GEOSCIENTIST

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The Fellowship Magazine of the Geological Society of London

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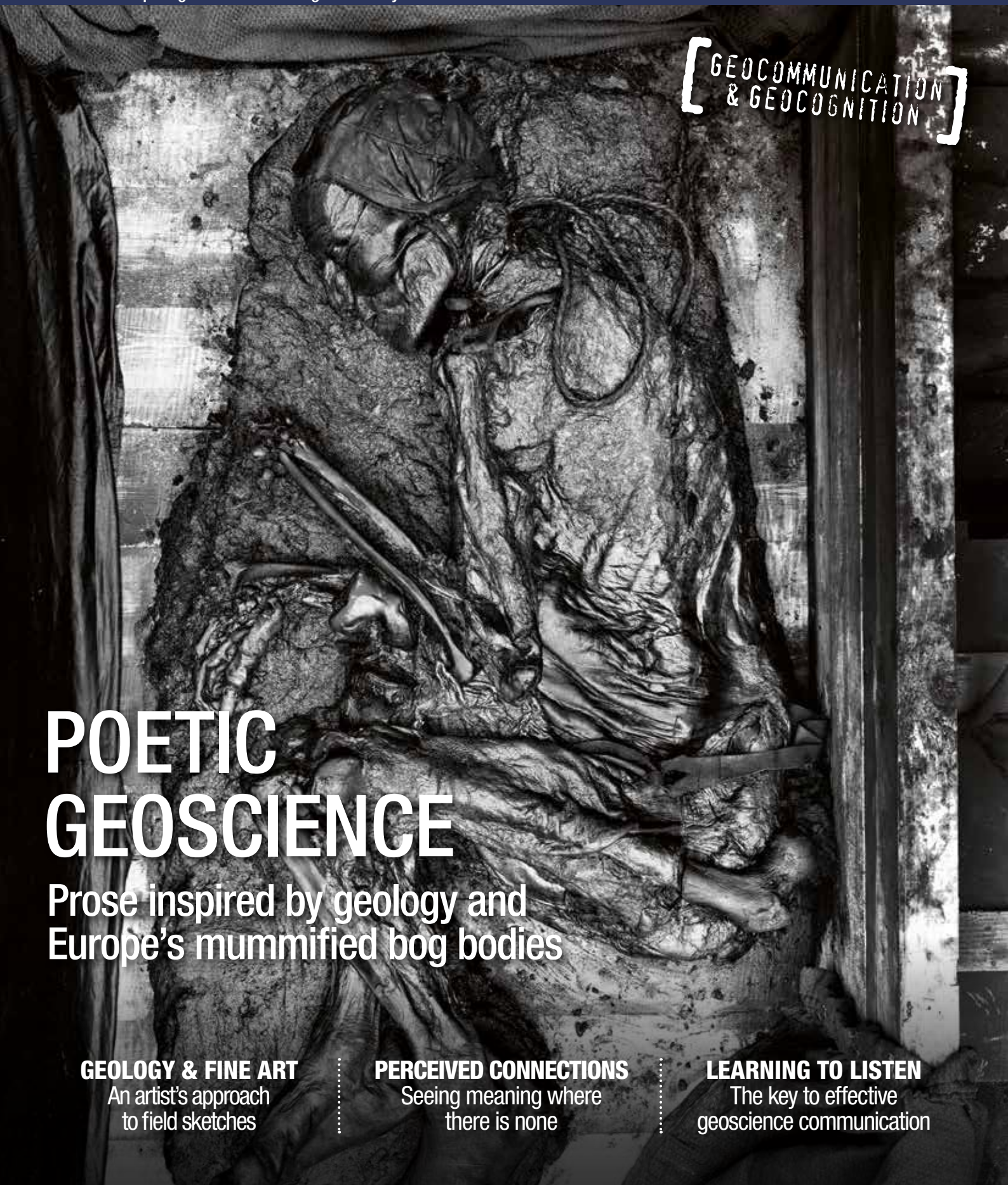


[GEOCOMMUNICATION & GEOCOGNITION]

POETIC GEOSCIENCE

Prose inspired by geology and Europe's mummified bog bodies

GEOLOGY & FINE ART
An artist's approach to field sketches

PERCEIVED CONNECTIONS
Seeing meaning where there is none

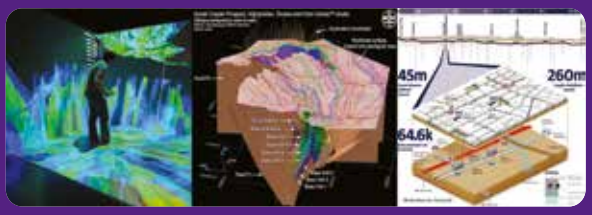
LEARNING TO LISTEN
The key to effective geoscience communication

The Geological Society
serving science, profession & society

4D Subsurface Modelling: Predicting the Future

A workshop for mining, civil engineering & energy

20-21 February 2019 | **The Geological Society, Burlington House, London**



Convenors

John Booth (Geotechnics) *GSL Science Committee Advisor*
Glen Burridge (Glen Burridge & Associates) *Co-chair*
Thomas Finkbeiner (KAUST) *Co-chair*
Jorg Herwanger (MP Geomechanics)
Wolfgang Hohl (Hohlraum ZT)
Richard Plumb (Plumb Geomechanics) *Co-chair*
Michael Prycz (University of Austin)
Katherine Royse (British Geological Survey)
Benedikt Steiner (Camborne School of Mines)

Further information

For further information please contact:
Georgina Worrall, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: 0207 434 9944
E: georgina.worrall@geolsoc.org.uk
Web: www.geolsoc.org.uk/4dsubsurfacemodelling19
Follow this event on Twitter: #4dsubsurfacemodelling19

Science and analysis of the solid earth is often conducted based on only sparse, incomplete or unverified information. To counter this, as Earth Scientists, we rely on remote sensing techniques across a broad range of scales to extrapolate from the limited number of data points in order to build models of what the "real" picture might be. To enable and manage this ambitious process, we capture our current thinking in the form of models, each one shaped by the problem it is specifically built to examine, the techniques that will inform it and the mindset of the people that will build it.

A comprehensive model of the Earth's subsurface will want to account for:

- Structural history that provides the geological framework & wider regional context
- Effects of past & present stress fields & resultant pore pressure regime
- Mechanical properties of the observed lithologies & regoliths
- Genetic processes that have led to the deposition of lithologies
- Distribution of relevant minerals within any commercial deposit & their quality
- Actions of all fluids likely to be present & their reactions with lithology
- Quality & distribution of data available seeking to discern the subsurface
- Uncertainties inherent in techniques & theories used as premises for interpretation
- Changes induced through modification of the volume of interest by human activities

This pioneering event examines current approaches and the vulnerabilities they create for high quality depictions of the subsurface in industrial contexts, the decisions we need to make about it, and our ability to accurately predict its future evolution.

In this forum earth scientists building virtual representations of their target environment share ideas with the engineers who build structures in response to them and managers who make decisions based on them. The event is also designed to build on previous related GSL events to continue to raise debate on how and why we build such depictions of the subsurface, the nature of inter-disciplinary interaction that goes on around them, and their effectiveness in risk mitigation and value creation.

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in association with EAGE

BRYAN LOVELL MEETING 2019

Role of geological science in the decarbonisation of power production, heat, transport and industry

21-23 January 2019 | **The Geological Society, Burlington House**

In the UK and elsewhere, decarbonisation of power production, industry, transport and heating to meet climate change targets is a major challenge and one that intrinsically involves the subsurface and geoscience.

Decarbonisation is central to Government and international policy and this three day conference will host national experts from industry, academia, and government to look at the geological and reservoir engineering aspects of the problem. The main objective will be to identify the high level barriers to progress and the main science questions - and begin a roadmap to solve the problems.

Convenors

Mike Stephenson (British Geological Survey)
Dave Schofield (British Geological Survey)
Sebastian Geiger (Heriot-Watt University)
Philip Ringrose (Statoil/NTNU)

Further information

For further information about the conference please contact:
Rhianna McLean, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: 0207 434 0981
E: rhianna.mclean@geolsoc.org.uk
Web: www.geolsoc.org.uk/lovell19
Follow this event on Twitter: #lovell19

Keynote speakers confirmed

Spencer Dale, Group chief economist, BP; Chris Stark, Chief Executive, Committee on Climate Change; Nick Pidgeon, Cardiff University.

Other speakers confirmed

Martin Blunt, Frances Wall, Jonathan Turner, Seamus Garvey, Clair Gough, Sebastian Bauer, Martin Smith, Jon Gibbins, Jonathan Pearce, Stephen Bull, Thomas Koebel, Thomas Driesner, Adele Manzella, Henrik Solgaard Andersen, John Underhill, Ben Sovacool, Toby Peters.

Call for abstracts

Abstracts are invited from early career researchers who wish to exhibit posters at the conference. Posters that address any aspect of decarbonisation geoscience are encouraged, for example geothermal, gas storage, compressed air energy storage, critical metals, radioactive waste disposal, CCS, and bio-energy and CCS (BECCS). Abstracts should be approximately 500 words and include a title and acknowledgement of authors and their affiliations where possible. Please send your abstract as a Word document to rhianna.mclean@geolsoc.org.uk by 1 October 2018.

2019 YEAR OF CARBON

The Geological Society
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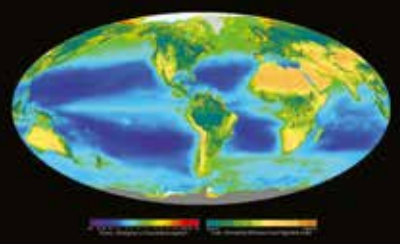
Earth System transitions

How resilient is the biosphere?

17-18 January 2019 | The Geological Society, London



Convenors

Dr Susan Canney (Oxford)
Professor Tim Lenton (Exeter)
Professor Graham Shields (UCL)
Professor Paul Valdes (Bristol)
Professor David Waltham (Royal Holloway)
Professor Paul Wignall (Leeds)
Dr Ying Zhou (UCL)

Further information

For further information please contact:
Georgina Worrall, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: 0207 434 9944
E: georgina.worrall@geolsoc.org.uk
Web: www.geolsoc.org.uk/biosphere19
Follow this event on Twitter: #biosphere19

The Geological Society, London

Earth System Science special interest group

Biosphere Evolution, Transitions & Resilience (NERC research programme)

The Earth system has evolved through major transitions towards its present well oxygenated, biologically diverse and ecologically complex state, but have these changes made ecosystems and environments more stable with time? This symposium will debate a series of major transitions in the light of the most recent research findings that may help us to assess the evolution of biosphere resilience.

The four main themes of this meeting are:

- Earth system transitions: the Precambrian
- Earth system transitions: the Palaeozoic Era
- Earth system transitions: the Mesozoic and Cainozoic eras
- How resilient is the biosphere – key notes and discussion.

Call for abstracts

We welcome oral and poster abstract contributions for this meeting. To be considered for a slot in the programme or a poster presentation, please send an abstract of no more than 500 words to georgina.worrall@geolsoc.org.uk, no later than **Friday 30 November 2018.**

THE JANET WATSON MEETING 2019

The Geological Society
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From core to atmosphere: Deep carbon

26-28 February 2019 | **The Geological Society, Burlington House**

Carbon is the element central to the evolution of life and maintenance of the Earth's habitability. Though the presence of carbon at Earth's surface is well known and vitally important, the majority of Earth's carbon is thought to reside in the Deep Earth. Constraining the magnitudes of the fluxes to and from the Earth's interior, and how they are controlled, is vital for understanding how the present-day Earth came to be and how it may develop in the future.

This three-day meeting will bring together early career geoscientists and senior members of the Deep Carbon research community. Presentations and discussions will encompass the latest advances in our understanding of the behaviour of carbon at the extreme pressures and temperatures of the Earth's deep interior, the exchange of carbon between the near-surface and deep reservoirs, the abiotic development of organic compounds through deep time, and the extreme limits of life on Earth. Mentoring activities will take place throughout the meeting, where senior scientists will lead small group discussions about their research careers and experiences in academia.

Conference themes

- Deep Carbon origins, storage and transport
- Carbon in the deep biosphere
- Deep Carbon through time
- The future of Deep Carbon research
- Deep Carbon synthesis

The final day of the conference is dedicated to workshops addressing the future of Deep Carbon research and exploring the application of new software driven tools for understanding carbon in the Earth.

Further information

For further information about the conference please contact:
Rhianna Mclean, Conference Office, The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: 0207 434 9944
E: rhianna.mclean@geolsoc.org.uk
Web: www.geolsoc.org.uk/jwatson19
Follow this event on Twitter: #jwatson19

Call for abstracts

There is a call for abstracts and oral and poster contributions are invited. Abstracts should be sent in a Word document to rhianna.mclean@geolsoc.org.uk by 14 December 2018. The abstract should be approximately 500 words and include a title and acknowledgement of authors and their affiliations where possible.

Convenors:

Simon Matthews (University of Cambridge)
Lotta Purkamo (University of St Andrews)

2019 YEAR OF CARBON

Geoscientist is the Fellowship magazine of the Geological Society of London

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https://commons.wikimedia.org/wiki/File:Tollundmanden_DO-10895_original.jpg

ON THE COVER:

FEATURES

REGULARS

GEOLOGISTS' ASSOCIATION 1858

GASS 2019

Geologists' Association Student Symposium

Geological solutions to global challenges;
What difference will your research make?

17th of May 2019
Burlington House, Piccadilly, London, W1J0BG

- **Prizes** will be awarded for the best oral and poster presentations.
- Confirmed keynote speaker: **Professor Iain Stewart** (Director of the Sustainable Earth Institute, Plymouth University)
- Registration **opens 1/1/19**
- Abstract deadline: 22/03/2019

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#GASS2019
Geologists' Association
gass@geologistsassociation.org.uk

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HERIOT WATT UNIVERSITY

Scottish Poetry Library

GEOPOETRY 2020 – Edinburgh –

1 October 2020

The Scottish Poetry Library and its environs, Edinburgh

Activities Include:

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

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

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

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

"We hear the red rock
Speak in ripples"

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

Proposed themes and activities

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

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

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

www.geolsoc.org.uk/geopoetry20

Organising Committee

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

The Geological Society

Call for meeting proposals

The Geological Society invites meeting proposals for 2019 and 2020 to be held at Burlington House, London.

