

Newsletter of The Farnham Geological Society

Volume 28, Number 1, February 2025

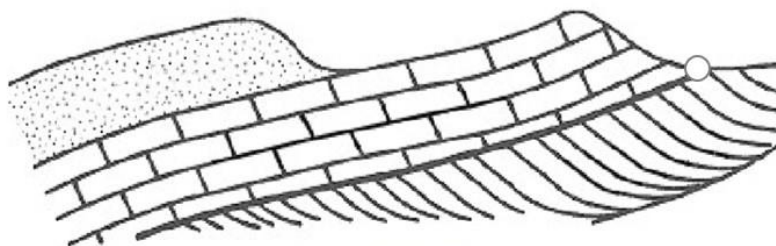


*Mount Etna as viewed from the Greek Teatro Antico di Taormina in
Sicily
by Mick Caulfield*

Farnham Geological Society



*Farnhamia
farnhamensis*



Founded 1970



*A local group
within the GA*

Volume 28, No. 1

Newsletter

Issue No. 127

www.farnhamgeosoc.org.uk

February 2025

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Editorial

Welcome to the latest edition of the FGS Newsletter. I hope you are all well and had a wonderful Christmas and a very happy New Year.

Our next lecture will be **Zoom only** on **Friday, 14 February** when we welcome The University of Bristol's **Dr. Maurice Tucker** who will be talking to us about "**Fossil Viruses and The Roles of Viruses in Earth Science**" which sounds like it will be a fascinating presentation.

This will be followed on **Friday, 14 March** with another **Zoom only** talk to be given by Consultant Astronomer **James Fradgley** who will be bringing us "**Rodinia and the Boring Billion - What does Earth's history tell us to look for to find life on exo-planets?**" ... should be a good one!

On **Friday, 11 April** we will be holding our **AGM** at **The Methodist Hall** on South Street in Farnham ... **a new venue for the FGS** ... see details of its location on **page 7**. Following the AGM, **Jean Davies** and **Jonathan Hannam** will be talking to us about "**The Suez Canal and the Corinth Canal**".

The Committee would like to encourage as many members as possible to come along to The Methodist Hall to support the excellent speakers assembled by Janet Catchpole, who take time out of their busy schedules to travel to Farnham on a Friday evening to present to the Society.

I would also encourage members to check out our **field trip section** both in the Newsletter and on our FGS website. **Tessa Seward**, our **Field Trip Secretary**, is working hard to organise interesting and accessible trips and I would urge you to join those that interest you, as well as **pass on any suggested trips** that you would like FGS to organise.

If you have visited a site of geological interest, listened to an interesting Zoom talk, podcast, webinar or TV programme, and would like to share with your fellow Members, then please feel free to get in touch with the **Newsletter Editor**, **Mick Caulfield** (newsletters@farnhamgeosoc.org.uk).

We are still looking for members to both join the FGS Committee, particularly IT/Sound, as well as help with organising the Societies various activities. Please contact our Chair Mick Caulfield (newsletters@farnhamgeosoc.org.uk) **if you would like to help.**

All of the information contained herein, both graphics and text, is for educational purposes only, as part of the Society's objective. There is no commercial gain for their use.

The views and opinions represented in the articles do not necessarily represent the views of the FGS Editorial Board or the FGS Committee.

Obituaries

Derek Jerram RIP, a long serving member of the FGS, died peacefully in his sleep on 22 December 2024. Derek and his wife Margaret attended many meetings and residential field trips before moving to Market Bosworth a few years ago, although both were regular Zoom meeting attendees. Our sincere condolences to Margaret and all the family.

Dick Moody RIP, a friend to the FGS and leader of a number of FGS field trips, passed away on 9 September 2024, one month short of turning 85. Dick had a long career as a professor and consultant geologist in the petroleum industry. Our sincere condolences to his wife Zoe and all the family.

<https://www.geolsoc.org.uk/About/History/Obituaries-2001-onwards/Obituaries-2024/Dick-Moody>

Front Cover

Photo courtesy of Mick Caulfield, FGS Chair and Newsletter Editor.

This month's **Front Cover** shows the **Teatro Antico di Taormina** with **Mount Etna** in the background.

The theatre is an ancient Greek theatre in Taormina, built in the third century BC, on the eastern coast of Sicily. It had a diameter of 107m and could hold around 10,000 spectators. It is one of the oldest theatres in Southern Italy (*Magna Graeca*) to have a curved *cavea* (seated area), rather than the older trapezoidal design. Today, the theatre is used as a venue for the annual Taormina Film Festival, as well as a variety of shows and as an historical monument.

Mount Etna is the highest Mediterranean island mountain and the **most active stratovolcano** in the world. The eruptive history of the volcano can be traced back 500,000 years and at least 2,700 years of this activity has been documented. The almost continuous eruptive activity of Mount Etna continues to influence volcanology, geophysics and other Earth science disciplines. The volcano also supports important terrestrial ecosystems including endemic flora and fauna and its activity makes it a natural laboratory for the study of ecological and biological processes. The diverse and accessible range of volcanic features such as summit craters, cinder cones, lava flows, and the Valle de Bove depression have made the site a prime destination for research and education.

References:

https://en.wikipedia.org/wiki/Ancient_theatre_of_Taormina

<https://whc.unesco.org/en/list/1427/>

Farnham Geological Society

Committee 2025

Chair	Mick Caulfield
Treasurer	Mike Millar
Secretary	Judith Wilson
Programme Secretary	Janet Catchpole
Membership Secretary	Sally Pritchard
Field Trip Secretary	Tessa Seward
Newsletter Editor	Mick Caulfield
Web Manager	Bob Rusbridge
Advertising	Peter Crow
IT/Sound	Mike Millar
Without portfolio	Peter Luckham
Ad Hoc Member	Liz Aston

Meeting Programme 2025

Please note **The Methodist Hall** and **Zoom**
only meeting times:
7.30 pm for 8.00 pm start.

Fossil Viruses and The Roles of Viruses in Earth Science

Dr. Maurice Tucker Friday, 14 February
University of Bristol

Rodinia and the Boring Billions

Dr. James Fradgley, Friday, 14 March
Consultant Astronomer

AGM + Suez Canal & Corinth Canal

Jean Davies & Jonathan Hannam,
FGS Members Friday, 11 April

Field Trip Programme 2025

(book via the FGS website)

DAY TRIPS

- Devil's Punch Bowl *tba*
- Brookwood Cemetery *tba*
- Charmouth / Lyme Regis *tba*
- **Dryhill Quarry** near Sevenoaks 26 July
Leader: Simon Drake

- **Lambourn Valley** 31 August
Leader: Lesley Dunlop

RESIDENTIAL TRIPS

- **Isle of Anglesey** 16 – 19 October
Leader: Robert Crossley

Places available on **Reading Geological Society's Spring Day** trips
(book via the RGS website
<https://readinggeology.org.uk/fieldtrips.php>)

- **The Ferricrete of Berkshire** 9 February
Leader: Lesley Dunlop
- **Gravestones of Oxford** 23 March
Leaders: Nina Morgan & Phil Powell
- **Sunken Lanes of Sussex** 13 April
Leader: John Boardman

Please let our Field Trip Secretary, Tessa Seward (wessa2006@hotmail.co.uk) know if you have other ideas for places of geological interest to visit.



Geologists' Association Lecture Programme 2025

<https://geologistsassociation.org.uk/lectures/>

Updating the geological map of the Yorkshire Wolds chalk aquifer
Laura Austin Sydes & Laura Burrell Garcia, BGS
Fri, 7 February

Stopes Medal Lecture. British Palaeolithic Archaeology in 2025: Making way in a Headwind
Dr. Matt Pope, Institute of Archaeology UCL
Fri, 7 March

Mull Dyke Swarm
Prof. Joe Cartwright, Oxford
Fri, 4 April

Reading Geological Society Lecture Programme 2025

<https://readinggeology.org.uk/lectures.php>

The caves and karst of North Greenland - physical records of cryptic geological intervals
Prof. Paul Smith, Mon, 3 February
Oxford University Museum of Natural History

Presidential Address
Prof. Alison MacLeod Mon, 3 March
University of Reading

Mesolithic Archaeology and environment history in the Kennet Valley
Prof. Martin Bell, Mon, 7 April
University of Reading

Mole Valley Geological Society Lecture Programme 2025

<http://mvgs.org.uk>

Horsham Geological Field Club Lecture Programme 2025

<http://www.hgfc.org.uk/>

The Geology and Formation of the Alps
Roger Smith, Wed, 12 February
Retired Engineering geologist

Unmanned Aerial Photogrammetry of Sea Cliff Erosion
John Barlow, Wed, 12 March
University of Sussex

Engineering Geological Investigation at Pumped Storage Hydroelectric Power Station, Coire Glas, Scotland
tbc Wed, 2 April

West Sussex Geological Society Lecture Programme 2025

<https://www.wsgs.org.uk/>

AGM + talk, show & tell

Fri, 21 February

The Onset of Modern Style Plate Tectonics

Dr. Craig Storey,
Portsmouth University

Fri, 21 March

Underwater Geology

Chris Bohea
WSGS

Fri, 11 April

Next Lecture

Friday, 14 February 2025

7.30 pm for 8.00 pm Zoom ONLY

Fossil Viruses and The Roles of Viruses in Earth Science

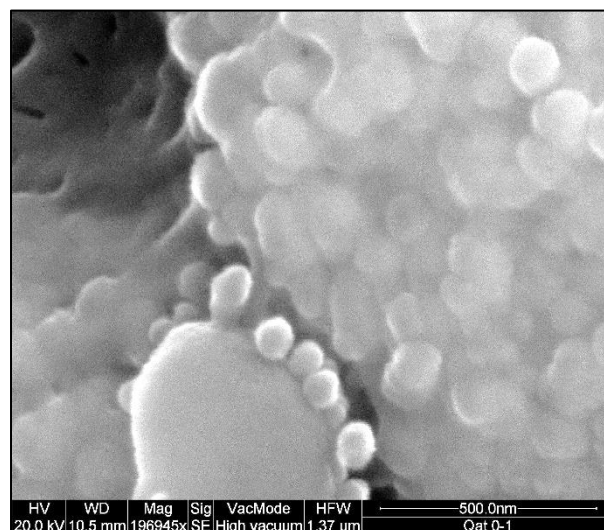
Dr. Maurice E. Tucker

School of Earth Science,
University of Bristol, BS8 1RJ
maurice.tucker@bristol.ac.uk

Viruses are very much in the news these days, unfortunately, but what about their geological history? Are viruses preserved in the fossil record? If so, how does that happen and how far back do they go? And what about the roles of viruses in the environment? Are they significant or were they just the nasty invisible parasites we regard them to be today, disrupting life as we know it and leading to the very sad and untimely death of 100,000s of people? Or are they both – good and bad?

Viruses need bacteria and animal-plant cells for their replication. They are obligate intracellular parasites. From a geological point of view, we know a lot about bacteria and their history: the earliest form of life, from the Archean, creating stromatolites, precipitating minerals (carbonates, phosphates, iron etc), causing disease in all living things, bottom of the food chain, present everywhere in enormous numbers. But there in even greater numbers are viruses, and everywhere too: all environments including extremes, deep subsurface, hot smokers, rain (even Mars?), and with significant effects as well: killing bacteria and higher organisms, recycling organic matter, providing nutrients. But the roles of viruses have rarely been considered in

geological processes. Viruses are the new frontier in Earth Sciences.



Viruses in a microbial mat from Qatar; some attached to a bacterium, others calcified and forming a cluster within EPS.

Maurice Tucker is a carbonate sedimentologist, now based at the University of Bristol, after nearly 30 years at Durham, previously Newcastle, Cardiff and Sierra Leone, with time at UC Berkeley and UWA Perth, and BSc Durham, PhD Reading.



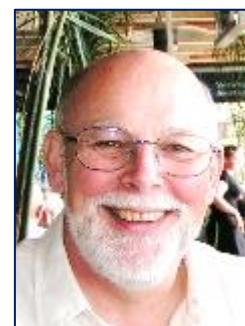
Researches limestones, any age - Archean to Recent, anywhere - Finnmark to Australia, N & S America, India – China, Bath.

Friday, 14 March 2025

7.30 pm for 8.00 pm
Zoom ONLY

Rodinia and the Boring Billions

James Fradgley,
Consultant Astronomer
<https://www.fradg.com/>



2025 Monthly Meetings

From **Friday 12th April 2025** our Monthly Meetings are moving to a new location, **The Methodist Hall** on South Street opposite the junction with Union Road in central Farnham.

The entrance to the Hall is at the back of the church via the public footpath between the Methodist Church and the Citizen's Advice office at 50 South Street. The Hall is on the ground floor with access to a kitchen for refreshments.

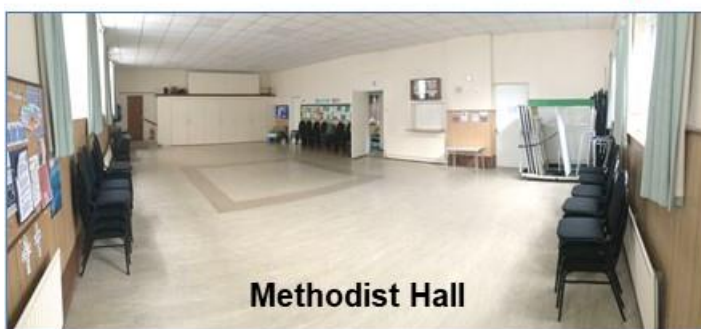
Car parking is available a short walk away at **South Street "Sainsbury's"** car park and at **Central** car park ... both £2 after 6:30pm. The **Waggon Yard** car park is free after 6:30pm.

Please note that we will be required to put out and stack away the chairs (and any tables) at the beginning and at the end of the meeting. **Anyone who is able to help with putting out the chairs please contact Peter Crow** (lidar.pete@gmail.com).

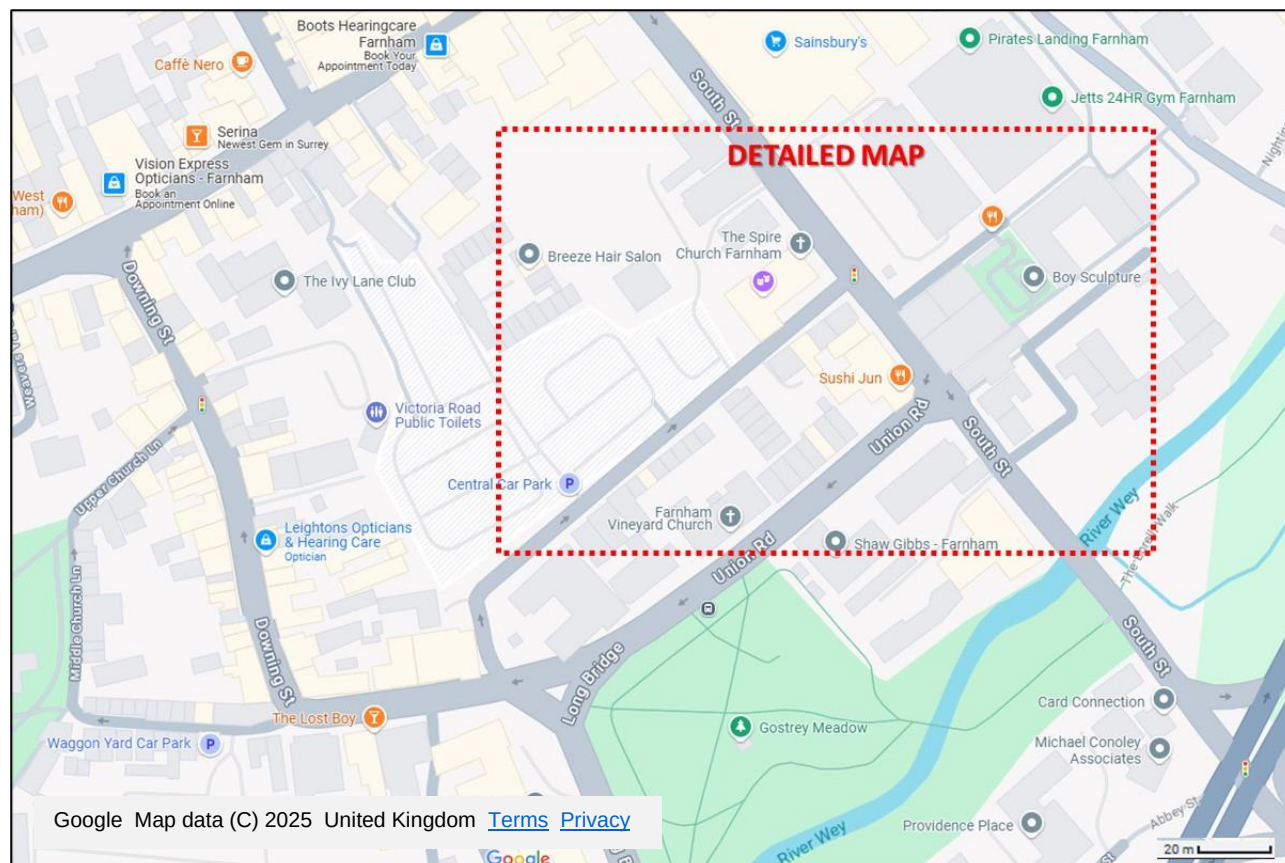
The Methodist Church Hall, Farnham

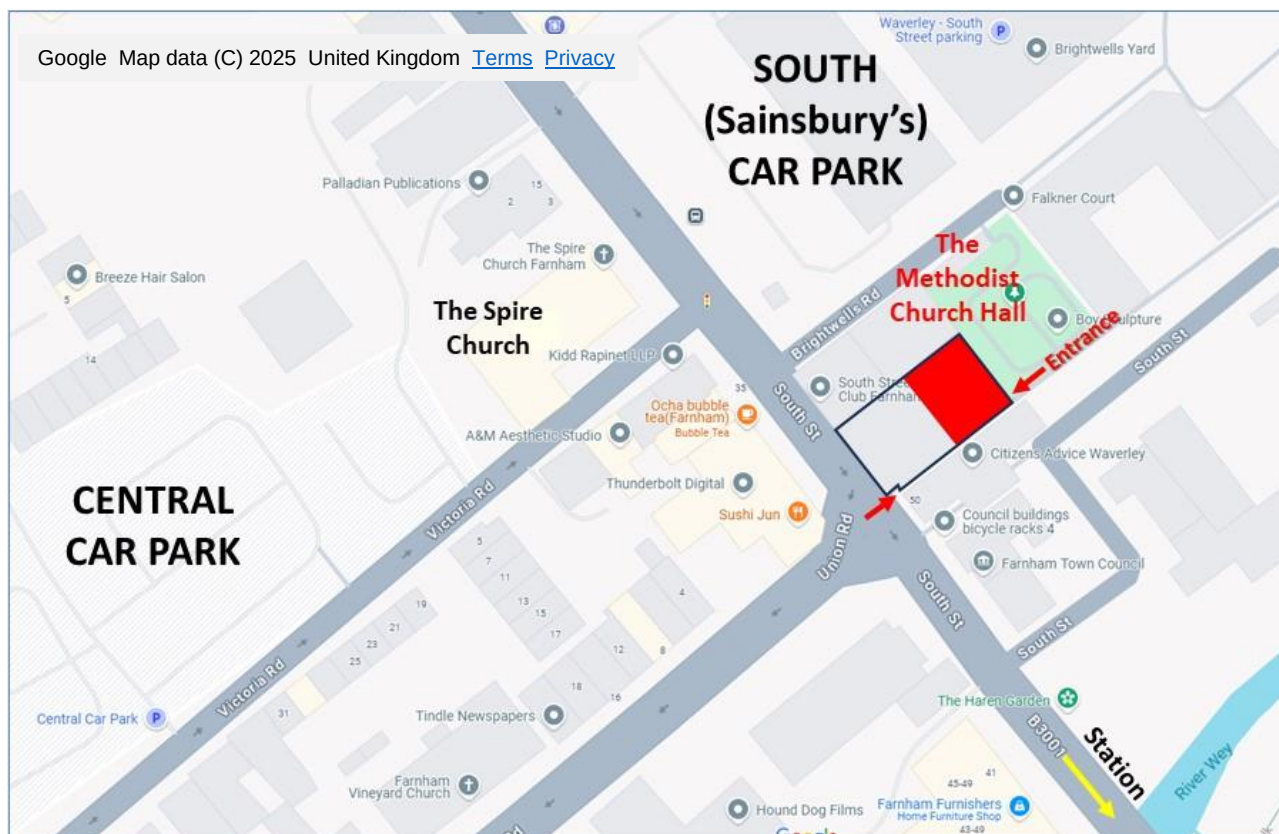


Public Footpath



Methodist Hall





Lecture Summary

Friday, 4 October 2024

On Friday, 4 October, 30 attendees at The Maltings and via Zoom welcomed David Bone in presenting our lecture.

The Ice Age enigmatic rocks of the West Sussex Coastal Plain

By David Bone

The Ice Age enigmatic rocks of the West Sussex Coastal Plain comprise a variety of non-local igneous, metamorphic, and sedimentary rock types that range in size from pebbles up to large multi-tonne boulders (*Fig. 1*). The largest boulder has been estimated at 12.7 tonnes. They are to be found widely scattered although more commonly around the coast where active erosion has revealed their presence. In the early 19th century, these were identified as 'erratics' that had been transported into the area by glaciers. More recently, work on the high-level raised beach gravels at Boxgrove near Chichester, resulted in coining the term 'exotics' to avoid the association with glacial activity, for which there is no evidence. The presence of Cretaceous sandstones and cherts from the Isle of Wight in other deposits are difficult to regard as



Figure 1. Boulder of porphyritic granite on the shore of Chichester Harbour. Estimated weight 2 tonnes. (Photo: David Bone)

exotic, so I have adopted the term ‘**enigmatic**’, which also reflects the many questions that surround the presence of these rocks.

In the mid-19th century, the first detailed description of these rocks suggested an origin in the Channel Islands and Cotentin Peninsula of France, with ice-rafting as the transport mechanism. It was also recognised that these rocks were associated with the series of raised beaches that are preserved on the coastal plain, particularly between the South Downs and Selsey Bill. However, similar rocks are also found in the basal fill of Pleistocene estuarine channels that are occasionally exposed along the modern coastline. These channels were formed during times of slightly lower sea level than today, either during falling sea levels at the onset of a glacial stage or during rising sea levels as the climate warmed.

A wide range of rock types have been recorded. Intrusive igneous rocks include syenite, granite, granodiorite, porphyrite, gabbro, dolerite, and vein quartz. Extrusive igneous rocks include andesite and basalt (including pillow lava). Metamorphic rocks include phyllite (*Fig. 2*), slate, hornfels, metasiltstone, metaquartzite, schist, gneiss, and greenstone. Non-local sedimentary rocks include shale, greywacke, grit, various sandstones, conglomerate, and various limestones. In addition, there is also Cretaceous age Upper Greensand and chert from the south coast of the Isle of Wight, as well as examples of Bembridge Limestone from the east coast of the Isle of Wight and Bognor Rock. Larger boulders, more commonly seen in the landscape, are generally granites and granodiorites, principally because they are the hardest rocks and resistant to erosion.

So where do these rocks originate?

The 19th century idea of a source in the Channel Islands and Brittany has been widely adopted, although this can now be questioned, as discussed. Other suggestions have included Pembrokeshire, the east coast of Ireland, and western Scotland. Moving farther afield, Laurentia, Greenland, Scandinavia and northern Scotland have also been raised as possible sources. If emplacement was at the time when the Dover Strait was closed, then the source must lie to the west. Emplacement at later times, with the Dover Strait open to the North Sea, increases the number of potential sources. Currently, we have no real idea about the source of the enigmatic rocks.

How did these rocks travel long distances to reach the West Sussex Coastal Plain?

Direct emplacement by glaciers was an original 19th century theory but is now rejected due to the lack of evidence. Transport by longshore drift or attachment to floating weed has been suggested, but this is impossible for such large boulders. Ice-rafting is the generally accepted method and there appears no reason to dispute this. Coastal ice could incorporate material from beaches or rock falls. This would break up to form ice floes that, during spring and summer thaws and storms, drift with the winds and tidal currents to the Sussex coast. The question here is whether ice floes would have been of sufficient size and permanence to carry multi-tonne boulders. If it is necessary to consider icebergs to transport the large boulders, then this questions the source being the French coastline, even farther south of any maximum glacial advance. More recently, it has been suggested that transport was aided by some sort of catastrophic event, such as a storm surge or tsunami. Another possibility suggested



Figure 2. Boulder of phyllite, recovered from Medmerry Managed Retreat Scheme in 2013, now on display at the RSPB Visitor Centre, Sidlesham. Estimated weight 3.8 tonnes. (Photo: David Bone)

is a mega-flood from the North Sea pro-glacial lake breaking through the Dover Strait. How does this explain the presence of Upper Greensand and chert from the south coast of the Isle of Wight?

A cold 'glacial' climate is essential for the formation of coastal ice or drifting icebergs to reach as far south as the Sussex coast. At this time, sea level would almost certainly be lower due to water being locked up in icecaps and glaciers. However, emplacement of the enigmatic boulders in the raised beaches requires a high sea level. The time of emplacement is therefore likely to coincide with the start of a cold phase before sea level fell, or at the end of a cold phase with sea level returning to an interglacial higher level. The problem with high sea level at the start of a cold phase is whether there would be enough ice formation, either in coastal ice or in icebergs from calving glaciers, to carry large boulders from foreign sources to West Sussex. It seems unlikely. Therefore, we are more likely looking at the end of a cold period with sea levels rising and a warming climate creating huge quantities of icebergs as glaciers and icecaps retreat.

Recent studies have identified another potential source in the Irish Sea Ice Sheet that, during maximum glacial advance, is now known to have extended well beyond the Scilly Isles and south across the Western Approaches to the English Channel. If so, icebergs calving from the front of the ice sheet would be carrying glacially-derived rocks from anywhere around the Irish Sea and up into north-west Scotland. These could have been swept up-channel during times when isostatic depression kept sea level relatively higher, a concept that removes some of the issues surrounding sea level, but all very complex!

Is there an answer to the many questions?

