

Newsletter of The Farnham Geological Society

Volume 29, Number 3, August 2026



*A couple of Tyrannosaurus Rex's at the MUJA
(Museo del Jurásico de Asturias) near Colunga in Northern Spain
(Credit: Sally Pritchard)*



*Farnhamia
farnhamensis*



Founded 1970



A local group
within the GA

Volume 29, No. 3

Newsletter

Issue No. 133

August 2026

www.farnhamgeosoc.org.uk

Editorial

Welcome to the latest edition of the FGS Newsletter. Here we are in August already having had three heatwaves over the summer. I do hope you are all fit and well and enjoying the weather!

Our next lecture will be at **The Methodist Hall** on **Friday, 11 September** at **8:00pm** when we welcome **Tristan Aspray** who will be talking to us about “**How Geoscience is Critical in the Transition to a Lower Carbon Energy Future**” which, I have no doubt, will be a very interesting presentation.

This will be followed on **Friday, 9 October** for our last meeting of the year at **The Methodist Hall** with a talk entitled “**Ammonites, their History and Geological Significance**” to be given by **Dr. Robert Chandler** ... who doesn't like an ammonite?

On **Saturday 7 November** at **The Festival of Geology** to be held in Burlington House, Piccadilly, the FGS will be staffing a table, talking to people about the local geology around Farnham and about the Farnham Geological Society. We will need volunteers to help plan the event and staff the table on the day. Please get in touch with **Mike Millar** if you would like to be involved in any way.

The FGS 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.

We are still looking for members to join the FGS Committee, particularly IT/Sound, as well as help with our Website and our Advertising / Outreach programmes and with the Societies various other outreach activities.

Please contact our Chair Mick Caulfield
(newsletters@farnhamgeosoc.org.uk) **if you are able 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.

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Obituary



Mike Rubra, a long-time active member of the Society, passed away on Saturday evening 25 April 2026. He had just turned 97 in March and was doing remarkably well all things considered but had become increasingly breathless over the last year due to heart and kidney problems.

His family were able to be with him during his final days sharing memories and laughing lots.

<https://www.funeralguide.co.uk/obituaries/143799>

Front Cover

This month's **Front Cover** shows a couple of Tyrannosaurus Rex's at the MUJA (Museo del Jurásico de Asturias) near Colunga in Northern Spain. (*Credit: Sally Pritchard*)

References: <https://en.asturias.com/jurassic-museum-muja/>
<https://www.museojurasicoasturias.com/en/el-museo>

Farnham Geological Society

Committee 2026

Chair	Mick Caulfield
Treasurer	Mike Millar
Secretary	Katherine Rusbridge
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	Vacant (Mike Millar)
Without portfolio	Peter Luckham
Ad Hoc Member	Liz Aston

Meeting Programme 2026

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

How Geoscience is Critical in the Transition to a Lower Carbon Energy Future

Tristan Aspray Friday, 11 September
Formerly ExxonMobil

Ammonites, their History and Geological Significance

Dr. Robert Chandler Friday, 9 October
NHM

The Geology of the Great Pyramid

Geoff Downer Friday, 13 November
Kent Geologists' Group

Field Trip Programme 2026

(book via the FGS website)

DAY TRIPS

- **Building Stones walk around Chichester**
Leader: David Bone Sunday, 26 July
- **Brookwood Cemetery**
Leader: Diana Smith Sunday, 11 October

RESIDENTIAL TRIPS

- **Gloucester** 20 - 23 October
Leader: Dave Green

Note:

- **Cut-off date for bookings: 23rd August.**
- The trip involves arriving on 20th October for an evening introductory lecture and spending three full days (21, 22 and 23 October) in the field.
- Departure on either the evening of the 23rd or morning of the 24th according to preference. There will be no geology on the 24th.

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 2026

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

Hybrid Meeting

Thirty years of discovery at the UK's largest dinosaur track site in north Oxfordshire

Prof. Kirsty Edgar Friday, 9 October
University of Birmingham

Hybrid Meeting

tbc

Dr. Holly Elliott Friday, 4 December
BGS

Reading Geological Society Lecture Programme 2026

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

Adventures in Volcanoland: from fuming volcanic vents to extinction events

Prof. Tamsin Mather Monday, 7 September
University of Oxford

Anatomy of a Jurassic Coastal Lagoon – bringing the past to life

Dr Matthew Wakefield Monday, 5 October
Lealt Stratigraphic Consultants Ltd

Past environments, past climates and impacts of major environmental change

Prof. Stuart Robinson Monday, 2 November
University of Oxford

Places available on **Reading Geological Society's Field Meetings**

(book via the RGS website -

<https://readinggeology.org.uk/fieldtrips.php>):

- **Chazey Heath** Monday, 17 August
Leader: Ross Garden, RGS

- **The Geology of Jersey**

25 September – 1 October

Leaders: Members of Societe Jersiaise and the Jersey Island Geopark Team

Mole Valley Geological Society Lecture Programme 2026

<http://mvgs.org.uk>

Pre-Long Weekend Field Trip Talk On The Geology Of Norfolk

Dr. Mark Eller Thursday, 3 September
MVGS

Zoom via Eventbrite

South England vineyards from Roman times to the present

Prof. Dick Selley Saturday, 19 September
MVGS 5:00 – 5:30 PM

<https://www.eventbrite.co.uk/e/south-england-vineyards-from-roman-times-to-the-present-prof-dick-selley-tickets-1992371188859?aff=erellivmlt>

The geology of the vineyards of Mole Valley and the Weald.

Dr. Mark Eller Saturday, 19 September
MVGS 6:30 – 7:30 PM

<https://www.eventbrite.co.uk/e/the-geology-of-the-vineyards-of-mole-valley-and-the-weald-dr-mark-eller-tickets-1990988158177?aff=ebdsoporgprofile#location>

**In Search Of Siberian Gold Mammoths
(Ore Bodies, Not Pachyderms)**
Dr. A Guryanov
Universal Exports Thursday, 12 November

Horsham Geological Field Club Lecture Programme 2026

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

Dinosaurs from Space
Prof. David Martill Wed, 9 September
University of Portsmouth

Mud forensics in the Anthropocene
Prof. Andy Cundy,
University of Southampton Wed, 14 October

Geology in art and art in geology
Roger Smith Wed, 11 November
Retired engineering geologist

West Sussex Geological Society Lecture Programme 2026

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

Marcasite from Shakespeare Cliff Dover in Kent
Dr. Colin Brough Friday, 18 September
Sussex Mineral and Lapidary Society

A geologic fieldtrip to the planet Mars with the Perseverance Rover
Alex Jones Friday, 16 October
Imperial College, London

The Groundwater Resources of Namibia
Nigel Hoad Friday, 20 November

Next Lecture

Friday, 11 September 2026

The Methodist Hall, Farnham

7.30 pm for 8.00 pm

How Geoscience is Critical in the Transition to a Lower Carbon Energy Future

Tristan Aspray

Tristan is a geoscientist who 3 years ago completed a 30-year career in the international energy industry. He is currently active in volunteering for local conservation groups, and in developing and presenting educational talks on geology and energy to local school classes.

During his industry career he held multiple roles up to and including senior executive / vice president positions in resource exploration and technology development. He had the privilege of working in multiple countries and cultures, and of leading a wide range of diverse, multi-national project teams.

He also held roles in strategy development, organization redesign and the integration of merged companies, as well as serving on several advisory boards.

Tristan is keenly interested in energy and in addressing the multiple challenges of transitioning to a lower carbon, more globally equitable energy future in which environmental conservation is strengthened.

Reference: <https://www.linkedin.com/in/tristan-aspray-a149319/>



Lecture Summary

Friday, 13 February 2026

On Friday, 13 February 32+ FGS members attendees **via Zoom**, together with other society members, welcomed **Professor Robert Spicer** in presenting our external lecture.

The Lost Landscapes of Tibet and how they Changed the World

Robert A. Spicer^{1,2,3}

1. School of Environment, Earth and Ecosystem Sciences, The Open University, Milton Keynes MK7 6AA, UK.
2. State Key Laboratory of Tibetan Plateau Earth System, Resources and Environment (TPESRE), Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100101, China.
3. CAS Key Laboratory of Tropical Forest Ecology, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Mengla 666303, China.

email: r.a.spicer@open.ac.uk

Report by Robert Spicer

Working in Tibet is not easy, being a region with a long history of being embroiled in complex geopolitical issues and often closed to foreigners, as it largely is now. With much of the Tibetan Plateau being at around 5 km in elevation, logistics and physical work are challenging. Over the past 30 years or so I have had the privilege of doing fieldwork in Tibet many times, and this is the story of that research.

Our understanding of the Late Cretaceous and Cenozoic evolution of the Pan Tibetan Highlands, a region that encompasses the modern high Tibetan Plateau, the Hengduan Mountains, the Himalaya and the Mountains of Central Asia (Fig. 1) has been transformed within the last 10 years, and it is likely that whatever you learned about the formation of the Tibetan Plateau is wrong. The 'classic' view was that the formation of the Tibetan Plateau was solely the result of the ongoing collision of India with Eurasia, with India pushing all before it. However, ideas involving a unitary or progressive north-eastward rise of the Himalaya and Tibetan Plateau, or a north-south expansion of a proto-plateau, have now been superseded by more complex growth models. These envisage a Paleogene pre-collisional Central Tibetan lowland bordered by the Gangdese Arc highlands (N4.5 km) to the south and the Central Watershed (Qiangtang) Mountains in the north (N4 km). The transition to the modern plateau involved 1) a rise of eastern Tibet during the Eocene, closing off the eastern end of this central lowland by a planated upland (2.5 km) that subsequently underwent erosion to form the high relief and deep valleyed Hengduan Mountains, and 2) an east to west progressive rise and infilling of the central lowland throughout the later Paleogene. The nascent modern plateau with internal drainage had formed by the late Oligocene to early Miocene, followed in the mid Miocene by the rise of the Himalaya to exceed the height of the newly formed plateau.

These new topographic reconstructions have largely come about through an iterative mutual improvement of both altimetric proxies and numerical climate modelling, validated by consilience across methodologies and disciplines. What has emerged is that the Asian monsoon system evolved progressively in tandem with regional topographic development and the impact of changes in atmospheric pCO₂ was minimal, which demands that realistic reconstructions of past landscapes are required for correct interpretations of climate and altitude proxy data. Asian monsoons in geological history were not what we see today in terms of extent, precipitation intensity and seasonal distribution, and air parcel trajectories, etc., and monsoon circulation continues to change, even in the present.

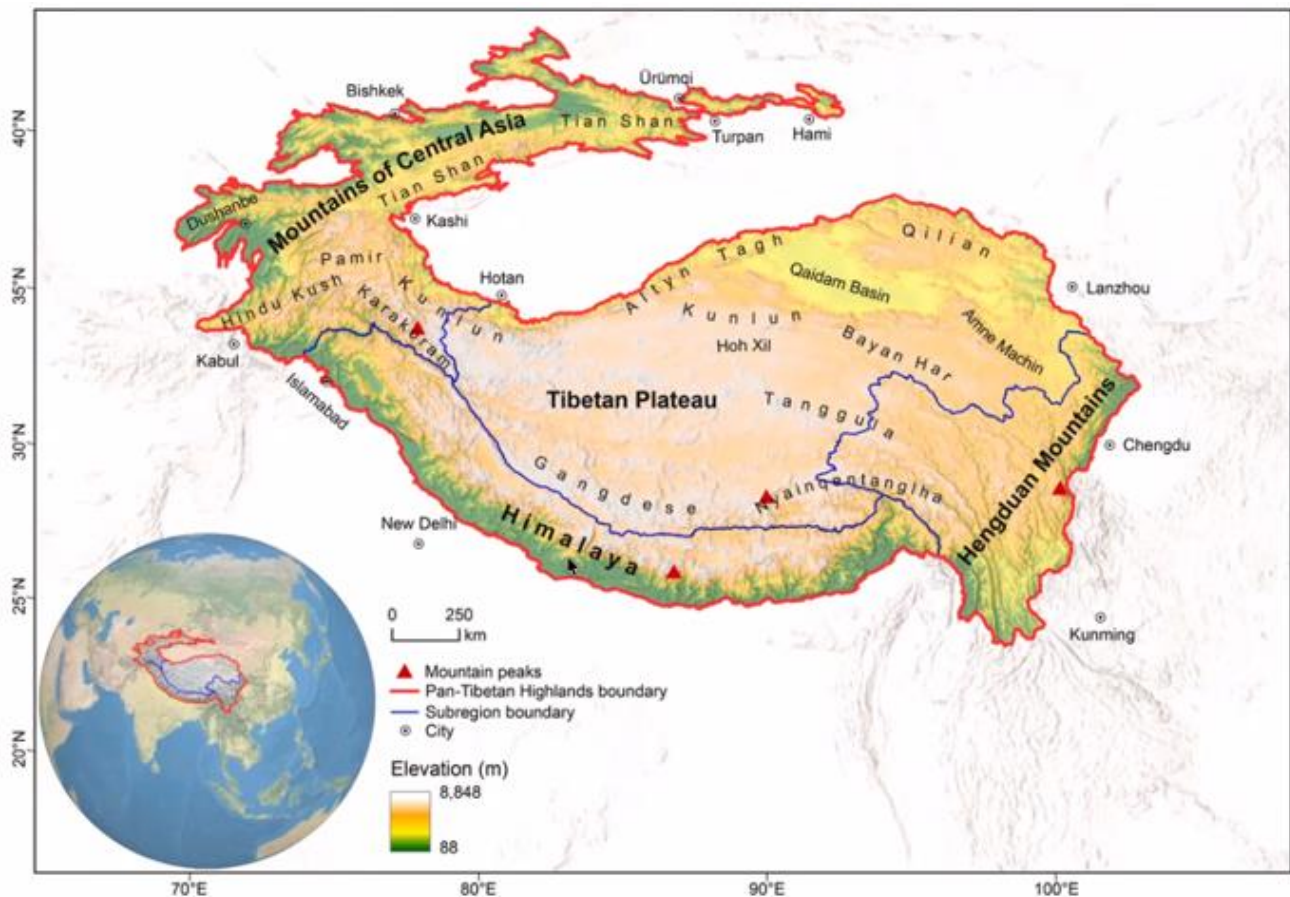


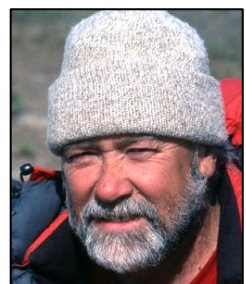
Figure 1: The blue line differentiates the Mountains of Central Asia from the Tibetan Plateau, the Himalaya and the Hengduan Mountains. The boundaries take into account major geological structures and relative relief. (Ref. Liu et al, 2022, *Global and Planetary Change* ... <https://www.sciencedirect.com/science/article/abs/pii/S0921818122001606?via%3Dihub>)

Geological proxies that require an understanding of past air parcel trajectories to reconstruct ancient land surface heights (e.g. stable isotope fractionation) cannot assume a modern monsoon circulation system, nor a similar thermodynamic profile, and past air parcel trajectories can only be simulated in numerical climate models using high spatio-temporal resolution past landscapes. With past landscape reconstructions that reflect reality we can begin to understand the evolution of both the Asian monsoon system and the incredibly diverse biota that it supports, as well as how best to conserve ecosystem services for the future.

Biography

Professor Bob Spicer has degrees in Botany (BSc) and Geology (PhD) from Imperial College and held a Lindemann Post-Doctoral Fellowship at the US Geological Survey in California. He taught at London and Oxford universities before becoming Head of Earth Sciences at the Open University and then Director of the Centre for Earth, Planetary, Space and Astronomical Research.

After 'retiring' from the OU, he has held several visiting positions with the Chinese Academy of Sciences. He is currently Adjunct Professor at the Institute of Tibetan Plateau Research in Beijing and a PIFI Fellow at Xishuangbanna Tropical Botanical Garden, CAS, splitting his time between the UK and China.



He has published over 300 papers and has been a consultant for various TV production companies including the BBC and Apple TV. In 2019 he was awarded the Harris medal for Lifetime Achievement in Palaeobotany.

Reference:

For those who wish to do some post-talk reading, see:

1. Spicer, R.A., Farnsworth, A., Su, T., Ding, L., Witkowski, C.R., Li, S.F., Xiong, Z., Zhou, Z., Li, S., Hughes, A.C., Valdes, P.J., Widdowson, M., Zhiang, X., He, S., Liu, J., Huang, J., Herman, A.B., Xu, Q., Liu, X., Jin, J., Pancost, R.D., Lunt, D., Zhang, S. 2024/2025. The Progressive Co-evolutionary Development of the Pan-Tibetan Highlands, the Asian Monsoon system and Asian Biodiversity. **Geological Society of London Special Publication 549** "Asian Geodynamics and Biodiversity". <https://doi.org/10.1144/SP549-2023-180>
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Friday, 13 March 2026

On Friday, 13 March 39+ FGS members attendees **via Zoom**, together with other society members, welcomed **Doreen van Seenus** in presenting our external lecture.

An Introduction to the Toba Super-Eruption

Doreen van Seenus

Report by Katherine Rusbridge

Introduction

Lake Toba today is a peaceful tourist destination in Northern Sumatra. At 100km by 30km, it is the largest lake in Indonesia. 74,000 years ago it was a very different story. It was the site of the largest super-volcanic eruption in the history of homo sapiens. It is estimated that it released 2800 cubic kilometres of material. This was so large that it had a long-lasting cooling effect on the climate resulting in an existential threat to all of humanity and other large fauna.

Lake Toba is in the Toba Caldera. This acts to “camouflage” the caldera and it was only during the second half of the 20th century that research was pieced together to identify Toba as the site of a massive super-volcano. Doreen van Seenus, our speaker, gave us a talk entitled “An Introduction to the Toba Super-Eruption”. She took us through the research story which identified Toba as the super-volcano eruption 74,000 BP. She then outlined the severe effects that were thought to follow, now referred to as the Toba Catastrophe Theory.

The following is a brief review of her talk. References with more details are given at the end.

What was the direct evidence for the Toba eruption?

It was almost an accident that the Toba super-volcano was identified. As with many discoveries in science, it was the accumulation of evidence from a range of sources, most connected to research on climate change, which was pieced together to point to a super-volcanic eruption at Toba.

One of these discoveries came from the analysis of acidity changes in ice cores, at different depths, representing different times. It is well known that the eruptions of volcanoes emit sulphur dioxide into the atmosphere, leading in effect to acid rain. Spikes in the acidity, as measured by electrical conductivity changes, can therefore be attributed to volcanic events.

Several acidity spikes dated at 74,000 BP were found in ice cores from Antarctica and Greenland. Wherever it had happened, it had been a big one!

Ocean sediment cores also played a part in identifying Toba's eruption. Samples taken from around the Indian Ocean contained characteristic ash and glass shards, all with the same % mix of compounds. This mix is like a fingerprint; different volcanoes have their own unique mix. Ash deposits with the identical compound mix were also found on the Indian sub-continent. This narrowed down the possible location of the super-volcano.