For more information please visit
www.geolsoc.org.uk/meetingproposal-submit

The Geological Society 2019 YEAR OF CARBON

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DIP INTO THE FASCINATING FIELDS OF GEOCOGNITION AND GEOCOMMUNICATION WITH OUR DECEMBER ISSUE

FROM THE EDITOR'S DESK:

A geoscientist's mind

With improved understanding of how people learn and make decisions, can we tailor our teaching and communication tools to enhance learning efficacy and audience engagement? This idea, when applied to the geosciences, is the philosophy behind geocognition—the science of how people perceive and understand the Earth and Earth processes.

Geocognition is a relatively nascent field, but is gaining traction and has significance beyond the realms of formal education. In an era of fake news and public distrust of science, geocognitive research, when applied to communication techniques, could help scientists reconnect with communities.

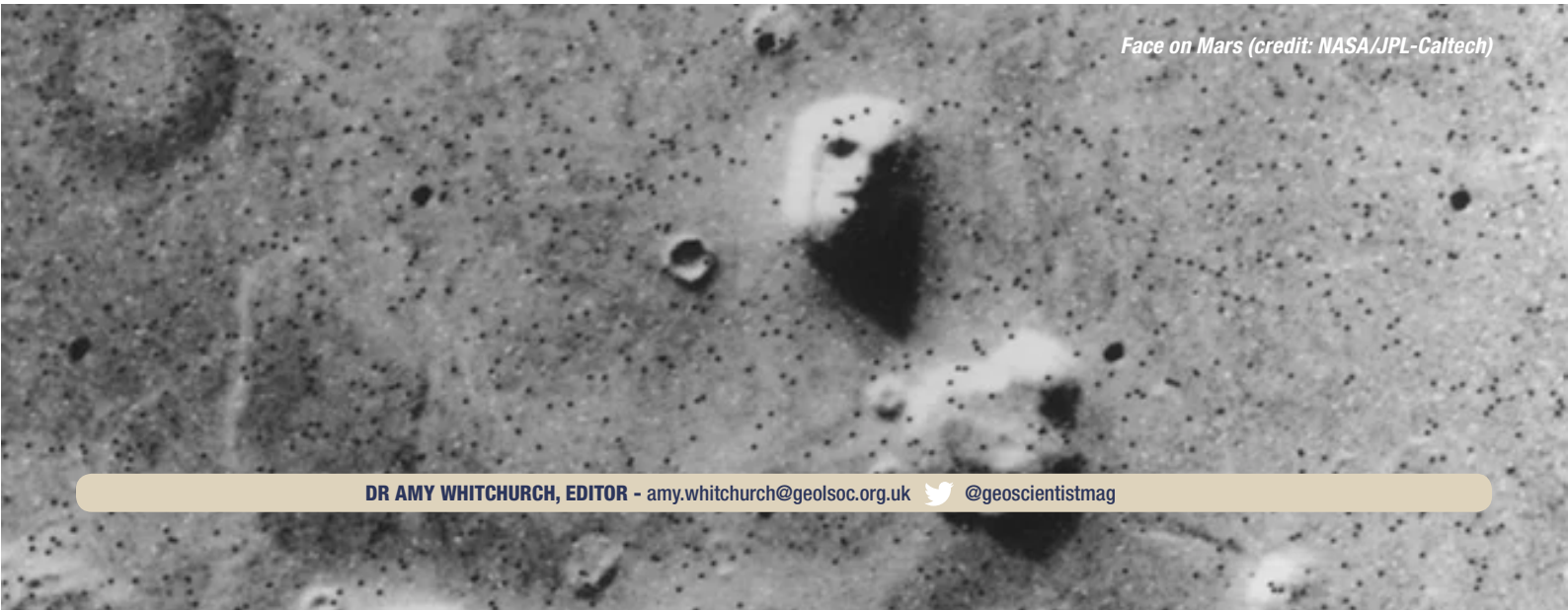
Geoscientific practices require essential cognitive skills. Geoscientists use spatial thinking to recognise patterns and classify objects, to use and make maps, and to visualise processes in three dimensions, ranging from microscopic to planetary in scale; they use temporal thinking to reconstruct sequences over timescales that are unfathomable to many; and they use systemic thinking to link observable features to their formational processes.

These cognitive skills are highly tuned in the experienced geoscientist compared to the novice. Experts are adept at rapidly filtering patterns from background noise—be that structures from noisy seismic sections, or bedding planes and lithological contrasts from fractured, weathered outcrops—and inferring links to conceptual models of formation. A preliminary investigation into field mapping skill (Petcovic et al., *J.Geosci. Educ.* 2009), for example, highlights novice-expert differences in both the approach to mapping and the final product. Interestingly, this study also reveals significant disparities between the maps produced by different experts. We view geological maps as objective representations of Earth, but they can be encumbered with personal bias.

Indeed, as explored in two features in this issue, the human brain is primed to draw meaningful connections, such as significance in lottery numbers, or to see patterns, such as the face on Mars, even where none truly exist. John Armitage and Tom Coulthard argue that testing data against predictive laboratory and numerical models can reduce bias, while Emma Jude calls on the techniques of fine artists to maintain objectivity in field sketches.

While we can put in place protocols to improve geoscientists' interpretational accuracy, it's impossible to remove subjectivity altogether. Like art, science requires a combination of technical competence and creativity, so that the final product is a translation of "a situation and a state of mind" (Osbourn, *Nat. Rev. Microbio.* 2006).

In a third feature in this issue, Mike Stephenson observes commonalities between the poets Seamus Heaney and Ted Hughes, and scientists in their attempts to describe and understand the world around them. But he also notes an important contrast, suggesting that unlike poets, scientists don't always take care with their words. Certainly, Heaney's description of a bog body and Hughes' take on the water cycle have replayed in my mind and stayed with me far longer than any description of these topics I've encountered in a journal article, text book or lecture theatre. Words are powerful and we should use them, creatively where possible, to reconnect our science to society.



Face on Mars (credit: NASA/JPL-Caltech)

DR AMY WHITCHURCH, EDITOR - amy.whitchurch@geolsoc.org.uk @geoscientistmag

SOCIETY *NEWS*

What your society is doing at home and abroad, in London and the regions

Council nominations—reminder

Fellows received two nomination forms with the October issue of *Geoscientist* for the election of new Council members for 2019/2020 and the President-designate.

The closing date for the receipt of nominations is **noon on Friday 4 January 2019**. Details of the process are on the nomination forms and in the Governance section of the website: **www.geolsoc.org.uk/councilservice**.

As part of our commitment to ensuring a more diverse and inclusive Council, the Society particularly welcomes nominations from under-represented groups allowing Council to better reflect the community it serves. Knowledge and experience of scholarly publishing and of fund-raising are also desirable.

Christmas and New Year closure

The Society (London and Bath) will close at 2.00pm on Friday 21 December, re-opening at 9.30am on Wednesday 2 January 2019.

The Publishing House will also be closed on Tuesday 4 December from 12.00pm and Burlington House will be closed on Wednesday 19 December from 12.00pm.

Research grants

Applications are invited for the 2019 round of the Society research grants. Please download the form from the Society Awards and Research Grants page at **www.geolsoc.org.uk/grants** where you will also find information about all the grants.

The Research Grants committee meets once annually. Applications must reach the Society no later than **12 noon on 1 February 2019** and must be supported by two Fellows of the Society who must each complete a supporting statement form. The committee will only consider complete applications on the appropriate form.

The Royal Commission for the Exhibition of 1851

The President of the Society is an ex-officio Commissioner of the Royal Commission for the Exhibition of 1851. Applications are open for their various awards, including Research Fellowships. For further information please go to: **www.royalcommission1851.org/awards/**

Member benefits

As part of the Society's membership with the American Geosciences Institute (AGI), Fellows now have free online access to EARTH Magazine (**https://digital.earthmagazine.org/**), as well as complimentary use of work and meeting spaces at the AGI Headquarters in Washington DC, subject to availability (**www.americangeosciences.org/workspace**).

PUBLIC LECTURE SERIES

Can Abandoned Mines Heat our Future?

Speaker: Charlotte Adams, Durham University
Location: Burlington House, London
Date: 6 December

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/gsllondonlectures18**. Entry by ticket only (contact the Society about four weeks before the talk). Due to popularity, tickets are allocated in a monthly ballot and cannot be guaranteed.

Contact: **Sarah Woodcock,** The Geological Society, Burlington House, Piccadilly, London W1J 0BG
T: +44 (0) 20 7432 0981 E: **receptionist@geolsoc.org.uk**

Council & OGMs 2019

OGMS: 6 February, 3 April
COUNCIL: 6 February, 3 April

GSDG Programme: 2018

The Geological Society Discussion Group meets at 18.30 for 19.00, when dinner is served. Attendance is open to all members of the Society. For up to date information concerning topics for discussion and speakers, please go to W: **www.geolsoc.org.uk/Groups-and-Networks/Specialist-Groups/Geological-Society-Discussion-Group**.

- Wednesday 5 December—Athenaeum, Pall Mall

For information and reservations, contact Sarah Woodcock E: **sarah.woodcock@geolsoc.org.uk**

Mentoring workshops

We ran a successful mentoring workshop on October 19 with 11 participants from a wide range of industry.

Some have enquired about the possibility of another workshop in late February or early March 2019. To be viable, we will need confirmed attendee numbers of 10 for Burlington House, London or 12 for elsewhere.

Please send indications of interest for a workshop in Burlington House or Manchester (or Leeds) to **Chartership@geolsoc.org.uk**, as soon as possible. If there is sufficient interest in one (or both) then arrangements will be made and dates advertised.

Eligibility to apply for Chartered Geologist

In the November issue of *Geoscientist*, Bill Gaskarth suggested that the Society would require a Master's degree qualification (or Supporting Documents demonstrating equivalent knowledge) as evidence of eligibility to apply for Chartered Geologist. This statement was made in error and he apologies for this.

We must clarify that at the current stage, this is only a proposal that would bring the Society's requirements into line with those of the Engineering and Science Councils. Any formal decision will be taken after discussion in the Chartership and Professional Committees. We welcome feedback on this proposal. To express your views please contact the Chartership Officer (**chartership@geolsoc.org.uk**).

FROM THE LIBRARY

Online Library catalogue

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

E-Journals and e-books

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

Literature searching

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

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Visit the Library

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

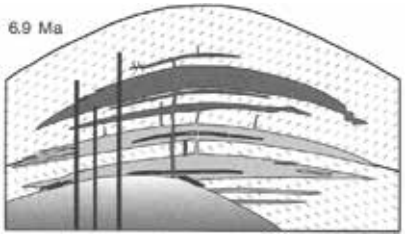
Library newsletter

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

Latest news from the **Publishing House**

For geologists after some festive journal and book content this holiday season, here are some suggestions

In two separate areas of western and central Elba Island (Italy), Late Miocene granite porphyries are found as shallow-level intrusions inside a stack of nappes rich in physical discontinuities. Detailed mapping of intrusive rocks, along with their relations with country rocks, show that outcrops from western and central Elba Island expose the same rock types, with matching intrusive sequence, petrography and geochemical features. Structural and geological data indicate that these layers were originally part of a single sequence that was split by eastward-directed décollement and tilting. The two juxtaposed portions of the original sequence allow the restoration of a 5-km thick sequence, made up of nine main intrusive layers, building three Christmas-tree laccoliths nested into each other to support a structural dome. During their construction, the role of the neutral buoyancy level was of minor significance with respect to the role played by the relatively thin overburden and/or the large availability of magma traps inside the intruded crustal section. Emplacement of the Monte Capanne pluton into the base of the domal structure likely caused oversteepening and initiated decapitation of the complex, with gravity sliding of the upper half off the top.



Rise and fall of a nested Christmas-tree laccolith complex, Elba Island, Italy
By D.S. Westerman, A. Dini, F. Innocenti and S. Rocchi

➤ **Read full abstract and paper in the Lyell Collection**
http://sp.lyellcollection.org/content/234/1/195

Garnets with snowball structures
http://mem.lyellcollection.org/content/48/1/295

On Reindeer (Rudolf's ancestors)
http://trned.lyellcollection.org/content/5/2/302

Land plant cover in the Devonian – the earliest Christmas trees!
http://sp.lyellcollection.org/content/339/1/59

Mistletoe documenting rapid warming at the Palaeocene – Eocene boundary in North America
http://jgs.lyellcollection.org/content/161/2/173

The formation of gold and other metals in well preserved Vent Chimney structures
http://sp.lyellcollection.org/content/148/1/241

The Bright Angel Shale
http://sp.lyellcollection.org/content/228/1/213

➤ **Read more here** www.lyellcollection.org

Speaking up for geoscience

Use of Earth's resources comes at cost. Still, we must exclaim the benefits provided by geology-related industries, argues **Mike Simmons**

The Petroleum Group recently held a provocative meeting on 'Communicating Geoscience'. It was a pleasure to be in the company of colleagues who are passionate about explaining geology to a wide cross-section of society, from politicians and policy makers, to everyday curious laypersons. An important target for outreach is those at schools and universities—we need to encourage the development of a new generation of geoscientists. This is critical, not just to further our academic understanding of Earth, but to encourage students to take up a career in a geology-related industry.

In conversations with students, I am conscious that many find little appeal in the prospect of a job in industrial geology, be that in the oil and gas sector, mineral mining, waste disposal or engineering geology. Many perceive these industries as being in terminal decline and 'dirty', being either directly or indirectly responsible for environmental damage. The general public and mass media often hold similar views. Admitting to being an industrial geologist can feel no better than admitting to being a sociopath or other such undesirable!

Take pride

No credible geologist would deny that society's use of Earth's resources can have negative impacts. One of our tasks as geologists is to better understand those impacts and minimise them. But geological industries also bring huge benefits to society. The provision of energy is progressively lifting the world's population out of poverty. In the last twenty years, 1.6 billion people have been given access to electricity for the first time, mostly from conventional, non-renewable energy sources. This means that 87% of the global population now has access to electricity. We should take some pride that geological industries can positively impact the quality of people's lives. We should also remember that we need conventional energy to develop renewable energy technology.

Without shying away from the complex environmental challenges geology-related industries face, we must communicate the positive messages from these industries. We are good at communicating the *wonder of geology* and there is a ready appetite to hear about dinosaurs, volcanoes and other spectacular geological phenomenon. But what about the *benefits of geology*? Who is speaking up for these and who should?

Speak up

Those of us working in industry can and should do our bit. But our voices are not always heard, perhaps because of an assumption that we have an agenda, either for ourselves, our employers, or our industry. We need an impartial, independent voice. I appeal to the Geological Society to be that voice—not to be apologists for the negative impacts, but to communicate what geology-related industries positively bring to society and how challenges are being dealt with. Ironically, 2018 was the Society's 'Year of Resources'. Their 'Geology for Society' document produced in 2014 was a good first step, but needs to be built upon.

