, shared lectures, secondments, and digital co-teaching.

Risk to national resilience

The UK faces growing pressures from drought, flooding, synthetic chemicals (such as per- and polyfluoroalkyl substances, or PFAS), and the low-carbon energy transition. Hydrogeology sits at the centre, yet the skills pipeline is nebulous.

When universities cannot staff hydrogeology courses, postgraduate routes falter, and early-career professionals cannot see a path to specialise, we weaken the very system that manages our most critical resource.

Building resilience means investing in the UK's infrastructure, but also in people: hydrogeologists who understand how water interacts with that infrastructure.

Where next?

The Level 6 Geoscience Apprenticeship has made a strong start. Collaboration between professional bodies is strengthening. These are genuine steps forward.

But the system lacks connection. Until the stories we tell in schools, universities, degree apprenticeships, and professional networks link together, and people can place themselves in those stories, we will continue to lose potential hydrogeologists to other sectors.

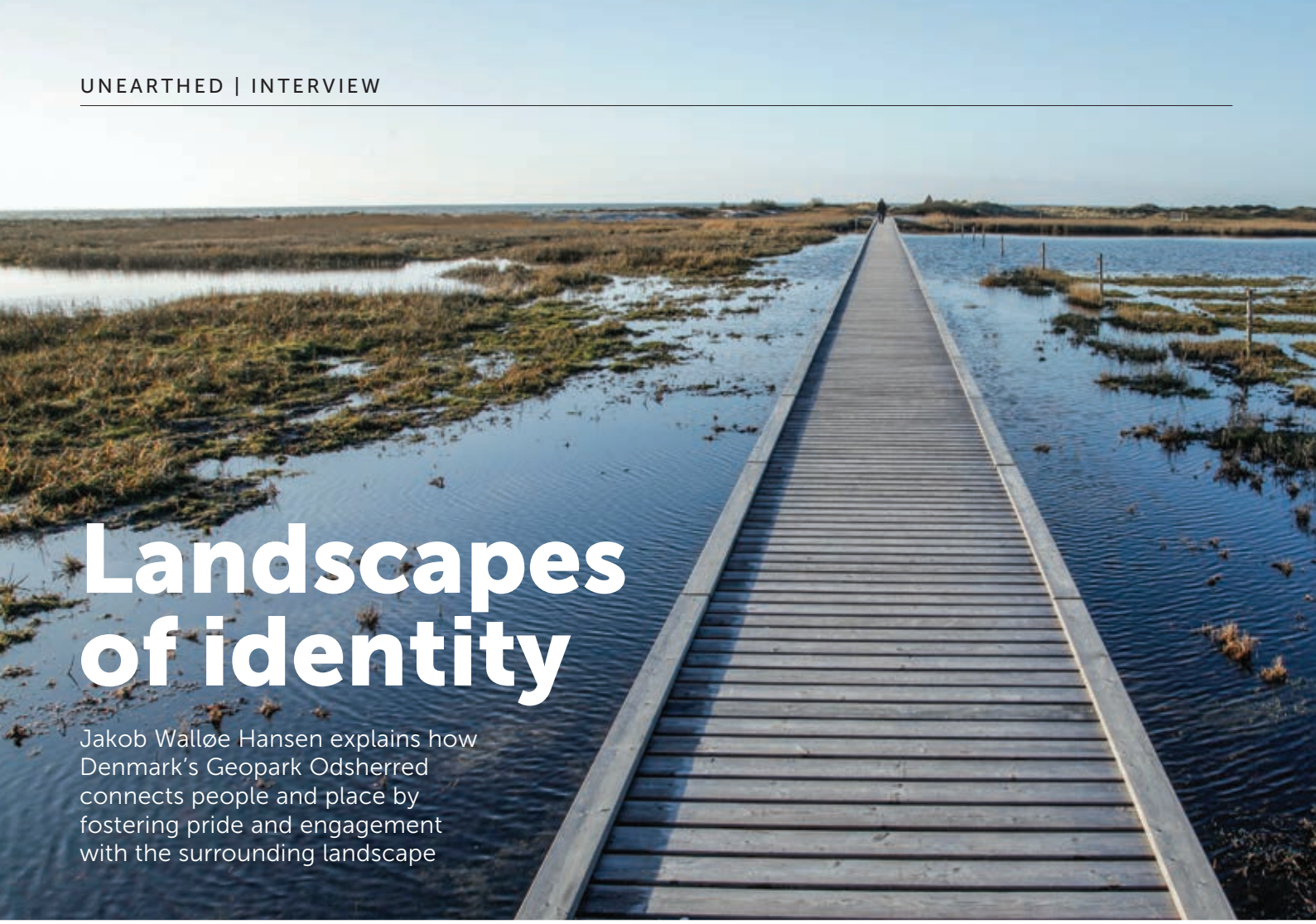
Hydrogeology doesn't need to be reinvented, but reconnected.

RHIANNON MARCHI-SMITH
RMS Groundwater Strategies Ltd., UK

FURTHER READING

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

- Level 6 Geoscience Apprenticeship; skillsengland.education.gov.uk/apprenticeships/st1356-v1-1
- Davies-Vollum, S. et al. (2023) Geoscience Degree Apprenticeship. Geoscientist 33 (4), 34-35; doi.org/10.1144/geosci2023-040
- Streetly, M. (2023) Access to Careers in UK Hydrogeology. Review for the Geological Society of London; hydrogroup.org.uk/wp-content/uploads/2023/08/Access-to-Careers-in-UK-Hydrogeology-2.4.pdf
- The Hydrogeological Group; hydrogroup.org.uk
- This is Geoscience; thisisgeoscience.com



Landscapes of identity

Jakob Walløe Hansen explains how Denmark's Geopark Odsherred connects people and place by fostering pride and engagement with the surrounding landscape

IN DENMARK, many people have a strong cultural attachment to their landscape. Outdoor activities such as cycling, hiking and swimming are often deeply embedded in daily life. The immense value placed on open space is reflected in the tradition held by many Danes of having two homes: a primary residence near work and a "sommerhus", often near the coast, lakes or forests, that offers a retreat into nature.

So, when in 2015 the peaceful and scenic Odsherred peninsula was established as Denmark's first UNESCO Global Geopark, the sentiment from some locals was one of "profound animosity", recalls Jakob Walløe Hansen, Head of Outreach and Education at Geopark Odsherred. Many worried that the UNESCO status might impose tighter land-use restrictions, divert funding away from schools, healthcare and infrastructure, and generate increased tourism, leading to overcrowding and damage to the landscape. However, sustained engagement has shifted perspectives, with residents recognising the geopark's cultural and environmental value and embracing the idea that their identity is bound to the landscape.

Connecting communities

For Jakob, working in Geopark Odsherred is the continuation of a childhood passion for palaeontology and public outreach that led him from his studies at the Natural History Museum of Denmark to his first – and still current – role. Over the years, Jakob has witnessed a transformation in local attitudes towards the geopark. Scepticism shifted to broad support with the realisation of the tangible benefits – for tourists and locals alike – associated with UNESCO Global Geopark status, thanks in large part to significant community involvement.

"We believe the geopark is about its citizens, not me and my colleagues, so we try to involve them in as many activities as possible," Jakob explains. "At festivals, locals disseminate information about the geopark through their own interpretations of art, literature and food. We have retired farmers who talk about agricultural traditions in the context of the landscape and an agreement with the council allows us to do outreach projects with local school groups. We are also collecting views from the local community on what information they would like to see in a new museum that will be opening in a few years. In this way, we are encouraging locals to take ownership of the geopark and feel pride over interacting with the landscape."