We do not know the source of the rocks; neither can we be sure about their date of emplacement. The periods represented by the Westbourne-Arundel Raised Beach and the Aldingbourne Raised Beach appear to be contenders, but the first is during an end inter-glacial marine regression and the other during a fully temperate interglacial. Is it therefore a possibility that emplacement occurred during these two periods during a high sea-level event that has not left any evidence in the geological record? This might fit with a mega-flood from the North Sea before the Dover Strait was fully open with the flood waters carrying icebergs southwards into the English Channel. What is the story behind the enigmatic rocks found in the lag deposits of the estuarine channels — yet another question that awaits investigation; or is there something really simple that is being overlooked but completes the picture?

This was just a brief overview of these enigmatic rocks, but there are multiple projects here waiting for anybody with the appropriate resources.

Further reading:

Bone, D.A. 2022. Enigmatic rocks and sarsen stones of the West Sussex Coastal Plain, southern Britain. *Proceedings of the Geologists' Association* 133, 2-21.

Bone, D. A. 2023. The enigmatic rocks of the West Sussex Coastal Plain. *Proceedings of the Open University Geological Society* 9, 23-28.

Friday, 8 November 2024

On Friday, 8 November, 23 attendees at The Maltings and 17 via Zoom welcomed Dr. Jason Canning in presenting our lecture.

The UK Search for a Geological Disposal Facility – The Role of the Geosphere in Deep Nuclear Waste Disposal

Jason Canning, Nuclear Waste Services

A Geological Disposal Facility (GDF) is the UK Government's preferred option for permanent disposal of the country's inventory of nuclear waste. Nuclear Waste Services (NWS) is the organisation tasked with delivering a GDF.

This talk provided an overview of the GDF siting process and summarised the geological investigations that NWS is undertaking in their Community Partnerships. NWS is working with three Community Partnerships. Detailed evaluation of these sites commenced in 2022 but no decisions on suitability has yet been made.

Jason Canning is a Principal Geoscientist in Nuclear Waste Services. Jason joined NWS in July 2022 and leads the team that is responsible for the development of Site Descriptive Models. Jason has been a professional geologist for more than 25 years, the bulk of which was in the oil and gas industry. His main skill set is in basin analysis. He is a Chartered Geologist and has served on the Council of the Geological Society.



Field Trip

Report on FGS Devil's Punch Bowl walk.

By Mick Caulfield

Date: 6 October 2024

Leader: Mick Caulfield

The walk mainly followed "The Sailors Stroll" trail, described by the National Trust as an easy walk with only gentle gradients and reasonably flat surfaces. It traversed Lower Cretaceous rocks and provided views of geological and geomorphological features.

Attendees:

Tessa Seward, Bob Rusbridge, Katherine Rusbridge, Colin Brash, Pamela Tayler, Sally Pritchard, Walter Bonnici, Maria Bonnici and David Williams.

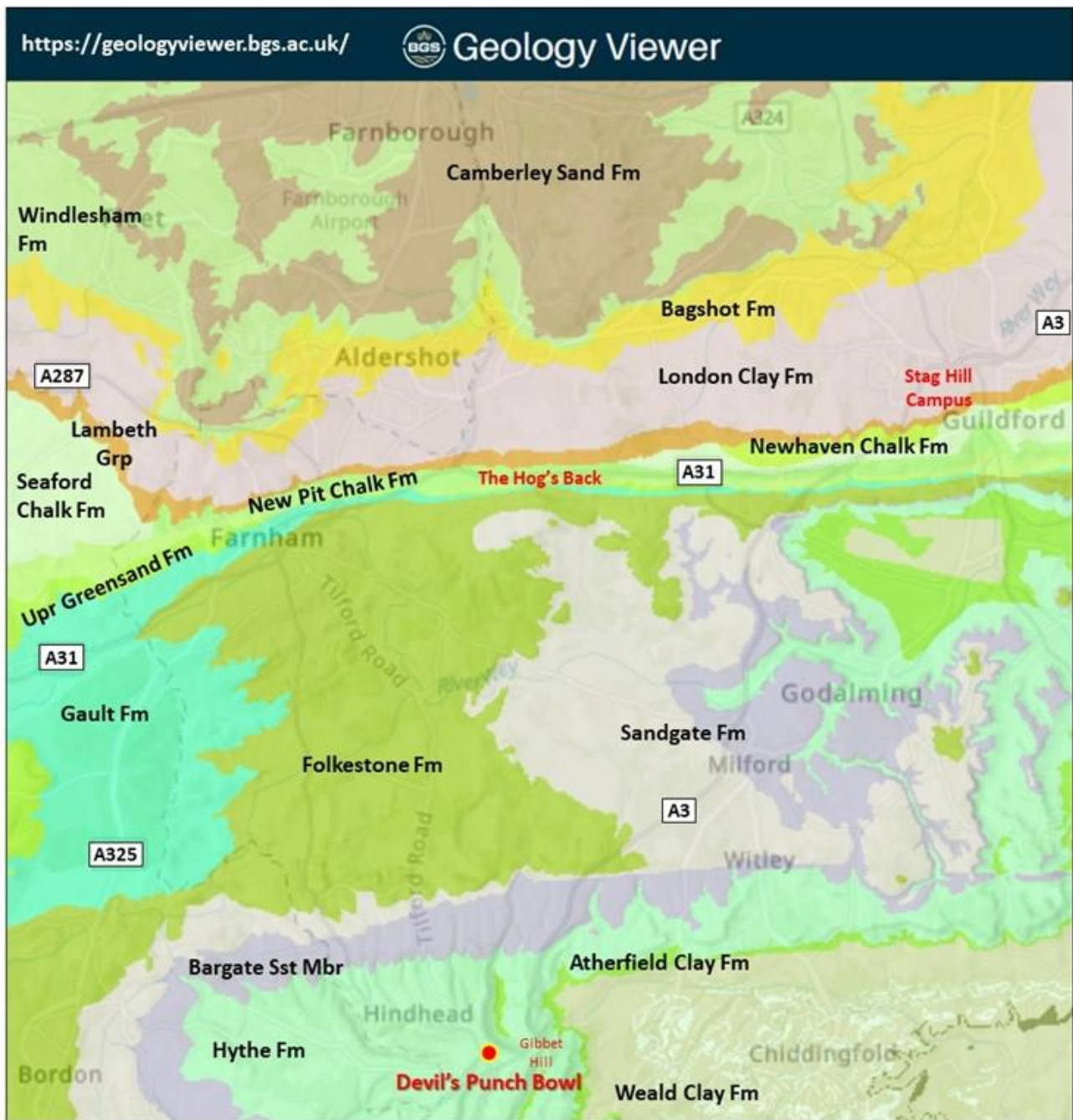


*View from the Landscape Sculpture looking North.
(Credit: Mick Caulfield)*

The **Devil's Punch Bowl** is a 697-acre National Trust visitor attraction and biological **Site of Special Scientific Interest**. It is part of the Wealden Heaths Phase II **Special Protection Area**.

It lies at the western end of the Lower Greensand outcrop. Standing at the **Landscape Structure** by the old A3 road at the top of the Punch Bowl itself, the view is approximately north, giving a good view of:

1. **Lower Greensand Group (Hythe Fm)** ... the rocks underfoot and under the heavily tree-lined slopes along the edge of the bowl.
2. The **Atherfield Clay Fm** ... low flattish ground at the base of the bowl.
3. Views across the **Gault (Clay) Fm** valley to the ...
4. Subvertical Chalk beds of the North Downs Hog's Back, which forms the ridge in the distance.
5. The **Upper Greensand** is not visible, but outcrops near Seale between the Gault Clay and the Chalk.



The Wealden Basin extends into France and lies to the south of the hard, mainly Precambrian, crystalline basement rocks of the London-Brabant Massif, a structural high that stretches from west Germany to north Belgium, the North Sea, East Anglia and the Thames Estuary, and continues west as far as Wales.

The Wealden Beds lie in the core of an eroded anticline that formed during the Tertiary Alpine Orogeny as Africa drifted north into Europe and the UK/Ireland islands. However, its history dates back to the Variscan Orogeny, when the Wealden area was part of a low fold belt on the north edge of the main orogeny, but which collapsed in the Triassic Period. It formed the deep Weald and Wessex Basins, in which thick sequences of sediments accumulated through the Jurassic, Cretaceous and Early Tertiary periods. Then, during the Alpine Orogeny, the basin was compressed, forming the Wealden Anticline — a classic example of structural inversion with a total uplift of more than 1,500 m. Today it forms a complex fold structure with a maximum elevation of 1,400 m at Ashdown Forest in East Sussex.



(Map Credit: BGS)

We began with a short introduction to the geology from Mick and a look at the BGS map before we set off on our walk. En-route we were to cross over Lower Cretaceous deposits; the Atherfield Clay and the Hythe Formation.

As good exposures were somewhat limited we were on the lookout for breaks in slope, changes in vegetation and drainage and other clues as to the underlying geology.

Why the Devil's Punch Bowl?

Legend has it that the Devil lived at the 'Devil's Jumps', near Churt. He would torment Thor, God of Thunder, who lived at Thor's Lie (Thursley), by jumping from hill to hill. Thor would try to strike the Devil with thunder and lightning and once scooped up a handful of earth and hurled it at the Devil. The depression that remained is the Devil's Punch Bowl.

Sir Arthur Conan Doyle, author of *Sherlock Holmes*, used to walk on Hindhead Commons and it's said that he used Hindhead as the inspiration for the book *'The Hound of the Baskervilles'*.

A brutal murder

In 1786 a sailor was brutally murdered by three men who he had befriended (in a local pub in Thursley) whilst walking from London to the docks in Portsmouth. Soon after the murder a stone was erected to mark the spot where the poor sailor met his death. The three villains were tried and then hung on Gibbet Hill, near the site of the murder, as a warning to other criminals.

After the hanging many fears and superstitions arose around **Gibbet Hill** and in 1851 Sir William Erle, an English lawyer, judge and Whig politician, paid for a Celtic cross to be erected to banish these fears and raise the local spirits.

Natural Amphitheatre

The Punch Bowl is a large natural amphitheatre. The London to Portsmouth road (the A3) skirted the rim of the site before the Hindhead Tunnel was built in 2011. The land is now owned and maintained by the National Trust. The highest point of the rim of the bowl is **Gibbet Hill**, which is 272 m (892 ft) above sea level.



Aerial view of Devil's Punch Bowl (photographed in January 2007, before the closure of the old A3). (Credit: Highways Agency)

Geology

The Devil's Punch Bowl was formed due to its underlying geology. The Hythe Fm are permeable, consisting mainly of fine-grained greensand and overlay the impermeable Atherfield Clay Fm layer. Rain that percolates through the free-draining sand layer travels sideways at the junction between layers of clay and sand and erupts out of the ground in the form of a spring. These springs cause progressive erosion backwards into the soft sandstones, creating a bowl-like shape.

This process is known as **“spring sapping”** and the Devil's Punch Bowl is the largest spring sapped valley in Britain.

The geology has an important influence on the land use and vegetation. The greensand was formed around 105 – 115 Ma ago during the Lower Cretaceous (Albian – Aptian). It creates a nutrient poor thin soil which is characteristic of most heaths. It supports plants that can cope with water loss and extreme conditions, such as the heather species seen in the area.

Sources

Cosgrove, J. W. 2020 'The deformation history of southern England, and its implications for ground engineering in the London Basin'. *Quart J Eng Geol & Hydrogeol* 55, qjehg2020-144; <https://doi.org/10.1144/qjehg2020-144>

Local Walks in: <https://www.haslemere.com/vic/pdf/2020/devilspunchbowlwalk.pdf>

NT Devil's Punch Bowl: <https://www.nationaltrust.org.uk/hindheadcommons->

TV Programme

Villages by the Sea

Runswick Bay

BBC 2 & iPlayer ... Series 5, Episode 1 of 6

Archaeologist Ben Robinson visits Runswick Bay on the North Yorkshire coast, where he discovers how this pretty village was once a place of danger. Ben explores the mythical 'hob-holes' to uncover how they once helped supply a thriving jet industry and finds evidence of how, in the late 1800s, the village became the inspiration for a group of artists who became known as the British Impressionists.

Geologists Chris Jackson (Jacobs Engineering Group) and Sarah Caldwell Steele (Durham University) describe how erosion and slope failures and the search for jet have influenced the history of Runswick Bay.

References:

<https://www.bbc.co.uk/programmes/m0024s6m>

[https://en.wikipedia.org/wiki/Christopher_Jackson_\(geologist\)](https://en.wikipedia.org/wiki/Christopher_Jackson_(geologist))

<https://eborjetworks.co.uk/sarah-caldwell-steele/>

"Whitby" Jet

A black organic gem material that is also a rock very similar to coal.

Hobart M. King, PhD, GIA Graduate Gemologist

What is Jet?

Jet is a black organic rock that forms when pieces of woody material are buried in sediment and are coalified. Though very similar to coal, it is less friable. Jet can be cut, carved, and polished to a bright lustre. People have used jet for thousands of years to produce gemstones, beads, and many other objects. Jet is one of just a few organic gemstones. It is the material that inspired the phrase "jet black," which means "as black as possible."

How Does Jet Form?

The material known as "jet" is very similar to coal, but the way that it forms is different. Most coal seams form when a swamp containing abundant woody material is buried; that woody material is then compacted, undergoes organic degradation, and is heated. The result is a coal seam.

Jet does not form in a seam. Instead, it forms when an individual piece of woody material such as a tree branch is washed into a body of water, becomes waterlogged, sinks to the bottom and is covered by organic-rich sediment. It is then compacted, degraded, and heated in isolation.



Faceted jet: Four stones of faceted jet from the Whitby area of England. These stones clearly show how jet can accept a highly reflective polish. The round stone at the bottom of this photo is about 12 millimetres in diameter.

This produces a material that is similar to coal; however, this material is much more influenced by the geochemical environment of the surrounding organic-rich shale. Jet is thought to absorb oils released by the decay of oil-rich organic debris in the surrounding rock, such as algae and plankton. As the jet is transformed into a rock, it does not develop a system of fractures, known as "cleat," which develops in a coal seam. This gives the jet a more uniform texture and a toughness that contrasts with the friability of coal removed from a seam.

The woody origin of jet has been confirmed because, when examined under magnification, jet contains the preserved cellular structure of the original woody plants. Some specimens display obvious plant structures without magnification.

"Hard" and "Soft" Jet

Craftsmen who work with jet recognize that material from some areas is much harder than that from others. The "hard jet" tends to be associated with bituminous shales that were deposited in salt water, while the "soft jet" tends to be associated with bituminous shales that were deposited in freshwater environments.

Jet found in the **Whitby area** of England was deposited in a saltwater swamp about 180 million years ago. It was then compressed during burial and geologically heated to temperatures and pressures that took it through the rank of lignite, and almost to the rank of sub-bituminous coal. This has given the hard jet of Whitby the better working qualities than any other jet that has been found in abundance. As a result, **"Whitby Jet"** is now famous throughout the world.

Physical Properties of Jet

Jet has a few properties that make it useful and desirable. These have dictated its use across the centuries. The first of these properties is its ability to be easily carved or cut into shapes. Jet is soft and has a uniform texture, which allows it to be carved with precision.

Jet can be rubbed to a nice matte finish or polished to a very bright lustre. Done well, these finishes enhance the aesthetic value of carved or cut pieces of jet.

Jet also has a low specific gravity. A strand of jet beads or a large cabochon thus weighs about 50% less than if they were made from agate, jasper, quartz, or other mineral material. This allows the beads to be worn with greater comfort and the brooch to be worn without placing as much stress or hanging awkwardly on the garment.

History of Human Use

The most important source of jet has always been the eastern coast of England and Scotland, centred near what is now the community of Whitby. In this area people found small, black, rounded, light-weight stones along the shoreline. They discovered that these stones could easily be fashioned into beads and other objects and could be polished to a very bright lustre. In ancient Egypt, small flat pieces of jet were polished to a bright lustre and used as mirrors.

Physical Properties of Jet	
Classification	Sedimentary rock similar to coal
Color	Black
Streak	Brown
Luster	Dull to matte to vitreous
Diaphaneity	Opaque
Cleavage	None, conchoidal to irregular fracture
Mohs Hardness	2.5 to 4
Specific Gravity	1.3 to 1.4
Diagnostic Properties	Low specific gravity, brown streak
Chemical Composition	Variable, but rich in carbon
Uses	Cut into faceted stones; carved into cameos, intaglios, bangles, rings, pins, combs, handles, and other practical or ornamental objects.

People have been making items from jet since the Stone Age. One of the oldest known jet objects is a necklace made from alternating jet and chalk beads found in a Neolithic burial in France. Necklaces of jet beads have been found in numerous bronze-age mound burials in England and Scotland. At two bronze-age sites in England, partially finished jet items, waste fragments, and the tools used to make them reveal an early jet industry.

During the Roman rule of Britain, much jet was collected along the beaches around Whitby and taken to York for manufacturing into jewellery and other items. These items were then marketed locally and sold to merchants in Europe. Items made with jet were marketed with stories claiming that the material had protective and healing properties. This inspired people to fashion jet into amulets and talismans that were worn for protection or good fortune.

The greatest popularity of jet began in about 1861 when Queen Victoria began wearing it in "mourning jewellery" after the death of her husband, Prince Albert. Perhaps inspired by the Queen, many people in England and other parts of the world began wearing jewellery made with jet. Jet was used to make beads, cabochons, cameos, intaglios, combs, hair pins, bangles, rosaries, cane handles, pens, seals, letter openers, candlesticks, silverware handles, and many other decorative and useful objects.

By this time, beachcombers in eastern Scotland and England had found most of the shoreline jet. Manufacturers then turned to mining the bituminous shales of the Upper Lias. These shales contained nodules and thin bands of jet. They were abundant enough that, in some areas, workers could tunnel into the shale and extract profitable quantities of jet. Jet mining began shortly before Queen Victoria called attention to jet and continued into the 1920s.

Deposits of jet were discovered in other countries beyond Britain, including Spain, Germany, China, Turkey, and Siberia. In the United States, jet has been found in Virginia, New Mexico, Utah, and Alaska. None of these locations produced jet that had the same working qualities and beauty as the jet found near Whitby.

In the 1920s, jet beads became very popular in the United States. Waist-length beaded necklaces made from jet were very popular. These necklaces were much lighter in weight than necklaces made from agate, jasper, or quartz beads with twice the specific gravity.

Use of Jet and Jet Substitutes Today

As a fashionable item, jet declined quickly during the Great Depression when the demand for manufactured goods of all kinds collapsed. It never regained its Victorian popularity and is used infrequently today.

Jet is one gem material that has been heavily replaced by look-alikes and imitations. When jet was popular, materials such as black glass and gutta-percha (a natural latex made from the sap of the *getah perca* plant) competed with jet for sales. These materials were less expensive and easily formed into beads and other shapes.

Today, modern materials, including plastic, vulcanite, glass, and black cubic zirconia compete with jet for market share. Price, availability, and ease of mass production give these materials a competitive edge.

It is possible that the world does not have enough jet to supply all of these uses. Glass, plastic, and cubic zirconia substitutes for jet are regularly marketed as "jet black" in colour. Even though jet as a material is rarely used today, its name persists in the marketplace - and some people still want the real thing.

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News

Mysterious 'blobs' in Earth's mantle are not what we thought, study claims

Lava that erupts from hotspots around the world seems to come from a similar ancestral magma, new research finds.

By Stephanie Pappas, *LiveScience*

9 October 2024

Lava around the world may come from the same magma ancestor deep in Earth's middle layer, new research finds.

The study suggests that the deep mantle, where magma arises, is more uniform than scientists thought. Instead of being a stew-like mix of rock compositions, the mantle might be more like a blended smoothie — well mixed and similar throughout.

"It tells us that the mantle is probably much simpler than we were starting to think it is," said Matthijs Smit, an Earth scientist at the University of British Columbia.

Structures observed inside the deep mantle may thus not be signs of different types of rocks, but rather temperature differences in the same kind of rocks, Smit said.

The study examined hotspot lavas, which come from plumes that billow upward from Earth's deep mantle and erupt at volcanoes at the planet's surface. Samoa, Hawaii and Iceland are all hotspots. The lavas that erupt at hotspots around the globe vary in their trace elements, which scientists have traditionally interpreted to mean that the mantle has lots of distinct reservoirs of different rock which don't mix, or mix slowly, said Paul Tackley, a geophysicist at ETH Zürich who was not involved in the study. But large-scale computer models of the mantle suggest that this layer of Earth probably does mix efficiently. If that's the case, it's possible that magmas all start out the same in the lower mantle and differentiate as they rise through the upper mantle.

"We have a hundred soups," Smit told **Live Science**. "Do we make them from a hundred different stock cubes, or do we actually have 100 different soups that we all made from the same stock cube?"

There's no way to peer into the lower mantle directly, but hotspot lavas do have chemical signatures that give hints of their history. Smit and his colleagues looked at lava concentrations of three elements - nickel, niobium and chromium. These elements behave differently as the melts rise and change on their way to the surface: nickel tends to become incorporated into crystals, so liquid portions of the melt have lower and lower concentrations of nickel as the melt goes through more changes. Chromium does the same on a different timeline, while niobium tends to stay in the liquid. By looking at the proportions of these different elements, the researchers could tell which lavas had gone through the most changes from their original source, and which were closer to that ancestral mantle magma.

In hotspot lavas around the world, the research team saw the same trends in these elements—and major similarities in the composition of lavas that had changed the least. The results indicated that lavas around the world are different not because they come from different stock, but because they change as they rise through varied rocks in the upper mantle and crust.



A lava flow in Hawaii. The Hawaiian islands are formed by a hotspot, and though lava from Hawaii differs in composition from lava emerging from hotspots in Samoa or Iceland, all three originate from the same source in the deep mantle, research suggests.

(Image credit: Juan Maria Coy Vergara via Getty Images)

"All hotspot lavas point to the same starting composition," Smit said.

Scientists still disagree about the composition of the deep mantle. There are odd structures near the core-mantle boundary called large low-shear velocity provinces (LLVPs), where seismic waves from earthquakes move unusually slowly. Some scientists have suggested these structures might be the remnants of ancient space rocks that hit Earth soon after it formed, or perhaps that they're material from Earth's ancient crust, shoved deep by subducting tectonic plates.

LLVPs are linked to the rising mantle plumes that eventually produce hotspot lavas, so the new study may indicate that all of these explanations are overcomplicated. Instead, he said, the bizarre structures may have the same composition as the rest of the mantle. The only difference, then, would be the temperature of these areas.

"[The] trend shows that it is the ingredients that make the soups different, not the stock. That is quite a fundamental change in the way we look at the mantle," Smit said. The ingredients – all the varying rocks the lavas pass through as they rise – are still important, he added, because they explain a lot about how the crust and mantle interact. But now there is no need for complicated explanations about how some parts of the mantle have stayed preserved in place over billions of years.

"We are finally liberated from this idea that there are unmixed pockets inside the mantle that have sat there since the Earth was made," Smit said.

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Never-before-seen head of prehistoric, car-size 'millipede' solves evolutionary mystery

The fossil showed unique stalked eyes and centipede-like characteristics.

Sierra Bouchér, *LiveScience*

9 October 2024

The face of a car-size, millipede-like creature — the largest arthropod ever to live — has finally been revealed thanks to two well-preserved fossils, a new study reports.

The arthropod, *Arthropleura*, lived in forests near the equator between 346 million and 290 million years ago, during the late Palaeozoic era. In the oxygen-rich atmosphere at that time, *Arthropleura* could grow to a massive 8.5 feet (2.6 meters) long and weigh over 100 pounds (45 kilograms).

"*Arthropleura* ... has been known since the 18th century, over 100 years, and we hadn't found a complete head," study first author Mickaël Lheritier, a palaeontologist at Claude Bernard Lyon 1 University in France, told **Live Science**. "Now with the completed head, you can see the mandibles, the eyes, and these characteristics can [help us understand] the position of this [creature] in evolution."

The giant arthropod had perplexed palaeontologists for decades. *Arthropleura*'s body had characteristics like a millipede. But without the head, scientists couldn't understand the creature's relationship to modern arthropods like millipedes and centipedes. While these two modern creatures

may look similar, they actually diverged about 440 million years ago, way before *Arthropleura* came around. Paleontologists wondered if *Arthropleura* was a member of the millipede group or the centipede group.

Arthropleura's family-tree controversy "features fierce debates about its affinities," James Lamsdell, a palaeontologist at West Virginia University who was not involved with the study, wrote in an accompanying perspective published in the same journal. But with the discovery of an intact head, "the mystery of *Arthropleura* now appears solved."

The CT scans virtually uncovered the fossilized head of two juvenile *Arthropleura* discovered within rock in the Montceau-les-Mines Lagerstätte fossil site in France. The CT scans revealed unique stalked eyes jutting from the side of the head; gently curved antennae; and small, centipede-like mandibles. Together, these traits made up a confusing amalgamation of centipede- and millipede-like characteristics.

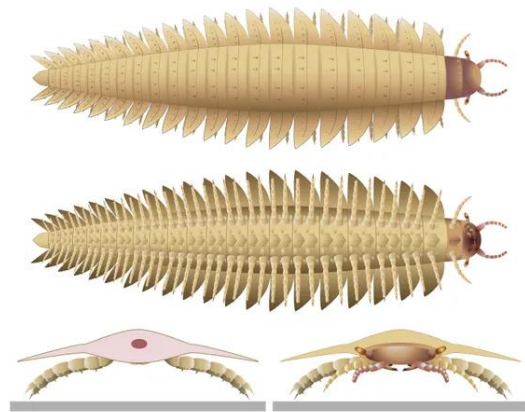
"These details, together, may appear to leave *Arthropleura* as much — if not more — a puzzle than before," Lamsdell said. "But the seemingly chimeric nature of *Arthropleura* is actually important evidence that may help answer a fundamental question regarding the [evolution of these species]."

Based on anatomical features, palaeontologists ultimately grouped *Arthropleura* as most closely related to the millipede family. However, the stalked eyeballs have never been seen in the millipede or centipede families. *Arthropleura* has been widely considered terrestrial, but eyestalks are typically found in semiaquatic or fully aquatic animals, like crustaceans.

