



Down to Earth

Issue 131 May 2025 • ISSN 0969-3408



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With the white buildings of Torquay in the background, this is the near vertical Devonian strata in the cliff. This location is known as London Bridge and will be seen on a boat cruise around the bay. (Image: Chris Darmon)

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We welcome your contributions, which should be with us no later
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cover story

Fine sedimentary structures in the calcareous sandstones of Western Arran, in the newly designated Global UNESCO Geopark. This is the famous Kings Caves section.

These Triassic rocks now form an excellent raised beach feature to the north of Blackwaterfoot.

(Image: Chris Darmon)



editorial

Earth science challenges for challenging times...

The first few months of Donald J Trump's second term as President of the United States had certainly been something of a roller coaster. At times it seems like announcements and new Presidential Orders were being signed by the hour. We've seen trade tariffs be announced only to be amended or even rescinded in days. Some of the changes that have come about challenge the world order that has existed for decades.

What has all this to be with Earth science, I hear you say? Well, in the middle of last year a paper was published which announced that continental and not ocean crust floored much of the Davis Strait between Canada and Greenland. At the same time, there have been fundamental challenges to the long held views about the evolution of the North Atlantic Ocean.

Rather than the ocean beginning to open some sixty plus million years ago, it now seems that our Hebridean Igneous Complex spewed out vast quantities of basaltic lava over what was, and still largely is, continental crust. Only in the much more recent past and centred on Iceland may the single plate of North America and Eurasia be beginning to break apart.

If true, then this is a very different narrative to the one that mainstream Earth scientists have been pedalling for the past fifty or more years. If true, it increases the area of continental crust quite considerably. More fundamentally it challenges the very foundations of plate tectonics. If the North Atlantic hasn't been spreading at 2cm per year how do we explain the apparent destruction of the Pacific Ocean.

Over the years, there have been a number of challenges to plate tectonics theory, some of which go to the very core of the argument which were around when pioneers like Arthur Holmes first came up with them. Physicists have challenged the idea that convective cells are the drivers of plate movement. Likewise mathematicians have also modelled some of the processes and found them wanting.

Whilst some of the more fanciful ideas such as an expanding Earth, something the Russians once held dear, can be dismissed, some of the more broadly based objections cannot be. One British plate tectonics doubter is Robert Maurer who's book "The Rotating Earth and Plate Tectonics" can be recommended.

Robert has an engineering background and could not square the convection cell model as proposed by Hess more than fifty years ago as an explanation for the formation of mountains like the Andes.

Whilst it would be tempting to dismiss a work such as this as being simply the work of one person who just happens to be out of tune with mainstream of scientific thinking. Let's, for a minute or two, look at the evidence. What is clear is that the final word about the evolution of the North Atlantic has not been written. We need to take a breath and rationally take in what's being laid before us. And yes, perhaps we do need to go back to the drawing board and look again at the fundamental principles of how the Earth works.

Chris Darmon, Editor



Myanmar's deadly 7.7 magnitude earthquake of March 28 claims the lives of thousands...

Approaching two months after a massive 7.7 earth struck the country of Myanmar and we still have little idea of the true death toll. Estimates vary wildly, but few think that it's less than 10,000 despite the most recent official figure being 3,300. Many more bodies are yet to be recovered from beneath countless collapsed buildings in the second city of Mandalay and the surrounding areas.

The actions of the military forces in the war torn country have played greatly into what has happened post the earthquake. Aid has been concentrated on areas controlled by the military junta, who have even been accused of continuing to bomb areas that have suffered earthquake destruction. Meanwhile the UN is still calling for urgent support from countries around the world. It was one of the first tests of US aid now that President Trump has taken office. Gone was the mass US aid effort that has characterised such disaster scenes in the recent past.

This comes from the USGS's website:

"On March 28, 2025, at approximately 12:50 p.m. local time, a powerful magnitude 7.7 earthquake struck near Mandalay, Burma's (Myanmar's) second-largest city, home to 1.2 million people. The shallow depth of the quake, about 10 kilometers (6.2 miles), resulted

in intense shaking that devastated the region and was felt as far away as Bangkok, Thailand.

This region has experienced similar large earthquakes in the past, with six other magnitude 7 and larger earthquakes occurring within about 250 kilometers (160 miles) of the March 28 event since 1900. The most recent of these was a magnitude 7.0 earthquake in January 1990, which caused significant damage and fatalities.



Utter destruction in Mandalay (Image: Al Jazeera)

The devastation in this event is a sobering reminder that large earthquakes in populated regions can result in catastrophe. One of the most effective ways to reduce risk and inform response and recovery efforts is through timely data and resources that characterize event details and impacts. The U.S. Geological Survey (USGS) plays a pivotal role in providing critical earthquake data to the global community through a suite of advanced tools and resources."

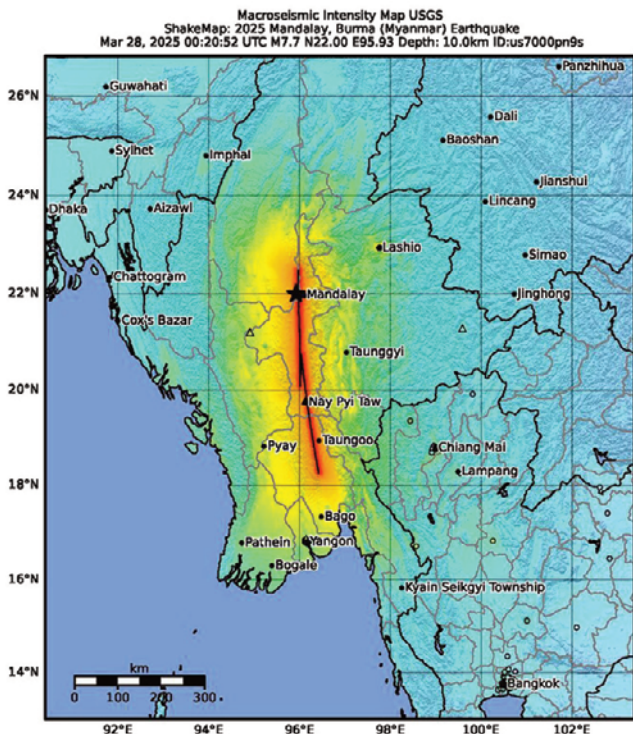
Back in the UK, the media were quick to report the event, but initially concentrated on tectonic plates 'bashing into each other', before being informed that it was due to a N-S fault movement, something similar to what happens on the San Andreas fault. In other words a classic strike slip movement, with plates moving against one another. That said, the mainstream media scored well for not only listening to the scientists they consulted, but also faithfully passing on the message.

With an absence of TV coverage from Myanmar itself, due to restrictions placed by the junta, it was perhaps inevitable that coverage would shift to Thailand and particularly the collapse of a partially built skyscraper in Bangkok. The most recent death toll from this collapse is 44 with many more injured.

So what caused the March 28th earthquake? Here's more from USGS:

"The March 28, 2025, M7.7 earthquake near Mandalay, Burma (Myanmar), occurred as the result of strike slip faulting between the India and Eurasia plates. Focal mechanism solutions indicate that slip occurred on either a north-striking, steeply-dipping, right-lateral fault, or a west striking, steeply-dipping, left-lateral fault. The finite fault solution indicates a north striking right-lateral fault. This focal mechanism and finite fault solution are consistent with the earthquake potentially occurring on the right-lateral Sagaing Fault that lies in the fault zone that defines the plate boundary between the Indian and Sunda plates.

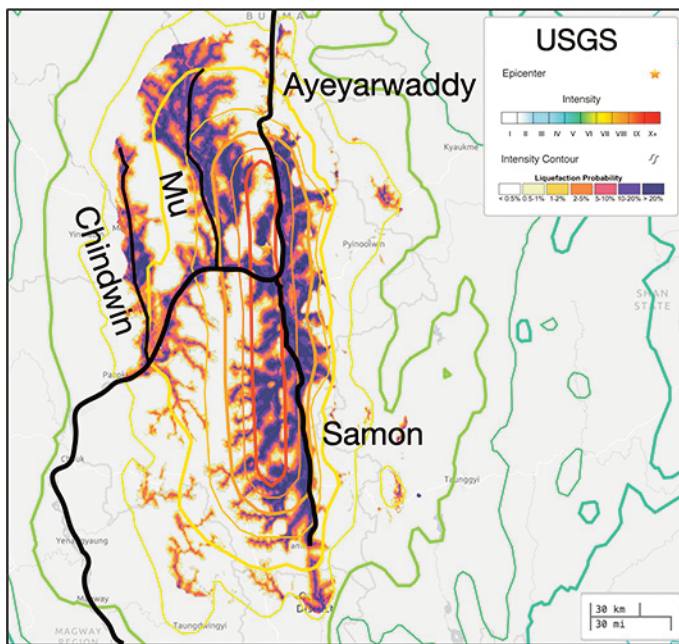
While commonly plotted as points on maps, earthquakes of this size



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very heavy
PGA(%g)	<0.046	0.097	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.021	0.135	1.41	4.65	9.64	20	41.4	85.8	>178
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based on Worden et al. (2012)
 Δ Seismic instrument ○ Reported intensity ★ Epicenter □ Rupture
 Version 17: Processed 2025-04-03T20:21:30Z

The Myanmar March 28th 7.7 magnitude earthquake. The Earthquake intensity map courtesy of USGS



*The tectonic setting of the Myanmar earthquake.
(Image: USGS)*

are more appropriately described as slip over a larger fault area. The finite fault solution, informed by satellite observations, indicates the size of the March 28, 2025 event is about 460 km by 15 km (length x width).

This region has experience similar large strike slip earthquakes, with six other magnitude 7 and larger earthquakes occurring within about 150 miles (250 km) of the March 28, 2025 earthquake since 1900. The most recent of these was a magnitude 7.0 earthquake in January 1990, which caused 32 buildings to fall. A magnitude 7.9 earthquake occurred south of today's earthquake in February 1912. Within this broad zone of tectonic deformation, other large earthquakes, including a magnitude 7.7 earthquake in 1988, have caused dozens of fatalities."

As for the on-going tectonic situation, there continue to be after shocks, one as high as 5.5 on April 16th. This is a highly unstable area where we can expect further major earthquakes to occur. What was unusual about this one was the fact that it affected Bangkok, where such events are particularly rare.

BGS - Making the case for Hydrogen storage in the UK as part of energy transition...

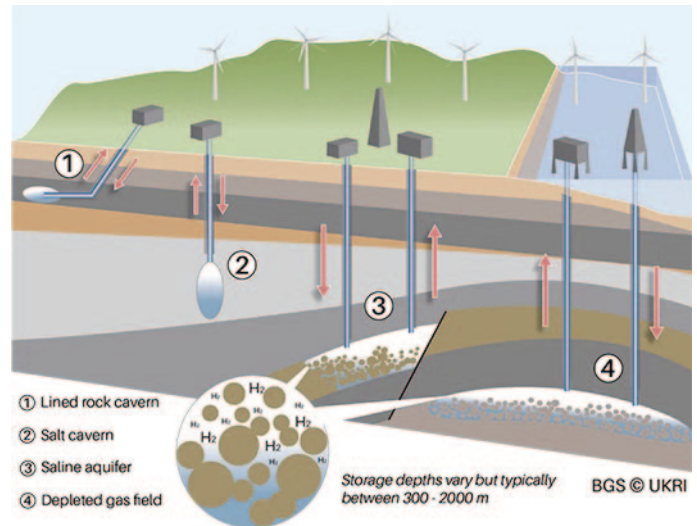
Underground hydrogen storage is a promising solution for large-scale, long-duration energy storage. The UK has such varied geology that there are a number of potential storage sites in a number of different settings. Currently there are a number of knowledge gaps and a briefing note from BGS aims to set out a way forward.

The BGS note entitled: *'Underground hydrogen storage: insights and actions to support the energy transition'*, outlines the current state of play in terms of hydrogen storage research and development, and names underground hydrogen storage as an emerging technology that will be crucial to support the UK's transition to net zero.

Various underground storage technologies, such as salt caverns, lined rock caverns and depleted hydrocarbon fields, provide scalable and long-duration hydrogen storage options. Although they require significant initial investment and specific geological conditions, these

technologies offer the potential for large-scale, long-duration storage capacities.

Currently, the UK energy storage system holds some of the lowest levels of gas storage in Europe, at 12 days average. Estimates for the hydrogen storage required by net zero in 2050 are up to five times greater than the current UK gas storage capacity, but there are still considerable knowledge gaps in how and where such large-scale storage can be achieved.



This image shows four potential methods of storing hydrogen: lined rock caverns; salt caverns; saline aquifers, and depleted gas fields. The inset highlights the storage mechanism in saline aquifers and depleted gas fields, where hydrogen is stored within the rock's pore space. (Image: BGS/NERC)

The briefing note provides key recommendations in order to close these knowledge gaps:

- implement more demonstration projects to build in situ technical capability, address market barriers and promote wider hydrogen adoption
- integrate hydrogen storage into the UK's energy strategy through comprehensive planning and supportive regulatory frameworks
- invest in research and development to rapidly expand knowledge in the hydrogen storage technologies essential for meeting clean energy targets

You can view the full BGS note here:

<https://www.bgs.ac.uk/news/making-the-case-for-underground-hydrogen-storage-in-the-uk/>

How was the Mediterranean sea refilled after a drought 5 million years ago?

For a while now we've known about the Messinian Salinity Crisis, which caused the Mediterranean Sea to dry up and which lasted between 5.97 and 5.33 million years ago. Now a team of scientists from around the world including from our own University of Southampton have found compelling evidence that it was ended suddenly by a megaflood. This ended a period during which the Mediterranean was a vast expanse of salt flats, something which is evidenced from a number of places including the island of Cyprus. The megaflood has been named the Zanclean.