Society will need geologists for the foreseeable future. We must ensure that people understand why and encourage students to consider careers as industrial geologists. The Society and industry have long had a mutually beneficial relationship. Let us work together to ensure that continues.

Mike Simmons is Technology Fellow for Geosciences at Halliburton Landmark; e-mail: Mike.Simmons@halliburton.com

SOAPBOX CALLING!

Soapbox is open to contributions from all Fellows. You can always write a letter to the Editor, of course, but perhaps you feel you need more space?

If you can write it entertainingly in **500 words**, the Editor would like to hear from you. Email your piece, and a self-portrait, to **amy.whitchurch@geolsoc.org.uk.** Copy can only be accepted electronically. No diagrams, tables or other illustrations please.

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

Precedence will always be given to more topical contributions. Any one contributor may not appear more often than once per volume (once every 12 months).

> "WHAT ABOUT THE BENEFITS OF GEOLOGY? WHO IS SPEAKING UP FOR THESE AND WHO SHOULD?"
>
> MIKE SIMMONS

THE ART OF SEEING

MIKE STEPHENSON MUSES ON GEOLOGY AND POETRY IN IRELAND

Over the last year I took part in two unusual events, in Dublin at the National Museum of Ireland, and at the Feile Na Bealtaine arts and poetry festival in Dingle, Ireland. At each, I gave a talk alongside poet and physicist Iggy McGovern, on the poetry of Ted Hughes and Seamus Heaney. We read some wonderful poems and discussed with audiences those great poets' intuitive grasp of geology and science. An unexpected insight was an appreciation of the similarity of the scientist's and poet's inspiration and motivation.

The talks were an attempt to bring poetry and science together, and came with exhibits, too. At the National Museum of Ireland, the audience was given a private view of fossilised bog bodies that inspired some of Heaney's most famous poems, while at Dingle the audience was treated to geological walks in the spectacular geology of the Dingle peninsular.

Hughes and Heaney had different styles, but both were inspired by the natural world and geology. To illustrate my point, I include here two poems—*Bog Queen*, by Heaney, taken from the collection *North* (1975) and *How water began to play*, by Hughes, from *Crow* (1970).

Bog bodies

Heaney was inspired by fossil humans from Irish and European bogs. *Bog Queen* describes the body of a woman preserved in a bog in Northern Ireland, and dating from about 490 BC. For a palaeontologist or archaeologist interested in preservation, Heaney's descriptions seem to catch the peculiar nature of the bodies in a way that a scientific description can't.

Bog Queen

I lay waiting
between turf-face and demesne wall,
between heathery levels
and glass-toothed stone.

My body was braille
for the creeping influences:
dawn suns groped over my head
and cooled at my feet,

through my fabrics and skins
the seeps of winter
digested me,
the illiterate roots

pondered and died
in the cavings

Head of bog body Tollund Man. Found 6/5/1950 near Tollund, Silkebjorg, Denmark and C14 dated to approximately 375-210 BCE. Photo by Sven Rosborn, Public Domain © Wikimedia commons

of stomach and socket.
I lay waiting

on the gravel bottom,
my brain darkening,
a jar of spawn
fermenting underground

dreams of Baltic amber.
Bruised berries under my nails,
the vital hoard reducing
in the crock of the pelvis.

My diadem grew carious,
gemstones dropped
in the peat floe
like the bearings of history.

My sash was a black glacier
wrinkling, dyed weaves
and phoenician stitchwork
retted on my breasts'

soft moraines.
I knew winter cold
like the nuzzle of fjords
at my thighs–

the soaked fledge, the heavy
swaddle of hides.
My skull hibernated
in the wet nest of my hair.

Which they robbed.
I was barbered
and stripped
by a turfcutter's spade

who veiled me again
and packed coomb softly
between the stone jambs
at my head and my feet.
Till a peer's wife bribed him.
The plait of my hair
a slimy birth-cord
of bog, had been cut

and I rose from the dark,
hacked bone, skull-ware,
frayed stitches, tufts,
small gleams on the bank.

This poem is a brilliant evocation of the physical appearance of the body, but also of palaeontological preservation and the passing of time. The 'creeping influences' evoke chemical fluids and processes that preserved the woman's body. The lines 'through my fabrics and skins/ the seeps of winter/ digested me' evoke fluids tanning the soft tissues.

Physical changes are also pictured: 'My brain darkening/ a jar of spawn' ▶

The Tollund Man (Image provided to Wikimedia Commons by Nationalmuseet, CC BY-SA 3.0. Photographer: http://samlinger.natmus.dk/DO/10895)

The author, Mike Stephenson, reading Heaney and Hughes poems after a guided geological walk at Clogher Strand, organised by iCRAG volunteers. Feile Na Bealtaine Arts Festival, May 2018

conjures organic decay. We see what these strange human artefacts look like. The 'plait of my hair/ a slimy birth-cord of bog' is almost a photographic image—but also adds the idea that the woman is symbolically sustained by the bog. The bog's juices, the 'seeps of winter' have given the woman a kind of eternal life.

To me, the vividness of the description supersedes the sort of description that a palaeontologist could provide, bringing an extra dimension of culture and history.

The geologist's eye

Hughes grew up in West Yorkshire and his early poetry is based in the farms of the Calder valley and the Pennine moorland. I wanted to read *How water began to play* because of its geological theme and because it contains something mystical about the physical function of water in the landscape, its fundamental gravitational flow and its role as a carrier of waste.

How water began to play

Water wanted to live
It went to the sun it came weeping back
Water wanted to live
It went to the trees they burned it came weeping back
They rotted it came weeping back
Water wanted to live
It went to the flowers they crumpled it came weeping back
It wanted to live
It went to the womb it met blood
It came weeping back
It went to the womb it met knife
It came weeping back
It went to the womb it met maggot and rottenness
It came weeping back it wanted to die
It went to time it went through the stone door
It came weeping back
It went searching through all space for nothingness
It came weeping back it wanted to die
Till it had no weeping left
It lay at the bottom of all things
Utterly worn out utterly clear

The poem personifies water as a desperate, hapless creature perhaps trying to escape the tasks that it has been set—and perhaps trying to escape Earth itself. Water wants to be set free, but like water vapour in Earth's atmosphere is held in the planet's gravitational grip. So water turns itself back to Earth, to the flowers

and the trees, where it finds that its role is not just part of the business and nurturing of life, but also of decay, rottenness and death. The cyclical nature of the physical work of water in the landscape takes hold through the rhythm of the poem, of water continually 'going and coming back', as it does in the natural world, in the hydrogeology of river catchments.

Then the use of water in the human world appears: 'It went to the womb it met blood'. Perhaps this is water as a washing medium, carrying waste away. Water goes into and out of people, factories and hospitals, and is finally released in rivers and streams. At the end of the poem, water has gone through such cycles, but is revealed as pure and clear, perhaps as it was before the cycles began. It '…lay at the bottom of all things'—revealed as the liquid within which most of life's business takes place.

Similarities?

Both poems had a powerful effect on the audience. There is something exhilarating about reading a poem in front of an audience—seeing people hanging on every word as it flows from the page. Sometimes it feels that we scientists don't have the grasp of words that poets have, or at least don't take as much care with our words as we should.

I wonder, are there similarities in the way that poets and scientists think? Poets take familiar sights, sounds, experiences and look at them in a new way, for example by building on a metaphor. In *Bog Queen*, Heaney connects the buried woman by 'a slimy birth-cord' to the bog, suggesting that in some way the bog sustains her. In *How water began to play*, water is desperate and burdened by the gravity that moves it and the human beings that enslave it—a metaphor that gives resonance to the idea that humankind is enslaving the Earth.

The poetry events in Ireland taught me that scientific and poetic imagination are similar: They help us see familiar things in a new way. But perhaps science and poetry then diverge by building on those insights differently. The scientist plugs her insight into a theory to revitalise it. The poet builds a story with metaphor and imagery to entertain a reader. As the Italian physicist Carlo Rovelli said: '*Our culture is foolish to keep science and poetry separated: they are two tools to open our eyes to the complexity and beauty of the world*'. ◆

Permissions: *Bog Queen* from *North*, by Seamus Heaney and *How water began to play* from *Crow*, by Ted Hughes reproduced following kind permission from publishers Faber & Faber Ltd, licence numbers: P180618/157 and P180618/156, respectively.

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FURTHER READING

Rovelli quote taken from *Reality Is Not What It Seems: The Journey to Quantum Gravity*, by Carlo Rovelli.

A recording of the Dingle event: https://soundcloud.com/user-78861479/tools-to-open-our-eyes-recording

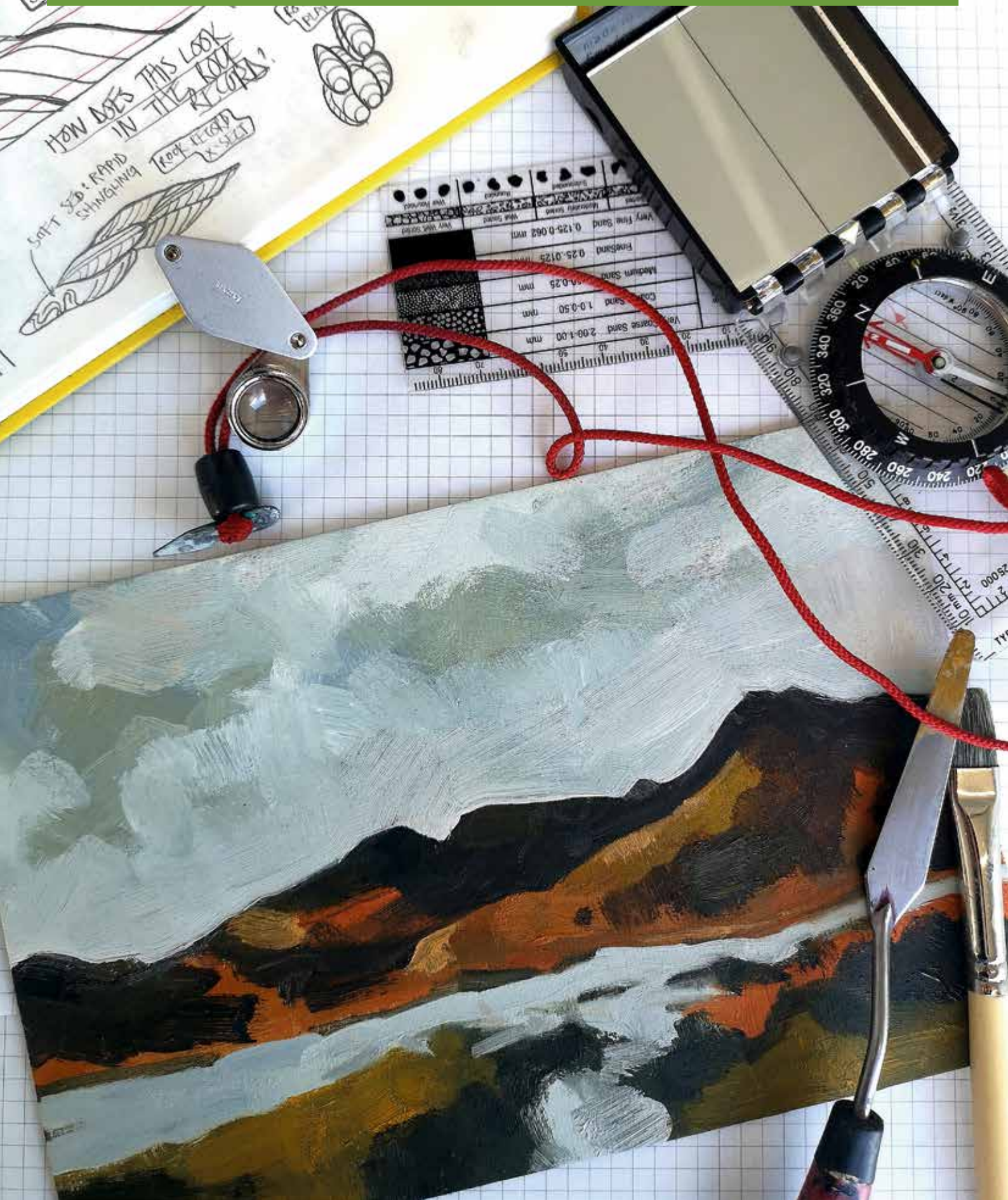
Upcoming conference (23/3/19) "Yorkshire geology, landscapes and literature": http://www.yorksgeolsoc.org.uk/EDITABLE/CallForPapersHull2019.pdf

Professor Michael Stephenson is Director of Science and Technology at the British Geological Survey, Keyworth; e-mail: mhste@bgs.ac.uk

The Dingle peninsular—a great backdrop for poetry and geology

The 'Morning poetry' readings at Dick Mack's pub, Feile Na Bealtaine, May 2018

FIELD SKETCHING THROUGH ART:
AN AID TO OBJECTIVITY



In geology, field sketches are a primary means of data collection. To gather these data accurately and impartially, **Emma Jude** argues that all geologists could learn from the techniques of fine artists

A good field sketch is a joy to behold; methodical, thorough, and instantly understandable to any geologist. Its primary aim is objectivity, detaching the expert eye from pure observation in order to observe unexpected relationships and form new ideas. It was only when I began to practice observational drawing in the classical style during fine arts education that I realised how much my undergraduate teaching in field geology had prepared me for it (Fig. 1).

Nowhere are we all more expert than in taking the information provided to us constantly by our eyes—lines, curves, shapes and tones—and converting it to meaning. In seeing the world, every minute of our lives we are a poor field geologist, taking a few vaguely familiar lines and converting them instantly into a table, an orange, a glass. This is most apparent, and worst directed, in the recognition of faces. Our brains are so primed to recognise faces that we constantly misdiagnose them; in the headlights and bumper of a car, the famous 'face on Mars' or a holy figure on a slice of toast. As geologists, this psychological phenomenon that causes people to see patterns in random stimuli, *pareidolia*, risks us being model-driven, unable to clearly distinguish between pure observations of field outcrops and our interpretations of the processes that created them. *Pareidolia* is similarly the main driver behind undercooked observational drawing among non-artists.