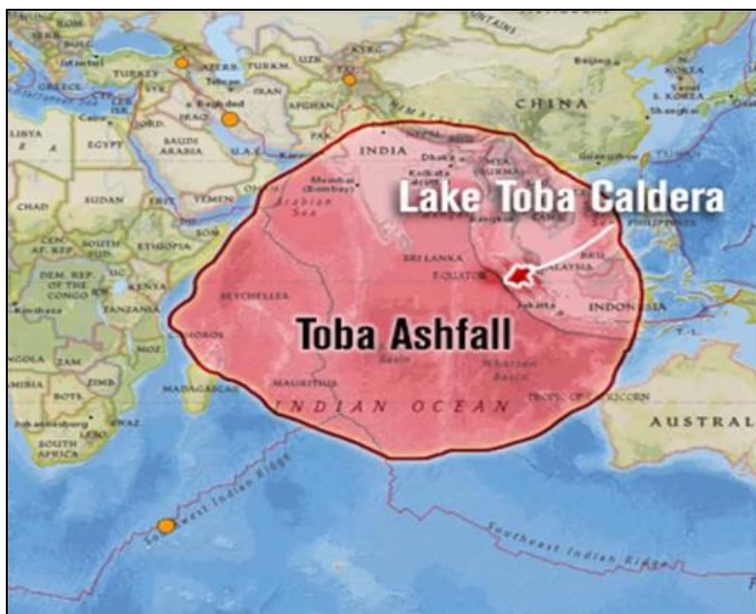
To complete the discovery, it was noted that Lake Toba has an intriguing morphology: very deep steep walls and volcanic ridges. Perhaps it was in a caldera. Analysis of material around the lake has

the correct “fingerprint”. By the 1990s, the mystery was solved; Toba was the source of the super-volcanic eruption 74,000 BP.

Toba eruption and climate change

The Toba eruption was thought to have had an effect on the Earth’s climate and hence on the survival chances of humans, though the extent of the effect has been a matter of debate.

Our speaker described one procedure used to study climate effects. This is a process known as oxygen isotope fractionation. Oxygen isotope fractionation occurs because oxygen has two main isotopes: the most common one is O-16, with a small proportion of O-18. Individual atoms of O-18 are heavier than O-16 because they contain two more protons. Consequently, the molecules of any compound including O-18 atoms will be slightly heavier than the molecules of the same compound containing O-16 atoms. This is particularly relevant for water molecules and carbonate compounds.



*Figure 1: The area of ash fall from the Toba caldera.
(Credit: Doreen van Seenus)*

Water molecules with an O-16 atom, being lighter, will evaporate more easily than those with an O-18. Rainwater is therefore enriched in O-16. During interglacial periods, the rainwater returns to the rivers and seas with no effect on the ratio of O-16 and O-18. At lower temperatures, O-16 enriched rainwater will be falling onto snow and glaciers rather than returning to rivers and seas, resulting in a higher proportion of O-16 in ice cores during glacial periods.

The complementary effect described above occurs in oceans. During glacial periods, oceans become enriched in O-18 atoms by the preferential evaporation of O-16 water and its subsequent incorporation in glaciers as it falls as rainwater. The fossilized calcite remains of plankton found in the ocean floor sediment thus show an increased amount of O-18.

Both ice cores and marine sediment cores serve as proxies for temperature. Research including evidence from these cores has shown that there was a cooler period during which the Toba eruption happened. This evidence contributed to the Toba Catastrophe Theory.

Toba Catastrophe Theory

The Toba Catastrophe Theory was put forward in the 1990s, once the magnitude of the Toba eruption had been identified. This postulated a link between the Toba eruption and the crash in the human population. Indeed, with only between 3,000 and 10,000 people surviving, the human race was nearly wiped out at about the time of the eruption. The basic reasoning was that the amount of ash released into the atmosphere would have led to a volcanic winter of a few years with a continuing cooling effect for 1,000 years. This would have greatly reduced photosynthesis, leading to famine and starvation.

The evidence that there had been a population crash comes from DNA analysis of modern humans. It is a core principle of evolution that minor changes in DNA happen by chance with more and more of these accumulating as generation follows generation. There is less variation in modern humans than expected if we had been evolving from many, many ancestors over many, many generations. Fewer variations implies a genetic bottleneck dated to around the same time as the Toba eruption, so consistent with it being caused by the after-effects of the eruption.

More recent research on the effects of the Toba eruption

Our speaker acknowledged that there had been discussion and debate about the effects of the Toba eruption; she did not have time within her talk to cover that in any detail. The following was not part of the original talk.

Current thinking is that the Toba eruption had much less impact on climate and hence on the human population than presented in the Catastrophe Theory. One important piece of evidence for this comes, rather surprisingly, from sediment cores taken from Lake Malawi, some 7,000 km away from Toba. These have been analysed and found to contain a layer of ash with the characteristic signature of Toba ash. This has the very useful property of defining a “before Toba” and “after Toba” in the cores. There is very little difference in the make-up of the sediments either side of the Toba event, suggesting there was very little change in the flora and fauna at that time.

Further evidence comes from the Dhaba site in Northern India. Stone tools were found dating from 80,000BP and significantly after the Toba eruption too, suggesting that the population there had survived, despite being relatively close to the eruption site where ash deposits would have covered all the land.

Biography

After Doreen retired from a career in medicine she was at last able to indulge her passion for geology and volcanoes in particular. This interest goes back to her childhood, when she lived with in Indonesia for three years. Wanting to get a good scientific grounding, she did an Open University degree course and graduated in 2017 with a B.Sc. (Honours) in Natural Sciences (Earth Sciences).

She is a member of the Kent Geology Group and the Open University Geological Society and has regularly presented talks on volcanoes for these organisations.

Further reading :

Overview of Toba eruption and effects on climate change

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

<https://www.sciencedirect.com/science/article/abs/pii/S1040618220303335>

<https://www.bbc.co.uk/news/science-environment-22355515>

The BBC page is the most accessible to the general reader. The Wikipedia and ScienceDirect articles give more scientific details and analysis.

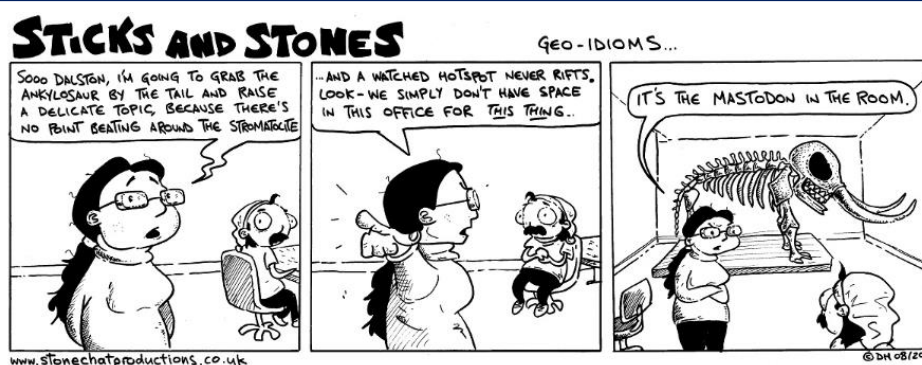
For specific details about the techniques used

Principles of oxygen fractionation

<https://pages.uoregon.edu/rdorsey/geo334/O-isotopes.html>

Acidity spikes in ice cores linked to Toba eruption

<https://www.sciencenordic.com/climate-change-denmark-geology/huge-eruption-adds-new-perspective-to-past-climate/1378744>



Reference:

<https://www.stonechatproductions.co.uk/page2.html>

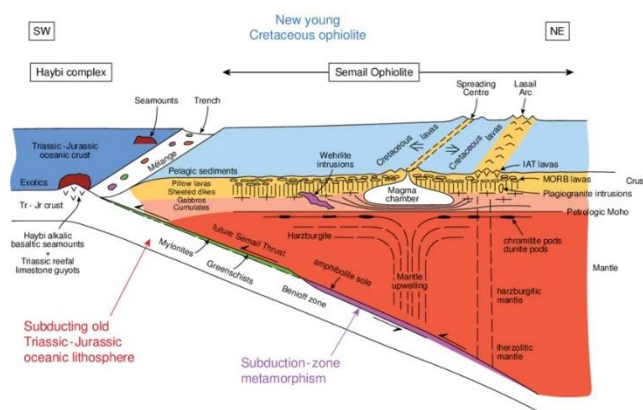
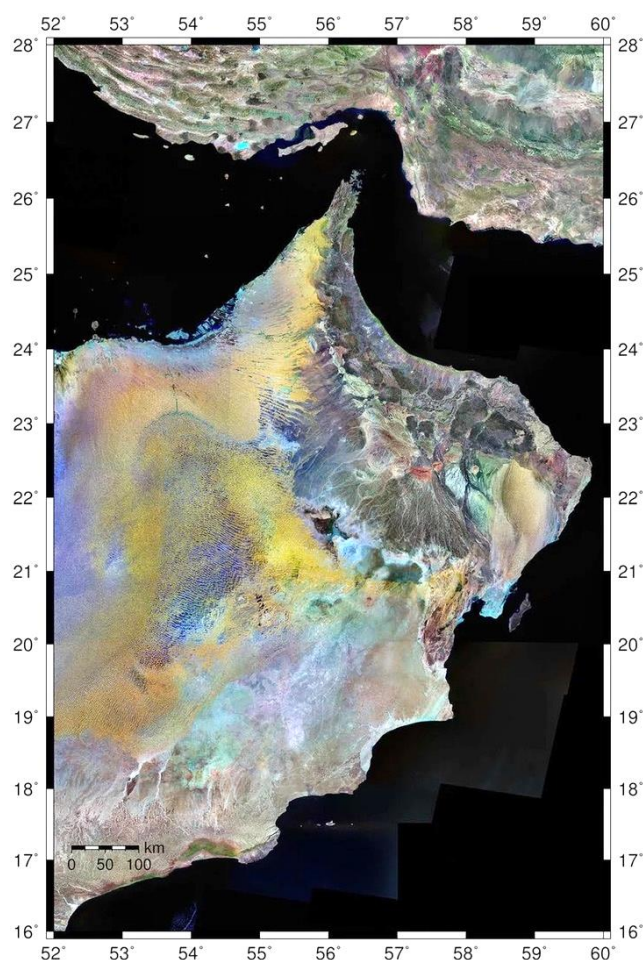
Friday, 8 May 2026

On Friday, 8th May 31 FGS members both at **The Methodist Hall** and via **Zoom**, together with other society members, welcomed Dr. Andrew Wood in presenting our external lecture.

The Sultanate of Oman's unique geological heritage

Dr Andrew Wood

Report by Dr Andrew Wood



Dr Wood took us on a virtual tour of the sultanate of Oman, one of the world's most remarkable natural laboratories for geology, highlighting the features that make the country's rocks and structures distinctive. He showed how its combination of exceptional exposure, tectonic complexity, and preservation of geological features spanning hundreds of millions of years has made the country a globally important destination for both academic and petroleum geologists.

The Al Hajar Mountains of northern Oman form one of the geological highlights of the country. These mountains contain the famous Semail Ophiolite, widely regarded as the best-exposed and most accessible section of oceanic crust and upper mantle anywhere in the world. The ophiolite represents a slice of Cretaceous ocean floor and mantle rocks that was thrust onto the Arabian continental margin during the Late Cretaceous. This process, known as obduction, is comparatively rare on Earth, and Oman provides one of the clearest examples. Rocks such as peridotites, gabbros, sheeted dyke complexes, pillow lavas, and deep marine sediments can all be examined in the field in their original structural relationships. Closely associated with the ophiolite are major thrust sheets and nappes, which record the compressional tectonics involved in emplacement of the oceanic crust onto the Arabian margin during the Late Cretaceous. These exposures have played a major role in advancing global understanding of plate tectonics, seafloor spreading, and mantle processes.

Another major component of Oman's geological uniqueness is the remarkable preservation of sedimentary successions spanning much of Earth history. The lecture highlighted extensive carbonate platforms, deep marine sediments, and desert deposits that record changing

environments through time. Oman contains important evidence for Neoproterozoic glaciations, early biological evolution, and major climatic transitions.

Particular attention was given to the late Precambrian to early Cambrian Huqf Supergroup of central Oman, which preserves sediments linked to some of the oldest complex life forms. The Huqf succession is of significant economic importance because it contains the source rocks that generated most of Oman's oil and gas, making Oman's petroleum systems unusual within the Arabian region. Whereas many Middle Eastern hydrocarbon provinces rely predominantly on younger Jurassic source rocks, Oman derives a large proportion of its hydrocarbons from the much older organic-rich sediments. The speaker noted that this gives Oman a distinctive position globally, since relatively few producing provinces are dominated by source rocks of such great antiquity.

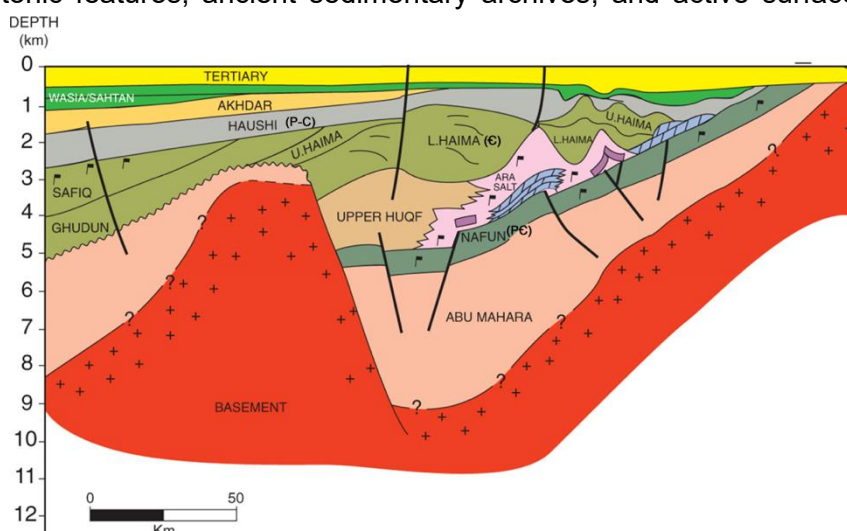
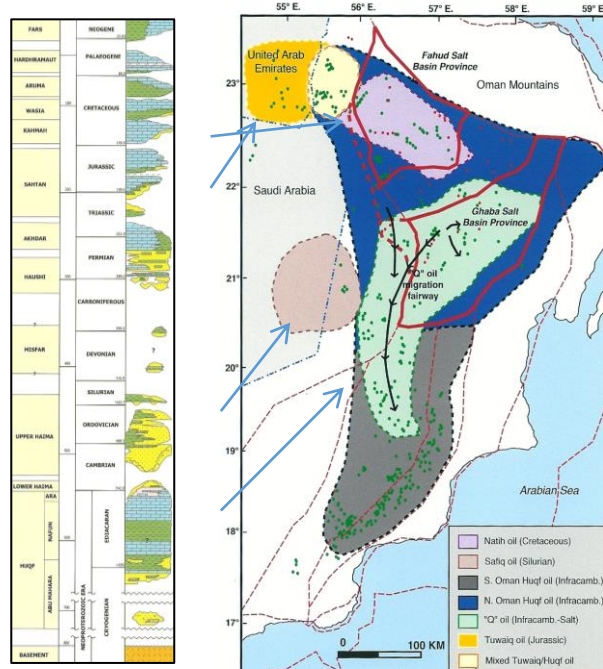
The talk also examined Oman's extensive salt basins, which are fundamental to the country's constantly evolving hydrocarbon systems. Thick subsurface salt layers have flowed and deformed over geological time, creating domes, traps, and structural features that strongly influenced hydrocarbon accumulation. This has created several unique play types including deep gas in tight Palaeozoic clastic reservoirs in North Oman, and self-charged carbonate and silicilite 'stringers' or rafts entirely encased in salt further south.

The deserts and modern landscapes of Oman were presented as another expression of active geological processes. Features such as the Wahiba Sands illustrate the interaction between wind, climate, and sediment supply, while wadis and uplifted terraces record ongoing erosion and tectonic uplift.

Overall, the talk portrayed Oman as geologically exceptional because it combines accessible exposures, globally important tectonic features, ancient sedimentary archives, and active surface processes within a relatively compact area. Few countries provide such an integrated view of oceanic crust formation, continental deformation, sedimentary basin evolution, salt tectonics, desert geomorphology, and Earth history in one setting. Oman therefore occupies a unique position in geological science, serving both as a field classroom and as a key reference point for understanding the evolution of the Earth's crust.

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FGS Field Trip Reports

Silcretes of Cobham, Kent

Wednesday, 29 April 2026

Leader: Geoff Downer

Report & photos by Tessa Seward



On a bright, sunny Wednesday in late April, two members of Farnham Geological Society, augmented by 4 members of nearby societies, met our leader, Geoff Downer outside the Three Crutches Pub on Old Watling Street near Rochester to spend the day examining silcretes in the Cobham area.

Location 1

Geoff led us to an area of grass just up the road where 4 large silcrete specimens were positioned, having been removed from their original location about half a mile away in 1997 during the construction of the nearby Wainscott Northern Bypass.

What is a silcrete? Geoff explained that they are quartz rich rocks cemented with a silica cement to form a durable lithified rock. They are in fact a suite of rocks ranging from finer grained sarsens comprised of silt/sand through to coarser gravel and conglomerates which could be brecciated or pebbles and are known as puddingstones (famous, for example, in Hertfordshire). Silcretes have a distribution from the Medway Valley through Hertfordshire, Buckinghamshire to Wiltshire. The Weald – Artois anticline and the Paris Basin also have them. Geoff showed us two hand specimens of puddingstone which he had brought with him. Geoff explained that the pebbles and cement in the first specimen contained much the same high proportion of silica and so it could fracture across the pebbles because the whole stone was of the same hardness. The second specimen contained a slightly weaker, less rich silica cement and so broke around the harder pebbles.

We examined the composition of the 4 large stones in front of us and agreed the grains were of a fairly coarse rounded sand, and thus sarsens not puddingstone. We then started to think about the environment of deposition. The silcretes at this location were found on the unconformity above the chalk and were deposited as marine sediments in the Paleogene. This was in a proto-sea which then

graduated through shoreline to land in an east to west direction. Geoff told us that the material in these silcretes has been shown to bear the greatest similarity to the sand and silts of the Upnor Formation. The Upnor Formation is sandwiched between the Thanet and Woolwich Formations of the Palaeocene. Geoff explained that silicification happened later than sedimentation, but we are not sure **when, why or how**.

One theory for **when** concerns the Palaeocene / Eocene Thermal Maximum (PETM). This occurred just after deposition of the Upnor Formation. This was a 200,000 year thermal spike of between 5 to 8 degrees and may have been sufficient to silicify the Upnor silcretes. However, silcretes also exist that are younger than the Paleogene and some in the south-west have been dated to the Neogene, so clearly the PETM is not responsible for all the silcretes.

The Upnor Formation is glauconitic – evidence of marine deposition. But Geoff explained that silicification took place during a land-based period of sea regression. The silica must have been present in groundwater but **why** was it there? Geoff outlined two possible origins: it could have occurred via grain-contact dissolution (pressure from the overburden as sediments are buried causing the sand grains to be pushed together and minerals, e.g. silica, dissolving out at their contact points – although there is an absence of evidence) or the silica could have had a plant origin.