The team have identified a series of geological features around South East Sicily that point to a massive flood taking place across the region.

This comes from the University of Southampton website:

“The Zanclean megaflood was an awe-inspiring natural phenomenon, with discharge rates and flow velocities dwarfing any other known floods in Earth’s history,” said Dr. Aaron Micallef, lead author of the study and researcher at the Monterey Bay Aquarium Research Institute in California. “Our research provides the most compelling evidence yet of this extraordinary event.”

During the Messinian Salinity Crisis, the Mediterranean Sea became isolated from the Atlantic Ocean and evaporated, leading to vast salt deposits which reshaped the region’s landscape. For years, scientists had thought that this dry period ended gradually, with the Mediterranean refilling over a period of 10,000 years. But this idea was challenged by the discovery of an erosion channel stretching from the Gulf of Cadiz to the Alboran Sea in 2009. The finding pointed to a single, massive flooding event, lasting between two and 16 years, which became known as the Zanclean megaflood.

Estimates suggest the megaflood had a discharge from 68 to 100 Sverdrups (Sv), with one Sv equal to one million cubic metres per second. The new research published in the journal ***Communications Earth & Environment*** combines newly discovered geological features with geophysical data and numerical modelling to provide the most comprehensive picture yet of the megaflood.



Aerial photo of a ridge eroded by the megaflood located north-east of Masseria del Volpe, south-east Sicily.

(Image: Kevin Sciberras and Neil Petroni)

The researchers investigated over 300 asymmetric, streamlined ridges in a corridor across the Sicily Sill - a submerged land bridge that once separated the western and eastern Mediterranean basins.

“The morphology of these ridges is compatible with erosion by large scale, turbulent water flow with a predominantly north easterly direction,” says Professor Paul Carling, an Emeritus professor in the School of Geography and Environmental Science at the University of Southampton and a co-author of the study. “They reveal the immense power of the Zanclean Megaflood and how it reshaped the landscape, leaving lasting imprints on the geological record.”

By sampling the ridges, the team found they were topped with a layer of rocky debris containing material eroded from the ridge flanks and the surrounding region, indicating it was deposited there quickly and with immense force.

This layer is right at the boundary between the Messinian and Zanclean periods when the megaflood is believed to have occurred. Using seismic reflection data - a kind of geological ultrasound

allowing scientists to see layers of rock and sediment beneath the surface, the researchers discovered a ‘W-shaped channel’ on the continental shelf east of the Sicily Sill.



Team members inspecting an exposed section of lithified sediment deformed by the megaflood.

(Image: Daniel Garcia Castellanos)

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ISOLATED, DESICCATED MEDITERRANEAN



FLOODED MEDITERRANEAN



*The Mediterranean, before and after the Zanclean megaflood.
(Image: Utrecht University)*

This channel, carved into the seabed, connects the ridges to the Noto Canyon - a deep underwater valley located in the eastern Mediterranean.

The shape and location of the channel suggest that it acted like a massive funnel. When the megaflood waters poured over the Sicily Sill, this channel likely carried the water toward the Noto Canyon and into the eastern Mediterranean. "These findings not only shed light on a critical moment in Earth's geological history but also demonstrate the persistence of landforms over five million years," Dr Micallef added. "It opens the door to further research along the Mediterranean margins."

You can read the full article here:

<https://www.southampton.ac.uk/news/2025/01/new-evidence-suggests-megaflood-refilled-the-mediterranean-sea-five-million-years-ago.page>

A fossil called Sue...



*The brand new fossil Keurbos susanae is an inside out organism.
(Image: University of Leicester)*

A new species of fossil from 444 million years ago that has perfectly preserved insides has been affectionately named 'Sue' after its discoverer's mum. The result of 25 years of work by a University of Leicester palaeontologist and published in the journal *Palaeontology*. The study details a new species of multisegmented fossil and is now officially named as *Keurbos susanae*, after the palaeontologist's mum.

Lead author Professor Sarah Gabbott from the School of Geography, Geology and the Environment at the University of Leicester said:

"'Sue' is an inside-out, legless, headless wonder. Remarkably her insides are a mineralised time-capsule: muscles, sinews, tendons and even guts all preserved in unimaginable detail. And yet her durable carapace, legs and head are missing – lost to decay over 440 million years ago. We are now sure she was a primitive marine arthropod but her precise evolutionary relationships remain frustratingly elusive."

The fossil was found in the Soom Shale, a band of silts and clays at a location 250 miles north of Cape Town in South Africa. It seems that the marine basin in which 'Sue' swam was somehow protected from the worst of the glacial conditions of the time and a fascinating community of animals, including 'Sue', took refuge there..

You can read the full account here:

<https://le.ac.uk/news/2025/march/new-species-inside-out-fossil-named-after-mum>

An unusual present idea - limited edition...

'The Cream of the Crop 2024'

As part of their work for Geo Supplies, your editorial team, Chris Darmon and Colin Schofield go to some very interesting places around the British Isles. Whilst they are in these places they often pick up rock specimens, most of which go to students and institutions both here and even around the world.

However there are also some rare or unusual rocks that don't form part of our regular stock and it is these that we've gathered together into a limited edition collection that we are offering as our 'Cream of the Crop 2024'.

The set comprises 12 carefully chosen specimens from the British Isles and Norway: carbonatite, Larvikite, phonolite, borolanite, picrite, 'oyster rock', teschenite, Ledmore marble, Aberfoyle slate, orthoquartzite, Torridonian breccia and micro-granodiorite. Each set comes boxed with notes and costs £49.95 including postage. The set is available and ready to be shipped NOW!

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The Anthropocene: Epoch, Episode or Process?

The geological timescale has evolved over a long period, beginning in the 1830s with the likes of Adam Sedgwick and Roderick Murchison. The most recent significant alteration, or addition to the column, was the insertion of the Ediacaran at the end of the Precambrian.

In recent years some have called for a new period of time that reflects the influence of humans to be called the Anthropocene. In this article, Tony Elger sets out the main arguments, for and against such a period of time...

In March 2024 the International Union of Geological Sciences (IUGS) rejected a detailed proposal to demarcate a new Epoch of geological time, the Anthropocene, to replace the most recent part of the existing, formally ratified, Epoch, the Holocene. This currently covers the period from the end of the last ice age (11,700 before present) to now. But what were the issues at stake in this controversy and has this decision ended the debate?

The original proposal to identify a new Anthropocene Epoch, to recognize the major impact of humans on contemporary earth science processes, is usually dated from an intervention by Paul Crutzen (1933-2021), a Dutch atmospheric chemist, Nobel laureate and 'public intellectual'. At a 2000 International Geosphere-Biosphere Conference, he collaborated with other earth system and climate scientists, like Eugene Stoermer (1934-2021), and precursors included earlier geologists, such as Vladimir Vernadsky (1863-1945), to bring forward such a proposal.

There is widespread recognition of the human impact on contemporary geological and earth system processes. Such anthropogenic features include buildings, roads, slag heaps, rubbish dumps and similar 'technofossils', as well as managed waterways, agricultural improvements, greenhouse gases and climate change, with their distinctive impacts on weather, icecaps and sea levels. The role of these features has been underlined by characterizing 'buildings as part of the rock cycle', and 'concrete as a new type of rock'. Indeed humans have been characterized as 'the ultimate system engineers' with a growing capacity for 'niche construction'.

However, Crutzen emphasized the dramatic, systemic and cumulative nature of such developments during the later Holocene. This justified designating a new Epoch because of significant climatic and geological discontinuities between the Pleistocene, the Holocene ('an island of climate stability') and the proposed Anthropocene. These changes 'transgressed the established boundaries of natural variability' and included the apparent reversal of an earlier trend towards global cooling. This argument was later reinforced by statistical documentation of the increasing rate of many earth system changes which became characterized as 'the great acceleration'.

There are, however, disciplinary protocols for translating geological features into demarcations between Epochs (or other geological intervals), which involve the delineation of an agreed boundary marking the start of each interval and identification and official IUGS ratification of a specific exemplar as a definitive Global Boundary Stratotype Section and Point (GSSP or 'golden spike'). Key criteria for such GSSPs are: major changes in stratigraphy and/or fossils; a clear and distinctive lower boundary (marked by a characteristic fossil or chemical signature); location within broader sections above and below for stratigraphic context; and synchronous occurrence across multiple sites around the earth. Considerable competition and controversy may surround the appropriate assignment of GSSPs but proposals are



Twentieth century ichnofossils at East Tilbury on the Thames Estuary.

adjudicated by a hierarchy of formal geological committees under the auspices of the IUGS.

After 2000 the Anthropocene rapidly became 'by far the dominant term to describe recent human impacts' on earth and geological systems, with numerous scientific papers, several new journals and an interdisciplinary reach. Among geologists and earth system scientists there were both proponents and critics of the proposal for a new Epoch, and controversy ranged particularly across the following topics: the overall scale and impact of anthropogenic change; the sequence of human innovations involved and their relative significance; the extent to which they were synchronous across the globe; and the extent of appropriate markers in the rock record.

Advocates of the Anthropocene agreed that this new Epoch involved a rupture from earlier Holocene conditions but disagreed about which human interventions drove this rupture, and where and when. Proposals included the extinction of the megafauna between 50,000 and 10,000 years ago; the origins or extension of farming between 11,000 and 8,000 years ago; rice production from 6,500 years ago onwards; the production of anthropogenic soils between 3,000 and 500 years ago; and the industrial revolution from 1760 to the present. However, all these important processes were characterized by regionally uneven and temporally staggered implementation, thus violating the pivotal requirement of synchronicity in defining the bases of epochs, a criterion that excludes large processes and impacts if they cumulate gradually over deep time (e.g. the Great Oxygenation Event).



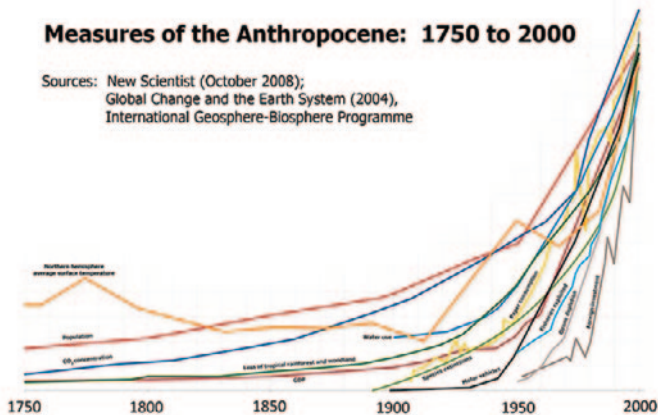
Paul J Crutzen
(Image: Courtesy of Wikipedia)

But three candidate processes had a more synchronous signature: the mixing of old and new world gene pools between the sixteenth and eighteenth centuries, involving a modest dip in carbon dioxide concentrations; residues from nuclear weapon testing and use since 1945; and industrial chemical pollution since 1950. In turn this focus on synchronicity gave a distinctive twist to the arguments about an Anthropocene Epoch: while broader debates continued about geological and earth system discontinuities and climate change, much of the technical discussion of potential GSSPs became narrowly focused on late twentieth century developments.

This focus on recent changes paradoxically reinforced a major theme among critics of the proposed Anthropocene Epoch, namely the relative brevity of the time during which distinctive geological processes have been played out. For many sceptics a deep time perspective registers human civilization as a blip rather than a geological epoch. This leaves little geological time for new stratigraphic features to form and will make it difficult to judge the temporary or permanent character of current developments until long into the future.

Measures of the Anthropocene: 1750 to 2000

Sources: New Scientist (October 2008);
Global Change and the Earth System (2004),
International Geosphere-Biosphere Programme



From 2009 much discussion of the pros and cons of identifying a new Anthropocene Epoch took place within the Anthropocene Working Group (AWG), a Task Group of the Sub-commission on Quaternary Stratigraphy (SQS). Long chaired by Jan Zalasiewicz, this involved over 30 active participants, primarily geologists and earth scientists but some from other disciplines. Their prolonged deliberations eventually resulted in a majority proposal to endorse an Anthropocene

Epoch and identified a potential GSSP in radio-nucleotide marked sedimentary deposits at Crawford Lake, Ontario. Controversy continued, however, and culminated in the decisive rejection of the AWG proposal in March 2024. The IUGS ruled rather tartly that the (lower case) anthropocene ‘will not be recognized as a formal geological term but will more usefully be employed informally in future discussions of the anthropogenic impacts on Earth’s climate and environmental systems’. The rules of the SQS and IUGS leave little scope for early revision of this conclusion, especially given the protracted debate and marshalling of evidence by both proposers and critics over recent years, and this decision must stand for at least a decade.

But this does not detract from the extensive evidence for the substantial and growing influence of human activities on the Earth, seen as a complex, dynamic but increasingly unstable, even crisis ridden, ‘system’. Such features as the long-term accumulation of anthropogenic effects; their destabilizing impact on the climate; their usually diachronic character (evidently more a ‘feature’ of human activity than a ‘bug’); and their recent ‘great acceleration’, remain important in characterizing contemporary geological and earth system processes. A key attraction of Crutzen’s original proposal was its focus on the implications of changing human activities for climate change, ocean acidification and related crises which represented immediate and growing challenges to humanity, and it is important to recognize that the IUGS decision does not foreclose research on such developments though it rejects a specifically geochronological basis for such analyses.

One emollient response to these arguments (mentioned by IUGS) is to treat the anthropocene as an ‘event’ rather than an epoch, analogous with the ‘Cambrian Explosion’ or the ‘Great Ordovician Biodiversification Event’, which were likewise diachronic and complex in character. This conception of an ‘event’ sits awkwardly with ordinary OED usage, where ‘event’ implies a single occurrence. But it nevertheless opens the way to distinctions between various diachronous geological and earth system processes, anthropogenic and otherwise, and comparisons have already been made between Systemic Events; Non-Systemic Events; State Shifting Episodes; and Reversible Episodes! Such distinctions may eventually illuminate the scope and limits of contemporary anthropogenic impacts on earth system processes, not least those associated with escalating crises and threatened tipping points, thus helping guide interventions which might limit or mitigate those crises.



