

# GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

 @geoscientistmag

[ A FRESH LOOK AT  
GEOSCIENCE EDUCATION ]

## TRAINING REVAMPED

John Underhill on the  
role of doctoral training  
in addressing 21st  
Century challenges

### GEOSCIENTISTS WANTED!

To steward the transition  
to clean energy

### FUTURE RESOURCES

Building a  
multidisciplinary community

### STATE OF PLAY

The worrying decline of UK  
geoscience education





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## The Geological Society Career and Industry Days 2019/20

**Wednesday 6 November 2019**

Venue: BGS, Keyworth, Nottingham, UK

**Wednesday 4 December 2019**

Venue: Our Dynamic Earth, Edinburgh, UK

**Wednesday 19 February 2020**

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

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

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

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

### Registration

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

### Contact Information

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

T: 0207 4349 944

E: [conference@geolsoc.org.uk](mailto:conference@geolsoc.org.uk) | Follow these events on Twitter: #GSLcareers2019 #GSLcareers2020

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# Geological Society Environment Network Inaugural Networking Event



**22 November 2019, 14:00** (Registration 13:00)

The Geological Society, Burlington House, London

The Environment Network of the Geological Society is pleased to announce their inaugural discussion and networking event.

Communication is key to engaging stakeholders about challenges ranging from diminishing resources, the production of hazardous wastes, contaminated land, marine and atmospheric pollution, climate change, and the effects of emerging pollutants. The afternoon will explore the role that scientists need to play as communicators and the role the Environment Network can play in facilitating communication between scientists.

The event will feature a keynote address on "Geoscientists as environmental communicators: arbitrators, advocates or activists?" by Professor Iain Stewart, University of Plymouth and will conclude with a networking reception.

**Geoscientists with an interest in any area of the environmental sciences are encouraged to attend.**  
[www.eventbrite.co.uk/e/environment-network-discussion-and-networking-event-tickets-67041469841](http://www.eventbrite.co.uk/e/environment-network-discussion-and-networking-event-tickets-67041469841)

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Cover image: The GDT's Academic Director,  
Professor John Underhill



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## THE MICROPALAEONTOLOGICAL SOCIETY AGM BIOSTRATIGRAPHY: A 21<sup>ST</sup> CENTURY SCIENCE

13–14 NOVEMBER, 2019 | BRITISH GEOLOGICAL SURVEY, KEYWORTH, UK

On day one, join us for a showcase of the applications of data science, machine learning and automation to biostratigraphy. Data science is changing our everyday lives and will drive increased efficiency and insight in many aspects of geoscience, including biostratigraphy.

Topics for discussion will include machine assisted interpretation of microfossil data in terms of biozone/age and palaeoenvironments; data extraction and synthesis; automation of microfossil identification.

Day two will include open sessions of short (c. 15 minute) talks and dedicated poster sessions. These sessions are open to any topic related to micropalaeontology.

CONVENERS: **Jim Riding** - BGS | **Mike Simmons** - Halliburton

For more information, to register, or submit an abstract please visit

<https://www.tmsoc.org/tmsoc2019/>

REGISTRATION CLOSES 23<sup>RD</sup> OCTOBER; ABSTRACT SUBMISSION DEADLINE 13<sup>TH</sup> SEPTEMBER



## Latest news from the Publishing House

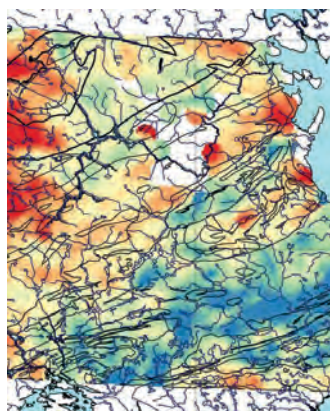
### State-of-the-art analysis of geochemical data for mineral exploration

By E. C. Grunsky and P. de Caritat

Multi-element geochemical surveys of rocks, soils, stream/lake/floodplain sediments and regolith are typically carried out at continental, regional and local scales. The chemistry of these materials is defined by their primary mineral assemblages and their subsequent modification

by comminution and weathering. Modern geochemical datasets represent a multi-dimensional geochemical space that can be studied using multivariate statistical methods from which patterns reflecting geochemical/geological processes are described (process discovery)...

➤ **Read the full abstract and paper in the Lyell Collection**  
<https://geea.lyellcollection.org/content/early/2019/07/11/geochem2019-031>



### Settlements and slides: a large landslide case study from the Central Cordillera of the Philippines

By Gareth James Hearn and Jonathan Roy Hart

The Central Cordillera of Luzon in the Philippines is home to some of the most complex geology, active plate margin tectonism, heaviest rainfall and steepest terrain in the world. It also hosts a thriving agricultural community that has developed its agrarian, municipal and transport infrastructure in a landscape of marginal stability and extreme geomorphological sensitivity. The village of Pilando occupies a saddle on a prominent ridge where it is crossed by the Halsema Highway. As a result of landslide displacements, both the highway and the village have been subsiding for several decades and many dwellings have had to be abandoned. From topographical survey and visual observation, average rates of settlement vary between c. 0.1 and 0.4 m a<sup>-1</sup>....

➤ **View the full abstract and paper in the Lyell Collection now**  
<https://qjgeh.lyellcollection.org/content/early/2019/06/24/qjgeh2019-050>





“GEOSCIENCE STUDENT NUMBERS ARE DWINDLING. THIS SPECIAL ISSUE ON GEOSCIENCE EDUCATION DELVES INTO THE POTENTIAL CAUSES, AS WELL AS INITIATIVES THAT AIM TO TACKLE THIS DEPRESSING TREND”

FROM THE EDITOR'S DESK:

## Halt the decline

Globally, geoscience departments are reporting that student enrolment in degree courses is declining. The reasons for this drop off are manifold and complex. In the UK, the dearth of exposure to geoscience, and particularly geology, during early education, the lack of focus on geology as a standalone subject, a shortage of trained teachers, and the erosion of the subject's status as a science all contribute to diminishing uptake (see page 16).

Perception is a major issue. Many people don't fully comprehend the essential role the geosciences must play in addressing the grand challenges and several geoscientific professions are not viewed as noble in the way they once were. The association of geoscience with the oil-and-gas and extractive industries has (not unfairly) led to the subject being labelled as 'dirty' (page 9), and few youngsters are interested in studying a subject that they perceive as having played a central role in damaging our planet. The problem is, geoscience also has a crucial part to play in fixing these issues and creating a pathway to sustainable development—we desperately need a new generation of skilled, passionate geoscientists to take up this mantle.

For example, the successful implementation of carbon capture and storage, the effective management of water resources, as well as the adequate supply of the raw materials needed to create renewable energy technologies, the infrastructure that underpins efficient, functional cities, and the fertiliser that nourishes crops to feed our exploding population, all rely on experts with an intricate understanding of the subsurface and Earth systems.

Fortunately, several initiatives are underway to boost teaching, challenge public perceptions and revamp geoscience-training courses. Organisations such as the Earth Science

Teachers' Association (page 16) and our own Society (page 8) are working with teachers in schools and universities to raise geology's profile. Post-graduate training courses are also evolving. On page 10, John Underhill discusses the Centre for Doctoral Training model—an exemplar of how a training course can successfully evolve from its oil-and-gas remit to address the challenges faced by society in the 21st Century.

This training evolution goes well beyond a simple rebrand. The next generation of geoscientists will need an expanded skill set that incorporates economics, social science and policy, and our training provisions must reflect this. Geoscientists will also need to work closely with experts from these sectors. The Researching Social Theories, Resources, and Environment International Summer School (page 24) was setup with precisely this aim—to facilitate connections between disparate disciplines and build a global community to tackle the issues of sustainable resource extraction.

It is heartening to learn that many in our community are working to halt the subject's decline. But, geology as a discipline remains at risk and we must each take every opportunity to engage the next generation. Complacency may contribute to the demise of our science.

In other news, change is coming. From mid-October, I will head off on maternity leave and Sarah Day will take over as *Geoscientist* Editor. Sarah will be familiar to many, having worked at the Society for 11 years as Earth Science Communicator and Head of Media Relations & Outreach. Sarah studied Natural Sciences, as well as the History & Philosophy of Science & Medicine at Durham University, before completing a Masters in Science Communication at Imperial College London. She is also an award-winning author, so I look forward to spending my sleep-deprived leave reading her beautifully crafted editorials.



# SOCIETY NEWS

## SOCIETY'S AWARDS 2020 – MAKE YOUR NOMINATIONS NOW!

*Fellows of the Society are encouraged to submit nominations for the Society's Awards for 2020.*

With the aim of broadening the demographics of those put forward, this year we set ourselves a goal to revamp the awards process. Undertaking a holistic review of the procedures, focusing on the nominations, application, submission, judging and assessment processes and criteria.

We now have one standard nomination form for all of our awards with the exception of the President's Award, which now has its own

form. Our guidance documents have been updated accordingly and help to explain how to go about nominating a person you feel is deserving of a Society Award.

Check out our new awards booklet, which shows all of the changes made and how easy the whole process is by visiting <https://www.geolsoc.org.uk/About/Awards-Grants-and-Bursaries/Society-Awards>

Full details of how to make nominations can also be found there.

Remember nominations must be received at the Society no later than **27 September 2019**.

## THE ENVIRONMENT NETWORK

*Questions of how to protect and preserve the environment while meeting the needs of a growing population have come to the forefront in recent years.*

The solutions require input from multiple branches of the geosciences, some of which lack a shared space for discussion. The Geological Society's Environment Network was established in 2011 to provide just that forum. In recent years, it has provided an online platform for information sharing. This year, it is renewing its focus on events and conferences designed to bring together researchers working in all areas of environmental sciences and policy.

The Environment Network's inaugural discussion and networking event will take place on 22 November, at 14:00 at Burlington House (<https://www.eventbrite.co.uk/e/environment-network-discussion-and-networking-event-tickets-67041469841>). This event aims to connect researchers looking at current and emerging environmental issues, with a focus on cross-cutting themes relevant to the Specialist Groups. Anyone interested in challenges such as diminishing resources, production of hazardous wastes, contaminated land, marine and atmospheric pollution as well as climate change and the effects of emerging pollutants

is welcome to participate in the discussion, and in the Environment Network.

If you would like to learn more about the network, please see the website <https://www.geolsoc.org.uk/Groups-and-Networks/Environment-Network/About-the-Environment-Network> or

contact the chair, Professor Bryne Tendelo Ngwenya at [Bryne.Ngwenya@ed.ac.uk](mailto:Bryne.Ngwenya@ed.ac.uk)



## CHANGE THE WORLD

**REMEMBER A CHARITY  
IN YOUR WILL WEEK**

**9-15 September 2019**

*The Geological Society has been at the heart of the geological community since it was established in 1807.*

Providing support to thousands of geologists and championing geoscience globally, the Society is integral to the development of the geosciences.

If the time is ever right for you to remember a charity in your Will, please consider supporting the Geological Society. As a registered charity (number 210161), every gift makes a huge difference—even 1%, or a modest sum of money will leave a lasting legacy.

September 9-15 is 'Remember a Charity' week (<https://www.rememberacharity.org.uk/for-charities/remember-charity-week/>). If you would like to find out more about remembering the Society in your Will, please contact our Development Team on +44 (0) 207 434 9944 or email [development@geolsoc.org.uk](mailto:development@geolsoc.org.uk)

## ONLINE JOURNAL ACCESS

*The Library can now provide Fellows with offsite access to Boreas, from vol. 44 (2015) onwards, and Sedimentology, from vol. 62 (2015), onwards.*

Boreas publishes papers on biological and non-biological aspects of the Quaternary environment, in both glaciated and non-glaciated areas. Subjects include climate, shore displacement, glacial features, landforms, sediments, organisms and their habitat, and stratigraphical and chronological relationships.