Observational drawing

To demonstrate, try to conceive drawing an eye (or if you have a pen to hand, draw one!). The most common response is to draw a 'symbol' based on our expert brain's assumptions: a lemon shape, a circle in the middle for an iris, eyelashes pointing outwards—and probably drawn without actually looking at an eye. The result is usually flat and more than a little unsettling. Compare the typically symbolic drawing of an eye (Fig. 2a) to those drawn using fine art techniques (Fig. 2b-d). The lemon shape, while present, is not the main feature, and eyes are often much more complicated than we think.

This is the core principle of observational drawing; look, then look again. It is only through detailed and accurate observation that we can switch off our 'inner expert' and create accurate representations of space. Fortunately, over the centuries of art practice, shortcuts have been developed to help this process—though these are rarely taught to non-artists. It is my firm belief that a solid foundation in drawing should be taught as a matter of course in undergraduate fieldwork, and more importantly reinforced through sketchbook marking and coaching. Conversely, the skills that an experienced field geologist gains through years of switching off the 'inner expert' can be elegantly transferred to drawing for pleasure with some application of basic theory.

Key skills

One might divide drawing skill into three main aspects. Cognitive skill is the ability that is practiced by all experienced geologists, that which allows us to make pure observations without bias. Practical skill might be defined as putting the observational data onto the paper in the place where you want it, and this is where the tricks and exercises of classical drawing can be employed to improve sketch quality and speed. Finally, you might define the ability to make a smooth and decisive line as physical skill (not always as easy as it looks!). Everything else—style, spirit, a sense of place—follows from grounding in these core principles.

For those who want to further develop their practical or physical skills, any foundational textbook of observational drawing will contain exercises, but the classic of the genre is *Drawing on the Right Side of the Brain*, by Betty Edwards, where the subject is approached from a methodical and scientific angle. It also benefits from believable before-and-after drawings from students of the author, showing how applying these cognitive skills can radically improve drawing in a very brief period.

Simple exercises

There are several simple exercises that can improve your sketches and test these theories, which might include:

Drawing upside down: Here you take a complex image (such as a face, figure or landscape) that you would like to copy, turn it upside down and make the copy that way. You will find that without expert shortcuts available to you, the copy will be far better than you expect. This combines cognitive and practical skills to get the shapes you observe down onto the paper in the right order.

Drawing negative space: Try drawing negative space by taking a small arrangement of objects and drawing out the shape of the spaces between them, as shown in Fig 3. These shapes do not have a pre-programmed assumption associated with them, and as such it becomes far easier to correctly perceive spatial relationships. This is a reinforcement of pure cognitive skill.

Summarising a complex subject: Squinting or half closing the eyes is a remarkably successful practical technique to reduce a mass of complexity into simple shapes, which can then be treated as in the negative space exercise. Try this experiment with a strongly-lit still life or sunny outcrop.

Developing a smooth line: Physical skill is mostly muscle memory, but a shortcut to making smooth lines is to restrict them to single curves and make the movement from the elbow or wrist rather than the hand. To experiment with this, take a large sheet of paper and hold the pencil as normal. First, try to draw a smooth curve in your normal style, likely by moving the fingers and the hand. Repeat the exercise but keep the hand fixed, swinging the ▶

Fig 1: The author's own sketch from the field, at Kettle Ness, Whitby

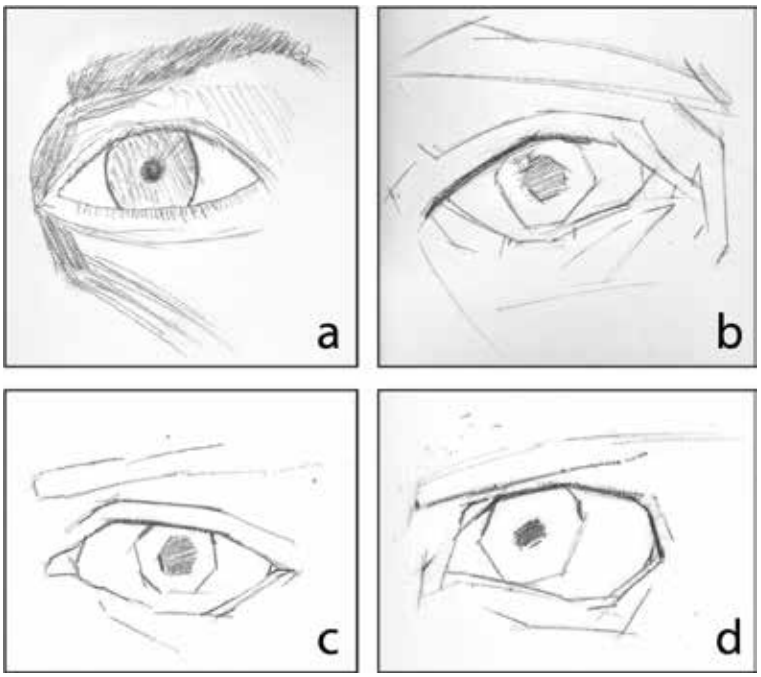


Fig 2: A symbolic drawing of an eye by a non-artist (a), and a comparison using observational techniques from this article (b-d)

Fig 3: A simple still life showing negative space. The shaded area in the right-hand-side image can be observed without interpretational biases, and placed more accurately, than drawing the objects themselves

arm from the elbow to make large, sweeping curves. Then try it with the elbow fixed and pivot from the wrist. Complex curves can be produced by amalgamating these simple curves.

Field application

These techniques can be applied in the field to improve landscape drawing, whether this is as part of field sketching or in the development of drawing for pleasure. While the exercises above can be done with a landscape rather than a still life or a photograph subject, some of the exercises I might teach in the field have an emphasis on application. For example:

Working with a viewfinder: A common piece of artists' kit, typically a rectangular frame made from card (Fig. 4), a viewfinder helps you to accurately map spatial and angular relationships. After first drawing around the viewfinder on your page, you then hold the viewfinder up to the outcrop to accurately represent proportions on the page. An effective way to combine this with the 'negative space' exercise might be to use it to establish an accurate cliff line in a complex outcrop sketch. In this example (Fig. 5), the shape of sky bounded by the cliff and the viewfinder is easier to draw than the cliff itself.

Refining a drawing: It is easy to get bogged down in an interesting area and distort the spatial and angular relationships of a whole outcrop. Before looking at any details, start with ten straight or single-curve lines to define the shape of the outcrop. Change coloured pencil and refine the accuracy with another ten lines, then repeat. You will find it easier to space out and size the features this way, and it results in a faster field sketch with fewer revisions (Fig. 6)

For Earth scientists, field sketching is one of the most fundamental and valuable skills. While drafting this article, I was genuinely surprised by the number of my colleagues who expressed frustration or nerves around the topic. A simple reference sheet or an enjoyable evening class in the field may improve the experience, not only leading to better and more efficient fieldwork but also allowing more people to access and enjoy art in their own way. ◆

> THIS IS THE CORE PRINCIPLE OF OBSERVATIONAL DRAWING; LOOK, THEN LOOK AGAIN. IT IS ONLY THROUGH DETAILED AND ACCURATE OBSERVATION THAT WE CAN SWITCH OFF OUR 'INNER EXPERT' AND CREATE ACCURATE REPRESENTATIONS OF SPACE

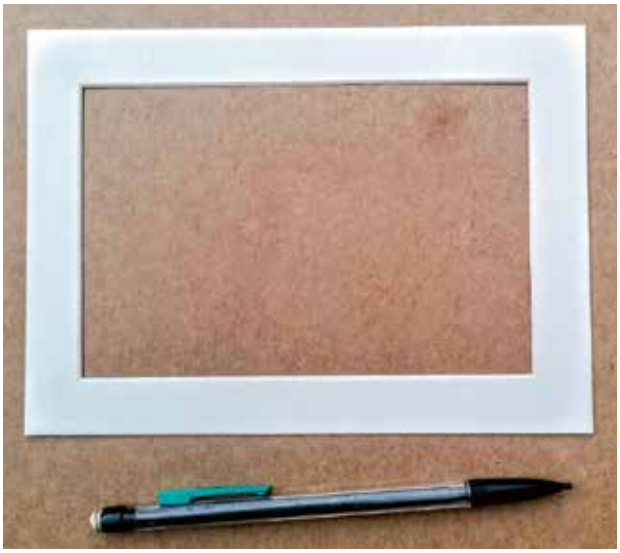


Fig 4: The author's viewfinder, taken from the inside of an inexpensive photo frame

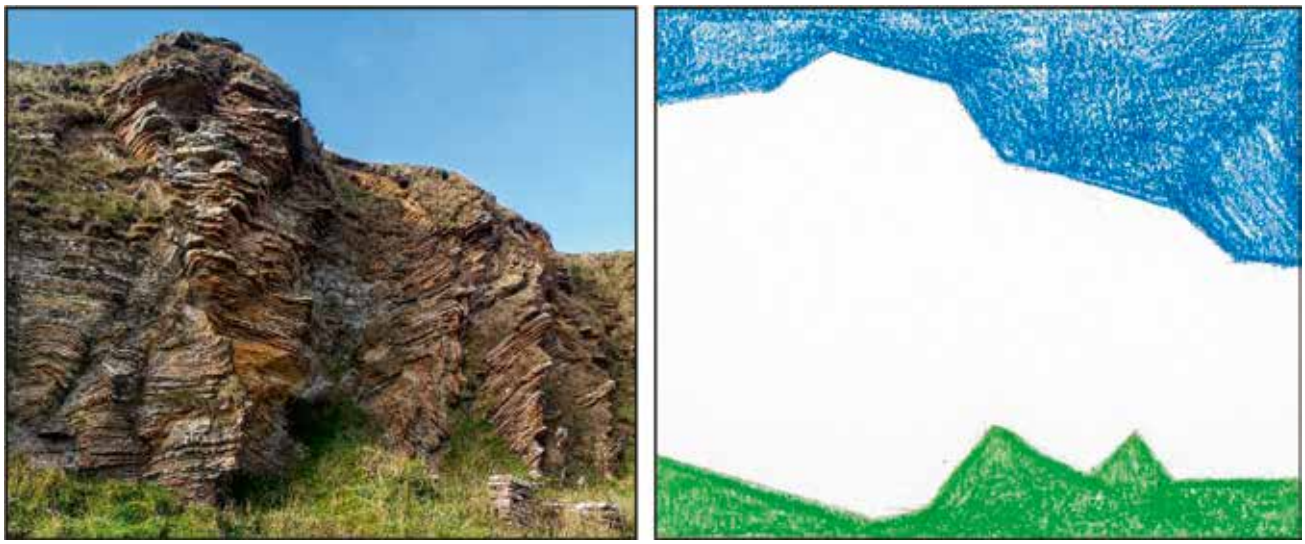


Fig 5: A complex folded lacustrine sequence at St John's Point, Caithness as would be seen through a viewfinder (left), and the 'negative space' exercise applied (right). The major fold structures can be more accurately represented once the large shapes are mapped in

FURTHER READING

Edwards, B. (1979) *Drawing on the Right Side of the Brain.* Penguin Putnam (revised and reprinted in 1989, 1999, and 2012), ISBN 0874774241.

The Official Website of Betty Edwards : www.drawright.com/

Emma Jude is a petroleum geologist and a locally exhibiting and practicing fine artist. She recently completed foundational studies accredited by University of the Arts London. She is developing a one-day field course in the South East teaching 'Observational Drawing for Field Geology'—for more details or to express interest contact emmatheresajude@gmail.com. To view her work exploring links between landscape, the process of interpretation and human history view her work at instagram.com/emmatheresaartist

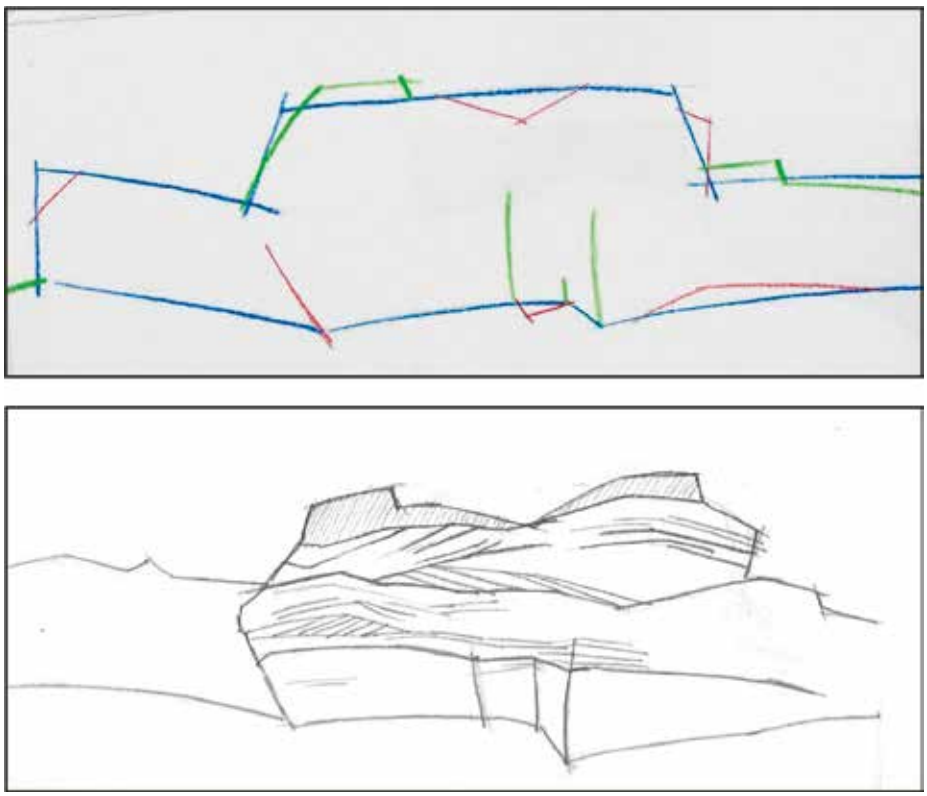


Fig 6: Progress of a refined field sketch. Starting with the broadest shapes and refining them (above) allows for the major geological observations to be mapped on (below) without losing spatial relationships

PERCEIVED CONNECTIONS:
INFERRING MEANING WHERE THERE IS NONE

Flysch sedimentary sequence in Zumaia (Basque Country). Image credit: shutterstock.com/By RudiErnst

Meaningless data are tough words to swallow. **John Armitage** and **Tom Coulthard** argue that Earth scientists must face up to the fact that some observations might be an aggregation of seemingly random events, where there is no cause and effect

Research suggests that humans have an innate difficulty in recognising genuinely random data. Experiments using streams of randomly generated binary sequences show a propensity for people to believe random data fluctuates more than it actually does (Goodfellow, *J. Experimental Psychology* 1938; Kahneman & Tversky, *Psychological Review* 1973; Falk & Konold, *Psychological Review* 1997). A more mainstream example of this is termed *gamblers fallacy*, where lucky or unlucky streaks are identified in the random selection of red or black on a roulette wheel.