The discussion then turned to **how** the silicification took place. Apparently there are two main methods of formation / cementation: A) Pedogenic – formation happens within the regolith (the loose unconsolidated layer of soil and rock on top of the bedrock) when there are alternating periods where silica will go into solution due to the warm environment and periods of silica precipitation, e.g. the Kalahari desert and the Australian desert or B) Non-pedogenic - linked to a silica rich water table at lower depths below the regolith. Silica solution is easily saturated thus it will precipitate out.

Why were these silcretes we were looking at left as scattered boulders upon the chalk? Geoff explained that the deposits of the Palaeogene (including any of the unsilicified Upnor Formation) were subsequently eroded away. Being made almost entirely of silica cement and silica quartz grains these silcretes were much harder (roughly as hard as quartz itself) and so did not get eroded. Instead, they moved down with the landscape as it eroded under the influence of gravity and are often found on the sides of or near valley bottoms.

Figures 1 and 2: Two of the sarsens at location 1 with mammillated texture.



These sarsens had a strikingly mammillated texture (Fig. 1 and Fig. 2) which resembled a large version of washing up liquid bubbles! We wondered how these structures could possibly have been formed, what the way-upness was and we put forward various theories. Whilst many sarsens don't exhibit this texture Geoff told us that mammillated ones also occur in the Essex Grays - Thurrock area and one theory is that they are load structures – density difference causing them to sink into softer sediment below. In such cases the mammillated would therefore be on the bottom side. However, we were confounded when Geoff pointed out that one of the sarsens we were looking at had mammillated on both sides and could not therefore have formed this way! Geoff explained that a likely explanation for the mammillated textures we were seeing here was that the silica precipitated out and cemented around multiple focal points or nuclei within the Upnor sediments. We also noticed some holes in the stones and conjectured that some were possibly root structures whilst others were where silicification had been incomplete. Geoff mentioned that whilst these silcretes were not in situ, an example of one (a puddingstone) in situ does exist at the Neolithic Bell mines in Pinner.

Location 2

We then drove to Cobham village to our next location at the Church of St. Mary Magdalene, where we had a look around inside it before lunch.

The oldest part of the church which is still standing is the chancel which dates back to 1220. Sir John de Cobham founded a chantry college at the church in 1362 and built Cobham College next door in 1370 to house the chantry priests. This building became almshouses after the reformation.

The church was renovated and rebuilt at Sir John de Cobham's expense. This included the north porch and the chancel's fine sedilia and piscina, all of which were designed by the master mason of the time, Henry Yevele. The chancel houses the graves of the Cobham family from 1300 to 1529 which are marked by 15 impressive and detailed brasses - said to be the finest collection in the UK if not the world (Fig. 3).

We also admired the octagonal ragstone font with its Purbeck Marble pillars (Fig. 4), the marble tomb of the 9th Lord Cobham and his wife and the black limestone ledger with its corals (possibly Devonian?) in the nave (Fig. 5).



Figure 3: The brasses marking the graves of the Cobham family with the tomb of the 9th Lord Cobham and his wife in the background.



Figure 4: Ragstone font with Purbeck Marble pillars.

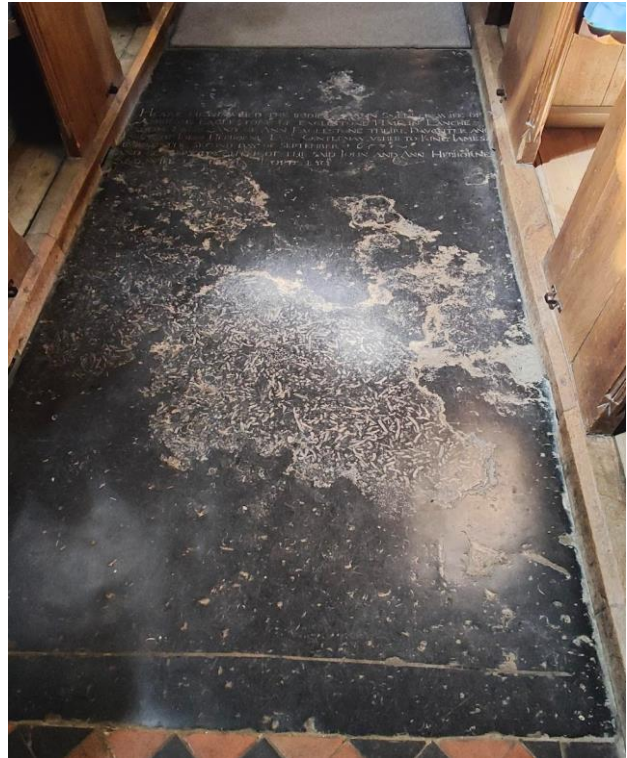


Figure 5: Black limestone ledger with corals.

We then enjoyed a great pub lunch nearby and returned afterwards, refreshed, to view the outside of the church.

The church stands on a hill which is the highest point in the village. Although the main building stones are flint / chert with Kentish Ragstone quoins/cornerstones etc there are also other materials scattered in the mix which we were keen to look at. To my surprise, I learnt that, apart from the ragstone quoins, the church would probably have been rendered and painted white to make it stand out on the hill, and that this was common practice with medieval churches. It would only have been after the reformation that the render was not maintained, and the mixture of building materials would have been seen.



Figure 6: Sarsen in porch wall of church surrounded by flints.



Figure 7: Sarsen in the church wall which had been worked into a block.



Figure 8: Purbeck Marble in church wall.



Figure 9: Sarsen in the churchyard.

We began our walk around the walls of the church, heading west from the north porch, and quickly saw two sarsons in the wall, one of which had (unusually - because sarsen stones are so hard) been worked into a block (Fig. 6 and Fig. 7). We spotted some Purbeck Marble in which we could clearly see the *Viviparus* gastropods (Fig. 8) and also saw another sarsen lying nearby on the ground in the churchyard (Fig. 9).

Puddingstones were in evidence amongst the flints in the south wall, with the silica cement being stained dark brown in some pieces due to iron content (Fig. 10). Geoff pointed out a puddingstone boulder at ground level and we observed the breakage around the pebbles, similar to one of the hand specimens he had shown us earlier (Fig. 11). He explained that Hertfordshire Puddingstone commonly has a black rim around the pebbles which was lacking here and so this puddingstone was likely to be local. We also saw a large sarsen in the fabric of the south wall and noted its sugary texture, common in many sarsens (Fig. 12).



Figure 10: Puddingstone with iron stained cement.



Figure 11: Puddingstone boulder with breakages around the pebbles.

We saw, in all, three arched portals – the portal to the front door of the north porch, the portal to the west door and a blocked-up arch in the south wall. These arches were, in the main, constructed of an oolitic limestone. We saw calcite veins in the limestone in the north portal's arch and Geoff explained that these had sealed joints in the limestone and were a diagnostic indication of it probably being Bath Stone - which is a Jurassic oolitic limestone. We saw that whilst the top of the blocked-

up arch in the south wall was of this same Bath stone and showed similar calcite veins, the bottom was of a different material. Geoff told us that this was probably Caen Stone from Normandy, another Jurassic limestone (Figs. 13, 14 and 15).



Figure 12: Large Sarsen in south wall.



Figure 13: Blocked arch in south wall.

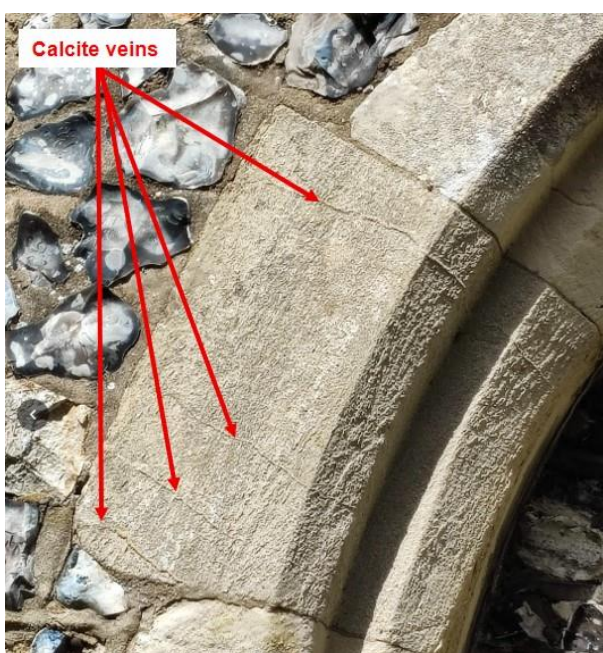


Figure 14: Bath Stone in south wall arch with calcite veins.



Figure 15: Caen Stone in south wall arch.

Making our way round the Church and coming back to the north wall, but this time east from the porch, we noticed a piece of limestone tufa in the wall (Fig. 16) and also what Geoff thought was Reigate Stone, from the Upper Greensand, due to its light grey/greenish tinge and specs of white mica (Fig. 17). Geoff explained that Reigate Stone is good for carving but fares badly outdoors – its surface blows easily and then it weathers back. This piece had likely been originally for another purpose and was re-used.



Figure 16: Limestone tufa in north wall.



Figure 17: Reigate Stone in north wall.

Location 3

Having left the church, we made our way on foot, via Battle Street, to Sarsens Close. Here there are several sarsens, from smaller to very large, in the gardens and driveways of the various properties (Figs. 18 and 19). They are probably what was left behind from a very large sarsen or sarsens in a field close to Battle Street which was broken up and mostly re-sited in the grounds of Cobham Hall, now an independent boarding and day school.



Figure 18: Sarsen in driveway of a property in Sarsens Close.



Figure 19: Very large sarsen in front garden of a property in Sarsens Close.

This was our last stop, so all that remained was to thank Geoff for a fascinating day. Before this, we'd had no idea that there was so much to learn about silcretes!

Bit: the smallest unit of data a computer can process (a single 0 or 1).

Byte: the fundamental unit of digital information in computing		=	8 bits
Kilobyte (KB)	= 1,024 bytes	Megabyte (MB)	= 1,024 KB
Gigabyte (GB)	= 1,024 MB	Terabyte (TB)	= 1,024 GB

Up and Down The Greensand

Saturday, 30 May 2026

Leader: Alan Smallwood

Report by Nick Stronach

Objectives

The field trip was led by Alan Smallwood (Dorking Museum and Heritage Centre) and consisted, as the title suggests, of a walk up and over the dip and scarp slopes of the Lower Greensand Group at Dorking, in order to view the overall geomorphology of the area and specific local points of geological and historical detail. Although Alan provided rich historical details of the places that we visited, this write-up focusses only on the geological content.

Timing and conditions

We set out from the museum in Dorking at 11.00am and returned at approximately 2.15pm. The weather was moderately hot, and the walk involved some climbing on rough paths. Fortunately, there was periodic shade, but managing pace and carrying water were essential.

Route and background

The overall route is shown in Fig. 1 on the geological map. This is based on a definitive GPS derived route provided by Bob Rusbridge (many thanks) which has been transcribed. Approximate locations of the stops visited are shown on Fig. 2, with elevation profile of the walk (again thanks to Bob).



Figure 1. Route of walk on geological map. (Reproduced with the permission of the British Geological Survey © UKRI [2026]. All Rights Reserved.)



Figure 2. Location of stops and elevation profile.

The area is on the north flank of the Weald Anticline with northward dipping units and south-facing erosional escarpments, which were cut in the Miocene-Recent period. Dorking represents one of few points (along with the River Wey at Guildford) where the consequent drainage of the River Mole on the north flank of the growing anticline has persisted through to the present day, eroding through the otherwise prominent North Downs.

The Lower Greensand units here consist of the Hythe Formation sandstones, the sandstones and silty mudstones of the Sandgate Formation, both Aptian in age, overlain by the Folkestone Formation, also sandstone, but Albian in age.

Stops

1. **Rose Hill.** Half way up the dip slope of Folkestone Formation. There is a large open space left between a grand mid-nineteenth century development of villas. Construction of walls could be noted at several points on the walk as composed of flint and ferruginous (haematite-cemented) sandstone (Fig. 3). This grassy area has been interpreted by the BGS as a Quaternary River Terrace, but this was doubted by Alan. We did not cross the fence to inspect a small pit in the middle of the green, but from distance it seems to expose "bedrock" sandstone.
2. **St Pauls Allotments.** This represents another level area interpreted as a Quaternary River Terrace. In this case its use for cultivation was thought to genuinely reflect mixed alluvial sediments, rather than the sandy bedrock (Fig. 4).



Figure 3. Rose Hill. (Photo MC)

“Outcrop” is limited to material unearthed by moles or other animals – a small mole hill further up the dip slope was pure sand, which was attributed to the Hythe Formation (Fig. 5). From this point there was a great view northward of the Chalk escarpment where the changes in slope indicate the Lower, Middle and Upper Chalk (Fig. 6).



Figure 4. St Pauls Allotments. (Photo NJS)



Figure 5. “Outcrop”. (Photo NJS)



Figure 6. Northward view from above St Pauls Allotments. (Photo NJS)

3. **The Glory Wood (top).** At the very crest of the Hythe Beds escarpment is a low relief ?Bronze Age tumulus, although this was largely obscured by bracken – Alan promised clearance in the future! It testified to the likely absence of the mixed woodland that characterises this area in those times. The escarpment (Fig. 7) steepens from this point to the south. There was some debate as to whether the feature is quickly established in a periglacial environment and remains more or less fixed by vegetation, or whether its formation is more gradual, and ongoing.



Figure 7. Hythe Formation scarp. (Photo NJS)

4. **The Glory Wood (Bottom).** At the base of the escarpment, the Hythe Beds sit on the Atherfield Clay, forming a spring line (Fig. 8). At the time of the visit, the spring pools were dry, but the change in slope and the move to oak-dominated vegetation and presence of irises testify to the change in bed rock lithology and damp soil conditions. There are re-entrants into the escarpment caused by erosional retreat at the position of the most active springs, analogous to, but on a greatly different scale to the Devil's Punch Bowl at Hindhead.
5. **Dorking Golf Club/Chart Park.** This location allowed a view back down the escarpment. The spring line and the change to Atherfield Clay is marked by a boggy oak wood, known as The Wet Grove.
6. **Hope Mausoleum.** Commissioned in 1818 to be excavated by Thomas Hope, a notable designer and art collector, in honour of his son, but used by subsequent family, including for Thomas himself. It was partly dug into the Hythe Beds escarpment (Fig. 9). It appears to be in a hummocky area low down on the escarpment, which may be land slipped blocks (Fig. 10). It was noted that, although the BGS map such features on the southern flank of Leith Hill, to the west, they do not here.
7. **Deepdene Terrace.** Back on top of the escarpment again to take in spectacular views to the south across the axis of the Weald anticline to the low-lying Weald Clay, wooded Ashdown Formation Ridges and to the distant South Downs (Fig. 11).



Figure 8. Spring Line. (Photo NJS)

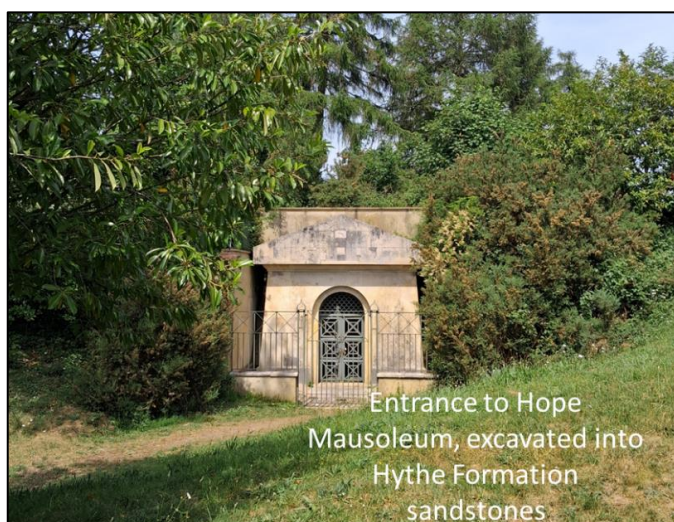


Figure 9. Hope Mausoleum. (Photo NJS)



Figure 10. Dorking Golf Club. (Photo NJS)

8. **Deepdene.** Gardens here were created in the 17th century, but the house, most latterly used as offices for the Southern Railway during WWII, was demolished and replaced by a modern building. Looking back up it is possible to view the entrance to a tunnel that was attempted to cut through the escarpment, as a means of more directly accessing the southerly views.

This, unlike the Hope Mausoleum excavation, failed because of the friable nature of the sandstone, and was not pursued due to collapse of the tunnel walls (Fig. 12). As an aside, it was interesting to note that the slopes on the northern side of the terrace (i.e. on the dip slope) seemed much steeper than those to the west (e.g. at location 2), and comparable to those on the actual southerly scarp face. It raised questions as to any structural control. Is faulting involved? (As a further aside, I discovered that the Brockham oil field, located in a deep fault block in the Jurassic, is located only some 1.4 km east of the Dorking Golf Club House, which we passed.)

9. **Cotmandene.** The trip ended here on the broad open terrace of Cotmandene (Fig. 13). This feature arose for two reasons – the excavation of the outcropping Sandgate Formation, which as a slightly more argillaceous facies of the Greensand, was used in the manufacture of roof tiles, and also the lower part of the area is a Quaternary River Terrace, as mapped by the BGS. This is common land used for grazing, and as we discovered on the day of our visit, for the drying of clothes!