Sedimentology is the journal of the International Association of Sedimentologists and publishes papers on sedimentology, sedimentary geology and sedimentary geochemistry.

Ask the Library for an OpenAthens login, if you don't have one and visit the Virtual Library webpages or the Library catalogue to discover the Library's collections of e-journals and e-books.

**What your society is doing  
at home and abroad**



## ACCREDITATION ASSESSED

**Bruce Yardley and colleagues from the Accreditation Committee ask whether the Geological Society's Accreditation Scheme for undergraduate degrees is fit for purpose.**

The Society's Accreditation Scheme for first degrees has been running for around 20 years. It was set up to provide a fast track for geologists and geophysicists to become Chartered, by demonstrating that their first degree adequately covered the basics.

Most UK Earth science degrees are now accredited. Such courses must include core geoscience content and departments must show that their teaching staff are appropriately qualified. Emphasis is on field training and independent mapping, but other requirements include basic mathematics and core subjects including structural geology, mineralogy, petrology, palaeontology, remote sensing and GIS. But, do these requirements really help make graduates more employable? Early in 2018, the Accreditation Committee, together with the Society's Education Department, decided to undertake a survey of employers to determine how satisfied they are with accredited degrees.

We received 124 responses, mostly from the engineering and environmental sectors. However, some responses came from the oil and gas, exploration and mining sectors, as well as from a range of consultants, and these employers seem to expect different skill sets compared to engineering and environmental employers.

Gratifyingly, over 73% of responses to the question "Overall, how happy are you with the quality of graduates from accredited undergraduate degrees?" were "happy" or "very happy", with just 6% "unhappy" (the other category was "ambivalent").

However, respondents from the minerals and hydrocarbon sectors are much more likely to be unhappy with the training of accredited graduates.

For most degree schemes, employers agree that the main topics specified for accreditation requirements are important. Mathematics, structural geology and geological fieldwork generally score 90% + approval ratings, while GIS/remote sensing is also highly rated. There is strong support for independent mapping projects, but also recognition that more could be done to teach students to take samples and use instruments in the field. Mineralogy, petrology and palaeontology fared less well. Fewer respondents reported these subjects as important in their work, but for respondents that see them as important, reported that training is often inadequate. The survey identified no single topic that should be added to the accreditation requisites, but many respondents asked for stronger requirements for statistics and communication skills.

We also asked, "Do you see differences between graduates with BSc and MGeol/MEarthSci (not MSc) undergraduate degrees?"

Evidently, some employers, like many university applicants, do not understand the difference between a taught postgraduate MSc and a four-year undergraduate masters. Many employers favour graduates with a BSc followed by a vocational MSc, but where the employer's priority is a good all-round training in geology, the undergraduate four-year degree is preferred. The Society accredits both types of degree. Should it also be proactive in explaining the options to potential students?

Overall, our survey suggests that existing accreditation requirements fall broadly in line with expectations, but the results

“OUR SURVEY SUGGESTS THAT EXISTING ACCREDITATION REQUIREMENTS FALL BROADLY IN LINE WITH EXPECTATIONS, BUT THE RESULTS PROVIDE IMPORTANT FEEDBACK”

provide important feedback to academic departments and the Accreditation Committee. Some employers are happy to take on graduates with a non-accredited degree, provided the graduate had a good all round training and fieldwork experience. Others prefer to focus on students with accredited degrees aligned with their sector, rather than general geology or geophysics degrees.

The Accreditation Committee's job is to specify the content that is required for graduates to qualify for fast track to Chartership, not to tell university departments what to teach. However, we hope departments will find the survey feedback interesting.

This is not the end of the process. We will send the full report to Council, to the respondents to the survey requesting further comments and to University Geoscience UK. The report will inform a broader review of accreditation being undertaken by the Society. We also aim to streamline the application process for both accreditation and re-accreditation of undergraduate programmes, to make it a less onerous task for departments.

*By Prof Andy Saunders (Accreditation Officer), Prof Andy Smith (Chair, Accreditation Committee), Prof Bruce Yardley (Chair, Accreditation Committee Review Group) and Dr Bill Gaskarth (past Chair, Accreditation Committee)*

Details of the current accreditation requirements are available at <https://www.geolsoc.org.uk/Education-and-Careers/Universities/Degree-Accreditation/Aims-and-Requirements-for-Accreditation>

A link to the full report from the survey is available with the online version of the article.





## PROMOTING ENGAGEMENT IN GEOSCIENCE EDUCATION

*Amy Ball and Rose Want report on the latest activities from the Education Department.*

Earth scientists have a critical role to play in tackling some of society's most pressing issues. As the Society's Education Department, it is part of our job to communicate this role to both teachers and students, and to show them that by studying the Earth sciences they can make positive changes in the world. For example, Earth scientists can help meet the challenges of decarbonisation and sustainability, in an effort to mitigate climate change; they can explore for and extract critical resource minerals and metals to help meet future demand; and they can understand and communicate the effects of geohazards. However, geology GCSE and A level are not taught in every secondary school across the UK, so it is crucial for us to encourage the current cohort of geography and science teachers to inspire students via other education initiatives.

One way of engaging students with geology is via participation in the Society's National Schools Geology Challenge (<https://www.geolsoc.org.uk/geochallenge>). The challenge asks teams of geology, geography or science students to compete in a regional heat—held by their relevant Regional Group. Using poster and short oral presentations, the students present a geological topic to a panel of judges. After competing in a quiz round, the teams with the highest combined score from all three elements proceed to the final at Burlington House, London. For 2020, the final has a new format to test student's teamworking and problem-solving abilities, as well as their geological knowledge. Regional Groups have already started the



ball rolling for the 2020 regional heats, so we are hopeful that we will maintain or beat 2019's record year for the number of entries.

Another way to get more Earth science into teaching is through the Geoscience Education Academy (<https://www.geolsoc.org.uk/gea>), a two-day teacher-training course for secondary school teachers and teacher trainees. The course aims to boost teachers' knowledge of Earth science, while providing innovative teaching ideas and activities that could be delivered in the classroom. This year's Geoscience Education Academy was held in July and included workshops such as 'a journey to the centre of the Earth', 'tectonic hazards and a nice cup of tea' and 'our climate disaster', as well as an urban geology fieldtrip to help teachers brush up on rock descriptions and a guest lecture on slow-slip earthquakes by Dr Rebecca Bell from Imperial College London.

If you are a teacher or teacher trainee interested in getting involved with the Schools Geology Challenge or attending future Earth science CPD courses, please contact the Education Department ([education@geolsoc.org.uk](mailto:education@geolsoc.org.uk)) to sign up to be one of our Geological Society School Affiliates. Similarly, if you are interested in getting involved in geoscience education and outreach, you can help us out by becoming a Geology STEM Ambassador, judging one of our competitions (such as the Schools Geology Challenge or the Early Career Geologist Award) or even by joining our Education Committee (<https://www.geolsoc.org.uk/About/Governance/Committees/External-Relations/Education>).

## PUBLIC LECTURE SERIES

### London Lecture: The Big Antarctic Freeze

**Speaker:** Caroline Lear, Cardiff University

**Location:** Burlington House, London

**Date:** 18 September

#### Programme

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

#### Further Information

Please visit [www.geolsoc.org.uk/gslondonlectures19](http://www.geolsoc.org.uk/gslondonlectures19). Tickets are now available on Eventbrite.co.uk and will work on a first come first serve basis. The lectures will be available to watch livestreamed at both the 3pm and 6pm lecture. To watch, please check the lecture webpage for the link. (This talk will be repeated as a Regional Lecture on 26 September, at the National Museum Cardiff; <https://www.geolsoc.org.uk/Events/Regional-Public-Lectures-2019>.)

### Regional Lecture: Volcanoes and past climate—adventures with deep carbon

**Speaker:** Tamsin Mather, University of Oxford

**Location:** University of Plymouth

**Date:** 23 September

#### Programme

- Evening talk: 18.30 Lecture begins; 19.00 Reception.

#### Further Information

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



# Petroleum Geoscientists ...wanted!

**John Warburton** asserts that a new generation is needed to steward the transition to a clean energy future



I read with great pleasure the article *Speaking up for Geoscience* (Geoscientist 28(11), 9, 2018). Mike Simmons recounts how resource industries have done their brand quality little service though poor communications with the societies they serve. This, he argues, has led to a perception that these industries are exacerbating environmental damage.

Given such negative branding it is unsurprising that school and university graduates have limited aspiration to pursue careers in resources or geological sciences. This is a bleak backdrop against which Mike calls on society and industry to work together to encourage new young professionals to take-up careers in industrial geosciences.

## Thirst for petroleum

I experienced first-hand how petroleum companies take extraordinary measures to reduce environmental harm while winning precious resources. Such measures are often demanded by vocal shareholders and activists.

Technological advances continue to enable petroleum exploitation from increasingly challenging settings, such as unconventional reservoirs. Furthermore, new sources of petroleum are under consideration (hydrates, deep-basin centres) as the World's insatiable thirst for a petroleum-based economy and lifestyle continues.

## Addiction transition

Anathema to our addiction to petroleum is the desire instantaneously to recover from it.

Sheikh Yamani was Saudi Minister of Petroleum from 1962 to 86 and OPEC minister for 25 years. In 1973, he predicted that alternative sources of energy would eventually compete commercially with petroleum products,

famously remarking "*The Stone Age didn't end because we ran out of stones*".

It is in the context of a measured (rather than an unrealistic, immediate) transition away from a lifestyle addicted to petroleum where I see the next generation of young petroleum professionals finding their voice.



There is increasing global emphasis on the role of natural gas, compared with oil and coal. Combustion of natural gas bears substantially lower carbon footprint than oil or coal. Advances in production technology increased daily shale gas production in the USA from about 2 billion cubic feet ('Bcf') in 2007 to 50 Bcf in 2015 with an attendant 10% decrease in annual CO<sub>2</sub> emissions\*. Furthermore, petroleum companies are increasingly experimenting with renewable energy sources (such as solar and wind) to curtail their carbon emissions. For example, solar panels can generate electricity for powering oil field pumpjacks or nodding donkeys that formerly relied on burning of diesel.

## Young professionals

Society needs a next generation of petroleum geoscientists to steward the transition from our fossil-fuel-addicted lifestyle to one predominantly reliant on renewables. Only with a profound understanding of petroleum geology can those elements to be replaced entirely by renewable energy sources be identified and the technological breakthroughs implemented in a sensible time frame. Perhaps petroleum geoscience is not so 'dirty' after all.

\* Energy in Depth Oct, 27 2015, EIA May 2016, Monthly Energy Review.

Professor John Warburton is Non-Executive Director of Senex Energy Ltd and of Empire Energy Group Ltd and a visiting Professor at the School of Earth & Environment, University of Leeds, UK; Email: johnwarb@bigpond.net.au

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

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“ ONLY WITH A  
PROFOUND  
UNDERSTANDING OF  
PETROLEUM GEOLOGY  
CAN SOURCES TO  
BE REPLACED BY  
RENEWABLE ENERGY BE  
IDENTIFIED ”

JOHN WARBURTON

# REVAMPING DOCTORAL TRAINING FOR A DECARBONISED FUTURE



*Fig 1: The CDT's Academic Director, Professor John Underhill at its official launch in 2014*



To equip students with the skills to tackle the grand challenges demands a new approach to education.