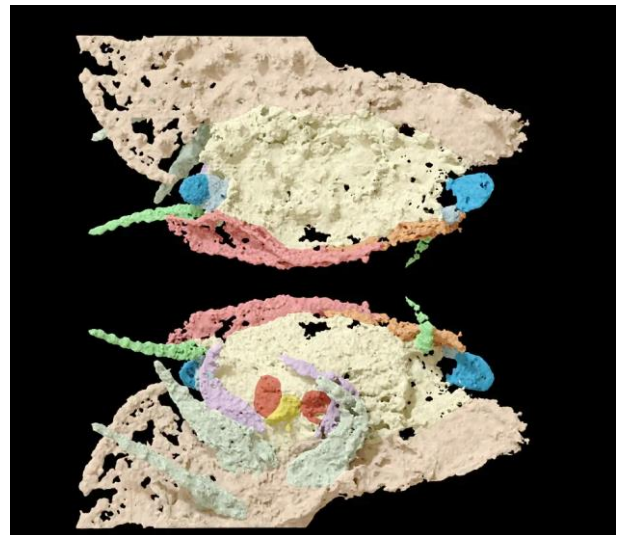
Because the head belongs to a juvenile, the explanation might lie in the animal's life stage, Lamsdell suggested. As juveniles, *Arthropleura* may have spent more time in the water, before losing the stalked eyes in adulthood. "The stalked eyes remain a big mystery, because we don't really know how to explain this," Lheritier said.

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The 6.5-foot-long (2 meter) arthropod's head has been found for this first time after hundreds of years of uncovering incomplete fossils. (Image credit: Mickaël Lhéritier, Jean Vannier and Alexandra Giupponi (LGL-TPE, Université Claude Bernard Lyon 1))



The stalked eyes of Arthropleura, in blue, may suggest that juveniles spent time in the water before becoming adults that lived on land. (Image credit: Mickaël Lhéritier (LGL-TPE, Université Claude Bernard Lyon 1) and Vincent Fernandez (ESRF))

UK Reserves and Resources Report as at end 2023

NSTA

22 October 2024

The latest Reserves and Resources report published today shows that the NSTA's estimate for **proven and probable UK oil and gas reserves** at the end of 2023 is **3.3 billion boe**.

This is 0.2 billion lower than at the end of 2022 which is due to production of around 424 mmboe in 2023 not being fully offset by additions following Field Development Plan approvals or additional reserves for producing fields.

Official government forecasts suggest that oil and gas will remain a part of the UK's energy mix as we transition to net zero. Managing the declining production to meet energy demands while they still exist; reduce reliance on imports; gain economic benefits; and secure an orderly transition is still vital.

Contingent resource – discovered undeveloped resources – stands at **6.1 billion boe**, with much of this resource in mature developed areas and under consideration for development.

In aggregate, UKCS petroleum reserves and discovered resources both remain at approximately 70% oil and 30% gas, when expressed in oil equivalent terms.

Definitions:

NSTA	North Sea Transition Authority
boe	barrel of oil equivalent
mmboe	millions of barrels of oil equivalent

Reference:

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Mega meteorite tore up seabed and boiled Earth's oceans

Georgina Rannard, *BBC Climate and science reporter*

22 October 2024

A huge meteorite first discovered in 2014 caused a tsunami bigger than any in known human history and boiled the oceans, scientists have discovered. The space rock, which was 200 times the size of the one that wiped out the dinosaurs, smashed into Earth when our planet was in its infancy three billion years ago.

Carrying sledgehammers, scientists hiked to the impact site in South Africa to chisel off chunks of rock to understand the crash. The team also found evidence that massive asteroid impacts did not bring only destruction to Earth - they helped early life thrive.

"We know that after Earth first formed there was still a lot of debris flying around space that would be smashing into Earth," says Prof. Nadja Drabon from Harvard University, lead author of the new research. "But now we have found that life was really resilient in the wake of some of these giant impacts, and that it actually bloomed and thrived," she says.

The meteorite S2 was much larger than the space rock we are most familiar with. The one that led to the dinosaurs' extinction 66 million years ago was about 10km wide, or almost the height of Mount Everest. But S2 was 40-60km wide and its mass was 50-200 times greater. It struck when Earth was still in its early years and looked very different. It was a water world with just a few continents sticking out of the sea. Life was very simple - microorganisms composed of single cells.



The meteorite was 40-60km in diameter and left a crater 500km across. (Source: Getty Images)

The impact site in Eastern Barberton Greenbelt is one of the oldest places on Earth with remnants of a meteorite crash. Prof. Drabon travelled there three times with her colleagues, driving as far as possible into the remote mountains before hiking the rest of the way with backpacks. Rangers accompanied them with machine guns to protect them against wild animals like elephants or rhinos, or even poachers in the national park.

They were looking for spherule particles, or tiny fragments of rock, left behind by impact. Using sledgehammers, they collected hundreds of kilograms of rock and took them back to labs for analysis.

Prof. Drabon stowed the most precious pieces in her luggage. "I usually get stopped by security, but I give them a big spiel about how exciting the science is and then they get really bored and let me through," she says.

The team have now re-constructed just what the S2 meteorite did when it violently careened into Earth. It gouged out a 500km crater and pulverised rocks that ejected at incredibly fast speeds to form a cloud that circled around the globe.

"Imagine a rain cloud, but instead of water droplets coming down, it's like molten rock droplets raining out of the sky," says Prof. Drabon. A huge tsunami would have swept across the globe, ripped up the sea floor, and flooded coastlines. The 2004 Indian Ocean tsunami would have paled in comparison, suggests Prof. Drabon. All that energy would have generated massive amounts of heat that boiled the oceans causing up to tens of metres of water to evaporate. It would also have increased air temperatures by up to 100°C. The skies would have turned black, choked with dust and particles. Without sunlight penetrating the darkness, simple life on land or in shallow water that relied on photosynthesis would have been wiped out.

These impacts are similar to what geologists have found about other big meteorite impacts and what was suspected for S2. But what Prof. Drabon and her team found next was surprising. The rock evidence showed that the violent disturbances churned up nutrients like phosphorus and iron that fed simple organisms.

"Life was not only resilient, but actually bounced back really quickly and thrived," she says. "It's like when you brush your teeth in the morning. It kills 99.9% of bacteria, but by the evening they're all back, right?" she says.

The new findings suggest that the big impacts were like a giant fertiliser, sending essential ingredients for life like phosphorus around the globe. The tsunami sweeping the planet would also have brought iron-rich water from the depths to the surface, giving early microbes extra energy.

The findings add to a growing view among scientists that early life was actually helped by the violent succession of rocks striking Earth in its early years, Prof. Drabon says. "It seems that life after the impact actually encountered really favourable conditions that allowed it to bloom," she explains.

The findings are published in the scientific journal **PNAS**.

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Effect of a giant meteorite impact on Paleoproterozoic surface environments and life

<https://www.pnas.org/doi/10.1073/pnas.2408721121>



The team of geologists analysed rock showing evidence of ripped up seafloor. (Image source: Nadja Drabon)

Delving Into The Archives

Suggested by Janet Catchpole

Journal of The Farnham Geological Society, Volume 1 December 1983

GEOPOETRY

Michael J Phillips

THE DESERT

I wonder why the desert draws me so,
It cannot be a softness to the Soul.
The stark land-climb and harsh reality
As plants and flowers parched grow.
The pared feeling everywhere that
There cannot be green fields anywhere.
But as I stand and feel
The sun's full radiant rays intensity,
And the bare rocks echo back the Solar Winds
In jutting reds and yellow-brown complexity -
Somewhere in England
A patch of green breathes soft tang of
Pine Woods that stretch for ever;
Rivers feeding Trout -
Makes me in the desert-blast cry out!



GEOLOGIZING IN SOUTH DEVON

Marybeth Hovenden & Elizabeth Matthews

A light-hearted look by a Society Member at a typical weekend "on the rocks".

In early March of the recent era of the Quaternary period, forty-four of the genus *Homo sapiens* who had the inclination to transgress to Torquay, twinned up at Farnham Station for transport by coach to South Devon, the subject - a weekend geologizing. Chisels, hammers, helmets, hampers and walking sticks were quickly thrust into the vesicle, while other agglomerates were deposited inside, albite disrupting the coach's synclinal axis. Too late now to remember balaclava, calamine or tufa, we were off into the rugose sunset.

Soon it was necessary for those whose porosity was apparent to stop at a filling station. After flexing adductor muscles, we were quiescent until deposition at The Hunters' Moon Hotel, where we found bar and crust awaiting. Then we were shown to our magma chambers, some to find competent beds and even basins, but in general all the matrices were glacial.

Our first day was one of condensed sequence. Hay Tor for most of us was to be the high spot of the day. It was elemental here to grasp the granite sequence. Serious students were looking at the horizontal jointing (Figure 1) and pondering how Carlsbad twinning had occurred. They marbled at this high example of Hercynian orogeny and at the pneumatolytic process of tourmalinisation that had been caused by boron and fluorine gases eating into the granite at the end of its crystallization. For those who weren't schorl, terms like 'megacrystic' and 'solifluction' were explained. The temperature here confirmed our suspicion that we were no longer in the sandy Sahara-like position 25 degrees North of late Carboniferous times. Many photos were taken of the Bovey Tracey Basin, source of china clay and kaolin for the pottery industry, and samples of erratic material that cluttered the slopes were collected.

We next entered Bullycleaves Quarry, where a series of dark grey limestone laid down in a back reef environment have for centuries provided building stone for such edifices as Buckfast Abbey. Promise of corals, stromatoporoids and umber had some of us paralic with excitement, while the more mature amongst us were eagerly discovering dykes, unconformities and thrust planes.

Then a lunch stop at the Dartbridge Arms, where we downed iron-stained quartz and hammers to take on fossil fuel. With all soon saturated we came upon a Lithostrotion junceum, and made off for an argillaceous afternoon on Goodrington Sands. This was a fossil desert environment, where angular rock fragments had been denuded by flash flooding into a Permo-Triassic basin. These deposits now lie with a strong unconformity on dipping Lower

Devonian purple slates. Burrows and pipes at Waterside Cove made by unknown organisms or agents gave rise to littoral suggestions of their possible nature which exposed our supratenuous gravity! Our serious student exchanged boudinage with his friend about the 2-folds while locating in the reddish crystallized calcite a fine specimen of dog-tooth spar.

That evening it was the composite opinion, after a trilobite, that the day had been an uplifting one, and banded by shared cleavage we went to our conchoidal beds.

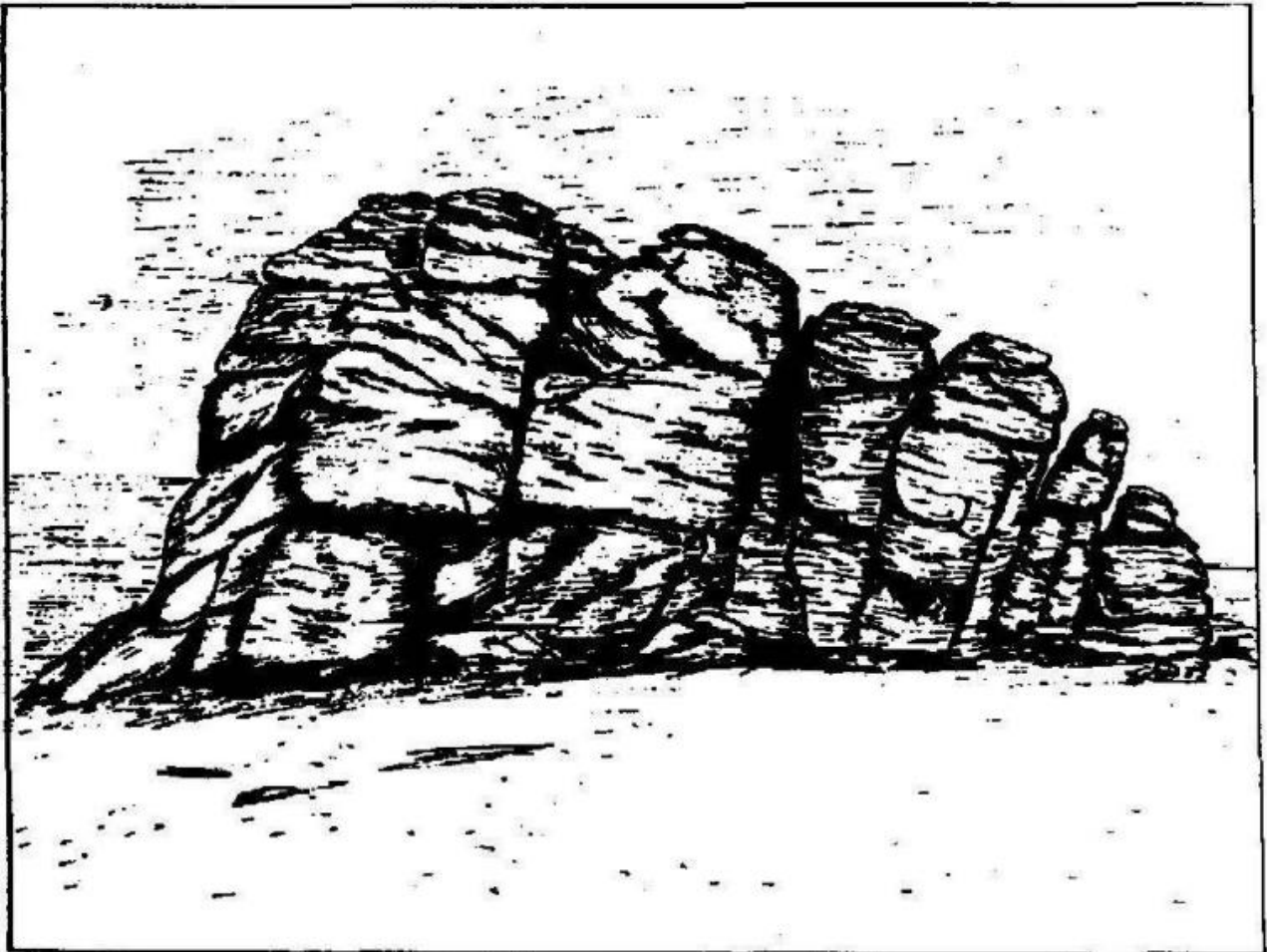


FIGURE 1: Haytor Rocks looking west (SX 759771) - a classic Dartmoor tor showing well developed near-vertical cooling joints and subsidiary horizontal pressure release planes.

Sketch by Charles Ives

On Sunday, warm convection currents made us rhyolite early, and after a Rhaetic series of starts, we declined into Kent's Cavern, the habitat of Early Man. With hardpan faces we injected the data about stalagmites and stalactites, hyenas, hunters, harpoons and dates varying erratically between twenty and two hundred and twenty million years. But it was flinty gravels we were after, so we next made the gradient to the Haldon Hills above Exeter. Soon this Blackdown facies was alive with the sound of hammers. Those who exposed Exogyra, Trigonia, and Venericardia can be very proud of these. When our entropy was exhausted, we refuelled at

an overthrust slope above Exeter, with fine views, then the drift was towards Dunchideock Quarry, where we conjugated with zeolite and calcite vesicles in lava. The way-up criteria here for some was a problem, but the affluent amongst us collected basic olivine-rich basalt and other fine specimens of the Exeter Volcanic Series.

Now to Seaton, where walking along the pebbly beach our wit noted that the rocks underfoot sounded "like a horse eating celery", an indication that he was not seriously geological. Above him, the chocolate-coloured marls, and beyond these, the last Chalk cliffs in a westerly sequence in England, were demanding attention. Romantics amongst us were gravelling in the apt names of Beerstone, Cowstone, and Foxmould we were searching for.

Now it was time to depart. Some were growing crumpled and inarticulate, and all were several stones heavier. So rejuvenated by such a magnetic excursion, and enriched by the syntaxis of this exogenetic experience, may we simply thank our leader, Dr. Olver, who is in no way responsible for any incongruities in the text!

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News

Fairy circles

Rather than looking for hydrogen in legacy wells, let's go and ask the fairies

Mariël Reitsma, HRH Geology

23 October 2024

Companies exploring for natural hydrogen are rapidly popping up everywhere, but how do the geologists decide where to start prospecting? Many of them look at historical data from "dry" hydrocarbon wells to see whether they accidentally found hydrogen instead. However, subsurface H₂ is formed by processes different from hydrocarbons, and hence, locations that were never on the radar for oil exploration might well be a good prospect for hydrogen.

So, rather than looking at legacy wells, exploring areas with known H₂ surface seeps is also a good place to start. It has been found that H₂ surface seeps regularly create easy-to-spot pock-marks at the surface, often called 'fairy circles'. These semi-circular depressions are frequently filled with water



Satellite image showing the fairy circles near the town of Moora, Western Australia. The circular depressions are aligned along the Darling Fault, a major crustal boundary between the granitic and (ultra)mafic rocks of the Yilgarn Craton to the East and the sedimentary rocks of the Perth Basin to the West. (Source: NASA)

and have vegetation growing around the edges. Fairy circles have been found all around the world, with examples in Russia, Mali, Brazil, the United States and Australia.

In the satellite image shown here, we see the many fairy circles near the town of Moora, located 150 km north of Perth in Western Australia. The **fairy circles**, locally known as **salt lakes**, vary in size from tens of meters to over a kilometre in diameter. They form a band along the eastern edge of the North Perth Basin, separated from the Yilgarn Carton by the Darling fault.

Hydrogen generation and challenges

The hydrogen is thought to be generated via serpentinization processes in deep aquifers that are in contact with Archean iron-rich basement. The gas subsequently migrates to the surface via the extensional fault network. Soil samples show that the fairy circles mainly seep H_2 around their perimeters.

Yet, the discovery of H_2 surface seeps does not automatically pave the way to announcing a commercial find. In contrast, the fact that seepage occurs can equally be an indication that the gas is not efficiently trapped in the subsurface. Therefore, additional work is required to firm this up.

The H_2 seeps near Moora are all closely aligned with the Darling fault zone, which most likely acts as a conduit for the upward-migrating H_2 . Towards the centre of the Perth Basin, where fewer faults transect the overburden, it may be more likely that an H_2 reservoir can be found if the play conditions of source, reservoir, and trap all prevail.

Reference:

<https://geoexpro.com/fairy-circles/>

Mysterious Craters Appearing in Siberia Might Finally Be Explained

By Jess Cockerill, Science Alert

29 October 2024



The first crater sighted in the Siberian permafrost in 2014. (Morgado, A. et al., Geophysical Research Letters, 2024)

If an explosion of gas opens a great cavity in Siberia's permafrost, and no one is around to hear it, does it make a sound? Well, the methane gases it releases certainly send ripples around the world, and now a team from the United Kingdom and Spain has traced its source.

Scientists first noticed these mysterious craters emerging in 2014, when they encountered a hole in the Yamal Peninsula in Siberia, about 30 meters across and more than 50 meters deep, surrounded by ejecta that hinted at its explosive origins.

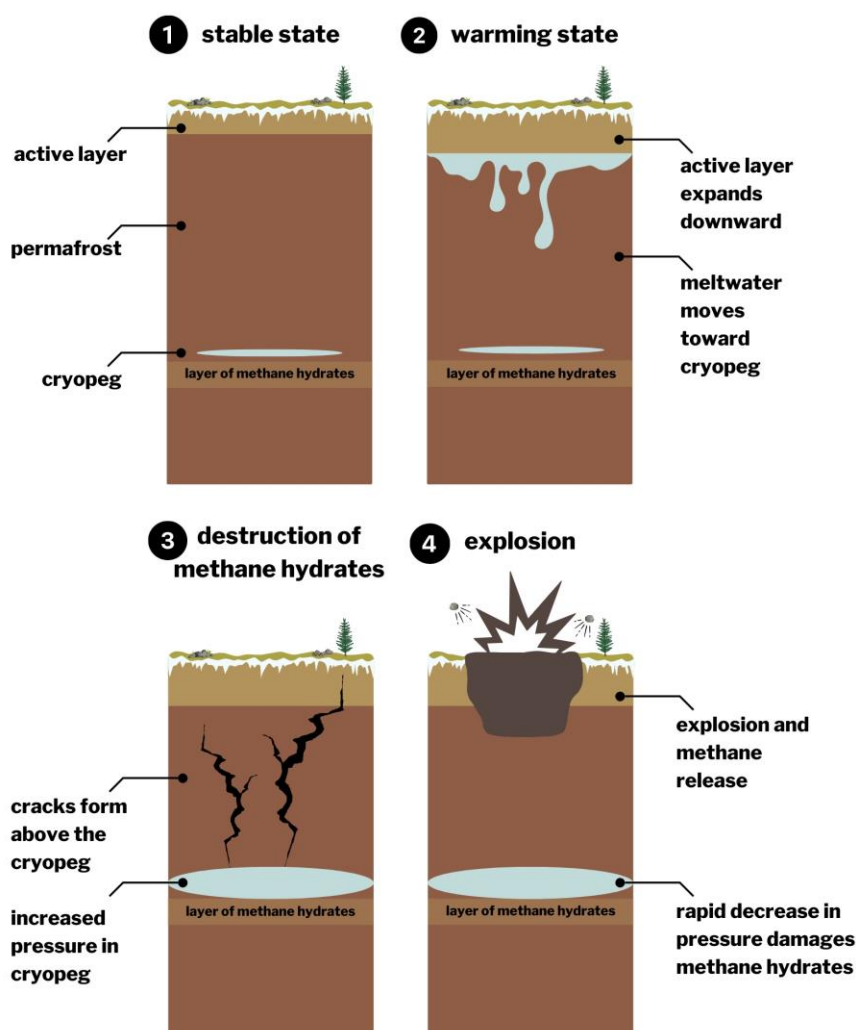
Since then, many more of these holes have burst forth from the surface of the Yamal and Gydan peninsulas, and chemical engineer Ana Morgado from the University of Cambridge says the massive amounts of methane they release could have a big impact on global warming.

"There are very, very specific conditions that allow for this phenomenon to happen," says Morgado. "We're talking about a very niche geological space."

The team found that it's not just a case of gas from the melting permafrost expanding and bubbling up due to warmer temperatures; that's definitely happening, but it wouldn't be enough for such big, forceful bangs. "There are only two ways you can get an explosion," geophysicist Julyan Cartwright from the Spanish National Research Council says. "Either a chemical reaction happens, and you have an explosion, like dynamite blowing up, or you pump up your bicycle tire until it blows up – that's physics."

And because there were no lights or combustion products reported from investigations into any of the explosions – which would signify a chemical reaction taking place – the researchers deduced the groundbreaking pressures must have a physical source. This, they propose, is **osmosis**: the tendency of a fluid to move in a way that equalizes the concentrations of the substances dissolved within.

As the permafrost warms (seasonally and, at present, for longer periods of time due to climate change), the surface soil, bustling with all the goings-on of life – thaws and expands downwards, with fresh meltwater trickling through the permafrost. Usually, this fluctuation is shallow, but due to climate change it is penetrating further into the ground. Here, the researchers report, it reaches a layer of salty water called a **cryopeg**, which typically evades



Graphical depiction of how warming destabilizes the layers and triggers explosions. (AGU/Madeline Reinsel)

freezing, due to its salinity, and pressure from above. And ordinarily, the cryopeg is nested carefully above a layer of methane hydrates – crystallized, hydrogen-bonded water and methane gas – which is maintained with the high pressure and low temperature afforded by the cryopeg. But as meltwater rushes in, the cryopeg, with its low pressure and high salt content, not only absorbs it as it flows down from the surface but acts as a kind of pump via osmosis. As this subterranean swell mounts, the pressure forms cracks in the permafrost above.

The stable sanctuary of the methane hydrates now ruptured, they are released as methane gas that belches up in a physical explosion.

These soil fractures were thought to occur across timescales of millennia, but the study found these osmotic forces can speed up the process to occur within decades – and thus lines up with global warming that began to accelerate in the 1980s.

"This might be a very infrequently occurring phenomenon," Morgado says. "But the amount of methane that's being released could have quite a big impact on global warming."

This research was published in **Geophysical Research Letters**.

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October 2024 was the second-warmest recorded October globally

Date: 08/11/2024

Location: Europe

Credit: European Union, Copernicus Climate Change Service Data

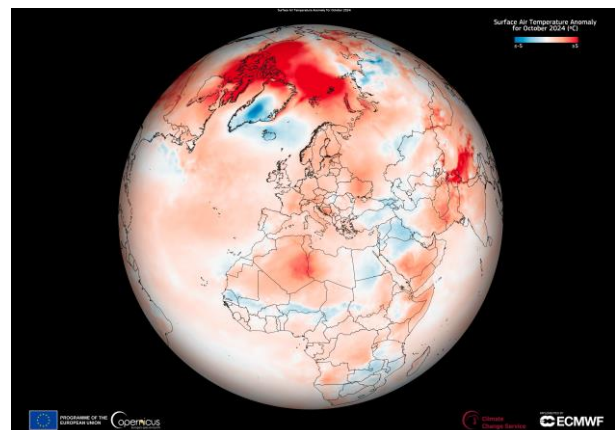
The **Copernicus Climate Change Service (C3S)** focused on key climate trends in its monthly Climate Bulletin in October 2024.

The bulletin reports that October 2024 was the second-warmest October on record globally, surpassed only by October 2023. The month was 0.80°C warmer than the 1991-2020 October average, with an absolute surface air temperature of 15.25°C, and marked the fifteenth month within a 16-month period during which global average surface air temperatures exceeded 1.5°C above pre-industrial levels.

Data from **C3S** is essential for monitoring trends in the global climate, ultimately supporting decisionmakers in creating and implementing climate strategies for the future.

Reference:

<https://www.copernicus.eu/en/media/image-day-gallery/october-2024-was-second-warmest-recorded-october-globally>



This data visualisation based on C3S data shows Europe, where October 2024 ranked as the fifth-warmest October on record, with average temperatures 1.23°C above the 1991-2020 monthly average.

When did plate tectonics begin?

By Stephanie Pappas, *LiveScience*

4 November 2024

Earth surface is covered with rigid plates that move, crash into each other and dive into the planet's interior. But when did this process begin?

It's one of many unique things about Earth: unlike every other known planet in the universe, Earth's surface is made up of rigid plates that shift, crash into each other and dive into the planet's interior. But when did Earth's surface splinter into tectonic plates? And when did those plates start moving? It's an important question because plate tectonics seems to fuel the evolution and complexity of life.

Surprisingly, geologists don't have a good answer for when plate tectonics emerged, and estimates range from 700 million years ago to before 4 billion years ago, when Earth was still in its infancy.