Crawford Lake Ontario, has been nominated as the global example of the beginning of the Anthropocene, the epoch when humans began irrevocably shaping the planet’s fate.

Debate on these issues predated the IUGS decision and will continue, even shorn of a geochronological base-line. One arena of debate has concerned possible technical fixes in response to current challenges. Such fixes may facilitate the management of pollution, sea-level rise, accelerated extinctions or climate change, but they rarely resolve what have been called ‘wicked’ (intractable, divisive) challenges. For example Crutzen advocated the use of sulphate aerosols to minimize global warming by deflecting sunlight, but critics highlighted potentially catastrophic side effects. Similarly plans for carbon capture and storage focus geological expertise on the capacities and vulnerabilities of existing and potential carbon stores, but critics emphasize that CCS is no substitute for controls over carbon generation itself.

This directs our attention to the wider social and political conditions which influence policy formation, from the powers and priorities of states and corporations to the attitudes and actions of local communities and social movements. This has prompted another criticism of the idea of the Anthropocene, which emphasizes how various human communities have been implicated in the causes and the consequences of climate change in markedly different ways. Consider early versus late industrializing countries; the differential impact on rich and poor individuals and nations; and the vulnerabilities of small island states and seaboard communities

Such comparisons also suggest that the obstacles to resolving such crises, including failures to secure meaningful international co-operation and regulation, may better be characterized in terms of the social relations of capitalism, colonialism or bureaucracy than in terms of the failings of humanity at large. This leads into a much bigger political argument about securing a habitable planet involving a good, or at least better, anthropocene. Such an orientation challenges climate complacency but also climate fatalism, and regards humanity's response as 'a work in progress' with varied and contested potential trajectories and outcomes.

Sources

This summary draws particularly on Erle C. Ellis (2018) Anthropocene: A Very Short Introduction OUP; International Union of Geological Sciences Statement (20/3/2024) 'The Anthropocene' www.iugs.org/pp2; and Jan Zalasiewicz et al (2017) 'Making the case for a formal Anthropocene Epoch: an analysis of ongoing critiques' Newsletters on Stratigraphy 50.2 205-226.

A little extra context to the complex arguments presented here comes from this; Erle Ellis's letter of resignation from the Anthropocene Working Group in July 2023 which underlines some of the arguments in play:

"To define the Anthropocene as a shallow band of sediment in a single lake is an esoteric academic matter. But dividing Earth's human transformation into two parts, pre- and post-1950, does real damage by denying the deeper history and the ultimate causes of Earth's unfolding social-environmental crisis.

Are the planetary changes wrought by industrial and colonial nations before 1950 not significant enough to transform the planet? The political ramifications of such a misleading and scientifically inaccurate portrayal are clearly profound and regressive."

The Editor comments: Thanks Tonmy for taking on this very complex topic. As you can see it's not as easy as you might think to make such an alternation to the geological time column and neither should it be. One thing for ure is that latest decision by the IUGS will not be the last word on the subject - watch this space!



rockstars

Another famous rock...

Tiree marble



Tiree is a small island offshore from the Isle of Mull and next to the island of Coll. Both islands are composed of ancient Lewisian Gneiss. I've visited Tiree only once, but Down to Earth reader Sid Lines has visited the quarry where this famous pink marble is sourced.

This comes from the website Canmore, which is part of Historic Environment Scotland:

This small quarry is situated at the foot of Balephetrish Hill, about 75 m SE of the steading of Balephetrish farm. A vein of pink marble which outcrops at this point has been quarried from an area measuring approximately 17.5 m in length from W to E by about 14.5 m in

Author: Chris Darmon

width. The worked E face is about 3.5 m in height, and impressions on the rock face indicate that blocks varying in length from 0.9 m to 2.1 m have been extracted from the quarry. The lower level of the S face bears a series of wedge-marks spaced at 0.9 m centres.

The occurrence of marble on Tiree was first recorded in 1764 by Dr John Walker, and thereafter blocks of marble were quarried at Balephetrish and transported to Edinburgh and Inveraray, some of it being fashioned for ornamental use. In 1789 Rudolf Erich Raspe, a Swiss geologist, prepared a report on the quarry for the 5th Duke of Argyll, and by 1791 marble-quarrying activities had been formally incorporated in a commercial company to which Raspe acted as principal adviser. The company was beset by problems of transport and finance, and ceased operations after only three years.

A later visitor to the abandoned workings censured the methods of quarrying employed by this company, and suggested that the quarry had been 'managed apparently by workmen ignorant of the use of the feather wedge or other modes of raising unstratified rocks. About half of it seems to remain untouched; but much even of that is split by the mines used in detaching the blocks which have been quarried'. Large blocks of marble were still lying at the quarry in 1843."

The pioneer Scottish Geologist John Macculloch says that the Tiree flesh-coloured marble:

'resembles the greater number of the primary limestones found in gneiss and mica-slate, and may be considered as a large nodule ... The nodule of limestone ... appears to be an irregular mass of about 100 feet in diameter, and is surrounded on all sides by gneiss.' [The marble] 'occasionally contains imbedded lumps of granite or gneiss, similar to those which occur in the limestone of Glen Tilt. These are always visible at the surface, from their superior power of resisting the action of the atmosphere.'

Today small pieces of the marble are used to make jewellery where it commands a good price.

Schist: the supreme foliated rock

I've long been of the view that metamorphic rocks are the most fascinating. Each one has a story to tell, not just of what it is now, but of what it was before.

In this article, Paddy steps into the world of metamorphic as he considers the rocks schist.

Over to you, Paddy...

'Clearly the tectonic history of such a rock [schist] is a complex one.'

Professor J. F. Kirkaldy D.Sc. (1963).

The rock called schist

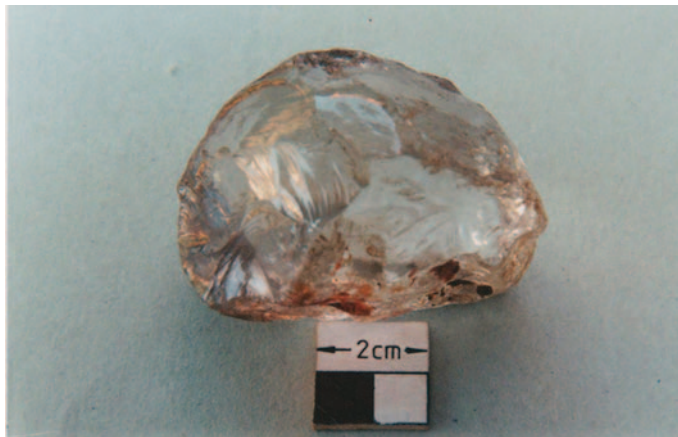


A sample of schist from the Mullet Peninsula, Co. Mayo, clearly showing its foliated nature.

Schist is characterised by its foliated appearance. That is, it is a layered (metamorphic) rock and can fairly easily be split along its parallel layers. It is a relatively hard rock which, on Moh's Scale of Hardness, is between 4 and 6 (on this scale 1 is soft and 10 is hard) and is medium to coarse grained making the main component minerals visible without using a hand lens.

The minerals, like the flat, flaky, thin mineral mica, are packed tightly together like the leaves of a book. Usually the mica is muscovite – a shiny, transparent mineral, which can often be prised-off using a finger nail. (Muscovite resembles the 'frost' of Christmas decorations.) Some of the main minerals in schists are: mica, feldspar, quartz, talc and the spotty mineral garnet and the rock is named after the predominant mineral; for instance mica schist, quartz schist, garnet schist, talc schist etc.

But the mineral composition of schist rocks is quite variable depending on the type of parent rock (called 'protolith') and the degree of metamorphism i.e. intense heat and pressure or low/moderate heat and pressure. Mica schist is the most common schist. These rocks can have different colours depending on the type of minerals present. Quartz in schist can contribute to its hardness while talc would produce a soapy feel to the rock.



A sample of the hard, vitreous (glassy) mineral quartz.



Flakes of the shiny mineral muscovite.

The origin of this rock's name

The name schist is derived from a Greek word 'schizein' which means 'to split'. It is thus called because this rock splits easily along its parallel planes. This rock has been known for millennia and the ancient Greeks and ancient Romans used it as a decorative stone and for building purposes.

How schists form

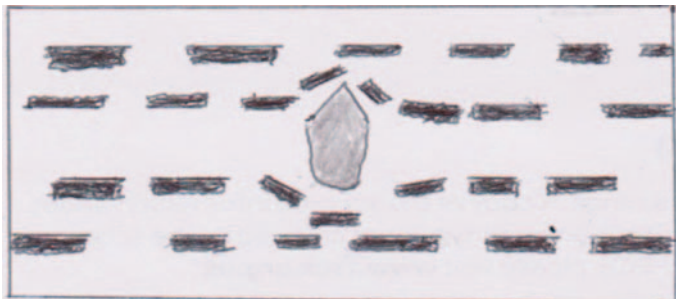
These rocks form by a process called metamorphism, that is recrystallisation of the original minerals, by the action of heat and pressure. The source of the heat can be igneous intrusions, or by tectonic activity involving the collision of plates gives rise to high pressures and temperatures resulting from deep burial in the crust.

Intensity of the metamorphism can be high-grade – high pressure and high temperature – but it can also be low-grade – low temperature and pressure. It is the pressure that gives rise to the parallel alignment of the mica minerals, which are described as 'wrapping around' other constituent minerals like quartz or garnet.

Schists largely form deep in the Earth's crust where high pressure is prevalent and these rocks can take millions of years to form. The

protoliths are sedimentary rocks like shales and mudstones and, occasionally, igneous and low-grade metamorphic rocks. (An example of a low-grade metamorphic rock would be slate.) Geologists studying schists can determine whether the metamorphism was high-grade or low-grade by identifying the component minerals; for instance if garnet was present it would have been high-grade whereas the presence of talc would indicate low-grade metamorphism.

In all things metamorphic its' important to remember the 'golden rules'. Metamorphic processes do not involve melting of the rock and they don't change the basic chemistry of the original rock in an appreciable way. So a limestone will always become a marble no matter what the grade of metamorphism. Clay rich rocks such as shales, give us the best chance of making rocks like schists.



*Diagram showing mica 'wrapping around' quartz.
(Mica is metamorphosed clay minerals.)*

Some of the main places world-wide where schist occurs

1 Appalachian Mountains, U.S.A.

This region underwent significant tectonic activity millions of years ago resulting in the formation of schists and other metamorphic rocks.

2 Scandinavian Mountains, Europe.

These mountains are in Norway, Sweden and Finland and have vast areas of schist due to Caledonian mountain building. This took place around 400 million years ago.

3 S. Alps, New Zealand.

There are extensive schist formations on New Zealand's south island due to the collision of the Pacific and Australian tectonic plates.



*The Haast schist of New Zealand showing the typical micaceous appearance.
(Image: Wikipedia)*

4 Highlands of Scotland.

Here schist formed due to the collision of continents. The best examples come from the Moine and Dalradian formations.

5 Western Alps, Europe.

These mountains run through France, Switzerland and Italy where large areas of schist and other metamorphic rocks occur due to tectonic activity.

6 Himalayas, Asia.

The collision of the Indian and Eurasian plates resulted in the formation of schists and other metamorphic rocks. Here reside the highest mountain range in the world.

7 Andes, S. America.

Significant schist and other metamorphic formations occur here, in the longest mountain range in the world, due to tectonic activity.

Caution in the use of schist for aggregate

One of the main uses of schist is for aggregate in concrete and, to a lesser extent, in mortar. The mica in schist can absorb moisture in the spaces between the mica layers and this can ultimately result in structural damage like fissures in the buildings which are built of concrete blocks that use crushed mica schist as aggregate. In very cold weather the moisture converts to frost which results in expansion and when it thaws damage to the masonry ensues.

This was considered to be the cause of much structural damage to properties in Donegal, which used crushed mica schist in the aggregate sourced from local schist quarries in that county. This was thought to be the main cause of the building problems until further research discovered that this schist also contained the metamorphic mineral phyllite and this is a sulphur-bearing mineral – the sulphur mainly in the form of iron pyrites (Fe S₂). When exposed to moisture, this can oxidise to sulphuric acid, resulting in major damage to the concrete blocks. To eliminate such outcomes, alternatives to mica schist like basalt or quartzite could be employed as aggregate for construction materials.

The rock pelite



A sample of pelite from Donegal.

Pelite is a metamorphic rock very like schist in that it has a schistose structure, and is shiny in appearance, but is finer grained. In fact any metamorphic rock with a schistose structure, like pelite, could be called a schist. Schist rocks are easily recognisable, even by novice amateurs, because of their layering and they formed millions of years before the dinosaurs, or indeed any reptiles, walked on Earth.

In general the term pelite and another term psammite will turn up in older books to refer to metamorphosed shales and sandstone respectively.



The Ukrainian rare Earth minerals hoax

On Monday March 17th, we ran two live Zoom sessions where we presented the geology and mineral resources of Ukraine to an audience of some 50 people.

This was in the light of considerable global interest in the subject, generated as a result of some of the pronouncements of US President Donald Trump, proposing a deal to acquire a stake in Ukraine's mineral resources.

In our investigations for those Zoom sessions we found out that a lot of what was being said didn't stack up...

In order to present the Zoom Chris & Colin carried out significant online research. We watched a number of YouTube videos, listened to a number of experts and read many documents about the subject. To start with Ukraine has a very long geological history, stretching back to the Archaean some 3.8 billion years ago.