**John Underhill** discusses the role that doctoral training needs to play in addressing decarbonisation

**A**t a time when prospective students are being put off by the perceived association of geologists with 'dirty' industries, energy resources and environmental damage, it is rather ironic yet apposite that geoscientists and their skill sets are a vital part of the solution, not just the cause.

While a better understanding of the subsurface was central to the carbonisation of our environment through the exploration, extraction and use of fossil fuels, the same skills and expertise that developed these resources can significantly contribute to decarbonisation solutions.

To address this issue (and the other grand challenges faced by humanity), and to provide a legacy and new generation of relevant, skilled geoscientists, we must reassess how we

educate and undertake research. As the latest reports have highlighted (GETI, 2019; OPITO, 2019), the landscape is changing rapidly. There is a skills gap that needs addressing and new methods of training that embrace new technologies and innovation are required.

To meet the demand, we need to change and evolve our geoscience provision and teaching to equip students. This means not just building essential geological and environmental expertise, but also giving students a broader bandwidth that includes elements relating to economics, engineering, social science, science communication and media relations.

The National Environment Research Council (NERC) Centre for Doctoral Training (CDT) model, of the type governed and run by Heriot-Watt University (<https://www.nerc-cdt-oil-and-gas.ac.uk/>) is extremely well placed





*Fig 2: Significant lithium resources exist in brine deposits associated with giant salt flats found in Argentina, Bolivia and Chile—South America's 'lithium triangle'*

to adapt and evolve to meet the challenge. Awarded in 2013 and launched the year after (Fig. 1), the CDT programme is an exemplar of how post-graduate research and training can evolve to move away from a specific oil-and-gas remit that it was originally ascribed, to address some of the key issues facing us and the changing world that we live in today.

## Reducing the carbon footprint

As the world's population grows and becomes more prosperous, there is an ever-increasing need to provide more energy to heat and light homes, fuel transport and power economic growth. Such development comes with a large carbon footprint that drives climate change, so we must ensure that as development progresses, it does so with reduced greenhouse gas emissions (Lovell,

2010; Stephenson, 2018). It is imperative that along with our commitment "to keep the lights on" and also achieve ambitious targets for converting to electric cars, we must also have in place a public mandate and social license to operate.

Additionally, as demonstrated by the major power outage that affected large swathes of the UK last month, the complex inter-linkage and intensity of energy sources can strain systems to the point where they fail, highlighting the key challenge to continue to secure and carefully manage our energy supplies as we decarbonise.

To meet the need for a sustainable, low-carbon energy future, measures are being introduced throughout the entire energy conversion chain, from the more efficient utilization of fossil-fuel resources for power generation and transportation, to improvements in consumption through

energy efficiency. Consequently, more countries are developing their renewable-energy resource capabilities and introducing clean energy solutions, in keeping with the United Nations' blueprint for a sustainable future for all (UN Sustainability Goals, 2019).

The UK is leading the way, with a number of initiatives taken and papers published by the UK and Scottish Governments (such as the HMG Industrial Strategy 2017; HMG Clean Growth Strategy 2017; BEIS Energy & Climate Plan 2019; Scottish Energy Strategy 2017), as well as by influential organisations like the Royal Society of Edinburgh (RSE Energy Inquiry Report, 2019) and the Committee for Climate Change (such as *Net Zero: The UK's contribution to stopping global warming* 2019).

The outcomes of several recent workshops, including a major Geological ►



*Fig 3: The CDT has a very strong governance structure, with committees overseeing the management, training and research of the programme. There is also an Industry Advisory Board and Graduate Committee to provide external input and provide direct feedback from the students*



*Fig 4: The CDT consists of a mix of field tuition and classroom-based practicals*



*Fig 5: The CDT students attending the field course examining an exhumed continental margin in the Alps*







► Society conference, also help to promote the decarbonisation agenda (such as the AAPG Energy Transition Forum 2018; The GSL Bryan Lovell Meeting 2019; Stephenson, *Geoscientist* 2019; Launch of EAGE's Decarbonisation Special Interest Group in June).

## Crucial role for geoscience

The geoscience of the subsurface clearly has a vital role to play in the decarbonisation world, through electricity production, industry, transport and heating. We need a combination of state-of-the-art technology, improvements to efficiency and low-carbon fuel switching to achieve both ambitious UK and international climate change and decarbonisation targets.

Some of the specific areas where geoscience will play a crucial role are in subsurface storage, geothermal energy, the sustainable and safe extraction of metals and mineral resources. An understanding of subsurface complexity can also provide essential quantification and an important sense check on remaining or potential resources (Underhill, *The Conversation* 2017a; Underhill & Corbett, *The Conversation* 2017) that may extend the life of productive basins.

## Subsurface storage

For some industrial processes, such as steel manufacturing, cement production, and refining, all of which have a large carbon emissions footprint, subsurface carbon-capture technologies are the only viable decarbonising solution. Whether

those solutions involve converting to a hydrogen-based economy from a methane-driven one (like the H21 project for Leeds), the continued extraction of oil and gas from the UK Continental Shelf (UKCS) as a bridge during the low-carbon transition, or an attempt to decarbonise the country's industrial clusters in Humberside, Teeside, the Midland Valley, Merseyside, the Thames Valley and South Wales, carbon storage is needed.

It is therefore crucial that we select the right sites for safe long-term storage, since selection of the wrong ones could lead to failure and loss of credibility (Underhill, *The Conversation* 2017b). That need demands geoscientific expertise to accurately characterise and parameterise the geology of the traps and the reservoir-seal pairs of the depleted fields or saline aquifers, and test which are suitable as potential carbon storage sites.

Similarly, if nuclear power generation is going to form a significant part of the UK's energy mix, as seems likely (e.g. with the build of Hinkley Point), it is essential that the safe geological storage of its waste products is addressed.

## Geothermal energy

Use of geothermal energy for electricity, heating and cooling has great potential, but irrespective of whether the more traditional, deeper, high-heat sources (such as in Cornwall and the Cairngorms) or less orthodox ones (like the re-use of old coalmines) are promoted, an understanding of the subsurface is required.

Successful deployment of coal mines as low-enthalpy heat sources could address one of the leading social challenges in the UK today, fuel poverty, which leads to more than a quarter of households struggling to make ends meet (Underhill, *The Scotsman* 2018; Adams *et al.*, *Geoscientist* 2019). The largest concentration of households affected lie in densely populated urban areas that grew up around heavy industry, coal mining and manufacturing centres. Many of these have long since reduced in size, or closed, leaving a landscape and community blighted by high unemployment and deprivation.

Despite the demise in the use of coal for fires for domestic heat, a major benefit is that most of the mines are located close to and often directly beneath the large conurbations where the problem is most

acute. Significantly, unlike much of the subsurface, where natural porosity, permeability or fracture patterns dictate flow, water can pass through a coalpit's trellised network of adits and shafts more easily since they are akin to fluid 'super highways'.

It's ironic and perhaps paradoxical therefore to suggest that a solution to the fuel poverty crisis could come from the most polluting, black and dirty fossil fuel that we, as a nation, have worked so hard to remove from our energy mix. However, it could be a case of the old black becoming the new green.

## Sustainable metals and mineral resources

To source the raw materials for electric cars, wind farms, solar panels and other technological needs, there has to be a sustainable and secure supply of mined materials (such as cobalt, lithium and rare earth elements), an ambition that looks extremely challenged. At present, the sources of key minerals are in places like the Democratic Republic of Congo and the "Lithium Triangle" that straddles the borders of Argentina, Chile and Bolivia (Fig. 2). Given the laudable but ambitious Government targets that have been set to electrify transport, the question is "can these source areas meet the demand in a sustainable way and, if not, are there other regions that could be developed without causing environmental damage?"

## The Centre for Doctoral Training

The UK has considerable experience in subsurface development and a wealth of knowledge that will be invaluable as we address the decarbonisation challenge. It is essential that we train future generations in the skills required for the emerging geoscience sectors and subsurface industries. However, to deliver such a workforce requires support for geoscience education. In particular, continued support for doctoral training that focuses on equipping students with advanced technical and scientific skills is vital. The benefit and impact of such support is proven by the thematic CDT model, a hugely successful, collaborative initiative involving 17 UK Universities, two Natural Environment Research Council (NERC) Research Centres (the British Geological Survey (BGS) and ►

► National Oceanography Centre (NOC)) and eight industry partners. Originally funded through a £3 million award from NERC that enabled the recruitment of 10 four-year PhD students in each of its first three years, the attraction of the CDT model has leveraged an additional £11.5 million to enable a further 110 PhD students to join the programme. £1.5 million of that has come from industry to support its training programme, £6 million from university scholarships and £1 million through the Department of Business, Energy and Industrial Strategy (BEIS) National Productivity Investment Fund (NPIF) initiative that has financed additional studentships in Clean Energy and

Artificial Intelligence (AI).

That support has now enabled the extension of the CDT programme for two years beyond its original period. The scheme has proved popular, as exemplified by the gender balance (>40% women have enrolled) and there is a keen competition for PhD places in the CDT programme. The first cohort of students have graduated in the past year and gone into jobs in Government, academia, industry and the media.

### Addressing the skills gap

The training agenda is central to the programme's success and adds value to a student's PhD research focus. It consists of 20 weeks of bespoke modules undertaken

by the students during the course of their PhD. The component parts cover a spectrum of topics with the dual aim of placing the student's individual specialist PhDs in their wider context and introducing the students to the full bandwidth of the research challenges faced in the subject area.

There is a mix of mandatory and optional modules, which are under continuous review. Reassessment led to the inclusion of more topics in environmental impact and regulation, as well as a substantial field-based component to address gaps in, the pressures upon and the demise of training in these areas in undergraduate and industry development programmes.



**Fig 7:** NERC's inaugural workshop on decommissioning was brokered by the CDT, held in Aberdeen and subsequently led to a call for proposals



**Fig 8:** The UK Energy Minister, Matt Hancock, visited the CDT and is seen learning about the challenges of subsurface mapping in the Southern North Sea



**Fig 9:** Scottish Energy Minister, Fergus Ewing, addressing the CDT Conference in 2015



The Geological Society recognised the quality and relevance of the training provided by the CDT, as well as the good governance afforded by its committees (Fig. 3) and Industrial Advisory Board, by bestowing the course with Accreditation. The fact that those graduating from the scheme are securing jobs in industry, academia, policy and communications attests to the fact that the training they received enhances their employability.

The benefit of the CDT approach means that students feel a part of a bigger connected community and a UK-wide initiative, as well as their host university's graduate school. The combination of lab- and field-based residential classes (Figs 4, 5) generates a strong "esprit de corps". This network will undoubtedly serve the students well throughout their subsequent careers. We have also seen more cross-university, collaborative, co-supervised projects that tackle key issues that spring up.

All students present posters and talks at an annual conference. The meeting is now an important date in the geoscience calendar, with nearly 200 attendees last year (Fig. 6, online). An additional benefit of having such 'critical mass' is that the CDT effectively becomes a one-stop-shop in the chosen theme. That value has seen UK Research & Innovation (UKRI) and

individual research councils, like NERC, being able to convene meetings with all the key players from Government, industry and academia in one room (Fig. 7). The CDT has also gained significant political traction, and has hosted visits from the Secretary of State for Scotland and the respective UK and Scottish Energy Ministers (Figs 8, 9) amongst others.

### Collective effort

It is evident that the commitment to decarbonise requires the provision of skilled practitioners, who have the pre-requisite technical expertise across the whole spectrum of energy systems. We will need a wide variety of geoscientific skills to evaluate safe carbon storage, supervise decommissioning and to examine the impact and potential of renewable sources, be they geothermal, wind, wave, hydro, solar, nuclear or in other novel forms, such as cold energy or heat storage.