Humans can also be influenced by a pre-existing idea or narrative. In their 1973 study, Israeli psychologists Kahneman and Tversky asked college students to rank a list of 9 subjects that an intelligent but non-creative, fictitious character, Tom W., would most likely study. The majority of those surveyed, on the basis of his character description, chose computer science, but statistically Tom W. would be most likely to study humanities—the most popular college course. Studying early onset psychosis, the German psychiatrist Klaus Conrad noticed patients reporting false meanings in their surroundings, for example feelings of repeatedly being watched, talked about or followed. He termed this process *Apophänie* or Apophenia (Mishara, *Schizophrenia Bulletin* 2009), the experience of seeing meaningful patterns or connections in random or meaningless data.

Of course, good Earth scientists may believe that they are not swayed by past scientific work and that they objectively view rock outcrops to make their own interpretations. As many facets of Earth science involve interpretation of data, we argue that the persuasiveness of a narrative and human difficulties in recognizing genuinely random data can lead to *apophenia*, and we will use examples to illustrate this problem. We urge Earth scientists to test their interpretations. As the old adage goes, correlation does not mean causation.

Sequence stratigraphy

Sequence stratigraphy relies heavily on causality—with changes in sedimentary deposits linked to drivers such as climate, tectonics, or base/sea level changes. The underlying physics for this causality (changes in energy gradients) are sound. However, river basin processes such as erosion and deposition are non-linear in their response to drivers such as climate and tectonics, and are also contingent upon the prior history of events in a basin—via sediment storage effects for example.

Such complexity has recently led researchers to suggest via field studies, laboratory and numerical models (Jerolmack & Paola, *Geophys. Res. Letters* 2010; Van de Wiel & Coulthard, *Geology* 2010; Phillips & Jerolmack, *Science* 2016) that river basins can filter and destroy, or shred certain signals from environmental drivers. Furthermore, the internal or autogenic processes of erosion and deposition can generate chaotic sediment signals equivalent in magnitude to those from external drivers. Outside of river basins, numerical and laboratory experiments (e.g. Burgess & Prince, *Basin Research* 2015) show that shoreline migration, too, can be a consequence of various external and internal processes within the sedimentary system. That is, it now seems that some stratigraphic patterns typically attributed to external drivers can be created by the sedimentary systems themselves.

Put simply, scientists may want to see signals and patterns in the data, which ▶

biases us from determining there are none. As the theoretical physicist Richard Feynman stated "the first principle is that you must not fool yourself—and you are the easiest person to fool".

Sample irregularity

The correlation between stratigraphic records and the drivers of, for example, climate change expose one central issue in Earth science: the irregularity of the spacing of samples in time. Irregular/infrequent data are not unique to sedimentology and can generate issues with how we test correlations and interpret them.

For example, the history of Icelandic volcanic eruptions creates an exceptional record of lava composition going back into the Pleistocene (Fig. 1; Gee et al., *Earth Planet. Sci. Lett. 1998;* Eason et al., *Bullet. Volcan.* 2015). At around 10,000 years ago, the ratio of niobium (Nb) to zirconium (Zr) reduces significantly, and this coincides temporally with rapid deglaciation at the end of the Pleistocene. It is tempting to causally relate the two and create a narrative that climate change influences volcanism. By generating this narrative, we could fall into a trap. The data set from Iceland is irregularly distributed in time, with large gaps. The number of samples is small, at around 300. To test for correlation against a climate record requires resampling the irregular data into some regular time series, and in doing so we make potentially misleading statistics.

To illustrate this point, we've taken two random distributions. By re-sampling the data to allow for correlation tests, we can obtain statistical correlations (Fig. 2). By testing for correlation we are in effect reducing the sample size and biasing this sample towards the mean. This increases the degree of correlation, but reduces the statistical power. At first glance, we would not believe that the two random samples are correlated, but resampling has in effect made them so.

Avoiding apophenia

The point is that data and observations can have gaps. To make the leap from the measured data to an understanding of the processes behind them requires interpretation. This is when apophenia is at its most dangerous, and recent research suggests that Earth scientists may not be so good at making correct interpretations. Bond et al., (*Geology* 2012) asked 184 tectonic geophysicists to interpret a synthetic seismic section generated using a geological model, so that the subsurface processes and final geometry were known. The researchers found that only one third of those tested came up with the correct interpretation. Whilst this is a specific seismic example, it is easy to draw parallels to other forms of interpretation in Earth science. It is human nature to seek causality, and it is in our nature to ignore statistical reasoning. Within a discipline that is often data-poor, interpretation to fill in data gaps is seductive, but the interpretation maybe inappropriate or incorrect. So how can we avoid apophenia?

We suggest one solution lies in predictive models. To illustrate our point, we could look at a 2016 study in *Science* by McKenzie and colleagues, which attempts to draw a correlation between past atmospheric CO_2 fluctuations and global plate tectonics. They analyse the uranium-lead (U-Pb) ages of detrital zircons found in sediments globally, and use this as a proxy for volcanism, assuming that peaks in zircon production reflect periods of active continental arc magmatism. The peaks in periods of young zircons ages look visually correlated with periods of high atmospheric CO_2 concentrations going back through the Cretaceous, but no statistical test was done because the CO_2 proxies are irregularly spaced in time. The researchers concluded that the high atmospheric CO_2 concentrations were due to increased back-arc volcanism during periods of widespread subduction. To test this narrative requires the development of a forward model of global plate tectonics, linked to a climate model, to explore how the change in back-arc volcanism impacts CO_2 release. When this was done by Brune and colleagues (*Nature Geoscience 2017*), it was discovered that increased CO_2 fluxes related to rifting and continental divergence (rather than arc volcanism) created a closer fit to the observed CO_2 time series.

Debates about the causes for past climatic change and how it is recorded within the geological record will likely continue. But we are concerned that too much is left to interpretation. It is human nature to be biased and to have little statistical intuition (Kahneman, 2011),

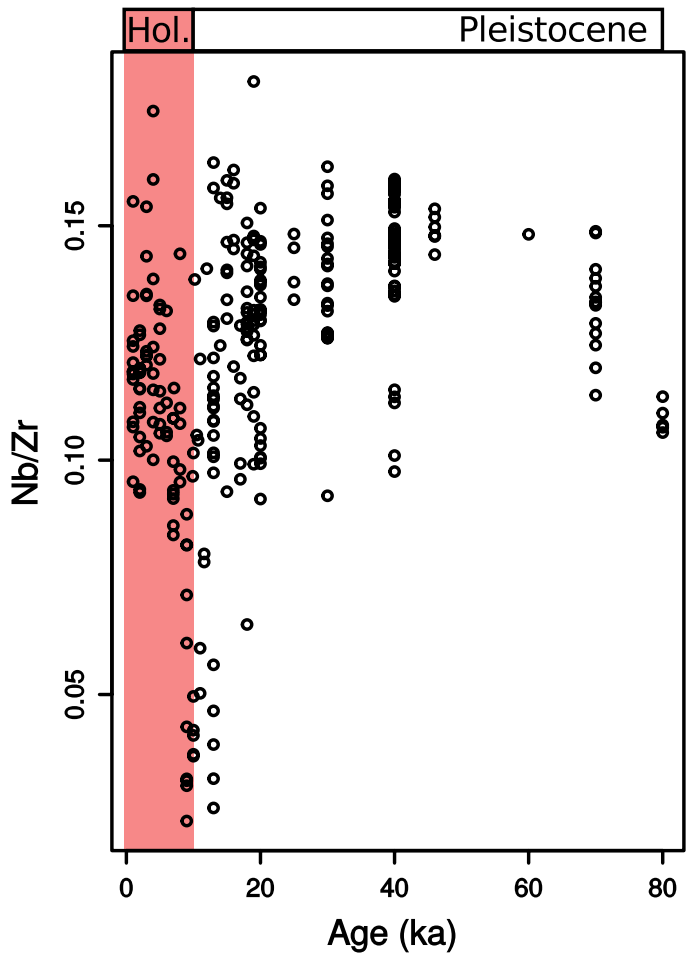


Fig 1: Time series data from Iceland. Observed Nb/Zr ratio from lavas erupted in Iceland during the Holocene and Pleistocene (with age in thousands of years, ka) (Data from Gee et al., Earth Planet. Sci. Lett.1998; Eason et al., Bullet. Volcan. 2015)

yet we can avoid apophenia by using laboratory and numerical models to test hypotheses against observations. This is not an easy task, given the complexity of Earth processes, and brings in another debate about the heuristics that might be required to build suitable models. The road to recovery, however, first lies in recognizing the problem—otherwise we risk publishing meaningless correlations. ◆

> THE PERSUASIVENESS OF A NARRATIVE AND HUMAN DIFFICULTIES IN RECOGNIZING GENUINELY RANDOM DATA CAN LEAD TO APOPHENIA

John Armitage is a Research Scientist at the Institut de Physque du Globe de Paris (email: armitage@ipgp.fr) and Thomas Coulthard is a Professor of Physical Geography at Hull University (email: T.Coulthard@hull.ac.uk).

Layers of sedimentary sandstone rock. Image credit: shutterstock.com/By SAPhotog

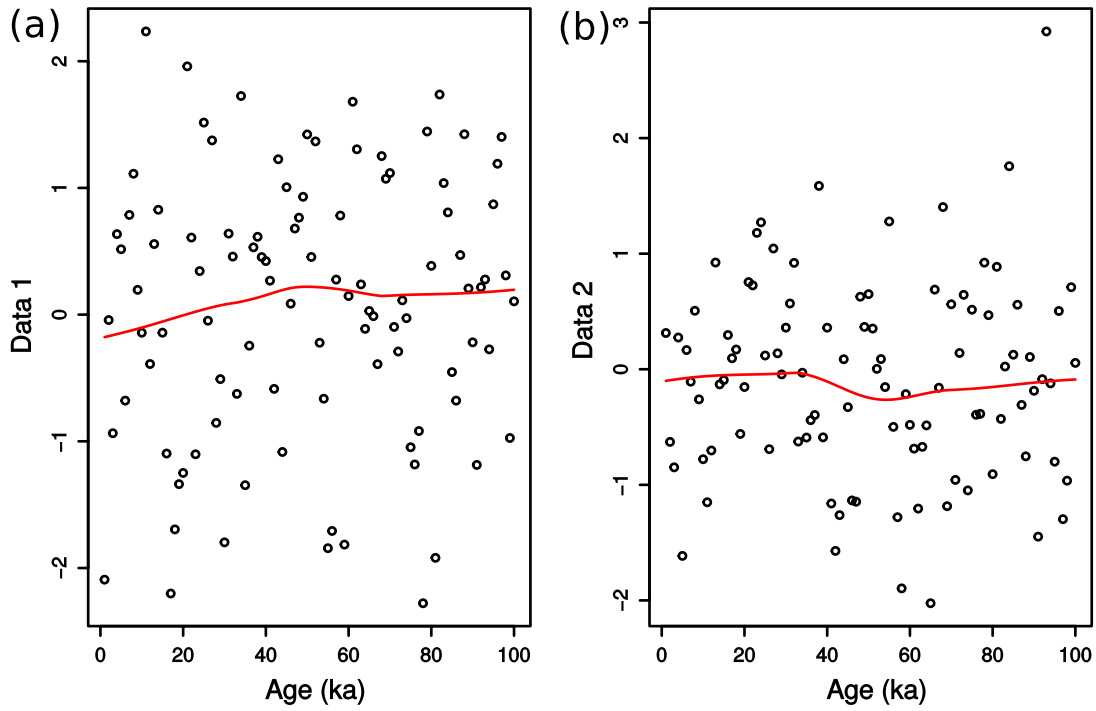
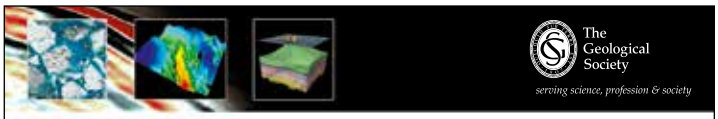


Fig 2: Irregular time series data. Two random distributions and their associated smoothed trends in relation to age. In this example the correlation coefficient between the two distributions is -0.64: they are strongly anti-correlated



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Call for Abstracts – Deadline: 1 December 2018

Hydrocarbons in Space and Time

9-11 April 2019

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Owen Sutcliffe
Halliburton

Frans van Buchem
Halliburton

Mark Houchen
Shell

Bruce Levell
Oxford University

Hannah Steaggles
BP

Mike Simmons
Halliburton

Keynote Speakers:

A diverse set of keynote speakers are being solicited from across the community

The global endowment of hydrocarbons is markedly uneven both spatially and temporally. In the 1990s, several key papers recognised that distinct stratigraphic and paleogeographic trends exist and that this knowledge was an important guide to successful exploration. So, what has changed in 30 years?

The industry has moved into new frontiers and basins, drilled deeper, found new plays and gone through a revolution that has brought unconventional resources to the fore. It is therefore timely to consider how our knowledge of the distribution of hydrocarbons in time and space has changed. What new insights have we gained? Can this new understanding be used to be better at predicting new hydrocarbon discoveries?

This 3-day conference will seek to share recent advances and case studies and will be built around four main themes:

- The known global heterogeneity of hydrocarbon resources – including source rocks
- The controls on heterogeneity – including palaeoclimates and geodynamics
- The geological and data science tools to aid prediction
- What our present understanding means for future exploration

Event to be accompanied by a post-conference field trip to the Wessex Basin.