A depiction of Earth's tectonic plates. While we know where the plates are now and into the distant past, we don't know when the process first began. (Image credit: Yarr65 via Shutterstock)

The oldest unambiguous evidence of modern plate tectonics dates to the Neoproterozoic (1 billion to 541 million years ago), Robert Stern, a geoscientist at the University of Texas, Dallas, told ***Live Science***. That's when the geological record reveals plentiful ophiolites — bits of oceanic crust shoved onto continents — and blueschists, which are metamorphic rocks that form in subduction zones, or areas where the plates collide and dive into the planet's interior. Subduction is a feature of plate tectonics, so these widespread rocks show with certainty that plates were crashing into and sliding under one another.

But many geologists think Stern's view is too conservative. Critics agree that rocks indicative of plate tectonics became widespread for the first time 700 million to 900 million years ago. But these rocks could have existed earlier and been wiped away by time, they suggest. For example, the Indian subcontinent collided with southern Asia a mere 55 million years ago, and many of those rocks have already eroded away, said Mark Harrison, a professor emeritus of geoscientist at UCLA. "The Tibet-India collision isn't over yet," Harrison told ***Live Science***. If the evidence of tectonics is disappearing even as a plate-to-plate collision is occurring, what hope is there of finding these same rocks from the much more distant past?

Stern argues that there is evidence for a little episode of subduction 1.8 billion years ago that didn't quite take, bolstering his viewpoint that if there had been plate tectonics consistently before about 800 million years ago, it would be clearer in the rock record. (Other scientists see this blip as evidence that plate tectonics was well underway by then.)

Many researchers put the transition to plate tectonics much earlier. There are numerous signs of some kind of geologic shift during the **Archean Eon** (4 billion to 2.5 billion years ago), with estimates of exactly when ranging from 2.5 billion to 3.8 billion years ago. For example, at least one ophiolite preserved today dates back 2.5 billion years.

Another line of evidence is in the chemistry of the crust. If the crust is brand-new volcanic rock, its chemistry will look much like the mantle from whence it came. If it is remelted and recycled by plate tectonics, this chemistry shifts. An influential 2012 study found that more crust began to be recycled around 3 billion years ago. This could mark the shift to subduction destroying and reworking crust, said study co-author Chris Hawkesworth, an emeritus professor of geosciences at the University of St. Andrews in the U.K..

Research on zircons — minerals that survive even when the rocks around them melt and reform — suggests that Earth's crust shifted earlier, around 3.8 billion years ago. "We start to see zircon structures that start to look more and more like what we see in subduction zones today," study author Nadja Drabon, an Earth and planetary scientist at Harvard University, told **Live Science**. Crust also became shorter-lived around that time, again suggesting the recycling process of subduction.

But does this transition reflect true plate tectonics? Zircon research published in 2023, which investigated the magnetic field conditions on Earth when the minerals formed, suggests that these grains more or less stayed where they were made until 3.4 billion years ago, hinting that landmasses weren't on the move until that point.

It's possible that different aspects of plate tectonics emerged at different times, Drabon noted. Perhaps subduction started 3.8 billion years ago, but it took time for the continents to start drifting around the globe.

A newer and more controversial idea suggests that Earth developed plate tectonics in the **Hadean** (4.5 billion to 4 billion years ago). This idea springs from increasing evidence that the newborn Earth was a surprisingly modern-looking place with oceans and continents — a conclusion drawn from zircon research and the chemistry of Earth's oldest surviving rocks. Some studies of Earth's oldest zircons, which date to this mysterious period of geologic history, found that they look remarkably like zircons that form in volcanic arcs over subduction zones today. And theoretical modelling shows it's possible for plate tectonics to exist in Hadean conditions, Jun Korenaga, a professor of Earth and planetary sciences at Yale University, told **Live Science**.

Every piece of evidence for each of these origin stories comes with weaknesses. For instance, the vast majority of very old zircons come from one location, the Jack Hills in Australia, and might not represent what was happening on the rest of the planet. The oldest rocks might also be weird — perhaps they're still hanging around today because they weren't like all the other rocks on ancient Earth. And you don't want to get in the middle of computer modelers when they're arguing about assumptions of the state of the mantle 4 billion years ago.

"It's shocking to realize there's no consensus view on when [plate tectonics] started," Jesse Reimink, a geoscientist at The Pennsylvania State University told **Live Science**.

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Shell wins landmark climate case against green groups in Dutch appeal

Anna Holligan, BBC Hague correspondent

12 November 2024

Oil giant Shell has won a landmark case in the Dutch courts, overturning an earlier ruling requiring it to cut its carbon emissions by 45%. **The Hague court of appeal** said it could not establish that Shell had a "social standard of care" to reduce its emissions by 45% or any other amount, even though it agreed the company had an obligation to citizens to limit emissions.

Three years ago, a court in The Hague backed a case by Friends of the Earth and 17,000 Dutch citizens requiring Shell to reduce its CO₂ emissions significantly, in line with the Paris climate accords. The ruling came as climate talks involving some 200 countries got under way in Azerbaijan.

Environmental groups can now take their case against Shell to the Supreme Court - meaning that a final verdict in this far-reaching case may still be years away.

At the time, the 2021 ruling marked the first time a court had ordered a private company to align its workings with the Paris climate agreement, meaning that it was not sufficient for a company simply to comply with the law - it had to comply with global climate policy too. Under the terms of the Paris Agreement on climate change, nearly 200 nations agreed to keep global temperatures "well below" 2°C above pre-industrial levels.

The appeals court judge said that companies such as Shell were obliged to contribute to combating climate change based on the human right to protection against dangerous climate change.

However, the court said Shell was already working to reduce its emissions and the court could not establish whether it should make a 45% cut or another percentage, as there was no current accepted agreement in climate science on the required amount.

Shell has argued that it is already taking "serious steps to reduce emissions". It complained the original ruling was unfair as it singled out one company for a global issue, and said it was unrealistic to try to hold Shell accountable for its customers' choices.

Shell said if people considered progress was too slow towards cutting emissions then they should lobby governments rather than Shell to change policies and bring about a green transition.

The oil firm says its aim is to reduce the carbon intensity of products it sells by 15-20% by 2030 from a 2016 baseline. Shell also aims to become a "net zero" emissions company by 2050.

Part of the historic legal case hinged on the interpretation of an "unwritten duty of care" that exists under Dutch law, which requires companies to prevent hazardous negligence.

Friends of the Earth Netherlands argued that there was an international consensus that human rights offered protection against dangerous climate change and that companies had to respect human rights.

Shell's successful appeal could have far-reaching implications for corporate climate responsibility. A number of environmental groups around the world are now trying to force companies and governments to comply with the accords through the courts.

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New evidence suggests Earth was covered in ice more than 660 million years ago

A new study published in the Proceedings of the National Academy of Sciences provides the best evidence for Snowball Earth theory

Amit Malewar, Tech Explorist
14 November 2024

While the Snowball Earth theory was proposed in 1960, geologist Joseph Kirschvink coined the term “Snowball Earth” in 1992. Since then, researchers have seemed to have divided opinions on the entire globe covered by thick ice.

Geologists have found imprints of thick ice along the ancient coastal areas. However, no evidence has confirmed snow presence close to the equator until now.

Researchers at the *University of Colorado, Boulder* have uncovered strong evidence that supports Snowball Earth theory. Laser ablation mass spectrometry on the Tavakaiv (Tava) sandstones of Colorado's Rocky Mountains proves that the rocks here were forced underground by the weight of huge glaciers. Laser ablation mass spectrometry is a dating technique that uses lasers to zap minerals and release some of the atoms inside.

“This study presents the first physical evidence that Snowball Earth reached the heart of continents at the equator,” said the lead author Liam Courtney-Davies.

The foremost reason to study the Rocky Mountains of Colorado is its attitude in the past. This region was once a part of the ancient **supercontinent Laurentia** and was situated **at the equator**. Geologists believe that glaciers can form anywhere if they form at the equator.



Snowball Earth (Credit: Tech Explorist)



Reddish-brown bands of Tava sandstone cut through other rocks. (Credit: Liam Courtney-Davies)

For geologists, Colorado serves as an unusual feature of the past. They believe that the brown rocks began as sand, and the weight of the glacier compacted it into thin layers.

"These are classic geological features called **injectites** that often form below some ice sheets, including in modern-day Antarctica," Courtney-Davies said.

To confirm the connection of Colorado to ice sheets, researchers collected tiny samples of the minerals rich in iron oxide and hit them with a laser. Due to zaps of laser, minerals discharged lead and the radioactive element uranium. As Uranium atoms decay into the lead at a uniform rate, researchers could state that glaciers pressed down rocks, around 690 to 660 million years ago.

Courtney-Davies has added that a better understanding of climatic evolution could offer better insights into life evolution. As several things happened during Snowball Earth, geologists could surface through evolutionary transitions. Additionally, the co-authors have asserted that they don't plan to stop here. They will be unravelling the story of the Snowball Earth deposits around North America as well.

"We want to get the word out so that others try and find these features and help us build a more complete picture of Snowball Earth," Courtney-Davies said.

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Fossil fills 70-million-year gap in understanding

Harriet Heywood, *BBC News*,
Cambridgeshire

14 November 2024

A fossil discovery could transform the understanding of how the brains and intelligence of modern birds have evolved.

Researchers, led by the University of Cambridge, external and the **Natural History Museum of Los Angeles County**, identified the fossil bird - which was roughly the size of a starling - from the Mesozoic Era, the age of dinosaurs.

The study aimed to digitally reconstruct the brain of the bird, which it is named ***Navaornis hestiae***, to determine the



Navaornis is named after William Nava who discovered the fossil in 2016 at a site near Presidente Prudente, Brazil. (Image source: Stephanie Abramowicz)

evolutionary origins of the modern avian brain.

Dr. Guillermo Navalón, the co-lead author of the study, said he was "awestruck" by the "one-of-a-kind" fossil which "lets us fully appreciate the anatomy of this early bird".

The complete skull has been preserved almost intact, which the study highlights makes it one of the most significant finds of its kind. **Navaornis** lived approximately 80 million years ago in what is now Brazil, before the mass extinction event that killed all non-avian dinosaurs. The fossil filled a 70-million-year gap in the understanding of how the brains of birds evolved: between the 150-million-year-old **Archaeopteryx**, the earliest known bird-like dinosaur, and birds living today.

Navaornis had a larger cerebrum than **Archaeopteryx**, suggesting it had more advanced cognitive capabilities than the earliest bird-like dinosaurs. However, most areas of its brain were less developed, suggesting that it had not yet evolved the complex flight-control mechanisms of modern birds.

Dr Navalón, from Cambridge's Department of Earth Sciences, said: "It was one of these moments in which the missing piece fits absolutely perfectly. This fossil is truly so one-of-a-kind that I was awestruck from the moment I first saw it to the moment I finished assembling all the skull bones and the brain, which lets us fully appreciate the anatomy of this early bird."

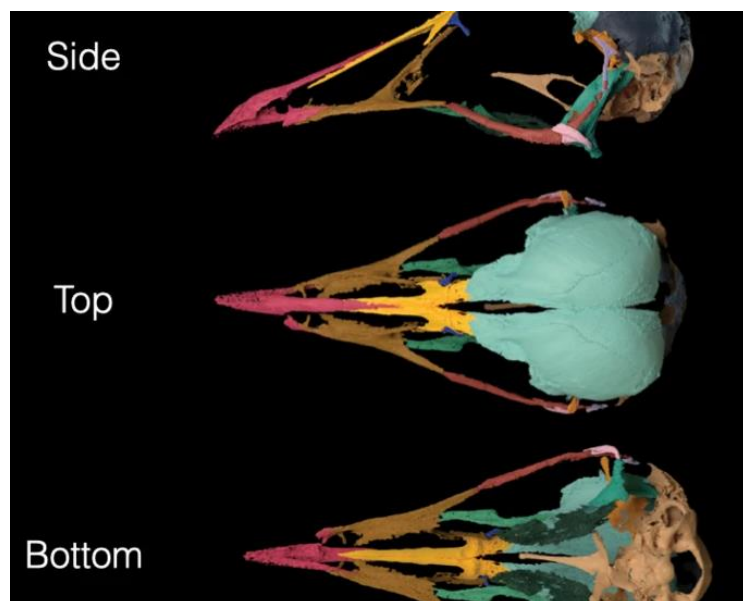
Professor Daniel Field from Cambridge's Department of Earth Sciences, who was the senior author of the research, said modern birds, like crows and parrots, had some of the most advanced cognitive capabilities in the animal kingdom.

He said scientists had struggled to understand how and when the unique brains and remarkable intelligence of birds evolved. He added: "The field has been awaiting the discovery of a fossil exactly like this one. This might be just one fossil, but it's a key piece in the puzzle of bird brain evolution," he said.

Dr. Luis Chiappe, a co-lead author from the Natural History Museum of Los Angeles County, added the discovery showed some of the birds flying over the heads of dinosaurs had a fully modern skull geometry more than 80 million years ago.

Reference:

<https://www.bbc.co.uk/news/articles/cvg5knlwyny4o>



While the discovery is a significant breakthrough, the researchers say it is only the first step in understanding the evolution of bird intelligence. (Image source: Dr Guillermo Navalón)

ka (kilo-annum)	=	thousand years (10^3)	One thousand seconds	=	16.67 minutes
Ma (mega-annum)	=	million years (10^6)	One million seconds	=	11.57 days
Ga (giga-annum)	=	billion years (10^9)	One billion seconds	=	31.71 years
Ta (tera-annum)	=	trillion years (10^{12})	One trillion seconds	=	31,709.79 years

Volcanoes once erupted on the far side of the moon

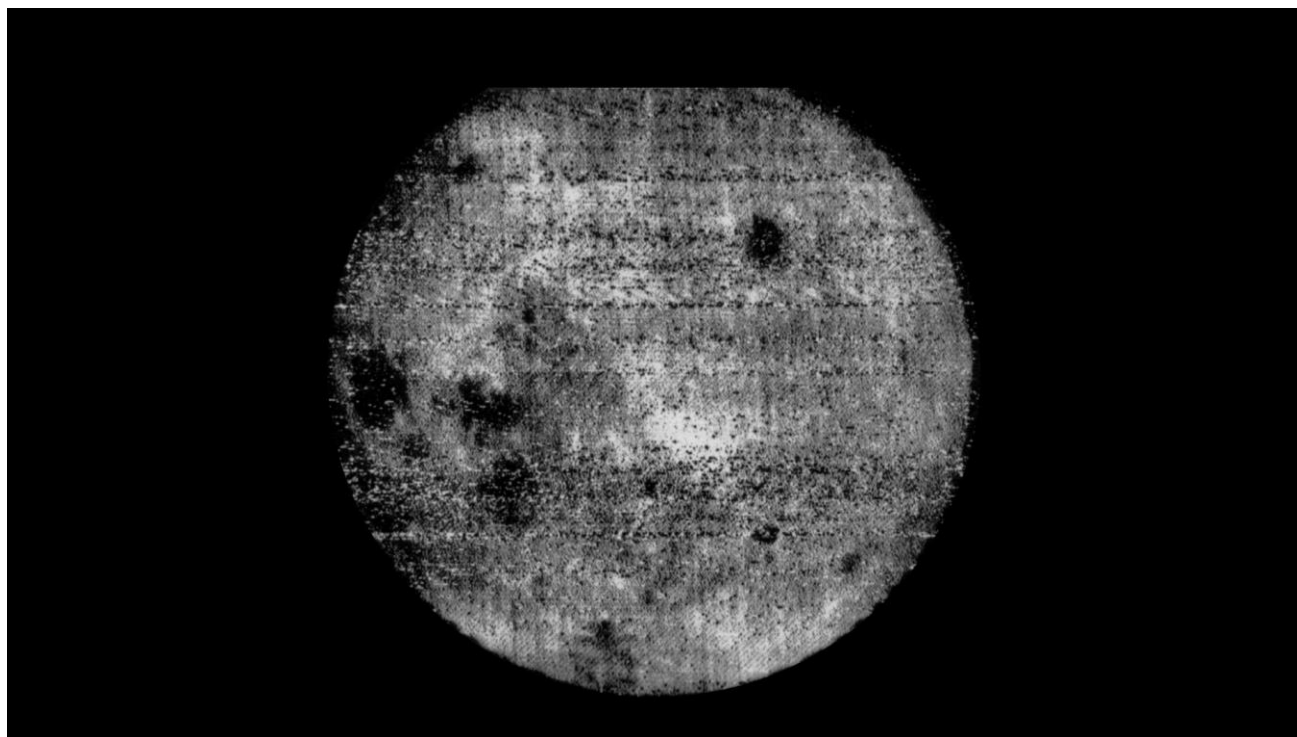
Tiffany Wertheimer, BBC News

16 November 2024

Volcanoes were erupting on the mysterious far side of the moon billions of years ago, US and Chinese researchers have found. Analysis of samples collected by a Chinese mission found basalt (volcanic rock formed after an eruption) fragments dating back **more than 4.2 billion years**.

The findings were published in the **Nature** and **Science** journals on Friday.

While scientists already knew of volcanic activity on the near side of the moon, which we can see from Earth, the "dark side" is very different in its geology, and remains largely unexplored.



In October of 1959, the Luna 3 spacecraft launched from the Baikonur Cosmodrome in Kazakhstan. Luna 3 was the third spacecraft to reach the Moon and the first to send back pictures of the Moon's far side. The pictures were noisy and indistinct, but because the Moon always presents the same face to the Earth, they offered views of a part of the Moon that had never been seen before. (Credit: NASA)

The rock and dust samples - the first to be retrieved from the far side of the Moon - were collected by the Chang'e-6 spacecraft, following a nearly two-month long mission which was fraught with risks. Led by experts from the **Chinese Academy of Sciences**, researchers used radiometric dating to determine the age of the volcanic rock. Their analysis also revealed a "surprisingly young" eruption occurred some 2.83 billion years ago, something which has not been found on the near side of the Moon.

"This is an incredibly exciting study", Professor Qiuli Li from the Institute of Geology and Geophysics wrote in a detailed peer review. "It is the first geochronology



The Chang'e-6 mission brought the first rock samples of the far side of the Moon back to Earth. (Credit: CNSA)

study to come from the Chang'e-6 samples and will be of immense importance to the lunar and planetary science community."

While it is widely known as the **"dark side"**, this part of the Moon actually gets plenty of sunlight - we just don't see it. This is because the Moon is tidally locked to Earth and takes the same amount of time to orbit our planet - about 27 days - meaning the same side always faces us.

The first image of the far side was captured in 1959 by the Soviet spacecraft, Luna 3. They were grainy but gave Earthlings a glimpse of the Moon from a different angle.

There have been several higher quality images beamed back since, including an extraordinary NASA video showing the Moon from the far side, with Earth in the background.

And earlier this year, during the Chang'e-6 mission, a small roving vehicle was deployed to take a selfie of the lander sitting on the far side's rocky surface.

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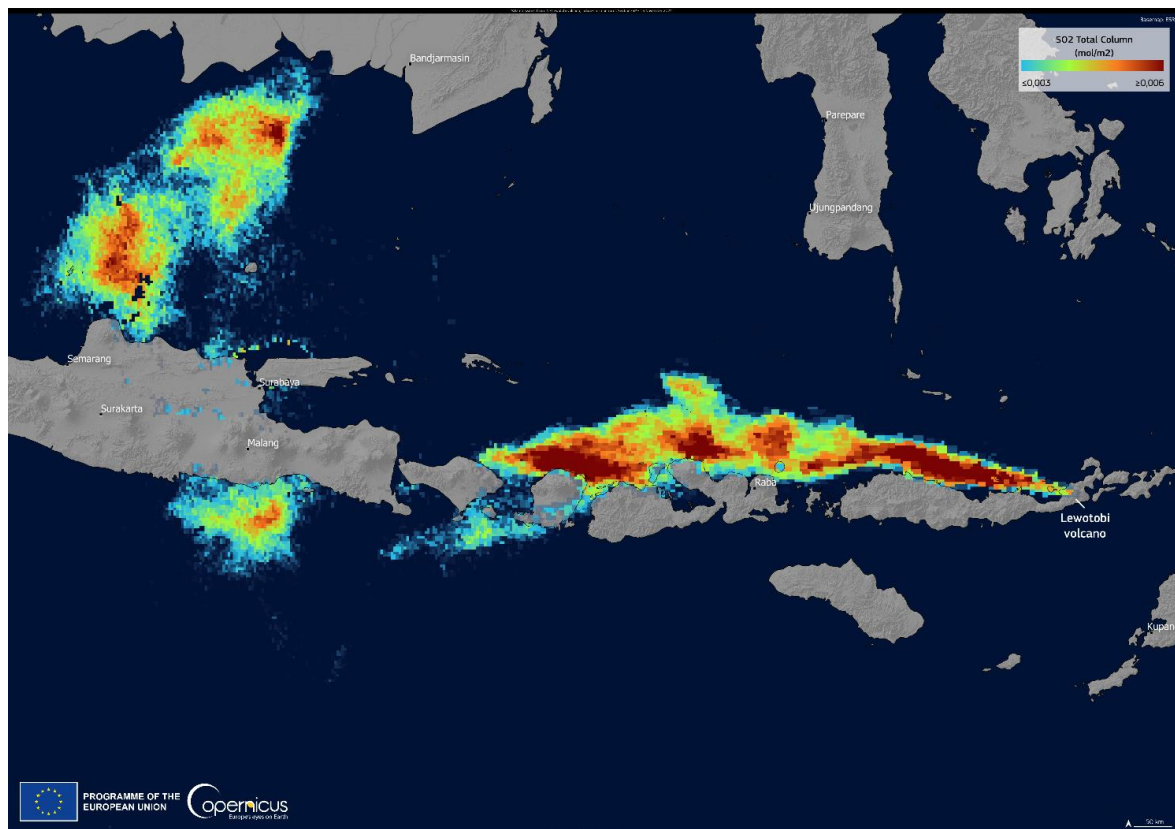
Image Of The Day 1

Eruption of the Mount Lewotobi Laki-Laki volcano, Indonesia

Date: 18/11/2024

Location: Indonesia

Credit: European Union, Copernicus Sentinel-5P imagery



On 4 November 2024, the **Mount Lewotobi Laki-Laki** volcano in eastern Indonesia erupted, impacting seven villages and killing at least ten people. Officials declared a state of emergency to ensure that aid can reach affected residents.

On 13 November, a new eruption occurred, impacting the ability of flights to land or depart from the Bali airport as volcanic material, including rock, lava, gravel and ash were spewed up to 8 kilometres into the air. This image, obtained with **Copernicus Sentinel-5P** data acquired on the same day, shows the **sulfur dioxide (SO₂) plume** released during the eruption.

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TV Review

Panorama: Can scientists save the world?

Professor Myles Allen, ECI Oxford

18 November 2024

Climate change needs addressing urgently the world's scientists agree, but exactly how we do that is where their views differ. Professor Myles Allen from the Environmental Change Institute is one of the leading climate scientists to feature in a BBC documentary.



Panorama's *Can Scientists Save the World?* looks at the technology which could help in the fight against climate change. They include mechanical trees that absorb carbon, machines that brighten clouds and a solar reactor that makes fuel from fresh air.

Prof. Allen, who leads the Climate programme at the Environmental Change Institute, (ECI) and who is Head of Atmospheric, Oceanic and Planetary Physics at the University of Oxford gives his view

on what's needed to halt global warming and examines the options to remove CO₂ and slow climate change. He said: "As the world warms, a lot of carbon stored in natural sinks like forests is actually getting released into the atmosphere."

Calling for a renewed focus on reducing fossil fuel use and scaling up permanent CO₂ disposal, Prof. Allen stresses: "We could stop climate change within a generation if we just put our minds to it. If we actually put the resource that's in the fossil fuel industry and require them to dispose responsibly of the CO₂ generated by the fuels they sell. The fossil fuel industry can afford to fix this. For what we paid for gas in 2022 in the UK, they could have captured every single molecule of CO₂ that gas generated back out of the atmosphere and stuck it back under the North Sea - twice over."

BBC journalist and Panorama reporter, Richard Bilton, said in summary: "There are reasons to have hope. Cutting carbon use is vital but the world also needs to remove what's already there. Science created our problems, and many believe science will be part of the solution."

The documentary coincides with a study published in **Nature** for which Prof. Allen is lead author: ***Geological Net Zero and the need for disaggregated accounting for carbon sinks.***

The study, coauthored by Dr. Stuart Jenkins, Researcher at the ECI, among others, draws attention to rules that allow countries and companies to offset ongoing CO₂ emissions from fossil fuels with CO₂ absorption by forests and oceans that is happening anyway as a result of past emissions.

This means the world could appear to achieve net zero by 2050 without actually stopping global warming – or even reducing emissions at all until the late 2030s.

Instead, the authors call for a recognition of the need for '**geological net zero**', that the only way of compensating for any continued production of CO₂ from burning fossil fuels is to capture and dispose of it back underground, or somewhere equally permanent.

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News

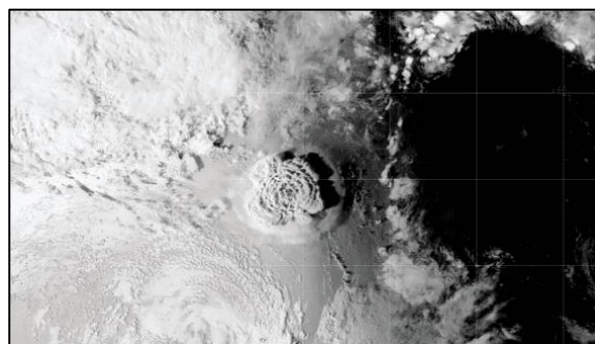
New trigger proposed for record-smashing 2022 Tonga eruption

Previously unstudied data from a seismic wave, detected 750 kilometres from the seamount, may bolster tsunami early-warning systems

18 November 2024

Fifteen minutes before the massive January 2022 eruption of the **Hunga Tonga-Hunga Ha'apai** volcano, a seismic wave was recorded by two distant seismic stations. Now, researchers argue that similar early signals could be used to warn of other impending eruptions in remote oceanic volcanoes.

The researchers propose that the seismic wave was caused by a fracture in a weak area of oceanic crust beneath the volcano's caldera wall. That fracture allowed seawater and magma to pour into and mix together in the space above the volcano's subsurface magma chamber, explosively kickstarting the eruption.