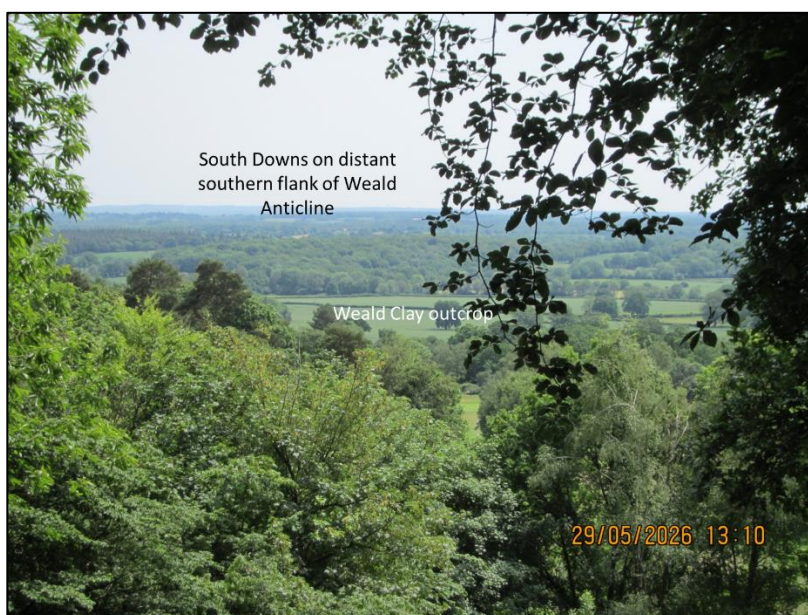


Figure 11. View south from Deepdene Terrace. (Photo MC)

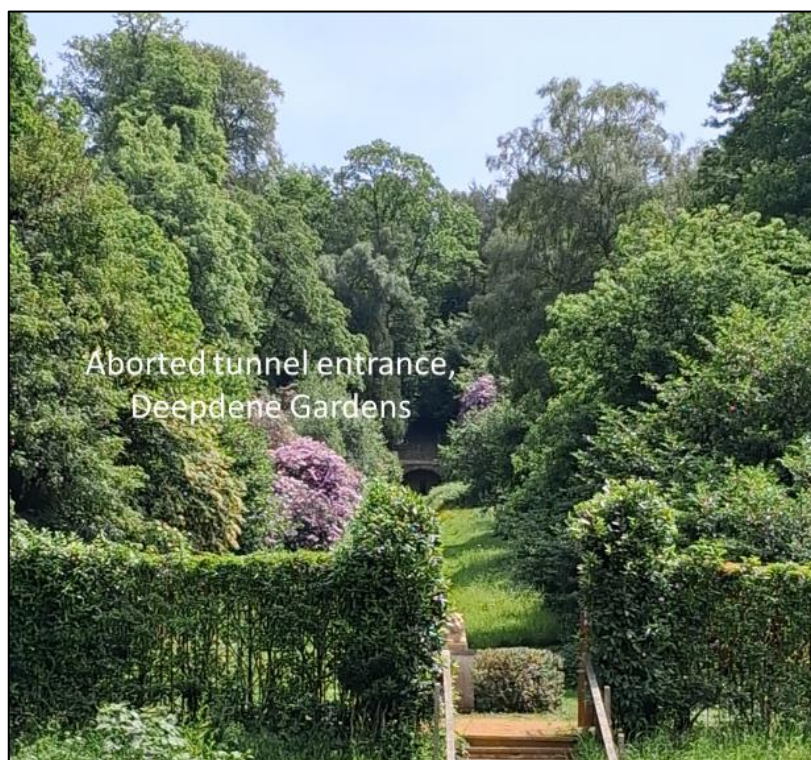


Figure 12. Deepdene Gardens. (Photo NJS)

Conclusions

This note only partly does justice to the colour that Alan provided, geological, geographical and historical. Many thanks are due to him for an interesting day travelling over the Greensand outcrop.

The FGS group are pictured in Fig. 14.

NJS 02/06/26



Figure 13. Cotmandene. (Photo NJS)



Figure 14. Weary participants! L to R: Katherine Rusbridge, Mick Caulfield, Nick Stronach, Jacky Thackeray, Tim Thackeray, Bob Rusbridge & Tessa Seward.

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Credit: LEONELLO CALVETTI / SCIENCE PHOTO LIBRARY / Getty Image

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Outreach

Churt Fete

13 June 2026

On Saturday, 13 June at the Churt Fete on the Churt Recreation Ground, Peter Luckham, Janet Catchpole and Mick Caulfield of the FGS had a stand displaying some of the Societies fossils, minerals and rocks.



L to R: Peter Luckham and Janet Catchpole at the FGS stand. (Credit: MC)

Situated between Farnham and Haslemere, Churt Village is on the edge of some stunning swathes of heath and common land from Hankley Common to The Devil's Jumps and The Flashes. Former Prime Minister, David Lloyd George, made Churt his home in 1921 and developed his estate in the village as he withdrew from the political scene.

A large crowd was in attendance enjoying such events as the dog show, tug-of-war and sack race among a large number of stands from local societies and businesses. Attendees and local businesses gave the event glowing reviews on social media. The 2026 event was celebrated for its fantastic family atmosphere and high-quality local stalls.

The FGS had a steady stream of visitor's throughout the afternoon: mainly families with young to teenage children interested in geology. We handed out "Rockwatch" literature to the children and FGS flyers to the adults. Hopefully one or two of the adults may be interested in joining the Society.

The revolution in dinosaur science started 50 years ago – here's what we have learned

Michael J. Benton & Emily Rayfield

31 March 2026



Artist's impression of a T. rex chasing a Velociraptor: the calculation of dinosaur running speeds in 1976 marked a revolution in palaeoscience. (Credit: Esteban De Armas/Alamy)

The study of dinosaurs has been through a revolution in recent decades. The story began half a century ago, when Robert McNeill Alexander, a professor of zoology at the University of Leeds, showed how the speed of an animal could be calculated from the spacing of its footprints and its body size.

This formula worked both for modern and extinct animals and so, for the first time, the speed of a dinosaur could be estimated from a fossilised trackway. Alexander calculated speeds for different dinosaurs of between 1.0 and 3.6 metres per second (up to 13kmh) – rather slower than others had guessed.

In the 1970s, dinosaurs were becoming exciting again after years of being treated as lumbering failures. Termed the “dinosaur renaissance”, American palaeontologists Robert Bakker and John Ostrom were among those transforming understanding by arguing that dinosaurs were active, possibly warm-blooded, and that they included the ancestors of birds. Remarkable fossils of feathered dinosaurs from China, found from 1996 onwards, cemented this idea.

Before Alexander's groundbreaking study in 1976, palaeontologists had made "reasonable guesses" about the function of dinosaurs – persuasive arguments but often untestable. Alexander began a movement to apply scientific methods to investigating dinosaur function and behaviour.

His research heralded the start of a revolution in palaeobiological methods, using modern scientific methods to bring dinosaurs to life in a testable way.

Modern techniques applied to the deep past

There are many questions about dinosaurian palaeobiology: what colours were they, how fast did they run, how did their jaws operate, how long did they take to grow to adult size?

Modern palaeobiologists conduct a three-step process to answer such questions. First, observe the fossil, then apply what we call the neontological toolkit – sets of observations and rules from the modern world that can be applied to ancient situations – and finally, make an inference about the dinosaur's behaviour.

To establish the running speed of dinosaurs from fossilised dinosaur tracks, Alexander measured the tracks, applied the formula derived from modern animals, and presented the speed calculation. He showed definitively that large dinosaurs could not gallop at the speed of a racehorse, as some had suggested.

A more recent example by one of us (Emily) is the use of engineering methods to establish dinosaurs' jaw movements. The computational methods are identical to those used to design aircraft, buildings and medical limb replacement devices, and so they are all stress-tested and they work. By making a 3D model of a skull or skeleton, the dinosaur's jaw movements and forces, as well as leg movements, could be calculated.



We now know the small Chinese dinosaur Sinosauropteryx had a ginger-and-white striped tail. (Credit: Cynthia Lee/Alamy)

Feeding calculations show that some flesh-eating dinosaurs punctured bone, while others pulled at their dead prey to yank off chunks of flesh. The most famous dinosaurian flesh eater, *Tyrannosaurus rex*, bit with a force of 50,000 newtons – enough to have bitten a car in half.

Scanning can reveal embryonic dinosaurs inside their eggs, and sections through their bones show growth rings that tell us their age at death. This means palaeontologists can calculate the rate of growth of dinosaurs and indeed some of them, during growth spurts, were putting on as much as 1-2 tonnes a year.

Earlier calculations suggested *T. rex* reached adult size of 6-8 tonnes at 20 years, but re-examination by Holly Woodward and colleagues suggests more like 30 years. This revision is not based on guesswork, but on counting bone rings and estimating body masses from a larger sample of specimens than first used.

But what about their colours? Even here, the new wave of investigative palaeontology has revealed the answer. In 2010, in work done between Bristol, Beijing and Yale University, the colours and colour patterns of two small theropod dinosaurs, *Sinosauropteryx* and *Anchiornis*, were published.

The neontological toolkit here was from modern birds, whose melanosomes (tiny capsules inside their feathers) contain variants of the pigment melanin. Two types of melanin give either black, brown and grey colours or ginger colours, and each type is contained in a differently shaped capsule.

These shapes were preserved in the dinosaurs' fossil feathers. Details of their coloured crests and wing and tail feather stripes show that small dinosaurs at least used these colours in competitive displays, just like some modern birds.

We don't need a time machine

All these studies are scientific hypotheses that can be disproved by contrary evidence. We don't need a time machine to determine, say, that the small Chinese dinosaur *Sinosauropteryx* had a ginger-and-white striped tail, or that *T. rex* could run at a range of speeds from 16 to 40 kilometres per hour.

Anyone who disagrees with these findings simply has to provide a critique of the chain of evidence to identify where an error has been made. But this scientific revolution in dinosaur studies does not mean every question about them has been answered.

For example, we don't yet know the sounds dinosaurs made, nor exactly how they communicated with each other. In some cases, researchers have reconstructed the nasal passages and discovered what toots and honks some dinosaurs made – but we cannot be sure these are realistic.

What are the limits of our knowledge about dinosaurs? It would be wise to be cautious in our predictions. After all, it was once widely claimed we would never know their true colours. A new generation of smart investigators may soon identify new toolkits that solve many more questions about these extraordinary creatures.

Reference:

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Humans' closest invertebrate ancestors date back much further than thought – how we discovered the fossils that show this

Luke Parry, Frankie Dunn & Gaorong Li, The Conversation

2 April 2026

Animal life is extraordinarily diverse and complex, having colonised almost all environments on Earth – from hostile hydrothermal vents in the deep sea to the skies across our continents.

But the planet was not always teeming with complex animal life. For the first 3.7 billion years after it originated, life was small, simple and largely confined to the oceans. This microbe-dominated world was a tumultuous place, with several major swings in its climate.

But all this appears to have changed about 538 million years ago (mya) during the Cambrian period. This critical juncture in the history of life saw animals bursting on to the scene in an event known as the “**Cambrian explosion**”.

All sorts of animals easily recognisable as groups alive today appeared in the fossil record, from echinoderms (starfish, sea cucumbers, urchins) and arthropods (spiders, crustaceans, insects) to various types of worm. This seemingly abrupt appearance of animals in a geological “blink of an eye” has puzzled scientists from Charles Darwin onwards.

Many of these new lifeforms belonged to a group of animals called *Bilateria*, so-named for their symmetrical left and right sides. This group now contains all animals with brains and complex musculature.

However, a longstanding question for palaeontologists has been whether this astonishing diversification event happened all at once during the Cambrian explosion – or if ancestors of Cambrian and modern animal groups can be traced further back in time. Our new study, published in the journal **Science**, could help to resolve this question.

Strange bodies

The preceding Ediacaran period (635-538 mya) was much more enigmatic than the Cambrian. Many organisms from that period have defied efforts to classify them. Their strange bodies – often resembling shapeless sacs or thin, quilted pillows – have no obvious counterparts among living species, let alone modern animals.

As a result, interpretations of Ediacaran creatures have encompassed almost all multicellular forms of life – from fungi and lichens to an extinct kingdom unrelated to anything multicellular alive today. These Ediacaran organisms lived in close association with mats of microbes that smothered the seafloor – a type of ecosystem that did not survive the advent of grazing bilaterians.

More recent evidence relating to their reproductive strategy and how they grew and developed has suggested they were, in fact, animals – albeit very simple ones without any direct, living descendants.

It isn't until the very end of the Ediacaran period that the fossil record gives hints that more complex – and recognisable – animals were around. And most of the evidence for these bilaterian animals has come from fossilised burrows and trails, suggestive of complex animal life but telling us little about the animals that made them.

This has led to much debate about the nature of the transition from the Ediacaran to the Cambrian period – the start of which geologists have defined by the action of complex animals churning up ocean sediment for the first time.



This fossil (plus artist's reconstruction), found in the Jiangchuan biota (~554-539mya), is an early cnidarian: the phylum that includes jellyfish, sea anemones and corals. Scale bar: 2mm. (Credit: Gaorong Li and Xiaodong Wang., CC BY-SA)

A discovery to fill the fuzzy gap

In spring 2023, one of us, Gaorong Li – then a PhD student at Yunnan Key Laboratory for Palaeobiology (YKLP) – made a discovery that helps to clarify this fuzzy gap between the weird Ediacaran world and the recognisable, complex animal-dominated Cambrian period.

Along with my PhD supervisors Wei Fan and Peiyun Cong, we explored Ediacaran rocks in the Chinese region of Eastern Yunnan. We were principally looking for fossil algae (seaweeds), the focus of my PhD thesis, in rocks known for well-preserved fossils called the Jiangchuan biota.

What we found in addition was a bizarre worm that lived tethered to the seafloor by an anchoring disc, and which could turn its strange proboscis inside out to collect food. These specimens were clearly complex animals, but not as they are known today.

We nicknamed it the “bugle worm”, and our team are still figuring out exactly where this strange beast fits into the classification of animals. Previously, it had been described based only on the disc anchoring it to the seafloor and named *Cycliomedusa* – but we found the whole organism, revealing it as something unexpected and strange.

As we continued splitting more and more rocks, it became clear there were more animals hiding in the Jiangchuan biota. In 2024 – now joined by a team from the University of Oxford including the co-authors of this article, Luke and Frankie – we went back into the field and pieced together this new fossil community.

We found some fossilised organisms characteristic of both the Ediacaran and Cambrian periods. But surprisingly, we also found some that had previously only been known from the time of the Cambrian explosion. These included a primitive animal similar to the Cambrian organism *Mackenzia*, as well as various worms and swimming predators called ctenophores.

Most striking of all, we found the oldest evidence for the group to which we humans belong: the deuterostomes.

Several of these specimens have a stalk and tentacles and closely resemble a group of Cambrian fossils called *cambroernids*. These now-extinct animals are related to living starfish and acorn worms – the closest invertebrate relatives to humans. This shows our own evolutionary story has its roots in the Ediacaran period.



A deuterostome cambroernid fossil from the Jiangchuan Biota (~554-539mya), plus artist's reconstruction (scale bar: 2mm). (Credit: Gaorong Li and Xiaodong Wang, CC BY-SA)

The discovery of diverse, complex animals in the Jingchuan biota suggests several animal groups shared the world with the weird and wonderful Ediacarans for millions of years. Diverse complex animal life has a more ancient heritage than the Cambrian explosion.

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Mount Etna is like no other volcano on Earth, representing 'a new type of volcanism,' new research reveals

Mount Etna's strange lava has long perplexed scientists, but new research reveals that the volcano formed in a bizarre way — making it unlike any other known volcano on Earth.

Stephanie Pappas, LiveScience

29 April 2026

Mount Etna is like no other volcano on Earth, new research finds. In fact, the volcano may have formed in a bizarre way, reminiscent of how some seamounts, called petit-spot volcanoes, grow on

the ocean floor, researchers reported April 7 in the journal **JGR Solid Earth**. Although these seamounts are tiny — just a few hundred feet tall — Mount Etna towers 11,165 feet (3,403 meters) above sea level.



Mount Etna's strange lava has long perplexed scientists. Now they know why it's so weird. (Image credit: Anadolu via Getty Images)

"This actually represents a new type of volcanism," Sarah Lambart, a petrologist at the University of Utah who was not involved in the new research, told **Live Science**.

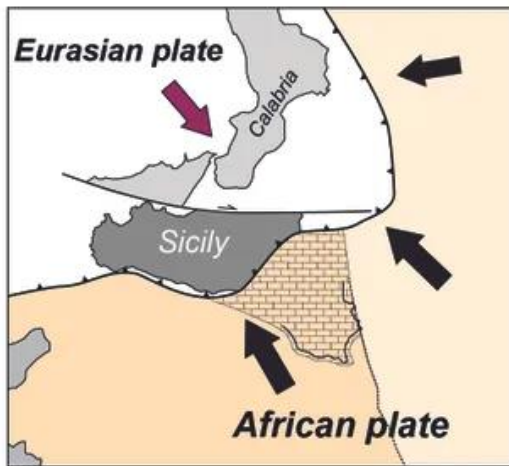
Before this study, researchers split volcanoes into three types, Sébastien Pilet, a lecturer in Earth sciences at the University of Lausanne in Switzerland, told **Live Science**.

Mid-ocean ridge volcanoes form where the oceanic plate pulls apart and magma from below rises to form a new crust. Then, there are **intraplate volcanoes**, like the Yellowstone caldera or the volcanoes forming the Hawaiian Islands, where a "hotspot" in the mantle causes a concentrated zone of eruptions. Finally, there are **subduction zone volcanoes**, like Mount Rainier in Washington and Mount Fuji in Japan. These volcanoes form on the continental crust inland from a subduction zone, where an oceanic plate pushes under the continent, and they're driven by the water in the oceanic plate causing rocks to melt in the subsurface.

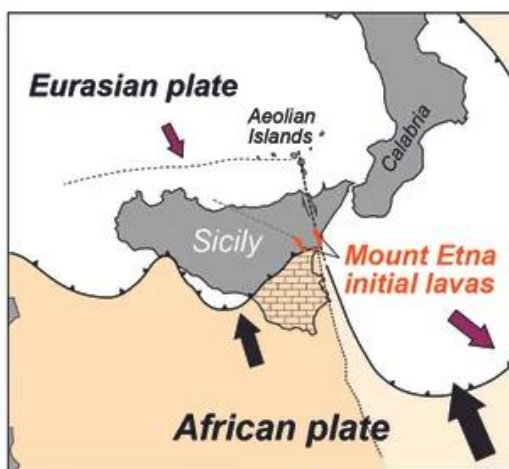
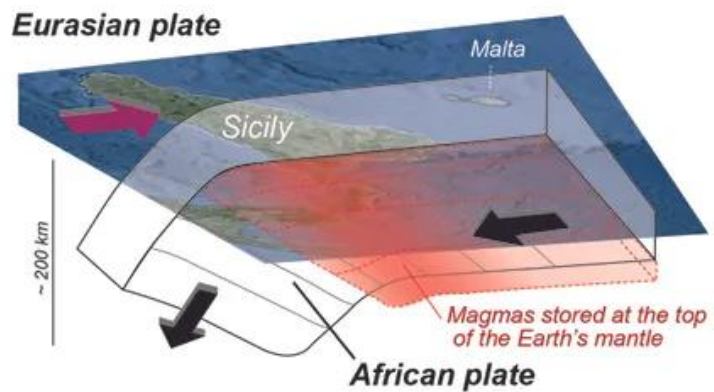
Mount Etna, located on the Italian island of Sicily, fits none of these categories. It sits near where the African Plate is sliding under the Eurasian Plate, but it's right on top of where the plates meet, rather than inland like most subduction zone volcanoes. Chemically speaking, Mount Etna's lava also looks like hotspot volcano lava, even though there is no evidence for a hotspot underneath it.

On top of that, Etna's evolution has been weird. Early in the volcano's history, it erupted small amounts of silica-rich lava. Later, it started spewing a lot of lava rich in alkali metals, like potassium and sodium. This is unusual, Pilet said; normally, silica-rich lava comes from magma reservoirs with a lot of melt, so they erupt in large volumes, while alkali-rich lava comes from less-melted rocks in the mantle and thus tends to erupt in small amounts.