For further information please contact:

Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.
Tel: +44 (0)20 7434 9944 or email: sarah.woodcock@geolsoc.org.uk

For Abstract Guidelines, please download a copy from the website:
https://www.geolsoc.org.uk/PG-Hydrocarbons-in-Space-and-Time

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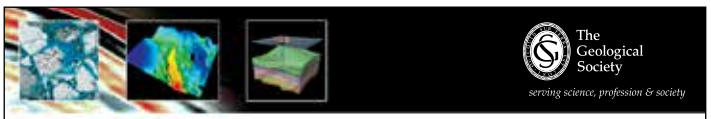

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Call for Abstracts – Deadline: 30 November 2018

Petroleum Geology of Mexico and the Northern Caribbean

14-16 May 2019

The Geological Society, Burlington House, Piccadilly, London

Convenors:

Jonathan Hull
Ophir Energy – Chair

Matthew Bowyer
Cairn Energy

Ian Davison
Earthmoves

Mike Hohbein
Ophir Energy

Aruna Mannie
Premier Oil

Chris Matchette Downes
CaribX

Adrian Neal
Badley Ashton

Mark Shann
Sierra Oil & Gas

Sponsored by:

Cairn

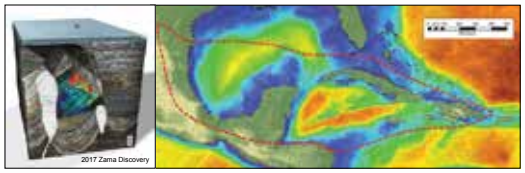
earthmoves

ERCE

ophir

PremierOil

BHP



The Gulf of Mexico is a world class prolific hydrocarbon system. As a result of recent energy reform the Mexican sector of this basin has been open to international companies for the first time through a series of competitive licence rounds. The first phase of drilling on these newly awarded permits has resulted in the discovery of giant hydrocarbon accumulations in the Mexican offshore sector. Geologically, the offshore and onshore basins of Mexico offer a diverse range of play types with multiple source / reservoir pairs and are characterised by complex tectonic evolution with associated halokinesis and shale tectonics.

More widely within the Northern Caribbean region, exploration activities are ongoing in several countries targeting both proven and frontier petroleum systems. Some of these play elements are potential extensions of the proven systems in Mexico. While geologically complex, these areas have the potential to emerge as major hydrocarbon basins.

This regional conference aims to bring together both academic and industry geoscientists together to discuss the current state of understanding of the geology and petroleum systems in these geologically complex, but prolific hydrocarbon basins.

The committee now invite submissions of abstracts along the following themes

- Regional Plate Tectonic Evolution
- Basins of Mexico and the Northern Caribbean
- Onshore Basins and the Laramide and Chiapas Fold Belt effects
- Petroleum Systems
- Exploration & Production History
- Neogene Clastic Depositional Systems
- Carbonate Depositional Systems
- Salt Tectonics
- Controls on hydrocarbon habitat – seal capacity
- Relevant GOM Analogues

Call for Abstracts:

Please submit talk or poster abstract to sarah.woodcock@geolsoc.org.uk by 30 November 2018.

For further information please contact:

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

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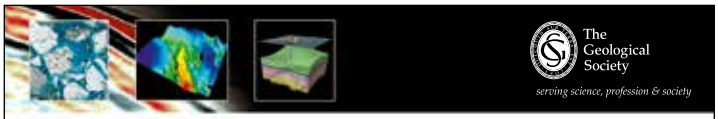

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Call for Abstracts: 14 December 2018

Celebrating the life of Chris Cornford (1948-2017)

Petroleum Systems Analysis 'Science or Art?'

24-25 April 2019

The Geological Society, Burlington House, London

Convenors:

Steve Lawrence
Subsurface Resource Consulting

Dan Cornford
IGI Ltd

Elin Rein
Equinor

David Gardiner
IGI Ltd

Abhen Pather
RPS Energy

Mark Groves Gidney
Energetical

Richard Bray
Subsurface Resource Consulting

John Argent
Sound Energy

Mark Osborne
BP

Approaches to tackling the scientific and practical questions in the fields of Petroleum Geochemistry and Petroleum Systems Analysis range from the entirely theoretical to the empirical. Chris Cornford embraced both in his working life. The integrated approach he espoused will form the basis of the technical programme for the Conference covering two themes:

- Recent developments in the use of data including integration of models and (big) data; use of visualisation and data exploration or mining techniques.
- Topical issues & controversies ranging from mass balance approaches, petroleum migration to specific modelling studies and practical applications.

The Conference will be inspired by Chris' ethos of innovation, encouragement of youth and challenging received wisdom.

Call for Abstracts:

Please submit abstracts for oral and poster contributions that cover any of the above themes to sarah.woodcock@geolsoc.org.uk before 14 December 2018

For further information please contact:

Sarah Woodcock, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.
Tel: +44 (0)20 7434 9944 or email: sarah.woodcock@geolsoc.org.uk

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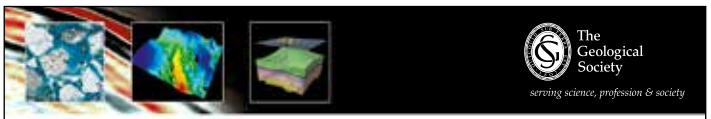

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Call for Abstracts – Deadline: 29 March 2019

Capturing Geoscience in Geomodels

26-27 June 2019

Robert Gordon University, Aberdeen

Convenors:

Matt Jameson
Glencore

Gwilym Lynn
Shell

Leigh Truelove
Schlumberger

Ingrid Demaerschalk
Tullow

Alun Griffiths
Rockhopper

Catherine Tonge
Shell

David Hulme
Equinor

Tom Marsh
Rock Flow Dynamics

James Aguas
Halliburton

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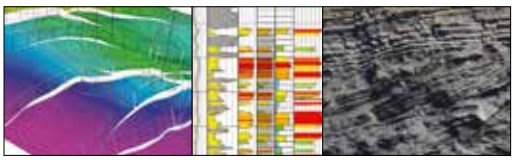
Schlumberger

HALLIBURTON



Over recent years the construction of 3D static and dynamic reservoir models has become increasingly complex. With the availability of extensive tools and technology it is important not to forget the objective of the modelling process.

As we develop our hydrocarbon fields it is essential that 3D Static Models be built with fit-for-purpose geological models, honouring the geological, geophysical and petrophysical data that they are created from.

This two-day conference will explore how geoscience information should be used to best effect, and how to identify when geoscience data may no longer add value. Sessions will include the following themes:

- Data integration: seismic, well log, sedimentological, core dynamic data and beyond
- Capturing conceptual geology in reservoir modelling for different settings and depositional environments
- Scale: geology vs model vs data
- Uncertainty: dealing with geological uncertainty in modelling and understanding its benefits and limitations
- Embracing new modelling technology and approaches.

Call for Abstracts:

Please submit talk or poster abstract to sarah.woodcock@geolsoc.org.uk by 29 March 2019.

For further information please contact:

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

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

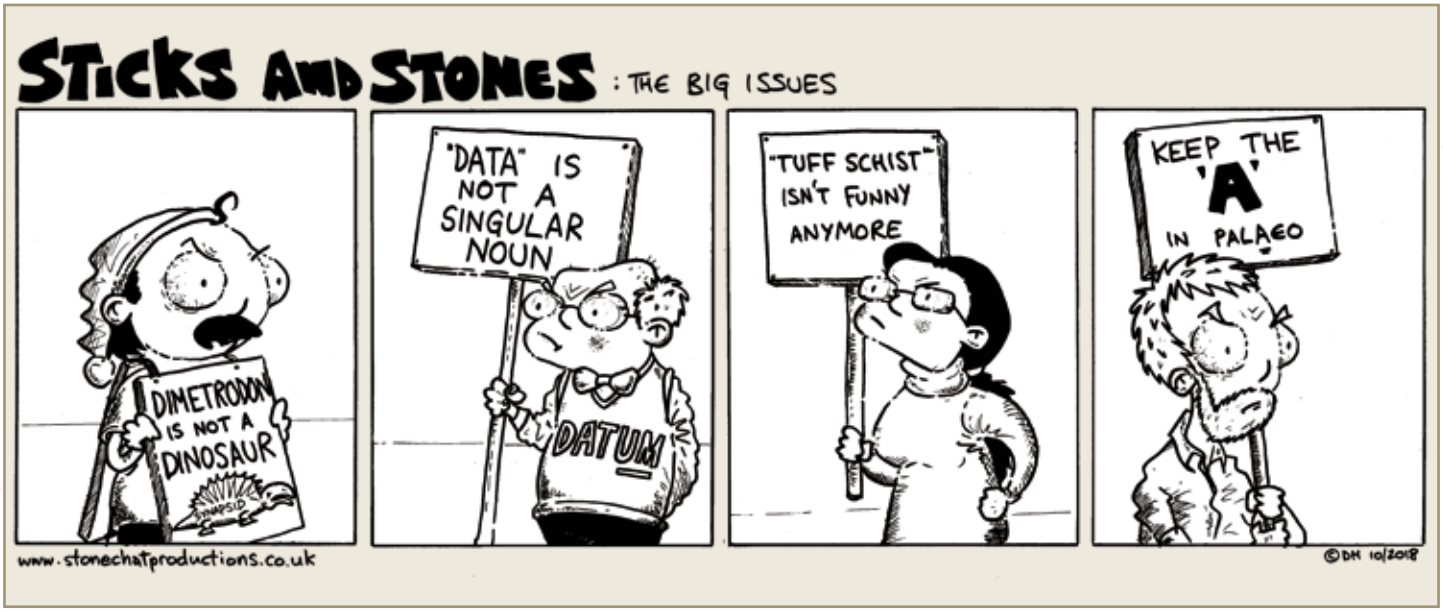
ENDORSED TRAINING/CPD

MEETING	DATE	VENUE AND DETAILS
Lapworth's Logs	n/a	Training. 'Lapworth's Logs' is a series of e-courses involving practical exercises of increasing complexity. **Contact:** Michael de Freitas or Andrew Thompson (First Steps Ltd) **E:** office@firststeps-geo.co.uk (mention Lapworth's Logs as the subject)

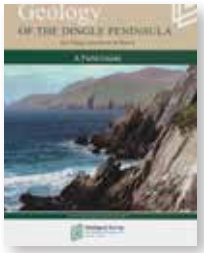
EVENTS

PLEASE NOTE THAT THERE ARE MANY MORE MEETINGS FOR WHICH WE DO NOT HAVE SPACE. ALWAYS CHECK WITH **WWW.GEOLSOC.ORG.UK/LISTINGS**

MEETING	DATE	VENUE AND DETAILS
Recent Work in Archaeological Geophysics	4 Dec	**Venue:** Burlington House, London **Contact:** Paul Linford **E:** Paul.Linford@historicengland.org.uk **W:** http://www.nsgg.org.uk/meetings/
Criminal and Environmental Forensics	5 Dec	**Venue:** Burlington House, London **Contact:** Jamie Pringle **E:** j.k.pringle@keele.ac.uk **W:** http://www.nsgg.org.uk/meetings/
AGU Fall Meeting	10-14 Dec	**Venue:** Washington DC, USA **W:** https://fallmeeting.agu.org/2018/
Volcanic and Magmatic Studies Group Annual Meeting 2019	8-10 Jan	**Venue:** St. Andrews, Scotland **E:** vmsguk@gmail.com **W:** https://vmsg666952477.wordpress.com/
Earth Systems transitions - How resilient is the biosphere?	17-19 Jan	**Venue:** Burlington House, London **Contact:** Sarah Woodcock **E:** sarah.woodcock@geolsoc.org.uk **W:** https://www.geolsoc.org.uk/biosphere19
Role of geological science in the decarbonisation of power production, heat, transport and industry	21-23 Jan	**Venue:** Burlington House, London **Contact:** Sarah Woodcock **E:** sarah.woodcock@geolsoc.org.uk **W:** https://www.geolsoc.org.uk/Lovell19



Geology of the Dingle Peninsula: A Field Guide



Call me superficial, but I have never found anything in geology more compelling than knowing what rocks are where. The courses I liked best had names like 'Regional Geology of the British Isles and Ireland' and the tweedy pipe-smoking people who taught them embodied the vanishing vibe that had attracted me to the subject—and still does; a world of 'Area Geologists' who know their patches and lovingly devote their lives to every square inch.

This book is clearly a labour of love; and it is heartening to see it published by, of all things, a national geological survey. There will be more like it, I understand; and I hope this one is taken as a model, because it is exemplary.

The Dingle Peninsula is one of those areas where universities used to (and maybe still do) love to take students—simply because you can see more geology per square inch there than almost anywhere else. The concentrated complexity of its rocks, combined with glaciation, has produced a rich variety of landforms. As well as lying on or close to major orogenic sutures, and bearing the overprint of more than one mountain-building episode, there are igneous rocks, fascinating sedimentology (unrivalled Devonian sequences) and even fossils to be found (assuming you're allowed).

After a short Introduction setting out the book's aims—and the usual health and Safety, and Country Code advice—the authors describe the broad geological evolution of the Dingle Peninsula from Ordovician to Carboniferous (and Quaternary) before taking the reader on excursions through four areas: SW, NW, SE and NE Dingle. These areas are helpfully delineated on a fantastic 1:50,000 solid geology map provided in a wallet at the back.

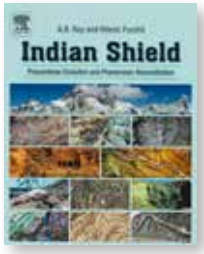
This is a large-ish book so it won't fit in your pocket unless you're also a shoplifter; but the gain in breathing space is worth it. Big, legible text, plenty of white space, beautiful colour photographs and what Dick Selley calls 'geophantasmograms' (sedimentological block diagrams, also in colour) are provided—all located conveniently within the text so you don't have to use all your fingers as bookmarks while referring to them.

I cannot praise the production too much. It has hardly any proofing errors, and those it has are not dangerous. There is even a glossary, which contained all the words I tested, and helpful further reading lists throughout. A delight.

Reviewed by: ***Ted Nield***

GEOLOGY OF THE DINGLE PENINSULA – A FIELD GUIDE
by Ken Higgs & Brian Williams, Geological Survey of Ireland
2018. 246pp. with map (pbk). ISBN: 1-899702-67-9
List Price: €20.00. W: https://gsi.ie/

Indian Shield: Precambrian Evolution and Phanerozoic Reconstitution



This welcome volume provides a geological account of the history, growth and evolution of the Indian Subcontinent. The Indian Shield is thought to have grown and evolved in the Precambrian, and then been reconstituted by later events and processes in the Phanerozoic. That provides the form of this book, within which the approach is to discuss the regional geology starting with the oldest sequences.

The rocks range in age from 3400 million years to the Quaternary. Two thirds of the book concentrates on the Archean, which in India is sub-divided into proto-continents, typically separated by Gondwana rift basins. The Southern India Granulite belt remains an area of significant interest internationally, and as more geochronological data become available worldwide it now appears that such terrains are a feature of the relatively late Archean. Subsequent chapters tackle issues such as Paleozoic basins and the evolution of life forms, the Gondwana supergroup, its origins and evolution, Gondwana break-up and the development of the Himalayas. The last major section is on Quaternary geology and seismicity, before a brief epilogue on correlation and the evolutionary history of the Indian shield.