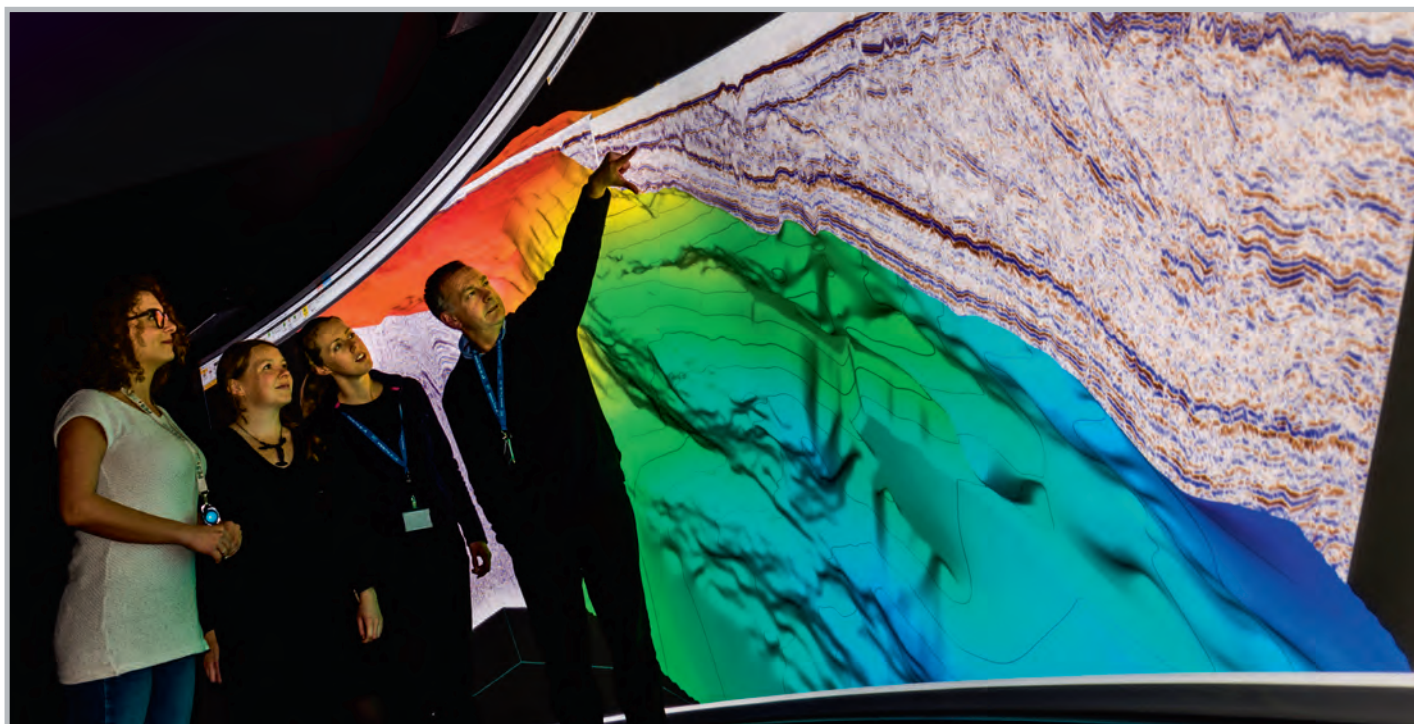
We will continue to need people who can undertake the environmental monitoring of oil and gas extraction (both conventional and unconventional, such as shale gas), including human-induced seismicity, as well as those who are best placed to extend the life of UK basins like the North Sea as we seek to move away from our fossil

fuel dependence.

The CDT's training provision already embraces innovation in areas like digital technologies, augmented reality, virtual reality, immersive 3D vision, machine learning and artificial intelligence (Fig. 10), but is open, keen and able to develop doctoral skill sets in these areas.

To achieve all of this demands a collective effort and partnership between research and training providers. It is essential to break down academic silos and accept that no one place has all the solutions. As the CDT model demonstrates, when collaboration is effective, the whole is greater than the sum of the parts. The scale of the geo-energy and decarbonisation challenge dictates that we adopt such an approach. The CDT stands ready to build upon its strong foundation to address the need to decarbonise.

**Professor John Underhill holds the Chair of Exploration Geoscience at Heriot-Watt University, sits on the Scottish Government's Science Advisory Council (SSAC) and is part of the Natural Environment Research Council (NERC)'s UK Geoenergy Observatories Science Advisory Group (GSAG) that is overseeing the delivery of the UK Geoenergy Observatories (UKGEOS) project. John is the Academic Director of the Centre for Doctoral Training (CDT); e-mail: J.R.Underhill@hw.ac.uk**



**Fig 10: Subsurface geology of the Inner Moray Firth in the North Sea and the disposition of the Captain Sandstone, a saline aquifer proposed for Carbon Storage. Use of new visualization and digitalization technologies will be vital in characterizing the subsurface. (Image: Taken in Heriot-Watt's Ogilvie-Gordon 3D Audio-Visualization Centre, used with permission of Stavros Vrachliotis).**



# EARTH SCIENCE EDUCATION: THE CURRENT STATE OF PLAY







Geoscience is critical for meeting the sustainable development goals, yet student numbers are dwindling. **Dan Boatright, Sian Davies-Vollum and Chris King** urge the geoscience community to make geology more visible on the curriculum

**T**he importance of what we learn at school must not be overlooked. In the UK, students face decisions about their future from the age of 14: What GCSEs should they study? What career paths should they follow? Where should they undertake further study? If an individual is not exposed to the breadth of study and career alternatives at a young age, how can they make informed decisions about their future?

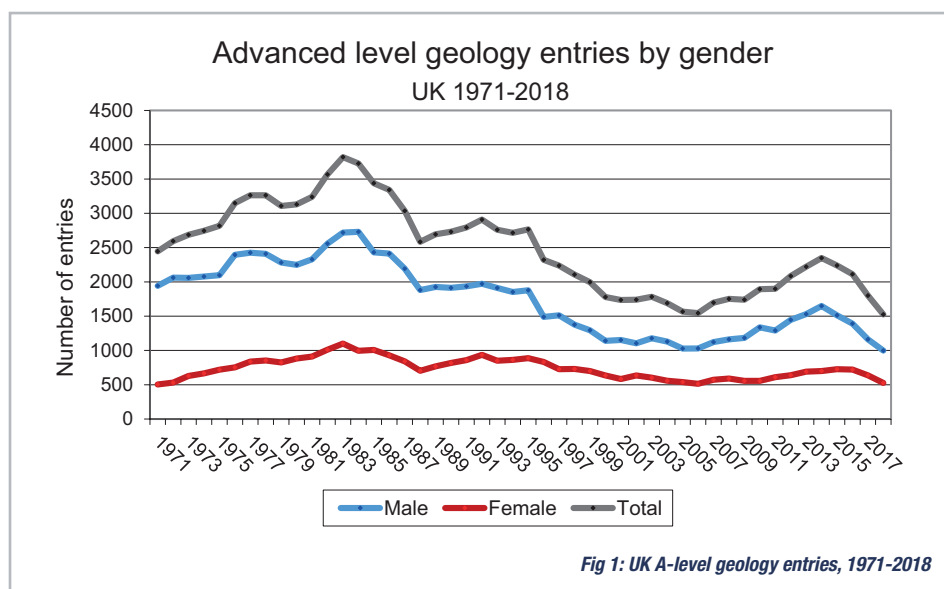
This is the situation geology, as a discipline, faces. While as children we may have had a rock collection, or been obsessed with dinosaurs, early exposure to geology is generally limited. If we want to inspire the next generation of geologists, we must ensure that Earth science is visible in the curriculum. Currently, this is not the case. Geology is randomly integrated into different subjects; it is occasionally found in a geography class, and sometimes in chemistry or physics. Consequently, geology is often an afterthought in the classroom, with many teachers feeling uncomfortable with teaching the content, and others frustrated by the lack of substantial Earth science. As a result, we find that the numbers of students studying General Certificate of Secondary Education (GCSE) and Advanced (A)-level geology are in serious decline, and the numbers in universities are now following the same trend.

### A brief history

Times have changed since the heyday of geology teaching in schools and colleges. In the 1980s, there were almost 4,000 entries for A-level geology, more than 8,000 entries for GCSE geology and several exam boards offered the subject (data from the Earth Science Teachers' Association, ESTA; <https://earthscience.org.uk/>). Geology teachers were trained at six institutions around the country. However, with the introduction of the National Curriculum in the late 1980s, a steady decline in both the GCSE and the A level followed.

A-level geology experienced a brief renaissance in the mid-2000s. Anecdotal evidence suggests that this was due to the introduction of the four Advanced Subsidiary (AS)-level system, with numerous students choosing AS-level geology as their fourth subject. Many then continued studying geology at A-level (Fig. 1). However, this trend has since been reversed, as A-level funding has been reduced and we return to the three A-level system.

Similarly, the introduction of a new, modernised and more relevant geology syllabus in the mid-2000s saw GCSE entries rise. However, this increase came to a shuddering halt in 2015, when Government introduced the Progress 8 initiative. Within Progress 8, geology is not counted as a science and so plays a minor role in the school league tables. There is now little ambition within schools to offer minority ►



► subjects. This perfect storm has brought us towards a cliff edge, with students less likely to be offered geology GCSE and unable to take a fourth subject as they undertake AS levels, fewer students are therefore taking geology A-level. From a high of 4,000 in the early 1980s, A-level entry to geology courses had fallen to 1,525 in 2018 (Fig. 1) with only two exam boards offering it.

The role of the A level should not be overlooked. Information from the Universities and Colleges Admissions Service (UCAS) shows that, in general, more than 40% of the applicants for undergraduate geology degrees had A-level geology (UCAS provided data for 2010, when 44% of applicants had A-level geology, and for 2012, when the figure was 43%. Since then, no data have been available from UCAS). Meanwhile research carried out by ESTA between 2009 and 2014 shows that 44% of students who gained A-level geology and went on to university, studied for a geoscience degree (data from 39 centres). These figures demonstrate that A-level geology is a critical recruiter for undergraduate geology degrees.

Anecdotal evidence from teachers working in Scotland, where Higher Geology used to be taught, suggests that it was not the interest of the school students that declined, but the availability of geology teachers (the last to be trained in Scotland was in 1966). So, when the two remaining institutions training geology teachers in England closed, ESTA took steps to offer training in geology teaching to practicing or newly-qualified teachers of science or

geography who had geology degrees. This training is offered at an intensive seven-day Summer School Masters (M)-level course at Keele University ([www.keele.ac.uk/tlge-module](http://www.keele.ac.uk/tlge-module)). The course is provided free-of-charge to participants, thanks to industrial bursaries, and eight geology teachers have been trained per year for the past four years. By maintaining the supply of geology teachers, we hope to continue offering geology in schools and colleges across the UK, but further funding is needed to ensure we can continue in future years.

## The Higher Education perspective

The Geological Society currently recognises 37 English, five Scottish and four Welsh Higher Education institutions that offer undergraduate and/or postgraduate degrees in the broad subject area of geoscience. These include degrees as diverse as a Bachelor of Science (Hons) in Environmental Earth Sciences, a Master of Science in Remote Sensing and Planetary Science and a Bachelor of Engineering (Hons) in Engineering Geology and Geotechnics. The diversity of degrees designated as ‘geoscience’ highlights the interdisciplinary nature of the subject and the ability of geology to make connections and contributions across the social and natural sciences.

