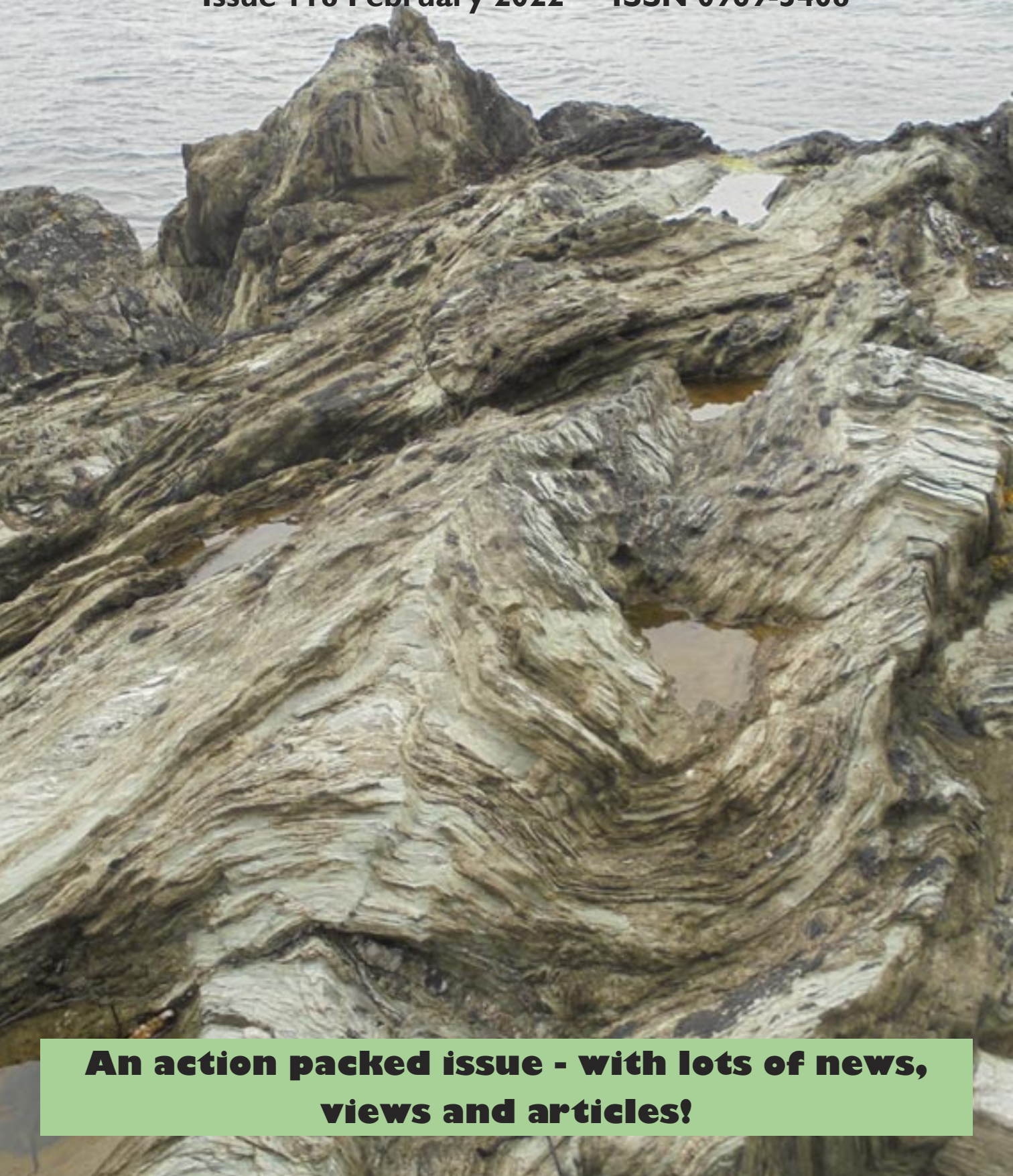




# **Down to Earth**

**Issue 118 February 2022 • ISSN 0969-3408**



**An action packed issue - with lots of news,  
views and articles!**



**Down to Earth**

# Get your bookings in for 2022 residential trips...

*This is the amazing Fingal's Cave on the Isle of Staffa, off the west coast of the Isle of Mull. It is composed of continental basalt that originated in Greenland.  
(Image: Chris Darmon)*

*With the lifting of the so called 'plan B' Covid restrictions, it's all looking good for our residential field trip programme for 2022!*

*We are especially pleased that we have the go ahead for our long delayed Summer School at the University of Worcester. This August event already has 30 people signed up and raring to go!*

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*For 2023 we are planning a return to Iceland, there's something to look forward to!*

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# Down to Earth 118

## February 2022

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Editor: Chris Darmon  
Assistant Editor: Colin Schofield

Tel: 0114 245 5746 • FAX: 0114 240 3405  
E-mail: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

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

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## cover story

*This image shows a beach outcrop of Dalradian phyllite on the west coast of the Isle of Arran.*

*Scale is all important here. These folded metamorphic rocks are only a matter of a few cm across from crest to crest.*

*You also get a feel for the shiny chlorite mineral that dominates this rock.*

*(Image: Chris Darmon)*



## editorial

### Tonga eruption - a tale of bad luck & the dangers of isolation..

At a time when the very future of 'global Britain' is under close political scrutiny, spare a thought for the inhabitants of the tiny Pacific state of Tonga. Tonga is a member of the British Commonwealth and a far flung part of our former empire.

On January 14/15th 2022 the island suffered a massive ash fall, followed by a tsunami, caused by a large eruption from a nearby undersea volcano.

The Hunga-Tonga-Hunga-Ha'apai volcano is probably not even one you've heard of. It's usually not much to look at. It consists of two small uninhabited islands, Hunga-Ha'apai and Hunga-Tonga, which stick out about 100m above sea level and lies 65km north of Tonga's capital Nuku'alofa. However beneath the waves it's a different matter, a massive volcano, around 1800m high and 20km wide.

The eruption of January 15th sent a column of ash high into the atmosphere. It was captured on satellite images that quickly flashed around the world. It's happened many times before and Tongans are used to dealing with it. There were eruptions in 2009 and 2014/15 with hot jets of magma and steam exploded through the waves. But these eruptions were small, dwarfed in scale by the January 2022 events.

The latest event, which triggered what has been described as a severe tsunami which has caused devastation across the main island and even greater damage on some of outlying islands. It has also impacted on the wider region, including in Japan and even on the west coast of the US.

Even a week after the eruption we still don't know the true extent of the damage and destruction caused to Tonga and its people. The one communication cable has been severed and even then internet is weak and sporadic.

Everywhere is covered in a blanket of grey volcanic ash and there is a desperate need for clean water. Whilst aid is ready to be transported by air from Australia and New Zealand, it's waiting for the Tongans to clear the runway of the thick layer of ash before that can happen.

As for larger shipments of aid that would normally come by sea, there are fears that the necessary port infrastructure has been wiped out and deep channels may have been lost.

The position of Tonga, close to where the Pacific Plate dives beneath the Australian Plate makes this a potentially dangerous place to live. That said, no amount of disaster planning could have prevented this from happening. They were simply too close to have anything more than a few minutes to move to higher ground as the tsunami struck.

Natural disasters like this will always happen. They are not, for once, related to climate change. They are a reminder that we live on an active planet where sudden eruptions can occur and where plates collide. Thank goodness we don't have to endure such disasters here in the UK.

*Chris Darmon, Editor*



## Tonga covered by a carpet of ash and suffers major tsunami damage after under sea volcanic eruption...



*It's a tiny island, but it sits on top of a major undersea volcano. Ash from the eruption has covered nearby Tonga and the island nation has also been damaged by the resulting tsunami. (Image: 1NewsNZ/Twitter)*

Prior to January 14/15th very few people will have heard of the Hunga-Tonga-Hunga-Ha'apai volcano but the people of the remote Pacific island nation won't forget the damage it has done to their property and livelihoods. The volcano formed a small surface feature but the resultant explosive eruption was large enough to be seen from space.

*This was published by the Smithsonian/USGS on their weekly volcanic activity report:*

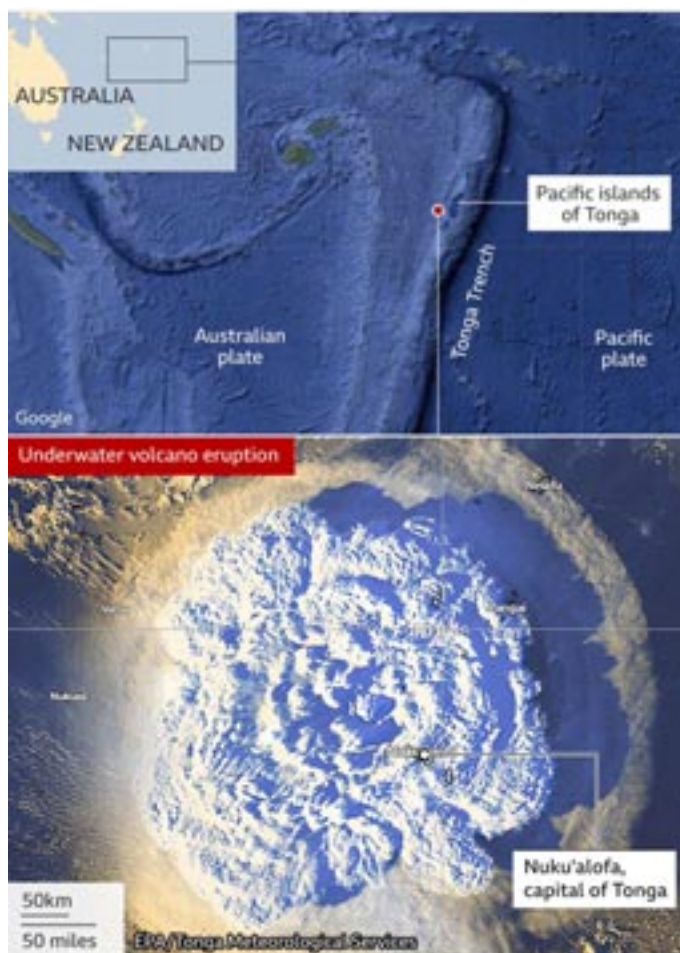
"Large eruptions at Hunga Tonga-Hunga Ha'apai on both 14 and 15 January produced plumes that reached the stratosphere and caused significant regional effects. Activity on the 14th apparently removed approximately the middle third of the island that had been expanded over the previous few weeks, revealed by a Planet Lab image acquired at 15.25 on 15 January. About two hours after that image was taken an even stronger eruption produced a stratospheric plume seen in satellite images, sent pressure waves across the atmosphere, and caused tsunami that traversed the Pacific. Following these explosions, a Sentinel image acquired on 17 January showed that most of the previous combined island had been destroyed, leaving only small parts of the NE island of Hunga Tonga (200 m long) and the SW island of Hunga Ha'apai (700 m long) above the ocean surface."

*Read the full report at:*

[https://volcano.si.edu/reports\\_weekly.cfm#vn\\_243040](https://volcano.si.edu/reports_weekly.cfm#vn_243040)

Since the initial eruption, the focus has been on the damage that has been wrought to the scattered inland settlements that make up Tonga. Amazingly, there appear to have been only three deaths and a relatively small number of injuries. However that has been widespread damage to buildings, infrastructure and loss of crops. Some of this has been caused by the blanket of ash that covers the area and also from the impact of the tsunami wave that followed the eruption.

The tectonic setting of the Hunga-Tonga-Hunga-Ha'apai volcano shows that it sits close to the where the Pacific Plate is being



*Tectonic map showing the tectonic position of Tonga (top) and the eruption as seen from space (bottom). (Image: USGS)*

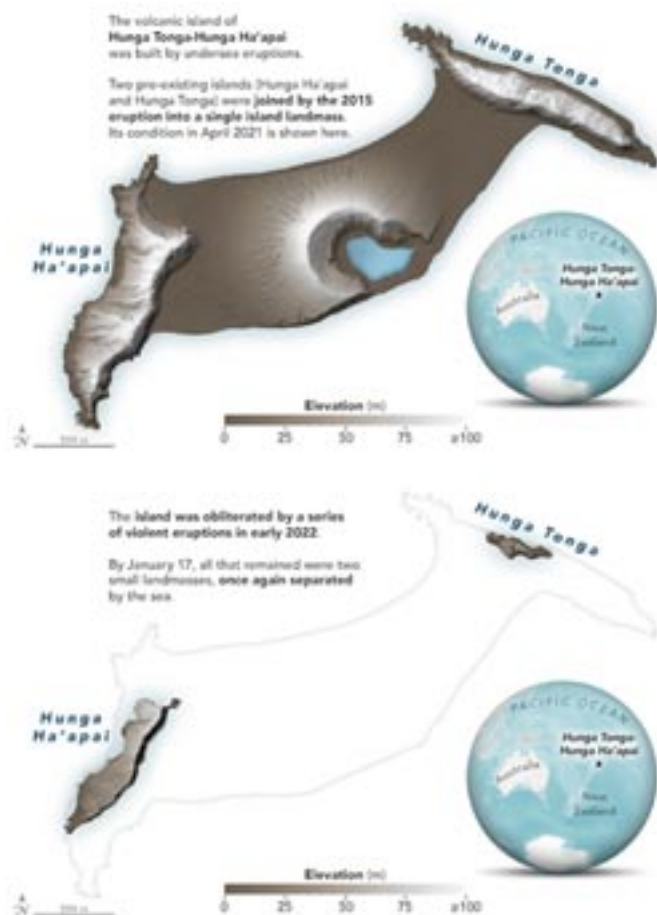
subducted beneath the Australian Plate at the Tonga Trench. It is the deepest trench in the Southern hemisphere and the second deepest on Earth after the Mariana Trench. The fastest plate-tectonic velocity on Earth is occurring at this location, so active volcanism is to be expected.