Throughout the emphasis is on the rocks, and their relationships in the field, with lots of field photographs and regional geological maps. These provide an excellent introduction to the geology of India, the references are comprehensive, and controversies over preferred interpretations are discussed where appropriate. Nonetheless it would have helped this reader, who is not very familiar with the geography of India, to have more in the way of larger scale maps showing, for example, the locations of the different Archean schist belts and how they related spatially to one another.

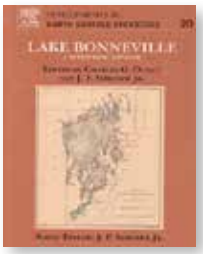
The ages of different units and geological events is increasingly an integral part of the geology of any area. These are discussed in the text, but there are no tables of even the key ages, nor any summary figures of when different events occurred, which would have made it easier to understand the context.

The tone of the book is reflected in the wealth of figures of field geology and local maps, but with much less in the way of summary age and tectonic diagrams. I would have enjoyed a smattering of such figures that might have been readily used in lectures and seminars, and hence brought the geology of India to a wider audience. Despite such concerns, I enjoyed this introduction to the Indian Shield, and it deserves to be widely used by those seeking to become familiar with different aspects of the geology of India.

Reviewed by: ***Chris Hawkesworth***

INDIAN SHIELD: PRECAMBRIAN EVOLUTION AND PHANEROZOIC RECONSTITUTION
by A.B. Roy & Ritesh Puohit, Elsevier 2018. 398 pp. (pbk).
ISBN: 9780128098394
List Price: £119.00. W: www.elsevier.com

Lake Bonneville: A Scientific Update



Lake Bonneville and its first monographer, Grove Karl Gilbert, are like beacons in the history of studies examining evidence for long-term climate change in the Quaternary Period. In the first Monograph

of the United States Geological Survey published in 1890, Gilbert meticulously described the regional landforms of Lake Bonneville and outlined the evidence for the changing lake-fill history and other geomorphological changes within the region.

The present volume provides a detailed update, based on numerous studies involving technologies such as geochemistry, geochronology (radiocarbon, cosmogenic nuclide dating), remote sensing and spatial analysis not available in Gilbert's day. It also builds upon and integrates the observations of countless researchers since Gilbert's seminal publication. The volume provides a template to evaluate many of Gilbert's hypotheses about the geomorphological evolution of the region, particularly in terms of more quantitative information.

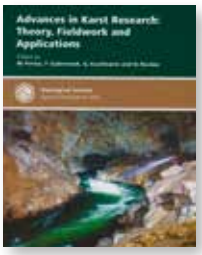
At its zenith, Lake Bonneville, a pluvial lake, covered an area of approximately 50,000 km^2 in what is now north-western Utah and parts of south-eastern Nevada. Named after Captain B. L. E. Bonneville who first explored the region in the 1830s, the lake developed and shrank during the Last Glacial Maximum at a time of increasing development of the Laurentide and Cordilleran ice sheets. The lake's presence at the time of substantial ice sheet development would at first appear enigmatic, but resulted in part from the diversion of the Bear River on the north-eastern margin of the enclosed depression of Lake Bonneville. The river diversion resulted from an episode of volcanism in the Blackfoot-Gem Valley volcanic field and led to a substantial inflow of water to Lake Bonneville. As the lake system filled, a succession of higher lake shorelines developed with the transgression culminating in the Bonneville shoreline, some 300 m above the elevation of the Great Salt Lake at Salt Lake City.

This really is a wonderful volume providing a wealth of quantitative information about the long-term development of Lake Bonneville. The topics covered are diverse and focus on specific lake shoreline successions (Provo, Bonneville), the history of the Bear River, landslides, alluvial fans and dam failure, changes in climate and vegetation, fishes, avifauna, vegetation changes, water chemistry, mountain glaciation within the Bonneville Basin, early human occupation of the region, application of high-resolution seismic reflection and remote sensing to better characterise the lake system, and Lake Bonneville geosites within an urban landscape. The book is a fitting tribute to the pioneering work of Gilbert and one is left wondering what he would make of this delightful and very informative volume.

Reviewed by: ***Colin V. Murray-Wallace***

LAKE BONNEVILLE: A SCIENTIFIC UPDATE
by Charles G. Oviatt & J. F. Shroder JR (Eds), Elsevier 2016.
ISBN: 978-0-444-63590-7. 659 pp. (hbk)
List Price: £121.00. W: www.elsevier.com

Advances in Karst Research: Theory, Fieldwork and Applications



The challenge for any book about karst research is focus—what constitutes research and what appeals to the generalist. The editors define karst as the slow work of dissolution exerted by water on soluble rocks. At first glance, karst research appears as a narrow field—as many cavers can attest! However, despite the definition, the papers range far and wide, covering topics from petroleum geology to conservation.

The editors deftly tee up the book by reminding readers that 14% of Earth's surface is potentially karstic and that 15% of the world's population drink water from karst aquifers. These bold claims are reflected in four sections—karst geology, geomorphology and speleogenesis; karst hydrology; karst modelling; and karst hazards and management. This editorial approach has risks, because it gives the impression of a lack of clear direction or even worse, good research topics.

Key contributions show the reader that karst research can provide Earth scientists with windows on geological processes that are difficult to unwind from the geological record. The papers on Israeli caves, for example, illustrate how speleothems provide details of both climate and vegetation changes over the past 3 million years. Likewise, the work on denudation, eustacy and uplift demonstrates the importance of understanding karst processes before determining subsidence rates or tectonic uplift.

One major criticism of the publication is the poor editing of the papers—did anyone (Book Society Editors?) read some of these papers before publishing? There is no excuse for verbosity or overly long papers, particularly where the authors have published extensively on the subject.

The editors state, "there are many unresolved theoretical problems in karst processes, water flow, and mass and heat transport"—this publication does not go far enough in trying to resolve some of these problems and, rather than having focus, has taken a shotgun approach in attempting to ground key issues.

Reviewed by: ***Stephen Crabtree***

ADVANCES IN KARST RESEARCH: THEORY, FIELDWORK AND APPLICATIONS
by M Parise, F Gabrovsek, G Kaufmann & N Ravbar (eds), Geological Society of London SP 466, 2018. 486pp. (hbk). ISBN978-1-78620-359-5 **List Price: £130.00. Fellow's price: £65.00. W: https://www.geolsoc.org.uk/SP466**

BOOKS FOR REVIEW

Please contact **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**

- **NEW! Minerals of the English Midlands,** by Roy E. Starkey, British Mineralogy Publications 2018, 426 pp. pbk.
- **NEW! The Himalayan Cryosphere: Past and Present, NC Pant, R Ravindra, D Srivastava & LG Thompson (Eds)** GSL SP 464, 2018, 216 pp. hbk
- **NEW! History of the European Oil and Gas Industry** by J Craig, F Gerali, F MacAulay & R Sorkhabi (Eds), GSL SP 465, 2018, 472 pp. hbk
- **NEW! Mesozoic Resource Potential in the Southern Permian Basin** by B Kilhams, PA Kukla, S Mazur, T McKie, HF Mijnlieff & K van Ojik (Eds), GSL SP 469, 2018, 572 pp. hbk
- **NEW! Petroleum Geology of the Black Sea** by MD Simmons, GC Tari & AI Okay (Eds), GSL SP 464, 2018, 484 pp. hbk
- **NEW! Geology and Geomorphology of Alluvial and Fluvial Fans: Terrestrial and Planetary Perspectives** by D Ventra & LE (Eds), GSL SP 440, 2018, 353 pp. hbk
- **NEW! Characterization of Ore-Forming Systems from Geological, Geochemical and Geophysical Studies** by K Gessner, TG Blenkinsop & P Sorjonen-Ward (Eds), GSL SP 453, 2018, 424 pp. hbk
- **Tectonics of the Deccan Large Igneous Province** by Mukherjee et al. (Eds), GSL SP445 2017, 363pp. hbk

Communicating geoscience in uncertain times

*In a meeting that discussed the art and science of geoscience communication, **Hazel Gibson** and **Jen Roberts** report that the most effective exchanges require us to listen, and not just speak*

Under the geoscience umbrella shelters a great breadth and depth of topics and concepts, from the applied to the abstract, and from the every-day to the extraordinary. This umbrella branches onto ethical and philosophical topics around the environment, society, justice, economics, heritage and so on—it is truly interdisciplinary. It is no wonder, then, that communicating geoscience can be tricky. Indeed, it is increasingly acknowledged that challenges in communicating geoscience are a major barrier to developing new geological technologies for society.

Many geoscientists will have witnessed or experienced times when the communication of controversial subjects caused turmoil, professionally and personally. Geoscientists worry about how to effectively communicate with various diverse stakeholders; how to 'get people onside' or seek 'permission' and 'support' to do their jobs, or simply be a geoscientist. This worry can turn to outright fear and trepidation when they see examples where communication is perceived to have gone badly, from either side of the argument.

A meeting at the Geological Society focused on exactly this issue of communication, from one of the fields that arguably experiences some of the most heated and emotionally charged conversations about development: Petroleum Geoscience. Organised by Kirstie Wright and Anna Clark from Heriot Watt University, the 'Communicating Geoscience: Building Public Interest and Promoting Inclusive Dialogue' conference **(https://www.geolsoc.org.uk/expired/PG-Communicating-Geoscience)** on September 4th was designed to be diverse, with speakers from industry, academia and NGO's from several countries sharing their experiences and advice. The discussions prompted participants to look beyond the gaps that separate us from our audiences and instead look for ways to connect with them.

Building public interest

The main themes from the day can be broken into two. The first, building public interest, was what many expect and rely on from conferences about geoscience communication; how do scientists reach beyond their own circle of colleagues to share their science with more diverse audiences? Particularly useful for those new to science communication, the talks covered topics such as: writing blogs; using Twitter, Instagram and other social media; creating video-blogs (vlogs) on YouTube; writing for popular media websites; and finding the story in your science.

> "SCIENTISTS TEND TO ASSUME THAT IF ONLY THEY COULD COMMUNICATE THE 'FACTS', THE AUDIENCE WOULD THEN THINK LIKE THEM"

Several professional and academic scientists shared their experiences of communicating to non-expert audiences and gave valuable advice for those looking to participate in broadening communication to outreach, engagement and beyond. Stephanie Zihms advised delegates to 'diversify your reach and break stereotypes by sharing more than your professional geologist persona on social media', Laura Roberts suggested that scientists should 'tell stories about your science that are relevant to your audience, in the same way that the mainstream media does', Jan Freedman proposed to 'use networks to find others who want to communicate about geoscience like you do' since effective communication is easier to achieve with a team and John Underhill emphasised that we shouldn't be afraid to communicate, telling participants to 'seize your opportunity'.

Promoting inclusive dialogue

The second theme of the conference was something a little different, exploring the idea that geoscience communication goes beyond the effective transfer of information from scientist to audience. Speakers introduced the ideas of the co-production of geoscience communication, dialogue-based practice and the critical need to engage with social science issues for the continued development of our field. It was almost like the first theme was telling geoscientists how best to talk, and this second theme was telling geoscientists how best to listen.

Social anthropologist, Anna Szołucha, talked about public concerns regarding the potential environmental and social impacts of fracking, as part of her work on the ReFINE project, an international research consortium on fracking. Anna raised a crucial point, that public objections highlight other voices that should be considered—and included—when determining our shared future. This perspective was echoed by many speakers. In a room full of scientists, it was refreshing to dwell on the argument that objection

and controversy aren't merely a factor of bad communication. While poor communication can exacerbate controversy, scientists tend to assume that if only they could communicate the 'facts', the audience would then think like them.

We discussed how best to nurture dialogic communication and draw communities into the co-production of outreach and decision making, what facts and values are and to whom, what it means to gain 'consent' from communities, and whether and how our identities as geologists and our perspectives about our field influence our communication. By exploring these themes, attendees were encouraged to not only reach across the divide, but to move their goalposts to accommodate a range of stakeholder views and needs.

Building geoscientists' interest

The 'Communicating Geoscience' conference was an encouraging experience. Not only did the event deliver on its title—to build public interest and promote inclusive dialogue—it seemed to also build geoscientists' interest in communicating geoscience. There was an energy for challenging each other to look into the future to envisage where we are going with geoscience communication.

The whole day was live streamed online enabling participants (who would not have been able to take part in any other circumstances) to engage remotely. We commend organisers in the Petroleum Group and the Geological Society of London for this innovative step forward, which felt particularly relevant for this conference; communication only works if everyone is able to be a part of the conversation.

Dr Hazel Gibson is in the Sustainable Earth Institute, University of Plymouth; e-mail: hazel.gibson@plymouth.ac.uk

Dr Jen Roberts is in the Department of Civil and Environmental Engineering, University of Strathclyde; e-mail: jen.roberts@strath.ac.uk

The Society notes with sadness the passing of:

Barnes, Barry *
Barnes, Simon James *
Booth, Tony *
Bowen, Geoffrey Gordon *
Carmichael, David*
Casey, Raymond *
Cooke, Herbert Basil *
Dobson, Margaret *
Fletcher, Brian *
Gladwell, David Robert *
Ince, David Martyn *
Kenna, Raymond *
Lambert, John F *
Llewellyn, Peter L
Lynch, Edward *
Manning, Aubrey *
Matheson, William *
Milward, Anthony Frederick *
Moores, Eldridge *
Morgans, Michael William *§
Okada, Hakuyu *
Pegg, Eric Arnold *
Roberts, Brinley
Shrimpton, Godfrey *
Smith, Howard James *
Thomson, Martyn Hugh *
Veevers, John James *
White, Owen *

In the interests of recording its Fellows' work for posterity, the Society publishes obituaries online, and in Geoscientist. The most recent additions to the list are in shown in bold. Fellows for whom no obituarist has yet been commissioned are marked with an asterisk (*). The symbol § indicates that biographical material has been lodged with the Society.

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

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

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DISTANT THUNDER

A Christmas cracker

Geologist and science writer Nina Morgan recalls how one Christmas kicked off with a bang

On Christmas eve 1965, people living near the Leicestershire village of Barwell were blinded by a flash, then deafened by a roaring noise and a tremendous bang that shook buildings. The flash was not the result of a Star from the East and the bang had nothing to do with Father Christmas crash landing his reindeer sleigh. Instead, the cause of all the commotion was a meteor strike. The 4.5-billion-year-old chondrite, or stony meteorite that hit the Earth near Barwell is the largest and best-recorded meteor fall in British history.