Jakob and his team also embarked upon educating a group of geoguides to enrich visitor experiences. "The geoguides received expert training over six weekends, consisting of five courses and an assignment that covered the key themes of the geopark: geology, landscape, arts, cultural history and local produce. Whilst we formally trained our geoguides almost a decade ago, some

Initially inundated during the Christmas hurricane of 1902, now a tranquil walkway guides visitors towards the sea at Korevle, Sejerø Bay, one of the most classical barrier island coastlines in Denmark
© *Claus Starup*

of them still work in the park part-time and have developed strong fields of expertise to teach and guide visitors. People come away from their talks realising that we are very much dependent on what we normally take for granted: the ground beneath our feet."

Today, Odsherred's outreach initiatives include almost one hundred information boards dotting the landscape, providing basic geological details for passing visitors, as well as dedicated teaching stations focused on the sea and agriculture that help school groups explore the connections between people and place. Activities such as soil core sampling and discussions of geoscience in local building materials bring science into everyday life too.

Nurturing partnerships

Currently, more than 200 UNESCO Global Geoparks are designated across 50 countries (each retains its status for four years before undergoing revalidation to ensure standards are being met).

"We are encouraging locals to take ownership of the geopark and feel pride over interacting with the landscape"

Collaboration with other international geoparks provides valuable opportunities to share knowledge and experience to further the goal of honouring the past but also looking to the future.

"We have a formal partnership with the Harz – Braunschweiger Land – Ostfalen Geopark in Germany, and I am currently working with geoparks in Norway (Magma), Slovenia (Idrija), Austria (Styrian Eisenwurzen) and Iceland (Reykjanes). Having had the privilege of visiting multiple geoparks now, there is a great deal of inspiration to be found in what to do and, perhaps most importantly, what not to do. The friends you make via the geopark network can give you so many valuable insights that might otherwise take a whole career to accumulate yourself."

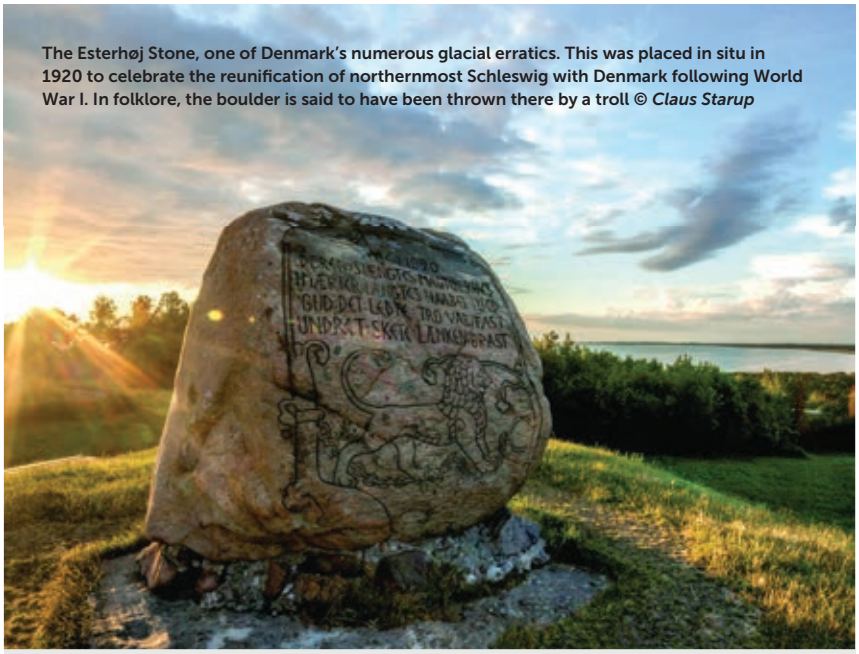
Jakob emphasises the importance of having a clear idea of what you want to gain before embarking on a partnership, to ensure the venture is fruitful for all parties. One such collaborative project involved working with three other geoparks to create a geology teaching kit that includes tools and activity packs, so educators and school groups have all the necessary equipment to explore the geopark and surrounding landscapes properly.

In another example, Jakob notes how effectively cartoon characters (used in signage and pamphlets, for example) work to engage visitors and school groups in Japanese and Korean geoparks. He hopes to implement similar visual media in future educational materials in Denmark.

Jakob is also working with colleagues from Nordic countries to develop a programme that aims to empower educators through the creation of "cross-sectoral hubs for lifelong learning". These collaborative digital and physical platforms will bring together people working across education, business, government, culture, non-governmental organisations and community groups to provide learning opportunities for people of all ages. Jakob hopes such hubs will eventually gain UNESCO endorsement.

"I would like to see UNESCO produce a universal education programme for every geopark to use to create a common language and standards. Additionally, I hope that the hard work many people do every day in geoparks around the world will eventually get the same amount of appreciation and recognition →

The remains of a Stone Age megalithic tomb in Plejerupdyssen stand within the hummocky terrain created as ice debris was deposited in moraines (commonly known as a dead ice landscape)
© *Claus Starup*



The Esterhøj Stone, one of Denmark's numerous glacial erratics. This was placed in situ in 1920 to celebrate the reunification of northernmost Schleswig with Denmark following World War I. In folklore, the boulder is said to have been thrown there by a troll © *Claus Starup*

AN EMERGING LANDSCAPE

UNESCO Global Geoparks encompass geological landscapes and cultural heritage sites that provide enjoyment, education and a framework for conservation and sustainable development. UNESCO provides financial support for some of these protected areas, which are vital not only for preserving environmental and social history but also for raising awareness of pressing issues such as climate change, natural hazards and the sustainable use of resources. The geoparks instil pride and a sense of place in local communities, while also attracting international visitors and contributing to global geotourism.

While not characterised by dramatic mountains, volcanoes or tectonic activity, Denmark's more 'subtle' geology is important for understanding Earth's history. Shaped by repeated Ice Age glaciations, the moraines, outwash plains and fertile soils tell a story of glacial landscapes, coastal evolution, and human-nature interactions that are reflected in the country's three UNESCO-designated geoparks: Odsherred, Vestjylland, and the South Fyn Archipelago.

Odsherred was designated a UNESCO Global Geopark in 2015 – the first in Denmark to achieve this status. Comprising hills, lowlands and beaches, Odsherred exhibits a wealth of textbook glacial landforms, including numerous terminal moraines and a large glacial erratic affectionally known as The Pocket Stone. The strong ties between the natural world and cultural history are evidenced by a folklore story that says a troll threw this stone in a bout of frustration.

Vestjylland was officially recognised as a UNESCO Global Geopark in 2018. Dominated by the Main Stationary Line, this boundary between a hilly glacial landscape to the north and flat outwash plains to the south formed during the last Ice Age between 115,000 and 11,700 years ago.

The South Fyn Archipelago, formally designated a UNESCO Global Geopark in 2024, is an inundated glacial landscape. Comprising 55 islands that developed approximately 8,000 years ago when rising sea levels flooded the region at the end of the last Ice Age, this geopark also represents Holocene coastal development, believed to have formed within the span of a single human generation.

“The integration of local voices into national strategy looks set to keep Denmark’s glacial landscapes at the heart of its future”

that our colleagues in the World Heritage designations experience."

Future horizons

Beyond education and outreach initiatives, Jakob and the geopark team are called upon as experts on the local area to help inform climate resilience strategies, particularly in relation to conserving nature and rewilding the area. As such, Geopark Odsherred has a role to play in Denmark's ongoing development of the Green Tripartite Agreement. This landmark deal between the government, agriculture and environmental groups aims to align climate, nature and land-use goals by transforming 15 per cent of the country's agricultural land into wild natural landscape, thereby supporting biodiversity and coastal ecosystems in particular.

