



Down to Earth

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Down to Earth

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The Claerwen Valley is part of the area flooded by the Elan Valley Reservoir in the Heart of Wales.
(Image: Cwm Elan Valley)

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We welcome your contributions, which should be with us no later than January 15th 2025 for the November issue.

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cover story

Clitheroe's Salthill Geotrail is probably the most unusual in the UK, set in a disused limestone quarry that's now an industrial estate.

It shows a cross section through a Carboniferous reef complex where different facies interdigitate as seen here - great geology for all to see!

(Image: Chris Darmon)



editorial

We're still missing too much low hanging fruit...

Here at **Down to Earth** we're committed to facilitating access for all to geological information and interpretation. Indeed we've been 'banging on about it' for years!

Thanks to the fact that Colin and I are out in the field for around a quarter of the year, we get to see an awful lot of geology both in the UK and overseas. As a result we see both the best and the worst in interpretation. From centres of excellence such as parts of the Malvern Hills and the Northwest Highlands of Scotland to 'geological deserts' in places like Bradgate Park in Leicestershire and Glen Nevis.

All sorts of reasons are given as to why the geology isn't explained from the economic - there's not enough money to provide an information board, vandals would destroy whatever we put up. I've even heard the comment 'that we don't want to share the geological significance of this place in case people destroy it'. If we go down that road we are surely making a mockery of education at all levels.

Whilst accepting that some of the reasons for not explaining the geology to the general public have some validity, particularly the economic reason in these times, there surely has to be another way to deliver a positive outcome.

A recent visit to the Ingleton Waterfalls Trail in North Yorkshire was a particularly valuable experience. This well known trail is situated in North Yorkshire and has been operated as a commercial undertaking since 1885. Owned by the Ingleton Scenery Company the five-mile long trail has geology at its very heart as it crosses and re-crosses the Craven Faults in two river valleys.

The current charge for accessing the trail is £10.00 per adult somewhat more than the original 2d charge in 1885, but for that you get a well maintained path (with around 1,000 steps) and a modern system of interpretation that cannot be disfigured or vandalised.

Visitors to the trail are encouraged to scan the QR code at a total of 16 places around the route for information about the landscape, geology and ecology. The same information can be obtained by downloading from the website to print or your phone.

This is very definitely a step in the right direction, particularly when trying to reach younger people as individuals or in family groups. This is how people want to consume information, to print or display on their mobile device. It's the way forward with leaflets and many information boards a thing of the past.

I would argue that a hybrid approach might be best with a single information board to grab people's attention. This would be good and provides an entry point to the app that then delivers the rest. There's also an added bonus, there are some great volunteers out there who want to deliver this sort of material. If you are in any doubt, look at what Mike Brooks has done for the Abberley and Malvern hills Geopark.

There really are no excuses left - it's time for action on interpretation!

Chris Darmon, Editor

What happened when a meteorite the size of four Mount Everests hit the Earth 3.26 Ga?

In recent years we've been gathering more and more information about the early years of our planet, that first 1 billion years or so when we were being bombarded with huge blocks of meteorite material. Around the world, teams of scientists have been examining the evidence and coming forward with new and surprising scenarios.

A team from the *Department of Earth and Planetary Sciences at Harvard University* led by *Nadja Drabon* has been investigating the Baberton Greenstone belt of South Africa. In particular they have been looking at the so called "S2" meteorite impact that dates to 3.26 Ga. The starting point for the study which has been published in the *Proceedings of the National Academy of Sciences*, was careful collection of rock samples centimeters apart and analysing the sedimentology, geochemistry, and carbon isotope compositions they leave behind.



Drabon with students David Madrigal Trejo and Öykü Mete during fieldwork in South Africa. (Image: Nadja Drabon)

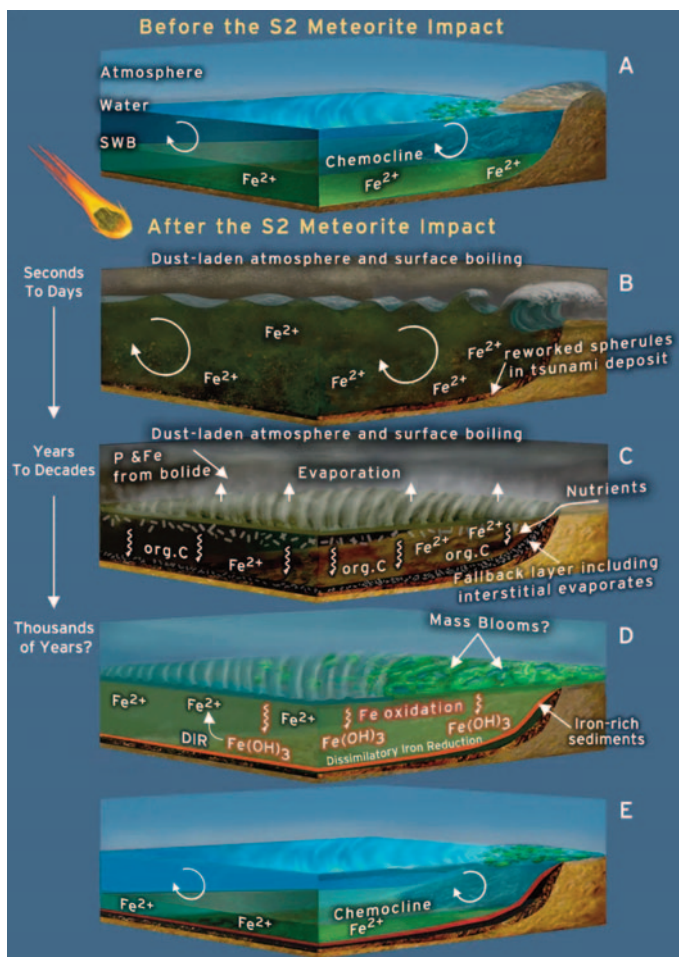
Graphic depiction of the S2 impact and its immediate after effects. (Image: Courtesy of Nadja Drabon)

Drabon's team paints the most compelling picture to date of what happened the day a meteorite the size of four Mount Everests paid Earth a visit. "Picture yourself standing off the coast of Cape Cod, in a shelf of shallow water. It's a low-energy environment, without strong currents. Then all of a sudden, you have a giant tsunami sweeping by and ripping up the sea floor," said Drabon.

The S2 meteorite, estimated to have been up to 200 times larger than the one that killed the dinosaurs, triggered a tsunami that mixed up the ocean and flushed debris from the land into coastal areas. Heat from the impact caused the topmost layer of the ocean to boil off, while also heating the atmosphere. A thick cloud of dust blanketed everything, shutting down any photosynthetic activity.

But bacteria are hardy, and following impact, according to the team's analysis, bacterial life bounced back quickly. With this came sharp spikes in populations of unicellular organisms that feed off the elements phosphorus and iron. Iron was likely stirred up from the deep ocean into shallow waters by the aforementioned tsunami, and

A digest of some of the latest Earth Science news from around the world.



Graphic depiction of the S2 impact and its immediate after effects. (Image: Courtesy of Nadja Drabon)

phosphorus was delivered to Earth by the meteorite itself and from an increase of weathering and erosion on land.

Drabon's analysis shows that iron-metabolizing bacteria would thus have flourished in the immediate aftermath of the impact. This shift toward iron-favouring bacteria, however short-lived, is a key puzzle piece depicting early life on Earth. According to Drabon's study, meteorite impact events — while reputed to kill everything in their wake (including, 66 million years ago, the dinosaurs) — carried a silver lining for life.

"We think of impact events as being disastrous for life," Drabon said. "But what this study is highlighting is that these impacts would have had benefits to life, especially early on, and these impacts might have actually allowed life to flourish."

These results are drawn from the backbreaking work of geologists like Drabon and her students, hiking into mountain passes that contain the sedimentary evidence of early sprays of rock that embedded themselves into the ground and became preserved over time in the Earth's crust. Chemical signatures hidden in thin layers of rock help Drabon and her students piece together evidence of tsunamis and other cataclysmic events.

The Barberton Greenstone Belt in South Africa, where Drabon concentrates most of her current work, contains evidence of at least eight impact events including the S2. She and her team plan to study the area further to probe even deeper into Earth and its meteorite enabled history.

Material for this article comes from The Harvard Gazette, to whom we are indebted.

Lithium mining goes from boom to near bust in a very short time...

Just a couple of years ago it seemed like Lithium mining was booming. Across the globe ventures were starting amid warnings of dire shortages of the metal that's vital for the supply of electric vehicle batteries.



Greenbushes Mine, Western Australia. (Image: Wikipedia)

Now in 2024 comes news that the Australian Lithium mining industry, the largest in the world, is teetering on the edge of collapse as prices tumble and demand shrinks. So what has gone wrong? It's all down to a combination of falling sales of electric vehicles and a consequent over supply of Lithium on world markets. As a result, prices have fallen by some 75% since June 2023.

Australia produces slightly more than half of the world's Lithium and has the second largest reserves after Chile with huge deposits in Western Australia and the Northern Territories. There have been significant mine shutdowns across Australia. At the same time, other mines in the country have been expanding, confident that the market for the metal will return again - soon.

Sidmouth cliff collapse is 'biggest in years'...

There has been a major cliff collapse at Jacob's Ladder beach between Sidmouth and Ledram on the Jurassic Coast of East Devon. Whilst this is an area where cliff collapses are frequent, this latest one is the largest to affect the area in many years.

A 400-year old thatched cottage has been left perilously close to the edge, but there were thankfully no injuries to anyone on the beach. Thousands of tonnes of sandstone came down over the night of November 1st.

The incident was heavily reported upon in the local media, but also reached some of the national newspapers and the BBC. There are some excellent images of the scene, including some drone images, which provide an excellent record of the event.

Despite the huge volume of material deposited on the beach, much of



In this view, taken just a day or so after the cliff fall, it's already apparent how material is being washed away by the sea. (Image: Sidmouth Herald)

it has already been dissipated by the twice daily incoming tides.

East Devon Council posted a notice on its website saying: "Following a cliff fall at Jacob's Ladder Beach in Sidmouth, we'd like to remind visitors to keep their distance from cliffs along the East Devon coastline. Cliff falls are a natural and unpredictable occurrence along the East Devon coast. This is because the rock from which the cliffs are formed is soft, and therefore prone to rock falls, and landslides, which can happen at any time."



A drone image showing the cliff fall clearly. The thatched cottage is on the skyline. (Image: DevonLive/Ian Hosker)

Geologically, we are seeing the soft Otter Sandstone which was deposited in the Triassic period around 230 million years ago. The succession is characterised by minor joints and faults which become conduits for water flow within the rock, thus increasing the chances of failure leading to landslips.

The apparent increasing frequency of these cliff falls is obviously worrying for people along affected coastal stretches. There is nothing that can practically be done to prevent such falls so there's every likelihood that we will be reporting more of these in the future. One thing for sure, if this was a similar sized pile of Jurassic rock, there would be fossil collectors swarming all over it!

The strange case of the matching dinosaur footprints on either side of the Atlantic Ocean...

Scientists at Southern Methodist University (SMU) led by palaeontologist Louis L. Jacobs has found matching sets of Early Cretaceous dinosaur footprints on what are now two different continents. They were found in South America and Africa respectively on either side of the Atlantic Ocean.

Here's the full story from the SMU website:

More than 260 footprints were discovered in Brazil and in Cameroon, showing where land-dwelling dinosaurs were last able to freely cross between South America and Africa millions of years ago before the two continents split apart.

"We determined that in terms of age, these footprints were similar," Jacobs said. "In their geological and plate tectonic contexts, they were also similar. In terms of their shapes, they are almost identical."



A long ornithomimid trackway at Passagem das Pedra, Sousa Basin preserved in floodplain deposits of Lower Cretaceous. (Image: Ismar de Souza Carvalho)

The footprints, impressed into mud and silt along ancient rivers and lakes, were found more than 3,700 miles away from each other. Dinosaurs made the tracks 120 million years ago on a single supercontinent known as Gondwana— which broke off from the larger landmass of Pangaea, Jacobs said.

"One of the youngest and narrowest geological connections between Africa and South America was the elbow of northeastern Brazil nestled against what is now the coast of Cameroon along the Gulf of Guinea," Jacobs explained. "The two continents were continuous along that narrow stretch, so that animals on either side of that connection could potentially move across it."

Most of the dinosaur fossils were produced by three-toed theropod dinosaurs. A few were also likely made by sauropods or ornithischians, said Diana P. Vineyard, who is a research associate at SMU and co-author of the study.

What's the geological context? SMU's website again:

Africa and South America started to split around 140 million years ago, causing gashes in Earth's crust called rifts to open up along pre-existing weaknesses. As the tectonic plates beneath South America



Left. Theropod footprint from Sousa Basin, Lower Cretaceous of Northeastern Brazil. Credit: Ismar de Souza Carvalho. Right Theropod tracks from the Koum Basin in Cameroon. (Image: SMU)

and Africa moved apart, magma from the Earth's mantle rose to the surface, creating new oceanic crust as the continents moved away from each other. And eventually, the South Atlantic Ocean filled the void between these two newly-shaped continents.