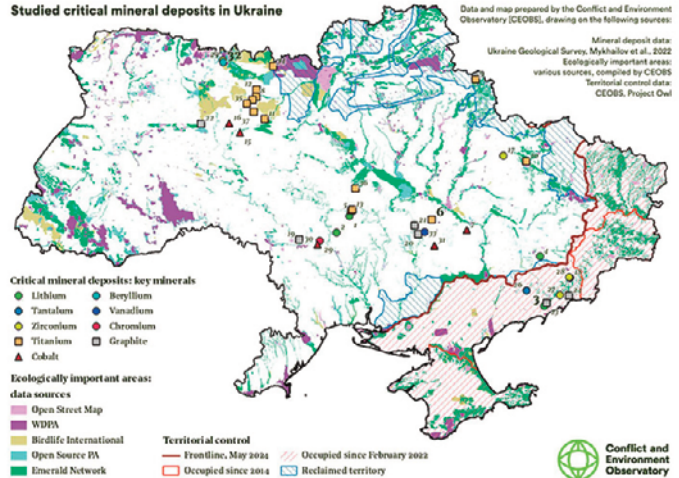
Called the Ukrainian Shield, these basement rocks are overlain by lots of sedimentary rocks that span all the periods of the Phanerozoic. Tectonically, the most interesting area is the Dneiper-Donetsk basin zone which lies across the northern part of the country and particularly in the northeast, the very area where the fiercest battles between the Russians and Ukrainians have been taking place.

Within the Ukrainian Shield there are large deposits of banded iron formation deposits, which were used, along with some of the coal deposits to make steel in the now destroyed plant at Mariupol. It's hard to see how Ukraine will once again ever become a big steel manufacturer. As for the coal deposits, they are considered to be dangerous and are virtually non-operational.



A Ukrainian quarry deploying Soviet era plant, which is common across the country. (Image: Odessa Journal)

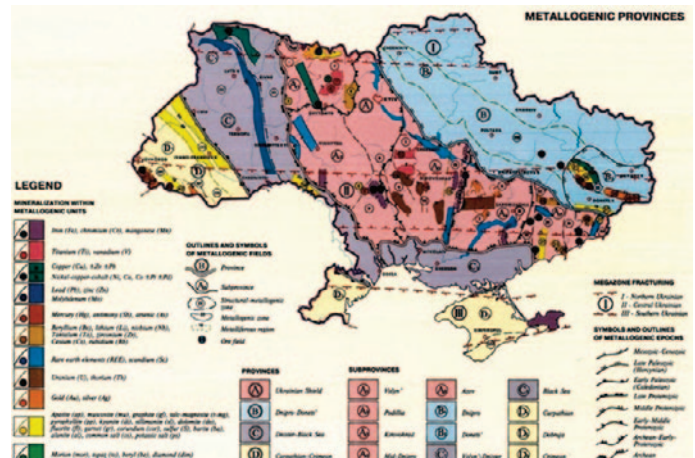
In any assessment of Ukraine's mineral resources, you have to take into account some basic facts. Firstly, what constitutes a 'mineral resource'? The answer is that it's a material that can be worked at a profit, which isn't happening in many places in Ukraine right now. So we are dealing with materials which we might describe as 'potential resources'.



A map of the critical minerals of Ukraine. Remember however that this is largely based on old exploration data and these are largely unproven. (Image: Conflict and Environment Observatory)

In order to realistically assess the potential mineral resources we need up to date survey data and for much of Ukraine this is not available. Before the war, Shell were carrying out some work on a gas deposit in the Dneiper area, but for much of the rest we are dependent upon Soviet era data from many years ago. The same goes for many of the existing mining operations.

There's a graphite mine, at Zavalievsky, operated by Volt Resources that's been operational since 1934. It's desperate for US (or anybody else) to invest in it. A glance at the plant shows that it's hardly moved forward over the past many years.



A metallogenic map for Ukraine. What REEs exist are likely to be found in the tailings of some of the old mines, none of which is working today. (Image: NATO Energy Security)

The same goes for the lithium mine near Zaporizhzhya which was recently seized by Russian forces. It falls within a larger area around Donetsk where there is thought to be significant amounts of the metal. Before any modern extraction could take place on the site it would take a considerable amount of time and a huge financial investment.



Volt Resources has a graphite pit at Zavallevsky but how much is being produced is not known.

But what about the rare earth elements (REEs)? To listen to President Trump you would be forgiven for thinking that Ukraine had lots of them, but this isn't true. According to Jack Lifton, the Co-Chairman of the US based Critical Minerals Institute, the only REE's in Ukraine are, like ours, to be found in the tailings of former metal mines. He says there are no primary REE deposits in Ukraine.

In a 9-minute Youtube presentation, Jack Lifton examines the case for commercial REE mining operation in Ukraine and finds there to be no case whatsoever. He also examines the geo-political case and even that he finds to be completely removed from reality. He actually accuses his own government as being clueless when it comes to the subject. In a telling remark he says that there's been no contact between his organisation and the US Government on the subject, which I found extraordinary.

As to where the US might get its REEs from he points to their own mine in California and the almost limitless supplies that can be won

from primary REE deposits across the northern border in Canada. Not only are these proven to exist, in some cases they are already in operation. Jack Lifton puts the prospect of mining REEs in Ukraine alongside similar fantasy projects in Greenland, Mars and mining the asteroids.

At the end of all this what can we conclude? There's lots of expert analysis that points to the nonsense of Ukrainian critical minerals and REEs being at the heart of this conflict, whatever Donald J Trump may tell us. You have to conclude that he's pursuing this deal for reasons other than we are being told right now.

*You can view the full 9-minute video here:
<https://www.youtube.com/watch?v=Ya9WKaveRXU>*

Postscript

It's now more than a month since our Zoom sessions and not a lot seemed to be happening either with Trump's peace plan for Ukraine or with his much heralded 'minerals deal' until, on April 17th, the signing of "an outline memorandum of understanding." Closer examination of this reveals that it's more about Ukraine's energy infrastructure than its minerals. Meanwhile, back in the US it doesn't seem that the likes of Anglo American are queueing up to begin work on the ground in Ukraine.

Tell us what you think. Is there something the President isn't telling us, or is it all a fiction?

Down to Earth readers welcome!

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- *Our residential field trips are suitable for adults of all levels of interest and geological knowledge.*
- *Our trips are friendly and informal and usually comprise 15-20 people. Overseas trips are usually larger.*
- *We usually make use of comfortable small hotels and guest houses and all meals are included.*
- *You have the services of Chris Darmon and Colin Schofield as field leaders. Both are highly experienced and knowledgeable field geologists.*
- *For some trips we have a hired minibus but on other trips we will use shared cars, or even public transport.*
- *Dates shown in this listing are the start and finish dates.*
- *Where prices are quoted, they are per person in a shared twin/double room.*

If you still have any questions or queries, don't hesitate to email us at: downtoearth@geosupplies.co.uk or tel: 0114 245 5746

Before you book one of our field trips...

We are always pleased to welcome new people along on our trips. So if you are thinking about it, what do you need to know before you 'take the plunge'?

Who are the trips aimed at?

The short answer is that they are not aimed at any particular group of people. Our participants are mainly older retired people who want to keep their minds and bodies active, but younger people are welcome.

Some people have lots of geological field experience whilst others are complete beginners. As one person put it to us "I've forgotten all I once knew and need to come along to hear it again." Our UK trips are all small groups of 15 to 20 people maximum so we can make lots of what we say personal to you.

Will I be able to manage the walking?

We always try to keep walking to a minimum, but, almost by definition, some walking will be involved. If you can't manage a particular walk, just tell us and it will never be a problem for you not to do it. We have one person who really enjoys sketching - she's done some amazing sketches while the rest of us visit a quarry!

How do we get about on trips?

It varies a lot from trip to trip. Sometimes we hire a minibus, on other occasions we use public transport and at other times we'll make use of shared cars. Look at the details for each trip to find out.

What about accommodation?

We always try to use hotels or guest houses that have ensuite rooms as standard. Most of our accommodation will provide breakfast and evening meals, but sometimes we eat in local restaurants. We include the cost of all food, including a packed lunch for each field day.

We prefer to use small family run hotels and guest houses but they are getting harder to find, so sometimes we use larger hotels such as Premier Inns and hotels in the Leisureplex group. Once again, see the individual trip brochures for details.

Are your bookings safe with us?

Yes indeed they are! We've been in the business of running trips a long time and ensure that all the money you pay us is safe in a client trust account until your trip is completed.

It's not too late to book for 2025...

We still have vacancies on the trips which follow for 2025, including single rooms on our Peak District Summer School in August, but hurry up and make your booking!

To make a booking for any of the following trips email us at: downtoearth@geosupplies.co.uk or ring us on: 0114 245 5746

Whilst the brochures are, available to view on our website, booking forms are only available from us. You can then arrange to pay the deposit and we'll send you the booking form.

Western Lake District, June 25-30

£895

The Lake District is renowned for its superb landscape and scenery, but access to the central part is limited and accommodation is very expensive. We have previously stayed at Summergrove Halls in Whitehaven, but this is no longer available to us. Accordingly we've turned to Workington and the comfortable modern Premier Inn.



*Amazing New Red Sandstone cliffs at St Bees.
(Image: St Bees community)*

From Workington we'll be able to access all of the Western Lakes, with trips to see places like Eskdale, Lake Windermere, the iron mines of West Cumbria and St Bees Head.

At the time of writing we still have room for a couple more people in twin/double rooms.



Don't worry, we don't bite!

All our educational classes and courses are friendly, informnd open to all.

Come and join us!

Welcome to our real world!



What is our Summer School?

Our Summer School is modelled on those that used to be run by the Open University a number of years ago. All are based on a campus of one sort or another where we can sleep in largely single, en-suite study bedrooms and enjoy on site meals. They are also more than just field trips with dedicated transport each day. There's an evening programme of talks from local experts and also social events. In short - something for everybody, including those with limited mobility!

Summer School Peak District, August 9-16 £1395

For the first time in the 7-year history of our Summer School weeks we're actually returning to a place that we've visited before. Cliff College in the Peak District of Derbyshire is a well known Methodist theological college. It provides excellent ensuite bedrooms and lovely home cooked food, and makes for an ideal summer school base.



The beautiful grounds of Cliff College (Image: Cliff College)

We'll be sampling lots of the excellent local geology and giving you those added summer school bonuses of evening talks and special visits to places of cultural and historic interest as well as geology.

The South Devon Riviera, Torbay, October 8-15 £1295



Distinctive Red Permian rocks of South Devon

The South Devon Riviera coast has been a holiday destination for more than 150 years and we will be staying in the family run Hotel Balmoral in Torquay. From here we will be exploring the local area that lies within the UNESCO world geopark. This is an area of great coastal scenery, with lots of Devonian sediments, plus some volcanics. As the geology is best seen from the sea, we'll ensure that we have at

least one boat trip out into Torbay to get up close and personal with the cliffs and their fabulous structures. We also hope to take a trip on the Paignton and Kingswear steam railway and combine it with another boat trip on the River Dart at Totnes.

Don't miss out on an Autumn break - come and join us in sunny Torquay!

We're already taking bookings for 2026 trips...

Over the last month or so we've been releasing trips for 2026 as soon as they were ready to go and we've been amazed at how quickly they are filling up! The Iceland trip planned which was postponed until September of next year is nearly full with 20+ people already confirmed and a number of other trips have bookings.

We're excited by what we have in store for you - we hope you agree!

The Jurassic Coast of Dorset, March 27-April 1 £995

Believe it or not, we have not visited the famous Jurassic Coast of Dorset since 2017, so it's high time that we put that right! As on the last occasion, we're basing our trip at the seaside town of Weymouth which is well connected in terms of public transport and also has suitable accommodation for us to use. We're going early in the season so that we can offer you a good value trip, but with the recent pattern of mild winters, we hope that by the end of March it will be reasonably warm.



The magnificent Durdle Door (Image: Visit Dorset)

As for the magnificent geology what can we say? We hope to take in some of the area's 'gems' including Durdle Door, Lulworth Cove and Swanage. It would also be good to call in on Mary Anning's favourite stomping ground of Lyme Regis. We also hope to take in the amazing fossil collection on show at Dorchester Museum.

Get in soon to secure your places on this early 2026 trip!

The Northwest Highlands of Scotland, April 14-22 £1695

Ask Colin and Chris what their favourite trip is and they will answer "the Northwest Highlands". It combines their favourite hotel with



Loch Assynt is but a stone's throw from the Inchnadamph Hotel
(Image: Wikimedia Commons)

their favourite geology and landscape! Accordingly we are once again offering this 8-night gem even though we were last there in 2024. On this trip we pay homage to Britain's oldest rocks in the form of the 3 billion year old Lewisian Gneisses, along with the overlying Torridonian Sandstones and the Cambro-Ordovician sediments. These all came together as a result of the Caledonian Orogeny some 420 million years ago.

In much more recent times, the Ice Ages of the last 2 million years have given us the most beautiful and unspoilt landscape that we can enjoy today.

We already have several bookings for this trip - come and join us!

Central Cornwall, May 1-8

£1595



Old mines and magnificent coasts. (Image: Into Cornwall)

We are visiting the same Cornish Hotel twice this year with American groups and just had to share it with you - hence this trip! We are based at Redruth's Trickys Hotel, in the heart of the former tin mining area. It's an excellent base from which to explore all parts of this amazing county. We'll be taking in the Land's End and Lizard areas, the North Cornish coast around Newquay, Boscastle and Tintagel, along with the china clays of the St Austell area and the granite.

This trip is already proving to be popular!

Teesdale and the North Pennines, May 16-23

£1395

We've been running trips for more than twenty years yet we have

never run a trip to this area! The problem, as is so often the case was the lack of suitable accommodation. That was before we discovered the Teesdale Hotel in Middleton in Teesdale.