Questions remain about how to compensate those whose livelihoods are affected. However, Jakob is optimistic that the Green Tripartite Agreement may be mutually beneficial, with Geopark Odsherred showing what can be achieved when the landscape and local community are considered hand-in-hand, as well as the potential for funding to support the geopark's future goals. Already, a multi-million-pound outreach project is underway to inform locals on the need for and best ways to harmoniously achieve this Agreement, so the integration of local voices into national strategy looks set to keep Denmark's glacial landscapes at the heart of its future.

JAKOB WALLØE HANSEN
Head of Outreach and Education at UNESCO Global Geopark Odsherred and Chair of the Geological Society of Denmark

Interview by Hannah Bird, Associate Editor, Geoscientist *magazine*

The Geological Society

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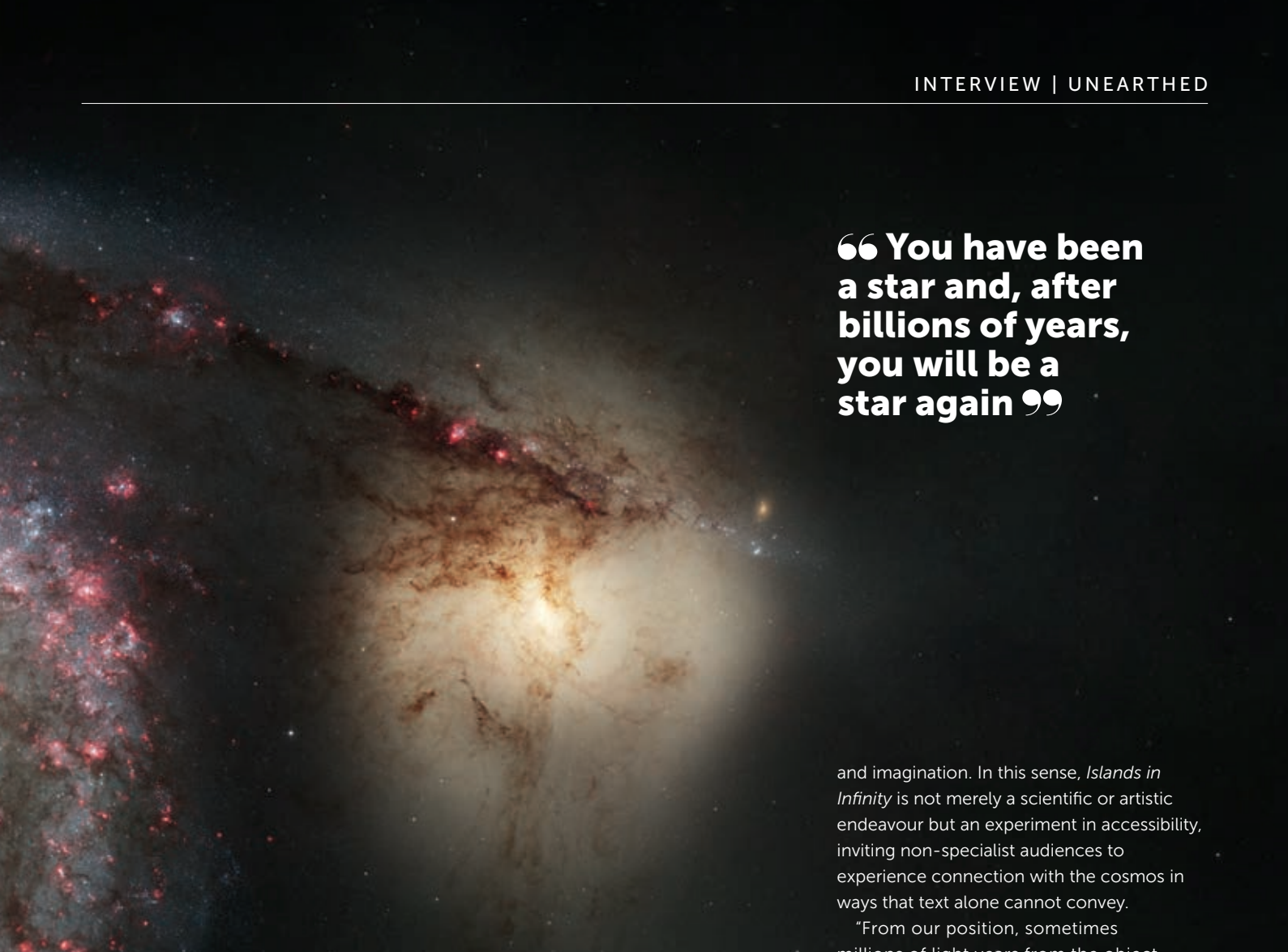
Islands in infinity

Through their three-dimensional vision of the cosmos, Brian May, Derek Ward-Thompson and J-P Metsävainio invite us to reimagine both space and our place within it

Whirlpool Galaxy M51NGC 5194 interacts with its 'companion' dwarf galaxy NGC 5195, located approximately 23 million light years from Earth
© NASA and the European Space Agency



> **“You have been a star and, after billions of years, you will be a star again”**

GALAXIES, NEBULAE AND interstellar dust clouds drift through the Universe in ceaseless motion, as vast architectures of light shaped over cosmic time. When captured through telescopes and cameras, for both science and art, their journey across space becomes still – a single frame in an eternal dance. Yet in capturing a singular moment, something is inevitably lost. This flat two-dimensional echo of billion-year histories can be a disservice to the Universe’s wonders.

And so, with a passion burning as bright as stars themselves, astrophysicists Brian May and Derek Ward-Thompson, alongside astrophotographer J-P Metsävainio, aim to bring a whole new dimension to viewing the night sky. Through their new book, *Islands in Infinity*: *Galaxies 3-D*, and the accompanying OWL stereoscopic viewer designed by Brian (which transforms pairs of two-dimensional photographs into a three-dimensional effect), everyone can learn to appreciate the realms beyond Earth. By inviting readers to experience astronomical imagery in three dimensions, the trio seek not only to reveal depth and scale, but to restore a sense of wonder often diminished by conventional photography.

Bringing the cosmos closer

The ability to visualise data has long shaped the way science communicates complexity. From geological cross-sections to astronomical composites, the translation of invisible processes into visual form bridges the gap between expertise and imagination. In this sense, *Islands in Infinity* is not merely a scientific or artistic endeavour but an experiment in accessibility, inviting non-specialist audiences to experience connection with the cosmos in ways that text alone cannot convey.

“From our position, sometimes millions of light years from the object we are studying, we can’t perceive depth information because our eyes are not far enough apart to give us the parallax differences between left and right views that communicate solid shape to us, as they do in the world immediately around us,” Brian explains. “J-P is an astrophotographical genius whose magical transformation of images gives us that vital extra perception, enabling our brains to instantly perceive these awesome objects as they really are in glorious 3-D. The insights that this gives us are inspiring like never before.”

The book’s approach echoes a broader shift in how astronomy engages the public. Projects such as Galaxy Zoo (zooniverse.org) – which invites volunteers to classify galaxies or identify features in telescope data – have shown how visual participation can transform passive audiences into active contributors. →

What Brian, Derek and J-P achieve through stereoscopy operates on a similar principle by transforming the viewer from observer to participant. Seeing in three dimensions is, in a sense, a kind of citizen science of perception, training the eye to discern the bigger context of the cosmos.

For J-P, this way of viewing the Universe can be transformative. "With the methods I have developed over the years, I am able to turn any astronomical image into a 3-D presentation that is as scientifically accurate as possible. Each image tells a story to the viewer. The final 3-D image is always an informed simulation of reality, based on established scientific facts, logical deduction, and a touch of artistic creativity." The result translates the intangible into something the human eye can grasp.