As late as January 22nd, the *Volcano Discovery* website was recording the movement of sulphur dioxide from the eruption, which at that time had reached the atmosphere above Madagascar. Such gasses can have a marked affect on the weather.

NASA has been tracking the eruption of Hunga-Tonga-Hunga-Ha'apai volcano since it began in December 2021 and especially since the violent eruption of mid-January. Jim Garvin and colleagues from NASA have been regularly compiling digital maps of the island using a combination of satellite data and surface geophysics.

Over a matter of a few months since April 2021 there have been dramatic changes to the island. What was one larger island has been reduced to just two small remnants that had been joined by the 2015 eruption. In effect, most of the former island has been blasted away and destroyed by the January 2022 eruption.

It will be interesting to see what happens to the volcano in the coming



***Dramatic changes to the volcano in a short period, April 2021 (Top) and January 2022 (Bottom). (Images: NASA)***

days, but it rises some 1800m from the seabed and covered a wide area being some 20km in diameter. We await the results of an underwater survey to see what remains today.

In recent days, the aid effort has been accelerated with both the airport and harbour once again open. Several countries including Japan, Australia and New Zealand have been in the vanguard of bringing much needed supplies including fresh water, food and construction materials. The single undersea fibre optic cable has also now been repaired.

***Read the full NASA account at:***  
<https://earthobservatory.nasa.gov/images/149367/dramatic-changes-at-hunga-tonga-hunga-haapai>

## **We know exactly when the dinosaurs went extinct...**

We know that the dinosaurs (and most of the rest of the world's flora and fauna) became extinct some 66 million years ago, thanks to an asteroid or similar body that impacted on the Yucatan Peninsula of Mexico. But now a new piece of research can give us far greater precision as to when precisely it happened.

A groundbreaking study led by researchers at Florida Atlantic University and an international team of scientists conclusively confirms the time of year of the catastrophic Chicxulub asteroid, responsible for the extinction of dinosaurs and 75 percent of life on Earth 66 million years ago. Springtime, the season of new beginnings,

ended the 165-million-year reign of dinosaurs and changed the course of evolution on Earth.



***Robert DePalma (left) and Anton Oleinik, PhD. at the site in North Dakota. (Image: Florida Atlantic University)***

Results of the study, published in the journal ***Scientific Reports***, greatly enhances the ability to trace the first stages of damage to life on Earth. FAU's Robert DePalma, senior author and an adjunct professor in the Department of Geosciences, Charles E. Schmidt College of Science, and a doctoral student at the University of Manchester; and Anton Oleinik, Ph.D., second author and an associate professor, FAU's Department of Geosciences, contribute to a major scientific advancement in the ability to understand the massive impact that brought an end to the dinosaurs. The new evidence comes from a site in North Dakota.

“This unique site in North Dakota had yielded a wealth of new and exciting information. Field data collected at the site, after hard work that went into analysing it, provided us with new incredibly detailed insight of not only what happened at the Cretaceous-Palaeogene boundary, but also exactly when it happened,” said Oleinik. “It is nothing short of amazing how multiple lines of independent evidence suggested so clearly what time of the year it was 66 million years ago when the asteroid hit the planet. One of the great things about science is that it allows us to look at seemingly well-known facts and events at different angles and with different precision, therefore advancing our knowledge and understanding of the natural world. It also proves that geology and paleontology is still a science of discovery, even in the 21st Century.

## **Richard Leakey, Kenyan pioneer anthropologist and conservationist dies at the age of 77...**

Some people are remembered for one things that they have achieved in their lives, usually these days in a fairly narrow subject area. That could never be said about Richard Leakey who has died at the age of 77. The Kenyan has been known for many years in many areas of science.

Some people will know him as a fossil discoverer, notably of early hominids. But he was also a museum director; a wildlife conservationist and enemy of poachers. He was also a politician in his home country of Kenya, founding his own party.

In many ways he was ahead of his time especially his championing of wildlife where he became a highly respected pioneer conservationist. For geologists, it has to be his work on the origin of the hominids that is the pinnacle of his life's work.



*The people are dwarfed by the fossil! This is the excavation of an exceptionally large ichthyosaur at Rutland Water. (Image: Anglian Water)*

### Did you see Dean Lomax and his ichthyosaur on TV?

The story of the discovery of Britain's largest fossil ichthyosaur in Jurassic mud at Rutland Water, a few miles east of Leicester has to be one that rivals the discovery of the skeleton of Richard III in a car park in the same city!

The story was carried on the archaeological programme *Digging for Britain* and also on Breakfast TV. In neither case did the BBC presenters cover themselves in glory by the standard of questioning of Dean Lomax, who was leading the team who were extracting the skeleton from the rock.

That said the 'dig' was expertly carried out and Dean certainly proved his skill as a geological communicator. What a lot of people will not know is that Dean, who is only about 30, is a self taught expert on ichthyosaurs. He's carried out a masters and also a PhD, without having been to university to study for an undergraduate degree.

His story is a fascinating one. Born and brought up in a deprived area of Doncaster. Dean has only ever wanted to be a palaeontologist. He wasn't at all academic at school which is why he never went down the usual road of A levels and a degree. Instead he went to Arizona and worked at a dinosaur park.

Speaking about his involvement with the Rutland Water project Dean said: "It was an honour to lead the excavation. Britain is the birthplace of ichthyosaurs - their fossils have been unearthed here for over 200 years. Despite the many ichthyosaur fossils found in Britain, it is remarkable to think the Rutland ichthyosaur is the largest skeleton ever found in the UK. It is a truly unprecedented discovery and one of the greatest finds in British palaeontological history."

Dean shows that palaeontology is still an area of science that anyone can get involved in. His passion rose above the formal qualifications that would normally be required. His story echoes that of Mary Anning 200 years ago.

*You can read Dean's personal story at:*  
<https://www.deanrlomax.co.uk/>

### Bring on the dinosaur embryo...

Over the years, we've brought you all kinds of dinosaur stories. Stories about big dinosaurs, small dinosaurs, baby dinosaurs and even dinosaur eggs, but we've never brought you a dinosaur embryo, until now.

The embryo was discovered in Ganzhou in southern China and

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**Dinosaur egg and embryo reconstruction**  
(Image: Julius Csotonyi)

researchers consider it to be from the Cretaceous period dating at between 72 and 66 Ma. It is believed to be a toothless theropod dinosaur, or oviraptorosaur, and has been christened 'Baby Yingliang'.

The embryo is articulated in its life position without much disruption from fossilisation. Estimated to be 27 cm long from head to tail, the creature lies inside a 17-cm-long elongatoolithid egg. The specimen is housed in Yingliang Stone Nature History Museum.

Fion Waisum Ma, joint first author and PhD researcher at the University of Birmingham, said: "Dinosaur embryos are some of the rarest fossils and most of them are incomplete with the bones dislocated. We are very excited about the discovery of 'Baby Yingliang' - it is preserved in a great condition and helps us answer a lot of questions about dinosaur growth and reproduction with it.

"It is interesting to see this dinosaur embryo and a chicken embryo pose in a similar way inside the egg, which possibly indicates similar prehatching behaviours."

'Baby Yingliang' was identified as an oviraptorosaur based on its deep, toothless skull. Oviraptorosaurs are a group of feathered theropod dinosaurs, closely related to modern-day birds, known from the Cretaceous of Asia and North America. Their variable beak shapes and body sizes are likely to have allowed them to adopt a wide range of diets, including herbivory, omnivory and carnivory.



**This is 'Baby Yingliang' as found in China**  
(Image: Courtesy of China University of Geosciences)

Professor Lida Xing from China University of Geosciences (Beijing), joint first author of the study, said: "This dinosaur embryo was acquired by the director of Yingliang Group, Mr Liang Liu, as

suspected egg fossils around the 2000. During the construction of Yingliang Stone Nature History Museum in 2010s, museum staff sorted through the storage and discovered the specimens.

"These specimens were identified as dinosaur egg fossils. Fossil preparation was conducted and eventually unveiled the embryo hidden inside the egg. This is how 'Baby Yingliang' was brought to light." Professor Steve Brusatte from the University of Edinburgh, part of the research team, said: "This dinosaur embryo inside its egg is one of the most beautiful fossils I have ever seen. This little prenatal dinosaur looks just like a baby bird curled in its egg, which is yet more evidence that many features characteristic of today's birds first evolved in their dinosaur ancestors."

*We are grateful to the University of Birmingham for material used in this item.*

## Icelandic facility stores carbon dioxide in rocks...

In Iceland a new facility called Orca is pulling carbon dioxide from the air and storing it underground in rocks.

Climeworks is the company that owns Orca. Adelaide Calory-Muzak is an engineer at Climeworks, she says: "At the rate we're going, we're going to need to be removing CO<sub>2</sub> from the air as well as reducing our emissions," adding that "the approach is vital to solving climate change."

At the facility, fans push air into filters, which trap carbon dioxide. When heated, the filters release the gas so it can be mixed with water. The carbon is then pumped underground where it turns to rock. The aim is to trap 4,000 tons of CO<sub>2</sub> a year in the first instance, before scaling up in the future.



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## The 2021 Fagradalsfjall eruption in Iceland

*For more than five months the world watched as Iceland played host to one of the best 'volcanic' shows' on Earth.*

*The Fagradalsfjall eruption was the largest that Iceland has seen for many years and it all took place less than 30 km from the capital Reykjavik.*

*Alan Clewlow has been running trips to Iceland with his company Volcanic Experiences for many years. Not surprisingly he was there last year to witness the eruption.*

*We invited him to share that visit with you...*

When there were the first indications of an eruption taking place in Iceland in March of last year, I felt that the fates had been conspiring against me. Having visited the country many times since first travelling there in 1993, leading groups to view the many classic outstanding volcanic and landscape features which Iceland has to offer, the one thing I had never been able to see was flowing lava. There had been a short eruption of Hekla in 2000, and the well-known Eyjafjallajökull ash-cloud eruption of 2010 (which had actually been preceded in the weeks before by a lava flow), but these took place at times when I was not able to visit, due to work commitments. Now no longer with no such work-pressures, I had to contend instead with a global pandemic and a government imposed lockdown preventing



*The volcano erupting on June 8th 2021*

travel abroad. The 2021 eruption fortunately outlasted the lockdown, and this enabled me to make two visits there in during the summer; firstly as a solo visit in early June and then again in mid-July when leading a "Volcanic Experiences" group tour.

The 2021 eruption focussed on the volcano Fagradalsfjall, lying on the Reykjanes peninsula, located around 40 km (25 miles) south-west of the capital city, Reykjavik. The mountain itself is named after Fagradalur (which translates as "beautiful valley") lying just to its north-west.



*The scene of the active crater and lava fields around it from the viewpoint on June 8th (access to this viewpoint was cut off by a lava flow just a few days later)*



*Lava flowing down a steep slope into the Natthagi Valley*

Fagradalsfjall is a volcano which last erupted around 6000 years ago. This forms part of the Krýsuvík-Trölladyngja volcanic system on the peninsula. This lies within the zone of active rifting between the Eurasian and North American tectonic plates, where the divergent plate boundary of the Mid-Atlantic Ridge rises above sea-level and forms part of the Icelandic landmass. The Krýsuvík volcanic system has been moderately active in recent geological times, with the last lava outpourings taking place during the “Krysuvik Fires” of 1151 to 1188. These ended not long before another episode on the Reykjavík peninsula - the “Reykjanes Fires” of 1210-1240, the last eruption on the peninsula before the present.

Like so many other volcanic eruptions around the world, the first indications that an eruption was a possibility came about with a series of earthquakes which began in December 2019. In the period between then and March 2021, there were many earthquakes, the strongest being a 5.7 magnitude shallow-focus seismic event on 4th February 2021 which shook the entire peninsula. Following this, in the three weeks prior to lava first appearing at the surface, over 40,000 tremors were recorded, a clear indication that magma was moving closer to the surface.



*The lava front in Hatthagi Valley on June 8th*

Eventually, on the evening of 19th March, an effusive eruption started in the Geldingadalir valley, lying to the south of Fagradalsfjall. Reports at the time stated that a 600 to 700-metre-long fissure had

opened from which lava was flowing, a situation which continued for several weeks.

In the period between 5th and 10th April three more fissures opened up, all with a general trend lying NNE-SSW. On 12th April, scientists from the University of Iceland measured the area of the lava field at 0.75 km<sup>2</sup> and its volume to be 10.3 million m<sup>3</sup>. The flow rate of the lava then was 4.7 m<sup>3</sup>/s, and sulphur dioxide, carbon dioxide and hydrogen fluoride gases were being emitted in huge amounts ~ a potential matter of concern for the authorities having to deal with huge numbers of visitors and the nearby resident population. On 13th April, four new craters formed in Geldingadalir, further boosting the lava output

Towards the end of the month, the eruption itself had changed in character from its early effusive nature, to one which was producing lava fountains up to 50 m. in height, though one burst did reach a height of 250 m. on 28th April.

Most of the earlier fissures had closed by 2nd May and by then only one remained active, but there were still occasional explosive eruptions within the active crater that sometimes reached heights of hundreds of meters. Lava at this time was flowing into the Meradalir valley (to the NE), and later the Náttthagi valley (to the south).