*The origins of the massive January 2022 Hunga Tonga-Hunga Ha'apai volcanic eruption may have been detected in a seismic wave recorded 750 kilometres from the volcano, according to new research in *Geophysical Research Letters*. (Credit: NASA)*

The research was published in ***Geophysical Research Letters***, an open-access AGU journal that publishes high-impact, short-format reports with immediate implications spanning all Earth and space sciences.

The results build on the researchers' previous work monitoring remote volcanoes. In this case, the *Rayleigh wave*, a type of seismic wave that moves through the Earth's surface, was detected 750 kilometres (approximately 466 miles) from the volcano.

"Early warnings are very important for disaster mitigation," said Mie Ichihara, a volcanologist at the University of Tokyo and one of the study's coauthors. "Island volcanoes can generate tsunamis, which are a significant hazard."

Silent precursor to a violent eruption

Hunga Tonga-Hunga Ha'apai is an oceanic volcano in the western Pacific Ocean in the Kingdom of Tonga. The seamount was created by the subduction of the Pacific Plate underneath the Australian Plate, a process that generates magma and leads to eruptions.

On January 15, 2022, the volcano erupted with record-breaking energy, injecting 58,000 Olympic swimming pools of water vapour into the stratosphere, setting off an unprecedented lightning storm

and generating a tsunami. That massive eruption was preceded by a smaller eruption on January 14 and, before that, a month of eruptive activity.

Researchers still debate the exact start time of the eruption, though most agree that the eruption started shortly after 4:00 Coordinated Universal Time (UTC). The new study reports a Rayleigh wave that started around 3:45 UTC.

The researchers used seismic data to analyse the Rayleigh wave, which was detected by instruments, but not felt by humans, at seismic stations on the islands of Fiji and Futuna. While Rayleigh waves are a common feature of volcanic eruptions and earthquakes, the researchers believe that this wave signified a precursor event and possible cause of the massive eruption.

“Many eruptions are preceded by seismic activity,” said Takuro Horiuchi, a volcanology graduate student at the University of Tokyo and the lead author of the study. “However, such seismic signals are subtle and only detected within several kilometres of the volcano.”

In contrast, this seismic signal travelled a great distance, indicating a huge seismic event. “We believe unusually large movements started at the time of the precursor,” Horiuchi said.

Secrets of the seamount

Scientists may never know exactly what caused the gigantic, “caldera-forming” eruption, but Ichihara believes that the process was not instantaneous. Instead, she thinks that this precursor event was the start of an underground process that ultimately led to the eruption.

But it can be difficult to nail down the origins of these rare, colossal eruptions. “There are very few observed caldera-forming eruptions, and there are even fewer witnessed caldera-forming eruptions in the ocean,” Ichihara said. “This gives one scenario about the processes leading to caldera formation, but I wouldn’t say that this is the only scenario.”

Regardless, detecting early eruption signals may give island nations and coastal areas more valuable time to prepare when faced with imminent tsunamis — even when the signal cannot be felt on the surface. “At the time of the eruption, we didn’t think of using this kind of analysis in real-time,” Ichihara said. “But maybe the next time that there is a significant eruption underwater, local observatories can recognize it from their data.”

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Iceland's Blue Lagoon evacuated as volcano erupts for seventh time in a year

ITV News

22 November 2024

A volcano in Iceland has erupted for the seventh time in 11 months, sending molten lava flowing towards **the Blue Lagoon spa**. The latest eruption on the Reykjanes Peninsula started on Wednesday evening and created a fissure around three kilometres long.



A new volcanic eruption that started on the Reykjanes Peninsula in Iceland. (Credit: AP)

The activity is estimated to be considerably smaller than the previous eruption in August, according to Iceland's meteorological office that monitors seismic activity. Most of the previous eruptions have subsided within days.

"In the big picture, this is a bit smaller than the last eruption, and the eruption that occurred in May," Magnús Tumi Guðmundsson, a professor of geophysics who flew over the scene with the Civil Protection agency to monitor the event, told national broadcaster RUV.

While the eruption poses no threat to air travel, authorities warned of gas emissions across parts of the peninsula, including the nearby town of Grindavík, which was largely evacuated a year ago when the volcano came to life after lying dormant for 800 years.

About 50 houses were evacuated after the Civil Protection agency issued the alert, along with guests at the Blue Lagoon. By Thursday afternoon, lava had spread across the car park of the geothermal spa, one of Iceland's biggest tourist attractions and had consumed a service building. Lava also reached the pipeline that supplies the peninsula with hot water for heating, the meteorological office said, though the pipes were built to withstand lava flow.

The repeated volcanic eruptions close to Grindavík, which had a population before the eruptions of 3,800, have damaged infrastructure and property, forcing many residents to relocate to guarantee their safety.

"Grindavík is not in danger as it looks and it is unlikely that this crack will get any longer, although nothing can be ruled out," Magnús Tumi said.

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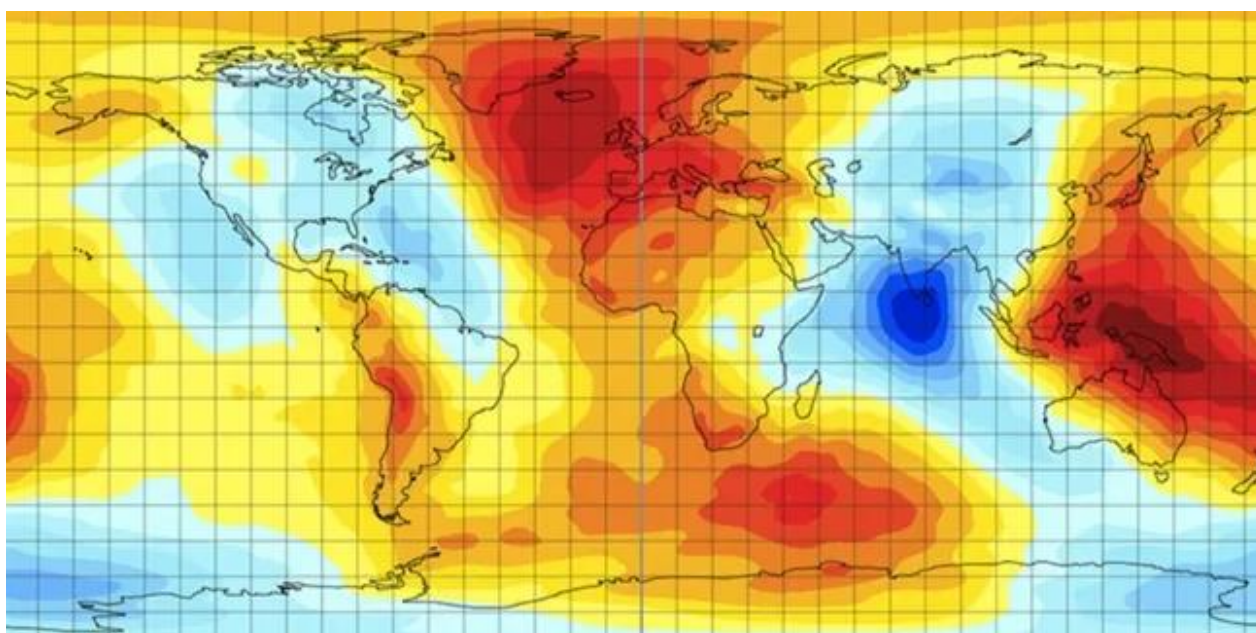
Indian Ocean gravity hole: The dent in Earth's gravitational field created by the death of an ancient ocean

Sascha Pare, LiveScience

22 November 2024

The Indian Ocean "gravity hole" is a region where Earth's mass is reduced, leading to weak gravitational pull, lower-than-average sea levels and a puzzle scientists have only just begun to solve.

A map of the world with gravity data showing the Indian Ocean geoid low in dark blue.



A map showing how water elevation and distribution would change due to gravity if the effects of tides and currents were removed. (Image credit: European Space Agency)

QUICK FACTS

Name:	Indian Ocean geoid low
Location:	Laccadive Sea, southwest of India
Why it's incredible:	The huge gravity hole formed on the site of a prehistoric ocean.

The Indian Ocean "gravity hole" is the site of the deepest dent in Earth's gravitational field. It's a circular ocean region with a gravitational pull that's so weak, sea levels are 348 feet (106 meters) lower there than elsewhere on Earth. Discovered in 1948, the origins of this giant gravity hole — or **geoid low**, as it is technically called — remained a mystery until recently.

The hole spans 1.2 million square miles (3.1 million square kilometres) and sits 746 miles (1,200 km) southwest of India. Various theories have tried to explain its existence since geophysicists first detected its trace, but the answer only came in 2023 with a study published in the journal **Geophysical Research Letters**. Researchers used 19 computer models to simulate the motion of Earth's mantle and tectonic plates over the past 140 million years and then teased out the scenarios giving rise to a geoid low similar to the real-life one.

The study indicated that the Indian Ocean gravity hole formed after the death of an ancient ocean called **Tethys**, which existed between the supercontinents **Laurasia** and **Gondwana**. Tethys sat on a chunk of Earth's crust that slipped beneath the Eurasian plate during the breakup of Gondwana 180 million years ago. As this happened, shattered fragments of the crust sank deep into the mantle.

Around 20 million years ago, as these fragments landed in the lowermost regions of the mantle, they displaced high-density material originating from the "African blob" — a compact bubble of crystallized magma, 100 times taller than Mount Everest, that is trapped beneath Africa. Plumes of low-density magma rose to replace the dense material, diminishing the overall mass of the region and weakening its gravity.

Scientists are yet to confirm these model predictions with earthquake data, which could help to verify the existence of low-density plumes beneath the hole. Meanwhile, researchers are realizing more and more that Earth's magma is full of strange blobs, including some that were thought to be missing and have turned up in unexpected places.

And it's not just Earth — explorations of Mars, too, have revealed blobs of all shapes and sizes lurking below the planet's surface.

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Largest marine reptiles may have been wiped out by hidden Triassic extinction

James Ashworth, NHM

4 December 2024

Over 230 million years ago, **long-necked plesiosaurs** and **dolphin-shaped ichthyosaurs** dominated the oceans, from open water to the shallow coasts. But within 30 million years, many of these marine reptiles went extinct. New research is shedding light on what might have happened.

A series of extinction events over 200 million years ago may have sealed the fate of many marine reptiles.

During the **Triassic**, between 252-200 million years ago, marine reptiles rapidly diversified into many different forms as they spread around the world. Some of the best known are the plesiosaurs and ichthyosaurs, which quickly became the top predators in the oceans.

Their rapid expansion was brought to a halt at the end of the Triassic 200 million years ago **by two extinction events** in quick succession. Despite the effects of the second extinction event already

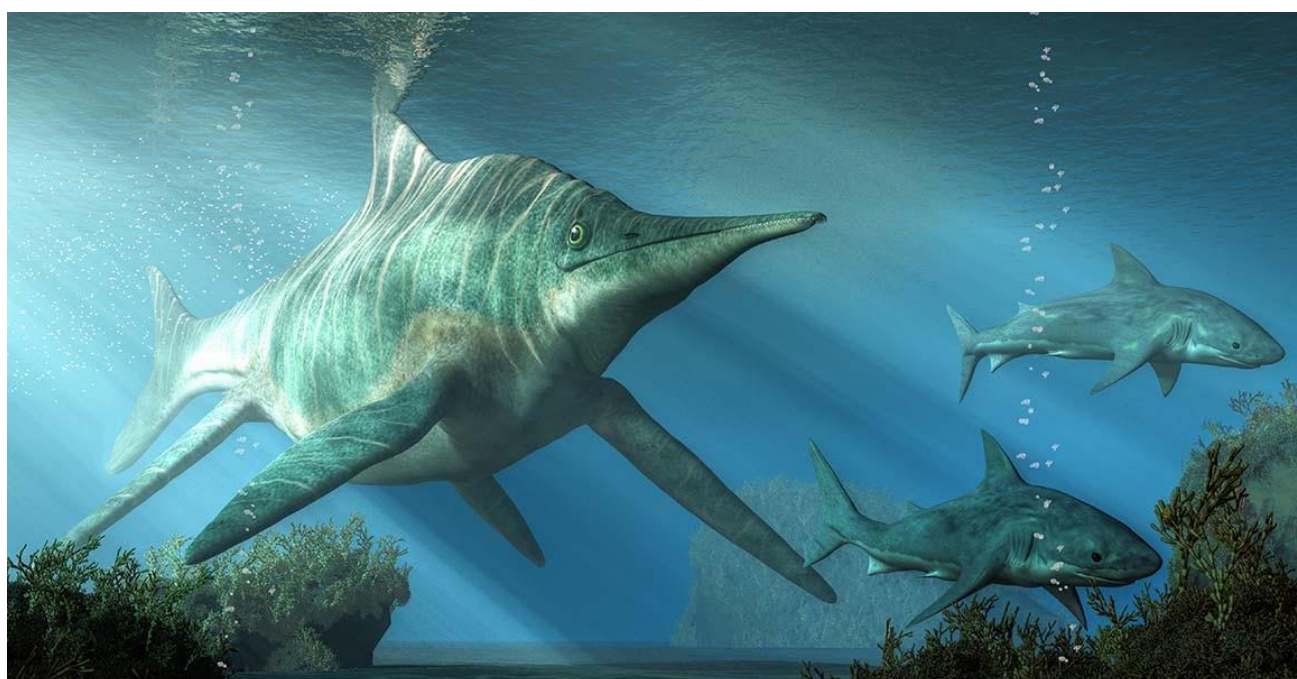
being known, new research shows that plesiosaurs and ichthyosaurs were more vulnerable because of a previous event several million years earlier.

While both groups survived as a whole, many species went extinct. Among the casualties were the **shastasaurid ichthyosaurs**, a group of whale-sized marine reptiles that could reach up to 21 metres long. Ichthyosaurs would never reach such massive sizes again for reasons that, according to PhD student Antoine Laboury, are “still a mystery”.

“These animals were at the top level of their food chains, so we expect that they would be highly susceptible to major changes in ecosystems and to extinctions affecting other species,” says Antoine, who led the new research. “However, we don’t have direct evidence to support this.”

“We’re currently lacking the data to show exactly what was happening to the shastasaurids at the end of the Triassic, and whether their extinction was abrupt or staggered. Finding new fossils would help us to shed light on this fascinating period of the history of ichthyosaurs.”

The findings of the study were published in the journal ***Evolution***.



Giant marine reptiles like Shastasaurus were once the ocean's top predators - but would disappear by the end of the Triassic. (© Daniel Eskridge/ Shutterstock)

Scanning our specimens

To answer questions about the evolution of marine reptiles, the researchers needed access to a variety of different specimens from the end of the Triassic and start of the Jurassic. Some of the most important are mounted on the wall of our (the NHM) Fossil Marine Reptiles gallery, which includes fossils collected by Mary Anning.

As these specimens are displayed high up on the wall, and passed by thousands of visitors every day, it’s simply not possible to take them down. Instead, the scientists had to scan the specimens where they are.

Dr. Marc Jones, the curator who looks after our fossil marine reptiles, says, “One of the biggest challenges was to scan the specimens behind glass, because the barrier can cause the scanner problems. The height is also a problem. But, with the help of a genie scissor lift and a portable scanner, we were able to get Antoine up to the specimens so he could start to digitise them.”

In total, 21 specimens from the **Fossil Marine Reptiles gallery** have now been scanned, with the data made publicly available online. Marc hopes that this will make them more accessible to researchers and members of the public all around the world.

“There are all kinds of possible uses for these scans, including further research but also science outreach and art,” Marc says. “The Museum of Lyme Regis, for example, is already 3D printing some of the skulls their education programmes, and this is just the start. In the future, we hope to get all of the fossil marine reptiles in the Natural History Museum scanned so they can be used by everyone.”

How did marine reptiles change in the Triassic?

The digitised specimens have been used by Antoine and the rest of the study’s authors in combination with hundreds of scans of plesiosaurs, ichthyosaurs and their relatives from other museums. This allowed the team to track the changes these groups experienced in the Triassic and into the early Jurassic.

After peaking in diversity during the Middle Triassic, and filling a wide variety of environmental niches, the researchers saw rapid changes in the fins of plesiosaur ancestors known as **pistosaurus** and the **parvipelvic ichthyosaurs**.

“The fins of these marine reptiles became more compact, which is characteristic of organisms highly adapted to open-ocean life,” Antoine explains. “This would have enhanced the ability of plesiosaurs to ‘fly’ underwater, and cruise over long distances.” In fact, this adaptation likely enabled early plesiosaurs and the pelagic parvipelvians to survive sea-level fluctuations in the Triassic, playing a significant role in their future evolutionary success.”

There were also changes in the heads of these animals, especially in ichthyosaurs. While by the Middle Triassic plesiosaur skulls had already evolved many different shapes, ichthyosaurs continued to experiment with head shape in a more complex way, often revisiting old forms.

“It’s commonly stated that ichthyosaurs in the Jurassic, and beyond, were very distinct from, and not as diverse as, their Triassic predecessors,” Antoine says. “However, that hypothesis has never been comprehensively tested. Our research showed that post-Triassic ichthyosaurs were still diverse, and that certain head and body plans recurred in distantly related species before and after the end-Triassic extinction. This explains why different ichthyosaurs can be found together at the same time, as their different morphologies allowed them to exploit different resources.”

While the plesiosaurs and ichthyosaurs were able to survive the end-Triassic extinction, they didn’t last forever. The last ichthyosaurs died out around 90 million years ago during the Cretaceous after they were unable to adapt to changes in the ocean and the extinction of some of their food sources.

Plesiosaurs, meanwhile, lasted until the end of the Cretaceous. They were eventually wiped out during the same extinction event that killed the non-bird dinosaurs.

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Fossilized Teeth Highlight Theropod Dinosaur Diversity in Prehistoric East Sussex

News Staff, SciNews

5 December 2024

Several groups of meat-eating dinosaurs — tyrannosaurs, spinosaurs and members of the Velociraptor family — stalked what is now the Bexhill-on-Sea region in East Sussex, England, approximately 135 million years ago (Early Cretaceous epoch), according to new research.

“Meat-eating dinosaurs are rare in the Cretaceous sediments of southern England,” said **Dr. Chris Barker**, a palaeontologist at the University of Southampton. “Usually, Isle of Wight dinosaurs attract most of our attention. Much less is known about the older Cretaceous specimens recovered from sites on the mainland.”

In the research, Dr. Barker and colleagues examined an assemblage of theropod teeth from the **Wadhurst Clay Formation**, mostly collected from the Ashdown Brickworks locality near Bexhill, East Sussex.

Theropod teeth are complex, and vary in size, shape, and in the anatomy of their serrated edges.

The authors used several techniques to analyse the fossils, including phylogenetic, discriminant and machine learning methods.

“Dinosaur teeth are tough fossils and are usually preserved more frequently than bone. For that reason, they’re often crucial when we want to reconstruct the diversity of an ecosystem,” Dr. Barker said. “Rigorous methods exist that can help identify teeth with high accuracy. Our results suggest the presence of spinosaurs, mid-sized tyrannosaurs and tiny dromaeosaurs — Velociraptor-like theropods — in these deposits.”

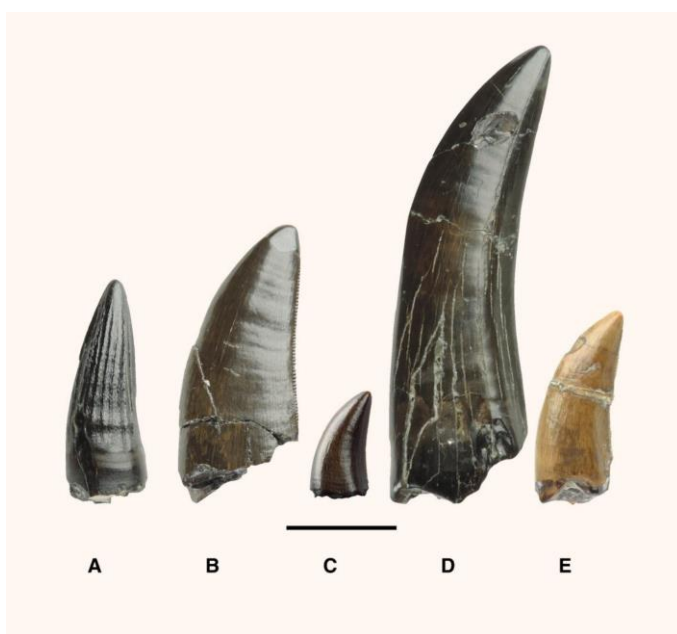
The discovery of tyrannosaurs is particularly notable, since the group *hasn’t previously been identified* in sediments of this age and region.

These tyrannosaurs would have been around a third of the size of their famous cousin *Tyrannosaurus rex* and likely hunted small dinosaurs and other reptiles in their floodplain habitat.

“Assigning isolated teeth to theropod groups can be challenging, especially as many features evolve independently amongst different lineages,” said Lucy Handford, a Ph.D. student at the University of York. “This is why we employed various methods to help refine our findings, leading to more confident classifications. It’s highly likely that reassessment of theropod teeth in museum stores elsewhere will bring up additional discoveries.”



An Early Cretaceous floodplain in southeastern England, 135 million years ago: a spinosaur (centre) takes over the carcass of an ornithomimid, much to the annoyance of the smaller tyrannosaurs (left) and dromaeosaurids (bottom right). (Image credit: Anthony Hutchings)



Theropod teeth from the Wadhurst Clay Formation. The teeth belong to a: (a) spinosaur, (b) tyrannosaur, (c) dromaeosaur (Velociraptor & its relatives), (d) possible tyrannosaur, (e) indeterminate tyrannoraptoran. Scale bar = 10 mm. (Image credit: Barker et al. & NHM. doi: 10.1002/spp2.1604)

“Southern England has an exceptionally good record of Cretaceous dinosaurs, and various sediment layers here are globally unique in terms of geological age and the fossils they contain,” said Dr. Darren Naish, a palaeontologist at the University of Southampton. “These East Sussex dinosaurs are older than those from the better-known Cretaceous sediments of the Isle of Wight and are mysterious and poorly known by comparison. We’ve hoped for decades to find out which theropod groups lived here, so the conclusions of our new study are really exciting.”

The findings appear in the journal *Papers in Palaeontology*.

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In Our Time ... Podcast

The Fish-Tetrapod Transition

Melvyn Bragg and guests discuss one of the greatest changes in the history of life on Earth.

Around 400 million years ago some of our ancestors, the fish, started to become a little more like humans. At the swampy margins between land and water, some fish were turning their fins into limbs, their swim bladders into lungs and developed necks and eventually they became tetrapods, the group to which we and all animals with backbones and limbs belong. After millions of years of this transition, these tetrapod descendants of fish were now ready to leave the water for a new life of walking on land, and with that came an explosion in the diversity of life on Earth.

With

Emily Rayfield, Professor of Palaeobiology at the University of Bristol

Michael Coates, Chair and Professor of Organismal Biology and Anatomy at the University of Chicago

Steve Brusatte, Professor of Palaeontology and Evolution at the University of Edinburgh

Released On: 20 Oct 2022



The image above is a representation of Tiktaalik Roseae, a fish with some features of a tetrapod but not one yet, based on a fossil collected in the Canadian Arctic. (Credit: Nobu Tamura)

Reference:

<https://www.bbc.co.uk/sounds/play/m001d56g>

<https://prehistoric-wiki.fandom.com/wiki/Tiktaalik>

Photo of the Month



Earth and Sky Francisco Negroni



(Credit: Francisco Negroni)

A double lenticular cloud is illuminated at nightfall by the lava emitted from the **Villarrica volcano**, Chile. Villarrica is in the town of Pucón in the south of Chile. It's one of the country's most active volcanoes and last erupted in 2015. Villarrica, with its lava of basaltic-andesitic composition, is one of a small number worldwide known to have an active (but in this case intermittent) lava lake within its crater. The volcano usually generates strombolian eruptions with ejection of incandescent pyroclasts and lava flows.

Francisco Negroni takes regular trips to Villarrica to monitor its activity. On this visit, he stayed nearby for 10 nights. He says every trip is "quite an adventure – never knowing what the volcano might surprise you with". Some nights are calm, others furious as in this photograph, where the brightness of the crater illuminates the night sky.

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News

Shell and Equinor to merge UK North Sea oil and gas assets

The deal will create North Sea's biggest independent producer

Guardian staff and agencies

5 December 2024

Shell and Equinor will combine their UK North Sea offshore oil and gas assets to create a new company with 1,300 employees. Based in Aberdeen, the company will be the North Sea's biggest independent producer is expected to produce more than **140,000 barrels of oil equivalent (BOE) a day next year**.

There will be no job losses as a result of the deal, Shell said, adding that it could “enhance” the longevity of UK oil and gas jobs.

Norway's Equinor employs about 300 people in oil and gas roles in the UK, while Shell employs about 1,000 people in similar jobs. Equinor said the 50-50 joint-venture would create a more “cost-competitive” way of exploiting a “once-prolific basin” where “production [is] naturally declining”.

The merger will include Equinor's vast **Rosebank oil field**, which sits 80 miles (130km) north-west of Shetland and, with almost 500 million barrels of oil and gas, is the UK's largest untapped oilfield. Climate campaigners recently urged a Scottish court to cancel the licence to drill Rosebank, arguing it would cause “sizeable” and unjustified damage to the planet.

Shell will contribute nine fields (Shearwater, Penguins, Gannet, Nelson, Pierce, Jackdaw, Victory, Clair and Schiehallion) to the venture and Equinor will add three (Mariner, Rosebank and Buzzard).

Shell's integrated gas and upstream director, Zoe Yujnovich, said “anyone who has a majority of their time” working on Shell and Equinor's North Sea assets, such as oil rigs, would transfer to the new company.

She added that the deal could result in a “growing and more prosperous combined entity. From an employee point of view, I think that that can really enhance diversity of career choices, but also, I would argue, longevity of their career under the new combined entity.”



The Mariner field in the UK North Sea. (Photo: Jamie Baikie/Equinor)

She said the new company would “sustain domestic oil and gas production for decades into the future, contributing to UK energy needs”. However, she added that the North Sea was “no longer the prolific basin that it once was”.

Yujnovich said: “After decades of production, of course, there is less oil and gas, and the maturity of the basin means that inevitably what is left is more challenging to recover. For production from the North Sea, to remain competitive with other global energy hubs, it is imperative that we continue to adapt to that changing reality and to do so proactively.”