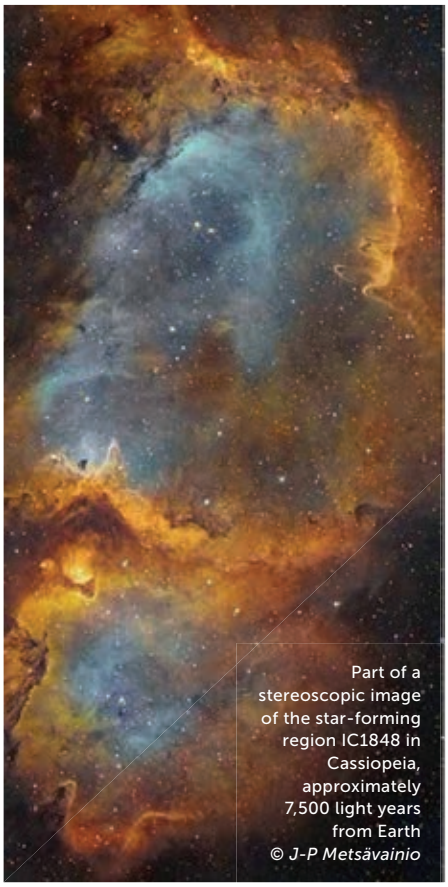
Windows to the Universe

Both space and ground-based telescopes are used to capture images of the cosmos. Whilst those in space are becoming ever-more advanced, Derek reiterates that there is still a "vital role" for those telescopes here on Earth because their larger size affords greater resolution and sensitivity. Furthermore, increasing the number of operable telescopes is necessary to meet the needs of researchers globally, who often only have a few minutes to capture images for their individual project.

"Ground-based observatories have had, and will continue to have, great value in science – and, in my case, art as well," J-P adds. "There is enormous global demand for imaging time, and the world's large ground- and space-based observatories cannot meet that demand alone.

"Large observatories produce material I could never hope to create, yet I can devote unlimited exposure time to generate images that these technical marvels could never produce. Although I photograph the sky purely from an artistic perspective, my images also meet the standards of scientific imaging and are sometimes used in scientific work as they are never altered beyond standard colour and tonal adjustments. When science and art meet, the result can be greater than either could ever achieve alone."

However, there is a growing danger to space observations and photography in the form of debris. Current estimates by the European Space Agency suggest there are over 54,000 objects orbiting Earth that are greater than 10 cm in diameter, with the number growing each year. While space telescopes are usually placed in very high orbits to reduce risk of impact, J-P suggests that the rapidly increasing volumes of space debris may place even these telescopes at risk.



Part of a stereoscopic image of the star-forming region IC1848 in Cassiopeia, approximately 7,500 light years from Earth
© J-P Metsävainio

"When science and art meet, the result can be greater than either could ever achieve alone"

The threat is both practical and philosophical: the more our orbit clutters, the more we risk obscuring our own view of the Universe. Preserving that line of sight is as much about safeguarding scientific capability as maintaining humanity's connection to the wider cosmos. Satellite imaging once designed to survey stars now helps monitor planetary change, from glacial retreat to deforestation. This exchange of methods has not only expanded the frontiers of research but also redefined how scientists tell stories about our place in the Universe. In the age of critical tipping points for Earth, ensuring the longevity of satellites is paramount to conserving our ability to look outward and inward as complementary ways of understanding a shared environment.

Powerful perspectives

Astronomy and geoscience depend on the act of turning raw data into vision. Each discipline seeks to make the unseen visible, revealing patterns and processes that unfold beyond the scale of ordinary experience.

"Both subjects produce beautiful pictures that are easy to relate to and, if anything, it is simpler for geoscience, being 'closer to home'," Derek states. "When we compare Earth to other planets, we realise just how special our home is. If we can get that message across to the majority of the population, then people might be even more conscious of its uniqueness and therefore be keener to look after it."

Brian concurs, believing that finding engaging ways to educate the public about the world is the necessary antidote to actions that harm it. "It is my experience that anyone who has learned to truly appreciate the wonders of the vast Universe around us, and our delicate place within it, is incapable of inhumane behaviour. In the 21st century, some powerful humans are attempting to undermine the work of generations of brilliant scientists. Right now, the

L-R: Professor Derek Ward-Thompson, Sir Brian May and J-P Metsävainio
© *Paul Harmer*

MORE INFORMATION

Islands in Infinity is available from: uk.bookshop.org/shop/geoscientist. Read our review on **page 53**

world desperately needs education to counterbalance pseudoscience and misinformation."

From a planetary point of view, education begins with perspective. Astronomers have long invoked the "overview effect", the profound cognitive shift reported by astronauts who have seen Earth from space and recognise both its unity and vulnerability. Through stereoscopic imagery, Brian, Derek and J-P attempt something similar for the armchair observer: to collapse incomprehensible scale into perceptible form and, in doing so, restore our sense of belonging to a shared cosmos.

If science begins in curiosity, it matures in empathy and the recognition that knowledge carries moral consequence. The act of seeing, whether through a microscope, a field lens or a stereoscope, becomes a form of stewardship. To learn to see is to learn to care.

Stellar legacies

One of *Islands in Infinity*'s most striking threads is its meditation on temporal as well as spatial scale. Just as geoscientists navigate billions of years of Earth's evolution, astronomers trace the lifecycle of stars across cosmic aeons. J-P's favourite subjects are supernova remnants – the ashes of stars that once forged the elements of life.

"Without supernovae, the Universe would consist almost entirely of hydrogen and helium," he says. "We are children of the supernovae. The iron in our haemoglobin, the carbon and oxygen that build us – all were forged in the hearts of ancient stars.

"Our own Sun is too small to become a supernova. When it dies, it will shed its outer layers, destroying the planets and scattering our remains into space. After aeons, those remnants will become the building blocks for a new generation of stars. There is a profound symmetry in this process: you have been a star and, after billions of years, you will be a star again."

That powerful sentiment distils the emotional core of *Islands in Infinity*: the recognition that the same physical laws shaping galaxies also shape us. The stereoscopic imagery is more than visual spectacle; it is a reminder that we, too, are part of the cosmic architecture.

SIR BRIAN MAY
Director of the London Stereoscopic Company, UK, and musician

PROFESSOR DEREK WARD-THOMPSON
Director of the Jeremiah Horrocks Institute at the University of Lancashire, UK

J-P METSÄVAINIO
Visual artist and astrophotographer based in Oulu, Finland

Interview by Dr Hannah Bird, Associate Editor, Geoscientist *magazine*

FURTHER READING

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

- European Space Agency; esa.int/Space_Safety/Space_Debris/Space_debris_by_the_numbers
- Galaxy Zoo; zooniverse.org/projects/zookeeper/galaxy-zoo
- Ward-Thompson et al. (2025) Islands in Infinity: Galaxies 3-D. The London Stereoscopic Company, 256 pp.

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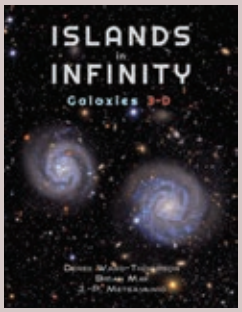
ISLANDS IN INFINITY: GALAXIES-3D

DETAILS

BY: Derek Ward-Thompson, Brian May & J-P Metsävainio (2025) The London Stereoscopic Company, 256 pp. (hbk)
ISBN: 9781838164560
PRICE: £40



REVIEWED BY HANNAH BIRD

Though styled as a coffee-table volume, *Islands in Infinity: Galaxies 3-D* is a richly ambitious guide to the Universe. What might initially appear as a collection of hundreds of striking images is, in fact, a layered exploration of the cosmos, blending cutting-edge science, dazzling photography and thoughtful reflection on humanity's place in the Universe. Professor Derek Ward-Thompson, Director of the Jeremiah Horrocks Institute at the University of Lancashire, and astrophysicist, stereoscopist and musician Sir Brian May guide readers through the origins of the Universe, the billions of galaxies it contains, and its possible futures.