On this trip we'll take in some of the magnificent scenery of Teesdale with High Force and Cauldron Snout with fine exposures of the Great Whin Sill as well as getting over into Weardale to see the North Pennine Geopark in all its splendour. See the Carboniferous limestones along with some of the former lead and zinc workings.

This trip is already half full so get in if you want to join us!

Shetland - the North Isles, June 17-25

£1895

Everyone should visit the Shetland Isles at least once in their lives, so says Chris, who's been there around a dozen times over the past 40 years. The best time to visit Shetland is around mid-Summer when it never really gets dark.

We invite you to join us as we take in the North of Mainland and the Northern Isles of Unst, Fetlar and Yell, home to some of the most amazing geology in the entire UK. Visit the Moho in a small quarry in Unst and get yourself a sample of serpentinite to rival any from Cornwall. Why not begin our Shetland adventure with an overnight boat trip from Aberdeen?

We expect this trip to sell well - so book up soon!

Iceland - the North & East Fjords, September 13-22

£2695



The Eastern Fjords are beautiful in any season!
(Image: Chris Darmon)

These days a lot of people go to Iceland, but they very rarely visit the north and east of country. In this trip with our usual guide and driver Ingi, we'll begin at Keflavik near the airport and then travel to Akureyri before working our way clockwise to Myvatn to the volcano Krafla before heading to the beautiful east Fjords.

We'll stop in the amazing geo-village of Borgarfjörður Eystri to see Iceland's most colourful rhyolitic rocks. The last time we were here we did see the Northern Lights in all their glory!

We travel back from Hofn to Keflavik completing our circuit of Iceland. There's an option of an additional night at the end to have a day looking at the most recent volcanic activity on the Reykjanes peninsula and viewing the recent lavas, which will still be hot!

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Richard Fortey - a very British Palaeontologist dies...

It's always sad when we lose someone of the calibre of Richard Fortey, who died on March 7th. aged just 79. I'm proud to say that I got to know Richard more than 20 years ago when he was on the judging panel of what started out as the LASMO Geological Challenge - an annual award made to an individual or group from the geological grassroots who had communicated or presented geology in an outstanding way.

Communication was what Richard Fortey did supremely well. He did it through his many books and also his lectures. I once remarked to some people that I needed a dictionary when reading one of Richard's books not for his geological pronouncements but for his use of rare and unusual words that exist elsewhere in the English language. Richard was, in the truest sense, a wordsmith who went out of his way to incorporate one or more of these words but this was always alongside the amazing and compelling geological story.



Richard Fortey (Image: Wikipedia)

But Richard was far more than just a prolific author, even if that was where so many people came to know him. Books like *Trilobite!* where he turned a humble fossil group into a bestseller or *The Earth: an intimate history*. Richard was a true academic, someone who immersed himself in whatever he was studying at the time. He was a graduate of Kings College Cambridge and the same institute awarded him a PhD and DSc. His professional career was spent at *The Natural History Museum* in London. He was also an accomplished lecturer and presenter, readily adapting his style to an audience of fellow academics or the TV viewing general public.

Above all, Richard was a gentleman and a true friend to many in the geological community. He always found time to encourage a beginner

or a young person to reach their full potential. Richard was more than just a palaeontologist, he was a British palaeontologist and proud to be so.

The Editor comments: After we published the above obituary in *DtoE extra* we received a couple of lovely comments from our readers which can be seen on our Feedback page. If you'd like to share your thoughts on Richard Fortey and how he may have impacted on your life, we'd love to hear from you.

Wales sees big, and expensive, problems with former coal tips...

Those of us who were around in 1966 remember the disaster that was Aberfan. On October 21st of that year, after heavy rain, a former coal tip above the village became unstable and slid down onto the local school, claiming the lives of 116 children and 28 adults.

Ever since that time, Wales has naturally been highly suspicious of such tips and has kept a close eye on them. With recent extreme weather events becoming ever more common there are some in the country who are becoming more worried.

In 2020, again after a bout of heavy rain, some 60 000 tonnes of soil and colliery waste slide down a hillside near the Rhondda village of Tylorstown. Luckily there were no casualties of this even but it could have been a very different story. Another incident occurred last year as a result of Storm Bert, when homes in Cwmtillery, Blaenau Gwent, were damaged and people had to be evacuated.



The Tylorstown slip of 2020 involved an estimated 60 000 tonnes of material. (Image: WalesOnline)

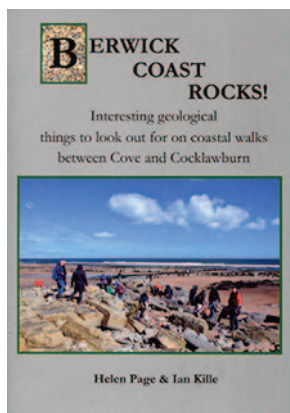
Now the Welsh Government has announced a fund of £34 million which will be used for safety inspections and remedial works across 10 local authorities and a total of 130 sites. The area with the most sites is Rhondda Cynon Taf where £11.5 million has been earmarked.

The Editor comments: As a result of this item appearing in *DtoE extra* in April, we received a response from Andy Lane and a longer article all about the Aberfan disaster will appear in the August edition of *Down to Earth*.

A best selling book gets an expanded second edition - thanks to its readers...

A few years ago the members of Alnwick U3A group set out to tell the story of their local rocks. As a result two books were produced, one covering a stretch of the Northumberland Coast, the other the coast of Berwickshire, mostly in Scotland.

Both books were superb and amongst the very best for people self guiding themselves along the coast and examining the rocks at the sites themselves. They used excellent photographic illustrations that actually showed you what to look for. Both books were reprinted thanks to demand by the readers.

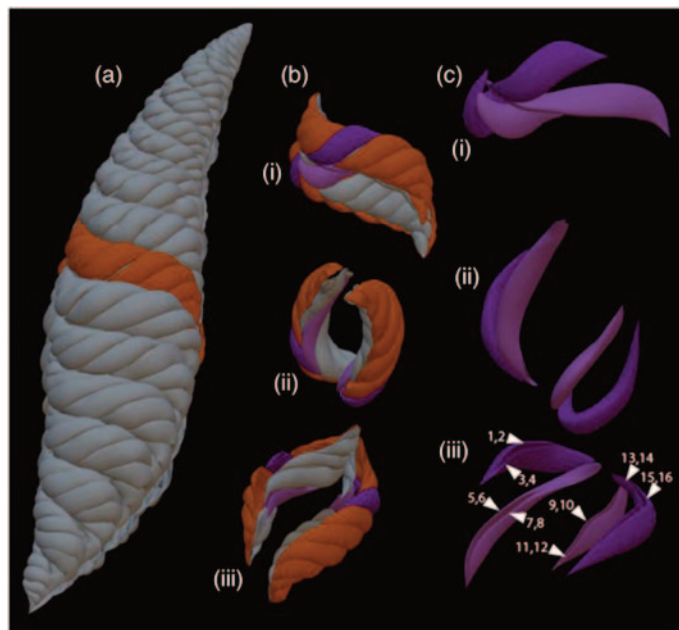


Now the Berwickshire volume has gone to a second and greatly expanded edition that runs to 140 A5 pages. There are sites from Cove in the north to Cocklawburn in the south. This is one book that crosses the border between Scotland and England effortlessly.

Much of the expansion of the second edition has been the addition of more high quality photographs that tell the story better than a thousand words could ever do. More to the point they help everyone understand what's going on and that, after all, is what they want the readers to do!

"Berwick Coast Rocks!" is available from Geosupplies Ltd for £17.00 including postage either via www.geosupplies.co.uk or by ringing us on 0114 245 5746.

A new look at *Charnia masoni*...



Primary-order branch of Charnia masoni reconstructed with secondary- and tertiary-order branches. (a) Primary-order branch with a single secondary-order branch highlighted in orange. (Based on Brazier et al 2012)

Way back in 1958 a 15-year old school boy called Roger Mason found

what was later confirmed as the first Precambrian fossil in a former slate quarry in Woodhouse Eaves in the Leicestershire countryside. The iconic fossil was described by Dr. Trevor Ford of the University of Leicester and named *Charnia masoni* after its finder.

The actual specimen is proudly displayed the New Walks Museum with casts in museums across the globe. But what did the actual living creature look like? D McIlroy of the Department of Earth Sciences at the Memorial University of Newfoundland has recently undertaken some architectural modelling of *Charnia masoni*.

The work has been published in the *Journal of the Geological Society* and is the result of 3D sculpting to reconstruct the body plan. It is based on an analysis of many different specimens from around the world, including from Newfoundland in Canada.

The Editor comments: At last, something that looks like a real animal that could have lived. Thanks for bringing *Charnia* to life for another old Leicestershire fossil!

You can read the full paper here:

<https://pubs.geoscienceworld.org/gsl/jgs/article/182/3/jgs2024-242/651575/Architectural-modelling-of-the-fractal-like>

More airborne geophysical surveys for West Cornwall...

Edinburgh based Bell Geospace has returned to carry more airborne geophysical surveys in West Cornwall that were begun in 2021/2. The data it collected then was sold to Cornish Lithium who are looking to source the metal across the area.



Bell Geospace's survey plane that has been carrying our work in West Cornwall (Image: Thomas Fraszczak)

Bell Geospace said then that the new "Full Tensor Gravity Gradiometry (FTG) data complement the existing Tellus South West airborne magnetic and radiometric data collected in 2013 and 2014 by the British Geological Survey and its partners. Combined, these geophysical datasets will enable a greater understanding of the subsurface in southwest England."

The latest work will build on the work done in 2021/2 and enable them to complete mapping of a new area of West Cornwall. The Basler BT-67 aircraft being used for the survey, which looks similar to a DC3 or Dakota aircraft, has two propeller engines and "a strong track record of reliability", Bell Geospace said. It added: "The survey will involve a plane flying in straight lines at an average height of 200m to collect geophysical information on the properties of rocks below the ground."

"The information being collected creates geological maps. These maps may be used for planning geothermal resources in the area or by domestic mining companies tasked with future-proofing the supply of critical minerals needed to build net-zero economies."

Once again, it seems that they are concentrating on the potential for geothermal energy and resources of lithium. This is of particular interest to Cornish Lithium who are pioneering a process for lithium extraction from hot solutions. The Company has recently been granted planning permission for the UK's first commercial geothermal lithium production facility based in Cornwall.

The Isle of Wight is the island that 'keeps on giving', when it comes to fossils...

These days when we hear of a new fossil discovery on the Isle of Wight, it's more often than not a dinosaur bone, or at least a vertebrate of some sort, but recently it was a stunningly preserved ammonite that was in the news.



This 'stunning' ammonite was found by Jack Wonfor and his 12-year old cousin Amelia. (Image: Jack Wonfor)

The finding of the fossil was covered both by the BBC and the local newspaper *The County Press*.

Jack who just happens to run Wight Coast Fossils and provides guided tours, was surprised to find this handsome specimen in the Upper Greensand formation. Most similar finds come from the Lower Greensand or the Chalk. They found the specimen in rocks at St Catherine's Point in the south of the Island.

Speaking about the find, Jack said: "They are usually also very thin and weak, meaning that they don't often survive the fossilisation process and if they do they usually fall apart when trying to extract the ammonite from the rock. So, I was super happy to have got this back complete."

For the moment Jack is enjoying his fossil before handing it over to the local *Dinosaur Isle Museum* in Sandown.

Just how many 'caves' are there beneath the City of Nottingham?

Yes, we all know about the much embellished legend of Robin Hood and his merry men, oh and not forgetting Maid Marion of course, but what Nottingham does have is lots of 'caves' beneath its streets.

Natural caves, most of them are not, but it was relatively easy for

people of the past hundreds of years to excavate cavernous holes in the soft Sherwood Sandstone of the Triassic.

These red sandstones were formed largely as giant sand dunes in the Triassic deserts of 200 million years ago. The most prominent above ground expression is the Castle Rock on which sits the city's museum and art gallery. But the sandstone is never far away beneath the city centre streets.



Archaeologist Scott Lomax of Nottingham City Council is kept busy investigating some of numerous caverns that keep turning up beneath the city's streets.

(Image: Nottinghamshire Live)

Beneath the former Broadmarsh Shopping Centre are the last remnants of Drury Hill, a street in the former 19th Century slums of Narrow Marsh. Overcrowding led to people living in grotto-like caves. The *City of Caves* attraction on Cliff Road allows visitors to see the basement walls of those slums and tanneries.

So numerous are these caverns that the City Council has engaged an archaeologist to map them and count them. Currently that archaeologist, Scott Lomax is up to a tally of 924 and he's still counting!

"I feel confident that within the next year, we'll be able to say that Nottingham has more than 1,000 caves representing 1,000 years of history," he said.

A recent discovery was made at Sneinton during building renovations at a pub. Scott said "They reflect so much of the history of the city, from its medieval past with industries such as tanning and malting, through to more recent aspects of history, such as keeping people safe during air raids."

Clearly the caverns can be of concern to the City Council due to the health and safety concerns around these historic structures being subject to crumbling and ultimately to collapse, but Scott is keeping his eyes on them and with colleagues, offering advice where appropriate.

Meanwhile we can all enjoy the caverns, either in the City of Caves visitor attraction, or enjoying a beer and a bite in the *Ye Olde Trip to Jerusalem Inn* beneath the Castle which has rooms in some of the caverns.

Fossil Ichthyosaur to form centrepiece of revamped museum...

Plans to transform Rutland County Museum into a state-of-the-art cultural and civic centre have taken a step forward, following approval from cabinet.



Palaeontologists are working on the Ichthyosaur skeleton found at Rutland Water August 26 2021

(Image: Anglian Water/Matthew Power)

At a recent cabinet meeting, members voted to accept all officer recommendations, including acquiring the Rutland Ichthyosaur (known as a Sea Dragon) from Anglian Water and beginning detailed design work.