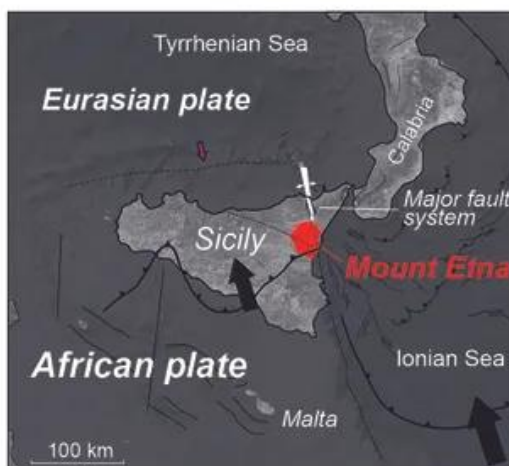
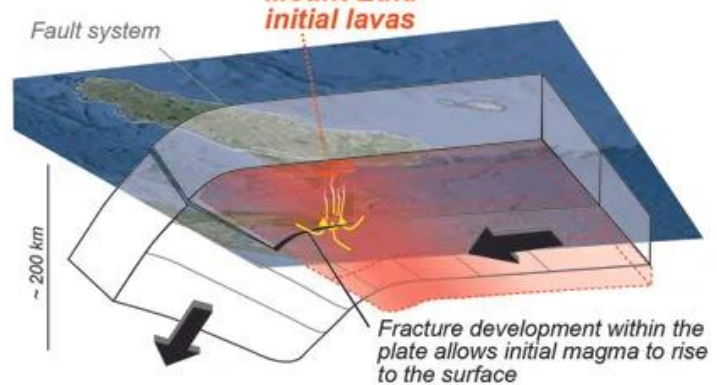
To figure out what's been happening at Etna, Pilet and his colleagues studied the geochemistry of the lava layers across the volcano's history.



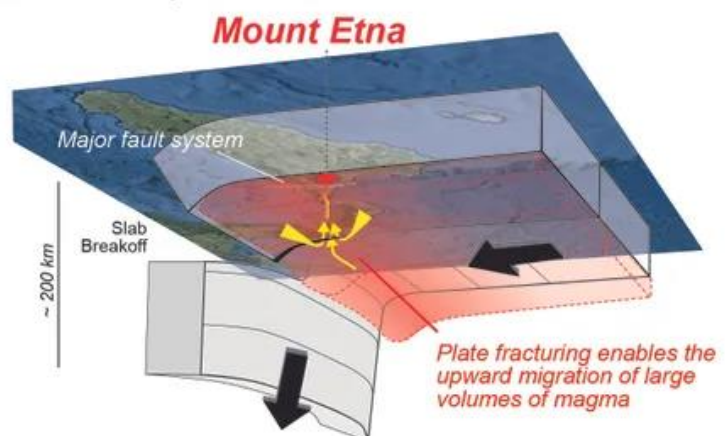
Situation 5 million years ago



Situation at the onset of Mount Etna (500'000 years ago)



Present-day situation



Mount Etna formation model, with the volcano starting to grow around 500,000 years ago. (Image credit: University of Lausanne)

They found that Etna's lava seems to arise from a melty layer at the top of the mantle known as a **low-velocity zone**, because seismic waves slowdown in these regions. These low-velocity zones are likely widespread, Pilet said, but the melt rarely reaches the surface. What makes Etna special is its location in a complicated tectonic zone. The subducting plate isn't diving under the Eurasian Plate evenly, Pilet said; it's partially stuck, leading to the rock folding and deforming. "The folds are allowing the magma to rise up" he said.

The initial magma had to travel from the low-velocity zone through the African Plate, and it reacted with the crust along the way to form large amounts of silica-rich lava, Pilet said. (Continental crust is rich in silica). After that passage, a more direct conduit from the mantle to the surface brought up less-adulterated alkali lava from the low-velocity zone, but in smaller supply.

This finding is intriguing, Lambart said, because the role of magma's interactions with the lithosphere, which includes the crust and upper mantle, in volcanic eruptions is underexplored. That means that, although Etna is one of a kind, the unique type of volcanism it represents might point to more widespread phenomena.

"The lithosphere might actually have a very important role in contributing one way or another to the magmatic activity we are seeing everywhere, not only Mount Etna," she said.

Article Source:

Pilet, S., Reymond, J., Rochat, L., Corsaro, R. A., Chiaradia, M., Caricchi, L., & Müntener, O. (2026). Mount Etna as a leaking pipe of magmas from the low velocity zone. **Journal of Geophysical Research Solid Earth**, 131(4). <https://doi.org/10.1029/2025jb032785>

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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

Triassic croc relative from Ghost Ranch, New Mexico finally identified after nearly 80 years in museum basement

During the Triassic, a newly described species related to modern crocodiles and alligators stalked prey on land, not the water, a new study finds.

Skyler Ware, LiveScience

16 April 2026

During the Triassic around 205 million years ago, a newly-identified relative of modern crocodiles stalked its prey, but not in the water, a new study finds.

Like other ancient crocodile cousins, this newly identified species hadn't yet ventured into the water. Instead, it hunted its prey on land, much like a modern fox or jackal, the researchers said.

It would have been a fearsome predator, with its fossil suggesting "specialization for a powerful bite," the researchers wrote in the study.

The specimen was originally discovered decades ago, in 1948 at Ghost Ranch, New Mexico, in a well known dinosaur death bed. At the time, it was tentatively catalogued as a specimen of *Hesperosuchus agilis*, a small, early relative of crocodiles and alligators. But now, the new study shows that the creature's unusually short snout and thick, reinforced skull set it apart as an entirely new genus and species, though the creature lived — and died — at the same time and place as *H. agilis*.

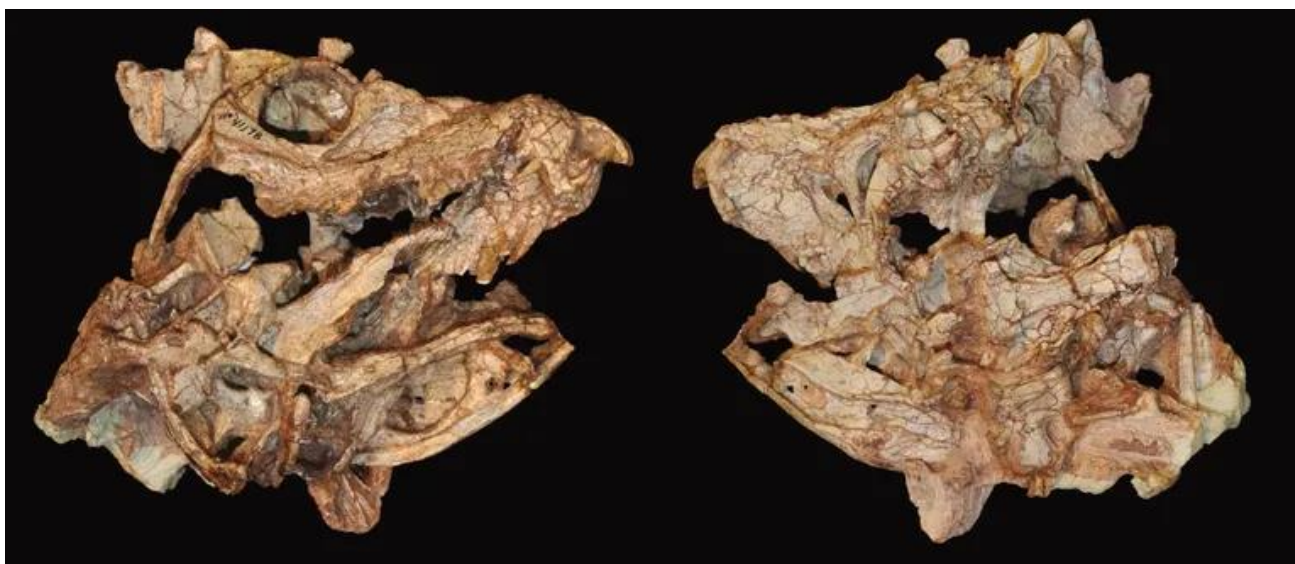
"This is the first really strong evidence we have of coexistence between two functionally different-looking crocodylomorphs," study co-author Miranda Margulis-Ohnuma, a palaeontologist at Yale

University, told **Live Science**. Crocodylomorphs include modern crocodiles, alligators, caimans and their extinct relatives.

The fossil of the short-snouted creature, newly dubbed *Eosphorosuchus lacrimosa*, was uncovered in a Late Triassic (237 million to 201 million years ago) formation. The animal's skull, the bones of one of its back legs, one vertebra, and three scales were preserved. The creature would have been about the size of a large dog.



The newly named genus and species Eosphorosuchus lacrimosa (left) is bitten by Hesperosuchus agilis (right) near a Coelophysis carcass at what is now Ghost Ranch, New Mexico. (Image credit: Julio Lacerda)



Photographs of the skull of Eosphorosuchus lacrimosa, viewed from bottom right (left) and top left (right). (Image credit: Miranda Margulis-Ohnuma)

"It was in the basement of the Peabody Museum [at Yale] for, literally, 75 years," Margulis-Ohnuma said. "People would sometimes come visit and look at it, but it had never been identified."

In the new study, published Wednesday (April 15) in the journal **Proceedings of the Royal Society B: Biological Sciences**, Margulis-Ohnuma and her colleagues categorized the fossil in detail and compared it with a fossil of *H. agilis* found about 15 feet (5 meters) away. The animals in this section of Ghost Ranch lived at the same time, and they died and were buried in a single event, possibly a flood.

E. lacromisa has a much shorter snout than *H. agilis*, the team found. It also has a larger, triangular postorbital — a bone in the skull — and matching features on its lower jaw that may have accommodated strong muscles for chomping. Together, those traits suggest the creature had a very powerful bite.

Because *E. lacrimosa* and *H. agilis* lived alongside each other, the team suspects they occupied different ecological niches. For example, crocodylians with shorter snouts may have fed on larger, less-agile prey than species with longer snouts did.

"It's really cool that it's not a lineage that's just struggling to take off — at this point, there's already diversity," Margulis-Ohnuma said. "We're really getting a snapshot of the very beginning of functional diversity across crocs."

Scientists don't know much about the early stages of crocodylomorph evolution. There aren't many of these animals preserved in the fossil record, Margulis-Ohnuma said, and many crocodylomorph species from the Triassic are represented by a single fossil specimen.

"For early crocs, we're very data deficient, so every new fossil that comes out is changing the story," Margulis-Ohnuma told Live Science. "If we can continue to describe this material that we have, and ideally find new fossils, it will change the story every single time."

Article Source:

Margulis-Ohnuma M, Ruebenstahl A, Meyer D, Bhullar B-AS. 2026 A short-snouted 'sphenosuchian' with unusual feeding anatomy demonstrates that ecological specialization occurred early in crocodylomorph evolution. **Proc. R. Soc. B** 293: 20260130. <https://doi.org/10.1098/rspb.2026.0130>

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The Colorado River disappeared from the geological record for 5 million years: Scientists now know where it went

Holly Ober, University of California, Los Angeles, PhysOrg

17 April 2026

Geologists have solved the mystery of the disappearance from the geological record, millions of years ago, of one of North America's most important waterways: the Colorado River. A paper published in **Science** shows that the river flowed into an upstream lake over the course of a few million years, then likely flowed for the first time into the Grand Canyon. The moment marked the Colorado River's transition to a continental-scale river as it made its way down to the Gulf of California.

"In some ways, you could really think of it as the birth of the Colorado River that we know today," said first author and UCLA geologist John He. "There are rivers everywhere, but a river that carries water

and sediment across the continent connects life throughout the region, and the entire ecosystem probably changed as a result of the arrival of the Colorado River into the basin."



(Credit: Pixabay/CC0 Public Domain)

The finding, based on the analysis of sandstone samples, complements paleontological evidence, such as fish fossils, that suggests life began to become part of an integrated ecosystem throughout the Colorado River basin during this hidden chapter of its history.

How and when did the Colorado River reach the Grand Canyon?

The Colorado River existed in western Colorado 11 million years ago and first exited the Grand Canyon around 5.6 million years ago. But how it navigated the terrain between the two points for around 5 million years had been a mystery.

Now, new evidence suggests it pooled just east of the Grand Canyon, in what is now part of the Navajo Nation, before charting a downstream path that ultimately led to the Gulf of California around 5 million years ago.

The Grand Canyon was carved in multiple phases over a long period of time, but precisely when and how much the Colorado River incised it remains debated among geologists.

"Geologists have proposed over a dozen hypotheses for the canyon's formation and the Colorado River's path," said co-author John Douglass, a geologist at Paradise Valley Community College.

One obstacle in the ancient river's path is the Kaibab Arch, a topographic high point located in northern Arizona and southern Utah. Geologists have proposed different scenarios for how the river crossed it, but one theory that the new evidence makes more plausible is lake spillover. In this scenario, the Colorado River would have filled a lake and eventually exited it along a course to the Grand Canyon.

"Other processes, such as karst piping, which involves water transport through rock, and headward erosion, may have also contributed to the establishment of the river's course," explained corresponding author Ryan Crow, from the U.S. Geological Survey. "Some reaches were likely newly carved, and others would have been significantly deepened by the integrated Colorado River over millions of years."

The collaborative work began when He, Douglass and Emma Heitmann at the University of Washington met in the field while studying the remnant deposits of Bidahochi Lake, an ancient lake on Navajo Nation land. Most of the deposits of this enigmatic lake have eroded away, so no one knows how large the lake was. Geologists also didn't know what rivers fed the lake, or why Bidahochi Lake eventually disappeared.



Dark red and green mudstone beds with tan sand-dominated layers above, marking the arrival of Colorado River sediment into the Bidahochi basin 6.6 million years ago.

(Credit: Drone image taken by Brian Gootee, with permission of the Navajo Nation)

To understand where the sediments in Bidahochi Lake came from, He searched for zircons in the sandstone they collected.

Zircons are microscopic crystals that form in cooling magma. They do not degrade or change much over time and therefore contain an accurate geochemical signature of the moment they were created. Zircon is found in granite and other volcanic rocks, so it occurs abundantly in many sediments after the source rocks erode.

Geologists have developed a technique called **detrital zircon geochronology** that uses lasers or ion beams to measure the ratios of uranium and lead isotopes in hundreds of zircons in a sample. The unique age and history of each zircon can thus be traced to learn the sources of a sediment and estimate when it was deposited. The age spectrum derived from hundreds of zircons in a sample is called its detrital signature.

"Zircons are some of the oldest fragments of Earth," said He. "They're like little time vaults, and by looking at the age and geochemical signature of zircons, we can tell where a sediment that has been moved by a river originated."

He was studying the detrital zircon signatures of the samples he collected when, to his surprise, he detected what he thought was the signature of sediments known to have been deposited by the Colorado River. When he brought this up to Douglass, his colleague said that was exactly what he, Crow and some of his colleagues at the U.S. Geological Survey were looking for at the same time.



Visualization of palaeotopography at ~6.5 Ma.

(Credit: *Science* (2026). DOI: [10.1126/science.adz6826](https://doi.org/10.1126/science.adz6826))

The researchers teamed up with USGS geologists and colleagues at the Arizona Geologic Survey, the University of Oklahoma, and the University of Washington.

Together, they compared the detrital signatures of thousands of zircons in the sand that He and co-authors collected with those from other known deposits of the ancestral Colorado River and a few other possible sources.

The results showed that signatures of the sediments deposited about 6.6 million years ago in Lake Bidahochi closely matched those of other Colorado River deposits downstream and upstream, including the Browns Park Formation in northern Utah and Colorado.

Study of rock layers in the field from this time period showed signs of rippling that indicated a strong river flowed into standing water, and fossils of large fish species characteristic of fast-flowing waters.

These lines of evidence strongly indicated that the Colorado River was supplying water and sediment to the Bidahochi basin before it spilled over and the river began to flow through the Grand Canyon. This set the stage for the mighty Colorado River that carved much of the Grand Canyon and upon which much of the West depends for water.

"I think there is something unique and disquieting when the planet's history is laid out before our eyes, but we cannot fully read it. We've always known the Grand Canyon is there, this solid towering wall of rock, but we're learning more each day about how it formed," said He.

Publication details:

John J. Y. He et al, Late Miocene Colorado River arrival in the Bidahochi basin supports spillover origin of Grand Canyon, *Science* (2026). DOI: [10.1126/science.adz6826](https://doi.org/10.1126/science.adz6826)

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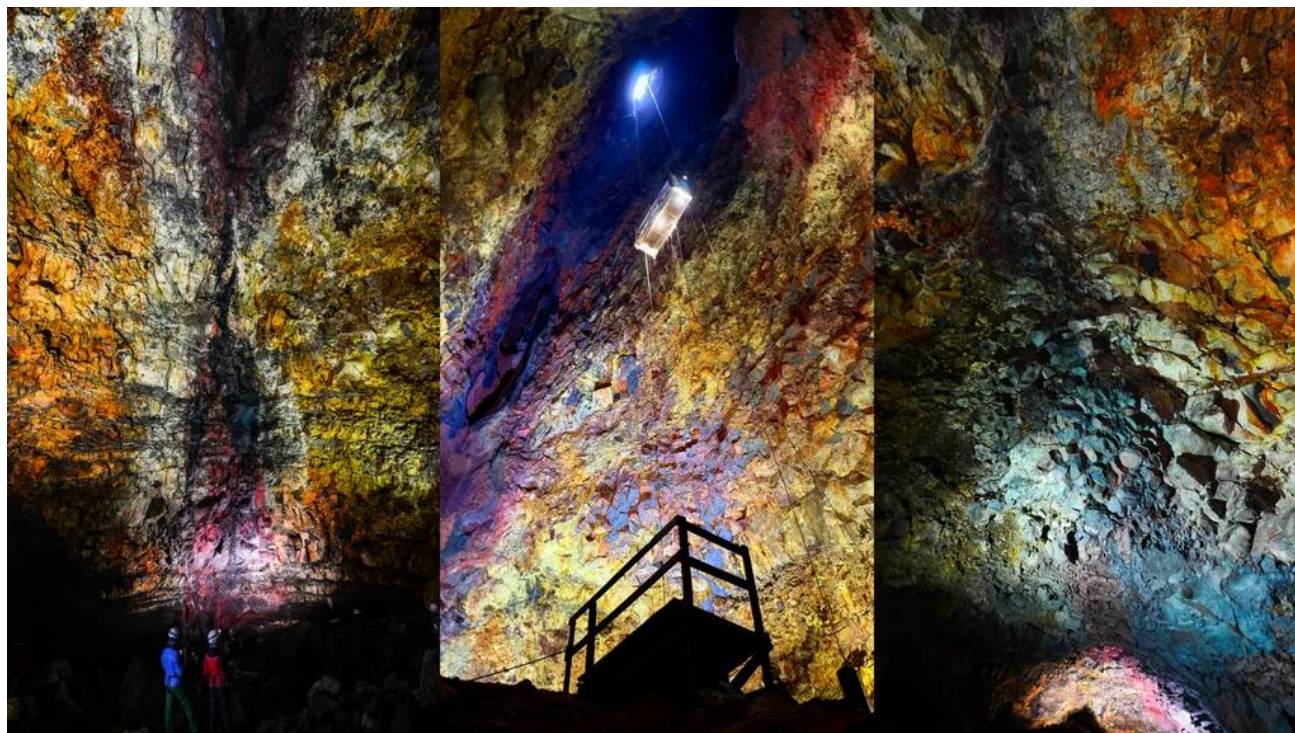
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Thríhnúkagígur: The only volcano on Earth where you can descend into a magma chamber

Thríhnúkagígur is a volcano near Reykjavík in Iceland with an empty magma chamber decorated with vivid colors that scientists and tourists can access via an open cable elevator.