Signs of some of those major events were evident between both locations where the dinosaur footprints were found – at the Borborema region in the northeast part of Brazil and the Koum Basin in northern Cameroon. Half-graben basins -- geologic structures formed during rifting as the Earth's crust pulls apart and faults form -- are found in both areas and contain ancient river and lake sediments. Along with dinosaur tracks, these sediments contain fossil pollen that indicate an age of 120 million years.

Before the continental connection between Africa and South America was severed, "rivers flowed and lakes formed in the basins" Jacobs said. "Plants fed the herbivores and supported a food chain. Muddy sediments left by the rivers and lakes contain dinosaur footprints, including those of meat-eaters, documenting that these river valleys could provide specific avenues for life to travel across the continents 120 million years ago."

Indonesia's Mount Lewotobi spews huge column of ash...

Indonesia has more active volcanoes than anywhere else on Earth and there's seldom a time when one or other of them is erupting. Currently it's Mount Lewotobi Laki-Laki. This erupted without much prior warning on November 4th, killing at least ten people.

The BBC reported:

The country's volcanology agency reported seven eruptions on Thursday, November 7th, with the most powerful ejecting a giant column of ash 8,000m into the air. Authorities imposed a 7km exclusion zone around the volcano on the island of Flores.

While visiting the devastated areas, officials found craters where rocks fell during eruptions, up to 13 meters (43 feet) wide and 5 meters deep, in several places including a destroyed school. "It shows a difference in characteristics from the previous eruption in January," said Wijaya, head of the volcanology center. He added that the earlier eruption mostly unleashed volcanic materials around the peak, followed by lava flows.



The Great Sulphur Vein saga Part 1

Here at Down to Earth we are always pleased to see original research especially when it's carried out by one of our readers. Over many years since his retirement, Lawrence Heslop has been actively working on aspects of his local geology in the Northeast of England. Here's his latest project...

Introduction

*'I see the nature of my kind as a locality I love.
Those limestone moors that stretch from Brough
To Hexham and the Roman Wall
These are the symbols of us all.'*

This verse from the W.H. Auden poem "New Year Letter" describes his appreciation of the North Pennine landscape, while environmentalist and botanist David Bellamy referred to these uplands as 'England's Last Wilderness'. Many centuries before either, the highest summit Cross Fell (2,930 feet) was called Fiend's Fell because it was the haunt of the devil. My relatives worked the coal seams along the fault lines on its northern edge, since childhood I have been a visitor and for a few years I lived close to the Cross Fell Inlier.

To me the North Pennines is a rare open landscape, a land from another time. Over the decades my understanding of the area's geology has grown enough to use a fascinating mineral vein, the Great Sulphur Vein (GSV) to open a window on the land where the North Pennine Orefield (NPO) belongs. Representative minerals are dominated by abundant sulphide ores especially galena and sphalerite with some deposits such as the GSV, richer in chalcopyrite, pyrite, pyrrhotite, marcasite and rare trace minerals.

The GSV from Knapside Hill on the western escarpment follows an easterly course across Alston Moor for nine miles to Darngill Bridge. At an elevation between 1,000 and 2,000 feet above sea level Alston Moor is delineated by the drainage system of the upper South Tyne valley. Until 1974 this was south-east Cumberland, now mid-east Cumbria and part of the 'North Pennines National Landscape' formerly the North Pennine ANOB. To celebrate the special nature of the orefield it was designated a UNESCO Global Geopark in 2003, Britain's first.

Structurally the GSV is a faulted monocline with a northward variable downthrow averaging 150 feet, and a maximum of 600 feet by the Cash Burn. The width of this mineralised vein also varies from 100 feet in the valley bottoms to 1,200 feet across the hilltop of Noonstones. From the early days of prospecting the vein promised the hardy miners their fortunes however a succession of attempts to find riches has yielded mainly disappointment. Having said that, as a geological feature the vein is of great interest and significance.

Background

At junior school I was told the Pennine Hills are the 'backbone of England' and made of limestone. They do form the spine of Northern England but are not one rock type, they are in the main formed by a



Sketch map showing location of Alston Moor in the regional context, as drawn by the author.

range of Carboniferous sediments deposited unconformably upon older Palaeozoic basement rocks. The overall structure of Northern England is dominated by a complex of fault bounded basins and blocks, their root cause being the closure of the Iapetus Ocean approximately 420 million years ago.

The North Pennines are divided by the Stainmore Basin into two blocks. The southern Askrigg Block and to the north the Alston Block. The latter is more heavily mineralised, hosting the North Pennine Orefield (NPO) covering an area of 580 square miles (roughly the size of Greater London), 440 mineral veins are named. On a global scale it has been recognised that this orefield has unique features. Alston Moor is located in the north-west corner of the NPO. The earliest evidence of mining activity comes from Bronze Age graves containing metal working tools at Kirkhaugh, close to Alston town, suggesting a link to local mineral exploitation. The adjacent Roman fort of Epiacum also points to the extraction of local minerals at least 2,000 years ago.



On the summit of Noonstones looking south west towards the hill tops of Cross Fell, Little Dun Fell and Great Dun Fell. The whitish blocky rocks are silicified sandstone.

The earliest extant mining records go back almost 900 years to the reign of Henry 1st, when the Carlisle Silver Mines (mines in the Lake District and Alston Moor) were mentioned. Elizabeth 1st used the expertise of German miners to exploit the Lake District's resources of lead and copper, when barren, some families moved across to Alston, almost certainly to develop the potential mineral wealth including the GSV. Several named veins in the vicinity are of Germanic origin. for example, Henrake (Heinrich barytes vein) on Great Dun Fell and Blagill (Bleigill) Mines just to the east of Alston. Thomas Robinson was born in Ousby a village overlooked by Alston Moor's high fells, he became the Vicar of Ousby whose parish includes part of Alston Moor. His passion for the natural world included geology and the miners.

There is a dedication to 'Gentleman Miners' in his first book '*Anatomy of the Earth*' published in 1694, when as a science, geology was in its infancy, 'To set some greater Wits on work to Improve the Subterranean Philosophy...your hearty well-wisher and humble Servant, Tho. Robinson'. In his next book published in 1709, '*An Essay towards a Natural History of Westmorland*' he mentions 'The Great Vein which hades east-west and contains Lead, Copper and Oker in four parallel mineral veins revealed by hushing'. He further remarks about 'the mighty vein of copperish sulphur'. Thomas Robinson died in 1719 and is buried in St.Luke's Chuchyard on the edge of Ousby village.

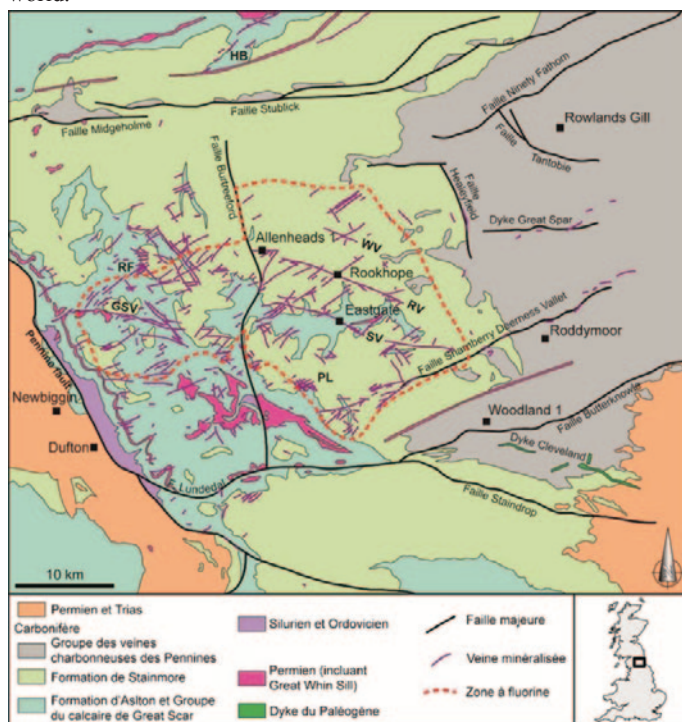
Another hundred years later an important early geology book was published, '*A Treatise on a Section of the Strata from Newcastle upon Tyne to Cross Fell*'. Its author, Westgarth Forster, was a highly respected local geologist, mining expert and a contemporary of 'Strata Smith'. Sourced from centuries of local lead miners' knowledge and personal observations, Forster worked out the stratigraphy of the Alston Block. Of importance to the surge in mining development with quaint terms : bedding planes were 'partings', veins were 'gashes' caused by earth movements, 'filled with mineral and earthy substances'.

He names the 'The Great Backbone' a 'powerful vein', explaining that 'it runs south-east to north-west, a great vein that contains quantities of Pyrites or sulphur stone blended with yellow copper ore. In Cross Gill Burn the produce of copper was so inconsiderable it would not

defray the expense of extraction.' This is the GSV, that almost divides Alston Moor into two halves. Westgarth Forster died in 1835; his grave can be seen in Garrigill cemetery.

In 1890 William Wallace's book '*Alston Moor, Its Pastoral People, Its Mines and Miners*' was published, a valuable cultural book and where I first found details of copper in the GSV : 'About 1814/15 the Commissioners of Greenwich Hospital commenced to make trials for the discovery of copper where it crosses Crossgill Burn. A level was made under the Scar Limestone and a sump was sunk to considerable depth. The operation was unsuccessful and the mine abandoned'. These workings were re-opened later during the 19th century by Messrs Cookson & Co. of Newcastle to raise sulphur pyrites. A hydraulic engine was placed in the Commissioner's shop (shop is a miners' term for a dwelling and site office). The venture was not profitable and closed down. The next attempt was in 1910, a 295 fathom (1,770 feet) borehole was put down by the North of England Mining and Mechanical Engineers, but once again results were disappointing.

Following his post-graduate studies (supervised by Arthur Holmes) and a government backed WW2 project of northern England's mineral resources K.C. Dunham wrote the now classic reference text '*The Geology of the North Pennines Vol. One*' published in 1948 by the HMSO. His book offers a wealth of information, facts and figures, e.g., between 1666 and 1938, 1,583 long tons of copper were mined on Alston Moor while all other districts of the North Pennines recorded negligible to zero quantities. The book can be considered the geological bible of the NPO for anyone drawn into this subterranean world.



A recent map of the North Pennine Orefield - note the position of the Great Sulphur Vein (GSV) (Image: Researchgate/Nicolas Charles)

The book contains two key findings by Dunham that have helped pave the way for future research:-

1. The spatial zonation of the two main gangue (non-metallic) minerals, a central Fluorspar zone surrounded by a barytes zone, thought to be one of the finest examples worldwide. These two

economically valuable minerals were once considered waste material by early miners. They occur as mutually exclusive deposits except in a narrow intermediate area where neither are abundant.

2. Dunham knew of the Cornwall & Devon ores and their link to the granites, guiding him to predict a pluton existed below the North Pennines. During 1960-61 a borehole was sunk at Rookhope and the weathered surface of a granite cupola was reached 1,320 feet below the surface, dating revealed an age of 410 million years old. Research and fieldwork continues in the North Pennines using new Technology and dating techniques.

The NPO has been one of the world's most active and investigated orefields over the past 300 years in which the GSV has played an integral part. The unearthing of mineral wealth in the NPO would have been more difficult without the pivotal historical and social changes shaping the industry's growth. Before the 1700's the area was a remote backwater, the landowner the Earl of Derwentwater (Sir Edward Radcliffe) bought Alston Moor in 1629 from the Crown. When the Earl took sides with the Jacobites in the 1715 uprising, his lands were confiscated by the Crown and the King gave all the mineral rights to the Greenwich Hospital for Seamen who leased the rights to the London Lead Company they managed the minerals and the mining families' needs.

At the time there were no roads, not even cart tracks, instead strings of Galloway ponies transported the ore mined on Alston Moor, 12 to 30 ponies per string, each carrying 200 hundredweight, 10 ponies per ton. Before the end of the century the Scottish civil engineer John Macadam was asked by the Company to construct a road network to connect the mines and settlements within the NPO. On September 29th, 1828, the main Newcastle-Hexham-Alston-Penrith Road was opened, the first east to west crossing since the Roman Maiden Way 1,800 years ago. New infrastructure on Alston Moor came with all the social welfare benefits expected from the Company's Quaker majority. Decent housing, libraries, schools and the integration of Methodism. By 1850 64% of the coalfield population could read and write, it was 90% in the NPO.



The derelict mine shop and an adjacent mountain ash tree on the reclaimed site of Smittergill Mine.

Stratigraphy

The Caledonian Orogeny took place in southern hemisphere; the complex tectonics involved the closing of the Iapetus Ocean to form ancient Lower Palaeozoic basement rocks. This important British geological event was part of a major tectonic zone stretching from the Appalachians across Greenland up to Northern Scandinavia. The rocks

of Northern England show evidence of the Ocean's destruction but of greater significance to this article are the structural elements of these basement rocks. The underlying rocks of Northern England are comprised of Ordovician Skiddaw Slates, Borrowdale volcanics and Silurian turbidites, strata that are well exposed in the Lake District but in the North Pennines they are restricted to outcrops along the foot of the western escarpment known as the Cross Fell Inlier, one other outcrop can be seen near Langdon Beck.