The deal is subject to regulatory approval and is expected to close by the end of 2025.

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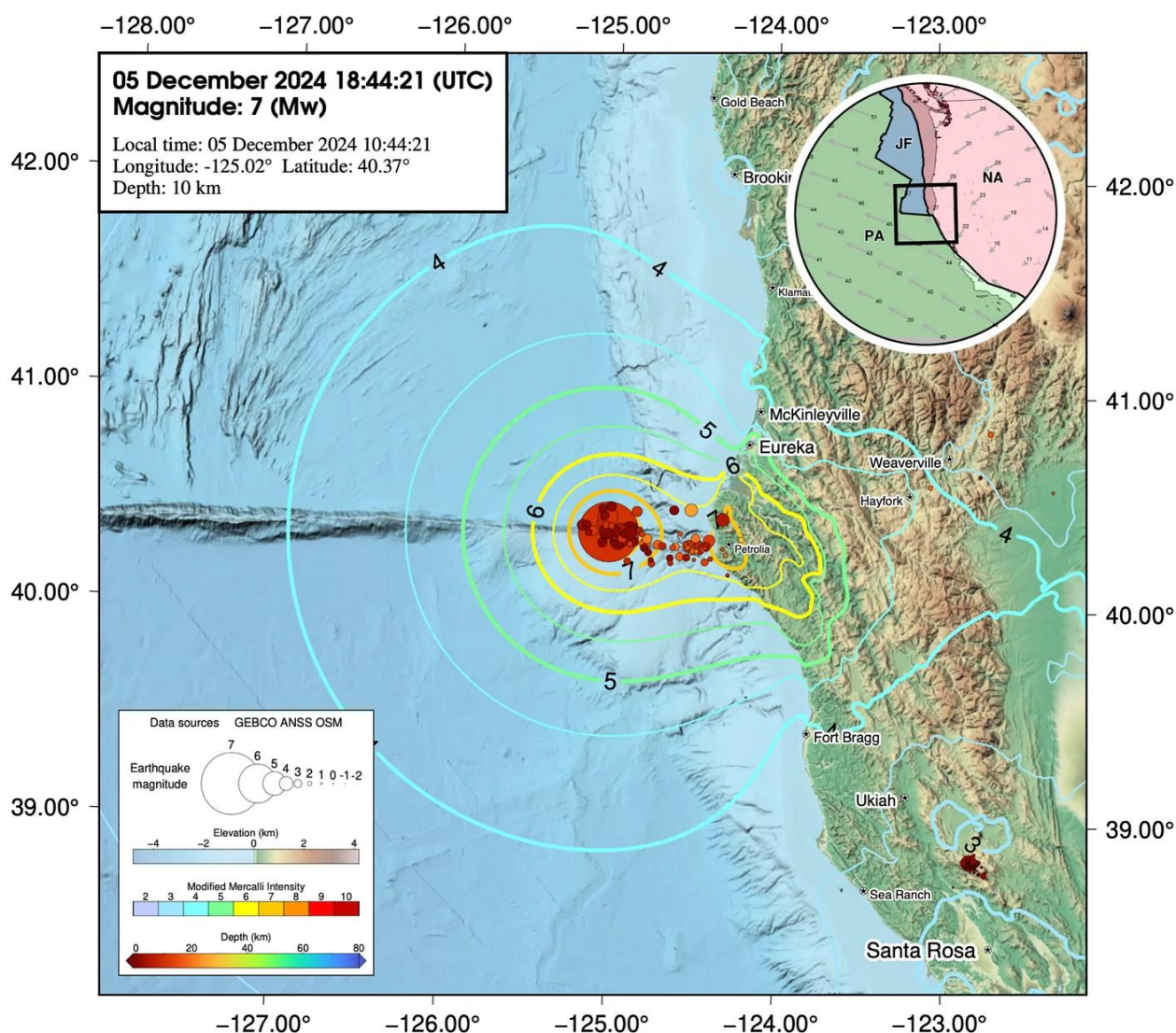
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Suggested by Angela Snowling

Massive magnitude 7 earthquake strikes off California coast

Laura Geggel, LiveScience

6 December 2024



A map showing the location and intensity of the earthquake. (Image credit: Leaflet, Google Maps, Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, **USGS**, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community)

A **magnitude 7 earthquake** hit off the coast of northern California on Thursday (Dec. 5).

However, a tsunami warning that had initially been prompted by the earthquake has now been cancelled, according to the U.S. Tsunami Warning System.

The earthquake hit at 10:44 a.m. PST (18:44 UTC) at a depth of about 0.4 mile (0.6 kilometres), according to the U.S. Geological Survey (USGS). The earthquake occurred off the coast, about 39 miles (63 km) northwest of the city of Petrolia in Humboldt County. It's likely that these numbers will be updated as the USGS gathers more information.

Currently, the USGS is reporting that the "landslides triggered by this earthquake are estimated to be limited in number." According to the **USGS Shake Map**, people reported feeling extreme shaking on the California coast by the earthquake.

Other small earthquakes, including a **magnitude 4.2** and a **magnitude 3.3**, have also hit the area today. There are no immediate reports of damage, according to the Los Angeles Times.

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Rare dinosaur trio fetches £12.4m at auction



The juvenile and adult Allosaurus sold for £8.130m (\$10.3m) (Image source: CHRISTIE'S IMAGES LTD. 2024)

Maddie Molloy, BBC Climate & Science

12 December 2024

Fossils from a trio of dinosaurs have sold for more than £12m at auction. The prehistoric skeletons, which date back approximately 150 million years, fetched £12.4m (\$15.7m) at Christie's in London.

All three skeletons - two Allosaurus and one Stegosaurus - were excavated from the same site in Carbon County, Wyoming and travelled to London in 12 crates, where they were rebuilt.

James Hyslop, Head of Science & Natural History at Christie's, said: "It is humbling to stand in the presence of these ancient giants and marvel at the wonders of our Earth's past."

The Allosaurus and Stegosaurus fossils represent two of the most recognisable dinosaurs from the Late Jurassic era, approximately 150 million years ago.

The Allosaurus, often seen as a precursor to the mighty *Tyrannosaurus rex* (*T. rex*), was a paramount predator in its day, notable for its sharp claws and a powerful bite.

Meanwhile, the Stegosaurus is seen as an iconic herbivore, whose armoured plates and spiked tail helped it to defend itself against predators and adapt to a challenging environment.



The Stegosaurus fetched a hammer price of £4.275m (\$5.4m). (Image source: CHRISTIE'S IMAGES LTD. 2024)

"There is no complete dinosaur skeleton" explained Mr Hyslop, so all three fossils have been enhanced with cast, sculpted, 3D-printed materials, and are displayed on custom frames.

In terms of fossils, the Stegosaurus has around 144 bone elements; the adult Allosaurus has about 143, with the juvenile version having 135.

Dinosaur bones can sell for millions, but auction sales have been criticised by some experts, who argue that fossils often end up in private collections which then denies researchers - and the public - any access to these significant discoveries.

"The problem is these specimens go on sale for huge amounts of money, far more than museums can afford," Dr. Susannah Maidment, from London's Natural History Museum, told the BBC in 2019.

However, Mr. Hyslop claimed, in his experience, "The majority of private collectors active in this area are keen to share their passion. In the case of the two most recent dinosaurs sold at Christie's - Stan, the T-Rex, and a raptor skeleton - both are now in the care of museums, or on public display," he said.

Reference:

<https://www.bbc.co.uk/news/articles/ceqlj97nq0jo>

'Alien plant' fossil discovered near Utah ghost town doesn't belong to any known plant families, living or extinct

Olivia Ferrari, LiveScience

19 December 2024

Fossilized plant remains discovered near a Utah ghost town have stumped scientists, who are unable to link them to any modern or extinct plants.

Scientists have discovered that an "alien plant" first found near a Utah ghost town 55 years ago doesn't appear to be related to any currently living family or genus.

Palaeontologists first found fossilized leaf specimens of the plant in 1969 and named it ***Othniophyton elongatum***, which translates to "alien plant." At the time, they believed the extinct species could be related to ginseng.

A more recent analysis, however, has challenged that hypothesis. Steven Manchester, curator of palaeobotany at the Florida Museum of Natural History and Utah fossil expert, came across an unidentified plant fossil while visiting the University of California, Berkeley palaeobotany collection. This plant fossil was well preserved and had come from the same area as the alien plant leaves.

Manchester's research team analysed the fossils and concluded they were from the same plant species, according to their study published Nov. 9 in the journal ***Annals of Botany***.

Both fossil specimens were excavated from the Green River Formation in eastern Utah, near the former town of Rainbow. Around 47 million years ago, when the plants lived, the region was a huge lake ecosystem near active volcanoes. Lake sediment and volcanic ash slowed decomposition in fish, reptile, bird and plant remains, enabling some to be extremely well preserved.

The researchers analysed both fossils' physical features and searched for living plant families that could be similar. Unlike the 1969 find, the specimen at UC Berkeley had leaves, flowers and fruits attached, which looked very different from those of plants related to ginseng. In fact, the researchers couldn't match the fossils to any of the over 400 families of flowering plants living today, and extinct families.

When scientists studied the original fossils in 1969, they were working only with leaves, not with flowers, fruits or branches; based on the arrangement of the leaves' vein patterns, they theorized the leaf structure could be similar to that of plants in the ginseng family. With the detail provided by the



The Othniophyton elongatum fossil. (Image credit: Florida Museum photo by Jeff Gage)



A reconstruction of Othniophyton elongatum. (Image credit: Ashley Hamersma, Manchester et al., 2024)

newer fossil, the researchers had a better picture of what the plant would have looked like and discounted the ginseng connection but still couldn't pinpoint the plant's family.

A few years later, the **Florida Museum of Natural History** had access to new microscopy and artificial intelligence technology that enabled even more detailed viewing of the plant fossils. Micro-impressions of small, developing seeds were visible in the fossil's fruits. The research team could also see stamens — flowers' male reproductive organs — which in most plant species detach after fertilization.

"Usually, stamens will fall away as the fruit develops. And this thing seems unusual in that it's retaining the stamens at the time it has mature fruits with seeds ready to disperse. We haven't seen that in anything modern," Manchester said in a statement.

Comparing these traits to extinct families didn't result in any matches either, but this isn't the only species from the Green River Formation that has stumped scientists. This region has previously produced other plant fossils, like *Bonanzacarpum* fruit and *Palibinia* leaves, that have surprised scientists and ultimately led to the discovery of extinct groups.

Reference:

https://www.livescience.com/planet-earth/plants/alien-plant-fossil-discovered-near-utah-ghost-town-doesnt-belong-to-any-known-plant-families-living-or-extinct?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=90483378-7F8C-42C0-9F24-19DEF9B27FD9&utm_source=SmartBrief

Cartoon

STICKS AND STONES : THE BIG ISSUES

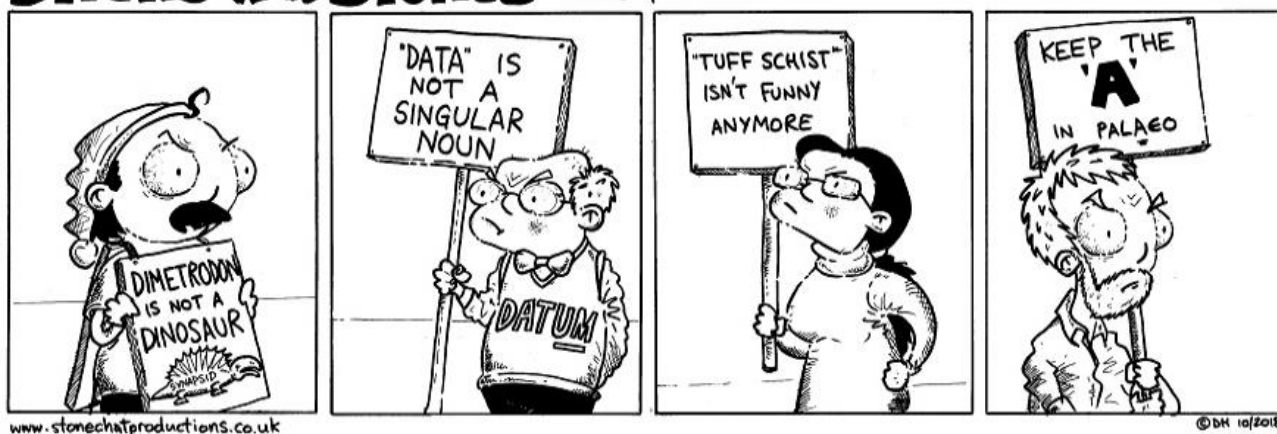


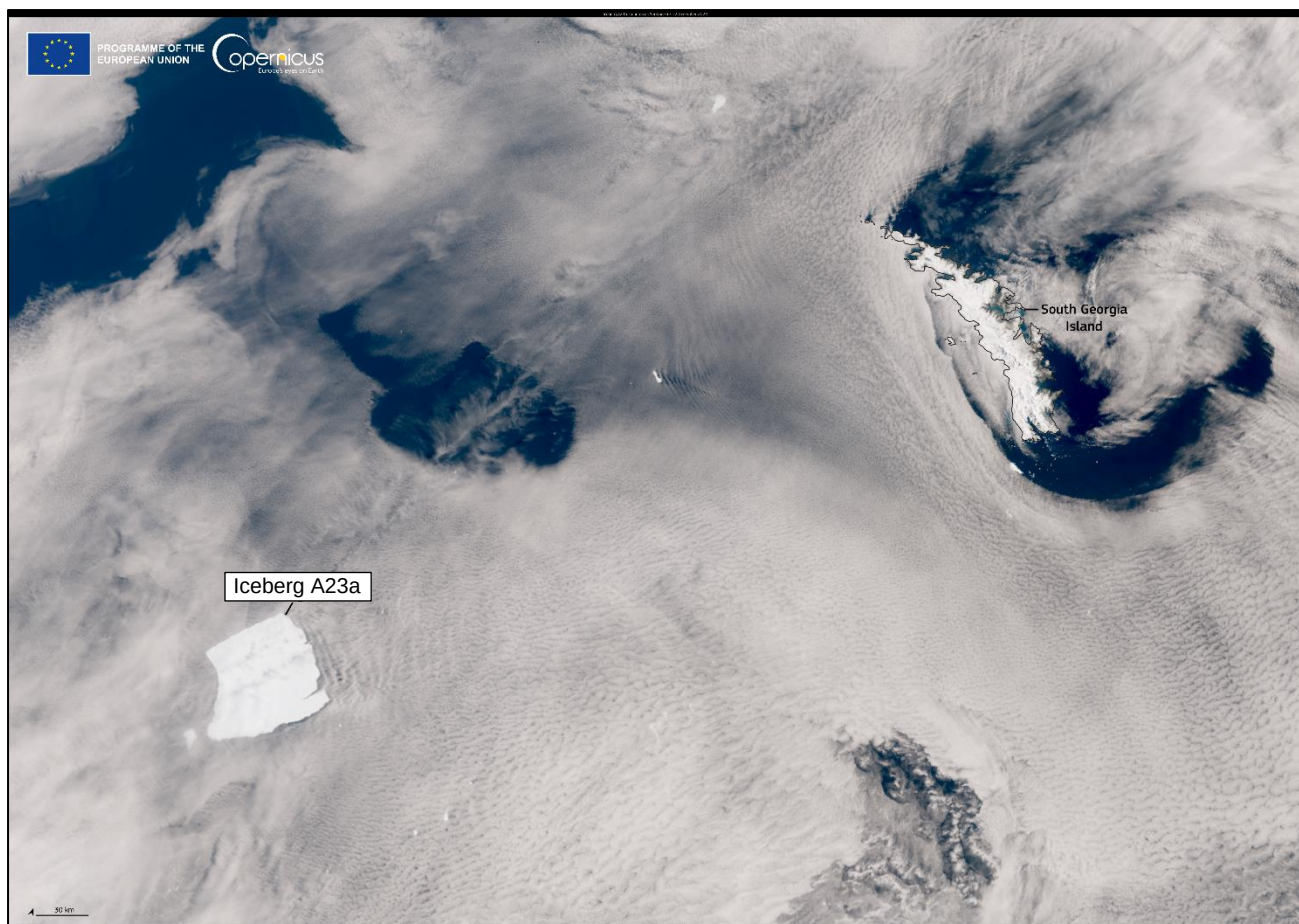
Image Of The Day 2

A23a the world's largest iceberg is moving northward

Date: 21/12/2024

Location: Antarctica

Credit: European Union, Copernicus Sentinel-3 imagery



With a surface area of almost **3,500 square kilometres** and a thickness of **400 metres**, A23a is the largest iceberg in the world. After calving from the Filchner-Ronne ice shelf in West Antarctica in **1986**, the iceberg was stuck on the floor of the Antarctic Ocean for over 30 years. However, it has recently started to move again, drifting northward towards the southern Atlantic Ocean.

Oceanographers suggest that A23a will eventually enter the warmer waters of the Atlantic Ocean, where it is expected to break into smaller icebergs and melt.

This image, acquired by one of the **Copernicus Sentinel-3** satellites on 12 December 2024, shows the iceberg when it was 400 km southwest of the island of South Georgia.

Reference:

<https://www.copernicus.eu/en/media/image-day-gallery/a23a-worlds-largest-iceberg-moving-northward>

TV Review

Monsters of the Deep: 20,000 Leagues Under the Sea

Channel 5

Sunday, 29 December 2024

Part 2 of 2. A look at the world of the deep-sea giants that live at depths over 1,000 metres, including the giant squid and the massive extinct shark species **megalo****d**on. Experts reveal rare behaviours and the incredible size of these creatures, with **Steve Backshall** meeting Dr. Nathan Robinson to uncover the giant squid's mysteries. Also featured is the cookiecutter shark, an abyssal giant that grow 700 times larger than its shallow-water equivalents, as well as new discoveries like **Ichthyotitan**.

News

'Significant' tree fossil find at Devon cove

The discovery of a tree fossil in Torbay has been described as a "remarkable find"

George Thorpe, BBC News, Devon

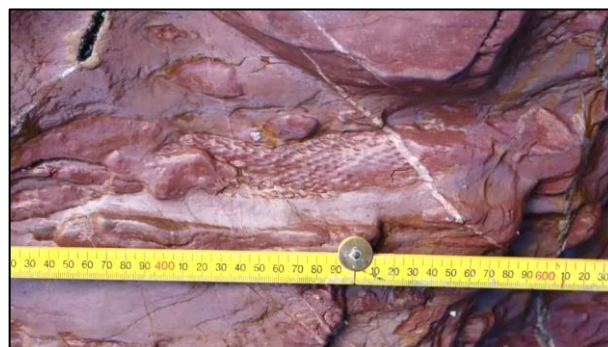
27 December 2024

A "groundbreaking" fossil has been discovered in part of south Devon, council bosses say.

Torbay Council said the fossils of trees, known as **lycopsids** and believed to be about **377 million years old**, were found by Dr. Kevin Page during a survey of Saltern Cove, near Paignton, which is part of the **English Riviera UNESCO Global Geopark**.

The council said *lycopsids* looked like palm trees and were the ancestors of giant trees that once contributed to coal formation.

Dr. Page, president of ProGEO [the International Association for the Conservation of Geological Heritage] and honorary senior research fellow at Camborne School of Mines, University of Exeter, said the discovery was a "remarkable find".



The discovery of a tree fossil in Torbay has been described as a "remarkable find". (Credit; Torbay Council)

'Devonian desert island'

Dr. Page said: "These fossils are incredibly significant as they provide valuable insights into the prehistoric environment of Torbay, including the presence of volcanic islands with trees growing on them. This could potentially be the first record of a Devonian desert island with trees."

Geopark coordinator Melanie Border said the fossil could open a "new chapter" of changing environments and conditions at the site. She added: "To date, our Devonian age rocks have only provided evidence of a marine environment. But it's very exciting to think we now have evidence of volcanic islands and trees too."

Reference:

<https://www.bbc.co.uk/news/articles/c5yd9jp89jxo>

Suggested by Anne & Mike Mitchell

NASA Is Watching a Vast, Growing Anomaly in Earth's Magnetic Field

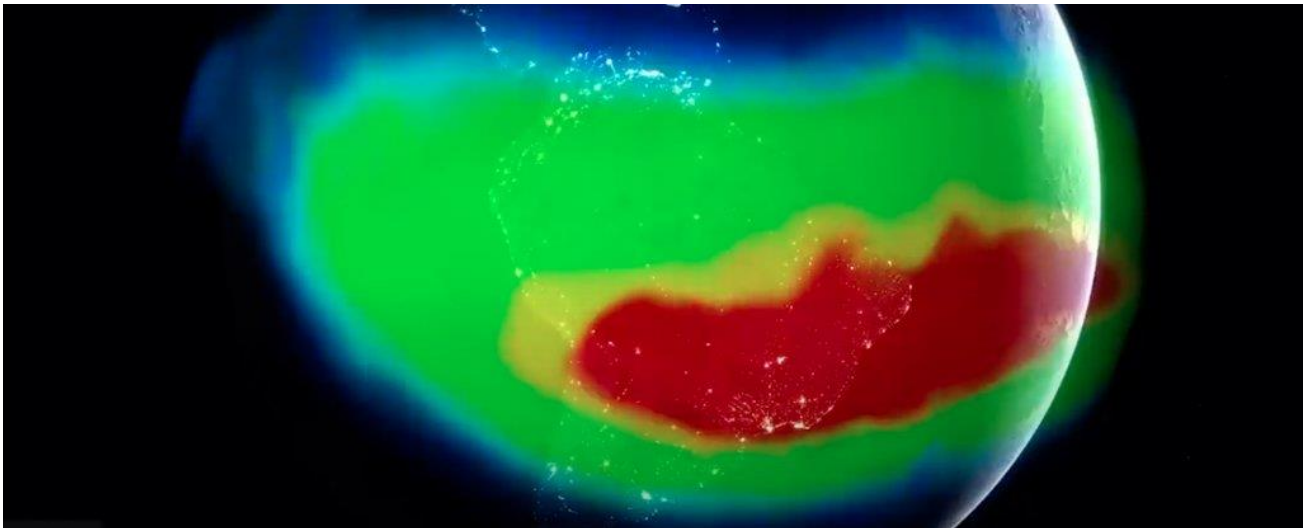
Peter Dockrill, ScienceAlert

29 December 2024

NASA has been monitoring a strange anomaly in Earth's magnetic field: a giant region of lower magnetic intensity in the skies above the planet, stretching out between South America and southwest Africa.

This vast, developing phenomenon, called the **South Atlantic Anomaly**, has intrigued and concerned scientists for years, and perhaps none more so than NASA researchers.

The space agency's satellites and spacecraft are particularly vulnerable to the weakened magnetic field strength within the anomaly, and the resulting exposure to charged particles from the Sun.



The South Atlantic Anomaly. (NASA Goddard/YouTube)

The **South Atlantic Anomaly** (SAA) – likened by NASA to a 'dent' in Earth's magnetic field, or a kind of 'pothole in space' – generally doesn't affect life on Earth, but the same can't be said for orbital spacecraft (including the International Space Station), which pass directly through the anomaly as they loop around the planet at low-Earth orbit altitudes.

During these encounters, the reduced magnetic field strength inside the anomaly means technological systems onboard satellites can short-circuit and malfunction if they become struck by high-energy protons emanating from the Sun.

These random hits may usually only produce low-level glitches, but they do carry the risk of causing significant data loss, or even permanent damage to key components – threats obliging satellite operators to routinely shut down spacecraft systems before spacecraft enter the anomaly zone.

Mitigating those hazards in space is one reason NASA is tracking the SAA; another is that the mystery of the anomaly represents a great opportunity to investigate a complex and difficult-to-understand phenomenon, and NASA's broad resources and research groups are uniquely well-appointed to study the occurrence.

"The magnetic field is actually a superposition of fields from many current sources," geophysicist Terry Sabaka from NASA's Goddard Space Flight Centre in Greenbelt, Maryland explained in 2020.

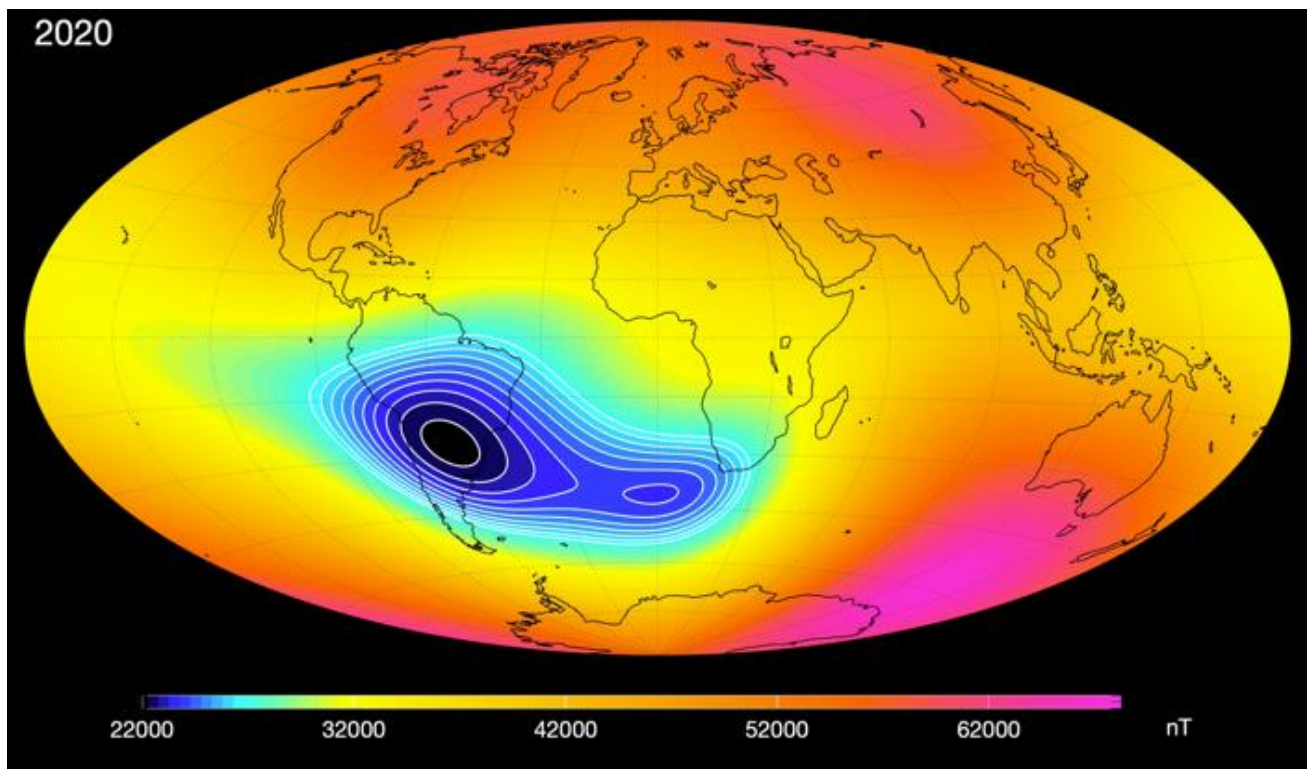
The primary source is considered to be a swirling ocean of molten iron inside Earth's outer core, thousands of kilometres below the ground. The movement of that mass generates electrical currents that create Earth's magnetic field, but not necessarily uniformly, it seems.