Mystery object

At first locals had little idea what had hit them. One woman reported hearing a tremendous crash when taking her dog for a walk in a nearby cow field, but she didn't recognise the significance of the noise. A member of a group of carol singers who set out across the village soon after the strike reported feeling something crunching under her feet. She picked up a piece of the meteorite, examined it under a street light, then threw it away. As she later explained, "I was out carol singing, I didn't want to carry a lump of rock around".

Other residents didn't realise what had happened until Christmas Day when they woke to find holes in the tarmac, broken windows and cracked roof slates. One resident whose new car was damaged by a meteorite fragment landing on its bonnet, initially threw the rock away, thinking it was a lump of concrete thrown by vandals. Once the true cause of the damage was recognised, insult was added to injury when his car insurance claim was refused on the basis that meteor strike damage was considered 'an act of God', and thus not covered. On receiving this response, the aggrieved car owner reportedly went to his local priest to see if the church would pay for the repairs. When the church declined, the incensed motorist fired off a letter of complaint to his insurers that began 'Dear God'.

Meteorite hunters

But local attitudes towards the meteorite changed quickly, once the Christmas Eve event was confirmed as a meteorite strike and museums offered money for fragments of the space rock. The result was the meteoric equivalent of a gold rush.

Among those who joined in the hunt were the astronomer Patrick Moore and the geologist Trevor Ford, who found a fragment weighing in at 5 kg (see Distant Thunder, *Geoscientist* March 2018). Some residents kept their meteorite fragments to display as a memento. But others cashed in. One local man, sold a large piece to the Leicester Museum for £39.50 and took his family on holiday on the proceeds. Another collector was even luckier: the 1 kg lump he picked up has a current estimated value of £20,000. In all, 44 kg of meteorite fragments were recovered.

But financial windfalls aside, the real winner in this saga is science. Meteorite fragments have the potential to provide important clues for understanding the origin and age of the Solar System. The Barwell meteorite is of particular interest because it is believed to be largely unmodified since its creation. And because pieces of meteorite were collected so soon after the impact, and many finders followed instructions to wrap samples in newspaper and avoid washing them, the samples were not degraded by weathering or contamination. To top it off, a pebble from another asteroid was found incorporated in one of the fragments, offering further clues about the meteorite's history and the formation of the early Solar System.

When it comes to Christmas presents, a fragment from the Barwell meteor must certainly beat a box of chocolates any day. A very happy holiday season to all!

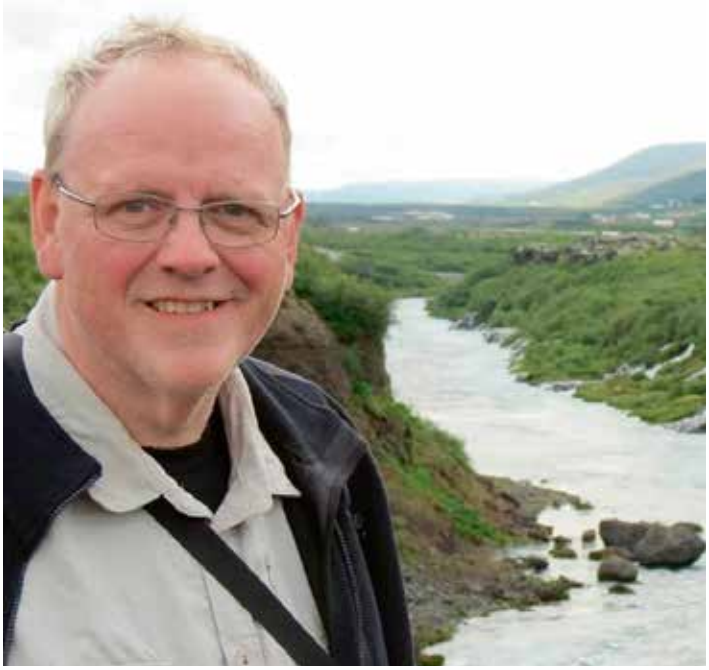
Image Credit: Llama Bear (Wikimedia Creative Commons Attribution-Share Alike 4.0 International)

End notes: Sources for this vignette include: *Incoming! Or why we should stop worrying and learn to love the meteorite* by Ted Nield, 2011; A blog by Kevin Yates available at **https://spacecentre.co.uk/blog-post/day-meteorite-landed-barwell/**; BBC news reports available at **http://www.bbc.co.uk/insideout/eastmidlands/series7/barwell_meteorite.shtml** and The hunt for the Christmas meteorite by Camila Ruz in BBC News Magazine available at **https://www.bbc.co.uk/news/magazine-35053786**

* **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

OBITUARY Paul Younger 1962-2018

Paul loved geology, rocks and energy, but there was more to him. He revelled in language, adored music and was a man of deep faith



Paul was born in North-East England, in Hebburn, on the south bank of the River Tyne. He moved over the river to attend the University of Newcastle, receiving a first-class honours B.Sc. Geology in 1984, and crossed the Atlantic, to Oklahoma State University, where he completed his M.S. Geology as a Harkness Fellow, specialising in hydrogeology.

Paul returned to Newcastle in 1986 to carry out a PhD on river-aquifer interaction in the Thames Valley. For those working at Thames Water, Paul's appearance as a CASE student was nothing short of a whirlwind of fresh air. After gaining industrial experience in Yorkshire and Bolivia, Paul took a lectureship at Newcastle University in 1992, where his career as an academic flourished. Internationally renowned for his work on mine-water pollution, Paul led the group that won Newcastle University's first Queen's Anniversary Prize for Higher and Further Education in 2005, for the team's work on 'Remedies for mine water pollution worldwide'. He was elected to Fellow of the Royal Academy of Engineering in 2007 and in 2008 became Pro Vice Chancellor for Engagement on the University's Executive Board—a highly appropriate position for one who invested much time engaging with industry, government and the public.

In 2012, Paul and his wife Louise moved to Glasgow, where Paul had accepted the prestigious Rankine Chair of Engineering at Glasgow University and researched geothermal and renewable energy. As always, Paul's enthusiasm and intellect resulted in a rise to prominence in the field, and in 2016 he was elected a Fellow of the Royal Society of Edinburgh.

> "PAUL REVELLED IN LANGUAGE—HE SPOKE FLUENT GAELIC AND SPANISH. HE LOVED MUSIC AND HIS ENGAGING SENSE OF HUMOUR ENRICHED THE LIVES OF COUNTLESS STUDENTS, ACADEMICS AND INDUSTRIALISTS ACROSS THE WORLD"

Paul revelled in language—he spoke fluent Gaelic and Spanish. He loved music and his engaging sense of humour enriched the lives of countless students, academics and industrialists across the world.

Paul was a man of deep faith. His last writings were reflective articles on the challenges of faith that were personal to him. He loved his family deeply: if any one of us can rely on a tenth of the care and support that Paul received from his family during his final months, then we can count ourselves blessed. It must have struck many as perverse that a loving God should see fit to allow Paul to be stricken with an aggressive brain cancer that would inevitably affect his speech and language abilities. At Paul's funeral, Father Jim addressed this head-on: Paul, we learned, did not regard himself as being "robbed" of these talents. His scientific prowess, his oratory, his languages were merely gifts, loaned to him for a short while. During his final months, Paul spent time consciously returning them to his creator. The reading chosen for Paul's funeral could not have been more fitting: "…as for prophecies, they will pass away; as for tongues, they will cease; as for knowledge, it will pass away… So faith, hope, love abide, these three; but the greatest of these is love."

The memory of Paul—his music, compassion, wit and knowledge—lives on in the hearts of his wife, Louise, and their lads, Callum, Thomas and Dominic.

By Adam Jarvis and Dave Banks

The full version of this piece 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.

OBITUARY Frederick Weir Dunning 1928-2018

Curator of the Geological Museum who began its modernisation only to see it subsumed as the Natural History Museum 'Earth Galleries'

When Fred Dunning was appointed Curator of the Geological Museum in 1970, his aim was to completely replace its antiquated displays, and instead to convey up-to-the-moment geological research to the museum's visitors, and to make it accessible through simple text and eye-catching displays.

He appointed designer James Gardner to realise the first stage of transforming the Geological Museum, with the *Story of the Earth* exhibition, opened by the Queen in 1972. The *Story* began inside a mysterious cleft in a rock face, a replica of a Moinian outcrop near Mallaig. In the dark space, the story began with the origin of chemical elements in stars. The visitor eventually re-entered the everyday world on an earthquake shaking-table. For transforming the Geological Museum into one of the most popular attractions in London, Fred was awarded the OBE. By his retirement in 1988, more than half the Museum's exhibition space was filled with modern displays.

Fred was unsatisfied with the level and quantity of information an exhibition could hold: his answer lay in a series of colour-illustrated small books the visitors could buy and read at home. These books have been so widely copied by other organisations, it is hard to remember just how revolutionary they were. Fred also fostered and expanded the Museum's outreach programme. As well as activities for schools, there were adult education courses, professional development courses for the stone industry, and geological field excursions for the public within the UK and abroad.

An unfortunate consequence of the relocation of the Museum's parent organisation, the British Geological Survey, to Keyworth was that the Geological Museum became absorbed into the Natural History Museum, as 'The Earth Galleries'. In 1990 Fred commented in the geological press 'a conscious policy of reducing the profile of geology… the Geological Museum has been abolished… its functions crippled', its education programme 'stopped dead in mid-programme'…'its world-famous booklet series … come to an end'.

Fred was active beyond the confines of the Geological Museum; within the Geological Society he was Foreign Secretary, also Secretary of the Dining Club. In 1988, Fred was awarded the Geological Society's Coke medal. He collated the mapchart *Geological Structure of Great Britain, Ireland and surrounding seas*, published by the Geological Society in 1985. Working with regional museums, Fred pushed for establishment of the Travelling Geology Curator post to assess the totality of geological material in UK Museums. After retirement, he became a member of the Museums and Galleries Commission.

In retirement, Fred followed his passion for gardening, producing guide books and explanatory panels for north-country gardens Harlow Carr, Holehird, and Otley Chevin Nature Reserve. He was editor of *The Northern Gardener*.

Fred's perfectionism pervaded his output, whether scholarly publications, such as the *Tectonic Map of the UK*, editorship of *The Mineral Deposits of Europe*, or his popular opus.

In 1950 he married Ingeborg Firth, who predeceased him. He is survived by their two children, Jane and Andrew, and his twin brother John. Fred died of heart failure in April, in Yorkshire.

➤ Compiled and presented by Susanna van Rose who particularly thanks Anthony Barber, Jane Friend, Gary Hincks, Crispin Paine and Ian Mercer for their reminiscences and contributions. Fred's daughter Jane Osborne, shared some of Fred's own contributions

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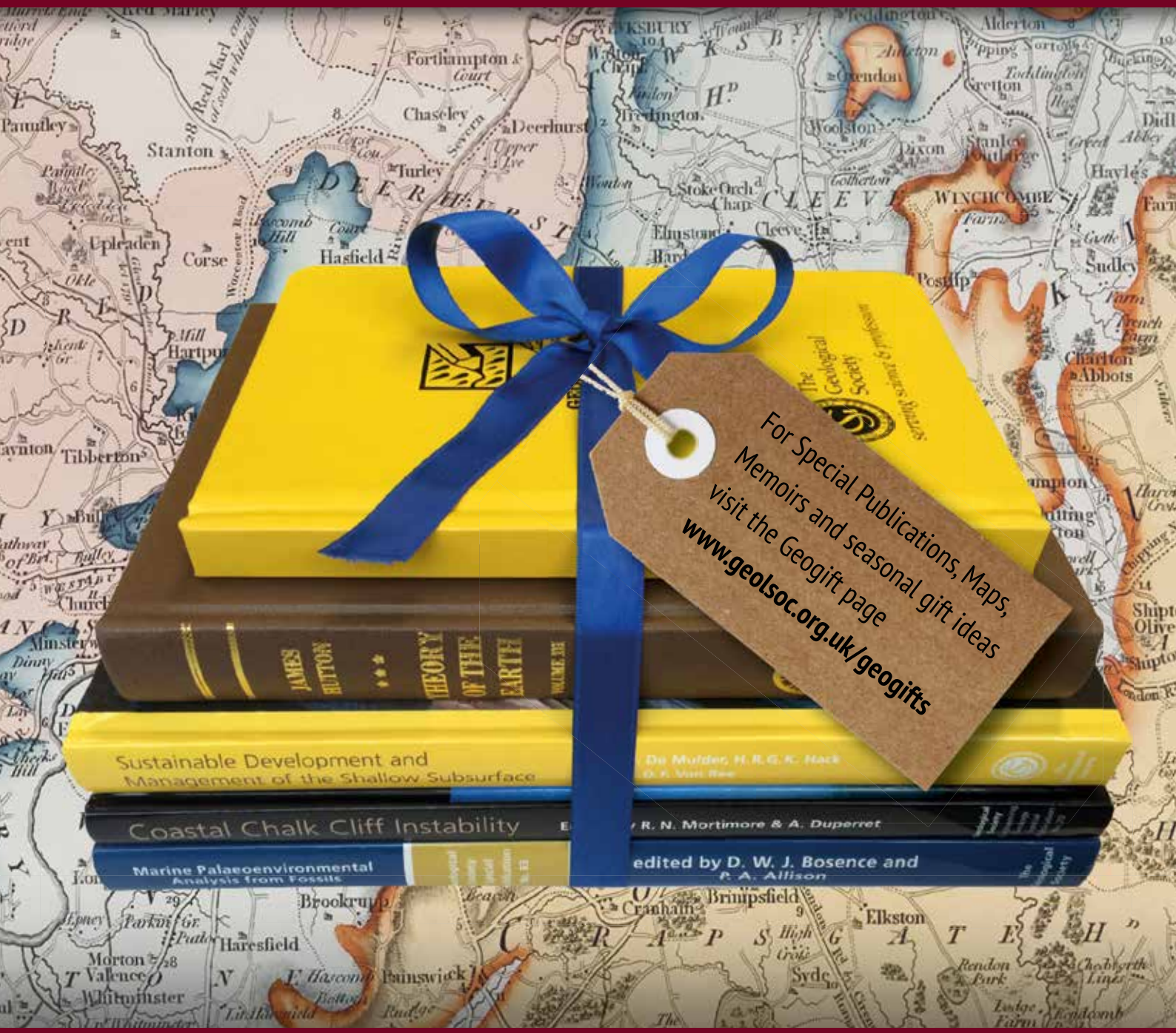

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