The collision of continents established the fundamental fault network and their reactivation by future tectonic events initiated the basin & block framework which played an important part in the course of later Palaeozoic and early Mesozoic sedimentation. The major fault lines or 'Caledonian Grain' are present in the Lake District, the North Pennines and the North Sea. As an example, the Causey Pike Fault extends from the west side of the Lake District across the Eden Valley and into rocks of the Cross Fell Inlier near to the west end of the GSV. Perhaps this fault's line of weakness influenced the position and trend of the GSV.

The early Devonian Acadian phase of tectonic deformation saw the emplacement of six granite plutons at a high level within the North Pennine strata forming an east north-east trending batholith 38 by 16 miles in extent. These plutons are 399 million years old, contemporary with, and of similar chemistry to the Skiddaw, Shap and Cheviot granites. The Tynehead pluton occurs under the central section of the GSV and with the other five were critical in underpinning and maintaining the structural high of the Alston Block, helping it to remain morphologically the same since the early Carboniferous.

Northern England was within a landlocked continent, any sedimentation was terrestrial there is no trace of Lower Devonian deposits and desert facies from the Upper Devonian remain only in pocket outcrops along the foot of the western escarpment. The Carboniferous rocks are present on a much greater scale, the period was named in 1822 for its abundance of coal-bearing strata and with a degree of contrariness these sediments in the North Pennines host the majority of the NPO mineral veins. From the late Mississippian 335 million years ago (mya) to mid-Pennsylvanian 310 mya, the 2000 feet-thick sequence of cyclothemic units present today on the Alston Block were deposited unconformably on the Devonian peneplain.

Many of the Alston Block's sedimentary beds were given their names by the lead miners. Erosion and reduced deposition have restricted their thickness during Carboniferous times to under half the amount measured in the adjacent sedimentary basins. Permian sediments are only exposed on the far eastern edge of the block and together with Mesozoic rocks occur more frequently in these basins surrounding the North Pennines. It is not until 2.6 mya when the Quaternary era began that new sediments were laid down. It is surmised likely that a cover of Jurassic and Cretaceous strata was laid down and completely eroded, creating an unconformity upon the Alston Block in the order of 300 million years.

Two significant igneous events occurred during this time period. First the Great Whin Sill: whin and sill are both terms first used by the miners of Alston Moor, whin meaning a hard layer of rock and sill, a layer which is by and large uniformly horizontal and persistent, the term sill describing a concordant igneous intrusion has become accepted worldwide. The sill was thought to be part of the normal succession until 1827 when Adam Sedgwick suggested it was an intrusion.

To be continued in the next issue of Down to Earth - DtoE 130

The Whin Sill igneous system extends south and west from Lindisfarne across Northumberland, the North Pennines to the Lunedale Fault and probably eastward under the North Sea.

At an average 90 feet thick with an estimated volume of 54 cubic miles, it is a quartz dolerite that was emplaced during very early Permian times rising and falling through different stratigraphic. Found from the lower Carboniferous through to the Coal Measures but not in the younger Permian strata, the sill's age ranges from 301 to 294 mya confirming intrusion occurred during the Carb-Perm unconformity. The Whin Sill is exposed in several places on Alston Moor's western escarpment and forms two impressive waterfalls.

Secondly a short distance to the south of the GSV a Palaeogene basalt dyke is exposed in a small valley and near the source of the South Tyne, aged 56 million years it is part of the Cleveland Dyke swarm originating on the Isle of Mull.

Tectonic history and orefield origins

Beginning with the North Pennine batholith. Confirmation of the batholith's existence in 1961 opened up possibilities of a direct link between the granite's heat flow and rising hydrothermal fluids as a source of the minerals. But a subaerial weathered roof and an age difference of 50 million years between the cooling granite and base of the Carboniferous period ruled out a direct link. Studies to determine the age of the North Pennine Orefield have offered ages from 290



million to 149 million years. William Wallace in 1861 gave the first comprehensive explanation. He thought the minerals came from the downward percolation of meteoric waters, listing five laws in control of the water's descent.

A branch of the exposed GSV crossing the river South Tyne. Note the veinlets of quartz.

J.G. Goodchild in response concluded that minerals were emplaced by thermal springs rising through pre-existing channels under great pressure during the 'Tertiary igneous cycle'. This contrasted to an idea in 1834 which reasoned that because minerals concentrated at certain horizons, they were in some way injected from below. An intriguing reference came from a paper in 1838 by a J. Leithart, "*Theoretical Principles to the Art of Mining*" he related that the formation of veins and their filling was due to 'terrestrial electricity'.

Dunham in his classic book noted 'of the ultimate origin of (mineralising) solutions, nothing is known' at the time he also discounted any connection with the Whin Sill. With increasing

technological and analytical improvements a favoured origin was based upon dating fluid inclusions in the quartz and fluorspar from the GSV. The trapped fluids within mineral cavities revealed saline fluids containing stable isotopes, originating from deep circulating connate waters that leached minerals by reacting with the Carboniferous wall rocks at depth. The heat source required was thought to be related to radioactive decaying minerals within the granitic batholith.

Some geologists added, the saline waters came from the Zechstein Sea. Entering the lower Palaeozoic basement during late Permian crustal extension, the fluids were heated and migrated upward around 200 million years ago to precipitate the minerals in the joints of the harder Carboniferous strata.

In 1990 Dunham's work on the GSV showed that with depth the abundance of quartz reduces as iron and copper sulphides increase suggesting to him a thermal gradient of rising fluids above the batholith to form the zonation of barytes and fluorspar minerals. New research in 2006 cast doubts on parts of this theory as findings show the inner boundary of the cooler barium zone (deposited between 130°C and less than 50°C) does not exactly coincide with the outer boundary of the hotter fluorite zone (deposited between 200°C and 100°C). This fact suggests these two zones are separate and represent two distinct events.

Geophysical work in 2018 offered supporting proof that the North Pennine Batholith was unlikely to be hot enough to create this thermal gradient also called 'the chimney effect'. Early this decade new scientific research by Dr. Eddie Dempsey and his colleagues opened up a new avenue which could prove to be the origin of the Alston Block's minerals. A key feature of this collective study are the four main orientations of the regional faults and fractures present within the Block's rock formations.

1. Cross Veins: NNW-SSE to NNE-SSW
2. Lead Veins: NE-SW
3. & 4. Quarter Point Veins: ENE-WSW and WNW-ESE

These are caused by four tectonic events from the early Carboniferous:-

- a) Thermal subsidence during the accumulation of sediments during the Carboniferous on the block and basin structure.
- b). The Variscan Orogeny (380 to 290 million years) across southern Europe had a 'far field' effect on Northern England in later Carboniferous times resulting in a north south crustal shortening powerful enough to reactivate old basement boundary faults including a deep-seated north/south trending east facing monocline, the Burtreeford Disturbance which almost bisects the Alston Block.
- c). Intrusion of the Whin Sill Complex, four separate sills were intruded over a six-million-year period from 300 mya caused by crustal extension of the lithosphere, magma and associated hydrothermal mineral rich fluids rose direct from the mantle through the roots of reactivated fault lines. Structural changes from the intrusion are thought likely to be responsible for the two sets of strike-slip faults, the cross veins and lead veins; they contain the majority of mineral veins.
- d) Towards the end of the Cretaceous and early Palaeogene a mantle plume close to present day Iceland initiated the opening of the North Atlantic causing an uplift of the North Pennines; again old fault systems were aggravated. This volcanic episode created many of the Scottish Inner Hebrides and produced dyke swarms, those originating from Mull spread south-east through Northern England. One of the most prominent dykes, Cleveland Dyke as mentioned, outcrops close to the GSV cutting through some mineral veins, dated 56 million years



The megafauna of the Ice Age

Material for Down to Earth arrives in many different ways from you, our readers. However one thing I can rely on is that for each issue there will be a contribution from Paddy Gaffikin.

The surprise is that I have no idea what subject he will tackle, this time it's the Ice Age megafauna...

*'All creatures great and small
.... The Lord God made them all.'*

C F Alexander (1818-1895)

The Ice Age

It was during the Pleistocene (2.58million years ago - 11,700 years ago) of the Quaternary Ice Age that the megafauna lived. Many evolved during the Ice Age but some evolved before it and they inhabited most of the continents. During this time there were severe glacial conditions but they were punctuated by warm spells (interglacials). The duration of the glacial and warm periods varied a lot from place to place due to factors like ocean currents, geography and the movement of the masses of ice.

When the (non-avian) dinosaurs, which dominated the Earth for about 150 million years, became extinct around 66 million years ago, they left an ecological niche in which the mammals thrived. At first the mammals were small in size – like rodents – but over millions of years they developed into larger mammals - to give us our megafauna. They were able to live through very cold conditions but most became extinct towards the end of the Ice Age (around 10,000 years ago).

However, not all the animals that lived through the Ice Age were massive in size. Examples would be: wolves, arctic foxes, snowy owls and eagles of the Steppes (Asia). They, like the megafauna, were able to adapt to changing climate and environment. A small number of large animals, which lived through the Ice Age are still with us today – e.g. Asian and African elephants and the white rhinoceroses. Modern humans also appeared during the Pleistocene Epoch (around 300,000 years ago).

Even during glacial episodes, like the last extensive glacial period for example, not all of the land was covered in ice. For instance, there were land bridges like the one connecting Alaska to Siberia, the one connecting Japan to mainland Asia and land linking Britain to Europe (Doggerland) and land joining northern Ireland to Britain because sea-levels were low as a lot of the water was locked up in the ice. It was not until the ice melted that these connections were severed. Among the Ice Age giants were woolly mammoths, sabre-tooth tigers, giant ground sloths and the giant Irish deer.

The woolly mammoth

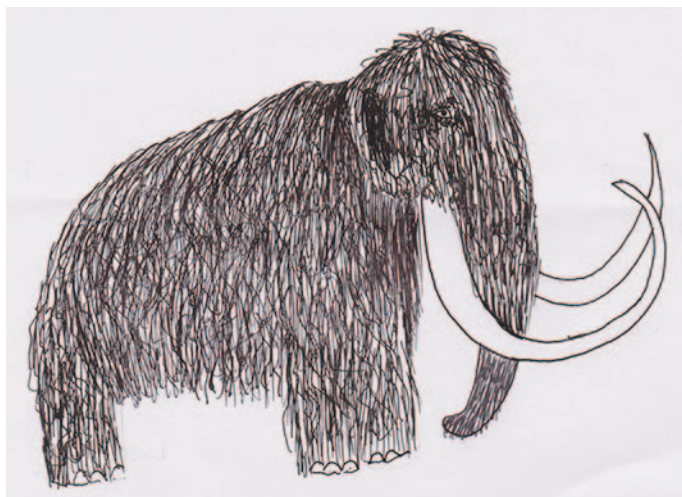
The woolly mammoth is probably the best known of all the megafauna of the Ice Age. It evolved around 250,000 years ago and it inhabited mainly Siberia, parts of Europe and North America. The last woolly mammoth died on Wrangel island in the Arctic ocean around 4,000 years ago. (It survived after most other megafauna became extinct.)

Very well-preserved fossils, thousands of years old, have been found in permafrost (frozen soil) and the permafrost, quick burial and natural



Ice Age megafauna in Beringia, Alaska (Image: Alaska National Park Service)

mummification permitted their excellent state of preservation. The frozen soil in permanently frozen ground provided the cold, dry conditions which prevented the growth of bacteria and so slowed decay. Many of the best preserved remains have been unearthed in Siberia and they provide scientists with valuable information about their biology and the ancient environment in which they lived.



Sketch of the woolly mammoth.

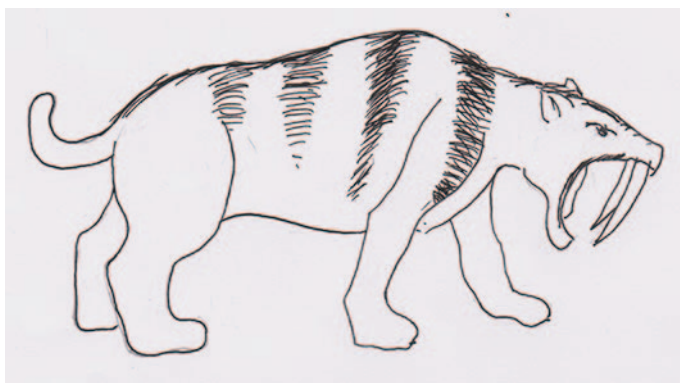
Remains include entire carcasses with fur and flesh and even the contents of their stomachs have sometimes been discovered. They possessed curved tusks, up to 3.5 metres long, which they would have used for foraging for food in the cold ground and their thick fur coats and robust build contributed to their long survival. The tusks may have also helped to deter predators (like the sabre-tooth tiger and wolves) as well as for display and maybe to attract mates for reproduction. Like their cousins, present-day elephants, they lived for 40-60 years. Factors such as environment, food availability and predation would have influenced their life-span.