The narrative begins with a history of humankind's attempts to interpret the night sky, from Galileo's 17th-century telescope to today's most advanced observatories, both on Earth and in space. A concise introduction to galaxy classification, imaging and observation sets the foundation before the book delves into case studies of classic galactic forms. From spiral and elliptical galaxies to unusual interactions, collisions and groupings, each is accompanied by imagery that reveals the diversity of cosmic structures. Turning the Milky Way "inside out", Ward-Thompson and May highlight how our vantage point within our own galaxy uniquely shapes our understanding of the wider Universe.

Astrophotographer J-P Metsävainio's high-resolution stereoscopic images (pairs of two-dimensional photographs that, when viewed through the supplied complimentary stereoscope designed by May, create a three-dimensional effect) bring the cosmos vividly to life throughout. These are not mere embellishments but central to the storytelling, offering perspectives that immerse the reader in galactic forms and interactions.

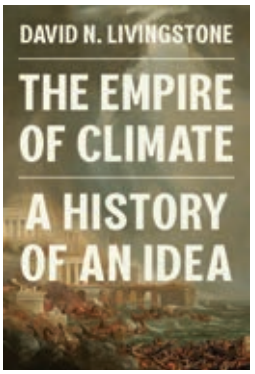
Despite the density of information, the text remains approachable, with diagrams and in-line definitions keeping explanations clear. While this is not intended as a definitive manual of galaxy taxonomy, it nevertheless serves both specialists and curious newcomers, striking a balance between scientific authority and accessibility.

Threaded throughout are reflective moments that elevate the book beyond science communication, with Ward-Thompson's opening words setting the tone for having perspective of human concerns on a cosmic scale. The Universe beyond Earth can often seem otherworldly and out of reach, but this book makes the field much more tangible. At a time when light pollution obscures the night sky for so many, *Islands in Infinity* offers both a window onto distant galaxies and a renewed sense of connection with the Universe we inhabit.

THE EMPIRE OF CLIMATE: A HISTORY OF AN IDEA

DETAILS

BY: David N. Livingstone (2024) Princeton University Press, 552 pp. (hbk)
ISBN: 9780691236704
PRICE: £32



REVIEWED BY LUCY BLENNERHASSETT

In *The Empire of Climate: A History of an Idea*, David Livingstone offers comprehensive insight on the evolution of climatic determinism and how the physical environment has shaped our societies since the dawn of Hippocrates, touching on human health, minds, wealth and war.

It is fascinating to learn of the climate's ability to affect our outlook on culture, prosperity, disease and genius, as well as conflict, tyranny and morality. Noteworthy explorations include that of historical European mindsets that viewed tropical locations as 'unhealthy' or 'morally corrupt' and drew (now discredited) links between latitude and racial superiority or economic success – notions that were used to justify past eugenic or colonial policies. Links between climate and the evolution of colonialism, racism, sexism, and capitalism prevail throughout the book's chapters, giving important historical context for how climate has governed human existence and how such concepts underpin the socioeconomic systems of today, including challenges like climate justice and adaptation. Ironically, these concepts historically linked to climate are therefore also inextricably associated with the nature-human disconnect that fuels our 21st-century climate crisis.

While Livingstone writes for a more specialist audience and the narration is, →

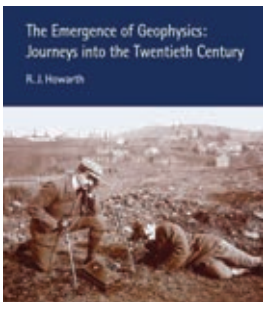
at times longer than necessary, those broadly interested in the topic can still engage with the common talking points of today when it comes to emerging climate concerns. Livingstone captures the true intersectionality of climate as a concept throughout social history, making *Empire of Climate* a timely and thought-provoking read. It serves as a valuable history on the intertwining of humanity and nature to compliment the science of today. This includes the effects of a changing climate on our physical and mental health, especially in regions where temperature changes will be most pronounced and economic investment in resources to support mitigation initiatives is lowest.

The book also serves as a political warning for how climatic instability could lead to modern weaponisation of past colonial climatic notions for prejudicial or imperialist agendas, perhaps most relevant for migration and resource conflicts that an ever-warming climate will likely bring.

THE EMERGENCE OF GEOPHYSICS: JOURNEYS INTO THE TWENTIETH CENTURY

DETAILS

BY: R.J. Howarth (2024) Geological Society of London, 438 pp. (pbk)
ISBN: 9781786206251
PRICE: £130

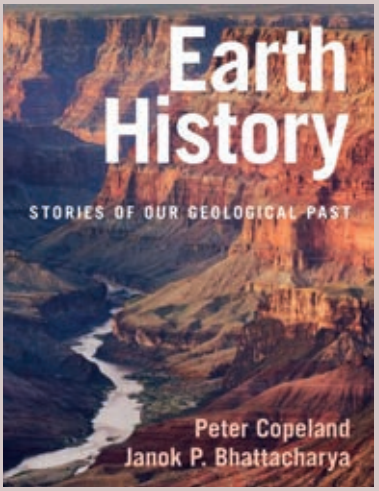


REVIEWED BY ROB BUTLER

If ever examples are needed of how nurturing curiosity-driven science supports a seedbed of unforeseen applications that benefit humanity – then Richard Howarth's memoir is the place to go. As noted in the introduction, *The Emergence of Geophysics* discusses "the development of geophysics, from its earliest days into the twentieth century". These journeys explore a wealth of geophysical techniques from their infancy, including magnetism, gravity surveying, geo-electrics, seismology, heat-flow, geodynamics and radioactivity.

Readers may be familiar with the use of magnetic lodestones as basic compasses a thousand years ago, but Howarth takes us all the way through the progress in instrumentation that led to marine magnetic surveys and the discovery of plate tectonics. The development of gravimeters takes a striking turn from early pendulums in the 1700s (including Nevil Maskelyne's famous Schiehallion experiment in Scotland and Pierre Bouguer's less-successful measurements on Ecuador's Chimborazo Volcano), to twentieth century regional mapping that used spring-based instruments, as well as the use of satellite-tracking technology to map Earth's gravity field. Some of the journeys are pretty wild – such as the historical use of earthquake damage to locate epicentres – but they have led to the development of the seismic reflection methods that have underpinned much of society's wealth-creation attributable to our science. As expected from an author who spent much of his career in applied science, there are extensive examples of how these methods evolved through prospecting for Earth's resources. Given this is a memoir that looks at the early foundations of geophysics and the scientific edifices built upon them, don't expect to find discussions of modern subdisciplines such as geodesy, a field that has revolutionised our understanding of active tectonic processes.

Yet, there is still so much more here. Howarth asks whether readers expect a history of geophysics to have been written by a geophysicist. Being a user of geophysical data, one step removed from its practice, has perhaps provided Howarth with perspective. It certainly



EARTH HISTORY: STORIES OF OUR GEOLOGICAL PAST

DETAILS

BY: Peter Copeland & Janok Bhattacharya (2025) Cambridge University Press, 408pp. (pbk/hbk)
ISBN: 9781108724159
PRICE: £54.99 (pbk), £120 (hbk)

REVIEWED BY CHRIS HAWKESWORTH

It is all in the title: this is Earth's history as told through stories, an approach that I think works extremely well. As the authors note, "rocks are books telling us about geological stories, written in a number of languages", including stratigraphy, petrology and palaeontology. The first six chapters provide a foundation for those that follow, with an overview of the major events in Earth's history and the techniques used to address them. These include overarching concepts like the differing philosophies and scientific methods of geology, Earth's origins, plate tectonics, natural selection and evolution, as well as case studies such

as reading strikingly exposed rocks in the Grand Canyon. Subsequent chapters build on key concepts: the origin of life, dinosaurs, the Cambrian explosion, and environmental change during Snowball Earth, as well as humanity's impact in the Holocene.