Sascha Pare, LiveScience

26 April 2026



The colours inside the magma chamber are attributed to microbes, sulfur-rich gases and rocks tumbling off the walls.

(Image credit: Pedro Carrilho (left and right) and KKKvintage (middle) via Getty Images)

Thríhnúkagígur is a dormant volcano near Reykjavík whose last eruption 4,500 years ago left a hollow magma chamber with bronze-and-indigo-coloured walls. It's the only place in the world where people can climb into a volcano's plumbing system and explore the cavern that held sizzling molten rock before an eruption.

Since 2012, visitors have been allowed to enter Thríhnúkagígur's magma chamber via an open cable elevator that was built in 2010 for scientists. The chamber is about 700

feet (210 meters) deep, or more than double the height of the Elizabeth Tower *aka* Big Ben. Visitors are lowered to the bottom of the cave in a metal cage, and then they are free to roam the 33,600-square-foot (3,120 square meters) cave floor.

QUICK FACTS

Name: Thríhnúkagígur, or Three Peaks Crater

Location: Southwest Iceland

Coordinates: 63.9984, -21.6989

Why it's incredible: The volcano hosts the world's only magma chamber that's accessible to humans.

Volcanoes don't usually have empty magma chambers beneath them. Typically, during an eruption, there comes a point when the pressure in the chamber isn't high enough to eject any more liquid. The leftover magma slowly solidifies inside the chamber, filling the ground beneath the volcano.

Thríhnúkagígur is an exception, but researchers don't really understand why. The magma that fed the most recent eruption seems to have disappeared, and scientists think it may have been sucked back down into Earth's crust.

"It's like somebody came and pulled the plug and all the magma ran down out of it," Haraldur Sigurdsson, a volcanologist and professor emeritus of marine geology and geophysics at the University of Rhode Island, told **Inside the Volcano**, a company that organizes tours of Thríhnúkagígur.

The colours inside the chamber are attributed to microbes, but not much is known about the organisms that live there. Sulfur-rich gases likely painted some parts of the cave yellow and orange, while rocks falling off the walls formed the indigo and blue patches. Visitors occasionally see puffs of steam rising from corners of the chamber, but these are caused by water dripping onto lamps that illuminate the cave and are not signs of an impending eruption.

Evidence suggests Thríhnúkagígur has erupted three times over the past 50,000 years. The volcano presents three peaks at the surface — hence its name, which translates to "Three Peaks Crater." They are similar in height — about 115 feet (35 m) tall — and they form a line, with about 660 feet (200 m) between each peak.



The opening where people can descend into the magma chamber is located atop one of Thríhnúkagígur's three peaks. (Image credit: Jorge Castellanos/SOPA Images/LightRocket via Getty Images)

The youngest peak dates to the eruption 4,500 years ago. At the top sits the opening where scientists and tourists start their journey into the heart of the volcano. The next peak in the line formed 5,000

years ago, and it is partly encircled with solidified lava from the most recent eruption, according to Inside the Volcano. The oldest peak formed 50,000 years ago, when Iceland was covered with a thick ice sheet. It is composed of hyaloclastite, a volcanic rock characterized by sharp, glassy fragments that appear when lava comes into contact with water and ice.

It's unlikely that Thrihnúkagígur will erupt anytime soon, even though the volcano sits within the Mid-Atlantic Ridge, a tear in Earth's crust where the Eurasian and North American tectonic plates are separating, according to Inside the Volcano.

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Dinosaurs may have originated 10 million years earlier than fossils show

Ingrid Fadelli, Phys.org

1 May 2026

Dinosaurs are among the most majestic and iconic animals to have ever walked on our planet. While they are now extinct, they are estimated to have inhabited Earth for over 165 million years.

Countless past studies have examined dinosaur fossils and tried to delineate their origin and evolution over time. Nonetheless, much about the history of these disappeared animals remains poorly understood.

Researchers at Yale University and Princeton University recently tried to re-trace the origins and early diversification of dinosaurs by analysing available datasets using advanced statistical techniques. The results of their analyses, published in **Proceedings of the Royal Society B**, suggest that dinosaurs might have originated between 250 and 240 million years ago, which is around 10 million years earlier than indicated by the oldest confirmed dinosaur fossils.

"Over 230 million years of Earth's history, dinosaurs became a major terrestrial animal clade and produced one of the most species-rich living tetrapod lineages: birds," wrote Chase Doran Brownstein and Christopher Thomas Griffin in their paper. "Yet, largely because of uncertainty surrounding the phylogeny of early dinosaurs, the tempo and mode of their emergence and initial radiation remain poorly constrained. We reconstruct the initial diversification of dinosaurs through Bayesian tip-dating analyses."

The analysis of morphological datasets

Brownstein and Griffin statistically analysed nine different morphological datasets compiled in recent years. These datasets include things like records of the shapes and sizes of dinosaur bones, the presence or absence of specific features (e.g., horns, feathers, etc.) and other traits or body features inferred from recovered fossils.

The datasets analysed by the team included information about the three major dinosaur groups (i.e., clades), known as theropods, sauropodomorphs and ornithischians. Theropods, such as the *T. rex*, were carnivore dinosaurs with hollow bones, typically walking on two feet and with three-toed hind limbs.

Sauropodomorphs, such as the *Brachiosaurus*, were middle to large-sized herbivore dinosaurs, which later evolved to have very long necks. Ornithischians, such as *Triceratops*, were another type of plant-eating dinosaur divided into different sub-groups with distinct physical features and characteristics.

The researchers analysed data related to the physical traits of these three types of dinosaurs using statistical methods. By looking at the estimated ages of fossils and previous evolutionary models, they were able to estimate when dinosaurs first appeared and the speed at which they evolved.

As part of their study, Brownstein and Griffin also tried to reconstruct the evolutionary relationships between species, testing different hypotheses about the relationships between different groups. In addition, they used an approach called fossil-birth-death (FBD) to model the origin of species, how they became extinct and their preservation as fossils over time.

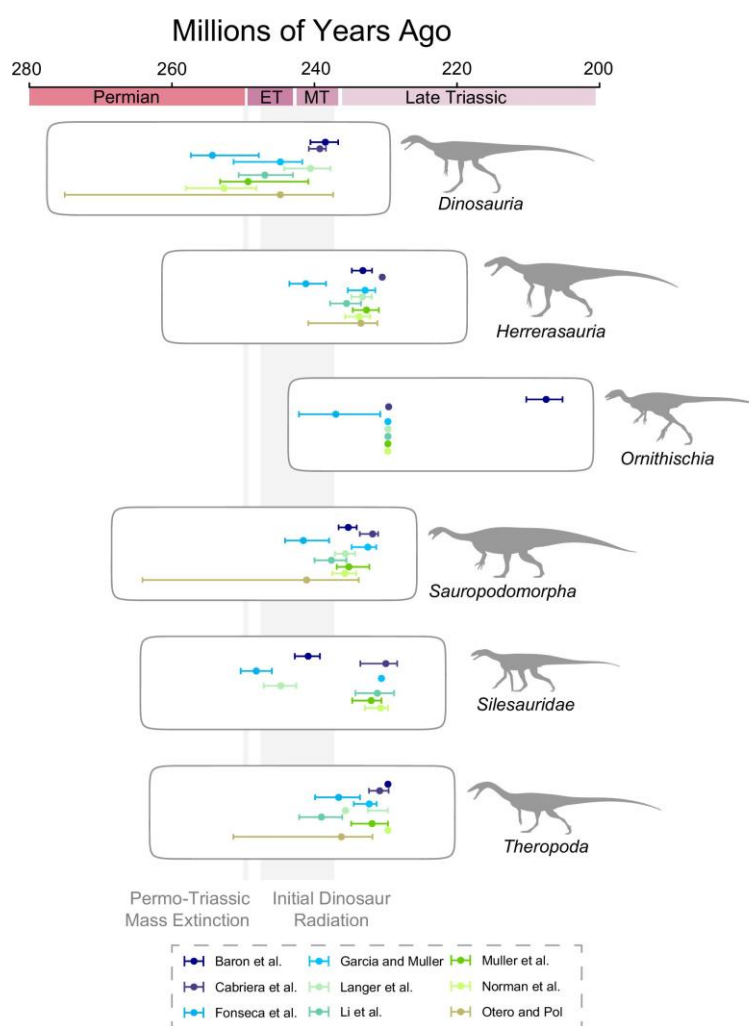
"We estimate that dinosaurs emerged between 250 and 240 Ma, 10 million years before the earliest unambiguous dinosaur fossils," wrote Brownstein and Griffin. "The emergence of the dinosaurs was followed by the rapid appearance and diversification of all major lineages, coinciding with a burst of morphological evolution that peaked in the early Late Triassic."

Dinosaurs might have emerged earlier than originally thought

The results suggest that dinosaurs may have appeared on Earth about 10 million years earlier than the earliest unambiguous dinosaur fossils indicate, diversifying rapidly into the main known groups.

Specifically, the team's findings indicate that an early burst of dinosaur skeletal evolution occurred near the origin of the group, around 250–240 million years ago in the Middle Triassic. This initial phase pre-dates the Late Triassic (237 to 201.4 Ma), when the fossil record shows dinosaurs already diversified into the major, physically distinct groups such as theropods, sauropodomorphs and ornithischians.

"The patterns that we infer are consistent with the expectations under a scenario of evolutionary radiation, in which ecologically disparate lineages rapidly diversify from a single common ancestor," wrote Brownstein and Griffin.

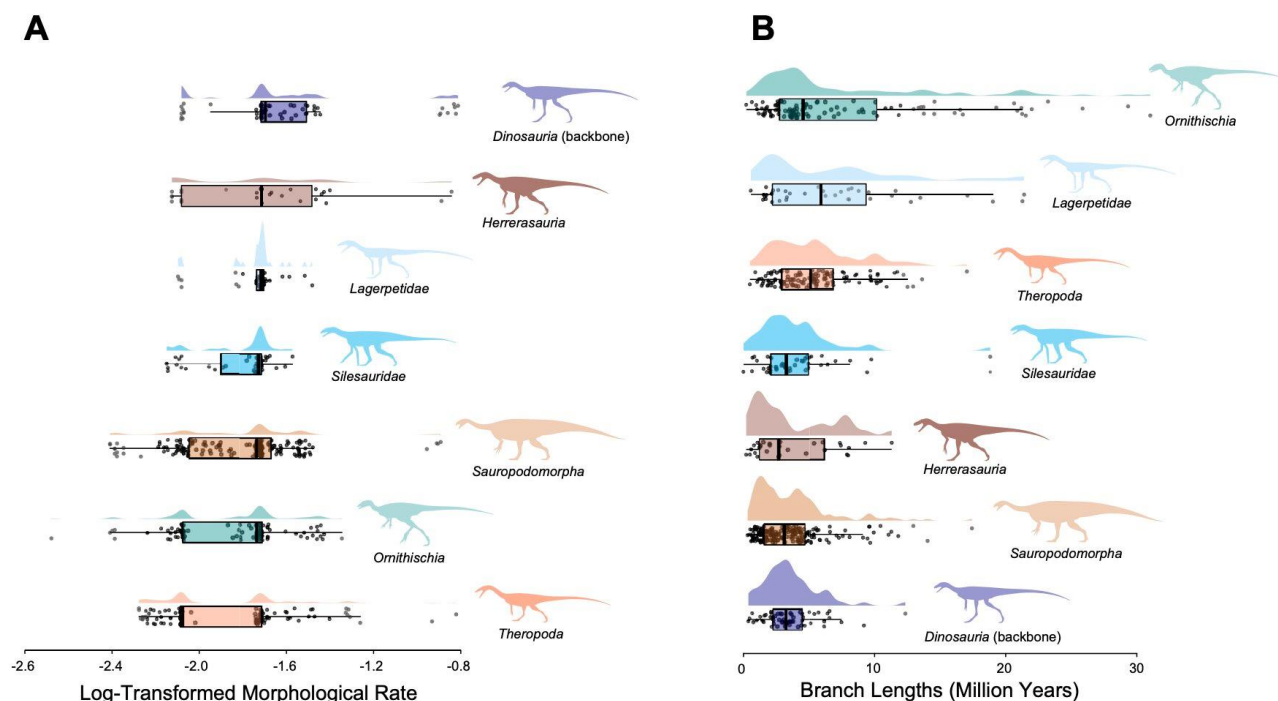


Estimating the age of dinosaurs. The plot shows median ages (dots) and 95% highest posterior density intervals (bars) estimated for six lineages across our Bayesian tip-dated phylogenies from nine different morphological matrices.

(Credit: Proceedings of the Royal Society B: Biological Sciences (2026). DOI: 10.1098/rspb.2026.0102.)

"In turn, our results provide a biological explanation for the instability surrounding early dinosaur phylogeny and suggest that the diversity of dinosaurs has been sculpted by multiple rapid radiations following successive mass extinctions in deep time."

Other researchers could soon conduct further analyses to validate the new insight and estimates provided by this study. In the future, these works could help to refine existing models and theories of dinosaur evolution, improving the present understanding of our planet's early history.



Morphological rates and branch lengths for selected clades. Box and whisker plots for (A) rates of morphological evolution and (B) branch lengths in millions of years for selected clades.

(Credit: Brownstein & Griffin. (Proceedings of the Royal Society B, 2026))

Publication details:

Chase Doran Brownstein et al, An early burst of skeletal evolution at the origin of dinosaurs, **Proceedings of the Royal Society B: Biological Sciences** (2026). DOI: 10.1098/rspb.2026.0102.

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Geoverse

Poems on geology, science, Horsham, life, the universe and everything

Suggested by Janet Catchpole

Rock Makers

Posted on October 16, 2024 by Gordon Judge

Minerals make rocks. One definition is: 'A structurally homogeneous solid of definite chemical composition, formed by the inorganic processes of nature'. But it's not a watertight definition; for example, mercury is classed as a mineral. As of July 2024, the International Mineralogical Association recognized 6,062 official mineral species, but other sources list more. So, here's a brief guide to differentiating between them in the field:

There's lots of us – we're minerals.
 You'll have seen us in the rocks
 When you've ventured out on field trips
 With hard hats and woolly socks.

So how should you describe us?
 What shape do you perceive?
 Our colour, lustre, density,
 How we fracture, how we cleave?

See what colour mark we make
 When you 'streak' us on a plate.
 Add a drop of HCl
 To test for carbonate.

Where are we on Herr Mohs' scale*?
 Try scratching us; and then,
 If your sample can't be scratched at all,
 It's diamond, hardness 10!

For other tests, you'll need a lab
 Does UV make us glow?
 Are we birefringent?
 Radioactive – yes or no?

(Some quick field tests were used once,
 Like taste, or bite, or smell;
 But they're not now recommended:
 They could make you quite unwell...)

So, use the simple tests above –
 There's nine of them to try;
 And when you're done you'll have a name
 To call your mineral by.

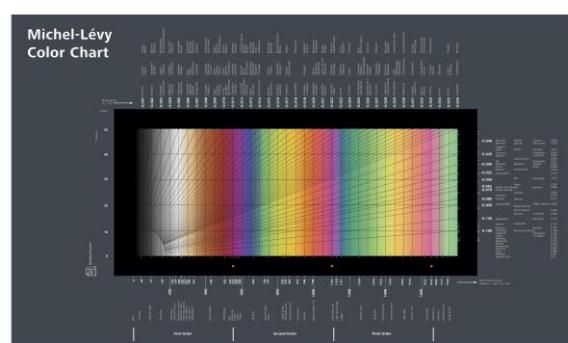
**Carl Friedrich Mohs (1773–1839), who devised a 10-point scale of relative hardness to help distinguish one mineral from another.*

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Mineral streak test.



Birefringence colour chart.



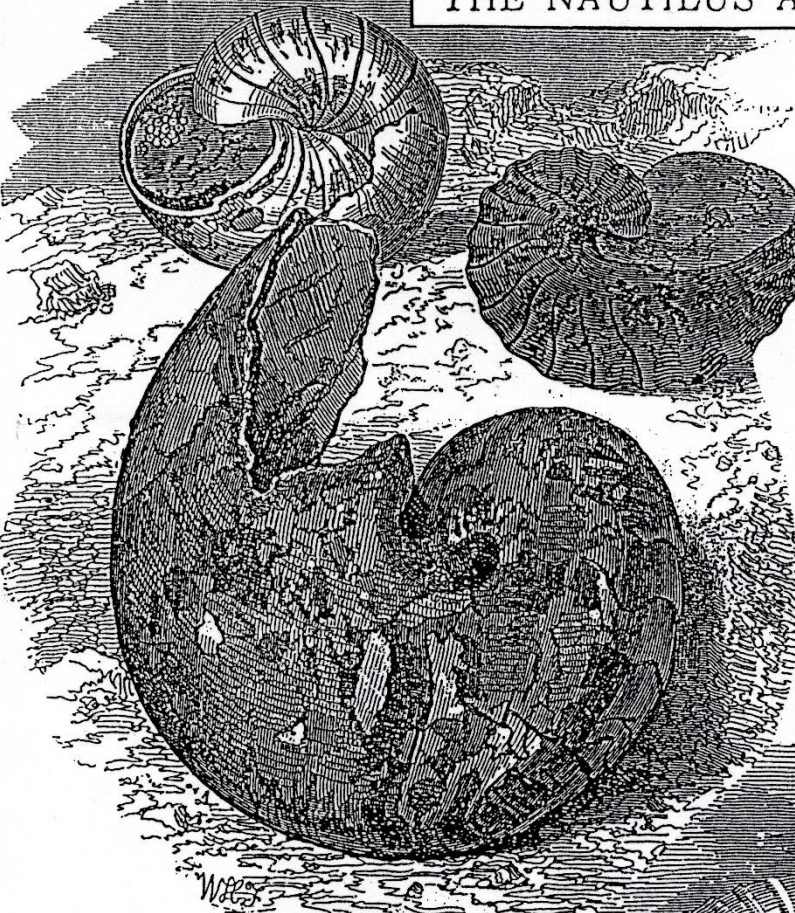
Mineral fluorescence.

The Nautilus and the Ammonite

Suggested by Janet Catchpole

"The Nautilus and the Ammonite" is a Victorian-era poem by George F. Richardson that explores geological time, friendship, and fate. It tells the story of two creatures - one a living species and one a fossil - who start together on the "sea of life" but face different, predetermined destinies.

THE NAUTILUS AND THE AMMONITE.



The Nautilus and the Ammonite
Were launched in friendly strife;
Each sent to float, in its tiny boat,
On the wide wild sea of life!

For each could swim on the ocean's brim,
And when wearied its sail could furl;
And sink to sleep in the great sea-deep,
In its palace all of pearl!

And theirs was a bliss more fair than this,
Which we taste in our colder clime;
For they were rife in a tropic life,
A brighter and better clime!

They swam 'mid isles, whose summer-smiles
Were dimmed by no alloy;
Whose groves were palm, whose air was balm,
And life—one only joy!

They sailed all day, through creek and bay,
And traversed the ocean deep;
And at night they sank on a coral bank,
In its fairy bowers to sleep!

And the monsters vast, of ages past,
They beheld in their ocean-caves;
They saw them ride in their power and pride,
And sink in their deep sea-graves.