They lived in herds, like modern elephants, and were fairly similar in size, when fully grown, to the large African elephants and, like them, were herbivores, feeding on grasses and shrubs. However, unlike elephants, woolly mammoths had a hump of fat on their backs, which would have assisted them to store energy during harsh winters. They overlapped with modern humans, who could use their bones for tools, dwellings and instruments for creating cave art. Some scientists think that using the DNA obtained from their (most recent) remains would enable them to bring back the woolly mammoths.

The sabre-tooth tiger

Of all the sabre-toothed cats the sabre-toothed tiger, which lived through the Pleistocene Epoch and became extinct when the ice melted around 12,000 – 10,000 years ago, would be the best known. Its generic name is *Smilodon* and is not related to present-day tigers or other modern cats. The name '*Smilodon*' is a combination of the Latin words for 'scalpel' and 'tooth' and it is the two external curved, sharp canine teeth, each one at the side of its mouth, that are most memorable.

The teeth, which were up to 20cms long, were used for stabbing and slashing prey and would have made them formidable carnivores - among their main prey were bison, camels, mammoths and deer. And they could open their mouths much wider than present-day cats. Many stood over one metre tall at the shoulder and had short limbs, a length of over two metres and a robust build – more so than most other extinct cats.



Sketch of a sabre-tooth tiger.

It is likely to have lived in forests, using the trees for cover when searching for prey. Its fossils have been found mostly in North and South America – most notably in Los Angeles, California in the La Brea Tar Pits, where over 2,000 skulls have been extracted. Although it is not certain, the sabre-toothed tigers were inclined to be solitary animals and did not live in packs say like modern lions.

The giant ground sloth



Sketch of a giant ground sloth.

The giant ground sloths are thought to have evolved around 35 million years ago, in South America, and migrated to North America around 8 million years ago. They lived during the Pleistocene Ice Age but became extinct at the end of the Ice Age. Modern tree sloths are related to them and, like them, are very slow in movement but are much smaller and, as their name implies, lived in trees unlike the giant ground sloths, which lived on the ground.

The ground sloths of the Ice Age were massive beasts, weighing up to 4 tonnes and stood on their hind legs, up to 3.5 metres tall. They had formidable claws but were herbivores; the claws enabled them to forage for food, which was mainly the leaves and twigs from trees. When standing on their hind legs, they could reach the upper levels of trees. Because of their hefty size and strength they would have required to consume huge quantities of food. Towards the end of the Ice Age they may have been hunted by modern humans to provide them with food.

They shared their environment with carnivores, such as sabre-toothed cats and wolves, but their huge size, especially displayed when the sloths were standing on their hind legs, was probably intimidating for predators. However, smaller juvenile ground sloths, because of their slow movement, would have been vulnerable to some predators. The likelihood is that they were, for the most part, solitary animals rather than existing in social groups. Fossils of ground sloths have been unearthed in North and South America.

The giant Irish deer



Sketch of the giant Irish deer.



Skeleton of the giant Irish deer on display in the Natural History Museum, Dublin.

(Image courtesy of Natural History Museum, Dublin.)

Sometimes the giant Irish deer is erroneously called 'the Irish elk' but

it was not, strictly speaking, an elk. It was not exclusive to Ireland but lived in other places such as England, Wales, parts of mainland Europe, Asia and the Isle of Man. The best preserved remains have been found in bogs in Ireland, for instance Ballbearing Bog in County Dublin, where over 100 fossilised skulls have been discovered.

Though very imposing, it was not the largest deer ever to exist but had the largest antlers, which measured over 3 metres from tip to tip. Only the males had the antlers and they were shed annually but regrew in the spring. It is thought the antlers were not employed for combat but probably for display, to attract mates for reproduction, and maybe to intimidate predators. Like other megafauna, it lived in the Pleistocene and became extinct around the end of the Ice Age.

They were herbivorous – feeding on vegetable matter such as grasses – and were social animals – living in (small) herds, providing safety in numbers. Predators, which are not thought to be very many, probably included wolves, brown bears and humans, who would have hunted them for meat, their antlers and hides. Fallow deer are their closest living relatives.

Extinction of the Ice Age megafauna

What caused the extinction of the Ice Age megafauna? Some possibilities are: rapid climate change, for example causing loss of habitats, predation by other animals, disease or over-hunting by humans. It doesn't seem to be just a coincidence that modern humans were increasing in numbers around the time of the demise of the giant Ice Age mammals. As with most extinctions over geological time, there is likely to be a combination of explanations. Maybe there was some factor, in at least some extinctions, that we don't know about yet. Anyway, there is no consensus to date among palaeontologists and other scientists as to the disappearance of some of the largest terrestrial mammals ever to exist.

Could some of the megafauna of the Ice Age be 'brought back'? All living things contain their unique DNA and it is in virtually every component of cellular life. Since Crick and Watson, in 1953, discovered the structure of DNA, there have been amazing strides in the understanding of DNA and in genetics generally. However, DNA deteriorates over time. Despite the assertions made in the Jurassic Park movies, the remains of ancient creatures like dinosaurs, which lived millions of years ago, would not yield suitable DNA to enable scientists to resurrect these creatures.

In the case of the well-preserved remains of animals, like the Ice Age megafauna, which lived thousands of years ago – a relatively very short time geologically speaking – may, in some cases anyway, yield DNA that theoretically could enable scientists to 'bring them back' – de-extinction as it is called. Besides the monumental technology that would be required for such a feat, there could be other major problems e.g. would it be ethical to do so?

There would also be ecological considerations. For instance, their habitat today would not equate exactly with the very cold, dry environment of the Ice Age. They could disrupt present ecological systems (e.g. be in competition for dietary needs with modern creatures). They may not be immune to present-day pathogens etc. And then there could be unforeseen consequences.

So, it remains to be seen whether the Ice Age mammals will be resurrected. There are some scientists, according to reports, who claim that they will be able to bring back the woolly mammoth in a few years time but, realistically, it's unlikely that it will happen anytime in the immediate future!

Another famous rock...

The Ross of Mull granite

Aside from a few well known rocks such as Shap Granite and Portland Limestone, most rocks found in the UK tend to be used in the area closest to where they have been sourced.

In the case of London and the Southeast this is more difficult as hard rocks cannot be found within around 100 miles of the capital. This explains why hard rocks from places like the Channel Isles are common in Central London.

However, in the case of the Ross of Mull granite there's a more local and specific explanation of why this rocks turns up across much of western Scotland and even beyond. The answer lies in the design and construction of numerous lighthouses by Robert Louis Stevenson and his descendents commencing in 1798 and lasting for around 150 years. At least 15 lighthouses were built using Ross of Mull granite shipped from the Mull quarries to the appropriate site.

This comes from the BGS website:

“Ross of Mull Granite was sourced from a cluster of quarries at the west end of Ross of Mull, on the island of Mull in Argyllshire. The stone comes from the Ross of Mull Granite Pluton, which formed during the Silurian Period (c. 425 million years ago) when Scotland was south of the Equator at roughly the same latitude as northern Angola is today.

Ross of Mull Granite was used locally, regionally, nationally and internationally, mainly to form masonry. Ross of Mull Granite is not quarried for building stone today.”



*A lovely example of polished Ross of Mull granite
(Image: turnstone.ca)*

This comes from <https://turnstone.ca/romg.htm>:

“The typical Ross of Mull granite is coarse (grain size circa 2-5 mm) and massive, pink in colour. It is a K-feldspar granite with pink K-feldspar predominant over white plagioclase, plus abundant brown-black biotite mica and smoky quartz. Lustrous brown sphene (titanite) is a common accessory mineral.”



*This is Ardnamurchan lighthouse the most westerly in the UK mainland, where Ross of Mull granite abounds, even in the outbuilding that now serves as a cafe.
(Image: Lochaber Geopark)*

In places the granite can be porphyritic and xenoliths are common in some parts of the intrusion.



*Ross of Mull granite in a former quarry at Fionnphort.
(Image: mullgeology.com)*



Things get a lot tighter for book publishers...

There was a time when the likes of Amazon were able to offer books at heavily discounted prices. They were only able to do this thanks to the enormous discounts they were able to squeeze out of the publishers. However over the past few months we've noticed two trends. Firstly cover prices are increasing by around 10% and secondly discounts to booksellers are being cut, again by at least 10%.

So whilst you are still able to shop around for the best prices, they aren't likely to be as low as they were. Sellers like Amazon look for the easy money, so don't expect to get something specialist for a bargain prices and look out for extra charges like a 'sourcing fee'.

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4/2024

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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 for 2025...

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.

The 2025 programme...

We are delighted to inform you that we have now completed our programme of residential field trips for 2025. The public offering of nine trips is less than in previous years because we have two private trips for Americans in the frame. We already have strong bookings, so you are strongly advised to get in as soon as you can.

To make a booking email us at:

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Whilst the brochures are, or will be, available 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.

Isle of Arran, March 30-April 6

£1395

Welcome to the Isle of Arran that is the original geologists' paradise. James Hutton was probably the first person to study the geology of Arran in 1786 when he described an unconformity at Lochranza. Since then, thousands have trod the paths to examine the rocks! Arran is currently going down the path to become a full geopark.



Arran on a beautiful day showing the landscape and a magnificent raised beach. (Image: Scottish Geology Trust)

This trip is based at the very comfortable (and warm) Best Western Kinloch Hotel at Blackwaterfoot on the Island's quiet west coast. We spend a leisurely week examining most parts of Arran, making full use of unlimited travel on the local buses - the terminus of the main route is right outside our hotel.

At this time there are vacancies for single and twin/double rooms.

Troodos Mountains, Cyprus April 24-May 1

£1795

Come and join us as we visit the Troodos Geopark in Cyprus for the very first time. In the company of an experienced local guide and geologist we'll explore something of the magnificent geology of this great Mediterranean island.

Five nights will be spent based at the Rodin Mount Hotel in the heart of the Troodos Geopark from where we will explore the rocks of this world renowned ophiolite complex. The final part of the trip will examine some of the sedimentary rocks from a second base in the heart of old Larnaca. This is a great time of year to be visiting this upland part of Cyprus - do come and join us!

Welcome to our real world!



The fabulous Troodos Geopark, where geology is at the heart of the landscape

Thanks to a cancellation, we have a double or twin room available for 2 people. In addition, we can accommodate both a male and female if you are willing to share a twin room with another male or female.

Scarborough, on the Yorkshire Coast June 1-6 £895

Amazingly, we have never based a trip at Scarborough the 'queen' of the Yorkshire Coast, for the simple reason that we've never found suitable accommodation! Based at the comfortable Cumberland Hotel, we'll spend 5-nights in and around the town, taking in field



The Cumberland Hotel in Scarborough. (Image: Leisureplex)

visits to places like Filey, Forge Valley, Robin Hoods Bay and Whitby to mention just a few. This will allow us to examine rocks from the Jurassic and also the Cretaceous with lots of fossils and sedimentary structures that give us clues to ancient environments.

At the time of writing we have single and double rooms available.

Isle of Mull & Ardnamurchan June 11-18 £1695

We have managed to secure reasonably priced accommodation at the Park Lodge Hotel in Tobermory and this trip replaces the one previously advertised to Raasay.

The Isle of Mull and Ardnamurchan will put two Tertiary igneous centres at our disposal with that on Mull being one of the most imposing, whilst that on Ardnamurchan is the most accessible. We also hope to be able to take in a visit to the tiny Isle of Staffa with its famous basalt columns, depending on the weather. Another highlight will be a visit to the Island of Iona with its Precambrian rocks.



Near the lighthouse at Ardnamurchan Point

With at least one full day on Ardnamurchan we'll be able to take in the fossiliferous Jurassic sediments as well as the basement metamorphics from the Moinian and the Tertiary igneous rocks.

At the time of writing we have only twin/double rooms available on this trip.

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. You'll be amazed at how much geological variety we can squeeze into this week of the best of the Lake District geology.

At the time of writing we can accommodate people in single rooms as well as twins and doubles.

NEW! Heart of Wales, July 9-16**£1295**

This is one of the most unusual offerings in our 2025 programme, for the simple reason that's an area that very few people know about. Mid-Wales, or as we prefer to call it, the Heart of Wales is a sparsely populated area set in the county of Powys.

We'll be based in the quirky Neuadd Arms in the quiet village of Llanwrtyd Wells, which offers excellent food, including an afternoon tea and cake, and even an onsite brewery!

From here we'll explore the surrounding area, taking in Llandrindod Wells with its fossils, Builth Wells with its volcanic rocks, Llandeilo and its famous Ordovician rocks. We take in the local Elan Valley rocks and scenery, the minerals of Cwmystwyth and the fine cliffs of Aberystwyth.

At the time of writing we have vacancies for about five more people.

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.

We can accommodate lots more people at this stage, including people looking for a single room.

Iceland - the North & East Fjords, September 1-11**£2595**

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 Borgarfjarðar Eystrí 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 fly back from Egilstaddir to Reykjavik and then transfer to Keflavik where we started. 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!

We can accommodate a few more on this trip.