Field work is arguably the key element that distinguishes geology graduates from their peers, providing them with unparalleled experiences in resilience, adaptability and project management—all highly valued skills in any employment sector. Geoscience undergraduate and

postgraduate degrees are clearly and increasingly allied to industry and employment. Most Masters degrees have an applied focus and many geoscience degrees can be studied as a four-year option, with a year in industry.

Despite these positive aspects, recruitment to geoscience degrees at UK universities is on a downward trajectory. Nationally, applications to geology programmes are down 9% (2018-2019) following a drop of 11% in 2017-2018 (for comparison marine and environmental sciences were up 10% this year). There were only 1,100 enrolments onto geology programmes in 2018-19, compared with 1,800 in 2014-2015. With the decreasing number of geology A-level entrants, and the challenge we have in attracting A-level students who have not previously studied geology, the trend looks set to continue (<https://www.ucas.com/data-and-analysis>).

The very nature of the subject itself is threatened as the UK’s Teaching Excellence Framework (TEF) struggles to establish where geology best fits. Originally placed in the physical sciences, alongside forensic and materials science, geology has now been placed with geography and environmental science, a group less likely to receive Science, Technology, Engineering and Mathematics (STEM) recognition. The possibility of the Augar review (the UK Government’s current review of post-18 education) advocating reductions to student university fees with a government-funded ‘top up’ for STEM subjects, places geology in a very precarious position if it is

“ GEOSCIENCE HAS A CRITICAL CONTRIBUTION TO MAKE TO THE ENERGY TRANSITION FROM FOSSIL TO RENEWABLE ENERGY SOURCES, AND IT HAS A KEY ROLE IN ADDRESSING THE CHALLENGES OF SUSTAINABILITY. GEOLOGY CONTRIBUTES TO THE UK GOVERNMENT INDUSTRIAL STRATEGY, THE 25 YEAR ENVIRONMENT PLAN AND THE CLEAN GROWTH STRATEGY. THIS IS A CRITICAL TIME FOR GEOLOGY ”



categorised as non-STEM.

Geoscience has a critical contribution to make to the energy transition from fossil to renewable energy sources, and it has a key role in addressing the challenges of sustainability. Geology contributes to the UK Government Industrial Strategy, the 25 Year Environment Plan and the Clean Growth Strategy. This is a critical time for geology. In schools and colleges it could dwindle as a standalone subject, and in higher education the STEM-status could be lost and student numbers could continue on their downward trajectory. We urge geologists in industry, government and education to work together to raise the profile of the subject and to alter the public perception of what geoscientists do and of the significant contribution they make to society.

## The future

The Earth Science Teachers' Association (ESTA) has worked to promote the teaching of geology and Earth sciences for over fifty years. As a charity, it has relied heavily on the free time of willing volunteers to guide the organisation and ensure teachers have the support to teach the subject effectively. Running a conference every year, the charity has built a strong relationship with universities and learned organisations. ESTA is now attempting to incorporate within its activities the teacher training and training workshops of the now disbanded Earth Science Education Unit, led by Prof. Chris King at Keele University. At the same time, Universities Geoscience UK (<https://www.geolsoc.org.uk/UniversityGeoscienceUK>), the association of geoscience departments and schools based within UK universities, is working with ESTA and other geological organisations and associations to raise the profile of geology, highlight geological careers and contemporise the often-outmoded public perceptions of what it means to be a geologist.

The reduction in schools and colleges offering geology threatens our subject. The map in figure 2 shows a broad distribution of centres currently teaching GCSE or A-level geology in



the UK, but very often class sizes are small, putting the subject at risk as schools and colleges consider cuts. With declining numbers of teachers and an ever-declining pool of talent from which to find new teachers, funding has had to become a focus. ESTA has started to develop closer links with corporate affiliates, patrons and learned associations, and looks forward to hearing from those who are interested in preserving geology in schools and colleges.

Educating the next generation of geology teachers, and promoting geology to school and college leaders, requires a new approach to funding. At ESTA, we have developed a range of membership categories to help different groups contribute to Earth science education. While we, as a community, have experienced a difficult few years, geology education has the potential to grow and

strengthen, with all levels of education working together. From primary to higher education, we have a strong and committed community, but we need to work with industry and learned societies like the Geological Society, to ensure geology remains in schools for years to come.

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**Dr K. Sian Davies-Vollum Head of School of Environmental Sciences University of Derby; Executive Secretary UGUK;** e-mail: [s.davies-vollum@derby.ac.uk](mailto:s.davies-vollum@derby.ac.uk)

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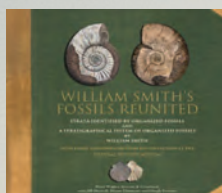




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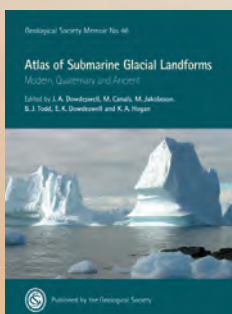
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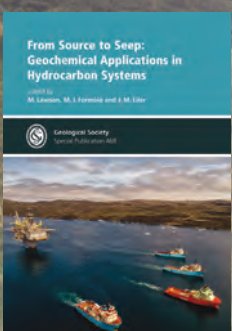
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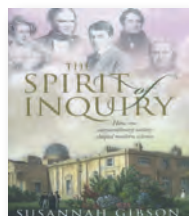
MEETING	DATE	VENUE AND DETAILS
The Geological Society of Namibia - 50th Anniversary Conference	1-4 Sep	Conference <b>Venue:</b> Windhoek, Namibia <b>W:</b> <a href="https://www.geolsoc.org.uk/GeolsocNamibia-50-Anniversary-Conference">https://www.geolsoc.org.uk/GeolsocNamibia-50-Anniversary-Conference</a>
Debris Covered Glaciers	2-4 Sep	Workshop <b>Venue:</b> Burlington House, London <b>W:</b> <a href="https://www.geolsoc.org.uk/GSL-Debris-Covered-Glaciers">https://www.geolsoc.org.uk/GSL-Debris-Covered-Glaciers</a>
Future of Mining EMEA 2019	4-5 Sep	Conference <b>Venue:</b> 8 Northumberland Avenue, London, UK <b>W:</b> <a href="https://www.geolsoc.org.uk/EMEA-Future-of-Mining19">https://www.geolsoc.org.uk/EMEA-Future-of-Mining19</a>
WMRG Chartership Evening	10 Sep	Evening meeting, lecture <b>Venue:</b> The Birmingham & Midland Institute <b>W:</b> <a href="https://www.geolsoc.org.uk/WMRG-CharterShip-Evening-2019">https://www.geolsoc.org.uk/WMRG-CharterShip-Evening-2019</a>
Yorkshire: Sub-surface surveys	11 Sep	Lecture <b>Venue:</b> The Adelphi Hotel, Leeds <b>W:</b> <a href="https://www.geolsoc.org.uk/YRGG-Subsurface-surveys">https://www.geolsoc.org.uk/YRGG-Subsurface-surveys</a>
WMRG Dorset Field Trip	14-16 Sep	Field trip <b>Venue:</b> Isle of Portland, Dorset <b>W:</b> <a href="https://www.geolsoc.org.uk/WMRG-Dorset-Field-Trip-2019">https://www.geolsoc.org.uk/WMRG-Dorset-Field-Trip-2019</a>
Making the most of recent advances in groundwater modelling & Darcy Lecture	19 Sep	Conference <b>Venue:</b> University of Birmingham's Edgbaston Park Hotel & Conference Centre <b>W:</b> <a href="https://www.geolsoc.org.uk/GWMF-HG-Making-the-most-of-recent-advances-in-groundwater-modelling">https://www.geolsoc.org.uk/GWMF-HG-Making-the-most-of-recent-advances-in-groundwater-modelling</a>
The Shackleton Conference: Marine Geoscience and Carbon	23 Sep	Conference <b>Venue:</b> Burlington House, London <b>W:</b> <a href="https://www.geolsoc.org.uk/MSG-Shackleton-2019">https://www.geolsoc.org.uk/MSG-Shackleton-2019</a>

## STICKS AND STONES

SESSION DEADLY SINS ....



## The Spirit of Inquiry: How One Extraordinary Society Shaped Modern Science



2019 is the bicentenary of a quintessentially British story of how a few like-minded souls managed, against the odds, to set up an organisation that

fostered a wider movement, which in turn overcame institutional apathy and some downright hostility to change. The like-minded souls were three geologists—Adam Sedgwick, John Stevens Henslow and Edward Daniel Clarke. The organisation was the Cambridge Philosophical Society. Their parent institution was the very one the trio wanted to reform—the ancient University of Cambridge, whose teaching programmes and examination processes had become intellectually moribund.

Susannah Gibson's *The Spirit of Inquiry* tells the fascinating story of how the foundation of this provincial society helped shape the emergence of modern science in Cambridge and beyond. It might sound a tall claim but 200 years ago, in the small market town of Cambridge, this geological trio managed to establish a new university-based elite and selective forum for the communication of new scientific discoveries. Despite its 18th century sounding name, the Cambridge Philosophical Society was a much more modern foundation. Its founders took as their model one of the most successful scientific societies of the early 19th century—the Geological Society of London.

*The Spirit of Inquiry* recounts how, with the changing spirit and culture of the early 19th century, an idea that happened to chime with the times was quickly transformed into a successful reality. In the early 1800s, there was growing criticism of the 'antediluvian' and inward looking scholasticism of British university education, compared with Europe.

Within a year, that idea had become a functioning and growing society that attracted eminent scientists, such as

Herschel, Babbage, Whewell and Farish. They were frustrated by the prevailing academic culture, which excluded science from its outmoded syllabus and system of examination.

As part of its bicentenary celebration, the Cambridge Philosophical Society commissioned historian of science Susannah Gibson to tell the story of the Society's foundation, its rise, decline and resurrection. She has managed the difficult task of bringing together the many different strands, which were part of the wider story of the development of science, and made it very readable.

Reviewed by: **Douglas Palmer**

### THE SPIRIT OF INQUIRY: HOW ONE EXTRAORDINARY SOCIETY SHAPED MODERN SCIENCE

by Susannah Gibson 2019. Published by Oxford University Press, 2019. 377 pp. ISBN 9780198833376 (hbk) List Price: £25.00 W: [www.oup.co.uk](http://www.oup.co.uk)

## The X Club: Power & Authority in Victorian Science



It is amusing to ponder whether the X Club, a dining society of nine influential men of science, would have commanded so much interest and

contemporary suspicion if they had gone with Thomas Huxley's suggested name of the 'Blastodermic Club'.

However, George Busk, Joseph Hooker, Herbert Spencer, John Tyndall, Thomas Huxley, William Spottiswoode, Edward Frankland, Thomas Archer and John Lubbock were 'blastodermic' in that they were the germ of change, seeking to introduce scientific habits of mind into Victorian society, riddled with theologians and blind respect, and to claim for science its proper cultural authority.

Barton shows us a group that came together somewhat randomly, and cooperated in different combinations on different subjects, according to personal interests. She is also keen to consider the X men's 'better halves'. Her analysis is detailed, convincing and long awaited.

Beware, though—this is not a book

written to sell. It is more like a long PhD thesis, aimed at historians, and libraries. Although strong on the Club's group dynamic and the influence of their 'Y-vs', one learns little about the X men as men that one didn't already know. Huxley, Tyndall, and Hooker remain prominent; shadowy members, like Busk, emerge from the thick London fog—into a slightly less thick mist.

Although the book provides portraits of all members, they are scattered. Knowing what people looked like might seem irrelevant to ideas and deeds, but it matters to the reader, if only to keep the lesser characters apart in the mind. Everything reads like an academic paper. The book itself has prologue and epilogue. Each chapter has abstract and conclusion and envoi to the next. While well copy-edited, editing went no further.