The design phase will reimagine the museum and Catmos Cottage site as a dynamic cultural and civic hub. The globally significant Rutland Ichthyosaur skeleton – Britain's largest and most complete fossil of its kind – could take centre stage alongside the county's Roman Mosaic in an innovative digital visitor experience.

Rutland County Council (RCC) has taken all steps to explore all options for the project, and this approach is seen as the most viable. It will help attract more visitors, support local businesses, and ensure the long-term sustainability of Rutland's heritage assets by establishing a new cultural focal point at the end of Oakham High Street.

The latest developments have been welcomed by Lawrence Fenelon, Chair of Friends of Rutland County Museum and Oakham Castle, who said: "The decision to retain Rutland County Museum in the prestigious 1795-built Riding School has been warmly welcomed by the Friends of the Museum and Castle. The acquisition of the 'Sea Dragon' fossil, alongside details of the Roman Mosaic from Ketton, will enhance this popular museum's appeal and boost the local tourist economy."

The project will be funded through the £22.95 million UK Government's Rural Innovation in Action scheme (formerly Levelling Up Funding). This will support the digitalisation of the Rutland Ichthyosaur and Roman Mosaic, as well as the development of a new visitor experience.

It's official: Arran is now the UK's 10th Global UNESCO Geopark!

On April 17th, geologists who have been working tirelessly since 2015 to establish a Global UNESCO Geopark got the news they have waited so long for - they have been admitted to the fold! During our recent visit to Arran, one of our group made a surprise

discovery which helped us to make the most of our visit and gave us some super additional information. What was then an 'aspiring UNESCO global geopark' had published a walking guide to bring their excellent geology to the attention of the thousands who walk Arran's footpaths and beaches every year along the way.



There are six designated walks which are scattered across the island. These cover: Hutton's Unconformity at Lochranza, the Dalradian of North Arran, the fabulous geology of Corrie Shore, the geology and geomorphology of Glen Rosa, King's Cavern and its superb dykes and the fabulous beach deposits at Kildonan which includes a footprint.



The granite hills of North Arran are a sight to behold.

(Image: Arran Geopark)

The booklet (which carries a discretionary donation of £3.00) is available from Information Centres across the island, whilst stocks last. We heartily recommend it to anyone who's thinking of visiting. In the meantime, if you are planning a visit to Arran, take a look at the superb geopark content that's available online. There's lots of it and it's of a very high quality.

You'll find lots more about the Arran Geopark here:

<https://www.arran-geopark.org.uk/>

Congratulations to all concerned on your designation - read more in the August issue of Down to Earth.

In the last issue we published a letter from Quaternary specialist Brian Ellis, refuting the suggestion that the Altar Stone at Stonehenge could possibly have been moved to the area as a result of glaciation.

As we expected, we got a response to that suggestion...

Dear Chris

Stonehenge Altar Stone

Fascinated by Brian Ellis's comments on the provenance of the Stonehenge Altar Stone and the attached Nature article. It would appear that the evidence for an Arcadian Basin source is robust. So how did it get from Northeast Scotland to Stonehenge?

Overland... unlikely; by boat... possible, but a six ton rock, 5m long would require much more than a dugout canoe; ice transport is about all that is left. During the last glaciation, ice transport from the Arcadian basin would have been from east to west, taking all entrained rocks to the Atlantic. Once the ice reached the sea and broken up into icebergs, these would have had to travel south (the North Atlantic would have been frozen over).

It seems to me to be reasonable to ask if these icebergs could have beached along the Welsh coast (although the currents were probably from north to south the winds most likely came from the southwest). We already know that the Neolithic people transported the Blue Stones from thereabouts, so why not the Altar Stone?

Andrew Wainwright

Elsewhere in this issue you'll see my obituary to Richard Fortey, who was arguably one of our most influential palaeontologists of the modern era. He undoubtedly played a great part in getting so many amateurs interested in fossils and geology more generally.

Two Down to Earth readers add their words of thankfulness. If you would like to send us your memories of Richard we'd love to hear from you and will carry those in the next issue of Down to Earth.

Hi Chris

Richard Fortey

Thank you for writing about Richard Fortey in the Editorial of the April issue of *DtoE extra*. I envy you having met him! I loved his calm, measured TV presentation of natural history, and his books are superb as you noted. He had something in common with the geologist William Buckland - he was always interested in trying to eat unusual animals and plants!

When we want to hear him again the 2nd February 2015 episode of *'Life Scientific: Richard Fortey'* is still available on the BBC Sounds app.

Peter Barnes

Dear Chris

What Richard Fortey did for me

Very saddened to hear of the death of Richard Fortey.

I grew up in the edge of the Peak District which is home to so many good rocks. I then moved to Switzerland where there were more wonderful rocks and 'stuff' everywhere. In total ten years of my life have been spent in the Alps.

As a result I increasingly asked: "why's this stuff there? Pink granite in the Mont Blanc massif, but such a short distance away a valley of vertical silver grey slates? I ended up in central Spain. In the Sierra's, where there was more pink granite.

What has all this to do with Richard Fortey you might ask? Well, I came back and found Fortey's books. Wow! I moved on from there and learned so much.

What an experience and what a life!

Julia Madelin

Dear Editor

The Aberfan disaster and today's mine tip problems in South Wales

Your article in *DtoE extra* (and also in this issue of *DtoE*) about Aberfan and the continuing tip problem struck a chord with me. In 1967 I was recruited by the NCB (South Wales) to help carry out the mandatory tip survey brought in as a result of the Aberfan disaster. 50 years later, on the anniversary I wrote a letter published in *Geoscientist* giving an account of the geologists' work that took place after the slide. In some ways it was a defence of geoscience which had got a bad name as a result of the slip.

I am wondering if you think a slightly edited version of my account would be of interest to *DtoE* readers – it would only take a few days to get the copy to you.

Andy Lane

The Editor replies: I'm delighted to be able to report that Andy has now sent us that article and it will be in the August issue of *DtoE*.

Dear Chris

Urban 'field trip' in London

I went on another of my urban field trips yesterday, following on from your "Hot Rocks" course. There aren't many volcanoes in London, so I went to Dulwich Picture Gallery to look at some granite sculptures in the gardens. There are three entitled "Walking the Dog" and carved by Peter Rendell-Page from some granite glacial erratics from Finland with an intricate pattern called the "Greek Key" which mirrors the frieze on the building. I suppose you could call them "Cold Rocks"! I thought they were lovely.

Sue Jacobs



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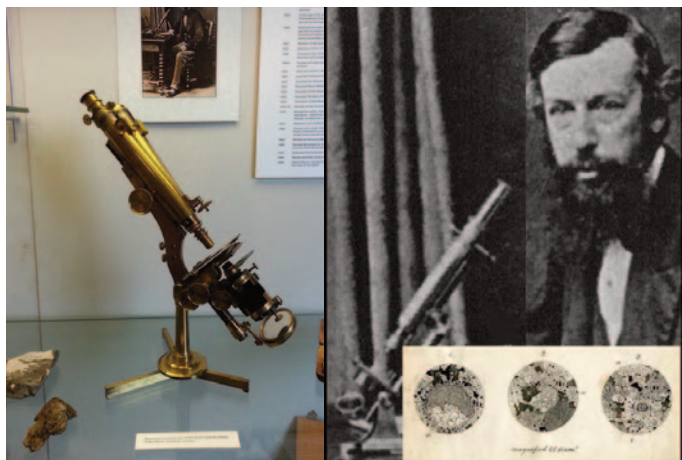
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In this new brainteaser, we ask the Questions...

Who, What & Where?



We knew that this 'Who, what & where' was a step up in terms of difficulty from some of our previous efforts, so we were not surprised to see that the number of entries dipped somewhat.

Well done to those of you had a go whether at home or who formally submitted a response.

Who? Henry Clifton Sorby (1826-1908)

What? Sorby's main contribution was the study of rock thin sections hence the section images and the microscope.

Where? Sorby was born and died in Sheffield and that's the place that's most associated with him and his work.

This is a sample of your comments about Sorby:

Patrick Collins said: "This is Henry Clifton Sorby 1826-1908, of Woodbourn, Sheffield and his Beck & Smith microscope. Although relatively unknown, he is important, in that he was the first to realise the importance of thin sections and his work formed the basis of igneous petrology. His work on slaty cleavage and schists is significant as is his pioneering the use of quantitative methods."

This is some of what Paul Thornley said: "Henry Clifton Sorby (1826-1908) is called the father of microscopical petrography (by those who can pronounce it!)"

In his photograph, he is in front of his Smith and Beck single pillar achromatic microscope bought in 1848. His interest in crystallography led him to adapt the method of taking thin sections of teeth, bone and wood to the grinding of rocks sufficiently thin to make them transparent and viewing them in polarised light. And three such sections appear in this photograph, allowing identification of the minerals along with the surrounding cements.

His system of petrological classification of sedimentary rocks was 'ground-breaking' and endures.

The photograph of the binocular microscope is of a 'Sorby pattern' Smith, Beck and Beck (name change 1854) with a polarising prism and concave reflectors for opaque subjects. This is similar to the one bought by Sorby in 1860 or 1861, but has a different serial number. Sheffield Museums own the microscope and claimed at one stage (but no longer) that it was Sorby's own; however, it possibly belonged to The Sheffield Lit and Phil Society (of which Sorby was a prominent member) which bought this type in 1860 and later donated it to Sheffield Corporation.

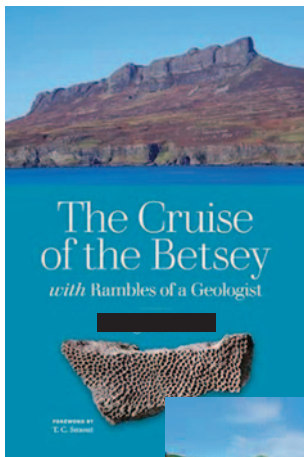
The method of using reflective methods for opaque subjects allowed Sorby to create methods for analysing metals - and so making a most significant contribution to the development of his local steel industry.

For this son of Sheffield, his role of the development of the University of Sheffield from Firth College, University College to the University itself in 1905 - and the adoption of scientific enquiry as integral to university research - was not the least of his achievements."

Our new brainteaser - it's not a competition with prizes! We'd like you to study these images and answer the Question: Who, What & Where?

Once again we're asking you to engage your little grey cells! Who was he, what's he known for and which places is he most associated with?

*Please contact us before July 15th.
by email:
downtoearth@geosupplies.co.uk*



Leeds Geological Association at 150!

In Down to Earth 130 the Editor asked the question "How long has your geological society been established?" This was in the light of significant anniversaries for both the Black Country Geological Society (50 years) and the Manchester Geologists' Association (100 years). Could that be topped? You bet it could, Leeds Geological Association is 150 years young...

I thought you might like to know that last year 2024, Leeds Geological Association celebrated its 150th Anniversary!

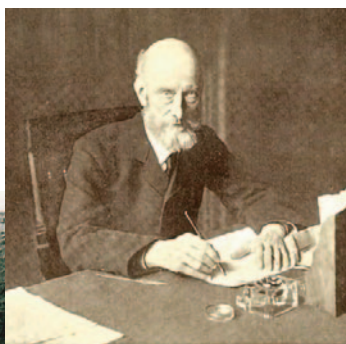
It was evidently the 11th society in the country dedicated to geology, the oldest being the Geological Society founded in 1807. The Geologists Association was founded in 1858 but I'd be interested to know who the other 8 were. Attached is potted version of the history of the LGA and a report of the indoor meeting that celebrated the event."

The origins of the LGA

The establishment of an amateur geological society in Leeds was one of the consequences of an educational revival that took place in the 1870's. Prior to this Leeds had little claim to be regarded as a centre of culture with one press statement describing it as 'one of the most benighted towns in the country'. The fact that out of the 1,698 people who attended the 1858 British Association for the Advancement of Science meeting held in the city that year, only 69 were local illustrated this.

At that meeting the President, Professor Richard Owen, made a point that it was the duty of a museum and its curator to give public lectures to illustrate the collections they held. It was to take eleven years before the Leeds Philosophical and Literary Society took up this suggestion and, in 1869 invited Mr Louis Compton Miall, a local teacher, to give a course of twelve lectures in Geology. The attendance at the first of these was 100, which was well maintained and included a large number of ladies. These lectures, along with others organised by the Mechanics Institute and by the Yorkshire Council for the Education of Women, gave encouragement to Trinity College,

Prof. Louis Compton Miall.
First President of LGA. 1874
(right) and an early field trip to
Ilkley Moor (below)



LGA members, including 4 Past-Presidents, at their 150th Anniversary Day at Leeds Museum on 18th May 2024

Cambridge, to pursue a scheme for the extension of university teaching into the larger towns of the country. In 1873, a petition from the Mayor to citizens of Leeds resulted in them agreeing to send lecturers to several towns grouped in a circuit who could guarantee funds.

Leeds, Bradford, Halifax and Keighley formed such a circuit and for the start of courses in Leeds a guarantee fund of £300 was raised and in 1874 the first session, January to March, began. Physical Geography was one of the courses held and W.J. Sollas, then a scholar at St John's College, Cambridge (having graduated six months earlier with a First Class Honours in the Natural Science Tripos) was the lecturer and attracted 82 people. The course consisted of 12 lectures and 12 classes and there was a voluntary exam available on completion. Records show that 7 students were placed in First Class and 11 in Second Class.

Between lectures 11 and 12 a field excursion was held in the Skipton area and during the day Sollas suggested it would be a good idea if the class could remain in touch with one another to continue their studies of the local area. Around 20 of those present agreed to do this and, on June 20th they were called to a meeting in Leeds where a committee of four was set up.