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

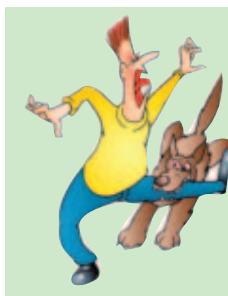
NEW! The South Devon Riviera, Torbay, October 8-15**£1295**

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.

The brochure for this trip is now out and we have already taken some bookings

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The Geology of the British Isles

This was one of the first distance learning courses that we devised. Over the years, many people have embarked on this geological journey since then, but now, for only the second time, we're bringing it to you live!

Chris is looking forward to sharing the British Isles' journey through time in 13 hour-long Zoom sessions. Each session will be brought alive through the use of YouTube videos and photographs, augmented by Chris's stories and Colin's material on Moodle. We want this to be the best course ever, aided and abetted by your own participation.

Course dates: Starts Monday November 11 - December 16 and then restarts January 13 for a further 7 weeks.

Cost: Thirteen hour-long Zoom sessions with electronic background papers £80.00 for one person or £95.00 for 2-people studying together. Printed background papers cost an additional £25.00.

Zoom sessions on Mondays at 2.00 and 7.00 pm (you choose)



The Severn Bridge spans the Bristol Channel - but what's the geological story? (Image: National Highways)

Time Traveller's Britain - all new locations!

Under this title we've explored more than 30 parts of the British Isles and examined the work of some of our geological pioneers, but for this short course, we're bringing you six more brand new episodes in the series!



*Book the whole course or individual sessions at £10.00 each.
Rock & Spindle volcanic neck, St Andrews*

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Course dates: Starts Thursday November 14 - December 19

Cost: take all six sessions for £40.00 for one person or £50.00 for 2-people studying together, or £10.00 for each session. Printed background papers cost an additional £10.00.

Zoom sessions on Thursdays at 2.00 and 7.00 pm (you choose)

The Wednesday club...

Over the past couple of years, we've been running a series of one-off sessions covering random geological topics. These were branded as 'Wednesdays at 7'.

Whilst these have been very popular, several of you urged us to also offer the same session in the afternoon. Well, we've listened and now you can enjoy the same content in the afternoon or the evening!

November 13	Alabaster - occurrence and uses
November 20	Graptolites - a geological enigma
November 27	Potash & Polyhalite mining in the UK
December 4	Metamorphic rocks in a nutshell!
December 11	The Ediacarans - the world's first fossils?
December 18	Gemstones of the British Isles

Cost: Take all six sessions for £40.00 or book them individually for £10.00 each.

Timings: Wednesdays at 2.00 or 7.00pm - your choice.

To register interest, email us at:

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You can enrol via our online shop at: www.geosupplies.co.uk



News from Essex - Ros and Ian Mercer are up to their geological tricks - again...

Down to Earth readers Ros and Ian Mercer are never still! Whether it's organising Essex Rock and Mineral Society's two venues with their monthly lecture programme, or the wider promotion of geology across Essex and beyond.

The latest is a 'mammoth project' which involves a huge sculpture being installed at Channels Park in Chelmsford. This striking piece of public art was a part of the original planning permission for the development of the site. The site now occupied by Channels Park was a former gravel quarry in the Essex White Ballast.



Ian and Ros Mercer with the sculptor Michael Condron stand in front of the mammoth at Chelmsford's Channels development.

A steering committee including Ros and Ian, was set up in 2020 to consider the theme and this is the end result. The mammoth, created by sculptor Michael Condron reflects the Ice Age history of the area with the sculpture being filled with glacial gravel from another local site, Bulls Lodge quarry, linking the geological and human history of the Channels site.

The 4.5 m tall, 5.5 m wide and 8 m long sculpture depicts a steppe mammoth which was a larger precursor of the woolly mammoth.



Close up of the sculpture showing its filling of glacial gravel. (Image: Ros Mercer)

Research into the geological past of the Channels site reveals that it was (and still is) the site of a glacial till cliff composed of well travelled rocks brought by the glacier.

The project has been funded through developer Section 106 contributions which can only be used for the use of public art, and routed through officers at Chelmsford City Council.

To get the 'back story' we contacted Ros Mercer and she told us:

"I had been liaising with the site owners and Chelmsford City Council for many years prior, regarding incorporating some aspect of the local geology into the development of the site. It had been a large quarry digging out Essex White Ballast deposited by the ancestral Thames which once flowed through mid Essex. My first letter was in 2008! Eventually it got to the stage of providing an appropriate artwork.

The neighbouring estate was in the grounds of New Hall, one of Henry VIII's palaces and so it was populated with deer sculptures as his hunting ground. For the Channels estate they wanted something as distinctive, but different. We were invited to the meeting at the City Council with the landscape consultants who showed us images of many public artworks including various rusty animals.

When it came to ideas for Channels, quiet descended over the assembled representatives of the developers, the site owners and the residents association. I then ventured to say "How about an Ice Age theme?" Then Ian said "What about a rusty mammoth?" All agreed that this was an idea they could run with, so the brief was sent out for an artwork with an Ice Age theme. We were asked to sit in on the short-listing and the final award of the commission. Michael Condron was what we considered the only true artist among them and his idea for a mammoth rising out of the landscape fitted exactly.

We worked with Michael to encourage him in his endeavours and to help with the workshop for local people as he was tasked with engaging with local people and schools as part of the brief. He was intrigued with the form of braided rivers that reflected the ancestral

Thames and he used this for the mammoth's cladding. Its body is filled with Essex White Ballast as it rises out of the landscape. It is located on a rise overlooking the main road into the development and particularly when floodlit at night, it stands out over the skyline."

The Editor comments: What a brilliant project! At a stroke this has raised the local profile of geology massively. It created nearly a page of coverage in the local paper and then it's there, in place for all to see for a very long time - Ros and Ian's mammoth!

Sad news for Lochaber Geopark...

During a recent *Down to Earth* field trip to the Fort William area we were pleased to see some of splendid work that has been done by the Lochaber Geopark. We were especially pleased to take in the stone circle which is located close to where the Caledonian Ship Canal enters Loch Linnhe.

This comes from 'wild about Lochaber':

"The Kilmallie Stone Circle is a stone circle created from of Highland rocks to showcase the geodiversity of the Highlands. The rocks span a major part of the Earth's history. The Circle was originally constructed in 1997 with funding from the Highland Council and Scottish Natural Heritage. It includes specimens of Dalradian slate from Ballachulish and Limestone from Torlundy, Moinian Serpentinite from Drumnadrochit, Cretaceous silica sandstone from Lochaline, Baryte from Strontian, Tertiary Basalt from Dunvegan and Gabbro from Mull, Cambrian Marble from Skye, Caledonian Granite from Strontian, Ross of Mull and Banavie, Caledonian Migmatite from Strontian, and Pegmatite from Loch Laggan, Torridonian sandstone from Western Ross, Moine granulite from Banavie and Lewisian gneiss from West Sutherland.



Kilmallie Stone Circle at Corpach.
(Image: Wild about Lochaber)

The Stone Circle provides a wonderful introduction to the types of rocks likely to be encountered in the region. There is an interpretation board on site, as well as an accompanying leaflet, produced by Lochaber Geopark Association. The leaflet provides a basic introduction to the geology of the region, as well as details of each rock type and its uses. The leaflet can be picked up from Kilmallie Community Centre (on site) or Tourist Information Centres."

However, it's long been known that Lochaber Geopark has suffered severe funding problems so it was sad to see that their information and exhibition centre on Fort William's High Street has now had to close permanently. They also seem to have suffered from problems with

their website. Let's hope that they can get things up and running again soon. In the meantime, discover some of their achievements, such as Kilmallie Stone Circle.

Better news for the aspiring Jersey Geopark...

Jersey is currently working on establishing itself as a fully fledged UNESCO Geopark. As well as a bold presence on the internet, the group also has a brilliant exhibition running at St Helier's Museum and Art Gallery.

At the helm of the current application process is Société Jersiaise and in particular its Geology and Jërriais Sections. Geologist Ralph Nichols is the Secretary, who says: "My favourite bit of Jersey geology is the Anne Port agglomerate and Anne Port rhyolite (Bouley Rhyolite Formation) with flow-banding, spherulitic rhyolite and columnar jointing. The columnar jointing at La Crête Point is similar to the Giant's Causeway in Northern Ireland but has no crater!"



Part of the Jersey Geopark exhibition at the Jersey Museum and Art Gallery
(Image: Chris Darmon)

Having visited Anne Port on our visit in September we can appreciate this fine geology too. Taking the wider view and the geology of the whole island, Jersey has a lot going for it as an aspiring geopark. Let us hope that it does not run into the financial problems that so many within the UK have suffered from in recent times.

Major Ichthyosaur find in the countryside of Leicestershire...

In some parts of the UK it's quite normal to halt work on a construction site, whilst archaeologists carry out work on a Roman site, such as those found in the City of York, but stopping to unearth an Ichthyosaur - that's something else!

Back in 2021 palaeontologists discovered what is now known to be the largest Ichthyosaur yet on the shores of Rutland Water. The latest find, which is part of an Ichthyosaur's skull, was discovered during the construction of the Melton Mowbray bypass, not far from Rutland Water and in similar Cretaceous and Jurassic strata. The 7 km long road is being constructed for Leicestershire County Council by Galliford and they have engaged a team of archaeologists who have investigated 11 sites along the route. Most of the interesting finds relate to aspects of human history from Mesolithic and Roman times onwards, but the Ichthyosaur skull at around 100 Ma is the oldest.

Ichthyosaurs were particularly long lived and examples are known from both the Jurassic and Cretaceous across the UK. They could grow up to 25 m long and in many environments were the marine apex predator species.

Whilst this is similar to the Rutland Water find of 2021, it's unlikely to be the same species and so far no more has been found of the current example.



*Part of the skull of a 100 million year old Ichthyosaur.
(Image: Archaeological Research Services)*

Whilst there are lots of upsides to the discovery of this and the associated archaeological finds, it does all come at a significant cost to the County Council, with an extra £11.6 million being added to the project budget.

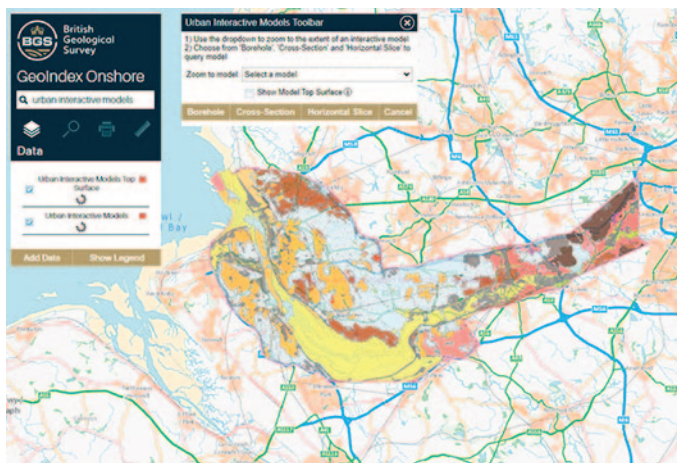
What lies beneath Liverpool (and Warrington)? - BGS launches new 3-D interactive tool...

This comes from the BGS website:

“The ground beneath our cities and towns is becoming increasingly important in a number of sectors. This is not only due to pressures from housing, transport, and utility infrastructure, but also from optimising the use of natural resources such as groundwater and heat.

BGS GeoIndex Onshore, which was produced and launched in 2021, is free for the public to use. It already includes conceptual models of London and the Thames valley, Cardiff, and the greater Glasgow region; now, a 3D interactive tool featuring Liverpool and Warrington has also been made available.

The tool provides a 3D characterisation of the rocks and deposits beneath the area that make up the upper tens to hundreds of metres of the below ground. This data provides a vital understanding of where certain geology is and can assist different sectors in their planning within urban areas. For example, it gives a heads-up to local authorities and engineering consultancies of where they should consider the management of groundwater, and identifies potential



geological resources, such as geothermal energy, when it comes to the planning and development of the area.”

You can find out more at:

<https://www.bgs.ac.uk/news/what-lies-beneath-liverpool/>

<http://geopark.org.uk/pub/2024/02/geofest-2024/>

Abberley & Malvern Hills Geopark report on another highly successful GeoFest...

Every year the Abberley & Malvern Hills Geopark undertakes a programme of events across the 800 square miles that it covers. Geopark partners - 24 in total - contribute their events to the GeoFest programme that was run over the months of June, July and August with thousands of people becoming involved along the way.

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The Stonehenge Altar Stone and its possible origin hit the news during the Summer and we covered it in our sister publication Down to Earth extra. It was suggested that the Old Red Sandstone came from somewhere in the Orcadian basin.

There was much press speculation about how the stone got down to Salisbury Plain including aspects of ancient trading arrangements. I stuck my neck out (as I often do) and suggested that glaciation may have played a part - below are some of the reactions that I got.

Hi Chris

"Great minds" evidently "think alike" (though I have never alluded to having a great mind!!)

Whilst reading the article on the Stonehenge altar stone, I remarked to my husband, I wonder why they are concentrating on Neolithic human transport & no one has mentioned that it could be an erratic?