In the following days, the eruption pattern changed from a continuous eruption and lava flow to a pulsating one, where periods of eruptions alternate with periods of inactivity. The magma jets became stronger, producing lava fountains of 300 m in height, visible from Reykjavík with the highest one measured at 460 m (1,510 ft). One suggestion put forward at the time was that the lava jets occurred as magma came into contact with trapped groundwater. By late May the lava flow rate was much higher than in the early stages of the eruption, with an average lava flow rate of 12.4 m<sup>3</sup>/s from 18th May to 2nd June.



*Glowing interior at the lava front*

The increase in lava flow was unusual, as eruption outputs typically decrease with time. Scientists from the University of Iceland have suggested that there is a large magma reservoir deep under the volcano, not the usual much smaller magma chamber associated with short-lived eruptions which empty over a short time. They also believe that there is a discrete vent under the lava feeding the main lava flow.

I was fortunate that my first visit to the volcano took place on 8th June. I took footpath “B” to a spot which gave an excellent viewpoint of the eruptions from the main crater. Just a few days later, on 13th

June, this footpath was breached by lava flowing down into the Nátthagi valley. At the time, the crater was producing what I would best describe as a “rapid flood” of lava about every 8 minutes. Each discharge lasted around a minute and sent a torrent from the southern lip, building up on its flank and spreading to the lava field beyond, sometimes accompanied by lava fountains within the crater.

My June visit also included the opportunity to walk down to the front of the lava flow in the Nátthagi valley, from where it was possible to see the incandescent red glow within the flow, and feel the intense heat being given off.

By the time I returned on my second visit on July 21st, the volcano had settled into a pattern of having regular episodes each lasting around 12-18 hours where there was little surface activity, followed by a similar period which produced regular eruptions and lava fountains from the crater. Unfortunately, on our Volcanic Experiences group tour, our arrival coincided with the start of one of the “quiet” periods. Weather and visibility were excellent on the day, but there was no sign of anything being erupted or any flowing lava. There had been activity earlier that morning, and it resumed once more by the evening, but by that time, our group had left the area!

My visit on that day also included a walk down into the Nátthagi valley. The lava by then was much further advanced to the south (nearer the road) than on my earlier visit, but was no longer too hot to the touch (it was barely warm), with no sign of any red glow from within. Its upper surface showed many classic “pahoehoe” coiled rope patterns. Broken fragments of the rock revealed a black glassy outer skin with a dark grey finely crystalline texture typical of basalt within. The rock was vesicular in nature and contained occasional pale green porphyritic crystals of olivine.

Following my return from Iceland in July, the eruption continued and shows no sign of any reduction in lava production, with the same regular pulses of fairly intense activity followed by a few hours of relative quiescence. Indeed, the rate of flow measured over 10 days in late July was 17-18 m<sup>3</sup>/s (the highest rate recorded). At this time and throughout August, the flowing lava was a spectacular sight, and there was much video footage posted on the internet of the scenes to behold.

Eventually, activity began to diminish, and the eruption stopped completely for over a week in early September, but after that short pause it resumed its normal pulsating activity from 11th until the 18th of September. On that date all lava production at the surface ceased and has not recommenced.

Whether it will resume again is uncertain. There are certainly indications from seismic monitoring that magma is still moving beneath the surface, but the general view from scientists at the moment is that, for the time being at least, the eruption has ended. The authorities have reduced the local alert level from orange to yellow, but are still monitoring the area closely to see how the situation develops.

I am now looking forward to returning to the area again in 2022 while leading our “Volcanic Experiences” group tour to the South of Iceland in September.

**The Editor comments:** Thanks Alan, you’ve inspired me to return with a trip to Iceland, planned for April 2023!.

Meanwhile, enjoy your trip in 2022, but save some volcanic action for me!



*View looking down into the Nátthagi Valley in Mid-July, showing proximity to the coastline and main road.*



# Rocks used as building stones - Part 1

*I always await the arrival of Paddy's latest installments for down to Earth with baited breath! There's no area of geology that cannot, potentially, be given his magic touch.*

*In this, the first of two parts, Paddy introduces us to some of the Emerald Isle's finest building stones...*

*'There are plenty of ruined buildings in the world but no ruined stones'*

*Hugh Mac Diarmid (1892-1978).  
From: 'On a Raised Beach'.*

## The early use of rocks in Ireland and Britain



*The entrance to Newgrange in Co. Meath, Ireland. The outside has been reconstructed but the internal space is original.  
(Photo: Mr. L. Speight, Co. Fermanagh.)*

Since time immemorial people have been using rocks. Our very distant progenitors, the Stone Age people, first used rocks like flint, porcellanite and obsidian for the manufacture of implements like axeheads, arrowheads and scrapers – artefacts that played a crucial part in their survival. Towards the end of the Stone Age (the Neolithic), monuments such as those at Newgrange in Co. Meath were constructed of stone. This was about 5,200 years ago – even before the Pyramids of Egypt. In West Kennet (halfway between Swindon and Salisbury) is one of the oldest structures made of stone – it would be over 5,500 years old. Stonehenge, in the Salisbury Plain (Wiltshire), is reckoned to have been built in stages around 5,000-4,500 years ago just at the end of the Stone Age and the beginning of the Bronze Age.

Its functions were likely to have been funerary, religious, social and even astronomical. All Neolithic structures were constructed using non-metal (stone) tools. During Stone Age times, dwellings were usually made of wood and reeds (for roofing) and, maybe, animal pelts for waterproofing, but they had not the permanence of stone. Large stones, called megaliths, were employed for graves and many

examples can still be seen today in Ireland and Britain. Thousands of years later, sophisticated buildings like monasteries and castles were built. As with the very ancient constructions, they illustrate the ingenuity of the people who designed and built them and leave us awe-struck at their stupendous achievements.



*Stonehenge, in the Salisbury Plain, showing the sarsen stones – a type of sandstone.*



*A megalithic tomb in Co. Sligo, Ireland.  
(Photo: Mr. L. Speight, Co. Fermanagh.)*

## What makes a rock suitable for use as a building stone?

All of our cities and many of our towns in Ireland and Britain have some buildings composed of natural stone or have rocks as cladding. Most, but not all, rock-types are suitable for building purposes. The main criteria that make rocks suitable are: (1) Durability, (2) Easy to acquire, (3) Strong, (4) Decorative and (5) Easy to work with.

### 1. Durability.

All rocks exposed at the surface of the Earth are broken down by weathering and worn away by erosion. Some rocks are more prone to weathering and erosion than others. In other words, some rocks are more durable than others and hence are more suitable for use as building stones. Rain and the wind, for example, are agents of

weathering and erosion. Nowadays, the durability of rocks can be tested in laboratories by simulation of the climatic, and other conditions, which the rocks may have to be subject to when used as building stones.

## 2. Easy to acquire

Rocks used for buildings should be readily available. In pre-Christian times, and even later, stone for buildings was obtained locally, but when the transport network (roads, canals and, later, railways) improved, stone could be obtained from more distant locations. Still, for a considerable time, this was expensive. In the Middle Ages, for instance, the cost of conveyance of rock was often higher than the combined cost of quarrying the stone and construction of the edifice.

Even when the polymath, Christopher Wren (1632-1723), in the 1700s, was designing the impressive St. Paul's Cathedral in London, the transportation cost of the limestone from the Isle of Portland in Southern England, to London, was higher than the cost of the stone blocks. Nowadays, however, carriage cost is not as expensive and problematic as in former times because of the efficiency of the transportation infrastructure.

Most cities in Britain and Ireland have employed rocks for buildings from far distant places. For instance, in Belfast rock from Brazil (gneiss), S. Africa (gabbro), Italy (marble and travertine), Norway (larvikite), India (granite), Sweden (granite) and Finland (granite) can be seen.



*A church in central Belfast built of (Scrabo) sandstone in 1856-7. Nowadays most churches, schools, commercial buildings etc, are constructed of reinforced concrete and/ or brick.*

## 3. Strong

Building stone should be robust to enable it to withstand the stresses and strains it would be subjected to when used for building structures. Most types of Chalk, for instance, would not be strong enough for most building purposes. Usually, rocks that are very prone to weathering and erosion would not be strong enough to qualify as building stones.

## 4. Decorative

Initially, blocks of rock produced in quarries rarely have an attractive appearance although many rocks, but not all, when cut and polished, display an attractive appearance. In the last 100 years or so, large buildings use reinforced concrete and natural stone has seldom been employed for the structure of edifices. One reason is economic because, among other things, labour costs have resulted in many former quarries closing. Natural stone is now often used just for cladding to embellish the appearance of buildings like shop fronts, banks etc. Cladding just consists of thin slabs of rock attached, with a suitable adhesive, to the front walls of buildings. Choice of the type of rock used for cladding can depend on current fashions.

## 5. Easy to work with

Now, and in the past, this was an important criterion although with modern machinery most rock-types are not as difficult to cut, polish and carve as in the past. As far as carving is concerned, the rock-type used should be, ideally, free from inclusions such as fossils.

## Some rocks used as building stones

### Igneous Rocks

#### Balmoral Granite



*Balmoral Red Granite from Finland.*

Although it is called 'Balmoral' Granite, it actually originates in Finland. The name 'Balmoral' is attributed to it because most of it was imported to Britain through Balmoral in Scotland when some Scottish granites were exhausted. It is around 1,500 million years old (Precambrian) and is used extensively to embellish façades of buildings while also being very popular as a grave headstone. The overall red colour is due to iron (ferric) oxide staining. Only a small amount of iron oxide produces this colour.

#### Baltic Brown Granite

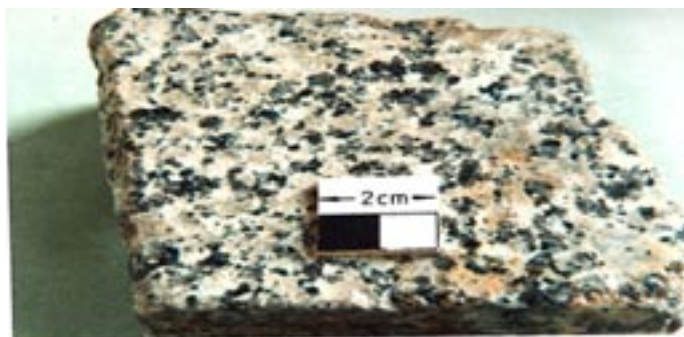
This orbicular granite is thus called because of the ovoids of feldspars, which are surrounded by darker iron-rich minerals in the matrix. Each ovoid consists of flesh coloured potassium-rich alkali feldspar, surrounded by a narrow rim of sodium-rich plagioclase feldspar – such an occurrence is known as zoning. It is from Finland and is around



***Baltic Brown (orbicular) Granite from Finland.***

1,500 million years old (Precambrian). Like Balmoral Red, it, when cut and polished, is used as cladding to enhance the appearance of buildings.

#### **Mourne Granite**



***A sample of cut and polished Mourne Granite.***

Mourne Granite, after cutting, can be polished to a high gloss. As with granites generally, it is very hard, and weathers well, but is not easily worked by hand – pneumatic tools have to be employed. It is Early Palaeogene in age, being about 56 million years old. Besides its use as cladding, many of the kerbstones in Belfast are composed of it and it is used in the pavements surrounding the City Hall in Belfast.

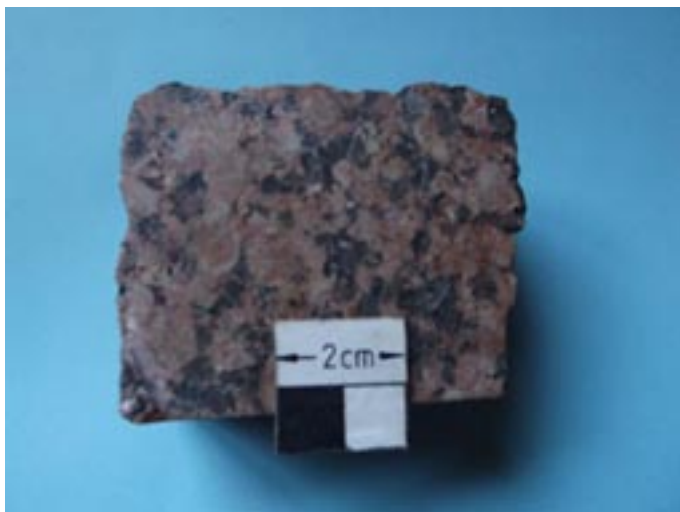
#### **Swedish ('Imperial') Granite**



***Swedish ('Imperial') Granite showing a xenolith. The xenolith is around 30 cm long.***

This decorative granite can be used to improve the appearance of the fronts of buildings like shops. The particular sample shown contains a xenolith, which is a fragment of pre-existing rock (sometimes called 'country rock') that fell into the granitic magma as it was cooling.

#### **Peterhead Granite**



***A sample of Peterhead Granite,***

Peterhead Granite, from near Aberdeen in Scotland, can sometimes contain xenoliths. It is around 400 million years old (Devonian) and, in appearance, can be distinguished from Balmoral Granite because it has an overall lighter red colour.

*To be concluded in the next issue of Down to Earth.*

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## All change at Suunto compasses with supply and price issues...

We've recently been informed that the Finnish company behind Suunto compasses is going through the process of being taken over. At the moment the UK distributor still has decent stocks of most models but is already aware that prices are going to rise and there will be short term supply problems over the coming months.