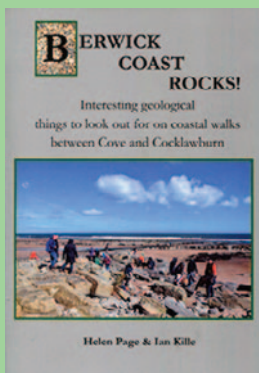
Miall, now the keeper of Leeds Philosophical Society Museum, recommended the formation of an independent geological field club and on July 3rd, 1874, a meeting of 12 persons was held at the Leeds YMCA. when it was agreed to form a body to be called the Leeds Geological Association. The Association, which had 32 original members, was the eleventh society in the country devoted entirely to Geology formed since the founding of the Geological Society of London in 1807 and was a purely amateur body with no connections to academia or the mining industry. Its aim was twofold:

- (i) "the particular and careful investigation of the geological features and structure of the neighbourhood of Leeds and more generally of the whole of Yorkshire".
- ii) "the endeavour to foster and cultivate a taste for scientific knowledge among the inhabitants of Leeds, to strengthen individual effort and to afford facilities for the reading and discussion of papers on Geology or on any branch of Physical Science bearing on the same."



Book Choice

Title: Berwick Coast Rocks!
 Authors: Helen Page & Ian Kille
 Publisher: Northumbrian Earth Publishing
 ISBN: 978 1 0484 155 0 0
 Format: Softback
 Cost: £15.00
 Level: Adult & general interest
 My rating: *****



I always think that a geological field guide should have definite high spot, a 'go to' if you like. In the case of the Berwickshire Coast, there's one site that sits head and shoulders above all the others, it's Siccar Point, the 'holy grail' of deep geological time. It was here, in 1788 that the 'father of modern geology' James Hutton declared the vastness of geological time as he admired the unconformity to end all unconformities.

The story of this little volume "*Berwickshire Coast Rocks!*" goes back, not to 1788, but to 2018 when a group of people from Alnwick U3A group published the first edition as a sequel to their ever popular guide to the Northumberland entitled "*Northumberland Coast Rocks!*".

This second edition has been much expanded and now runs to a total of 140 A5 pages. Authors Helen Page and Ian Kille have added some superb extra photographs along with some rock thin sections with the help of Newcastle University. All this comes whilst retaining what I call 'the spirit of the U3A ethos, that of finding out for yourself and the excitement of discovery that comes from personal observations.

The superb photographs can do far better than hundreds of words. Seeing is the start of the coastal geology journey and there plenty of potential journeys within these pages. The itineraries spread along the coast from Cove to Cocklawburn and takes in places such as Siccar Point, St Abbs, Eyemouth, Berwick and Spittal. Many of these locations provide hours of enjoyment with the state of the tide being often the only time limiting factor.

In my opinion, what makes a good field guide even better is if it can use the specific field sites to draw out more general points of geology and this is exactly what the expanded 'information pages' at the rear of the book do. Here the reader can find more details about a diverse range of topics from the Eyemouth volcanoes to the formation of calcretes and concretions and the formation of the Berwick monocline to ice carving.

An excellent book - even if you have already got the first edition!

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Book Choice

Title: This Volcanic Isle
 Author: Robert Muir Wood
 Publisher: Oxford University Press
 ISBN: 978 0 19 887162 0
 Format: Hardback
 Cost: £20.00
 Level: Adult & general interest
 My rating: *****

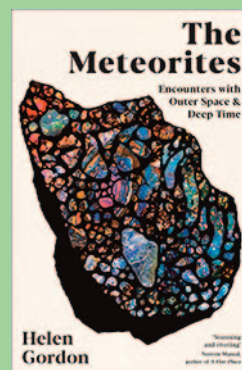


There's a saying that you should never be tempted to judge a book by its cover and I'm also tempted to add, don't judge a book by flicking through the pages. If you do, you'll find that there are no stunning colour photographs, just a few monochrome maps and line drawings, and text, lots of it.

However, as Professor Iain Stewart notes on the back cover this is a 'beautifully written account of how our appreciation of the natural world around us can be immeasurably enhanced by viewing it through rock-tinted spectacles'.

This is a book about the violent past of the British Isles, but it would also be a mistake to think of it as being a start to finish account of the geological history of the British Isles. Instead he concentrates on our more recent past, beginning with the great volcanic events that rocked the Hebrides 60+ million years ago. What he reveals, is a rollercoaster of a ride offering insights into a violent Tertiary volcanic episode, and the processes that forged the resultant landscapes of these isles.

Title: The Meteorites
 Author: Helen Gordon
 Publisher: Profile Books
 ISBN: 978 1 80081 534 6
 Format: Hardback
 Cost: £20.00
 Level: Geological & scientific interest
 My rating: ****



Helen Gordon is a well known science writer who you may be familiar with from her much praised book *Notes from Deep Time*. Turning her attention to the subject of meteorites she ranges over not just the scientific, but also the real connections with other planets and outer space. Yes, a meteorite is probably the oldest object that you will ever see or touch. It has also travelled on the longest journey ever undertaken to get to the surface of our planet. Contrary to popular views the arrival of such extra terrestrial material on Earth is far from uncommon. The consequences of meteorite impacts on the Earth have been immense, including the demise of the dinosaurs, and the triggering of volcanic eruptions to name but two. It's a great story that Helen tells with much enthusiasm and painstaking research.



diary of events

lectures/zoom meetings

May

- 8 "Sea level change in the Anthropocene" by Colin Summerhayes
Organiser: Hertfordshire Geol. Soc. Details: <https://www.hertsgeolsoc.org.uk/>
- 8 "Updating the geological map of the Yorkshire Wolds aquifer"
by Laura Austin-Sydes & Laura Burrell-Garcia
Organiser: Leeds GA Details: <https://leedsga.org.uk>
- 8 "The birth, life and death of the Rover Mole" by Dick Selley
Organiser: Mole Valley Geological Society. Details: www.mvgs.org.uk
- 9 "Dinosaurs and deserts in Wales" by Cindy Howells
Organiser: Farnham Geol. Soc. Details: www.farnhamgeosoc.org.uk/meetings/
- 12 "Uncovering the dinosaur highway" by Emma Nicholls
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 12 "Tectonic plates" by Alisa Burrows Organiser: Huddersfield Geology Group Details: <https://www.huddersfieldgeology.org.uk/talks/>
- 12 "Unravelling the glacial history of Eastern England" by Phil Gibbard
Organiser: Cambs. Geol. Soc. Details: <http://www.cambsgeology.org/events>
- 13 "Reconstructing the eruptions of Soufriere, St. Vincent and what it tells us about volcanic risk" by Jenni Barclay
Organiser: West of England GA Details: <https://www.wega.org.uk/>
- 13 "The 200th anniversary of Iguanodon" by Chris Duffin
Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>
- 14 "Research from the Stanmore Gravel Project" by David Brigland
Organiser: Harrow & Hillingdon Geol. Soc. Details: <https://www.hhgs.org.uk/>
- 14 "Project EARTH: Iceland as a unique geophysical laboratory"
by Fiona Simpson
Organiser: Shropshire Geol. Soc. Details: <https://shropshiregeology.org.uk/>
- 15 "Finding flint tools" by Jonathan Spencer
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Stanway)
- 20 "The geology of Antarctica - a personal journey" by James Cresswell
Organiser: Mid-Wales Geology club Details: www.midwalesgeology.org.uk/
- 20 "The Toba Super-Eruption" by Doreen van Seenus
Organiser: Kent Geologists' Group Details: www.kgg.org.uk/

June

- 2 "The late-Devonian mass extinction: the terrestrial story" by John Marshall
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 3 "Rock solid - Trilobites and friends" by Ros Mercer
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Shenfield)
- 6 "The Great Glen Fault Zone" by Eddie Dempsey Organiser: Geologists' Association Details: [https://geologistsassociation.org.uk/lectures/\(Zoom\)](https://geologistsassociation.org.uk/lectures/(Zoom))
- 8 "The evolution garden - uncovering a history of plants" by Paul Kenrick
Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>
- 9 "Landscapes and environments of long ago" by Mike Tuke
Organiser: Cambs. Geol. Soc. Details: <http://www.cambsgeology.org/events>
- 10 "Diamond geology" by Tony Waltham
Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>
- 11 "Volcanoes and climate change" by Siwan Davies
Organiser: Harrow & Hillingdon Geol. Soc. Details: <https://www.hhgs.org.uk/>
- 12 "Adventures of an Argon geochronologist: why do we date rocks?"
by Sarah Sherlock
Organiser: Hertfordshire Geol. Soc. Details: <https://www.hertsgeolsoc.org.uk/>
- 17 "Palaeolithic archaeology in a chalk landscape capture point" by Letty Ingrei Organiser: Kent Geologists' Group Details: www.kgg.org.uk/
- 18 "Brecciation - types and sources" by Bill Bagley
Organiser: Mid-Wales Geology club Details: www.midwalesgeology.org.uk/
- 19 "The wood age - new discoveries of Pleistocene woodworking"
by Annemieke Milks
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Stanway)

July

- 1 "Museums & micromounts" by Nadine Gabriel
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Shenfield)
- 3 Short talks by members
Organiser: Bath Geol. Soc. Details: <https://bathgeolsoc.org.uk/lectures/>

Please be aware that a number of clubs/societies are currently operating with a mix of live events and Zoom meetings. Please check with the organisers what model they are working to on each occasion.

- 4 "Here be sea monsters: new perspectives on fossil tetrapods"
by Rebecca Bennion. Organiser: Geologists' Association
Details: <https://geologistsassociation.org.uk/lectures/>
- 9 "Montserrat & Caribbean Volcanoes" by Richard Robertson
Organiser: Harrow & Hillingdon Geol. Soc. Details: <https://www.hhgs.org.uk/>
- 10 "Subsurface water flow through Hertfordshire" by Dan Matthews
Organiser: Hertfordshire Geol. Soc. Details: <https://www.hertsgeolsoc.org.uk/>
- 15 "Evaporites and the Sussex gypsum mines" by David Alderton
Organiser: Kent Geologists' Group Details: www.kgg.org.uk/

day field trips & visits

Please ensure that you contact the organisers in advance of any field trip advertised. Please don't just turn up, it may be for members only.

May

- 10 Visit to the Evolution Garden NHM, London with Diana Clement
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/>
- 10 Geconservation day at Portway Hill, Rowley
Organiser: Black Country Geol. Soc. Details: <https://bcgs.info/>
- 11 Field visit to Cullercoates Bay & Marden Nature Reserve with Jon May
Organiser: North Eastern Geol. Soc. Details: www.negs.org.uk
- 11 Geology and landscape of the South Downs with John Lonergan
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk>
- 14 Carboniferous rocks around Wirksworth with Martin Whiteley
Organiser: East Mids. Geol. Soc. Details: www.emgs.org.uk
- 17 The Todmorden area with Ian Warrington and local experts
Organiser: Huddersfield Geology Group
Details: <https://www.huddersfieldgeology.org.uk/fieldtrips/>
- 17 Field visit to Cefn Onn near Cardiff with Stephen Howe
Organiser: S. Wales GA Details: <http://swga.org.uk/>
- 17/18 Two field days in the Cotswolds with Nick Chidlaw
Organiser: West of England GA Details: <https://www.wega.org.uk/>
- 28 Field visit to see Edinburgh's urban geology
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
- 31 Field visit to Cocklawburn Beach at Berwick
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>

June

- 3 Building stones in the churches of Shere and Albury
Organiser: Mole Valley Geological Society. Details: www.mvgs.org.uk
- 3 Volcanological lessons from iron slag at Workington with Bernard Skillern de Bristowe Organiser: Cumberland Geol. Soc. Details: <https://www.cumberland-geol-soc.org.uk/events/>
- 4 Field visit to Hare Hill SW Pentland Hills
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
- 7 Field visit to the Chelmsford area with Ros & Ian Mercer
Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>
- 7 Field visit to Todmorden
Organiser: Manchester GA Details: info@manchestergeology.org.uk
- 10 Visit to National Museum of Wales, Cardiff
Organiser: Farnham Geol. Soc. Details: www.farnhamgeosoc.org.uk/meetings/
- 11 Field visit to Ogmere & Southerndown, S. Wales with Paul Wright
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 14 Field visit to Alderley Edge, Cheshire
Organiser: Manchester GA Details: info@manchestergeology.org
- 15 Field visit to Malham & Gordale Scar with Ailsa Burrows
Organiser: Huddersfield Geology Group
Details: <https://www.huddersfieldgeology.org.uk/fieldtrips/>
- 18 Field visit to Side Pike with Dave Hasledon Organiser: Cumberland Geol. Soc. Details: <https://www.cumberland-geol-soc.org.uk/events/>
- 19 "The Malvern and Lower Severn Axis - new evidence" by Gavin Gillmore
Organiser: Bath Geol. Soc. Details: <https://bathgeolsoc.org.uk/lectures/>
- 21 Pebbles on the beach Alan Winter & Ray Cooper
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk>
- 21 Field visit to Dinefawr Park, Carmarthenshire with Lesley Cherns

Organiser: S. Wales GA Details: <http://swga.org.uk/>
22 Field visit to Tan y Foel quarry, Adfa
Organiser: Mid-Wales Geology club Details: www.midwalesgeology.org.uk/
28 Field visit to see Copford church walls & Little Tey Museum
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/>
28 Field visit to Barns Ness & Siccra Point
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>