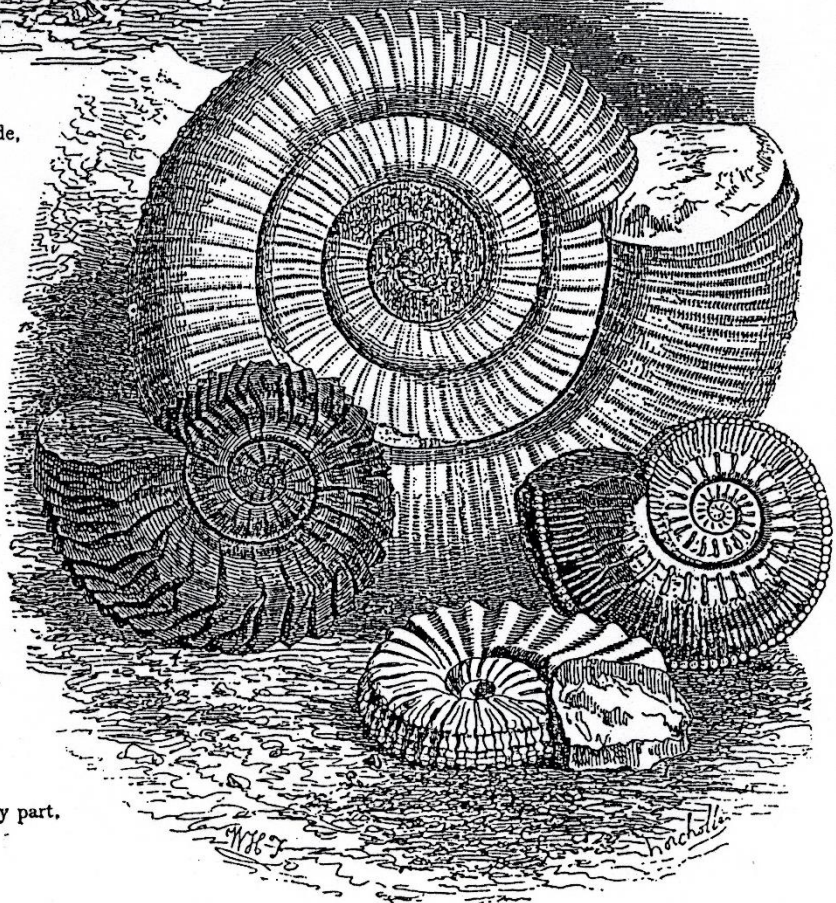
And hand in hand, from strand to strand,
They sailed in mirth and glee;
These fairy shells, with their crystal cells,
Twin sisters of the sea!

And they came at last, to a sea long past,
But as they reached its shore,
The Almighty's breath spoke out in death,
And the Ammonite lived no more!

So the Nautilus now, in its shelly prow,
As over the deep it strays;
Still seems to seek, in bay and creek,
Its companion of other days.

And alike do we, on life's stormy sea,
As we roam from shore to shore;
Thus, tempest-tost seek the lov'd, the lost,
But find them on earth no more!

Yet the hope how sweet, again to meet,
As we look to a distant strand;
Where heart meets heart, and no more they part,
Who meet in that better land.



The poem originally appeared in the 1838 edition of *Sketches in Prose and Verse* by **George F. Richardson**. George was the curator of the Mantellian Museum, which was in the process of being purchased and absorbed by the British Museum. This volume included a description of the museum's collections in their "present separate state," alongside poetry and other musings. George proudly mentions that *The Nautilus and the Ammonite* was recited by Gideon Mantell himself at the beginning of a scientific lecture.

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News

Giant new dinosaur identified from fossils in Thailand



The Nagatitan lived between 100 and 120 million years ago (Credit: Reuters)

Vicky Wong, BBC Science

14 May 2026

A new type of giant long-necked dinosaur has been identified by scientists from remains dug up in Thailand.

The *Nagatitan*, the largest-ever dinosaur found in South-East Asia, weighed 27 tonnes - as much as nine adult Asian elephants - and measured 27m (88ft) in length, longer than a diplodocus. Like that dinosaur, it belonged to the sauropod family of long-necked herbivores.

A team of researchers from the UK and Thailand identified the species from fossils found beside a pond in north-eastern Thailand a decade ago.

They say the discovery sheds light on how changes in ancient climatic conditions allowed gigantic dinosaurs to develop.

The dinosaur's full name is *Nagatitan chaiyaphumensis*, with "naga" referring to a serpent in South-East Asian folklore, "titan" referring to the gods in Greek mythology, and chaiyaphumensis meaning "from Chaiyaphum", the province where the fossils were discovered.

It lived between 100 and 120 million years ago - around 40 million years earlier than the *tyrannosaurus rex* - and is about twice the size of that creature.

Thitiwoot Sethapanichsakul, a Thai doctoral student at University College London (UCL), was the lead author of the study which was published in the **Scientific Reports** journal. He said the researchers referred to the *Nagatitan* as "the last titan" of Thailand, because the fossils were found in the country's youngest dinosaur-bearing rock formation. "Younger rocks laid down towards the end of the time of the dinosaurs are unlikely to contain dinosaur remains because the region by then had become a shallow sea. So, this may be the last or most recent large sauropod we will find in South-East Asia,"

Sethapanichsakul, a self-confessed "dinosaur kid", said in a UCL press release that the study also "fulfils a childhood promise of naming a dinosaur". The *Nagatitan* is the 14th dinosaur to be named in Thailand. Palaeontologist Dr Sita Manikoon, from Mahasarakham University, said that the country has a high diversity in dinosaur fossils and is "possibly the third most abundant in Asia in terms of dinosaur remains".

The *Nagatitan* roamed Earth when the planet's atmospheric carbon dioxide levels were rising in line with high global temperatures.

The study's co-author, UCL's Prof Paul Upchurch, said the sauropod family of dinosaurs had become quite large at this time, telling National Geographic: "It seems a little odd that sauropods were able to cope with higher temperature conditions", as large bodies retain heat and are harder to cool down.

He told the Reuters news agency that it was "likely that the high temperatures had an impact on the plant fodder that was important to sauropods, which were very large-bodied herbivores".

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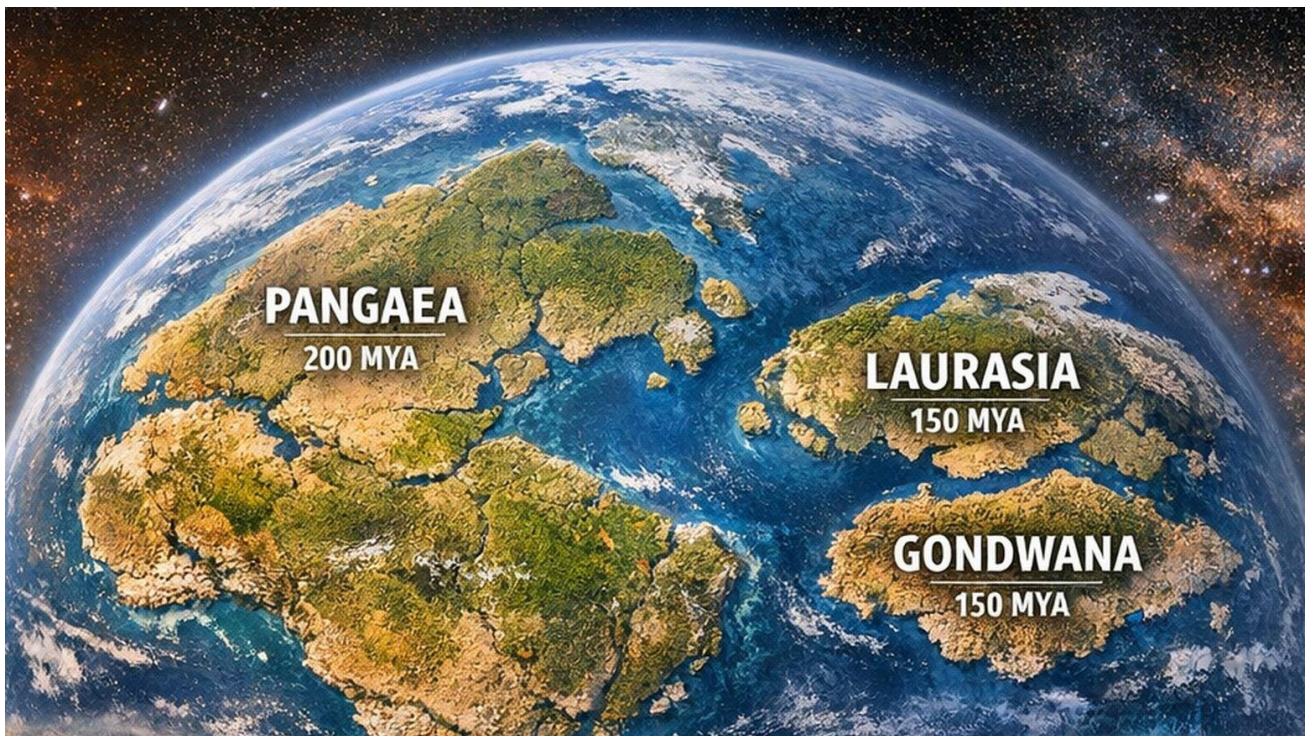
Our ancient continents were built from sun-baked ocean leftovers, proving Earth was recycling long before it was cool

Written by Sayan Tribedi, edited by Stephanie Baum, reviewed by Robert Egan
Science X

12 May 2026

New isotopic evidence is rewriting the story of Earth's first continents. Imagine the planet nearly 3.8 billion years ago: a water world ringed by volcanic islands. How did solid continents arise in such an alien world?

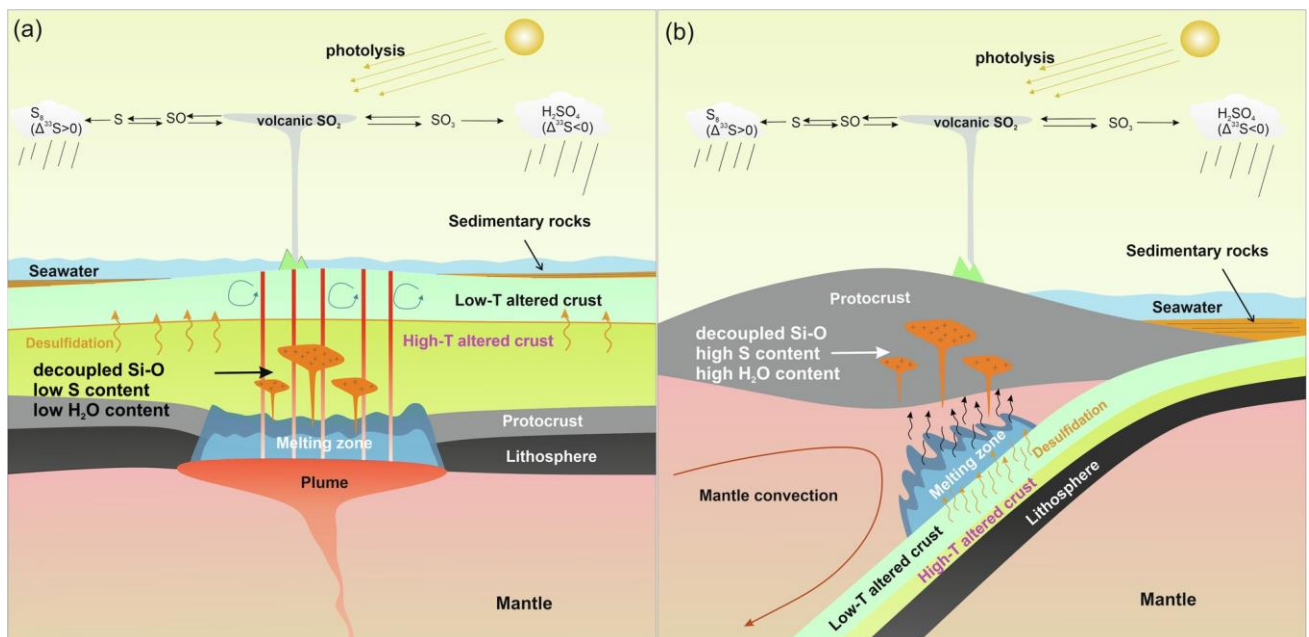
A recent study in **Nature Communications** suggests a surprising twist: These ancient landmasses were largely built from recycled surface rocks, not just fresh mantle material. By analysing rare sulfur and silicon atoms in 3-billion-year-old granites, researchers have uncovered fingerprints of an ancient oceanic origin for our planet's oldest crust.



Credit: Image generated by the editorial team using AI for illustrative purposes.

During the Archean period, the continental crust on Earth was characterized by rocks called tonalite-trondhjemite-granodiorite (TTG), and these offered some insight into the early history of the planet. Scientists have known for some time that TTGs were formed through the melting of hydrous mafic rocks, but debate has raged regarding their source rocks.

Single-atom studies (using oxygen, boron, etc.) gave mixed hints - some samples looked "mantle-like," others bore signs of seawater alteration. The new approach was to combine multiple types of atoms: sulfur and silicon. These two elements lock in distinct surface-process signatures that are hard to erase, even through later heat and pressure.



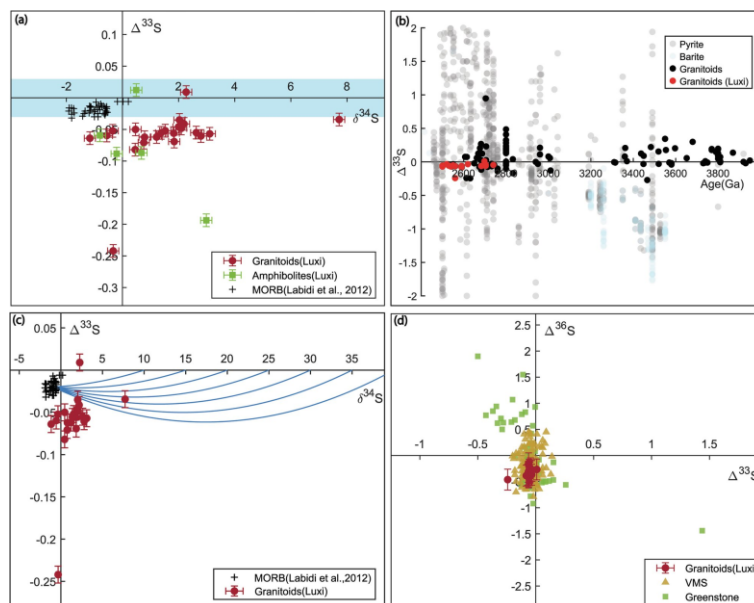
Schematic diagrams of two plausible models to generate TTG (Tonalite-Trondhjemite-Granodiorite) in the Archean Earth. (Credit: Nature Communications (2026). DOI: 10.1038/s41467-026-72701-4)

What ancient rocks whispered to scientists

In the study, scientists collected Archean rocks from China's North China Craton - one of the oldest crustal fragments on Earth. They analysed 22 granitic rocks and several amphibolites (basaltic rocks) dated to about 2.7 to 2.5 billion years ago. For each, they measured different forms of sulfur atoms (including a special kind called mass-independent $\Delta^{33}\text{S}$) and silicon atoms.

The results were striking: all the granitoids showed subtle but clear sulfur anomalies (meaning the mass-independent $\Delta^{33}\text{S}$ was not zero, which is unusual) and slightly "heavy" silicon (meaning the silicon atoms had a higher proportion of heavier varieties than is typical for rocks from Earth's deep interior).

These unique atomic signatures cannot be produced by the simple melting of dry mantle rocks. Instead, they require inputs from Earth's surface - altered ocean crust or sediments - that carried the atomic imprint of the early atmosphere and seawater. In short, the rocks demanded a source that originated from Earth's surface, overturning the assumption of a purely deep origin.



Sulfur isotopic composition and source constraints of the Luxi granitoids. (Credit: Nature Communications (2026). DOI: 10.1038/s41467-026-72701-4)

Two tiny clues, one big story

The clue lies in these special atomic signatures. Under the oxygen-free Archean sky, ultraviolet light created unusual sulfur atom patterns in the air - patterns later locked into rocks at the surface. A non-zero mass-independent $\Delta^{33}\text{S}$ (and a related $\Delta^{36}\text{S}$) is a telltale sign of this ancient photochemistry, virtually absent in rocks from Earth's deep interior. Likewise, silicon atoms become heavier (meaning a higher proportion of heavier silicon varieties) when basalt reacts with seawater or when silica settles out of solution.

The punch comes in the combination: By itself, each atomic signature could be skewed by other processes, but together they form a "fingerprint" of surface material. As the authors note, "Covariation of quadruple sulfur isotopes and silicon isotopes thus provides compelling evidence for the recycling of supracrustal materials into the magmatic sources of Archean continental crust."

In other words, finding both anomalies in the same rocks is like finding fingerprints of the ancient ocean in the heart of early continents.

Recycling Earth's first continents

When first author Shang and his colleagues compared their Chinese data with global Archean records, a pattern emerged: all known continental granites formed after approximately 3.8 billion years ago show these same atomic signs. That means nearly every piece of preserved Archean crust carries evidence of surface recycling.

"Our results show that most, if not all, Archean continental crusts were derived from partial melting of supracrustal sources rather than unaltered mafic cumulates," the team writes. In other words, Earth's first continents were largely made from recycled oceanic crust and sediments.

So, what are the implications for our planet? This suggests early cycling of crustal material into the deep crust or even Earth's mantle, likely by early proto plate tectonics, or through the emplacement of a heavily volcanic crust. Such cycling had unique connections among the atmosphere, the ocean, and the interior of Earth, suggesting a unique "coupling" of these elements. It is proposed that this process established early habitability on Earth around 3.8 billion years ago. However, it provides a fascinating insight into the building blocks of our own environment, the mixing of altered seawater crust with the precursors of the modern continents.

In conclusion, the research provides a novel origin story whereby the first continental crusts were formed by the melting of surface rocks that had been modified rather than purely by magmas beneath the surface. This unusual insight into the early days of our planet provides a new understanding of how Earth's surface and interior interacted.

Publication details:

Kun Shang et al, Coupled sulfur-silicon isotopes reveal supracrustal origin of Archean continents, **Nature Communications** (2026). DOI: 10.1038/s41467-026-72701-4

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Image Of The Day 1: Mount Vesuvius

Chelsea Gohd, Space.com

8 June 2026



Mount Vesuvius as seen from space in 2026. (Image credit: ESA/NASA – S. Adenot)

"From orbit, volcanoes are some of the most beautiful natural sights."

Why is it incredible?

French astronaut Sophie Adenot captured the view of a lifetime in a new image of Mount Vesuvius, as seen from aboard the International Space Station. "End of April, Etna caught me by surprise one

morning as I opened the shutters. The whiteness of its slopes... and that elegant plume of smoke, which is a gentle reminder that it's only lightly, very lightly, asleep. I just had time to take a quick photo, but I kept an eye out for it the next day to capture a few more! Less than a minute later, and we're flying over Vesuvius, instantly recognisable by the vast crater, the path winding up to the summit, and, most of all, Naples spread out all around it."