..... then I scrolled down and read your editors comments!
Thank you, it restores my faith in my own intellect!

Jenny Allen

Dear Chris

I am responding to your suggestion that the recently analysed Altar Stone may have been carried there by ice. I think that is very unlikely. The most recent glaciation was centred around Loch Lomond which is a long way south of the Orkney Islands.

The ice moved away from Loch Lomond so any blocks of sandstone would have been carried towards Scandinavia, the movement of the ice has been well documented by tracing out the scour marks on the outcrops of the exposed base rocks in Scotland.

I also think that you are under estimating the technology of Neolithic Man, they were using stones from the far east in their jewelry and the Pharos used the technology they developed when they were building Maeshowe at Stenness in the Orkneys.

The stone must have had some religious significance for it to justify the effort that was required to move it such a long distance. The standing stones and carvings point to the Orkneys being an important centre.

I also think that the timescales mitigated against the earlier movement.

Peter Christie

Hi Chris

I was interested in the story about the sandstone boulder used as an Altar Stone at Stonehenge. I could not believe the guff coming from the Pundits on TV.

Talk of Neolithic Man dragging it down from Scotland seemed so daft that I waited for a more sensible suggestion to be put forward. To most Geologists the most likely reason was that successive Ice ages

transported it to the Midlands or even Thames Valley. It seems the lack of Geologists is affecting sensible discussions including the route of HS2!

Mick Penn

Dear Chris

This is Jim Miller from the Seattle area of Washington State USA. I agree with your comment about the potential for glaciation to move the altar stone far south of the source location. The erratic concept makes sense to me, much more than humans moving the stone 700+ km.

Jim Miller

The Editor comments: I'm delighted that we have had such a good response to my original piece. What baffles me though is the utter silence (or so it appears) from the wider geological world to the original press coverage.

Is it that the press weren't interested in an alternative view or was the geological world asleep or away on holiday at the time? We need to be awake to respond each and every time something is put out there that doesn't seem right to us. We need to knock on the doors of the press and media to ensure that our voice is heard.

Dear Chris

James Dent letter DtoE 128, August 2024

I was interested to read the letter in *Down to Earth 128* that James Dent was refused a voluntary holiday job ('no experience') by the Curator of Geology at Ipswich Museum in the mid sixties. I have looked at my records (I commenced as geologist there in April 1965) and that must have been a bad day because in the mid sixties I employed volunteer students from local schools for sieving, sorting and excavation work, usually one or two days a week, but a few for a week long. For example, from the local Northgate schools there were three students in 1965, nine in 1968. Few had any experience when they started.

Bob Markham

Dear Chris

Tell me about Ga

I enjoyed your meteorite article but can you please explain 'Ga' when talking about time. I'm a geologist but originated many years ago and a bit out of date. Also I am an avid proponent of not using initials, abbreviation etc except when needed (as in this case), and then only with accompanying, explanatory text. My view is that we need to draw people in, not divide and make others feel inferior.

Ruth Allen

The Editor replies: Ga is the official abbreviation for billions of years as in 'giga annum'. Sorry if this offended anyone.



Down to Earth

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

Who, What & Where?



The responses this time, to our little quiz were, to put it mildly, disappointing. We can only assume that it was too easy for you! You would have been correct if you thought the following:

What? The picture shows the entrance steps to the Sedgwick Museum.

Where? It's at the University of Cambridge.

Who? Professor Adam Sedgwick

Once again, I'm pleased to report that everyone who responded, got it all correct, so well done to you all. It's the little anecdotes that make this quiz so interesting - here are a few of your comments.

Julia Madelin summed it up in just a couple of lines: Adam Sedgwick, famous ground breaking geologist who sorted out geological periods in late 18 early 19 centuries. The building is the

Sedgwick Museum in Cambridge.

The couple of other respondents were even briefer in their comments, so it's down to your Editor to fill out the space!

I have a lot of time for the work of Adam Sedgwick as a true pioneer of English (and Welsh) geology. He was working at a time when there were few rules of the geological game, indeed he was working on those rules as he went from outcrop to outcrop. It's a bit like going on a journey where there are no maps of the road network and the communities along the route are all devoid of any clues as to their identity.

Like his arch rival (and former friend Roderick Impey Murchison), Sedgwick's passion was to 'read the rocks'. He was seeking to prove the order of the succession and to fit his rocks into the time ladder along with that of Murchison.

Unlike Murchison, Sedgwick was a diligent worker, someone who seems to have enjoyed the field environment with its highs and lows. There must have been times when he got extremely tired and lonely. Imagine what it must have been like to not have someone to share your field problems with. After he spectacularly fell out with Murchison, they certainly couldn't have had a cosy chat!

So what was Sedgwick's legacy? To start with he gave us 'The Sedgwick Club' the oldest student run geological society, set up at Cambridge in 1880 in his honour. His memorial at Cambridge was the new and enlarged museum that we see today.

Geologically we owe the naming of the Cambrian and the Devonian periods to Sedgwick. In the case of the Devonian this was jointly with Murchison.

As an academic he was an outstanding Professor of Geology at Cambridge and someone who had a profound influence on the young Charles Darwin, along with countless other students who had the pleasure of hearing him lecture to them.

Back in his native Yorkshire, a geological trail has been established, known as the Sedgwick Trail, it follows the River Clough, highlighting rock features and exploring the Dent Fault. This, along with the memorial of Shap granite in Dent and the Sedgwick Museum in Cambridge are constant reminders of a great pioneer geologist.

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?

No clues for this one and we think it's somewhat harder especially with a modern portrait!

As always we like to hear any anecdotes that you can add.

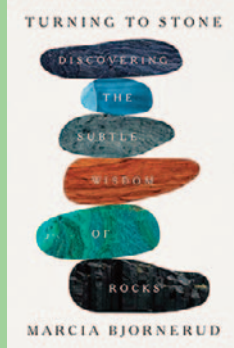
Please contact us before January 15th, by email.





Book Choice

Title: Turning to Stone
 Author: Marcia Bjornerud
 Publisher: Wildfire
 ISBN: 978 1 4722 9845 4
 Format: Hardback
 Cost: £25.00
 Level: Adult general interest
 My rating: *****



Since we first advertised “*Turning to Stone*” in our sister publication *DtoE extra* a couple of months ago, it has been well received, with several readers commenting how well it is written. Apparently, Marcia Bjornerud tells a great story!

I like books that take an alternative approach to geology, an author who tears up textbooks about rocks and says: “no to all that, I’ll do it my way.” And that’s exactly what Marcia does in her approach to rocks.

You can only do that if you are supremely confident with your subject matter, so that you can still weave into the narrative those facts that you need to. Marcia is, above all, a superb communicator, someone like the legendary Richard Fortey, who can make fossils into celebrities. She makes rocks into rock stars and it’s all about writing a compelling story.

A glance at Marcia’s other writing credits tells you all you need to know. She’s a professor at Lawrence University, but she writes for the likes of the Wall Street Journal, New Yorker and the Los Angeles Times. She’s also the author of *Reading the Rocks*, *Timefulness* and *Geopedia*. Through all of this she’s developed a style that combines the academic with the journalistic to give us something that’s informative, educational and yes, even mildly addictive.

So how do you write a book about a seemingly random list of rocks into something that’s so much more? Well, you have a concept and for Marcia this is to go back to what is essentially the rock cycle. To take rocks such as sandstone, basalt, turbidite, granite and eclogite and to tell their eventful and interesting stories.

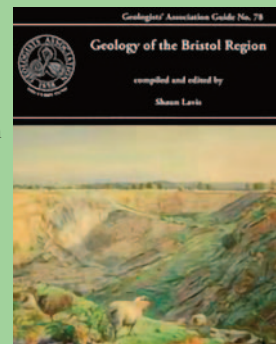
Rocks are the constant in our planet’s long and complex story. Each of the ten rocks she has chosen to tell their story, has a contribution to make not only to the our past but also our present and future.

This is an incredibly personal story. Marcia describes “*Turning to Stone*” as “the story of my deepening relationship with our rocky planet”. You can almost feel that relationship develop as you work through the chapters. One word of advice, don’t skip the prologue or the epilogue, the latter covers beach stones - as these are an integral part of the story.

This is one of those books, where lavish photograph in glorious colours would be a definite distraction. All you get are a few tasteful sketches and diagrams and that’s all you need. Marcia tells the story in words that replace a thousand photographs. One word for this book - brilliant! I can’t wait for the Netflix movie.

Book Choice

Title: Geology of the Bristol Region
 GA Guide No. 78
 Editor: Shaun Lavis
 Publisher: Geologists’ Association
 ISBN: 978 1 9996757 8 3
 Format: Wiroback
 Cost: £25.00
 Level: Adult & general interest
 My rating: *****



I’m amazed at how a society such as the GA, run largely by volunteers, can manage to keep up the flow of new guides - but they do! The latest guide, No. 78, is a triumph both in size, it’s 222 A5-pages and content, in that it covers the solid geology of much of Somerset.

This guide complements GA Guide No. 71 that covers the Quaternary and geomorphology of the Bristol region, that was published a couple of years ago. There hasn’t been a guide covering the solid geology of the Bristol area since “*Geological Excursions in the Bristol District*” was published by the University of Bristol in 1977. Needless to say, a lot has changed since then, not least the exposures and their geology.

The present guide is an absolute tour de force that manages to squeeze in a total of 16 excursions covering the geology in order of age, beginning with the Upper Palaeozoic rocks of Portishead, through to Jurassic rocks around Bath. There are also two building stone itineraries for Bristol city centre and Clifton.

As with all recent GA guides there is real quality here, in the geological information and also in the supporting text be it risk analysis, directions or logistics. Great care has also been taken with the use of full colour geological maps, sections, diagrams and full colour illustrations. I was impressed by the quality of many of the field images, where the light and weather conditions set off the outcrops to their very best.

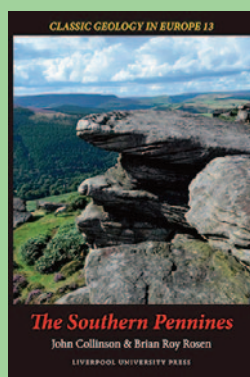
When you are covering so many famous locations such as Cheddar Gorge or Henry de al Beche’s Vallis Vale, you have to get it right, the geology almost demands that you do. This book doesn’t disappoint in any way.

My test, if one were needed, was to compare what this guide says about places that I’ve visited on many occasions, places like Portishead, Middle Hope and Weston super Mare. There really was no comparison between what this guide says and what was previously offered. Questions that I’d asked myself are answered here and you can’t have higher praise than that.

The only criticisms that I have are around the presentation of the information. Yes, this is a large book and I pose the question which others may well have noted. Is it perhaps too large, with the material sometimes looking a little too compressed? I wonder whether it would have been better for this to be in two volumes rather like the recent GA Guides to Cumberland and Furness. This is one of those arguments for which there is no answer that will suit everyone. Suffice it to say, this is a great guide - well done GA!

Book Choice

Title: The Southern Pennines
 Author: John Collinson & Brian Rosen
 Publisher: Liverpool University Press
 ISBN: 978 1 780461 00 7
 Format: Softback
 Cost: £30.00
 Level: Adult & general interest
 My rating: ****



This book has been in preparation for some time and was in the programme for release by Dunedin Press. Now that Dunedin has been taken over, it's in the stable of Liverpool University Press.

At a stroke, John Collinson and Roy Rosen have produced an up to date guide covering the area between the southern Yorkshire Dales and the southern edge of the Derbyshire Peak District. The book concentrates on the main Pennine range and the White Peak, but also includes high ground to the west; Rossendale, Forest of Bowland and the Staffordshire Moorlands. I wonder if people seeing the guide's title would realise that this is the case?

The first part of the book provides a modern explanation of geological succession including speculation about the pre-Carboniferous rocks. I particularly appreciated the section about the structure and tectonics that has been explored by BGS in recent years. However a cross section here would have been most informative.

John Collinson's expertise in the Carboniferous comes to the fore with his work on the provenance and palaeogeography of the time. It was also good to see recent work on the origin of the hydrothermal minerals and the importance of the contemporaneous igneous rocks given an airing.

The majority of the book is given over to a total of six regional excursions covering Nidderdale to Airedale, Clitheroe and Bowland, Millstone grit deltas of the Central Pennines, Kinder Scout and the Northern Derwent Valley, the Derbyshire Massif and the Southern Derwent Valley, the Staffordshire Basin and its Eastern margin.

Within these six itineraries are a large number of localities. Many of these are covered quite briefly, but adequately. A large number of them are abandoned quarries with open access, but for some of the localities ownership isn't known for certain.

The authors refer users to Google Earth and Google street view for maps of some areas and each site is provided with GPS coordinates. Readers are referred to the publishers website where these GPS coordinates can be down loaded on the book's web page.

There is a wealth of information in this book, with enough locations for months of field work around the region. Indeed I doubt whether anyone will manage all of them, but don't be put off by the volume of sites. My advice is to start with some of the well known areas such as the Monsal Dale Trail or Dovedale and then when you've done these go on to the more remote places.