July

5 Field visit to Lyme Park
Organiser: Manchester GA Details: info@manchestergeology.org.uk
6 Field visit to Walton on the Naze with Gerald Lucy
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/>
9 Field visit to Carlops
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
10 Field visit to Harrow Weald Common with Diana Clements & Liz Chui
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
12 Field visit to Pulborough with David Bone
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk>
13 Field visit to see North Pennines mineralisation with Brian Young
Organiser: North Eastern Geol. Soc. Details: www.negs.org.uk
16 Field visit to Orton Scar with Paul Carling
Organiser: Westmorland Geol. Soc. Details: <https://westmorlandgeolsoc.org.uk>
17 Two walks through time with Mike Howgate
Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>
19 Field visit to St Bees with Emrys Phillips and John Merritt
Organiser: Cumberland Geol. Soc.
Details: <https://www.cumberland-geol-soc.org.uk/events/>
20 All day workshop on igneous rocks in hand specimen and thin section
Organiser: Shropshire Geol. Soc. Details: <https://shropshiregeology.org.uk/>
26 Field visit to Trowbarrow
Organiser: Manchester GA Details: info@manchestergeology.org.uk
26 Field visit to Naunton Quarry, Glos. with Mike Milward
Organiser: S. Wales GA Details: <http://swga.org.uk/>
28 Field visit to Dryhill Quarry near Sevenoaks
Organiser: Farnham Geol. Soc. Details: www.farnhamgeosoc.org.uk/meetings/
30 The dinosaur trackways at Dewar's Farm, Ardley & the Great Oolite at Kirtlington with Duncan Murdoch, Emma Nicholls & Ross Garden
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com

August

2 Field visit Bulmer Brick & Tile Co. with Jonathan Spencer
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/>
2 Field visit to Girvan
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
3 Field visit to Barrow Hill volcano near Dudley with Mike Allen
Organiser: East Mids. Geol. Soc. Details: www.emgs.org.uk
24 Field visit to Tynemouth with Jon May
Organiser: North Eastern Geol. Soc. Details: www.negs.org.uk
27 Field visit to Garrigill with Steve Rozario
Organiser: Cumberland Geol. Soc.
Details: <https://www.cumberland-geol-soc.org.uk/events/>
30 Field visit to Belhaven & Dunbar
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
31 Field visit to the Lambourn Valley
Organiser: Farnham Geol. Soc. Details: www.farnhamgeosoc.org.uk/meetings/

residential field trips

June

1-6 Scarborough on the Yorkshire Coast with Chris Darmon
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk
11-18 Isle of Mull & Ardnamurchan with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk
13-15 Kendal and the Central Lakes with Richard Wrigley
Organiser: Geologists' Association
Details: <https://geologistsassociation.org.uk/lectures/>
25-30 The Western Lake District with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

July

4-6. North East England & SE Scotland with Alison Tymon

Organiser: Huddersfield Geology Group
Details: <https://www.huddersfieldgeology.org.uk/fieldtrips/>
9-16 Heart of Wales with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

August

9-16 Peak District Summer School with Chris Darmon & the team
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk
29-31 Eden Valley field trip with Noel Worley & Mike Allen
Organiser: East Mids. Geol. Soc. Details: www.emgs.org.uk

September

20-24 Field visit to Cornwall with Jonathan Turner
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com

October

8-15 Torbay & South Devon with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk
9-13 Field visit to Anglesey with Robert Crossley
Organiser: Hertfordshire Geol. Soc. Details: <https://www.hertsgeolsoc.org.uk/>
16-19 Field visit to Anglesey
Organiser: Farnham Geol. Soc. Details: <https://www.farnhamgeosoc.org.uk/>

2026

March

27-April 1. The Jurassic Coast of Dorset with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

April

14-22. The Northwest Highlands of Scotland with Chris Darmon & Colin Schofield.
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

May

1-8 Central Cornwall with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk
16-23 Teesdale & the North Pennines with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

June

17-25 Shetland the Northern Isles with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

September

13-22 The North & Eastern Fjords of Iceland with Chris Darmon
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

October

Dates tbc Anglesey with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

fairs, shows & special events

May 24 - August 31

GeoFest 2025 - three months of events for everyone- many are FREE!
Organiser: Abberley & Malvern Hills Geopark
Details: www.geopark.org.uk

July

5/6 A weekend of events to celebrate the 50th Anniversary of the Black Country Geological Society
Organiser: Black Country Geol. Soc. Details: <https://bcgs.info/>
12 Essex Rocks! a free day of events for all the family at Tollgate Hall
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/>
26 Family geology day at Rustington Museum, BN16 2NW
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk>

August

16 Geology Day at the Novium Museum
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk>
23 Family fossil day at Penarth with John Nudds & Cindy Howells
Organiser: S. Wales GA Details: <http://swga.org.uk/>



Sally sets us a rock poser...



I suspect not many people will be familiar with the geology of Breidden Hills in Powys. So when I received this picture from Sally Whipple-Green, I set up and took notice.

Sally recently led a visit of the hill where this rock was picked up. she says:

"If Breidden is indeed a laccolith, why was this apparent projectile found sitting in a crater. Its composition is the same as the surrounding rock at the macroscopic scale. Much debate ensued within my group. If it is a section of blasted columnar dolerite why was it found in its own crater, and how were the top and bottom rounded. All suggestions welcomed."



The massive working site that is Criggion Quarry (Image: Agg-Net)

This is what Wikipedia says:

"The hill is largely formed from a mass of gabbroic-dolerite which is exploited for roadstone at the large Criggion Quarry excavated into its western and northern sides. This rock was intruded into the mudstones of the surrounding Stone House Shales Formation in the form of a laccolith during the Ordovician period. An alternative interpretation is that the intrusion takes the form of a sill. A separate intrusion of

andesitic magma forms Moel y Golfa whilst Middletown Hill and the lower summits to its northeast are formed from tuffs and volcanoclastic material which form the Caradoc age Bulthy Formation. The hills are largely devoid of superficial deposits though the low ground between the summits is mantled with glacial till.

The quarry was already operating prior to the construction of a railway link in 1866, a line which continued to serve it until 1959. A key product in earlier years were road setts but crushed roadstone was the main output by 1912. It was operated as a single 200m high face before being benched in 1967. Output peaked at 350,000 tonnes a year in 1973. The presence of the minerals chlorite and epidote give the quarried rock its characteristic green colour. Material quarried in the upper part of the workings drops via a steep chute bored through the hill to a tunnel leading to the processing works below."

Cornwall Museum is shortlisted for award...

Cornwall Museum and Art Gallery, previously known as the Royal Cornish Museum, has been shortlisted for a major national award just weeks after reopening following a major investment. The Museums and Heritage Awards are a prestigious event that celebrate the best in museums, galleries, and cultural heritage.



Part of the mineral exhibits in the revamped Museum. (Image Visit Cornwall)

The museum houses a collection of Cornish minerals that span several centuries and act as a reminder that the county was once a world leading producer of tin, copper, lead and zinc.

The Museum is situated in the heart of the historic county town of Truro.

Cornwall Museum and Art Gallery, 25 River St, Truro TR1 2SJ
Email: enquiries@cornwallmuseum.org. Tel: 01872 272205

We are grateful to Down to Earth reader Tony Wardle for this news item.

Spotlight on Arran...

Down to Earth recently took a group to the Scottish island of Arran. We enjoyed a great hotel along with excellent geology and superb weather - Chris even managed a sunburnt nose! During the varied week we managed to see some superb geosites and got to meet almost all the island's bus drivers and ride aboard their somewhat worn out

buses. Trust us when we say that no bus would survive long on the island's dreadful roads!

Arran 1 - Hutton's Unconformity at Newton Point...

The 'father of modern geology', James Hutton visited Newton Point, near Lochranza in the north of the island in 1787. Here he clapped eyes on the first of three unconformities that were to convince him of the enormity of geological time.

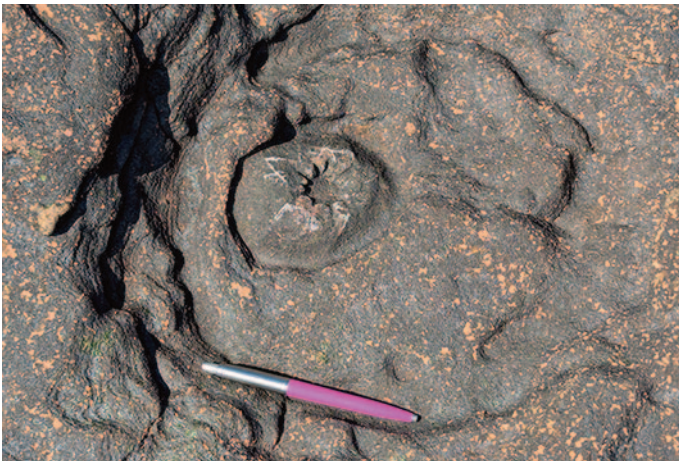


Hutton's unconformity at Lochranza is an iconic site. (Image: Chris Darmon)

Here we can see two formations, the metasediments of the Dalradian overlain unconformably by the red sandstones of the Carboniferous. Whilst this unconformity lacks the grandeur of the one at Siccar Point, it does show the biggest time gap between the two formations.

Arran 2 - the Fulgurite...

Corrie shore on the eastern side of Arran shows one of the finest field sections anywhere in the UK. You can see (from north to south) within a mile, rocks from the Devonian, Carboniferous and Permian. Whilst most of the rocks are sedimentary there's some basalt and volcanoclastics as well. The Devonian Old Red Sandstone is a high energy conglomerate formed by flash floods, the Carboniferous is marine limestone and fluvial sandstone and finally the Permian is a bright red aeolian sandstone with superb dune cross bedding. It's this that contains the Fulgurite.



Fulgurite on Corrie shore, but what is it? (Image: Neil May)

This comes from Wikipedia:

"Fulgurites (from Latin fulgur 'lightning' and -ite), commonly called "fossilized lightning", are natural tubes, clumps, or masses of sintered, vitrified, or fused soil, sand, rock, organic debris and other sediments that sometimes form when lightning discharges into ground. When composed of silica, fulgurites are classified as a variety of the mineraloid lechatelierite."

How rare are Fulgurites? This is the only one that Chris has seen in more than 50 years of fieldwork!

Arran 3 - the reptilian footprint...

When I think about a reptilian footprint my mind naturally goes to that most famous group the dinosaurs. Equally, whenever you say dinosaur and Scotland in the same sentence, it's the Isle of Skye that immediately springs to mind.

However Arran has two examples of reptilian footprints and neither was made by a dinosaur. Whilst not expecting to see either we actually saw them both, or at least one of our group, intrepid Neil May did. With the help of accurate plotting and an accurate sat-nav. He found and photographed this hand-sized print in Triassic sediments on Kildonan shore in the south of the island.



*Footprint of *Cirotherium* an ancestral crocodile that was around at the same time as the dinosaurs. (Image: Neil May)*

And finally...

This is the waiting room for ferries and river cruises that was erected around a hundred years ago in Lisbon, Portugal. The rock columns are marble - they don't make waiting rooms like this any more!



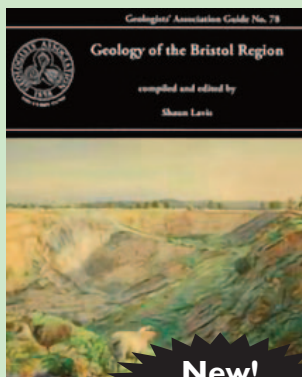


Featured books May to July

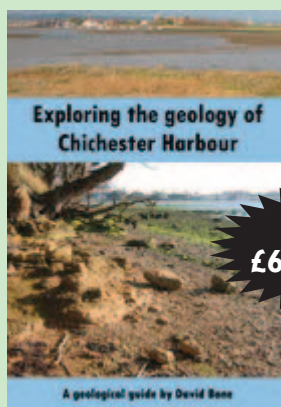
In each issue we are pleased to be able to introduce you to a range of featured books. Where they are being offered at reduced prices, these will be current to the end of July 2025 provided that stocks are available. Please note, all prices include UK postage.



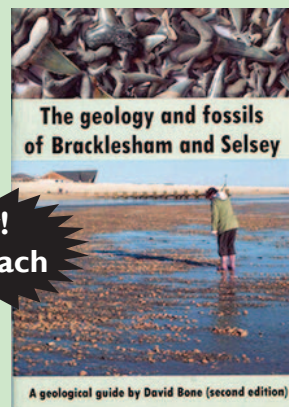
New!
£32.00



New!
£29.00



New!
£6.00 each



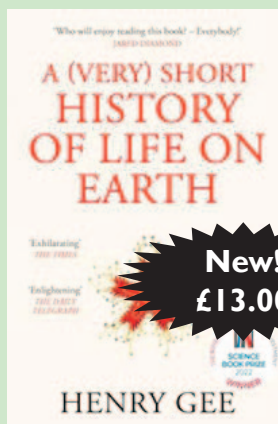
Buy both of the above for £10.00



New!
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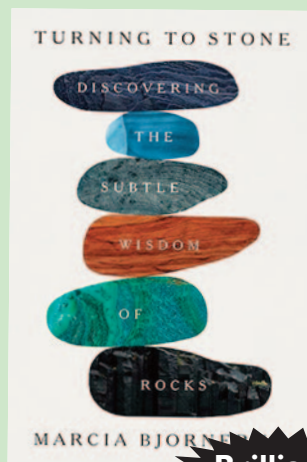
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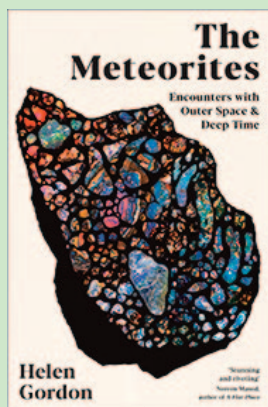
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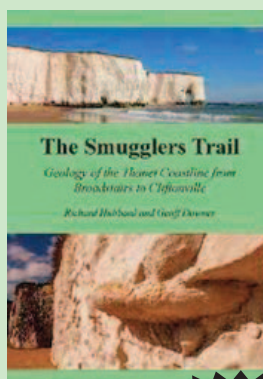
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Good!
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Great!
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