A huge reservoir of dense rock called the African Large Low Shear Velocity Province, located about 2,900 kilometres (1,800 miles) below the African continent, is thought to disturb the field's generation, resulting in the dramatic weakening effect – which is aided by the tilt of the planet's magnetic axis.

"The observed SAA can be also interpreted as a consequence of weakening dominance of the dipole field in the region," said NASA Goddard geophysicist and mathematician Weijia Kuang in 2020.

"More specifically, a localized field with reversed polarity grows strongly in the SAA region, thus making the field intensity very weak, weaker than that of the surrounding regions."

While there's much scientists still don't fully understand about the anomaly and its implications, new insights are continually shedding light on this strange phenomenon.



Satellite data suggesting the SAA is dividing. (Credit: Division of Geomagnetism, DTU Space)

For example, one study led by NASA heliophysicist Ashley Greeley in 2016 revealed the SAA slowly drifts around, which was confirmed by subsequent tracking from CubeSats in research published in 2021.

It's not just moving, however. Even more remarkably, the phenomenon seems to be in the process of splitting in two, with researchers in 2020 discovering that the SAA appeared to be dividing into two distinct cells, each representing a separate centre of minimum magnetic intensity within the greater anomaly.

Just what that means for the future of the SAA remains unknown, but in any case, there's evidence to suggest that the anomaly is not a new appearance.

A study published in July 2020 suggested the phenomenon is not a freak event of recent times, but a recurrent magnetic event that may have affected Earth since as far back as 11 million years ago. If so, that could signal that the South Atlantic Anomaly is **not a trigger** or **precursor** to the entire planet's magnetic field flipping, which is something that actually happens, if not for hundreds of thousands of years at a time. A more recent study published this year found the SAA also has an impact on auroras seen on Earth.

Obviously, huge questions remain, but with so much going on with this vast magnetic oddity, it's good to know the world's most powerful space agency is watching it as closely as they are.

"Even though the SAA is slow-moving, it is going through some change in morphology, so it's also important that we keep observing it by having continued missions," said Sabaka. "Because that's what helps us make models and predictions."

Reference:

<https://www.sciencealert.com/nasa-is-watching-a-vast-growing-anomaly-in-earths-magnetic-field>

UK's biggest ever dinosaur footprint site unearthed

Rebecca Morelle, BBC Science Editor & Alison Francis, BBC Senior Science Journalist

2 January 2025

The UK's biggest ever dinosaur trackway site has been discovered in a quarry in Oxfordshire. About 200 huge footprints, which were made 166 million years ago, criss-cross the limestone floor. They reveal the comings and goings of two different types of dinosaurs that are thought to be a long-necked sauropod called **Cetiosaurus** and the smaller meat-eating **Megalosaurus**.

The longest trackways are 150m in length, but they could extend much further as only part of the quarry has been excavated.

"This is one of the most impressive track sites I've ever seen, in terms of scale, in terms of the size of the tracks," said Prof. Kirsty Edgar, a micropalaeontologist from the University of Birmingham. "You can step back in time and get an idea of what it would have been like, these massive creatures just roaming around, going about their own business."



These footprints were made 166 million years ago as a dinosaur walked across a lagoon. (Image source: Kevin Church/BBC)

The tracks were first spotted by Gary Johnson, a worker at Dewars Farm Quarry, while he was driving a digger.

"I was basically clearing the clay, and I hit a hump, and I thought it's just an abnormality in the ground," he said, pointing to a ridge where some mud has been pushed up as a dinosaur's foot pressed down into the earth. But then it got to another, 3m along, and it was a hump again. And then it went another 3m - hump again."

Another trackway site had been found nearby in the 1990s, so he realised the regular bumps and dips could be dinosaur footprints. "I thought I'm the first person to see them. And it was so surreal - a bit of a tingling moment, really," he told BBC News.

Last summer, more than 100 scientists, students and volunteers joined an excavation at the quarry which features on the new series of **Digging for Britain**.

The team found five different trackways. Four of them were made by sauropods, plant-eating dinosaurs that walked on four legs. Their footprints look a bit like an elephant's - only much much bigger - these beasts reached up to 18m in length. Another track is thought to have been created by a Megalosaurus.

"It's almost like a caricature of a dinosaur footprint", explained **Dr. Emma Nicholls**, a vertebrate palaeontologist from the Oxford University Museum of Natural History. "It's what we call a tridactyl print. It's got these three toes that are very, very clear in the print."

The carnivorous creatures, which walked on two legs, were agile hunters, she said. "The whole animal would have been 6-9m in length. They were the largest predatory dinosaurs that we know of in the Jurassic period in Britain."

The environment they lived in was covered by a warm, shallow lagoon and the dinosaurs left their prints as they ambled across the mud.

"Something must have happened to preserve these in the fossil record," said Prof Richard Butler, a palaeobiologist from the University of Birmingham.

"We don't know exactly what, but it might be that there was a storm event that came in, deposited a load of sediments on top of the footprints, and meant that they were preserved rather than just being washed away."

The team studied the trackways in detail during the dig. As well as making casts of the tracks, they took more than 20,000 photographs to create 3D models of both the complete site and individual footprints.

"The really lovely thing about a dinosaur footprint, particularly if you have a trackway, is that it is a snapshot in the life of the animal," Prof. Butler explained.

"You can learn things about how that animal moved. You can learn exactly what the environment that it was living in was like. So, tracks give us a whole different set of information that you can't get from the bone fossil record."

One area of the site even reveals where the paths of a sauropod and megalosaurus once crossed.

The prints are so beautifully preserved that the team have been able to work out which animal passed through first - they believe it was the sauropod, because the front edge of its large, round footprint is slightly squashed down by the three-toed megalosaurus walking on top of it.



Scientists think these distinctive three-toed prints were made by a Megalosaurus. (Credit: Emma Nicholls/Oxford University Museum of Natural History)



The trackways form a prehistoric crossroads. (Image source: Kevin Church/BBC)

"Knowing that this one individual dinosaur walked across this surface and left exactly that print is so exhilarating," said Dr. Duncan Murdock from Oxford University. "You can sort of imagine it making its way through, pulling its legs out of the mud as it was going."

The future fate of the trackways hasn't yet been decided but the scientists are working with Smiths Bletchington, who operate the quarry, and Natural England on options for preserving the site for the future.

They believe there could be more footprints, these echoes of our prehistoric past, just waiting to be discovered.

*The excavation is featured on **Digging for Britain, Series 12, Episode 2** and is available on BBC iPlayer.*

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<https://www.theguardian.com/commentisfree/2025/jan/05/i-can-just-see-those-dinosaurs-plodding-through-the-cotswold-mud>

Tibet earthquake: scores dead and hundreds of homes damaged

Quake damaged buildings in Shigatse and could be felt hundreds of kilometres away in Nepal and the Indian state of Bihar

Helen Davidson, The Guardian in Taiwan and agencies

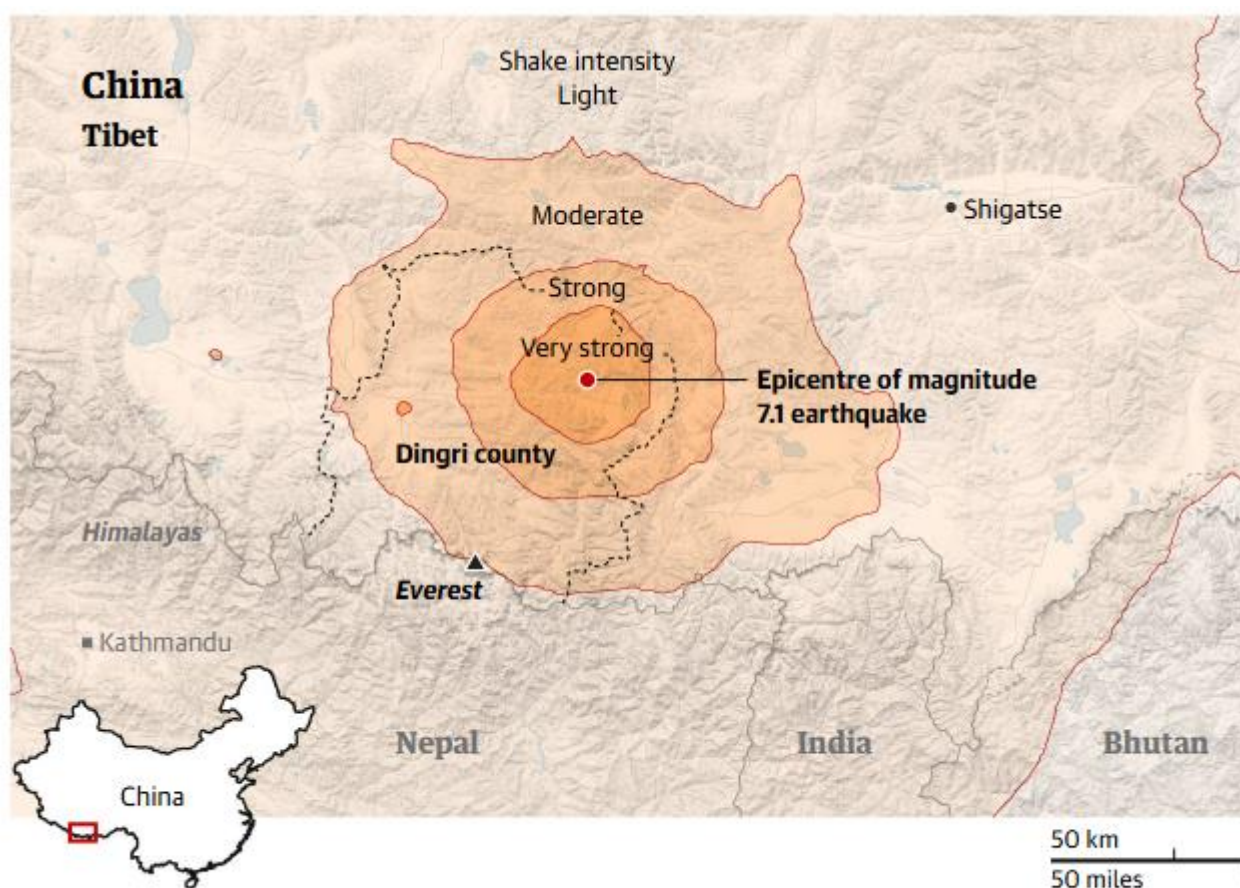
7 January 2025

A strong earthquake has struck near Shigatse, one of Tibet's holiest cities, killing scores of people, damaging buildings, and sending people running to the streets in neighbouring Nepal and India.

Chinese state media said at least 126 people had died, more than 188 had been injured, and about 1,000 houses were damaged in the quake, which hit at 9.05am on Tuesday. The US Geological Survey said the earthquake was centred in the Tibet region at a depth of about 10km (6 miles). It measured the tremor at **magnitude 7.1**, while China recorded it as **6.8**.

The Chinese president, Xi Jinping, said all-out search and rescue efforts should be carried out to minimise casualties, properly resettle the affected people, and ensure a safe and warm winter.

The Dalai Lama, the spiritual leader of Tibetan Buddhism, who lives in exile in India, said he was "deeply saddened" by the natural disaster. "I offer my prayers for those who have lost their lives and extend my wishes for a swift recovery to all who have been injured," he said.



Guardian graphic. Source: USGS

Tenzin Lekshay, a spokesperson for the Central Tibetan Administration, the government in exile for Tibet, said: "We are deeply saddened by the loss of lives and the extensive destruction of property in Tibet following the recent series of earthquakes. Our heartfelt condolences go out to the grieving families. We are holding a prayer service in remembrance and solidarity."

More than 1,500 local firefighters and rescue workers have been dispatched to the affected areas, Xinhua news agency reported. Some 22,000 items including cotton tents, cotton coats, quilts and folding beds have also been sent to the quake-hit region, it said.

The state broadcaster CCTV said earlier: "Dingri county and its surrounding areas experienced very strong tremors, and many buildings near the epicentre have collapsed." It said more than 40 aftershocks had been registered by midday, including 16 above magnitude 3.0.

Dingri is a county home to about 60,000 people, according to 2020 figures. The average altitude in the area around the epicentre, which borders the Himalayas, is about 4,200 metres. Temperatures in Dingri are around -8C (18F) and will drop to -18C this evening, according to the China Meteorological Administration.

Li Qiang, China's premier, stressed the need to ensure that people in the quake-stricken area were kept warm, according to Chinese state media.

Shigatse is regarded as the seat of the Panchen Lama, a holy figure in Tibetan Buddhism who is second only to the Dalai Lama.

Crumbled shop fronts could be seen in a video showing the aftermath from the nearby town of Lhatse, with debris spilling out on to the road.

Reuters was able to confirm the location from nearby buildings, windows, road layout and signage that match satellite and street view imagery. The date could not be verified independently.

Tremors were felt in Nepal's capital, Kathmandu, 400km (250 miles) away, where residents ran from their houses. Tremors were also felt in the northern Indian state of Bihar, which borders Nepal. As walls shook, people rushed out of their homes and apartments to open areas. So far, no reports of any damage or loss to property have been received, officials in India said.

A magnitude 7.1 quake is **considered strong** and is **capable of causing severe damage**.

South-western parts of China are frequently hit by earthquakes. A huge quake in Sichuan province in 2008 killed almost 70,000 people.

According to CCTV, there have been 29 earthquakes with magnitudes of three or higher within 200km of the Shigatse quake in the past five years, all of which were smaller than the one that struck on Tuesday morning.

In 2015, a magnitude 7.8 tremor struck near Kathmandu in neighbouring Nepal, killing about 9,000 people and injuring thousands in that country's worst earthquake.

Reuters and Agence France-Presse contributed to this report

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Image Of The Day 3

Serranía de Hornocal, the 'Mountain of 14 Colours', Argentina

Date: 05/01/2025

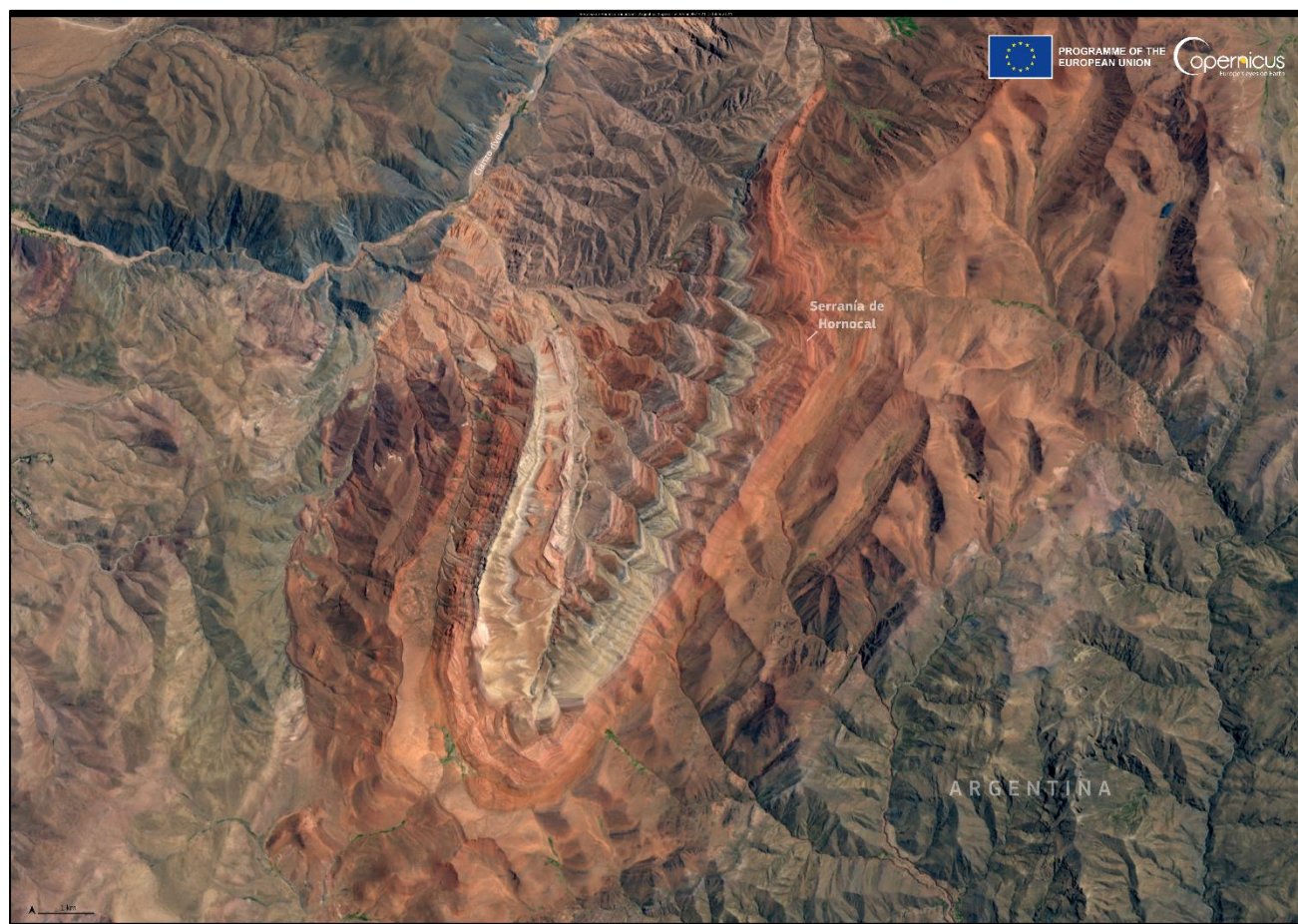
Location: Argentina

Credit: European Union, Copernicus Sentinel-2 imagery

The Serranía de Hornocal, located in northern Argentina, is a striking mountain range famous for its vibrant, multi-coloured slopes. Known as the '**Mountain of 14 Colours**', it provides one of the most stunning landscapes in the Andes. The colours are the result of **mineral-rich sedimentary layers**, creating a vivid palette of reds, purples, greens, and yellows.

The range is part of the larger Quebrada de Humahuaca UNESCO World Heritage site and is popular with hikers and photographers alike.

This **Copernicus Sentinel-2** image, acquired on 21 October 2024, shows the beautiful hues of the Serranía de Hornocal mountain range.



Reference:

<https://www.copernicus.eu/en/media/image-day-gallery/serrania-de-hornocal-mountain-14-colours-argentina>

Further Reading

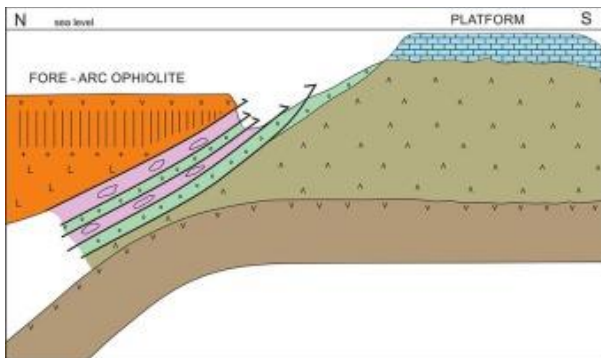


Neotethyan Ankara Melange, central Turkey: Formation by accretion of seamounts and supra-subduction zone ophiolites in an oceanic fore-arc setting

Suggested by Angela Snowling

Alastair H.F. Robertson, Osman Parlak, Kemal Taslı, Paulian Dumitrica & Timur Ustaömer

*Journal of Asian Earth Sciences:
Volume 10, 1 December 2023*



<https://www.sciencedirect.com/science/article/pii/S2590056023000166>

What were the first birds like?



The earliest ancestors of birds were a lot more dinosaur-like in appearance. (© Liliya Butenko/ Shutterstock)

Birds have many features that distinguish them from other animals alive today, but

their earliest ancestors looked noticeably different from the familiar creatures we've come to recognise.

Emma Caton, NHM

https://www.nhm.ac.uk/discover/what-were-the-first-birds-like.html?utm_content=pod2-cta&utm_medium=email&utm_source=2532335_ma_sciencestories_20241014&utm_term=&ID=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&dm_i=2XEG,1I9YN,6L3SCQ,60ZKI,1

'It's our moonshot': Why scientists are drilling into volcanos

Adrienne Murray, BBC Science

18 October 2024



Iceland is one of the world's most volcanically active places. (Credit: Getty Images)

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Fossils show flying reptiles ate squid and fish

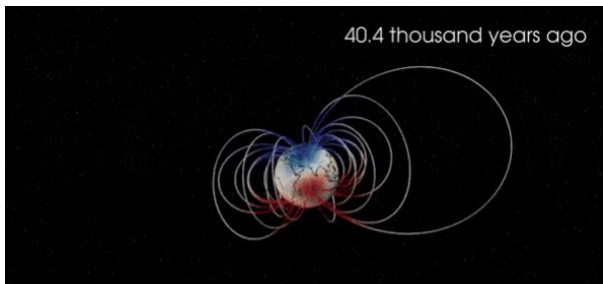
BBC Science

28 October 2024

<https://www.bbc.co.uk/news/articles/cx2ym7zedrno>

Listen to haunting sounds of Earth's magnetic field flipping 41,000 years ago in eerie new animation

A new video shows how Earth's magnetic field weakened and warped before temporarily flipping during a recent "polar reversal event."



(Image credit: Animation and science: Maximilian Arthus Schanner and Guram Kervalishvili (GFZ); Sound: Klaus Nielsen (DTU Space))

Harry Baker, LiveScience

21 October 2024

https://www.livescience.com/planet-earth/geology/listen-to-haunting-sounds-of-earths-magnetic-field-flipping-41-000-years-ago-in-eerie-new-animation?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=4C1BB011-AFD8-4390-8A38-D495FEF0CC47&utm_source=SmartBrief

Spider relative 3D fossil preserved in fool's gold

BBC Science

30 October 2024



University of Oxford associate prof Luke Parry called the fossils "spectacularly preserved" (Credit: PA)

<https://www.bbc.co.uk/news/articles/cy8n92w5d1eo>

Wheels up to change rules of oil & gas game in UK waters while windfall tax hike gets green light

Melisa Čavčić, Offshore Energy

4 November 2024

<https://www.offshore-energy.biz/wheels-up-to-change-rules-of-oil-gas-game-in-uk-waters-while-windfall-tax-hike-gets-green-light/?cdmwt=ASEABAAQUKEAVQELkkPUAxb8skRiEzlaBMhljg>

New study on moons of Uranus raises chance of life



Uranus and its five largest moons had been thought to be inactive and sterile. (Credit: SPL)

Pallab Ghosh, BBC Science Correspondent

11 November 2024

<https://www.bbc.co.uk/news/articles/cgk1333k0ypo>

https://www.space.com/the-universe/uranus/are-there-hidden-oceans-inside-the-moons-of-uranus-their-wobbles-could-tell-us?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=640E6FC6-8026-4B10-8917-28651DE4F017&utm_source=SmartBrief

Hiker discovers first trace of entire prehistoric ecosystem in Italian Alps

Angela Giuffrida, *The Guardian Rome*
14 November 2024

Melting snow and ice has revealed footprints of reptiles and amphibians, dating back 280 million years



A prehistoric ecosystem dating back 280m years has been discovered in the mountains of Lombardy. (Credit: Museo di Storia Naturale di Milano)

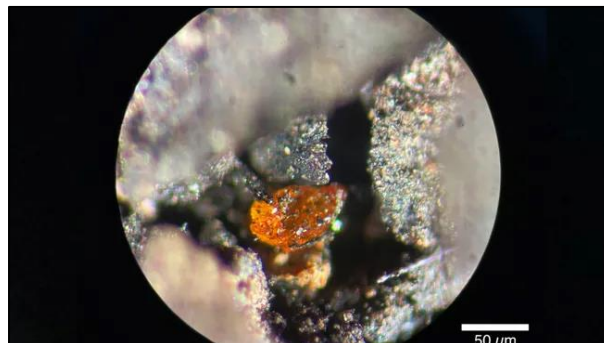
<https://www.theguardian.com/world/2024/nov/14/hiker-discovers-first-trace-of-entire-prehistoric-ecosystem-in-italian-alps?fbclid=IwY2xjawGj4vtleHRuA2FlbQIxMAABHUHpa43Zq2Q9LOFCxWM6ioBAuncDsZoXYDbjEF717eFbnXhzcMilPdRNAaemvIIRxbMyHjOoBhbj-I9dSw>

'Another piece of the puzzle': Antarctica's 1st-ever amber fossil sheds light on dinosaur-era rainforest that covered South Pole 90 million years ago

Until now, Antarctica was the only continent on Earth without any known amber fossils. But sediment cores taken from below the seafloor have revealed a tiny piece of fossilized resin holding fragments of an ancient rainforest that covered the South Pole during the Cretaceous period.