The message here is that if you need any of their products - get your order in now!

*The Suunto MC2 compass clinometer has been a firm favourite of geology students over many years.*



## Better news from US compass manufacturer Brunton

In the last issue, we told you about Brunton compasses in the US, who had dismantled their European distributor and we feared that they may not be available going forward.

We have now made contact at the highest level and the CEO and owner, Lauren Heersch, has assured us that they will still be supplying their excellent compasses into the UK.

Geo Supplies is now able to deal directly with the factory in the US and we are even able to get slightly better terms than we used to enjoy. Lauren is also looking to stocking more of the popular models balanced for Europe, which should have the effect of reducing lead times for orders.

## We are getting really short of some rock and mineral specimens...

We supply rocks, minerals and fossils to schools and individuals and are short of some supplies. We are currently in need of plagioclase and peridotite. *Please contact: [lensims@geosupplies.co.uk](mailto:lensims@geosupplies.co.uk)*

## And then there were three (jigsaws)...

Just before Christmas and completely out of the blue, we received a brand new 1000-piece jigsaw puzzle from BGS!

The puzzle should be a real hit with jigsaw buffs out there! It features the magnetic rocks of the UK in glorious hues of red and blue!

*The puzzle costs £24.95 including UK postage*

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1/2022



**If you haven't joined one of our residential field trips before, what can you expect?**

- *Our residential field trips are suitable for adults of all levels of interest and geological knowledge.*
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- *We 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.*
- *During the current period, even if we have a minibus you will be able to use your own car if you wish.*
- *Dates shown in this listing are the start and finish dates.*

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



*Participants on a trip to the Wren's Nest National Nature Reserve where fossil trilobites can be found in the Silurian limestones.*

## The 2022 Residential Trip programme...

*We're really looking forward to the coming season of field trips, commencing with North Cornwall in early April. Bookings are looking good with a number of trips either full or very nearly so. We want to confirm hotel bookings as soon as possible so urge you to make contact now if you are wanting to join us.*

We are pleased to confirm that our popular Summer School will be running this August based at the University of Worcester. With lots of single rooms, everyone is welcome!

For 2022 we are hoping to return to making use of a hired minibus driven by our own Colin Schofield. However, if you wish to use your own car you are welcome to do so. For the time being, we are keeping things simple and, aside from a trip to Ireland, will not be running any overseas trips. These will hopefully resume in 2023.

*Advance announcement - watch out for the return of our ever popular trips to Iceland for the early part of 2023!*



*Folded rocks at Bude*

### Bude, North Cornwall, April 2-9

This trip, which is based at the Cliff Hotel in Bude, takes in the varied geology and fabulous scenery of North Cornwall. Rocks of Devonian and Carboniferous age have been superbly folded and faulted in the Variscan Orogeny. We'll be taking in places such as the Delabole Slate Quarry, Tintagel and the amazing cliffs of Hartland Quay. Add in some of the granite around the north of Dartmoor and we have a great trip in store for you.

### Raasay & Skye April 21-28

The island of Raasay is situated just off Skye and is a geologists' paradise with rocks ranging from the Lewisian to the Tertiary with Torridonian, and fossiliferous Triassic and Jurassic rocks in between. All this on an island that's 4 miles across and 11 miles long. We also spend two full days on Skye in what will be a truly memorable trip. *(Very few remaining places available.)*

### Northwest Highlands of Scotland April 29-May 6

Based at the famous Inchnadamph Hotel in Assynt, this trip takes in some of the UK's finest geological sites in the Moine Thrust and other classic places. We journey to the 'multi-coloured rock stop', Smoo Cave and beautiful Achmelvich on the coast. See our oldest rocks and get to grips with the processes that were in place nearly 3 billion years ago. *(Few places remaining on this trip.)*



**Don't worry, we don't bite!**

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

**Come and join us!**

# Welcome to our real world!



## Dingle Peninsula, Ireland May 18-25

The west coast of Ireland is amongst the most beautiful in the whole of the British Isles and we want to share it with you! See amazing folds in the rocks of the Lower Palaeozoic and also a great variety of different rocks, minerals and fossils. For this trip, flights to and from Cork are recommended. *(Very few places remaining.)*



*In your face geology at Mingary Pier, Ardnamurchan*

## Mull & Ardnamurchan June 4-11

This trip is based in the beautiful Mull village of Tobermory. We will spend much of the week studying the rocks of Mull, including taking in a trip to the island of Staffa (weather permitting). We'll also spend two full days on the Ardnamurchan Peninsula where we will be able to see Jurassic sediments with fossils, along with excellent igneous rocks from the Tertiary. Back on Mull we'll also take in the rocks of Iona and places like Calgary and Dervaig. This promises to be a great trip, full of varied geology and scenery. All this and a comfortable, modern hotel, who could ask for more!

*We have to confirm places with the hotel very soon - so if you want to come - act now!*

## Pembrokeshire June 25-July 2

We've been trying to return to this, one of our favourite areas, for two years! This trip is based in the town of Haverfordwest enabling us to travel to all the best sites in Pembrokeshire, and allowing you to travel by train to the field area. We'll be taking geological sites at Marloes, St Davids, Broadhaven and Saundersfoot, to name but a few. This is Palaeozoic geology at its best, all folded and faulted in the Variscan Orogeny. *(Few places remaining on this trip.)*

## Northeast Scotland July 20-27

This trip examines the coastline of Moray and Nairn, along with some of the inland outcrops. It's known to geologists as the 'kingdom of Dalradia' because it's dominated by the metamorphic rocks of the Dalradian formation. That said, we'll also see sediments from the Old and New Red Sandstones and even a little Jurassic. Come and explore an area of Scotland that lies between Inverness and Peterhead, we promise that you will not be disappointed!

## University of Worcester Summer School August 13-20

Our annual summer school is beginning to feel a bit like the Tokyo Olympics! We first tried to run it in 2020 and then the University could not accommodate us this year, so we've gone for 2022! We are sure that it will have been worth the wait as we bring you a varied programme of field visits across the Midlands and Welsh Borders, from our bases in Worcester. Accommodation at the University is mainly in en-suite single rooms. *(We have a number of bookings already in place, but can accommodate more.)*

## Berwick & the Borders September 1-8

This trip includes a visit to the 'holy grail of geological time' at Siccar Point and lots of other amazing places. From our base at the comfortable Castle Hotel, we'll be taking in both coastal and inland locations from Northumberland and Berwickshire. Marvel at folded Carboniferous sediments at Scremerston, the granite scenery of Cheviot and volcanics at St Abbs. In short, there's something for everyone on this week. *(Very few places remaining on this trip)*



*Lundy Island, home to the eponymous Tertiary granite*

## Minehead, Somerset September 14-21

The coast of North Somerset is the 'other' Jurassic Coast with similar geology to that of Dorset, but without the crowds! We'll be taking in the Devonian rocks of Lynmouth and the landscape of the Exmoor National Park. Weather permitting, we'll also take a day trip to the fabulous Island of Lundy in the Bristol Channel where you can examine a Tertiary granite.

## Malvern Hills September 28-October 2

Great Malvern is world famous for its spring water that flows from fissures in the Precambrian rock of the hills made famous by Elgar. Aside from these ancient igneous rocks there are also nearby exposures of Lower Palaeozoic limestones along with sediments from the Carboniferous and Permo-Trias. We'll also be including a trip along the Severn Valley railway to view Coal Measures and dunes.



### The Yorkshire Coast October 10-15

This trip is based at the small North Yorkshire village of Hunmanby, just to the south of Filey. From our comfortable guest house base, we'll get to see Jurassic and Cretaceous rocks from Scarborough down to Flamborough as well as taking in the fine Quaternary cliffs of Holderness and the unique inland scenery that is the Yorkshire Wolds. A great way to round off the 2022 field season!

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### Day Trips...

*We're currently working on a short programme of Day Trips commencing in May and running through to September/October.*

*These will cost £10.00 per person. Full details will appear in the March issue of our online publication Down to Earth extra. If you don't currently receive it, you can get it FREE - just send us your email address.*

### Welcome to our virtual world!

#### Virtual Day Schools

*Our popular Day School format, transcribed into a virtual format, with some lively topics for you to enjoy! Individual day schools cost £20.00 each. Printed background papers cost an additional £5.00 per day school. Day schools begin at 10.30 and involve three Zoom sessions of about 45 minutes each with time for you to carry out your own guided study in between.*

*Our Virtual Day Schools cost £20.00 each or £25.00 if you want the background materials in printed form.*

*You can book online at: [www.geosupplies.co.uk](http://www.geosupplies.co.uk)*

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#### February 2 Limestones of the UK

They are amongst our most treasured assets. Limestones have been used in so many ways for hundreds of years, and they occur across the length and breadth of our country from the Northwest Highlands of Scotland to the South Down of Sussex and to Torquay. They range in age from the Cambrian to the Tertiary, yet all are the products of mainly shallow tropical seas. In this day we'll learn more about what limestones are and how they form, and what they tell us about our geological journey through time.

#### February 9 Silicate minerals make rocks

Next to Carbon, Silicon is able to make the most chemical compounds, so it's no coincidence that Silicon forms the basis of most rock forming minerals and also artificial intelligence. This day will take the lid off silicates and explore how they define not only igneous rocks, but also metamorphics and sedimentary types. Don't let a bit of basic chemistry frighten you!



#### February 16 Metamorphism & metamorphic rocks

Of the three classes of rocks, metamorphics are the least understood. In this day school we'll debunk these rocks and show how to understand and appreciate them. By the end of the day we hope that you not only know more about them, but also that metamorphic rocks will be your favourites!

#### March 2 Black Diamonds the coalfields of the UK

During the nineteenth and the first half of the twentieth centuries, the UK was one of the world's largest producers of coal. We exported it around the globe from numerous places around our coastline. In this day we'll be exploring how that coal formed, and where and how it was mined. Today we view coal as an evil substance that has been a major contributor to global warming, but back in the day it was seen as a saviour to industrial prosperity.

#### March 16 The geology & landscape of Yorkshire

Yorkshire is a large county with a geology that stretches back to the Silurian and along the way includes rocks from the Carboniferous, Permian, Triassic, Jurassic, Cretaceous, Tertiary and Quaternary. Come with us on this rich and varied journey through the geology of 'God's own county'!



#### March 30 Torridonian, Old Red & New Red - the continental sandstones of the UK

Through the long geological history of the UK, there have only ever been three really important and thick continental sandstones, the Torridonian, the Old Red Sandstone of the Devonian and the New Red Sandstone of the Permian and Triassic. In this unusual day school we'll take a look at each of these formations. We'll examine their shared characteristics and the environments in which they formed.



## The Yellow Sands of Cullercoats Bay

*During the last, almost two years, of the Covid pandemic, many of you have turned to your the rocks and landscape of your local area. They have become something to enjoy and study.*

*Lawrence Heslop previously submitted an article about the rocks of Tynemouth, now he turns his attention to nearby Cullercoats...*

This article is my interpretation derived from researching text books and by making my own observations. Whilst there are numerous, grander geological topics of great interest, I find this 'doorstep geology' very rewarding and would encourage all like-minded enthusiasts to explore the rocks nearest to their front door.

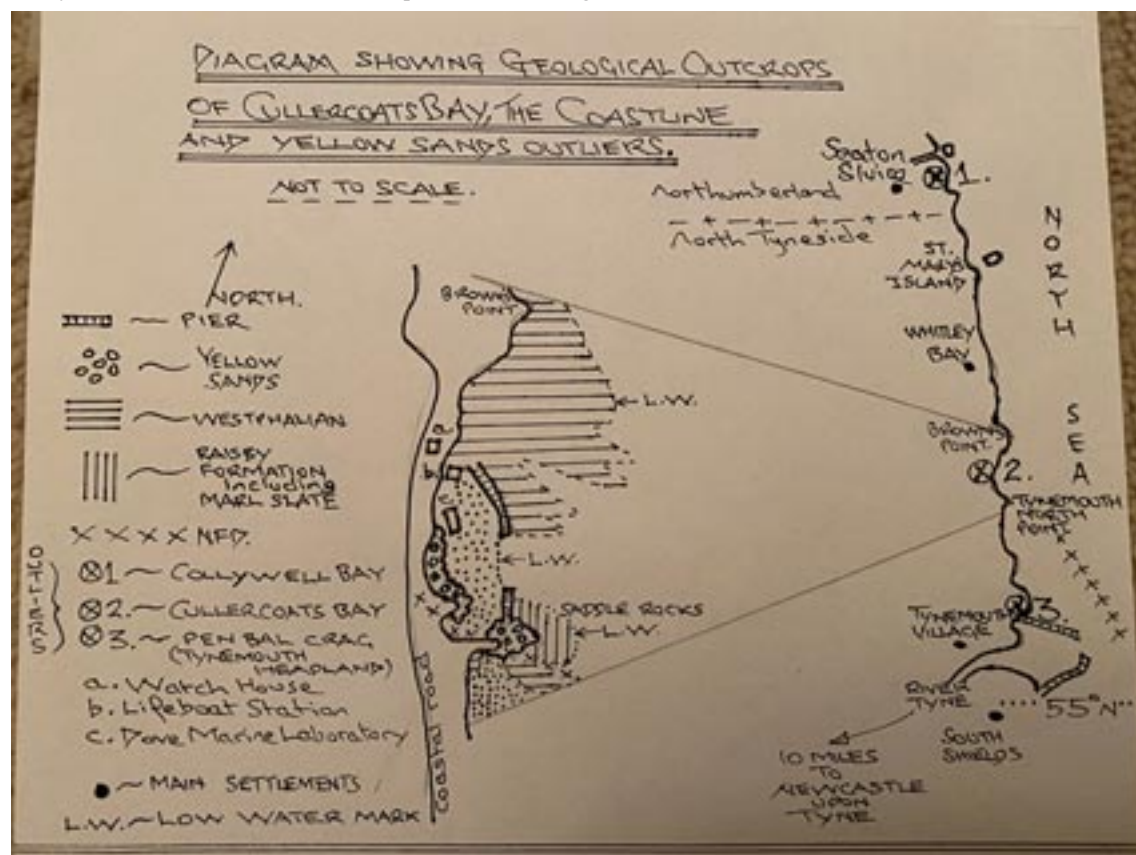
It is centred on the outcrops of Permian age Yellow Sands near to where I live and involves a wide-ranging geological story. The Yellow Sands are essentially 'fossilised sand dunes'. By discounting tertiary dykes and glacial deposits, rocks of the Permian system are the youngest in North East England. Studied rigorously from the early nineteenth century, the geological history of this particular system is well documented, though interpretations on some aspects allow for differing opinions with improved techniques suggesting possible changes to published literature.<sup>1</sup>

Cullercoats is a small coastal village two miles north of the mouth of the River Tyne. Two hundred years ago the bay was a busy centre of industrial activity based upon coal mining, quarrying and fishing. Today, leisure and recreational activities predominate through a

recent surge in sea bathing, kayaking and paddle boarding, plus a wealth of new eating places and local arts, the village has acquired the nickname "Cullerfornia". What is not always appreciated is that this attractive village's popularity has fascinating geological foundations. At a little over 55° north of the equator this settlement is 40° and almost 3,000 miles north of its geological beginnings when a tropical environment during Carboniferous times hosted Tyneside's ubiquitous coal measure sedimentation. As the Permian system dawned the area became landlocked, part of the vast supercontinent of Pangea, shaped like a fattened letter "C", North East England was located in the arid central upper half of the "C".