There is an impressive coherence and thread through the different topics, which surely reflect years of teaching courses on Earth's history. The book is written for North American undergraduates, so inevitably there is emphasis on examples from North America, including tectonics in the west and closure of the Iapetus Ocean from an Appalachian perspective. These are excellent case studies, even if not immediately accessible to European students, as might also be said of the Himalayas and, to a lesser degree, the Messian salinity crisis.

The writing style is engaging and light of touch. Each chapter has key words to accompany concepts in the text, alongside further reading and review questions, which allows for welcome flexibility in how each chapter is taught. It succeeds in drawing on a variety of sub-disciplines to provide students who have little or no previous knowledge of geology with a broad understanding of our planet and its fascinating journey. There is an excellent glossary, and the online resources include figures, lecture PowerPoint slides and a test bank for instructors. Overall, the chapters are impressively comprehensive, yet they provide the opportunity to be read at different levels depending on the Earth history course they accompany. The authors are to be warmly congratulated on what may turn out to be a hallmark book in the teaching of geology.

helps him to place the history of physical phenomena research into broader context and attribute key technical and methodological developments that are widely used today. For Howarth, this research has clearly been a labour of love and is reflected in the memoir being an excellent, methodical and illuminating read, with fantastic use of historical images. The production values are a credit to the Geological Society of London's Publishing House. It's a must-read, not just for geophysicists but for all interested in the origins of our science.

MORE INFORMATION

Geological Society of London titles are available at: geolsoc.org.uk/bookshop For all other books, visit: uk.bookshop.org/shop/geoscientist

THE SOUTHERN PENNINES (CLASSIC GEOLOGY IN EUROPE 13)

DETAILS

BY: John Collinson & Brian Roy Rosen (2024) Liverpool University Press, 371pp. (pbk)
ISBN: 9781780461007
PRICE: £29.99

REVIEWED BY PAUL WINROW

The Southern Pennines replaces the many outdated field guides to the region, not only with much needed updates on current geological thinking but also with key information on sites that remain accessible.

The geology discussed focuses heavily on the tectonic development of the Southern Pennines during the Carboniferous, with an account of the region's complex and important stratigraphy highlighting the many Stage stratotypes that can be found here. The authors note that they are using the latest stratigraphic nomenclature and caveat that "readers of earlier literature must be prepared for some confusion".

Description of the Carboniferous sedimentology and palaeogeography incorporates a rich array of diagrams, profiles, maps and charts demonstrating the region's history. A particularly interesting addition is a reflection on the area's industrial heritage mining for coal and metals, much of which was driven by the local geology.

Most of the book comprises of field descriptions, with a focus on describing individual localities rather than outlining field trips, although some "geo-walks" in Derbyshire are included. This approach enables the reader to either visit individual sites or develop a field trip based on their own interests. Collinson and Rosen also take account of the needs of those with limited mobility by identifying suitable sites to visit and even enable virtual fieldwork by noting those which can be viewed on Google Earth and Google Street View.

The field localities are clearly described, including grid references and GPS coordinates. The detailed site descriptions are liberally supported by photographs, drawings and diagrams (such as sedimentological logs) and helpful advice on access, including parking and paths. Being familiar with one of the locations, Castleton, it was simple to verify that the descriptions are highly informative.

Overall, this is an excellent guide, providing great background on the complex and fascinating Carboniferous geology of the Southern Pennines, as well as high-quality field descriptions invaluable to exploring the area.

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ROBERT MAURER

1935 – 2024

Bob aspired to transform an initial hobby into a lasting legacy

BY LIZ CHIU, *HARROW & HILLINGDON GEOLOGICAL SOCIETY*

ROBERT 'BOB' MAURER'S breadth of experience spanned engineering, metallurgy, mineralogy, fossil collecting and flow-meter design. Combining his long career with geological hobbies, he developed a new theory for plate tectonics that he hoped would see mainstream acceptance.

Engineer, inventor, innovator

Bob graduated as a mining metallurgist in South Africa and worked in gold, uranium and diamond mines before studying electrochemistry at the University of London. This took him into research projects on the growth of single crystals of alpha–uranium and the hydrogen embrittlement of high tensile steels, and then onto a career in engineering.

Bob's main career as an engineer focused on innovative liquid flow measurement instrumentation. He could be called the 'Father of Turbine Flow' instruments, having produced many unique devices across a wealth of industry sectors through his company Maurer Instruments Ltd, as well as designing and manufacturing advanced high-pressure samplers for the oil industry. Bob was well known and respected in these fields of precision engineering and won many prestigious international contracts. He was proud to receive a maintenance request in 2024 for a meter he had designed and built that was still working at 20,000 revolutions per minute without stopping for 34 years.

Geological puzzle

Bob's hobby of mineral and fossil collecting yielded stunning collections that are a testament to his knowledge of both fields and his high proficiency of preparing samples for display. He generously shared his knowledge on these with friends, colleagues and geologists.

While fossil collecting in Bolivia, he was struck by the undisturbed, still horizontal, sedimentary layers in the high Andes, 5,000 m above sea level, and wondered what forces could possibly be strong enough to cause this uplift. His expertise in fluid flow convinced him that convection currents in the mantle could not have raised these mountains from below sea level without any crumpling. The only force he could imagine strong enough would be at the planetary level, such as Earth's rotation. It came as a surprise to him that many tectonics researchers do not consider planetary forces in their models of crustal movement, and so began his 20-year obsession to try to change this.

> **“Bob's hobby of mineral and fossil collecting yielded stunning collections that are a testament to his knowledge”**

Theory publication

Bob's attempts to publish his theory in academic journals were unsuccessful, and he eventually decided to self-publish *The Rotating Earth and Plate Tectonics* in 2020. This sets out a mathematically justified drive mechanism for tectonic plates, capable of rifting continents and moving them over the oceanic lithosphere. In his final year, Bob gained recognition in Japan with the publication of a paper by Okayama University, and in Iran where he gave the keynote presentation at a Conference on Tectonics and Structural Geology, held at the University of Tabriz. Despite poor health, he was able to do this via a video recording presented online to the live audience. Bob sadly died on 27 December 2024 having seen some acceptance of his theory, but wider recognition is yet to come.

© Richard Pattrick and Susan Treagus

JACK EDWARD TREAGUS

1935 – 2025

Structural geologist who made immense contributions to our understanding of Britain's Caledonian deformation

BY RICHARD PATTRICK AND SUSAN TREAGUS

JACK TREAGUS was born in Portsmouth on 20 December 1935 where he attended Portsmouth Northern Grammar, becoming Head Boy. After National Service, he studied geology at the University of Liverpool, where student fieldwork in the deformed and metamorphosed Dalradian of Connemara, Ireland, and the Precambrian of Holy Island, Wales, were to define his future career. He stayed at the university to undertake a PhD on the Moine and Dalradian of Perthshire, Scotland. After short spells in Leeds and Ghana, Jack obtained a lectureship at the University of Manchester in 1966, where he stayed for the rest of his career, teaching structural geology and geological mapping.

Scottish fieldwork

Jack's forte was in the field, and his research in many challenging regions of the British Isles provided new interpretations based on meticulous field observations of meso- and micro-structures. He leaves a seminal body of work in unravelling the stratigraphy, metamorphism and structural evolution of the Dalradian of the Southwest and Central Highlands of Scotland, from Kintyre to Aberdeenshire. The multiple episodes of Caledonian deformation that Jack identified and correlated right across this terrane now define our understanding of the Dalradian; a host of high-quality publications are characterised by detailed evidence and structural cross-sections in the impressive *The Dalradian of Scotland* (Geologists' Association Guide No. 67, 2009).