The donnish habit of purging human interest from material is especially handicapping to a work of group biography. We hear that X-Club satellite Dr Carpenter (registrar of London University) suffered a 'sudden death'. In fact, he managed to immolate himself in a bath—when camphor fumes (he was suffering from a cold) were ignited by the heater underneath. Barton mentions that Tyndall took various Victorian uppers and downers, but not that he died at the hands of his wife, who got mixed up and administered chloral in a dose appropriate for milk of magnesia. Tyndall tossed it off, remarked on its sweet taste, and, as he watched her realise her terrible error, said: "Yes, my poor darling, you have killed your John." Strange that, given Barton's enthusiasm for documenting the influences of females on the men of the X, this extreme example should have been missed out.

But, don't let this put you off—you can supply your own colour where it is wanting in this valuable and long-awaited group portrait.

Reviewed by: **Ted Nield**

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

### THE X CLUB: POWER & AUTHORITY IN VICTORIAN SCIENCE

by Ruth Barton 2018, Published by: Chicago University Press 604pp. ISBN: 978-0-226-55161 (hbk) 978-0-226-55175-3 (ebook). List Price: £33.99 W: <https://press.uchicago.edu>





## Reservoir Quality of Clastic and Carbonate Rocks: Analysis, Modelling and Prediction



This volume follows a Geological Society conference of the same name. Both showcase the latest understanding and controversies through discussion and

case-study in clastic and carbonate reservoir quality. The opening sentence of the first paper summarizes the importance of this volume for petroleum exploration, stating how reservoir quality is the fundamental control on the economic viability of a petroleum accumulation.

The volume discusses how reservoir quality is studied by almost separate specialist communities, one for clastic rocks and one for carbonate rocks. Yet, these communities use similar techniques and both benefit from the study of modern analogues. Although the modelling approaches are quite different for these two families of rock type.

The opening paper summarizes the significant difference in controls on reservoir quality per sediment type and very clearly states how reservoir quality is controlled by interdependent sedimentary and diagenetic factors that can be bracketed into depositional characteristics, eodiagenesis, mesodiagenesis and telodiagenesis. It is worth reiterating how these factors include the primary make-up of sediments and sedimentation (including depositional environment and hinterland conditions), as well as diagenetic processes.

Numerous controversies remain in the study of diagenetic processes that impact reservoir quality. These debates are reviewed, including the difference between chemical compaction and pressure solution features, geochemical flux of material to or from reservoir formations, the impact of hydrocarbon emplacement on the diagenesis of a formation and the long-lived research on diagenesis of burial dolomitization.

This collection of papers contains case-study based examples of sandstone and carbonate reservoir quality prediction, including a fascinating paper on how areas of good reservoir quality in The Raytown Limestone of Kansas were created by

successive diagenetic events, resulting in the spatial distribution of good reservoir quality being correlated to palaeotopographical and structural highs.

Another paper looks at the impact of a diverse depositional environment and depositional cyclicity on reservoir quality of the mid-Cretaceous Mishrif Formation. Using porosity logs, a change in reservoir quality could be systematically interpreted within regressive cycles, which contained deep-marine to shallower-shelf margin facies that include rudist shoals.

The volume also presents papers on modern analogues, outcrop analogues, modelling and advanced analytical approaches. I recommend this volume as a source for understanding reservoir quality because of the great topical reviews and plentiful accompanying case-studies.

Reviewed by: **Simon Kettle**

### RESERVOIR QUALITY OF CLASTIC AND CARBONATE ROCKS: ANALYSIS, MODELLING AND PREDICTION

by P.J. Armitage, A.R. Butcher, J.M. Churchill, A.E. Csoma, C. Hollis, R.H. Lander, J.E. Omma & R.H. Worden (eds) 2018, 435 pp. ISBN: 9781786201393 (hbk.)  
List price: £100.00 Fellow's price: £50.00  
W: <https://www.geolsoc.org.uk/SP435>

## Derbyshire Blue John



The late Trevor Ford, had a well-earned reputation as the geological guru of the Peak District in Derbyshire. Among many other things, he was the acknowledged expert on the fluorospar variety known as Blue John (see Distant Thunder, August 2017)—a mineral prized for its decorative qualities and found only in veins in the caverns and mines of Treak Cliff near the Peak District town of Castleton in Derbyshire. Ford's book, *Derbyshire Blue John*, billed as the only comprehensive account of Blue John stone ever written, has long been out of print. Now thanks to the efforts of Tony Waltham and Noel Worley, this classic guide has been resurrected and given new life.

This new edition covers the same ground as Ford's original, but it is much more modern, clearer, brighter and slightly larger format. The text, based on Ford's original, has been edited, corrected, brought up-to-date and augmented with

additional information on the origin of the mineral and its colour. The original book included a mixture of black-and-white and colour illustrations. This new, all-colour edition includes more than 100 additional high-quality colour photographs, with the result that the mineralogy, as well as the decorative properties of Blue John are beautifully and clearly displayed. For mineral fans and those who love decorative stone, this book is a must-have for the pictures alone.

But, even more valuable, to my mind, is that with its concise text, clear colour geological sketch maps and block diagrams, this book also serves as an excellent pocket guide to the geology, geological history and mineral mines of this classic and popular tourist area.

Published by the East Midlands Geological Society, the book is currently available at gift shops in the Blue John caverns, outlets in Castleton and the surrounding area, as well as online. With such high-quality production available at a bargain price, it's a real impulse buy that will open the eyes of many visitors to the fascinating geology and mineralogy of this classic area.

Reviewed by **Nina Morgan**

### DERBYSHIRE BLUE JOHN,

by Trevor Ford (Tony Waltham & Noel Worley, eds),  
Published by East Midlands Geological Society, 80 pp.  
List Price: £6.50  
W: <https://www.moorebooks.co.uk>

## BOOKS FOR REVIEW

Please contact [amy.whitchurch@geolsoc.org.uk](mailto:amy.whitchurch@geolsoc.org.uk) if you would like to supply a review. You will be invited to keep the review copy. See a full up-to-date list at [www.geolsoc.org.uk/reviews](http://www.geolsoc.org.uk/reviews)

- ◆ **NEW! The Rocking Book of Rocks**, by Amy Ball & Florence Bullough, Quarto Publishing 2019 95 pp. hbk.
- ◆ **NEW! Tales From the Himalaya**, by Henry Edmundson, Vajra Books 2019, 423 pp. pbk.
- ◆ **NEW! Groundwater in Fractured Bedrock Environments: Managing Catchment and Subsurface Resources**, by U. Ofterdinger et al. (eds), Geological Society of London SP 479 2019, 250 pp. hbk.
- ◆ **NEW! Mining in Zimbabwe: From the 6th to the 21st Centuries**, by Martin Prendergast & John Holloway (eds), The Chamber of Mines of Zimbabwe 2019, 645 pp. hbk.
- ◆ **NEW! Metamorphic Geology: Microscale to Mountain Belts**, by S. Ferrero et al. (eds), Geological Society of London SP 478 2019, 482 pp. hbk.

## Resourcing a sustainable future

***We must resource present and future generations sustainably. But how? Jen Roberts and Anthea Lacchia report on an international summer school that is building a global community to bridge disciplines and sectors, and tackle sustainable resource extraction***

Immense and rapid societal and technical changes are necessary to achieve a low-carbon future. Globally, most nations have committed to meeting the goals outlined in the United Nations Paris Agreement, but the changes in technologies anticipated to achieve these goals, and the minerals and metals that are used in their manufacture, place new and unprecedented pressure on Earth's resources. This is on top of changing needs due to global population growth, rising standards of living, and potentially large shifts in the distribution of populations owing to the climate crisis.

Determining how we will resource present and future generations in a sustainable way is a complex and global endeavour of rising importance. The inaugural Researching Social Theories, Resources, and Environment (ReSToRE) International Summer School (<https://www.icrag-centre.org/restore/>) brought together a group of 42 geologists and social scientists, all at an early-career stage, from 28 nationalities (of which 19 are developing countries) to tackle the question of how society should meet the challenge of providing water, energy and mineral resources in a sustainable way. Participants concluded that inclusive, collaborative problem-solving that embraces different perspectives is essential in addressing such complex and thorny topics; the circular economy, which is inherently multidisciplinary and collaborative, is key to sustainable resourcing; and the way forward requires the combined efforts of those working across the natural and social sciences, in academia, industry and in government.

### Course vision

Hosted by the Irish Centre for Research in Applied Geosciences (iCRAG), the summer school took place at University College Dublin, Ireland, in July 2019. Director of iCRAG, Murray Hitzman, said: "Moving forward for sustainable development is very complicated. There are challenges in terms of Earth resources and energy, and also in terms of how people perceive these challenges and sustainable development more generally. These are critical issues and this summer school is trying to help to tackle these, not just in one society, but in multiple societies".

Attendance at the summer school was competitive, and financial support was available for half of the participants due to sponsorship from the International Union of Geological Sciences (IUGS), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and industry sponsors. A quarter of the participants were from the extractive industries (such as mining, petroleum, and related services) and the remainder from academia. They brought together expertise in geology, economics, ecology, business, law, engineering, and communications. Women constituted over a third of participants, and all attendees were within ten years of completing their studies.

The programme aimed to harness the diverse experience and skills of the participants, and created a space for interdisciplinary and visionary collaboration and knowledge sharing. Working in teams, attendees were challenged to define the problem, prioritise needs and derive solutions across four themes that spanned both local and global issues relating to the resourcing and consumption of Earth's materials: 1) Community engagement in Earth resource extraction and use; 2) Societal perceptions of the extraction industry; 3) Earth resources and the circular economy; and 4) Ethical and responsible sourcing of Earth resources.

The four topics were identified by a team of world-leading scholars,

practitioners, and stakeholders, many of whom acted as expert mentors during the week. The topics are considered to be critical to the global challenge of sustainable resourcing of future generations. Crucially, there are no simple solutions to these problems, and all require an interdisciplinary and multi-perspective approach.

In line with the summer school ethos, the team of mentors and other contributors was also diverse. Representing ten different nationalities (including three from developing countries), the team's expertise covered multiple disciplines and career stages from across industry, government and academia, including Cardiff University (UK), Plymouth University (UK), Newcastle University London (UK), Nottingham University Business School (UK), University of Strathclyde (UK), University of Groningen (Netherlands), Shinglespit Consultants Inc. (Canada), Cornell University (US) and PetraScience Consultants (Canada), as well as IUGS, UNESCO, iCRAG, Geoscience Ireland and Geological Survey Ireland.

Dr Ozlem Adiyaman Lopes from UNESCO's Division of Ecological and Earth Sciences said "this course is asking the right questions at the right time and the mix of social scientists and geoscientists and environmental scientists together is a triangle we really need." Professor Wouter Poortinga, an environmental psychologist at Cardiff University, agreed that the summer school "puts a spotlight on the social relevance of these big societal

**“ AN INCLUSIVE APPROACH  
REQUIRES AN INTERPLAY  
BETWEEN THE TECHNICAL AND  
NON-TECHNICAL WORLDS,  
BRIDGING POLICY, INDUSTRY,  
PRACTITIONERS AND ACADEMIA,  
AND UNITING GEOSCIENCE AND  
ENGINEERING WITH SOCIAL AND  
POLITICAL SCIENCE ”**



challenges". And these challenges involve everyone, as Dr Judy Muthuri, an expert in corporate social responsibility at Nottingham University, explained: "Sustainable resource development requires a collective effort from everybody. When you talk about governance of resource, there is a role for every actor in society to play if the UN's Sustainable Development Goals are to be realised".