299 million years ago the Permian, which concluded the Palaeozoic Era of earth history began its 48 million year time span. Sir Roderick Impey Murchison unveiled this system, the final piece of the Geological Time Scale. Named after sediments he identified in the Perm region of Russia in 1841, it was a feather in Murchison's cap and it bolstered the scientific reputation of the British Empire in its era of 'empire building'. The Permian strata of Cullercoats were first studied in 1829 and the deposits now known as Yellow Sands were first assigned the name Basal Sands and Breccias.

In the order of 370 million years ago and for the duration of 100 million years the Variscan Orogeny developed and influenced tectonic activity across the lower latitudes of the northern hemisphere. The Carboniferous strata in Northern England and the Scottish Borders were compressed and uplifted, creating the structural and geographical



*This is Lawrence's geological sketch map of his study area.*

*It's based on his own mapping and field observations.*



*Photo taken from the south pier looking in a north westerly direction, shows the full remaining outcrop of the Yellow Sands Cliffs. The village sits on glacial deposits which cap the cliffs. From left to right the 3 buildings in the diagram are Dove Marine Laboratory and Lifeboat Station above high water mark, with Watch House on the cliff top.*

setting in which the rocks of Cullercoats Bay formed. Concurrently, continental glaciers spread over much of the southern hemisphere causing a eustatic fall in sea level, increasing the landmass of Pangea, reducing maritime influences and expanding aridity. Weathering, erosion and denudation of the raised late Carboniferous topography prevailed and continued into early Permian times. The main consequence was a substantial hiatus of any sedimentation for perhaps 15 to 20 or more million years<sup>2</sup>. The Permian Unconformity represents this long event, perhaps occupying most of the Cisuralian, the first of the three Permian epochs<sup>3</sup>.

The relentless wearing down of higher ground produced a mature, gently rolling peneplain upon which the first extant Permian sediments are laid down. Alluvial fan and flash flood breccias known as Brockram were deposited to the west of a central area of higher relief, the proto-Pennines. To the east and of the same Guadalupian age are the Yellow Sands. These deposits cover almost two thirds of the Unconformity's surface in the North East and consist of weakly consolidated sands, sandstones and breccias, evidence of the latter two is known from boreholes and quarrying. Structurally the peneplained

landscape is termed the East England Shelf and is located on the western edge of a subsiding basin. The variable thickness of the Yellow Sands deposit is due to their aeolian source, undulations of the peneplain and subsequent modifications by marine incursions.

Imagine standing at Cullercoats 275 million years ago and looking east. The sea was not there. Instead, the panorama was a vast Sahara-like desert stretching across what is now the lowlands of Europe as far as the Ural Mountains, a north-south chain of peaks, the topographic division

between Europe and Asia. Formed by the Uralian Orogeny and contemporary with the Variscan Orogeny. Out of the desert blew seasonal winds laden with quartz grains, millet seed in size and frosted by the constant attrition of aeolian transport. The interlocking grains seen through a hand lens brings to life in miniature the dynamic processes necessary to shape and move countless siliceous spheres, grains of sand that have been transported hundreds of miles to form enormous linear dunes. Perhaps resembling in magnitude the Great Sand Sea between Libya and Western Egypt. Surveys on Tyneside and eastern County Durham have ascertained that up to eight longitudinal dunes formed, tens of kilometres in length, 1.5 to 3.5 kms wide and trending in a ENE-WSW direction. Borehole details suggest an estimated height of 60m high and separated by 1km wide corridors of thin sandy deposits. The aeolian quartz contained large amounts of iron pyrite which has oxidised into limonite weakly cementing the unconsolidated grains. Unoxidised and subsurface they have a dull grey colour less pleasing to the eye than the distinctive yellow rocks at the surface.

Subsidence within the vast continental interior of Pangea and periods of glacial melting in the southern hemisphere encouraged the formation of a large epicontinental body of water, the Zechstein Sea<sup>4</sup> whose incursion ended aeolian deposition by the start of the Lopingian epoch. The Marl Slate, a silty, laminated dolomite covered the lower areas of the Yellow Sands and deposits of 6 metres have been mapped though most are under 2 metres. Under seasonal and anaerobic conditions this fossiliferous strata was deposited in only 17,000 years.



*The NFD fault plane, its only surface exposure is here at Tynemouth North Point. The Westphalian coal seam with seat earth (fireclay) below can be easily seen to the left side. With the wavecut platform to lower right. Glacial till caps this outcrop.*



*Photo taken on the wavecut platform standing on the line of the fault plane looking west. To left are Westphalian Coal Measures with the Yellow Sands to the right. Immediately north of TNP is the arch of Smuggler's Cave. Moraine caps the exposure and slumps to the south side of the fault plane which can be seen dipping to the north.*

The rich organic layers have a well-preserved fish fauna and rare small land dwelling reptiles have occasionally been found, the gliding reptile of Hetton le Hole near Durham City is a notable example. In these warm latitudes limestones and dolomites formed in the shallow tropical waters of the slowly subsiding basin. Eventually all remaining irregularities of the desert topography were covered by late Permian sediments to start another fascinating chapter in our country's geology.

North of the River Tyne, the Yellow Sands outcrop in three places, all are outliers at coastal localities and they are enclosed by the prevalent, older coal measures. Situated in Cullercoats Bay, the cliffs and southern foreshore are the most extensive and significant of the outliers.

The cliffs reach a maximum height of 100 feet and outcrop for almost 450 yards along the back of the bay. They present a profile of a dunal ridge, large scale tabular and wedge shaped cross bedding, considered to be a section of an original Pangean desert dune. The cliffs are relatively robust but WNW-ESE jointing has been exploited by incessant wave action forming two elongated caves at the apex of the bay. The bedding has a southerly dip which increases to 40 degrees at the headland, the Tynemouth North Point. This is because here, one of the major structural features of Northern England is revealed in the cliffs and it is the main reason we have this very fine pocket of the Yellow Sands.

The Ninety Fathom Dyke [NFD] is the eastern branch of a major east west fault system which had its origins 420 million years when the Iapetus Ocean closed. Its westward continuity via the Stubbs and Maryport faults is the structural divide between the Alston Block and the Northumberland Trough and is key in their influential geological roles since inception. The sand dunes had covered the NFD however the fault system was reactivated by crustal extension during the Mesozoic era and 150 metres of strata were downthrown to the north. The photograph shows the result: older Westphalian strata are resting cheek by jowl next to the Yellow Sands. All the strata in the vicinity have to some extent been affected by what must have been a powerful series of large earth movements.

On the north side of Cullercoats Bay the Westphalian coal measure beds up to their junction (the junction is thought to be concealed behind the Dove Marine Laboratory) with the Yellow Sands also dip to the south. A dip enhanced by the Whitley Dome whose centre is offshore, east of Whitley Bay beach is part of the overall structural activity along this south eastern margin of the Northumberland Trough. The NFD fault plane dips 35 degrees to the north and is clearly visible on the south edge of the headland, it can be followed across the wavecut platform separating fragmented Permian and Carboniferous strata. At the low tide mark the plane has a more south easterly direction, obliquely moving away from the river mouth and out into the North Sea. To form and retain a headland the Yellow Sands have been strengthened by permeating barytes rich fluids reinforcing the less robust limonite. The fluids were able to migrate along the fault plane from its connection to the north side of the North Pennine Orefield 25 miles to the west. Other mineralisation is by calcite and quartz. Calcite occurs as a patchy cement and lines of small nodules along some bedding planes in the cliffs of the bay. While the quartz tends to be found near to the fault in granular anastomosing (an interlinked network) veinlets characteristic of the stresses at work during the downthrow.

Further evidence of the upheaval close to the NFD is found immediately to the north of the fault line. Here the spacious Smuggler's Cave formed from a widened joint fracture and a potential roof collapse will leave an uncommon Yellow Sands sea stack. Adjacent to the cave is a foreshore area of lower Yellow Sands known as Saddle Rocks, which represent the southern limb of an easterly plunging faulted syncline. Along the minor fault are fragments of marl slate. The narrow centre of the syncline consists of broken slabs of bedded dolomite which belong to the Raisby Formation, they were deposited in the warm tropical coastal shallows of the Zechstein Sea. The north limb of the syncline, crossed by the south pier, exposes more marl slate at a very low tide. Several notable species of fish fossils have been discovered here, because of shifting sands I have so far had no success finding this exposure before it disappears seawards.

In conclusion the picture postcard setting of Cullercoats Bay, beloved of the 19th century American painter Winslow Homer and today's popularity, is largely due to the remarkable Yellow Sands outcrop; however, to a substantial proportion of visitors this pleasant scenery belies the mighty upheavals of northerly drifting continents, the environmental changes and the complexities of lithological processes. An information board explaining the geology would mean a wider audience could enjoy the knowledge that I have discovered, hopefully that will happen here and elsewhere[?].

## NOTES

- 1 New discoveries will improve knowledge and speculation concerning influential structural changes. EG. Radiometric dating of minerals in fault gouges has revealed possible evidence for Jurassic to early Cretaceous Lake District and Pennine fault movements. This would have reactivated the Ninety Fathom Dyke.
- 2 It has been difficult to find a more exact figure for the time scale of non-sedimentation. Recent studies have demonstrated how conodont discolouration is affected by burial at depth has helped geologists estimate that 2,000 metres of coal measure material was removed.
- 3 Three Permian Epochs  
**Cisuralian:** 299 to 273 million years. Named after the foothills of the Ural Mountains near Perm  
**Gaudalupian:** 272 to 259 million years. Named after the Guadalupe Mountains of New Mexico  
**Lopingian:** 258 to 251 million years. Named after a landlocked area of southeast China.
- 4 Zechstein Sea, zechstein, means 'mine stone'

Another famous rock...

# Hornton Stone

*We've been running this feature for some time now in Down to Earth and it's normally down to the Editor to select the rock and write about it.*

*This time, he's pleased to hand over the task to Down to Earth reader Brian Ellis. Perhaps you have a favourite 'Rockstar' and would like to tell us about it?*



Edge Hill, **[Photo 1]** familiar as the site of the first battle of the English Civil War (1642), forms a prominent escarpment in South-East Warwickshire. It is capped by an outcrop of Hornton Stone, now formally designated by BGS as the Marlstone Rock Formation. This is a ferruginous limestone and ironstone deposited in shallow seas approximately 174-191 million years ago during the Jurassic Period. It consists of coarse to fine grained material and it weathers to a rough surface texture with a distinctive orange/brown colour.



Hornton Stone was quarried extensively along the escarpment's dip slope both in Warwickshire and in the adjacent parts of Oxfordshire, although most of the quarries are now closed. **[Photo 2]** Hornton village, from which the stone takes its name, is in Oxfordshire. The presence of abandoned quarries has enabled Warwickshire Geological Conservation Group to designate five 'Hornton' Local Geological Sites details of which can be found on its website (LGS 33, 35, 50, 59, and 88) ([www.wgcg.co.uk/LGS/LGS lists](http://www.wgcg.co.uk/LGS/LGS%20lists)).