> **"The Caledonian deformation he identified defines our understanding of the Dalradian"**

Jack later returned to this region of Scotland, as manager and contributor to a major mapping project funded by the British Geological Survey, resulting in the production of a solid geology map sheet and accompanying memoir (Treagus *et al.* 2001. Schiehallion: Solid Geology Map: Sheet S55w. 1: 50 000 Series Geological Maps, Scotland). Additionally, he redefined the major sinistral fault suite (Loch Tay, Ericht and Tyndrum faults) of the Central Highland Terrane, and the relative slip components in relationship to epigenetic mineralisation.

Jack also produced a structural reinterpretation of the contorted Hawick Group rocks of the Southern Uplands, was editor for *Caledonian Structures in Britain: South of the Midland Valley* (Geological Conservation Review Series No. 3, 1992) and contributed to other conservation review volumes. In 2003, he was awarded the Clough Medal, the premier honour of the Edinburgh Geological Society, for his work on the geology of Scotland.

Impactful partnership

Jack had many successful collaborations, but one that (officially) started in 1970 lasted for 55 years; that with his wife Sue. Structural geology brought them together. They published numerous papers together, on folding, strain, and deformed conglomerates. During retirement, they tackled another Precambrian-Cambrian complex, re-interpreting the highly deformed Monian Supergroup of Anglesey, and produced the delightful book, *The Rocks of Anglesey's Coast*.

Jack taught structural and field geology at the University of Manchester for 35 years and was much loved by students, his interactions characterised by patience and kindness. He died on 7 March 2025, and is survived by wife Sue, daughters Helen and Jane, and three grandsons.

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EDWARD JAMES WILSON

1936 – 2025

Edward was a gifted geotechnical engineer

BY DAVID WILSON

EDWARD (TED) JAMES WILSON, born in Bradford, spent his Yorkshire childhood roaming the local moors and valleys, which together with school science club trips to woollen mills, steelworks and a coal mine, all sparked his initial interest in geology.

Geological foundations

On graduating from the University of Liverpool in 1958 with BSc Honours in Geology, he initially considered emigrating to Canada to take up a job in copper mining. However, that was the year copper prices fell on the world market, so he stayed in the UK and did National Service while seeking employment. There he taught English, Maths and General Studies to other servicemen as part of the Royal Army Educational Corps. Once, when leading a night exercise involving map reading with no torches allowed, he inventively found a glow-worm to light the map.

Ted's career began in 1961, working in British Rail's Civil Engineering lab next to Paddington Station. Here he gained an in-depth knowledge of soil mechanics before moving on to ground investigations for projects such as new bridges, signal boxes and stations, as well as remedial works for embankment landslips and track bed failures.

Entrepreneurial spirit

In 1965, Ted accepted a job as Soil Mechanics Engineer with Geotechnical Engineering Ltd in Gloucester, eventually rising to and serving many years as Technical Director before setting up his own independent consultancy in 1979. Whilst work naturally concentrated on Gloucestershire and especially landslips within the Cotswold and Stroud valleys, trips were also made to Libya to undertake ground investigations for a water-storage tower, motorway flyover and a 22-storey tourist hotel.

Service to others

Ted attained several professional qualifications and memberships, becoming a member of the Institution of Civil Engineers and Institution of Mining Engineers (now the Institute of Materials, Minerals and Mining), a Fellow of the Geological Society of London, and he served a term as chairman of the Midland Geotechnical Society. In 1984 he acted as Visiting Examiner on the master's course in Engineering Geology at Imperial College London, and very much enjoyed being called to the civil court to act as an expert witness.

He retired in 2001 after a long and fascinating career, and was very proud to pass the business to his son David, also an engineering geologist, who continues to run the Gloucester-based consultancy.

Throughout his career and retirement, Ted was an active church member involved in many stewardship roles and a Gloucester Civic Trust guide. Ted also found enjoyment in watercolour painting, Roman and Saxon history, researching his own family history, winemaking and photography (including judging numerous local camera club competitions).

Ted is survived by his wife Anne and children Julie, David and Helen, who are thankful for his long and eventful life.

THE SOCIETY NOTES WITH SADNESS THE PASSING OF:

- Attree, Mark
- Bennett, Ivor
- Bradshaw, John
- Cooper, Eric
- Firth, John
- Fleuty, Mike
- Harris, Tony
- Hopkinson, David
- Howarth, Mike
- James, Stephen
- Jones, William Barry
- Lane, Andrew
- MacDonald, Hugh
- McDowell, Peter
- Naylor, David
- Osterloff, Peter
- Pearce, Martin
- Petrides, George
- Reading, Peter
- Robinson, Eric
- Rolfe, Ian
- Stanley, Peter
- Stainforth, John
- Ward, Graham

To submit an obituary, please contact geoscientist@geolsoc.org.uk

FIVE MINUTES WITH...

"Many jobs are dead boring; this one isn't"

→ DR DAVID GILES is Senior Consultant at Geotechnical Consulting Group (GCG) and the 2025 recipient of the Society's Glossop Medal.

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What is a typical day for you?

My workload is quite varied, providing geological support for the vast array of projects that GCG is involved with and providing opinions in legal disputes for a variety of engineering geology problems.

What interesting projects have you worked on?

Currently, I am involved in a large site assessment for new solar panel farms across Serbia, distributed in differing geological terrains with associated hazards. From knowing very little about Balkan geology, I have learnt about some very interesting and complex geological settings, such as ophiolites and zeolite mineralisation.

I have also enjoyed leading undergraduate and postgraduate engineering geology and geohazards field trips to France, covering the French Alps, Provence and the Chaîne des Puys volcanoes. It was a wonderful checklist of rocks, landslides, tunnels, dams and Quaternary glacial deposits!

What have you learned moving between academia and consultancy?

In academia you build an enormous bank of geological trivia – little snippets of information from lectures, field trips and student projects that you supervise. I didn't have an outlet for this geological background until moving to industry where I use it for desk studies and geohazard assessments, highlighting the geo-related issues that may need to be addressed during project planning.

Have you faced any challenges?

When I was a student and later a staff member, the Engineering Geology and Geotechnics degree programme was set by lecturers who understood its vocational and hybrid nature. With a mix of short and long courses, field trips and labs there were long contact hours, trips out of term time and extended projects. But when college degree programmes had to be repackaged into a one-size-fits-all model, it was a challenge to work out what to cut from the course. I was taught how to survey, mix a concrete batch, repair an ohmmeter, prospect in an African craton, explore for groundwater and write a Fortran programme using insights from other subjects and teaching departments, all of which became impractical and undeliverable with unitisation. We seem to have forgotten that multidisciplinary degrees should have a place in a varied curriculum.

What inspired you to follow this career path?

It all started with a visit to the Palaeolithic flint mines at Grimes Graves, Norfolk. This triggered a geological interest that ultimately led me to hearing Pete McDowell's sales pitch for BSc Engineering Geology and Geotechnics at Portsmouth Polytechnic – once I had heard that, there was no turning back! The variety of subjects studied and projects that I could be involved in was an exciting prospect.

Has receiving the Glossop Medal influenced your next career move?

From the feedback I received after giving the Glossop Lecture it is evident there is still much to do in the engineering geology community to spread the word about the significance of the Quaternary to ground engineering. I intend to carry on assisting the initiative developed by the Engineering Group and Quaternary Research Association to develop field training programmes on Quaternary Engineering Geology to support early career geoscientists.

What advice would you give to someone hoping to work in your field?