## Cross-cutting themes

The outcomes of the week's discussions highlighted the necessity for a long-term adaptive and continuous programme of activity. A key message is that the different actors necessary for resourcing a sustainable future cannot be considered in isolation. Consumer demand, business practices, environmental and societal impacts, community involvement in decision-making and development are all intrinsically interlinked in a non-linear chain that interweaves resource supply, use and reuse. Failure to consider resourcing issues through a collective lens will not support effective and efficient change.

An inclusive approach requires an interplay between the technical and non-technical worlds, bridging policy, industry, practitioners and academia, and uniting geoscience and engineering with social and political science. This isn't easy. For many, working at the edge of one's discipline, and stepping into the space of others, can be challenging, and uncomfortable. Building collaboration across divides requires resources and support. Thus, interdisciplinary and cross-sectoral fora are fundamental if future resource development is to align with global sustainability goals.

Another key theme was the clear opportunity for the resources chain to embrace the circular economy. A responsible resources sector will be clean and efficient, with reduced, managed and, where possible, reused waste. Some companies are already moving towards such a circular resource economy, but there is huge scope to do more. Enabling a circular economy requires transparent and collaborative input from all stakeholders, clear connections between producers, markets and consumers, and facilitation by economic and societal factors, including consumer demand and supportive policies. The summer school participants



*Six ReStoRE participants from all over the world. From left to right: (back row) Emilio Castillo (from Chile), Halleuya Ekandjo (from Namibia), Muhammad Tahir (from Afghanistan), Geertje Schuitema (Director of ReStoRE); (front row) Laura Berdi (from Hungary), Josphat Nguu (from Kenya) and Sarah Caven (from Northern Ireland)*

proposed that, in the circular economy, mining companies may even re-emerge as 'materials' or 'resources' companies. And once again, interdisciplinarity is fundamental, as Wouter Poortinga expressed, "the circular economy is inherently interdisciplinary—it forces us to think beyond disciplinary boundaries."

## The way forward

So how do we move forwards, and fast? Immersive events like the ReStoRE summer school play a key role in creating a safe space for interdisciplinary connections. As Professor John Thompson from Cornell University and PetraScience Consultants remarked, "Interdisciplinary collaboration is absolutely key; the really innovative ideas happen when you're working with others at the edges of your expertise. That's where you will find innovation, within the common ideas that evolve from there." He added that "workshops like those at this summer school are one of the things that will actually move us forward, by defining the gaps, the research opportunities, the themes to pursue, policies that we might need to consider or advocate for—all of those things are going to lead to action, potentially new programmes, different ways of collaborating."

ReStoRE grew out of the Resources for Future Generations conference, which was chaired by John Thompson and held in Vancouver in summer 2018 (<http://www.rfg2018.org/>). It is intended that the ReStoRE programme is just the beginning of a network of activities in a crucial field. As Dr Maeve Boland, of University College

Dublin's School of Earth Sciences and Geological Survey Ireland, explained: "One of the goals of the summer school is to facilitate the development of a global network of people working in this truly interdisciplinary area. We want to build a community that will share experiences to generate new knowledge, strengthen individual actors, and ultimately to advance us as a community working in a field of great societal relevance."

## Further Information

A suite of summer school resources, including live-streamed videos of the presentations and discussions by expert mentors, blogs from the summer school participants, and movies capturing the ReStoRE programme can be found on the ReStoRE webpage: <https://www.icrag-centre.org/restore/>.

iCRAG, the International Union of Geological Sciences and Geological Survey Ireland were the organising sponsors of ReStoRE, which was held under the patronage of UNESCO. Sponsorship came from BHP, Boliden, Rio Tinto, Teck, with additional support from the Irish Research Council and UCD College of Business.

The UN Paris Agreement (to date, 185 Parties have ratified of 197 Parties to the Convention); <https://unfccc.int/process/the-paris-agreement/status-of-ratification>

**Dr Jen Roberts is Chancellor's Fellow at the University of Strathclyde, Glasgow.**

**Dr Anthea Lacchia is a Research Fellow in iCRAG at University College Dublin.**

## DISTANT THUNDER

### *Geologist and science writer Nina Morgan charts the rocky road to gender equality*

**T**he British Geological Survey (BGS) was founded in 1835, and for the first 108 years of its existence, its professional ranks remained an exclusively male preserve. It wasn't until the Second World War that female geology graduates were allowed to join its scientific staff. The first, Eileen Guppy [c. 1904-1980], who joined BGS as a technical assistant (petrology), was promoted to the rank of assistant geologist in 1943—but then demoted to the grade of Senior Experimental Officer in 1945. During the war, BGS also employed a number of women graduates, nicknamed 'Water Babies', who travelled mainly on bicycles carrying out an inventory of water bores and wells to help ensure vital water supplies. It wasn't until 1957 that Diane Knill became the first woman to directly enter the Survey as a Geologist. And it took until 1978 before Edna Waine was put in charge of the Analytical and Ceramics Unit and became the first female head of a BGS unit.

Women power was clearly too good to waste, and as time went on more and more pioneering female geologists broke into the BGS's scientific ranks. In 1967, Sue Arnold joined the crew on the Moray Firth IV and became the first woman employed by BGS to carry out research at sea. Then, in 1972, Audrey Jackson, a graduate of Trinity College Dublin with previous field experience, became the first female geologist employed by BGS to spend extended periods in the field as a geological mapper. In 1995, the geochemist Jane Plant [1945-2016] became the first woman to hold the position of Deputy Director of BGS. She went on to serve as the Survey's chief scientist from 2000 until 2005, before leaving BGS to become Professor of Geochemistry at Imperial College, London. Today, 39%

## *Turning the tide*



of the BGS geological staff are women, and although BGS employment statistics suggest there is still a significant pay gap between men and women, working towards gender equality is now definitely on the BGS agenda.

### **Your marriage or your job**

Nevertheless, there is no denying that it has been a long journey. No women at all were recruited into the BGS until the 1920s, when an advertisement for technical staff specified that women candidates "must be unmarried or widows and will be required to resign their appointment upon marriage". In fairness, the BGS was far from alone in restricting married women from employment. It was not until the Sex Discrimination and Equal Pay Acts of 1975 came into force that employers were prevented from forcing women to resign when they married.

Women were not the only ones to suffer from this draconian restriction in order to keep their geological jobs. The geologist Adam Sedgwick [1785-1873] was also forbidden to marry under the terms of his employment as Woodwardian Professor of Geology at Cambridge University.

Fortunately, these days the tide is turning. Although there is still some way to go before true gender equality in employment and pay for female geologists is achieved, thanks to changing social

mores when it comes to marriage, women now have many more choices. For all sorts of reasons, many women are choosing to raise families together with a partner outside of marriage, so remain 'technically' unmarried. Back in the old days, co-habiting was thought of as 'living in sin'—certainly not something the ordained Reverend Sedgwick would have ever considered. But, looking at it logically, it might have served as a clever way of outsmarting the marriage ban.

**End notes:** Sources this vignette include: Freedom and Equality by Rod Bowie [[bgs.ac.uk/education/archive\\_awareness](https://www.bgs.ac.uk/education/archive_awareness); <https://www.bgs.ac.uk/downloads/start.cfm?id=904>]; The historic role of women scientists at BGS by Catherine Pennington [<http://britgeopeople.blogspot.com/2015/02/the-historic-role-of-women-scientists.html>]; Down to Earth One hundred and fifty years of the British Geological Survey by H.E. Wilson, ISBN 707304733; gender employment statistics were provided by BGS [a 2017 report is available here: <https://www.bgs.ac.uk/contacts/people/BGSGenderPayGapReportvFinal@5April2017.pdf>].

**\* Nina Morgan** is a geologist and science writer based near Oxford. Her latest book, *The Geology of Oxford Gravestones*, is available via [www.gravestonegeology.uk](http://www.gravestonegeology.uk)





## GeoWeek—for everyone?

*The relevance and importance of geoscience is opaque to many. As a community, we are responsible for raising the subject's profile. One way to do this is by organising an event for GeoWeek 2020, as Chris King & John Stevenson report*

GeoWeek ran for the second time this year, with a more than 100% increase in activities and participants. There were 76 events, rising from 36 in 2018, with an increase in participants from 900 in 2018 to 2,200 in 2019. Regional coverage of events dramatically increased (sadly, no events were held in Wales, but in the future, who knows?).

Given the success of GeoWeek 2019, we have set ourselves ambitious targets going forward. We want to achieve more than 10,000 participants in ten years and gain representation in all UK regions within seven years.

Meeting these targets will only be possible if many *Geoscientist* readers take part. So what does taking part involve? It means planning an event to inform and educate members of the public about the geoscience that is on their doorstep and beyond, for GeoWeek 2020.

It also means noting that GeoWeek has no funding or remit for local advertising. Event organisers plan what to do, submit details to the GeoWeek website at <https://www.bgs.ac.uk/geoweek/>, advertise the event locally and run the event on the day.

What do you get in return? Satisfaction that more people in your area have a much better idea of what geoscience is and what it does. GeoWeek has generated significant interest and excellent feedback from participants. This year 95% of the organisers rated their organising experience as 4 or 5 (5=very good), commenting:

*"It definitely makes you feel fulfilled in your*

*job when the public you are communicating to are engaged and leave informed about geoscience. Outdoors is the best learning and communicating environment in my opinion!"*

*"It always amazes me how interested people are. The landscape and rocks beneath Britain are so varied that it is easy to captivate people and to surprise them with facts like England and Scotland were once separated. Also helping them to realise how useful rocks and minerals have been (and still are) whether that's for storing water, supplying building materials or for future geothermal energy."*

*"It shows the value of Earthcaches (and GeoWeek that gave me the impetus) and how we can teach Earth Science to a class even when we are not there!"*

GeoWeek events provide a fun and simple way to engage your local community and educate them in the importance of geoscience as a subject. For inspiration, check out our report on GeoWeek 2019 on *Geoscientist* online, as well as the GeoWeek website ([www.geoweek.org.uk](http://www.geoweek.org.uk)). To join the GeoWeek Supergroup, or for general information, contact us at [ESEFEW@gmail.com](mailto:ESEFEW@gmail.com). You can also find guidance and the publicity toolkit at <https://www.bgs.ac.uk/geoweek/toolkit.html>



### The Society notes with sadness the passing of:

**Almond, David \***

Black, John Henry

Crossley Nutt, Michael John \*

Lumsden, Alastair \*

Marriott, Derek Leslie \*

McCann, David Michael

Osmaston, Miles \*

Rocha, Rogerio \*

Simpson, Peter Robert \*

Talbot, Christopher J

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

If you would like to contribute an obituary, please email [amy.whitchurch@geolsoc.org.uk](mailto:amy.whitchurch@geolsoc.org.uk) to be commissioned. You can read the guidance for authors at [www.geolsoc.org.uk/obituaries](http://www.geolsoc.org.uk/obituaries). To save yourself unnecessary work, please do not write anything until you have received a commissioning letter.

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

## Staff Matters

**Sarah Day**, Head of Media Relations & Outreach, has left her current role to take up the position of locum Editor for *Geoscientist* magazine. The Society thanks Sarah for her valuable contribution to its outreach work over the years and wishes her every success in her role at *Geoscientist*.