Whilst this guide is written and illustrated at a technical level it will appeal to many visitors to the area, especially those with an existing interest in geology.

Title: Uncovering Dinosaur Behaviour
 Author: David Hone
 Publisher: Princeton University Press
 ISBN: 978 0 691 21591 4
 Format: Softback
 Cost: £25.00
 Level: Adult & general interest
 My rating: ****



"Oh no, not another dinosaur book I hear you say!" But this is no ordinary dinosaur book. It's not the right shape for a coffee table to start with and there aren't enough images either.

David Hone is a dinosaur expert who believes in putting theories about these creatures through rigorous tests. He's part of a movement of academics who study dinosaurs using all means at their disposal.

He's Reader of Zoology at Queen Mary College, University of London.

This summary comes from the publisher's website:

Our understanding of dinosaur behaviour has long been hampered by the inevitable lack of evidence from animals that went extinct more than sixty-five million years ago and whose daily behaviours are rarely reflected by the fossil record. Today, with the discovery of new specimens and the development of new and cutting-edge techniques, paleontologists are making major advances in reconstructing how dinosaurs lived and acted. *Uncovering Dinosaur Behaviour* provides an unparalleled look at this emerging field of science, presenting the latest findings on dinosaur behaviour and explaining how researchers interpret the often minimal and even conflicting information available to them.

David Hone begins by introducing readers to the fundamentals of dinosaur biology, diversity, and evolution, and goes on to describe behaviours across the whole range of species and groups, from feeding and communication to reproduction, sociality, and combat. Speculation about dinosaur behaviour goes back to the earliest scientific studies of these "terrible lizards." Hone traces how pioneering science is opening a window into prehistoric life as never before, and discusses future directions of research in this thrilling and rapidly growing area of paleontology.

Written by one of the world's leading dinosaur experts and featuring accurate colour recreations by paleoartist Gabriel Ugueto along with a wealth of photos and diagrams, *Uncovering Dinosaur Behaviour* is a foundational work on the subject and an invaluable reference for anyone interested in these amazing creatures.

Whilst this is a fairly academic book you'll find it easy to read as it's such a compelling narrative.

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diary of events

lectures/zoom meetings

November

- 15 Members' show and tell
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org>
- 15 "Orogenic bridge theory" by Jean-Bapiste Koehl (Zoom)
Organiser: North Eastern Geol. Soc. Details: <https://www.negs.org.uk>
- 18 "Aspects of my work at Oxford Natural History Museum"
by Duncan Murdoch
Organiser: Black Country Geol. Soc. Details: honsec@bcgs.info
- 19 "Salt of the Earth and salt of the sea" by Ann Barrett
Kent Geologists' Group Details: www.kgg.org.uk/
- 19 "How to measure the universe" by Chris Suddick
Organiser: Liverpool Geol. Soc. Details: lgssecretary19@gmail.com
- 20 "From cataclysmic super-eruptions to monogenetic burps: a crystal-eye-view of the timescales of volcanism" by Katy Chambers
Organiser: Westmorland Geol. Soc. Details: <https://westmorlandgeolsoc.org.uk>
- 21 "Identifying rocks" with Ian & Ros Mercer
Organiser: Essex Rock & Min. Soc. Details: <http://www.irms.org/> (Stanway)
- 21 "The Permian geology of the Wakefield district" by Tony Felski (Zoom)
Organiser: Hull Geol. Soc. Details: <http://www.hullgeolsoc.co.uk/hgmeet.htm>
- 23 "Changing perspectives on subsurface resources in Northern England"
with various speakers Organiser: Yorkshire Geological Society
Details: <https://www.yorksgeolsoc.org.uk/events>
- 25 "The story of flint: a really close look at an old friend" by Chris Clay
Organiser: Teme Valley Geol. Soc. Details: enquiries@geo-village.org
- 27 "Iceland granite - a model for Earth's early continents" by Sally Law
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
- 27 "Volcano-ice interactions in Iceland and Chile" by Dave McGarvie (Zoom)
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>

December

- 2 "Scotland's greatest ice age" by Ian Fairchild
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 5 "Fossil and mineral fakes and forgeries" by Ian Dunne
Organiser: Bath Geol. Soc. Details: <https://bathgeolsoc.org.uk/lectures/>
- 6 "Geological considerations of landfill design" by Ewan Thomas
Organiser: Geologists' Association (Hybrid Zoom/lecture)
Details: <https://geologistsassociation.org.uk/lectures/>
- 7 AGM followed by Jane Francis, Director of British Antarctic Survey
Organiser: Yorkshire Geological Society
Details: <https://www.yorksgeolsoc.org.uk/events>
- 9 "The geodiversity of landscapes of Cambridgeshire" by Steve Boreham
Organiser: Cambs. Geol. Soc. Details: <http://www.cambsgeology.org/events>
- 10 "The Thames through time, the history of an ice age river" by Ian Mercer
Organiser: Amateur Geol. Soc. Details: www.amgeosoc.wordpress.com
- 10 "The complex geology of the Somerset Coalfield" by Andy Gordon
Organiser: Dorset GA Group Details: <https://dorsetgeologistsassociation.org/>
- 11 "Sir Arthur Russell and his mineral collection" by Roy Starkey
Organiser: Shropshire Geol. Soc. Details: www.shropshiregeology.org.uk
- 11 "The Herefordshire Lagerstätte: soft-bodied virtual fossils from a Silurian volcanic ash" by David Siveter
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>
- 11 "Larvikite - a unique Norwegian rock" by Alan Smith
Organiser: Cumberland Geol. Soc.
Details: <https://www.cumberland-geol-soc.org.uk/events/>
- 12 "The taphonomy of a pantodont-rich assemblage from the San Juan Basin of New Mexico" by Paige de Polo
Organiser: Geol. Soc. of Glasgow. Details: <https://geologyglasgow.org.uk/>
- 12 "The Rutland ichthyosaur: digging up a dragon" by Emma Nicholls
Organiser: Hertfordshire Geol. Soc. Details: <https://www.hertsgeolsoc.org.uk/>
- 13 "Tufa in West Sussex and the place name of Steyning" by David Bone
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org>
- 13 "The history of oil and gas exploration, West of Shetland"
by Nick Schofield
Organiser: Farnham Geol. Soc. Details: www.farnhamgeosoc.org.uk/meetings/

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.

- 14 "Medicine and geology - an exploration" by Albert Benghiat
Organiser: East Midlands Geol. Soc. Details: emgs.org.uk
- 14 "Pembrokeshire, some geological highlights" by Sid Howells
Organiser: South Wales GA Details: <http://swga.org.uk/>
- 16 Members' evening & Christmas social
Organiser: Black Country Geol. Soc. Details: honsec@bcgs.info

January

- 5 "The sedimentology of palaeontology: how to accumulate richly fossiliferous deposits" by Jon Noad (Zoom)
Organiser: Geologists' Association
Details: <https://geologistsassociation.org.uk/lectures/>
- 6 AGM & members' evening
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 7 LGS in Iceland 2024" by Alan Clague & "Treasures of the Messel Pit"
by John Iley
Organiser: Liverpool Geol. Soc. Details: lgssecretary19@gmail.com
- 7 "Rock Solid 1 - millions of years" by Ian & Ros Mercer
Organiser: Essex Rock & Min. Soc. Details: <http://www.irms.org/> (Shenfield)
- 8 "From cataclysmic super-eruptions to monogenetic burps: a crystal eye view of the timescales of volcanism" by Katy Chamberlain
Organiser: Shropshire Geol. Soc. Details: www.shropshiregeology.org.uk
- 8 "Remote sensing of earthquakes and other hazards" by Ekbal Hussein
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>
- 9 "Mass extinctions" by David Bond
Organiser: Geol. Soc. of Glasgow. Details: <https://geologyglasgow.org.uk/>
- 11 "Atlantic Oceans" by Tony Waltham
Organiser: East Midlands Geol. Soc. Details: emgs.org.uk
- 11 Holiday geology
Organiser: South Wales GA Details: <http://swga.org.uk/>
- 13 Members' talks and New Year social
Organiser: Cambs. Geol. Soc. Details: <http://www.cambsgeology.org/events>
- 13 "Fossil trees" by Jed Atkinson
Organiser: Huddersfield Geology Group.
Details: <https://www.huddersfieldgeology.org.uk/talks/>
- 14 "Mass extinctions" by Michael Benton
Organiser: Amateur Geol. Soc. Details: www.amgeosoc.wordpress.com
- 14 "The world's oldest wooden structure" by Larry Barham
Organiser: Liverpool Geol. Soc. Details: lgssecretary19@gmail.com
- 14 "Geology and wellbeing" by Ruth Allen
Organiser: West of England GA Details: <https://www.wega.org.uk/>
- 15 "The evolution of the crust of southern Britain" by Tim Pharaoh (Zoom)
Organiser: Westmorland Geol. Soc. Details: <https://westmorlandgeolsoc.org.uk>
- 15 "Origin of mixed magma ring intrusions: implications for their extrusive, explosive ignimbrite equivalents in the BPIP, west Scotland"
by Linda Cotterill (Zoom)
Organiser: Edinburgh Geol. Soc. Details: <https://www.edinburghgeolsoc.org/>
- 16 "Early humans in Britain" by Jim Rose
Organiser: Warwickshire Geocons. Group Details: <https://www.wgcg.co.uk/>
- 17 "The Solent's tsunamis" by Steve Russell
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org>
- 17 "Granites - pipes or pizzas?" by Neil Phillips (Zoom)
Organiser: North Eastern Geol. Soc. Details: <https://www.negs.org.uk>
- 21 "The story of lead mining told by rocks" by Judith Milton
Organiser: Kent Geologists' Group Details: www.kgg.org.uk/
- 21 "The art of sand - from the Isle of Wight to Iowa - Part 1: Isle of Wight"
by Phil James
Organiser: Dorset GA Group Details: <https://dorsetgeologistsassociation.org/>
- 22 "The Anthropocene and its deep time geological context"
by Jan Zalasiewicz
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>
- 23 "The wood age: new discoveries of Pleistocene woodworking"
by Annemieke Milks
Organiser: Essex Rock & Min. Soc. Details: <http://www.irms.org/> (Stanway)

February

- 2 “Geological drugs and prophylactics - a look at the historical uses of fossils, minerals and rocks in the prevention and treatment of disease”
by Chris Duffin (Zoom)
Organiser: Geologists’ Association
Details: <https://geologistsassociation.org.uk/lectures/>
- 3 “The caves and karst of North Greenland” by Paul Smith
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 4 “Non-metals and metalloids - native elements” by Alistair Rickards
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Shenfield)
- 4 “Deep sea canyons” by Kostas Kirlakoulakis
Organiser: Liverpool Geol. Soc. Details: lgsecretary19@gmail.com
- 6 “Species loss, community collapse and ecosystem recovery during times of mass extinction” by Alex Dunhill
Organiser: Geol. Soc of Glasgow. Details: <https://geologyglasgow.org.uk/>
- 8 “Geothermal energy” by Ian Stimpson
Organiser: East Midlands Geol. Soc. Details: emgs.org.uk
- 10 “Railway Quaternary geology” by Sebastian Gibson
Organiser: Cambs. Geol. Soc. Details: <http://www.cambsgeology.org/events>
- 11 “Rise and fall of a Lake District Wolfram mine” by Chris Darmon (Zoom)
Organiser: Amateur Geol. Soc. Details: www.amgeosoc.wordpress.com
- 11 “The geology of Oman” by James Cresswell
Organiser: West of England GA Details: <https://www.wega.org.uk/>
- 12 “The 1831 Darwin-Sedgwick tour of North Wales” by Michael Roberts
Organiser: Shropshire Geol. Soc. Details: www.shropshiregeology.org.uk
- 12 “Geothermal energy” by Chris Rochelle
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>
- 13 “Economic geology” by Klara Brooksby
Organiser: Geol. Soc of Glasgow. Details: <https://geologyglasgow.org.uk/>
- 14 “Exploring Antarctica’s buried landscapes” by Stewart Jamieson (Zoom)
Organiser: North Eastern Geol. Soc. Details: <https://www.negs.org.uk>
- 15 “The letters of William Smith” by Kevin Privett
Organiser: South Wales GA Details: <http://swga.org.uk/>
- 18 “The Toba super-eruption” by Doreen van Eenus
Organiser: Kent Geologists’ Group Details: www.kgg.org.uk/
- 18 “Satellite monitoring of our hazardous planet” by Tim Wright
Organiser: Liverpool Geol. Soc. Details: lgsecretary19@gmail.com
- 19 AGM & Presidential address by Hugh Tuffen
Organiser: Westmorland Geol. Soc. Details: <https://westmorlandgeolsoc.org.uk>
- 20 “Rock Solid 2 = feldspars” by Ros & Ian Mercer
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Stanway)
- 21 AGM plus talk, show and tell
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org>
- 26 “Are dinosaurs warm or cold blooded?” by Alfio Chiarenza
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>