Many jobs are dead boring; this one isn't! In engineering geology, the variety of geological settings, hazards and geotechnical challenges, as well as the data types, modelling and analysis are constantly different, meaning projects are never dull or repetitive. It is truly a holistic discipline and rewarding career.

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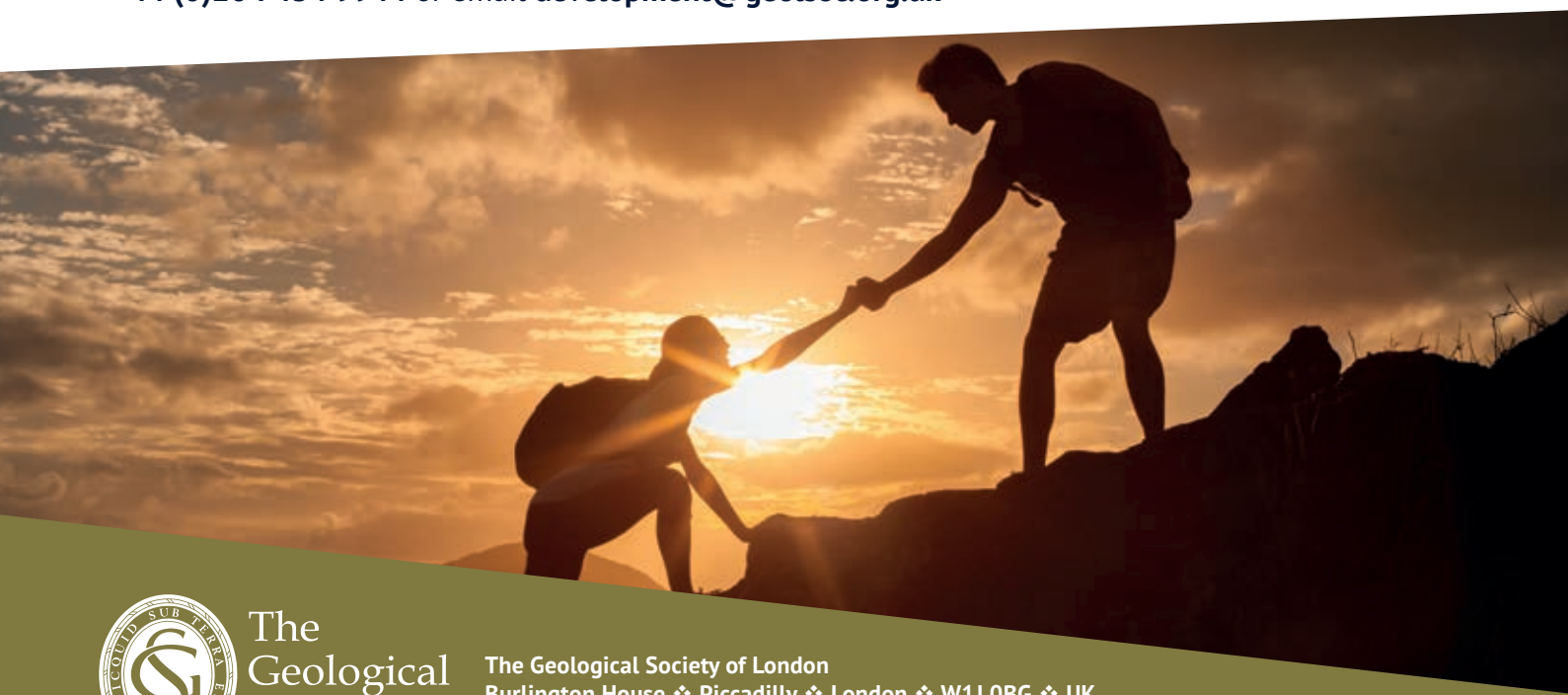

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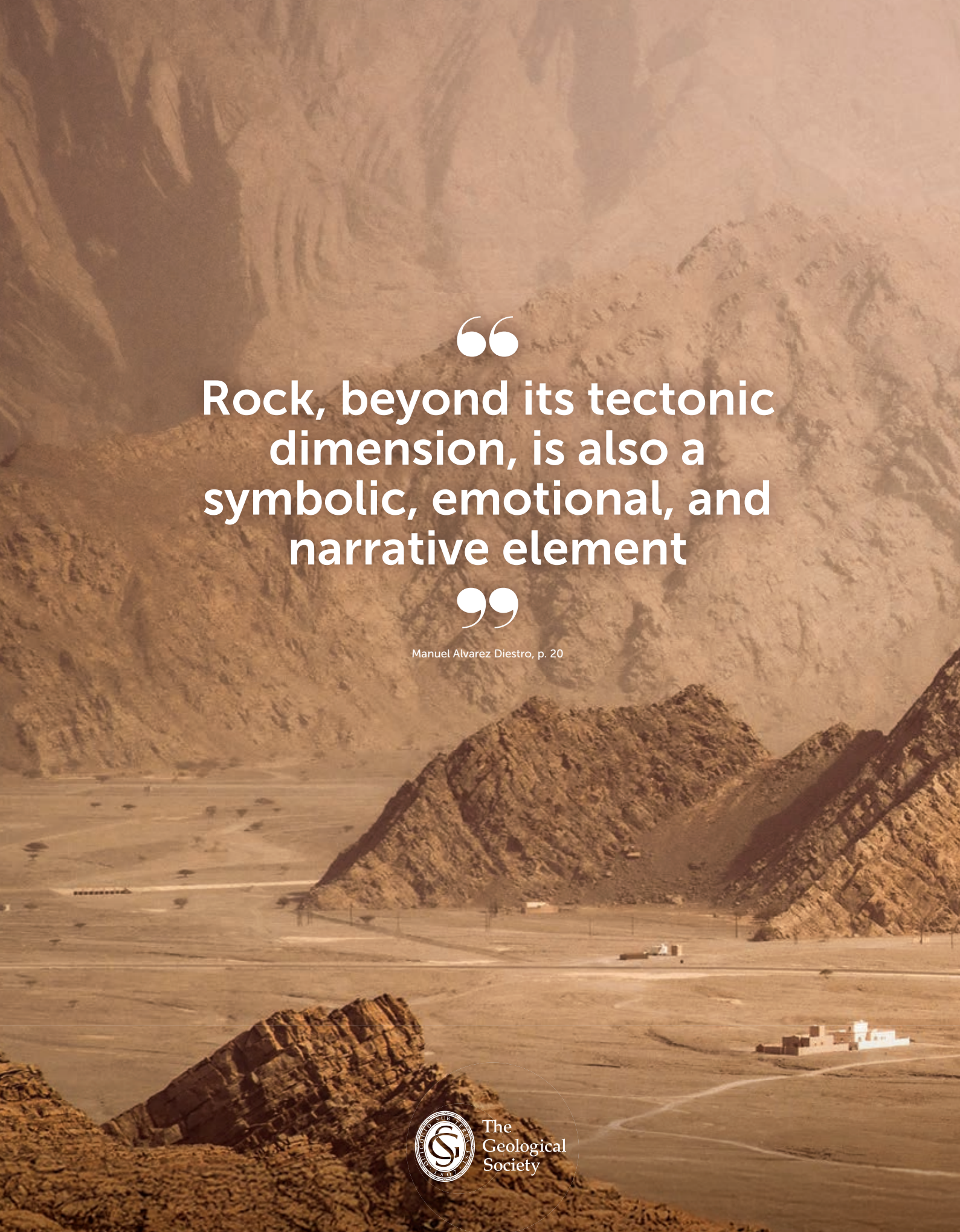

> Rock, beyond its tectonic dimension, is also a symbolic, emotional, and narrative element

Manuel Alvarez Diestro, p. 20

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