**Author: Brian Ellis**

*Illustrations courtesy of author.*



The stone was used primarily as a building and walling stone but also for grave headstones, monumental masonry, decorative fireplaces amongst other uses and notably for sculpture. Most of the parish churches on or near the outcrop are built of Horton Stone. **[Photo 3]** Its warm colour in domestic buildings helps account for the distinctive character of these Cotswold-fringe villages. **[Photo 4]** The Burton Dassett Hills, in Warwickshire, are an outlier of the main escarpment. Here the iron content of the rock was just sufficient for it to be quarried for iron ore in the late nineteenth century. Quarrying ceased





in the 1920s. The area is now a Country Park. **[Photo 5]** The rock is also fossiliferous and when cut and polished makes attractive facing stone, as in the Shire Hall in Warwick. **[Photo 6]**

In his early career the English sculptor Henry Moore was attracted to



Hornton Stone partly because it was easily obtainable and more affordable; and it had not been used before for sculpture. He valued it as a rougher and vivid stone which did not look pristine when freshly carved. He tended to use it for heavier, more powerful forms. Moore called it "a friendly stone that I like carving". **[Photo 7]**



## your feedback

*Hi Chris*

### *Greetings from the Arctic*

We are currently inside the Arctic circle. We visited North Cape yesterday & the wind chill was ferocious but the views stunning. We are experiencing a twilight time. No sun above the horizon for a little while longer. We have been lucky enough to view the Northern lights for four consecutive nights.

The ship is now returning South - our return destination is Dover next week.

However the reason for this contact is about the new under water cable from Norway to Blyth which only came on stream in October 21. Electricity is being sent to the UK. Another one is planned to go to Scotland but that is still in the planning stage. Do you have any more details? The technology involved to make it function efficiently and be 'bomb proof' must be quite something.

*Richard Mann & Val Bannister*

**The Editor responds:** Can anyone provide us with more details?

*Dear Editor*

### *Re Cove Bay - DtoE 117*

Really good picture of Cove Bay in the current edition of **DtoE** but the rocks shown are Permian, not Triassic!

The Hopeman sandstone was firmly dated after the discovery of a dicynodont skull in Clashach Quarry in 1997. The original block of sandstone containing the mould and a 3D plastic-printed model of the skull are on display in Elgin Museum - yet another reason to come in and see us next year.

**Tell the Editor what you think about any geological subject or article in DtoE**  
**Email: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)**  
**or write to him at the usual address**

The block has recently been rescanned at the University of Bristol by Dr Davide Foffa of NMS; more anatomical detail should be apparent in the higher resolution CT scan so expect more information over the next few months.

*Alison Wright, by email*

I would add that there is additional significance in how the redating came about, to celebrate women in geology. Carol Hopkins was a housewife and OU student and almost daily in Clashach Quarry in 1990s where she built up relationship with the quarrymen. (Shades of our male Museum founders and how Elgin area became so significant in Victorian geological advances.). They started looking out for interesting things to put aside for her - hence the subsequent identification from the void. Carol's particular interest was the reptile trackways and other traces. We could write this up more lucidly as a short piece if you wanted. *(Yes please, that would be good - Ed.)*

*Janet Trythall, by email*



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Calsite with chalcocopyrite  
Cloud Hill Quarry  
Leicestershire

Please mention Down to Earth  
when contacting us



In this competition, we ask you to  
'exercise those little grey cells'...

## What's the story?



*This picture came from DtoE reader Doug Lester who wanted help to interpret what it shows. Over to you Doug:*

"Much of the Midland Valley of Scotland is now a defunct coal mining area. The spoil bings are locally quarried for footpath and trackway surfacing etc. This Carboniferous rock is thus fairly common.

In this specimen there appear to be two distinct environments, the upper one organic-rich, the lower one much less so. In both parts the small-scale environment seems to be changing rapidly. Both show current bedding. What sort of environment do these represent?"

*Unusually, our mystery picture for this issue is an extremely well known rock exposure in North of England.*

*Because it's so well known, we are looking for nice, complete answers!*

*The closing date is April 15th. 2022. The prize this time is a free BGS jigsaw puzzle of your choice, worth £24.95.*

*We welcome images for use in this feature.*

*Email your answers and images to:  
downtoearth@geosupplies.co.uk*

*Now to your replies, the first is from Mark Wilkinson from the University of Edinburgh:*

"The sample is a sandstone with ripple cross-lamination picked out by a rusty-red weathering mineral which is probably siderite. The darker bands in the top half of the sample (I think it is shown the correct way up, look carefully at the ripples) are possibly shale but appear to pass laterally into the more weathered red colour. They are probably more intensely cemented by siderite which is less weathered. Siderite cements are common in non-marine sandstones, though I've never understood why – iron doesn't seem to be especially abundant in river water so maybe it is related to something generated in soils that gets washed into the rivers as part of the sediment load?"

Anyway, such sandstones are common in the Midland Valley, having been deposited in rivers or shallow lagoons. I had wondered how the siderite picks out the ripples so clearly, until we found similar textures in sandstones of the Brent Group of the North Sea. There, with the help of a scanning electron microscope, we could see that the siderite was growing on mica flakes, often inside the flakes as they altered and expanded during burial. I'm not sure exactly why this happens, but the flakes lie on the tops of ripples and hence so does the siderite."

*Richard Mann, was also brave enough to have a go:*

"The photograph shows a distinct change from rippled slightly carbonaceous siltstone with de-watering evidence upwardly becoming a silty Carbonaceous shale. This may be as a result of depositional depth change rather than a change in current direction and would likely form a stratigraphic boundary."

**The Editor comments:** This is a hard one! Without access to the specimen itself and the information that was given with the picture, you may even have considered that this was a metamorphic rock, such as a gneiss.

It's the nature of geology that we have to take in the context of something as well as just the visuals. Likewise, it could be that the darker bands are iron rich as Mark suggests, or are they carbonaceous as Richard hints.

*Unusually, let's leave this open until we hear back from Doug, because he's the one with the specimen after all!*





## Conserving the machair at Achmelvich back in 1977

*We always like to hear from you, our readers, even when it's events that have happened a long time ago. We were delighted to hear from Liz Randall with this story from the Northwest Highlands...*

"In 1977 I was in a group of Conservation Volunteers 'mending Achmelvich beach', and I think it would interest your field-trippers (on the Northwest Highlands trip) to see how the beach has fared in the intervening years, in terms of erosion.

By 1977 increasing caravans and boat trailers brought to the beach were cutting through the machair and the sand was being blown out from underneath the thin layer of grass, undermining and killing it. The park rangers noticed a marked loss of sand from the beach through this destruction of the machair, and asked the National Conservation Corps to spend a couple of weeks re-seeding machair to halt the loss.

We cut grass turves from less vulnerable places well away from the beach, placed them in grids on the sandy slopes of the beach and sowed machair grass seed (mixed in a kind of rubber solution) onto the sand in between the turves. The wind blows relentlessly up there and we got a lot of rubber solution and grass seed in our hair, also hopefully some on the sand as well! Here are photos of what we did and what the bay looked like in May 1977."



*Work that had been done in 1977 to protect the machair landforms at Achmelvich beach. This included re-seeding some of the grassy dunes.*

## A GeoWeek with 'Net zero by 2050' in mind...

Organising geo-events back in May 2021 wasn't easy, but with Cop 26 on the horizon, the overarching theme was 'Net zero by 2050' – what will it mean for our region?

Leaders were asked to take members of the public to areas with views and rock exposures. Then to discuss the impact on the local area that the Government targets to reduce carbon emissions to net zero by 2050 might cause.

Despite the best laid plans, the Covid 'rule of 6' meant that no national



*The viewpoint at the head of the Porter Valley on the western side of Sheffield affords a fine view over the city. (Image' Peter Kennett)*

events could be advertised. Instead, groups across the country were encouraged to add 'to the GeoWeek map, examples of their self-guided geological walks. In addition a few locally advertised in person net zero events were held, limited to groups of just 5 people.

"There was some excellent feedback, including one person who pointed us to a long-term building site where carbon sequestration by enhanced weathering might have been going on as we spoke" reported Peter Kennett.

## Volcanic Experiences 2022

Small group tours to areas of superb geological interest

**Santorini** May 4<sup>th</sup> to 11<sup>th</sup>

The island which gave rise to the legend of Atlantis

**Sicily & the Aeolians** June 14<sup>th</sup> to 21<sup>st</sup>

Includes visits to Etna, Vulcano & Stromboli

**Iceland ~ the South**, Sept 4<sup>th</sup> to 11<sup>th</sup>

Including visit to Fagradalsfjall eruption site

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email [volcanicexperiences@aol.com](mailto:volcanicexperiences@aol.com)





*This is the view from Halidon Hill, over Berwick upon Tweed, visited on a trip led by Elizabeth Devon (Image: Patrick Dixon)*

With the experience gained in 2021, it is hoped that we can pick up the theme again in May of this year with a larger programme of 'net zero' events. GeoWeek 2022 runs for 9 days May 7-15, with the launch event on May 5th.

You can find out more at the GeoWeek website:  
<https://www.earth-science.org.uk/geoweek/>

*We are grateful to Peter Kennett for this information*

### **Abberley & Malvern Hills Geopark looks forward to 2022...**

*Now that some of the Covid restrictions have been lifted, we can once again enjoy the countryside and even take in a cafe! Not only is it possible to take a stroll as a family group, much larger groups such as geological clubs and societies can meet up again. The Abberley & Malvern Hills Geopark is centrally located and an ideal place to take in the geology as Peter Oliver explains...*

"There are lots of self guided walks for you to try out. They are available most of the year at venues such as Severn Valley Country Park, Arley Arboretum, Worcester Cathedral, Hartlebury Castle, Wyre Forest and National Trust at Croome and Dudmaston. They cover natural and man-made landscapes, wildlife, geology and history.



*The Huntley Quarry Reserve in Gloucestershire*

There are also self guided trails in the general landscape across the Geopark; and printed leaflets for these can be obtained from various outlets or downloaded from the website. Have a look at **'Explore Geology and Landscape - Walking Trails'** for more details. Some of the walks are in town centres like Bridgnorth, Bewdley and Hereford and some are out in the countryside such as the Malvern Hills, the Froome Valley and May Hill. And there is the Severn Valley Railway train ride trail - from the luxury of your carriage seat."

You can find out more at:  
<http://geopark.org.uk/pub/>

### **Do you remember the 'secret quarry' last year?**

*Do you remember the TV reports of Natural History staff dashing up to a 'secret quarry' in the Cotswolds' to extract echinoderms? Tim Ewin, one of the palaeontologists involved says this in an introduction to talks that he is going around the country:*

The find, in the county of Wiltshire, has now been declared as a new UK Bathonian (Middle Jurassic) lagerstätte. It has revealed one of the most important Jurassic echinoderm localities in the world. Excavation of the site has produced thousands of exceptionally preserved articulated echinoderms including at least 18 species, belonging to all five extant echinoderm classes. Fossilised purple crinoid pigment has also been found at the site. Other significant fossils include plants and Radiolaria, the latter being rarely seen in UK onshore Jurassic rocks.



*A slab of the amazing fossil echinoderm material from the quarry (Image: The Natural History Museum)*

The fossils are preserved in various orientations, indicating brief transportation prior to rapid burial (obturation). Other shelly fauna are more disarticulated and suggest greater residency within the environment and greater transportation prior to burial. The echinoderm fossils are dominated by the true comatulid crinoid *Palaeocomaster* sp., represented by over 3000 individuals, and the stalked crinoid *Isocrinus* sp. This is the earliest incidence of true comatulid crinoids dominating a sea floor environment. It is significant as "comatulid meadows", important areas of biomass and diversity in several modern soft sea floor ecosystems (such as at continental shelf margins), are unknown in the fossil record before the Cretaceous.

### **Huge millipede fossil found on Northumberland beach...**



*The huge Carboniferous millipede found at Howick Bay - read more in DtoE extra (Image: Neil Davies)*



# ask the audience

*We thank you for the response to the question raised in the last issue, and also for the new stock of questions. We regret that, owing to the packed nature of this issue, some items have had to be held over until the next time.*

*Please keep the questions (and answers) coming in!  
Email: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)*

## Answers from the last issue...

*I would love to say that we have the answers for you, but alas we've drawn a blank this time I'm afraid. But, as you know, we don't give up easily, so here are the two of the same queries that will hopefully jog a couple of you into action!*



*The first comes from Kathryn Logan who wants to know more about the nature of this folded and slumped sandstone that she saw in an old quarry in Ross-shire*

Don't be put off if you've not been to Ross-shire,, you may have seen something similar elsewhere.

*The second comes from Glenn and Marilyn Vickers and shows an exposure on the Northumberland coast. Marilyn says:*

*"At the southern end of the beach at Creswell in Duridge Bay, there is a structure reminiscent of a dyke. It forms a vertical wall projecting out of the cliff and there is an interesting slump structure by the side of it and what looks to be a basal conglomerate."*

*Study the picture (on the next column) and then see if you can help Marilyn. This is a well known area, surely somebody out there will have an idea!*

**Now that things are slowly returning to normal, we welcome back our popular feature where we challenge you, our audience, to solve problems posed by our readers.**



## The new Questions...

*We've just enough room to squeeze in two in this issue of Down to Earth. We begin with this from Eva Peringer:*



*"I would love to know whether these two semicircular cutouts are natural or man-made: they don't appear to go anywhere. I took the picture in an old quarry on the Apley Estate a couple of miles from Bridgnorth in Shropshire."*

*The second comes from Pete Milsom, who took this picture at Fraisthorpe, East Yorkshire.*

*If you are familiar with the Quaternary deposits in this area, do tell us the story!*





## Book Choice

Title: Northumberland Rocks  
Author: Ian Jackson  
Publisher: Northumberland Wildlife Trust  
ISBN: 978 1 9142376 7 6  
Format: Softback  
Cost: £10.00  
Level: Adult & general interest  
My rating: \*\*\*\*\*



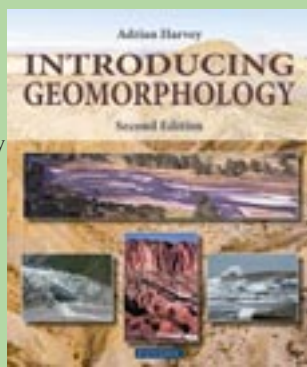
Anniversaries are funny things. Sometimes there are easy ways to celebrate them. It's always seems easier to celebrate the special milestones of people rather than organisations. However for the Northumberland Wildlife Trust they celebrated their 50th anniversary with a grand rock festival that featured many geological gems over the course of 2021. Now 50 of them have been made into a book.