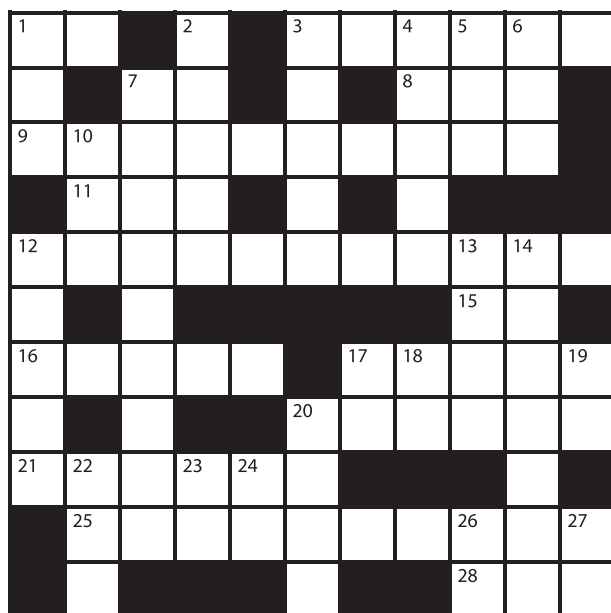
### CAROUSEL

All Fellows of the Society are entitled to entries in this column. Please email [amy.whitchurch@geolsoc.org.uk](mailto:amy.whitchurch@geolsoc.org.uk), quoting your Fellowship number.

#### ◆ Phil Gibbard



At the international STRATI 2019 Congress in Milano, Italy, Professor Phil Gibbard was awarded the prestigious Digby McClaren Medal by the International Union of Geological Sciences' International Commission on Stratigraphy (Photography by Dr Angela Coe).



# Crossword

## Across

- 1/8** E.g. "-----" Lister, location of the Walcott Cirque (5)  
**3** Long stretches of elevated ground (6)  
**7** Metallic element in black desert varnish (2)  
**8** See 1  
**9** Natural rubber (10)  
**11** Graphic User Interface (3)  
**12** Depressions left by melted drift covered ice (6,5)  
**15/27d** The sea eagle (4)  
**16** A Scottish mountain over 3000 feet (5)  
**17** Paddington, Rupert and Baloo for example (5)  
**20** Fluvioglacial outwash fan (6)  
**21** A country extending beyond the Arctic Circle (6)  
**25** Precipitation from the Cold War (6,4)  
**28/10** A time of globally low temperatures (3,3)

## Down

- 1** Waterproof coat originally made from 9ac (3)  
**2** An indigenous people of the Arctic (5)  
**3/7** Glacial sheep rock (5,9)  
**4** Commonly, an Italian cathedral (5)  
**5** According to Flanders and Swann, neither man nor moose (3)  
**6** And so on (3)  
**7** See 3  
**10** See 28 Across  
**12** Cones of glacial sand and gravel (5)  
**13** Metal once used in plumbing (4)  
**14** Ice transported rock (7)  
**17** Bachelor of Arts (2)  
**18** Half of an em (2)  
**19** SI unit of solid angle (2)  
**20** A form of solid precipitation (4)  
**22** Welsh river with a spectacular, possibly glacial, gorge (3)  
**23** Postcode for Darlington (2)  
**24** The "—", a railway in several American cities (2)  
**26** Artificial Intelligence (2)  
**27** See 15 across

By Bindweed

**Solutions August | Across:** 1 Jurassic 6 Ute 7 lbo 9 Nal 10 bocage 12 ohm 14/5d nacho 16/13 Toth 17 Ca 19 Sword 22 hl 23 Normandy 25 Om 26 e'd 28 massif 30 Gold 31 IHS 32 cog 33 Caen 34 loess **Down:** 1 Juno 2 Utah 3 Reims 4 Shotton 5 See 14a 7 IGN 8 beach 11 Chorda 15 Calvados 18 gnomie 19 SMEs 20 wadis 24 Omaha 27 loge 29 SSE 30/21 goody 32 cl

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**OBITUARY****Derick Leonard Helm (1949-2017)**

**D**erick Leonard Helm was born in Gorleston, Norfolk on the 10th July 1949, the fourth of six children and the only brother to five sisters.

After graduating with a 2(i) in Geology from Bristol University in 1974, Derick got his first job as a geologist with Shell Coal. He was posted to Mbabane, Swaziland, where he 'cut his teeth' on the St. Phillips coal project. Although only recently graduated, he set high standards and possessed a high degree of pragmatism.

Derick left Swaziland in 1978 and following stints at Shell's Holland and London offices, he was posted to explore for coal in the Transvaal in South Africa. He returned to the UK in 1982 and went on to work in China for several three-month periods. This proved to be a difficult time for Derick as the joint venture with the Chinese National Coal Company was beset by internal political wrangling and differences in working culture.

### South America

Following redundancy from Shell Coal in 1987, Derick set up his own consultancy business, Explorex. It was in 1990 that he was recruited to explore for coal in Venezuela and this began a relationship with South America that would last for the rest of his life.

By 1996, he had moved to

**Sociable, quick-witted with a cheeky sense of humour, he was a pragmatic economic geologist who was generous with his time and resources**



IMAGE CREDIT: DAMARIS HELM

“DERICK WAS A FIRST-CLASS GEOLOGIST, PRAGMATIST AND FRIEND. HE WAS INTELLIGENT AND GENEROUS OF BOTH HIS TIME AND RESOURCES”

Maracaibo and started work for Cosila S.A. on its Las Carmelitas coal project, located close to the border with Colombia. Despite the complexities of both the geology and the local security,

Derick successfully defined over 30 million tonnes of coal resources and by 2006, delivered a project which, whilst awaiting permits, was ready to go forward to mine development.

However, in November 2008, frustrated by the shut-down of Las Carmelitas, Derick moved to Uruguay to become Chief Geologist for Minera Aratiri on its Las Valentines iron ore project. His task: reinvigorate the existing exploration and fast-track the project to mine development. He accepted the challenge with his usual high

level of enthusiasm.

At the height of the project, Derick managed a team of 18 geologists. At least eight drill rigs were running, 24 hours a day. Under his leadership, over 264,000 metres of drill core and chips were drilled. Over two billion tonnes of iron ore resources were defined.

### Retirement

Derick retired in 2014 and early in 2015 he moved to Puerto de Santa Maria, Spain. Despite a third heart attack in 2015, he maintained a positive outlook and enjoyed a relatively peaceful retirement on the Spanish coast for the next two years. However, he sadly died from his heart condition in Spain on the 18th June 2017.

Derick was a first-class geologist, pragmatist and friend. He was intelligent and generous of both his time and resources. He also mentored many younger geologists during his career.

Derick is survived by his five sisters (Maureen, Janet, Christine, Sheila and Linda), his first wife Rosemary, third wife Damaris, four children (Matt, Jonny, Tessa and Leonela) and his granddaughter Maya.

► Compiled and written by Iain Henrys who thanks Matt Helm, Jon Codd, Dulce Pachano and Natalia Seluchi for providing contributing information.

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

**OBITUARY****Peter Marriott Barber (1950-2018)**

**D**r Peter Barber died peacefully in December 2018. He was 68 years old.

Peter was born in Newark-on-Trent, Nottinghamshire. He grew up with his younger brothers, Martin and Jerry, in various parts of the UK. Peter was four years old before his parents realised that he was profoundly deaf. Despite this and with the help of a hearing aid, Peter did very well at school and gained a scholarship to the University of Wales, Aberystwyth. He graduated in 1972 with a BSc (Honours) degree in Geology.

**Petroleum projects**

Peter's first job was with Core Laboratories working mainly in the North Sea, USA, Iran and Madagascar. In 1974, he joined Phillips Petroleum Company as a project geologist in their London office. Apart from fieldwork in Egypt as part of his PhD research, Peter remained in Phillips' London office until 1978 when he was transferred first to Singapore and then to Perth. In 1982, he was awarded a PhD in Geology from Imperial College London for his studies on the sedimentology of the Nile Delta, Egypt. After short spells with WMC Petroleum in Adelaide and Petroz N.L. in Perth in the late 1980s, Peter re-joined Phillips in 1990 and focussed his attention on the geology of the North West Shelf, publishing several professional papers, including landmark papers

**Well-known petroleum geologist and sequence stratigrapher, he was a font of knowledge and a mentor to those with whom he worked**



“PETER HAD THE ABILITY TO TOTALLY IMMERSE HIMSELF IN HIS PROJECT AND HE PRODUCED SOME OUTSTANDINGLY INSIGHTFUL WORK THAT WAS WIDELY ADMIRER”

on the geology of the Exmouth Plateau in 1982 and 1988.

Peter and Phillips parted company in 2000 and Peter founded ISIS Petroleum Consultants Pty Ltd with former colleagues Paul Robinson (geologist) and

Paul Carter (geophysicist). The consultancy was very successful and gained a reputation in the industry for high-quality petroleum geoscience work. Peter developed a solid reputation in the petroleum exploration industry as an expert in sequence stratigraphy. Peter had the ability to totally immerse himself in his project for days and weeks at a time and he produced some outstandingly insightful work that was widely admired. He developed strong collaborative professional links with many top professionals in the exploration industry. He was a member of the Geological

Society of London, AAPG and PESA.

ISIS was incorporated into RISC in April 2014 and became RISC G&G. The timing of this transformation and name change was prescient as the rise of the global terror group with the same name would not have been good for business.

**Writing**

Peter was diagnosed with Parkinson's Disease in 2010. He persevered as the disease gradually took hold. He also battled cancerous tumours in his later years. He retired at the time of the ISIS-RISC merger and devoted his spare time to painting and writing his book. The book "Journeys in Deep Time" is a collection of stories he originally wrote for his grandchildren in which he described various phases of his varied and eventful life. The book was completed only a few weeks before his passing. He maintained his positive attitude to life and sense of humour until the very end.

Peter is survived by his wife Elaine, his sons Francis and Simon, and his two grandsons William and Bobby.

Peter, rest in peace. We mourn your passing but your passion for geology, gentle wit and kindness live on. We all miss you greatly.

► By Chris Swarbrick

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

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





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# Conferences and Abstract Deadlines

## **Debris-Covered Glaciers: from remote sensing and field-based tools to local communities**

2 -4 September 2019

Registration Open

The Geological Society, London

[www.geolsoc.org.uk/GSL-Debris-Covered-Glaciers](http://www.geolsoc.org.uk/GSL-Debris-Covered-Glaciers)

## **Responsible Investment in Natural Resources**

7 - 8 October 2019

Registration Open

The Geological Society, London

[www.geolsoc.org.uk/GSL-Responsible-Investing](http://www.geolsoc.org.uk/GSL-Responsible-Investing)

## **Salt Tectonics: Understanding Rocks that Flow**

29 - 31 October 2019

Registration Open

The Geological Society, London

<https://www.geolsoc.org.uk/PG-Salt-Tectonics>

## **7th London Geothermal Symposium**

5 November 2019

Abstract deadline: 30 September 2019

The Geological Society, London

[www.geolsoc.org.uk/GSL-7th-Geothermal-Symposium](http://www.geolsoc.org.uk/GSL-7th-Geothermal-Symposium)

## **Geopoetry 2020**

1 October 2020

Abstract deadline: 1 March 2020

Edinburgh, Scotland

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Reflecting the high-quality technical content, 50% of the audience is G&G, with 20% of the audience identifying themselves as C-level executives.

This year the PESGB has received over 90 high quality abstract submissions which will form a diverse and relevant technical programme. Submissions have once again come from across the industry spectrum and include oil companies, service companies and academia. All the main prospective regions of Africa will be considered. We are looking forward to papers on, recent discoveries and forthcoming wells in Africa, including high impact and play-opening wells presented by their Operators. Technical overviews of basins hosting licences rounds will provide a unique opportunity to fast track your technical knowledge ahead of bid deadlines. A range of submissions provide an overview of technical workflows that set the standard for industry best practice. Once again the conference will be the "go to" for Africa E&P activity and in-depth geological understanding of the continent.



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**60%**

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companies represented at Africa 2017



**29%**

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