Harry Baker, *LiveScience*

14 November 2024



Researchers found Antarctica's first ever piece of amber in sediment cores collected from the seafloor off the icy continent's coast. (Image credit: Alfred-Wegener-Institut / V. Schumacher)

https://www.livescience.com/planet-earth/fossils/another-piece-of-the-puzzle-antarcticas-1st-ever-amber-fossil-sheds-light-on-dinosaur-era-rainforest-that-covered-south-pole-90-million-years-ago?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=F9F54481-73E0-473D-AB52-A61066173D4D&utm_source=SmartBrief

Geology is racist as it is 'linked to white supremacy' claims Queen Mary University of London professor

Rory Fleming, *The Daily Mail Online*
16 November 2024

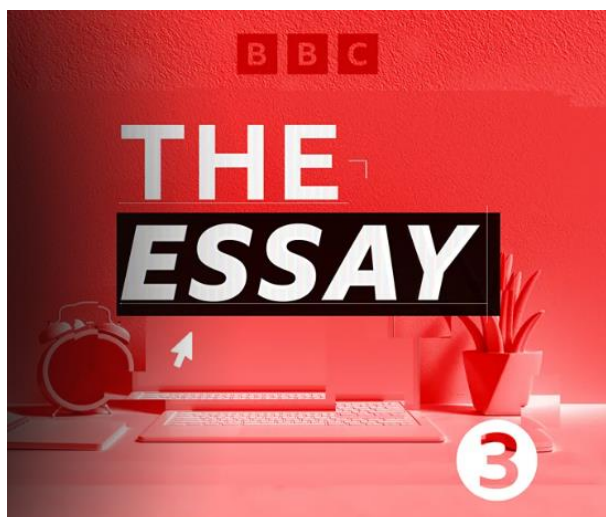
A geography professor at a leading British university has described the study of rocks and the natural world as racist and linked the academic field to 'white supremacy'.

Kathryn Yusoff, who lectures at the prestigious Queen Mary University of London, said that the geology as a subject was 'riven by systematic racism' and influenced heavily by colonialism.

The study of prehistoric life through fossils was also branded as an enabler for racism, with the professor referring to the field of palaeontology as 'pale-ontology'.

Arguing that geology began as a 'colonial practice', Professor Yusoff stated in her book 'Geologic Life' that the extraction of metals such as gold and iron had created hierarchies, pushed materialism, ravaged environments and was the root cause of climate change.

<https://www.dailymail.co.uk/news/article-14091119/Geology-racist-linked-white-supremacy-claims-Queen-Mary-University-London-professor.html>



Suggested by Judith Wilson

BBC Radio 3 Podcast

The Essay

Leading writers on arts, history, philosophy, science, religion and beyond, themed across a week - insight, opinion and intellectual surprise.

Scotland Rocks

Gold, Agate, Aquamarine, Serpentine, Amber

Kenneth Steven combines Scottish landscape and geological history with his own poetry.

<https://www.bbc.co.uk/programmes/b006x3hl>

UK's offshore oil & gas decom bill to hit £24.6 billion by 2033

Melisa Čavčić, Offshore Energy

19 November 2024

While the oil and gas industry's decommissioning activities accounted for 12% of total expenditure on the UK Continental Shelf (UKCS) last year, Britain's trade body for the offshore energy industry, Offshore Energies UK (OEUK), has outlined the possibility of an uptick to 33% by 2030 in its new report. As a result, decommissioning work could account for 22% of the cumulative oil and gas spend over the next ten years.

https://www.offshore-energy.biz/uks-offshore-oil-gas-decom-bill-to-hit-24-6-billion-by-2033/?utm_placeholder_value=&cdmwt=IACA AABQoCLRBVKxWJKDBnw7UusfAEY060KO

Charles Darwin: History's most famous biologist

By Kerry Lotzof, NHM

Charles Robert Darwin (1809-1882) transformed the way we understand the natural world with ideas that, in his day, were nothing short of revolutionary.

He and his fellow pioneers in the field of biology gave us insight into the fantastic diversity of life on Earth and its origins, including our own as a species.

https://www.nhm.ac.uk/discover/charles-darwin-most-famous-biologist.html?fbclid=IwY2xjawGxF1pleHRuA2FlbQlXMAABHaqOjoXPW33WFXbTobvxynP3O2MpRLALKzixwwdyrJZjLIQCM19EUeDnUg_aemUiSMggjkTqtpf6_2szqNmQ

Dinosaur fossils reveal how birds got their distinctive walks

James Ashworth, NHM

20 November 2024

<https://www.nhm.ac.uk/discover/news/2024/november/dinosaur-fossils-reveal-how-birds-got-distinctive-walks.html#:~:text=One%20of%20the%20two%20lower,all%20descended%20from%20extinct%20dinosaurs.>

28 November 2024

Did alien life exist in hot water on Mars billions of years ago?

Robert Lea, space.com

22 November 2024

The Mars meteorite 'Black Beauty' suggests there used to be hot water on the Red Planet.



(Left) an image of Mars as the dry and arid planet we know today; (right) the Mars meteorite Black Beauty which indicates the planet's watery past. (Image credit: NASA/Curtin University)

https://www.space.com/mars-hot-water-alien-life-past?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=C327009D-052E-4F8A-8F8E-06F7B220F47A&utm_source=SmartBrief

1.5 million-year-old footprints reveal our Homo erectus ancestors lived with a 2nd proto-human species

Kristina Killgrove, LiveScience



An aerial photograph of excavated footprints, with research team members standing alongside. (Image credit: Louise N. Leakey, Turkana Basin Institute and Stony Brook University)

A set of footprints found at the site of Koobi Fora in Kenya reveals that our ancestor Homo erectus coexisted with a now-extinct bipedal hominin, Paranthropus boisei, 1.5 million years ago.

https://www.livescience.com/archaeology/1-5-million-year-old-footprints-reveal-our-homo-erectus-ancestors-lived-with-a-2nd-proto-human-species?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=66B32502-FF0B-4D6D-AE13-7495107EE7CA&utm_source=SmartBrief

Carbon capture and storage (CCS)

New powder that captures carbon could be 'quantum leap' for industry

Katharine Gammon, The Guardian

29 November 2024

A 'covalent organic framework' can be used to capture carbon to store it or convert it for industrial use

<https://www.theguardian.com/environment/2024/nov/29/covalent-organic-framework-carbon-capture-powder>

NSTA awards Endurance first ever UK carbon storage permit

NSTA

10 December 2024

- *First injection could come as early as 2027*
- *Site off coast of Teesside could store up to 100 million tonnes of CO2*

<https://www.nstauthority.co.uk/news-publications/nsta-awards-endurance-first-ever-uk-carbon-storage-permit/>

Philippines volcanic eruption: Kanlaon volcano 'may progress to further explosive eruptions'

Pandora Dewan, LiveScience

9 December 2024

The Kanlaon volcano in the Philippines erupted today (Dec. 9) at 3:03 p.m. local time, spouting an eruption column of up to 1.86 miles (3 kilometres) into the sky and triggering the evacuation of 87,000 people.



The Kanlaon Volcano erupted on Monday afternoon, sending a column of ash and smoke into the sky. The urgent evacuation of 87,000 people is already underway. (Image credit: PHIVOLCS)

https://www.livescience.com/planet-earth/volcanos/watch-kanlaon-volcano-in-philippines-erupt-spewing-ash-almost-2-miles-into-the-sky?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=7A7B2A45-A691-4F2C-9501-EA12CE2D1012&utm_source=SmartBrief

https://www.advocatesomi.com/2024/mass-evacuation-almost-complete-as-kanlaon-volcano-eruption-forces-thousands-to-safety?fbclid=IwZXh0bgNhZW0CMTAAAR2AxYf1fA8mI40Z7q5j8qDlc6nz3ZJed85TOjPI9VcJYVR9TobWMckvIXE_aem_FnO9koNHQBqI50nXh3UHw

The position of the magnetic north pole is officially changing. Why?

Skyler Ware, LiveScience

17 December 2024

The updated version of the **World Magnetic Model** was released on Dec. 17, with a new prediction of how the magnetic north pole will shift over the next five years.

https://www.livescience.com/planet-earth/the-position-of-the-magnetic-north-pole-is-officially-changing-why?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=7A7B2A45-A691-4F2C-9501-EA12CE2D1012&utm_source=SmartBrief

NY homeowner makes jaw-dropping mastodon discovery in backyard

Rachel Looker, BBC News, Washington

18 December 2024

<https://www.bbc.co.uk/news/articles/c05p9gld4v9o>

There's a massive fault hidden under America's highest

mountain — and we finally know how it formed

Stephanie Pappas, LiveScience

23 December 2024

Today, the Denali Fault rips apart some of the North American plate, but it was once a place where tectonic plates came together.

https://www.livescience.com/planet-earth/geology/theres-a-massive-fault-hidden-under-americas-highest-mountain-and-we-finally-know-how-it-formed?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=E970CBC9-CB29-45F4-80AA-7A4844D58CB3&utm_source=SmartBrief

Satellites map Earth's ocean floors in unprecedented detail

Skyler Ware, LiveScience

1 January 2025

A newly-deployed satellite has created the most-detailed map yet of the ocean floor, finding hundreds of hills and underwater volcanoes that were previously missed.

https://www.space.com/the-universe/earth/just-a-fraction-of-the-hydrogen-hidden-beneath-earths-surface-could-power-earth-for-200-years-scientists-find-clone?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=6706549A-D659-4A20-82F0-74B87F40683A&utm_source=SmartBrief

From field to Vault, how the largest Winchcombe meteorite was found

Tammana Begum, NHM

First published 5 October 2021

The story of the Winchcombe meteorite

Did you know you can see the first fallen meteorite to have been recovered in the UK for 30 years here in our galleries. It fell from the sky in 2021 and was discovered in sheep poo in Winchcombe, Gloucester! Early analysis shows that it came from somewhere near Jupiter and has a similar chemistry to the Sun. Come and see it for yourself in the Vault at the back of the Minerals Gallery.



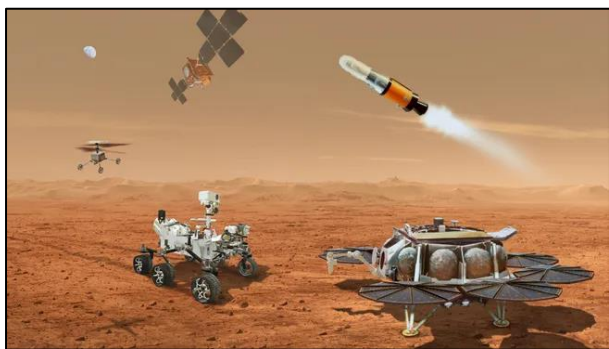
https://www.nhm.ac.uk/discover/news/2021/september/from-field-to-vault-how-the-largest-winchcombe-meteorite-was-found.html?utm_content=pod6-cta&utm_campaign=Winchcombe%20Meteorite

[te&utm_medium=email&utm_source=2567258_ma_whatson_enews_20241216&utm_term=&ID=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&dm_i=2XEG,1J0WQ,6L3SCQ,64MTP,1](https://www.space.com/the-universe/mars/can-nasas-troubled-mars-sample-return-mission-be-saved?utm_medium=email&utm_source=2567258_ma_whatson_enews_20241216&utm_term=&ID=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&dm_i=2XEG,1J0WQ,6L3SCQ,64MTP,1)

Can NASA's troubled Mars Sample Return mission be saved?

By Leonard David, Space 3 January 2025

NASA wants to return Mars samples to Earth, but budget problems and technical woes have the mission caught between a rock and the Red Planet.



The now vetoed NASA Mars Sample Return architecture made use of a set of machines, including use of helicopters, to collect Martian soil, rock and atmospheric specimens for return to Earth. (Image credit: NASA/JPL-Caltech)

https://www.space.com/the-universe/mars/can-nasas-troubled-mars-sample-return-mission-be-saved?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=20393055-EFAD-4448-9835-8BAC8F561C3F&utm_source=SmartBrief

Ethiopia evacuates 80,000 after earthquakes, fears of volcanic eruption

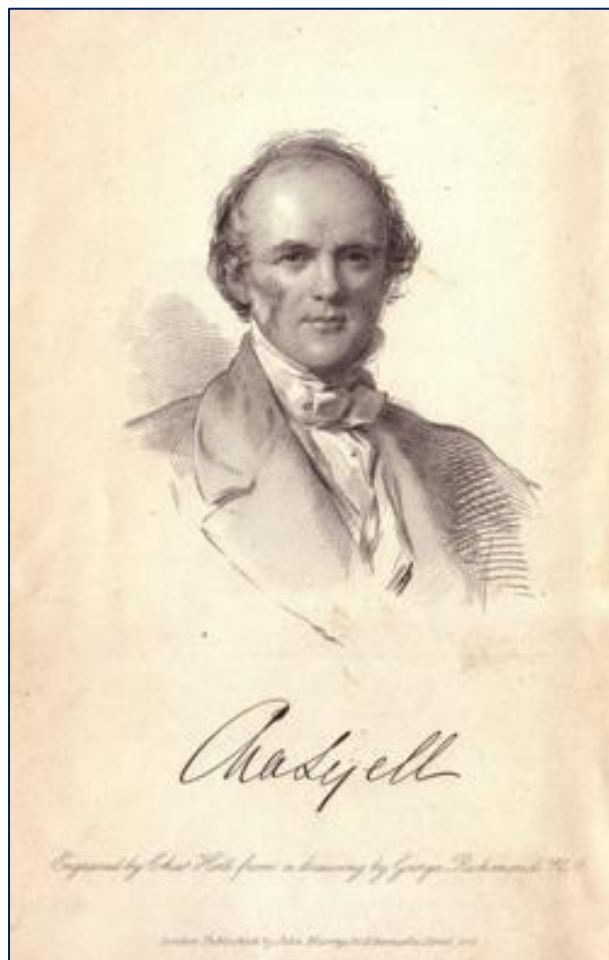
Gelmo Dawit, VOA News 4 January 2025

https://www.voanews.com/a/ethiopia-evacuates-80-000-after-earthquakes-fears-of-volcanic-eruption/7924462.html?fbclid=IwZXh0bgNhZW0CMTEAAR1KBvaoOVqcJ3erf7zvXLYJLwHnUTG1KRV6bzFai_24Vj5aZNpgylUoHpY_aem_pcw_vvLi6A_RXfhop05fAw

Charles Lyell and deep time

Time is of the essence, or so the saying goes. But is an awareness of the magnitude of time really essential to humanity? Is it possible to invent time?

Richard A. Fortey writes on Charles Lyell, high priest of deep time.



Geoscientist 21

09 October 2011

<https://www.geolsoc.org.uk/Geoscientist/Archive/October-2011/Charles-Lyell-and-deep-time>

'Red flags' raised over ancient sea monster pulled from Moroccan mine



An illustration of *Xenodens calminechari*, a mosasaur whose description was based on fossils that scientists now think might be fake. (Image credit: Henry Sharpe)

Jeanne Timmons, LiveScience

12 January 2025

A mosasaur species with saw-like teeth that was described by scientists in 2021 may have been based on forged fossils, and researchers are now calling for CT scans to determine the creature's origin.

https://www.livescience.com/animals/extinct-species/red-flags-raised-over-ancient-sea-monster-pulled-from-moroccan-mine?fbclid=IwZXh0bgNhZW0CMTAAAR2JD_Mx2K50ynKTGs_1pKfwV5coHI5DAHvR8P6Gd1d-KA2ENNxNM4wmZNco_aem_SWpJtMh_Sb2_hnHF4GOMnMQ#izzapk6h0h3a358efncy1ychhxww3a1

Enormous skull of 200-million-year-old giant dinosaur discovered in China

Richard Pallardy, LiveScience

13 January 2025

The well-preserved skull belongs to a never-before-seen species of sauropodomorph that potentially grew up to 33 feet long.



*The skull of *Lishulong wangi* was unearthed at the Lufeng Dinosaur National Geopark in Yunnan Province, southern China (Image credit: Qian-Nan Zhang et al/PeerJ, 2024)*

https://www.livescience.com/animals/dinosaurs/enormous-skull-of-200-million-year-old-giant-dinosaur-discovered-in-china?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=CFA5DC43-B842-4DB4-A143-7D29CC54D762&utm_source=SmartBrief

Earthquake sends tremors through coast

BBC

27 January 2025

An earthquake took place off a county's coastline during the early hours of Sunday morning.

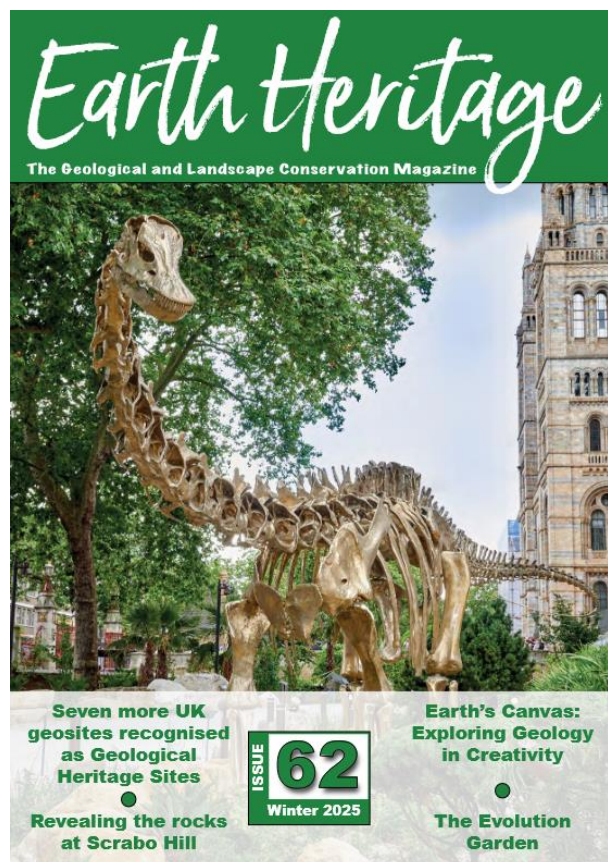
The tremor was recorded at 04:32 GMT in the North Sea, roughly 62.1 miles (100km) north-east of Cromer, Norfolk.

According to the British Geographical Survey, the earthquake had a 3.0 magnitude and occurred at a shallow depth of 6.2 miles (10km).

The organisation said about 20 to 30 earthquakes are felt by people each year, while hundreds of smaller ones are recorded by sensitive instruments.

<https://www.bbc.co.uk/news/articles/cy0p49wyx8xo>

Earth Heritage Issue 62

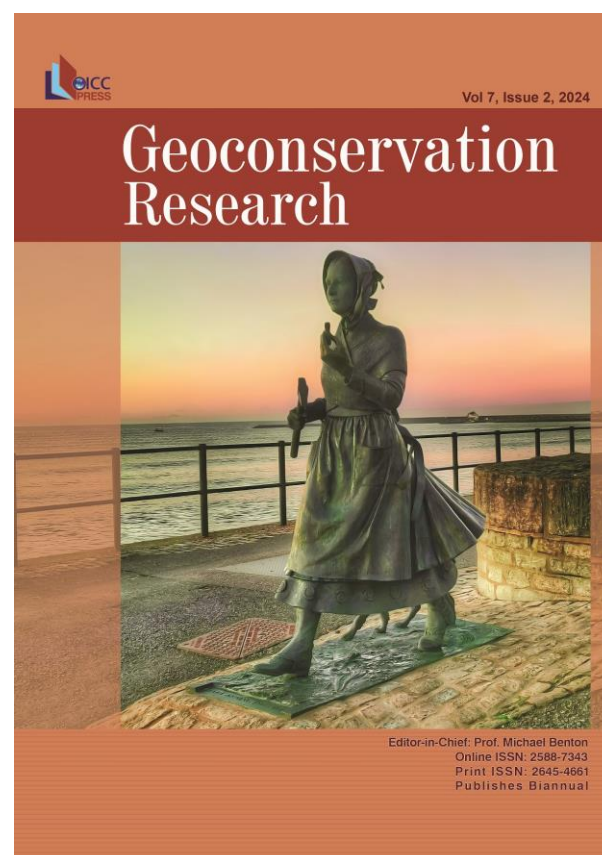


The current issue includes articles on:

- Revealing the rocks at Scrabo Hill.
- Seven more UK geosites recognised as globally important Geological Heritage Sites.
- Pebbles for the People! Geology at the heart of the community – an update on Harrow Weald.
- A mammoth arises near Chelmsford.
- The Evolution Garden.
- Blast off at Brymbo Fossil Forest...
- GeoAnimations – using animations to explore geology in nature.

<https://www.earthheritage.org.uk/downloads/>

Vol 7, No 2 (2024): Geoconservation and Museums



<https://oiccpres.com/gcr/issue/view/826>

Open access articles

'Once-in-a-century' discovery reveals spectacular luxury of Pompeii

Rebecca Morelle, BBC Science Editor & Alison Francis, BBC Senior Science Journalist

17 January 2025

Reporting from Pompeii, southern Italy

After lying hidden beneath metres of volcanic rock and ash for 2,000 years, a "once-in-a-century" find has been unearthed in the ancient Roman city of Pompeii.

Archaeologists have discovered a sumptuous private bathhouse - potentially the largest ever found there - complete with hot, warm and cold

rooms, exquisite artwork, and a huge plunge pool.

The spa-like complex sits at the heart of a grand residence uncovered over the last two years during a major excavation.

"It's these spaces that really are part of the 'Pompeii effect' - it's almost as if the people had only left a minute ago," says Dr Gabriel Zuchtriegel, director of the Archaeological Park of Pompeii, who has revealed the new find exclusively to BBC News.



The bathhouse changing room has vibrant red walls, a mosaic floor and stone benches. (Credit: Tony Jolliffe/BBC)



Twenty to 30 people could bathe in the cold room's plunge pool, which is more than 1m deep. (Credit: Tony Jolliffe/BBC)

Pompeii: The New Dig – House of Treasures available on the BBC iPlayer.

<https://www.bbc.co.uk/news/articles/c15zgvnk4do>

Scientists discover 'sunken worlds' hidden deep within Earth's mantle that shouldn't be there

Harry Baker, LiveScience

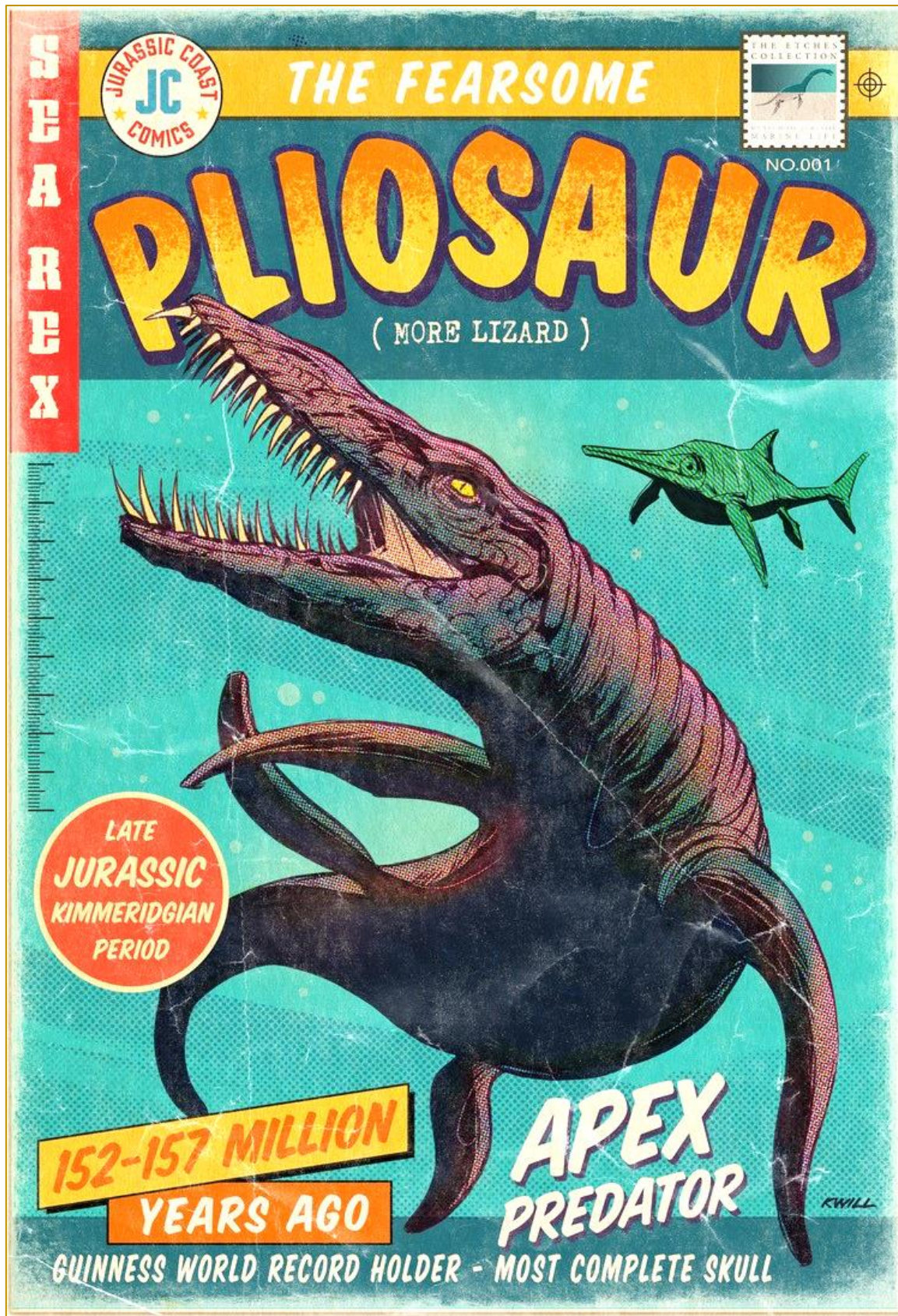
14 January 2025

A new way of measuring structures deep inside Earth has highlighted numerous previously unknown blobs within our planet's mantle. These anomalies are surprisingly similar to sunken chunks of Earth's crust but appear in seemingly impossible places.



New research has identified numerous potential subducted slabs in surprising locations throughout Earth's mantle — the second outermost layer of our planet. (Image credit: Vadim Sadovski/Shutterstock)

https://www.livescience.com/planet-earth/geology/scientists-discover-sunken-worlds-hidden-deep-within-earths-mantle-that-shouldnt-be-there?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=D88EA8BD-89B3-4E1C-8D1D-3F5C10FDFA02&utm_source=SmartBrief



https://www.theetchescollectionshop.org/collections/the-etches-collection-exclusive-merchandise/products/a2-poster-print-the-sea-rex-comic-book-poster?fbclid=IwZXh0bgNhZW0CMTEAAAR3S7NV_cNGI65P0yYIJffF4ZdWcPueUNtPyfoQISccWK-xDJEQRv9SjOSM_aem_vPRAkruExp5Nbcj0UIZGDA