March

- 2 Presidential address by Alison MacLeod
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com
- 4 “The history and importance of the Ludlum mineral collection”
by Mike Rumsey
Organiser: Essex Rock & Min. Soc. Details: <http://www.erms.org/> (Shenfield)
- 4 “A revision of the Ordovician volcanoclastic and Caledonian structural evolution of Northern Eryri – why change the status quo?” by Alistair Baird
Organiser: Liverpool Geol. Soc. Details: lgsecretary19@gmail.com
- 10 “Geology of Gerrotxa (NE Spain)” by John Williams
Organiser: Huddersfield Geology Group.
Details: <https://www.huddersfieldgeology.org.uk/talks/>
- 10 “Crossrail construction” Ursula Lawrence
Organiser: Cambs. Geol. Soc. Details: <http://www.cambsgeology.org/events>
- 11 “Palaeobotany and the Tibetan Plateau” by Bob Spicer
Organiser: West of England GA Details: <https://www.wega.org.uk/>
- 11 “Practical session: ice ablation” by Maggie Williams
Organiser: Liverpool Geol. Soc. Details: lgsecretary19@gmail.com
- 12 “The role of the Ediacaran strata of the Longmynd in determining the severity of Earth’s first mass extinction” by Alex Liu
Organiser: Shropshire Geol. Soc. Details: www.shropshiregeology.org.uk
- 12 “Bologna stone: a curious tale of persistent photoluminescence”
by Frank Ince
Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>
- 12 “Himalayan geology” by Danny Clarke-Lowes
Organiser: Cumberland Geol. Soc.
Details: <https://www.cumberland-geol-soc.org.uk/events/>

- 18 “Rocks & minerals under the microscope” by Brian Lines
Organiser: Kent Geologists’ Group Details: www.kgg.org.uk/
- 18 “The art of sand Part 2: Iowa” by Phil James
Organiser: Dorset GA Group Details: <https://dorsetgeologistsassociation.org/>
- 19 “Five Hundred million years that changed the world: geological travels in South Africa through Earth’s first oxygenation” by Stefan Schroeder
Organiser: Westmorland Geol. Soc. Details: <https://westmorlandgeolsoc.org.uk>
- 21 “The onset of modern style plate tectonics” by Craig Storey
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org>

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

December

- 14 Geoconservation day at Portway Hill, Rowley
Organiser: Black Country Geol. Soc. Details: honsec@bcgs.info
- 18 Visit to National Museum of Wales, Cardiff with Cindy Howells
Organiser: Reading Geol. Soc. Details: rgs.secretary@btinternet.com

March

- 15 Hade Edge, West Yorkshire with Bob Appleyard
Organiser: Huddersfield Geology Group.
Details: <https://www.huddersfieldgeology.org.uk/talks/>

residential field trips

2025 March

- 30-April 6 The Isle of Arran with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

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
- Mid-June Glamorgan Coast with John Nudds
Organiser: Farnham Geol. Soc. Details: wessa2006@hotmail.co.uk
- 25-30 The Western Lake District with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

July

- 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

September

- 1-11 Iceland: the North & East Fjords with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

October

- 8-15 Torbay & South Devon with Chris Darmon & Colin Schofield
Organiser: Down to Earth Details: downtoearth@geosupplies.co.uk

fairs, shows & special events

November

- 16 Sussex Mineral & Fossil Show**
At Haywards Heath College, Harlands Road, RH16 1LT
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org>
- 30 North London Mineral, Gem & Fossil Show** At Trinity Church, Nether Street, London N12 7NN
Organiser: Amateur Geological Society
Details: www.amgeosoc.wordpress.com
- 30 Southeast England Regional Conference “People and Places”**
At Kings Church, Brooks Road, Lewes BN7 2BY
Organiser: Anthony Brook Details: anthony.brook27@btinternet.com



Let's begin with a serpent!

The Victorians loved a spectacle and weren't too bothered about the truth of the statements they made, especially when it came to entertainment.

Down to Earth reader *Caz Donovan* recently unearthed this gem of a poster:-

TOWN-HALL, NEATH,
(By Permission of the Worshipful the Mayor.)
On Thursday, Friday and Saturday,
JANUARY 30th and 31st, and FEBRUARY 1st, 1851, will be Exhibited
an extraordinary Specimen of

THE WONDERS OF NATURE,

*Found on Friday, January 17, 1851. Embedded in a Coal Vein at the Kimle,
on the Gnoil Estate, near Neath.*

It has been inspected by several Gentlemen of great Geological Acquirements, who have not succeeded in arriving at a satisfactory conclusion as to its identity with any of the Fossil Inhabitants of by-gone worlds; but do not hesitate, from the perfect state of the Scales with which it is covered, and the natural coil or twist in the Trunk or Body, to pronounce it a

FOSSIL SERPENT!

It measures 8 feet 3 inches long and 7 inches across, and must have been when alive, (some thousands of years since,) a Reptile of immense strength.

GEOLOGISTS, NATURAL HISTORIANS, and the PUBLIC
generally, will find this a most interesting Exhibition.

Admission:—Ladies and Gentlemen, 1s. each; Tradesmen, 6d.; Working Classes, 3d. Open from 11 o'clock in the Morning until 1, & from 2 until 10 o'clock in the Evening.

T THOMAS, PRINTER AND STATIONER, NEW-STREET, NEATH

So what was this 'fossil serpent'? The clue comes from the fact that it was found 'embedded in a coal vein' - why it's a *Lepidodendron* tree fossil!

We enjoyed our trip on the Welsh Highland Railway, under steam power...

If, like me, you're a railway buff you'd have enjoyed our trip in July on the Welsh Highland Railway which runs from Porthmadog to Caernarfon.

A trip along the full length of this narrow gauge line was out of the question for at least two reason, the cost and also the time that it takes. We had to remind ourselves that it was geology and landscape that we were primarily here for, after all!

The timetable indicated that our train was likely to be a diesel in at



Our beautifully polished Beyer Garratt locomotive with its rare Welsh coal piled high in the tender at Beddgelert.

(Image: Chris Darmon)

least one direction between Porthmadog and Beddgelert. At least this would mean that our people would be more focused on the geology!

As it turned out not only did we manage to see some superb scenery along with slates and igneous rocks, but we were pulled by two different Beyer Garratt locomotives, one built in Gorton, Manchester and the other in Belgium. Even more remarkably, they were burning some of the very last Welsh coal from the recently closed colliery at Ffos-y-Fran, which closed last year.

Jersey security patrol...

We saw this attached to the gateway of a private residence on the island of Jersey. We're not quite sure that sort of message it was trying to get across and to whom it was being addressed! Perhaps it's just the calling card of the home's residents!



From cats to an alligator...

The last thing you expect to find in the countryside of North Yorkshire is an alligator, but here he (or she) is at the entrance to the Ingleton Waterfalls trail.



It's actually a somewhat vicious metal trap designed to let vehicles out of the car park but not to allow them to go in - trust me it's the correct name for them!

A visit to Sintra near Portugal's capital city of Lisbon...

I've recently returned from a holiday in Portugal where I was able to observe geology that I expected and some that I did not. I expected to find Mediterranean sediments, especially fossiliferous limestones and sandstones, but not granites!

Sintra is just a few miles west of Lisbon and quite close to the Atlantic Coast. It's a cultural city with a great Moorish history. It's also the place to see royal palaces and castles. The castle walls have been built on top of granite tors - no wonder the walls go up and down!



I found this useful summary of the geology online:

The Serra de Sintra is a landmark on the western coast of the Iberian Peninsula, resulting from the intrusion of a complex of alkaline igneous bodies during the upper Cretaceous in a stretched continental passive margin associated with the opening of the Atlantic Ocean. It is a differential erosion mountain standing out on a coastal plateau laid over the Mesozoic sedimentary rocks of the Lusitanian Basin and where the Cenozoic materials are scarce, difficult to date and essentially of continental facies. The morphological evolution of the Serra de Sintra reflects its progressive isostatic rebound and the work of marine erosion combined with Quaternary fluvial retouching.

Meanwhile in Evora, there's a Roman temple and lots of xenoliths...

Never let it be said that your Editor isn't up for a bit of culture, in this case it was a visit to the Portuguese city of Evora to see both Moorish and Roman remains.

To see a part of a 2000 year old Roman temple in the heart of the city was pretty amazing even if it was surrounded by busy traffic which somewhat spoils the place.



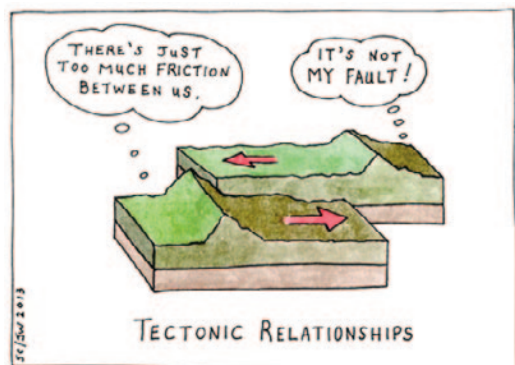
The Roman temple at Evora - taken during a gap in the traffic!

Around the centre of Evora the usual marble and basalt, black and white pavements were replaced with slabs of granitic material, many of which contained mafic xenoliths.

The origin of these slabs (along with others which were high grade metamorphic rocks) is a local massif of Carboniferous age. This dome like structure is the explanation for the high ground which was an obvious attraction for ancient inhabitants as it could be more easily defended.



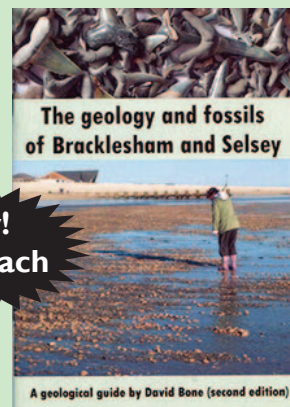
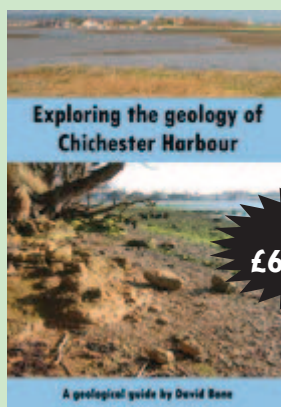
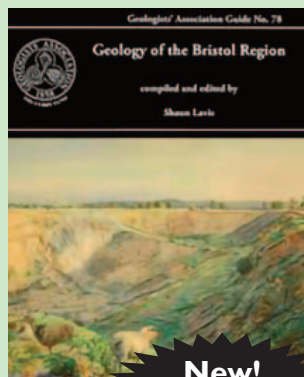
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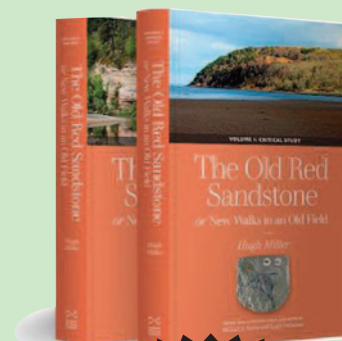
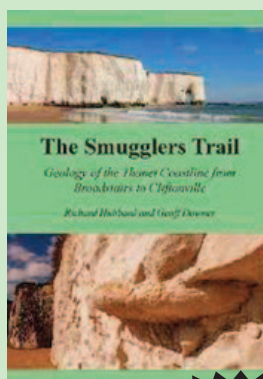
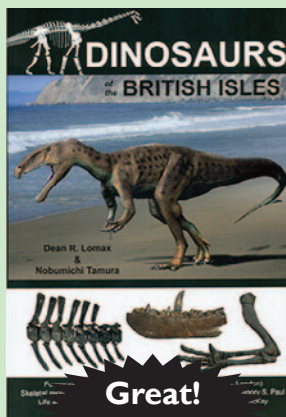
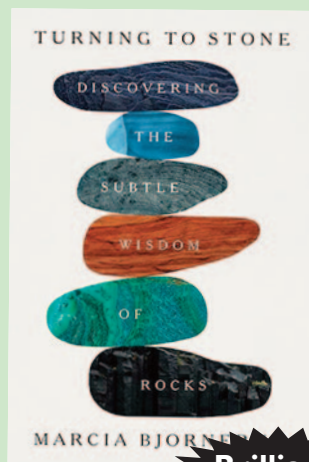
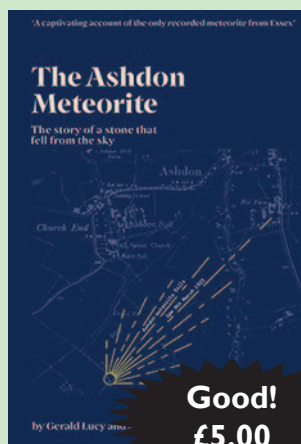
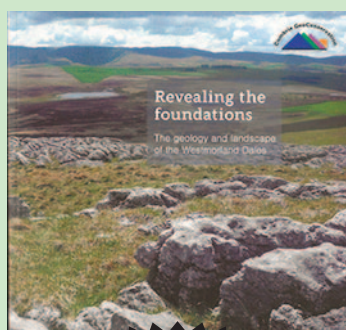


Featured books November to January

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 January 2025 provided that stocks are available. Please note, all prices include UK postage.



Buy both of the above for £10.00



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