Written by local geologist and organiser of the Rock Festival, Ian Jackson, it tells the amazing story of Northumberland's geological history from 425 million years ago right up to today and explains how and why its rocks are the reason for the region's outstanding scenery and landscape. The book has been endorsed by BBC TV presenter Iain Stewart and international best-selling author Simon Winchester.

The 114-page book opens a window into the Northumberland beneath everybody's feet and reveals the origins of its landscape and its habitats. It encourages people to look at their landscape with fresh eyes and inspire them to go explore the region. The 50 rock sites described are diverse and range from Berwick-upon-Tweed in the north to Allenheads in the south and from Haltwhistle in the west to Tynemouth in the east. Some of the images may surprise you, there's even includes the urban geology of central Newcastle. But they all form part of the rich tapestry that is Northumberland.

Above all, the images and excellent accompanying text tell the story of Northumberland. The book benefits from it having an unusual format - A4 landscape. Never has this format been put to better use than to show Northumberland's landscape! The cover price has obviously been chosen so that it flies off the shelf. Highly recommended.

Title: Introducing Geomorphology  
Second Edition  
Author: Adrian Harvey  
Publisher: Dunedin Press  
ISBN: 978 1 78046 103 8  
Format: Softback  
Cost: £9.99  
Level: Adult & general interest  
My rating: \*\*\*\*\*



It's pleasing to present yet another of the excellent Dunedin introductory Earth science texts has gone to a second edition. Introducing Geomorphology was first published in 20XX now author

Adrian Harvey has revised and updated his text. He has also included some new and refreshing colourful images that will add to the readers; enjoyment and understanding of some of the important topics.

Geomorphology isn't an easy subject and it takes someone of the calibre and knowledge of Adrian Harvey to put it across in a way that people can understand. Above all, he's a well travelled man with huge experience in the field which enables him to bring you some of the finest examples from across the world.

Yes, the book has been improved with this second edition, but one thing that hasn't changed is the price, which is excellent news.

Title: Classic Geology in Europe 3  
Iceland Third Edition  
Authors: Thordarson & Hoskuldsson  
Publisher: Dunedin Press  
ISBN: 978178046 092 5  
Format: Softback  
Cost: £25.00  
Level: Adult general interest  
My rating: \*\*\*\*



It's good to see that despite the Covid pandemic, there are still enough tourists going to Iceland to warrant this excellent guide going to a third edition.

For a number of years now this has been the standard guidebook for students and others visiting Iceland to study the rocks across the whole of the country. It was first published in 2002 by Terra and this edition looks, and feels very different to that. To start with, there are lots of full colour images, maps and diagrams.

Because of the pandemic, publication has been delayed and this has allowed the authors, both of whom work at the University of Iceland, to include the 2021 eruption on the Reykjanes Peninsula. This alone should encourage even more people to go to Iceland to study the volcanic processes.

But Iceland's geology is so much more than just volcanoes and volcanic rock. There's also the record of sedimentary rocks, some of which date from before the onset of glaciation around 3 million years ago. There are also a few fossils, including rare Tertiary flora.

This comprehensive guide covers the geomorphological processes that also act on this island that ensure that weathering and erosion go hand in hand with igneous processes to bring us new rocks.

This well produced guide isn't cheap but it is still very good value.

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# diary of events

**Until such time as some sort of 'normal service' is resumed by clubs and societies, we are concentrating our efforts of telling you about 'real' fieldwork opportunities. Do tell us about YOUR activities.**

## lectures/zoom meetings

### February

4 "Pushing back the boundaries of early life" by Martin Homann (Zoom)  
Organiser: GA Details: <https://geologistsassociation.org.uk/lectures/>  
7 "Thirteen degrees of warming - understanding the Eocene Earth"  
by Tom Dunkley Jones (Zoom)  
Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
8 "The magnetic personality of bacteria" by Greig Paterson (Zoom)  
Organiser: Liverpool Geol. Soc. Details: <https://liverpoolgeologicalsociety.org/>  
9 "Darwin and the geology of Galapagos" by David Norman (Zoom)  
Organiser: Shropshire Geol. Soc. Details: [www.shropshiregeology.org.uk](http://www.shropshiregeology.org.uk)  
9 "Geology of Islay and whisky" by David Webster (Zoom)  
Organiser: Cumberland Geol. Soc. Details: [www.cumberland-geol-soc.org.uk](http://www.cumberland-geol-soc.org.uk)  
9 "The Forties (Ratray) volcanic province in the Central North Sea 1970-2020" by Kevin Smith (Zoom)  
Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)  
9 "Trees of the North Pole" by Neil Davis (Zoom)  
Organiser: Essex Rock & Min. Details: <http://www.erms.org/>  
9 "Ethiopian volcanics" by Ben Clarke (Zoom)  
Organiser: Leicester Lit. & Phil. Soc. Details: [www.charnia.org.uk](http://www.charnia.org.uk)  
9 "Darwin and the geology of the Galapagos" by David Norman (Zoom)  
Organiser: Shropshire Geol. Soc.  
Details: <http://www.shropshiregeology.org.uk/>  
9 "The Geology of Ruislip Woods" by Alan Wheeler (Zoom)  
Organiser: Harrow & Hillingdon Geol. Soc. Details: <https://www.hhgs.org.uk/>  
10 "3D geological outcrop modelling and visualisation" by Brian Burnham (Zoom) Organiser: North Staffs.GGA Details: <https://nsgga.org/lectures/>  
10 "The eruption of the Soufriere Hills volcano Montserrat" by Steve Sparks (Zoom) Organiser: Herts.Geol. Soc.  
Details: <https://www.hertsgeolsoc.ology.org.uk/>  
12 "Yorkshire's (and the East Midlands) ancient storms" by Andy Howard (Lecture) Organiser: East Midlands Geol. Soc. Details: [www.emgs.org.uk](http://www.emgs.org.uk)  
15 "Land of the long white cloud" by Tony Mitchell (Zoom)  
Organiser: Kent Geologists' Group Details: [www.kgg.org.uk/](http://www.kgg.org.uk/)  
15 "Colours in dinosaurs and minerals" by Richard Jarvest (Zoom)  
Organiser: East Herts. Geol. Club Details: <http://ehgc.org.uk/>  
16 "Clogau Gold Mine exploration, North Wales" by Mark Austin (Zoom)  
Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)  
16 "The Kilchrist Caldera, Skye" by Simon Drake (Lecture & Zoom)  
Organiser: Warwickshire Geol. Cons. Group  
Details: <https://www.wgcg.co.uk/events>  
16 "Iceland geology with recent developments" by Chris Darmon (Zoom)  
Organiser: Mid-Wales Geology Club  
Details: <https://www.midwalesgeology.org.uk/programme>  
17 "Hydrogeology - the amazing behaviour of water within rock"  
by John Heathcote (Lecture)  
Organiser: Aberdeen Geol. Soc. Details: [www.aberdeengeolsoc.org.uk](http://www.aberdeengeolsoc.org.uk)  
17 "Icelandic volcanoes" by Glynis Easterbrook (Lecture Stanway)  
Organiser: Essex Rock & Min. Details: <http://www.erms.org/>  
21 "The rocks that don't belong" by Martha Johnson (Zoom)  
Organiser: Black Country Geol. Soc. Details: [secretary@bcgs.info](mailto:secretary@bcgs.info)  
22 "Karstic landscapes of England & Wales: the good, the not so good and the ugly" by Alan Thompson (Zoom)  
Organiser: Liverpool Geol. Soc. Details: <https://liverpoolgeologicalsociety.org>  
25 "Volcanic hazards in the Pacific Northwest USA" by Jon Major (Zoom)  
Organiser: Northeast Geol. Soc. Details: [www.negs.org.uk](http://www.negs.org.uk)  
28 "Tectonics and magmatic structures in the West Midlands"  
by Carl Stevenson (Lecture)  
Organiser: Teme Valley Geol. Soc. Details: [martleypfo@gmail.com](mailto:martleypfo@gmail.com)

### March

1 "Geomicrobiology: life in a pinch of salt" by Terry McGerity (Lecture Shenfield) Organiser: Essex Rock & Min. Details: <http://www.erms.org/>  
2 "Rare Earths" by Martin Smith (Lecture)

Organiser: Brighton & Hove Geol. Soc. Details: [www.bhgs.org](http://www.bhgs.org)  
2 "Recent discoveries in the early Carboniferous of northern Britain"  
by Tim Smithson (Zoom)  
Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)  
3 "Geology and war: an exploration of how the ground influencers battles" by Paul Nathanall (Lecture). Organiser: Bath Geol. Soc.  
Details: <https://bathgeolsoc.org.uk/lectures/>  
4 "The power of outreach in the geosciences" by Amy Edgington (Zoom)  
Organiser: GA Details: <https://geologistsassociation.org.uk/lectures/>  
7 "Engineering geo-hazard challenges for construction upon the Hythe Formation in Kent" by Clive Edmonds (Zoom)  
Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
8 "Crystals and crystalline materials" by Ian Mercer (Zoom)  
Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>  
8 "Cruising the 'Trans-Pangaea Highway' for searching for Triassic gas" by Brian Williams (Zoom)  
Organiser: WEGA Details: <https://www.wega.org.uk/wega-lecture-programme>  
8 "Sheridar Neanderthals" by Chris Hunt (Zoom)  
Organiser: Liverpool Geol. Soc. Details: <https://liverpoolgeologicalsociety.org/>  
9 "The geology of the Chiltern Chalk and the impact of HS2"  
by Haydon Bailey (Zoom)  
Organiser: Harrow & Hillingdon Geol. Soc. Details: <https://www.hhgs.org.uk/>  
9 "Redrawing the geological map of South Wales" by John Cope (Zoom)  
Organiser: Shropshire Geol. Soc.  
Details: <http://www.shropshiregeology.org.uk/>  
10 "A History of Plants in 50 Fossils" by Dr Paul Kendrick, Natural History Museum, London Organiser: Mole Valley Geological Society. Details: Barrie Williams 01737 245709  
10 "Some of the more unusual landforms in Western Australia"  
by Brian Burnham (Zoom)  
Organiser: North Staffs.GGA Details: <https://nsgga.org/lectures/>  
10 "What can satellites tell you about local geology?" by Jo Conway (Zoom)  
Organiser: Herts.Geol. Soc.  
Details: <https://www.hertsgeolsoc.ology.org.uk/>  
12 "Landforms of the Yorkshire Dales" by Tony Waltham (Lecture)  
Organiser: East Midlands Geol. Soc. Details: [www.emgs.org.uk](http://www.emgs.org.uk)  
14 "An introduction to Bedfordshire geology" by Bev Fowlston (Zoom)  
Organiser: Essex Rock & Min. Details: <http://www.erms.org/>  
14 "The future of sequence stratigraphy" by Peter Burgess (Zoom)  
Organiser: OUGS North West. Details: <https://ougs.org/northwest/>  
15 "Minerals and the microscope" by Brian Lines (Zoom)  
Organiser: Kent Geologists' Group Details: [www.kgg.org.uk/](http://www.kgg.org.uk/)  
15 "The discovery of a lathe fossil reptile" by Mark Wildman (Lecture)  
Organiser: East Herts. Geol. Club Details: <http://ehgc.org.uk/>  
16 "Wine, whisky and beer - the role of geology" by Alex Maltman (Lecture & Zoom) Organiser: Warwickshire Geol. Cons. Group  
Details: <https://www.wgcg.co.uk/events/>  
16 "Mires, meteors and mass extinctions: what does coal tell us about deep time climates?" by Rhodri Jerrett (Lecture)  
Organiser: Manchester GA. Details: [lectures@mangeolassoc.org.uk](mailto:lectures@mangeolassoc.org.uk)  
16 "The geology and evolution of near-surface fissure systems in Caabria, Itlay & other areas" by Kit Hardman (Zoom)  
Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)  
16 "Boxstones: the search for Miocene in Suffolk" by Tim Holt-Wilson (Zoom) Organiser: Mid-Wales Geology Club  
Details: <https://www.midwalesgeology.org.uk/programme>  
17 "Minerals and green energy" by Dan Smith (Lecture Stanway)  
Organiser: Essex Rock & Min. Details: <http://www.erms.org/>  
18 "The Kas Crater" by Alison Ure (Zoom)  
Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk/>  
30 "The day a tsunami hit Scotland" by Mark Bateman (Zoom)  
Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)

### April

1 "The pebbles of the Ice Age coast" by Mike Horne (Lecture/Zoom)

Organiser: GA Details: <https://geologistsassociation.org.uk/lectures/>  
 4 “The voyage of The Beagle” by Peter Worsley (Zoom)  
 Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
 4 “From greenhouse to icehouse; from forests to frosts, Antarctica’s climate history” by Jane Francis (Zoom)  
 Organiser: Leicester Lit. & Phil. Soc. Details: <https://www.charnia.org.uk/>  
 6 “Tales from the Chalk - new technologies” by John Barlow (Lecture)  
 Organiser: Brighton & Hove Geol. Soc. Details: [www.bhgs.org](http://www.bhgs.org)  
 8 “Glossop” by David Shilston (Zoom)  
 Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk/>  
 12 “Volcanic Experiences in Iceland” by Alan Clewlow  
 Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>  
 12 “The Ice Age River Story” by Mike Howgate (Lecture)  
 Organiser: East Herts. Geol. Club Details: <http://ehgc.org.uk/>  
 13 “Adventures under the microscope” by Martin Carruthers (Zoom)  
 Organiser: Shropshire Geol. Soc.  
 Details: <http://www.shropshiregeology.org.uk/>  
 13 “The importance of London Geodiversity Partnership sites around Harrow and Hillingdon” by Di Clements (Zoom)  
 Organiser: Harrow & Hillingdon Geol. Soc. Details: <https://www.hhgs.org.uk/>  
 14 “Geology and the construction of HS2” by David Eye (Lecture)  
 Organiser: Herts.Geol. Soc.  
 Details: <https://www.hertsgeolsoc.ology.org.uk/>  
 14 “Did the Earth move for you? Measuring tiny ground movements from space” by Dr Philippa Mason, Imperial College, London. Organiser: Mole Valley Geological Society. Details: Barrie Williams 01737 245709  
 19 “The muck above the Chalk” by Nick Baker (Zoom)  
 Organiser: Kent Geologists’ Group Details: [www.kgg.org.uk/](http://www.kgg.org.uk/)  
 20 “Jurassic brain teasers” by Stephan Lautenschlager (Lecture & Zoom)  
 Organiser: Warwickshire Geol. Cons. Group  
 Details: <https://www.wgcg.co.uk/events/>  
 20 “Landscape evolution of southwest Wales” by Peter Kokelaar (Zoom)  
 Organiser: Mid-Wales Geology Club  
 Details: <https://www.midwalesgeology.org.uk/programme>

#### May

5. “The day after tomorrow is the Gulf Stream set to shutdown?”  
 by Jon Robson (Lecture)  
 Organiser: Bath Geol. Soc. Details: <https://bathgeolsoc.org.uk/lectures/>  
 6 “Defining catchments in Karst environments” by Vanessa Banks  
 (Lecture/Zoom)  
 Organiser: GA Details: <https://geologistsassociation.org.uk/lectures/>  
 10 “Greenland: bits of rock and lots of ice” by Tony Waltham (Lecture)  
 Organiser: Amateur Geol. Soc. Details: <https://amgeosoc.wordpress.com/>  
 12 “Why is Venus so different to Earth ?” by Dr Richard Ghail, Royal Holloway, University of London. Organiser: Mole Valley Geological Society.  
 Details: Barrie Williams 01737 245709  
 12 “Civil engineering meets geology at the Panama Canal” by Tony Waltham  
 (Lecture) Organiser: Herts.Geol. Soc.  
 Details: <https://www.hertsgeolsoc.ology.org.uk/>  
 17 “Connecting East Kent to a wider regional and global geological story” by  
 Lawrie Cowliff (Zoom)  
 Organiser: Kent Geologists’ Group Details: [www.kgg.org.uk/](http://www.kgg.org.uk/)

## day field trips

#### February

20 Coombe Gibbet Down and Bugnium Lane, Inkpen with Roger York  
 Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
 20 Geoconservation day at Gilbert’s Pit, East London  
 Organiser: London Geodiversity Partnership  
 Details: <https://londongeopartnership.org.uk/>

#### March

5. Field visit to Tor Hill & Wookey Hole Caves with Doug Robinson  
 Organiser: Bath Geol. Soc. Details: <https://bathgeolsoc.org.uk/lectures/>  
 28 Geology in Nymans’ Gardens with John Loneran  
 Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)

#### April

23 Sarsens of the West Woods area of the Marlborough Downs with Peter

Worsley. Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
 24. Visit to Pulborough Ride with John Loneran  
 Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk/>

#### June

18. Visit to Down House Kent, home of Charles Darwin  
 Organiser: West Sussex Geol. Soc. Details: <http://www.wsgs.org.uk/>

## residential field trips

#### April

2-9 Bude, North Cornwall with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)  
 21-28 Isle of Raasay & Skye with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)  
 29-May 6 The Northwest Highlands with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

#### May

4-11 Santorini with Alan Clewlow  
 Organiser: Volcanic Experiences. Details: [volcanicexperiences@aol.com](mailto:volcanicexperiences@aol.com)  
 10-16 The Isle of Man with David Quirk & David Burnett  
 Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)  
 14-21 Anglesey with Graham Leslie  
 Organiser: Edinburgh Geol. Soc. Details: [www.edinburghgeolsoc.org](http://www.edinburghgeolsoc.org)  
 16-19 Pembrokeshire with Sid Howells  
 Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
 18-25 The Dingle Peninsula of Ireland with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

#### June

4-11 Mull & Ardnamurchan with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)  
 14-21 Sicily and the Aeolians with Alan Clewlow  
 Organiser: Volcanic Experiences. Details: [volcanicexperiences@aol.com](mailto:volcanicexperiences@aol.com)  
 25-July 2 Pembrokeshire with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

#### July

20-27 Northeast Scotland, Moray & Nairn with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

#### August

13-20 Summer School at Worcester with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

#### September

1-8 Berwick & the Borders with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)  
 4-11 Iceland - the South with Alan Clewlow  
 Organiser: Volcanic Experiences. Details: [volcanicexperiences@aol.com](mailto:volcanicexperiences@aol.com)  
 9-12 The Peak District - to be confirmed  
 Organiser: Reading Geol. Soc. Details: [rgs.secretary@btinternet.com](mailto:rgs.secretary@btinternet.com)  
 14-21 Minehead, North Somerset with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)  
 28-October 2 Malvern Hills with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)  
 30-Oct 2 Famborough Head with Janet Wright  
 Organiser: Herts.Geol. Soc.  
 Details: <https://www.hertsgeolsoc.ology.org.uk/>

#### October

10-15 The Yorkshire Coast with Chris Darmon & Colin Schofield  
 Organiser: Down to Earth Details: [downtoearth@geosupplies.co.uk](mailto:downtoearth@geosupplies.co.uk)

## fairs, shows & special events

#### February

19 Essex Gem & Mineral Show at North Romford Community Centre  
 Organiser: Essex Rock & Mineral Society Details: [www.erms.org](http://www.erms.org)

**We begin this Pygidium with a couple of pieces of sad news...**

### **Rest in peace, we remember Mavis Gill...**

At the end of November, we learned of the sad news that long time supporter of all things geological, Mavis Gill had passed away after a long and brave battle with cancer.

As well as a successful career in the health service, Mavis, from Rowlands Gill in Tyne and Wear, devoted much of her spare time to her many pastimes, including astronomy and geology. Mavis never did anything by halves and was always amazingly enthusiastic and knowledgeable. She went on numerous field trips with *Down to Earth* readers. And right up to the end was taking part in Zoom sessions and courses, almost to the last.

*Rest in peace Mavis, you will be sadly missed - Editor.*

*Mavis as we remember her - with a smile on her face! Here she is overlooking Bergen in Norway.*



### **Much loved and highly respected - Dr Paul Olver dies...**

Over the years, I've met many, many people in the geological work, but few came close to matching Paul Olver in terms of his knowledge, intellect and sheer humanity. In recent years, even when he was really ill he kept on working on various projects almost to the last.

Anyone who had been on a field trip with Paul, has memories that will last them a lifetime. His sheer capacity for work couldn't be matched by people even half his age. Everything he got involved with became a passion for him. He will be missed, not just across the Midlands where he did a lot of his work, but throughout the country.

Paul came from a world where University academics shared their knowledge and enthusiasm for geology with the public at large, through Adult Education classes with organisations like the Workers Education Association (WEA). Paul would roll up his sleeves and carry his boxes of specimens to church halls around the country.

Paul was never somebody to blow his own trumpet, but this, from Paul's Linked In entry, says a lot:

"After completing my doctorate in geological science at Birmingham



*This is the Paul Olver that many people will remember from his latter years. He always had an open casual approach and a smile!*

University, I joined Surrey County Council's adult education service as a tutor/organiser. During my 25 years service, I was eventually appointed as Deputy Principal at Waverley (S.W.Surrey) and then Principal at Mid-Surrey. I have taught in adult education for the whole of my teaching career specialising in ACCESS courses and joint work with sixth-form colleges and with universities.

From 1999 – 2006, I worked for Herefordshire Council as their Lifelong Learning Development Officer and co-ordinated a successful Grundtvig intergenerational learning project called TEDDY BEAR. This led me into work with the Federation of Stadium Communities and co-ordination of their Grundtvig LEGENDS project (2009 – 2011) which focussed on sport, health and well being as its main theme for intergenerational work.

I currently also work as a part-time tutor for the WEA in the West Midlands delivering a wide variety of courses and one-day workshops in both geology and astronomy. I am an experienced geology field trip leader in both the UK and Europe. Recent excursions for the Geologists' Association have been to the Italian Volcanoes and an introduction to the Geology of France.

I am a trustee for the Herefordshire & Worcestershire Earth Heritage Trust where I specialise in developing European environmental projects. I am also currently a member of the Council of the Geologists' Association and lead their Membership Team." Paul, you will be greatly missed!

*Chris Darmon, Editor*

### **Hornfels, but not as you know it...**

I thought you might enjoy this sentence which I found on a web page about how to identify hornfels.

'Hornfels does not display foliage.'  
It's so much better than foliation!

*Peter Barnes*

## Now that's what I call large...

Last year I was working on 2 very large carvings, both of fossils which were for a show in Hampshire. They are still for sale but I am struggling to find room for them here - they are over 1.5m. high.

Both are made of Kilkenny Limestone (and the polishing has revealed hundreds of crinoids!) This may seem an odd request but as a result of the exposure you gave my other 2 pieces of work in *DtoE* I sold both pieces. These are large, outdoor works and I did think of them working well at the start of a geo trail but have no ideas who I might contact on this.



*'Beautiful Crescent' (the trilobite Calymene) and the other is called 'Lepidodendron'.*



*If anyone is interested in purchasing either, or both of these works, please contact the sculptor direct, He's Glenn Morris, email: [arctictreesurgeon@yahoo.co.uk](mailto:arctictreesurgeon@yahoo.co.uk)*

## Hertfordshire Puddingstone... in Hertfordshire!

*Down to Earth* reader **Mike Penning** spotted this in a news item:

Many of you will be familiar with the Tertiary rock called 'Hertfordshire Puddingstone'. It's a very hard conglomerate with brown pebbles of flint in a hard matrix.

It belongs to a family of rocks known as 'sarsen stones' and it occurs in random patches within the Reading Beds. Despite its name, it's more commonly found in Essex and Buckinghamshire.

Workers constructing the A120 Little Hadham bypass discovered the 3.5-tonne slab of Hertfordshire puddingstone was discovered by workers constructing part of the A120 Little Hadham bypass.

Rather than throw it away, the local Parish Council sought a place where it could go for everyone to see, hoping that it could become a centre point. The large block has now found a permanent home by one of the signs at the entrance to Little Hadham.



*Hertfordshire Puddingstone at Little Hadham  
(Image: Hertfordshire County Council)*

## A giant T-rex jumper...

When the Natural History Museum was looking for a Christmas jumper for their animatronic T-rex, they turned to a Leicester company who came up with the goods!



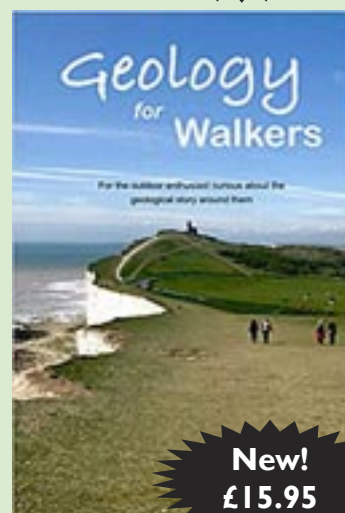
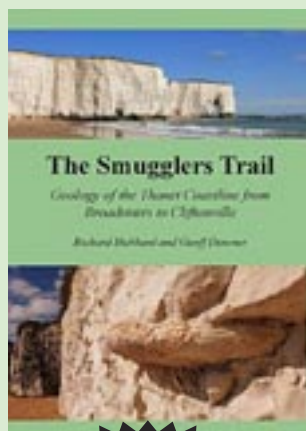
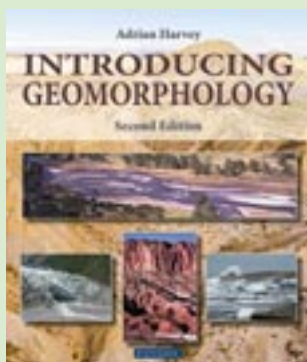
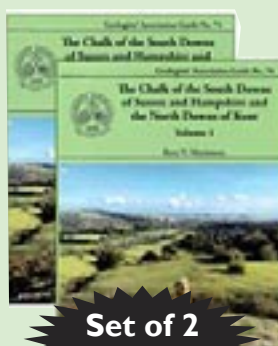
British Christmas Jumpers Director 'Snahal Patel' said the latest design was the company's biggest job yet and took staff 100 hours to complete.

"My dad's never done anything like this and he's been in this business for 35 to 40 years," Mr Patel said.



# 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 November 2021 provided that stocks are available. Please note, all prices include UK postage.



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