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News

We may have just cracked one of Stonehenge's greatest mysteries

A glacier may have carried the site's massive Altar Stone part of the way from Scotland

Michael Day, BBC Science

4 June 2026

One of Stonehenge's enduring mysteries is how its **Altar Stone** made the 700km (435-mile) journey from Scotland to southern England. Now, researchers think they may have part of the answer: a glacier helped transport it.

The massive six-tonne sandstone slab lies at the centre of the monument and is thought to have arrived on Salisbury Plain around 5,000 years ago. Previous studies traced the stone's origins to northeast Scotland but left unanswered how it covered such a vast distance.

After studying ancient ice flows, scientists at Sheffield Hallam University and Curtin University in Australia believe a glacier carried the Altar Stone from the Orcadian Basin in northeast Scotland to Dogger Bank during Britain's last ice age, between 33,000 and 11,700 years ago.



Stonehenge at twilight. (Photo credit: Getty)

Dogger Bank, now submerged beneath the North Sea, once formed part of Doggerland – the vast prehistoric landmass that connected Britain to mainland Europe. Because the area contains no natural source of large stones, any boulders found there must have been carried in by glaciers.

Sheffield Hallam University's Dr Remy Veness, co-lead author of the paper in the ***Journal of Quaternary Science***, said: "We recently discovered that the origin of the Altar Stone is northeast Scotland, but how it travelled 700km to Salisbury Plain is widely debated.

"What is exciting about these findings is that they could imply that the people of Doggerland attached cultural significance to the Altar Stone long before it was incorporated into Stonehenge.

"The Altar Stone must have been significant enough [for people] to be willing to move the stone at least twice; first to save it from being submerged by rising sea levels at the end of the last ice age and then again to its final resting place on Salisbury Plains."

Co-lead author Dr Anthony Clarke, from Curtin's School of Earth and Planetary Sciences, said the findings suggest glaciers carried the Altar Stone as far as Doggerland, leaving Neolithic people to transport it the rest of the way to Stonehenge.

"Our modelling shows glaciers may have transported rocks part of the way during the last Ice Age – potentially as far as Dogger Bank in the North Sea – but not into southern England, meaning the stone would still have needed to be moved hundreds of kilometres by people" said Dr Clarke.

While the study suggests glaciers carried the Altar Stone south, the researchers found no viable glacial pathway linking its Scottish source directly to Stonehenge. Instead, they believe Neolithic people transported the stone in stages, using a combination of overland, coastal and river routes.

They add that the feat of moving such a massive object over long distances points to a level of organisation and cooperation among Neolithic communities not previously fully appreciated.

"Transporting a stone of this size over such a long distance would have required planning, coordination and a deep understanding of the landscape – not to mention tremendous determination" Dr Clarke said.

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How did animals survive the asteroid that killed the dinosaurs?

It helped to have a number of features to aid survival following the end-Cretaceous mass extinction.

Isabel Gil, LiveScience

24 June 2026

Around 66 million years ago, a gigantic asteroid smashed into Earth and wreaked chaos globally.

Superheated rock from the impact spewed into the air, creating a mushroom cloud that heated Earth's upper atmosphere to a scorching 439°F (226°C). Mile-high tsunami waves rushed through the Gulf of Mexico and disturbed ocean basins half a world away. Fires raged, burning animals and plants to a crisp. Shock waves propagated, blasting everything in their path. And particles from the collision, including sulfur, shot upward, blocking the sun and falling down as acid rain.



An asteroid caused the demise of the non-avian dinosaurs 66 million years ago, so how did other animals survive?

(Image credit: angel_nt via Getty Images)

In all, 75% of Earth's species went extinct, including the non-avian dinosaurs. So how did some animals — including species of birds, turtles and mammals — survive the catastrophic asteroid collision and its aftermath?

Size, it turns out, played a crucial role. Earth's largest apex predators and herbivores — dinosaurs like *Tyrannosaurus rex* and *Triceratops*, and marine reptiles like *plesiosaurs* and the behemoth *Mosasaurus* — were doomed from the moment of impact, Kenneth Lacovara, founding executive director of the Edelman Fossil Park and Museum of Rowan University in New Jersey, told **Live**

Science. That's because their enormity meant they were more likely to be harmed during the initial blast, were unable to hide in a safe place during the apocalyptic aftermath and needed massive amounts of sustenance to survive in a time when food was scarce.

It's not too surprising that size would be linked to survival, Lacovara said. On land, "it's pretty clear in terms of correlation that you have to be small, and you have to be a burrower to get through this event," said Lacovara, who is also a professor of palaeontology and geology at Rowan University. Small animals, such as some lizards and mammals, which were no larger than badgers at that time, were more likely to find shelter from the asteroid's immediate and long-term aftereffects. Other small animals that required less food, such as some turtles and fish, were sheltered in the water.

The avian group that led to modern birds survived likely because they were small and had powerful wings and chest muscles that allowed them to fly well and escape dire situations or find new opportunities. Their chicks also grew quickly, meaning they could soon fend for themselves and not overtax their parents.

This led to an overall shift in the average size of Earth's animals. On land, most of the largest surviving animals were about the size of house cats; in the water, the largest survivors were about the size of a "run-of-the-mill shark" Lacovara said.

What the survivors ate

Diet was likely another important factor, said Roger Benson, a curator of dinosaur palaeobiology at the American Museum of Natural History in New York City. The plant eaters and those that ate them were especially hard-hit, as the sun was obstructed for up to a decade. Even with size on their side, some smaller creatures, such as certain lizard and turtle species, went extinct because their diets were too reliant on photosynthesizing plants, Benson said.

Aquatic ecosystems were a bit more shielded from the asteroid's initial impact, especially in deeper oceans and freshwater ecosystems. But as photosynthesizing plankton died off due to a lack of sunlight, food systems collapsed and large marine animals starved. Those that consumed dead, organic detritus had a better chance of survival. Some of those resilient marine creatures included the sea sponges, sharks of the *Carcharias* genus, and molluscs, including the lineage that led to today's chambered nautilus (*Nautilus pompilius*).

Seed eaters, including birds, and foraging insectivores, such as the tree-dwelling primate *Purgatorius janisae*, had a better shot at surviving because their food sources of seeds and insects weren't destroyed by extreme temperature changes and a lack of sunlight.

A common theory is that species with more generalist diets had a better chance of surviving the drastic environmental change. For example, *Purgatorius coracis*, a small mammal, survived the mass extinction thanks to their wide-ranging diet of insects, fruits and seeds. (This trend holds true for modern animals facing climate change: those with generalist diets, such as crows and raccoons, are expected to do well because they have a wide range of foods to fall back on in case one food source disappears.)

Some species got lucky if their prey were also survivors. A few aquatic turtle species, like *Hutchemys rememidium*, had an adaptive feeding habit of eating shelled creatures which were living off detritus in aquatic ecosystems. A 2026 study found this adaptation, called **durophagy**, was linked to comparatively high survival rates during this mass extinction.

Certain behaviours, such as a higher capacity for reproduction or behavioural flexibility in a changing environment, may have enabled survival, Benson said.

Mysterious exceptions

Despite current evidence, there are still unknowns surrounding mass extinction survivorship. Recent research indicates we don't know why certain adaptations helped some species but not others.



The avian group that led to modern birds (like this sandhill crane, pictured above) survived likely because they were small and had powerful wings and chest muscles, had fast-growing chicks and ate seeds. (Image credit: Arthur Morris via Getty Images)

For example, many present-day species of bivalves feed on microscopic aquatic organisms that rely on the sun to survive. However, among the aquatic bivalves that survived the asteroid and its impacts, reliance on the sun didn't strongly determine survivorship. In another case, night lizards that survived near the impact site are known to have small litters, which goes against the hypothesis that fecundity is advantageous following extinctions. However, these night lizards' slow metabolisms were likely helpful for their survival, and they persist today, the study noted.

And the discovery that a large, terrestrial croc (*Tewkensuchus salamanquensis*) survived the asteroid strike in what is now Argentina raises questions about how this 660-pound (300 kg) species survived. This also raises questions whether the asteroid's impacts weren't as strong in the Southern Hemisphere as they were in the Northern Hemisphere. For example, the wide diversity of plant fossils uncovered in present-day Argentina suggests plants were able to regrow faster at southernmost latitudes.

"We also don't know why mammals emerged from the extinction as the dominant macrofauna," Lacovara said. One theory is that mammals are more resistant to fungal infections than reptiles are, giving mammals a better shot at surviving the "mini age of fungus" that followed the mass extinction.

After all, how evolution proceeded following the mass extinction is a part of humanity's history. The animals that survived ultimately ushered in the age of mammals, including humans, that continues to this day.

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Meet the legends of Earth's prehistoric oceans, from the pliosaur – a gigantic, gnarly toothed creature – to the ichthyosaur, a majestic and speedy, dolphin-like predator. Not to mention, the fiercest hunter to ever rule the waves, T. rex of the sea, the mighty mosasaur.

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It's the perfect blend of prehistoric monsters, memory-making moments and hands-on discovery from our expert palaeontologists.

Dive in, if you dare! Recommended for fearless underwater adventurers aged 8+.

Open until 3 January 2027

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News

'Unequivocal evidence' of Earth's oldest impact crater turns out to be off by half a billion years

A new study updates the age of Earth's oldest known meteorite impact crater, the North Pole Dome crater, which scientists previously claimed was 3.47 billion years old.

Sascha Pare, LiveScience

23 June 2026



The world's oldest known meteorite impact crater is located in Western Australia's Pilbara region. (Image credit: Curtin University)

Earth's oldest known impact crater formed when a meteorite slammed into what is now Australia about 3 billion years ago — 470 million years later than scientists previously claimed, a new study suggests.

The impact crater, known as the **North Pole Dome** crater, is located in Western Australia's Pilbara region, which is home to some of the planet's oldest rocks. It remains a record-breaking structure, beating the world's next-oldest known meteorite impact crater — the Yarrabubba impact structure, also in Western Australia — by roughly 800 million years.

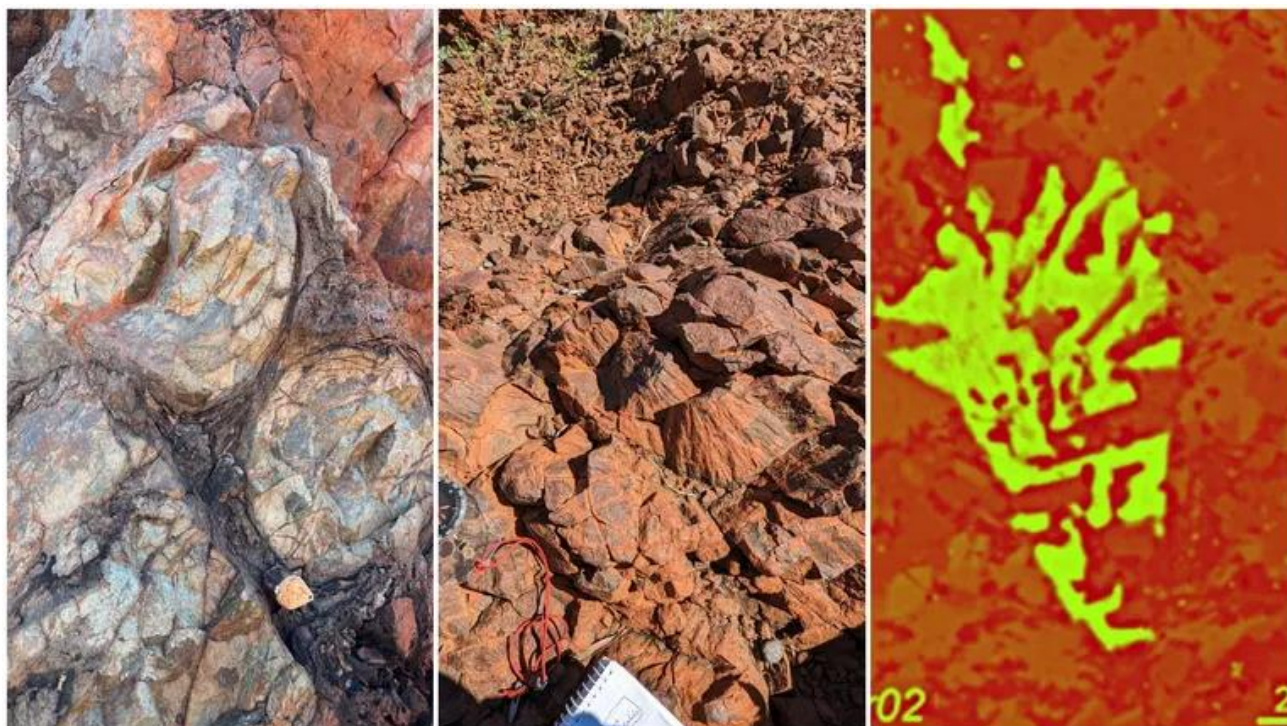
"While the site had previously been identified as an ancient impact structure, its exact age remained uncertain," study first author Chris Kirkland, a professor in the School of Earth and Planetary Sciences at Curtin University in Australia, said in a statement. "The impact left a 'mineral clock' behind. By dating minerals that were remade or newly grown in the damaged rocks, we can now pin down when this extraordinary event happened."

In a study published last year, Kirkland and his colleagues said they had "unequivocal evidence" that the North Pole Dome crater was **3.47 billion years old**, based on an analysis of cone-shaped chunks of rock known as "shatter cones" that form when the shock waves from a meteorite impact propagate downward.

However, a study published four months later in the journal **Science Advances** called the other team's results "inaccurate," arguing that the impact occurred no earlier than **2.7 billion years ago**.

For the new study, Kirkland and his colleagues used advanced mineral dating techniques to estimate the ages of zircon, apatite, calcite and muscovite in shatter cones from the North Pole Dome crater. The researchers analysed two samples of shatter-cone-bearing rocks, as well as a shocked quartz vein — a sheet-like deposit that typically forms when superhot, mineral-rich water circulates in the cracks between shocked rocks.

"The key evidence comes from zircon, a tiny but extraordinarily resilient mineral that can keep geological time for billions of years," Kirkland said. "Some zircons at North Pole Dome have unusual branching, skeletal shapes. We interpret these as impact-modified crystals, formed when older zircon was disrupted, partly recrystallised, and in places regrown during the intense heating caused by the impact."



Researchers analysed zircon and other minerals in North Pole Dome rocks. (Image credit: Curtin University)

The age recorded in zircon was the same as that locked inside apatite minerals, giving the researchers confidence that the impact occurred a little more than 3 billion years ago. The younger shatter cones in the **Science Advances** study may have formed subsequently due to tectonic and thermal activity, the team wrote in the new paper, which was published Tuesday (June 23) in the journal **Geology**.

"Ancient impact craters are incredibly difficult to date because over billions of years, rocks are altered by heat, pressure and fluids, which can obscure or reset the original impact signals," Kirkland said. "The new age places the North Pole Dome structure as Earth's oldest known impact crater and the only recognised example from the Archean eon [4 billion to 2.5 billion years ago], a time when the planet's earliest continents were forming."

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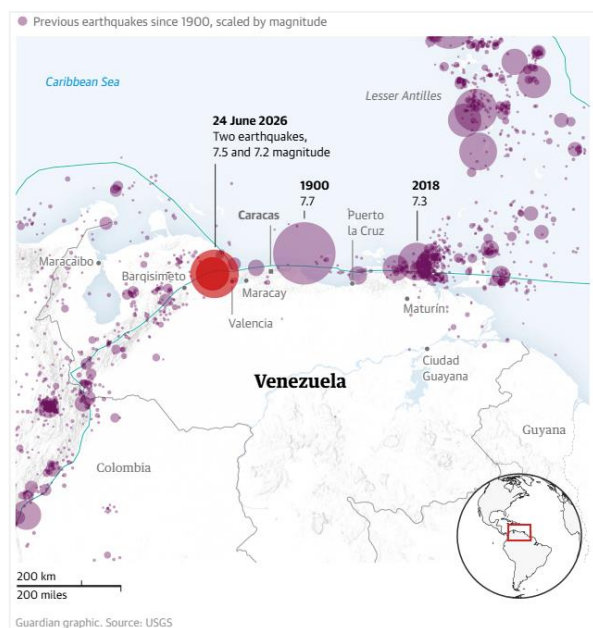
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Rescue teams race to Venezuela amid fears thousands killed in earthquakes

US among countries sending help to search for survivors on north coast, where dozens of buildings flattened, as official death toll reaches 235

The Guardian: Tom Phillips in Rio de Janeiro, Camille Rodríguez Montilla in La Guaira and María de los Ángeles Graterol in Caracas
26 June 2026

Rescue teams are racing to Venezuela's shattered northern coast after almost simultaneous earthquakes reduced dozens of buildings to rubble, killing at least 235 people but with thousands more fatalities feared. Officials said at least 4,300 people were injured as rescue missions continue.



The US secretary of state, Marco Rubio, said the defence department would help search and rescue teams deploy to the affected region after Venezuela's main gateway, the Simón Bolívar international airport, near the capital, Caracas, was badly damaged by 7.2 and 7.5 magnitude quakes less than 40 seconds apart, late on Wednesday afternoon.

He said the most immediate need was search and rescue. "They have [lots of] collapsed buildings and so they will need a lot of help in terms of digging through that," Rubio told reporters, adding that the next 72 "golden" hours were critical. "In search and rescue you are trying to get to people while you can still save their lives – they are buried under rubble."

The coastal area near the international airport, around the cities of La Guaira, Catia La Mar and Caraballeda, appears to have sustained by far the worst damage, with a string of large tower blocks levelled and people desperately hunting for missing loved ones. In some cases, families of four or five people have disappeared.

“This is an utter tragedy,” the acting president, Delcy Rodríguez, said in a televised broadcast, declaring the La Guaira region a disaster zone.

Caracas also sustained severe damage, with several buildings collapsing in the Altamira and Los Palos Grandes neighbourhoods. On Thursday evening the official death toll was raised to 235, with an earlier count putting the number of people missing at 157.

Tom Fletcher, the head of the UN’s humanitarian agency, Ocha, said: “We are fully mobilised right now ... We will surge in people, we will surge in solidarity and, most important, we will surge in search and rescue support ... for people who have lost so much ... Now is the time for action.”

The UN agency reported that more than 100 buildings had collapsed in the La Guaira region alone. They included a large block of flats called the Ritasol Palace and the seafront Eduard’s Hotel. Those missing include children as young as five as well as elderly people.

The quakes were so strong that they were felt in the Brazilian city of Manaus, in the Amazon, more than 1,000 miles to the south of Caracas, forcing people to flee their homes.

As aftershocks continued to shake northern Venezuela on Thursday, world leaders offered their condolences and support to a nation already reeling from years of economic and humanitarian crisis and political repression. Brazil, Mexico, Spain, Portugal, Canada and Qatar promised to send aid.

The French president, Emmanuel Macron, said: “France stands ready, alongside its European partners, to provide assistance to the affected populations ... A team of 85 French specialised rescuers ... will be deployed immediately.”

Brazil’s president, Luiz Inácio Lula da Silva, voiced “great concern and dismay” for the people of Venezuela, who had already shown “great resilience in the face of adversities”.

The US president, Donald Trump – who turned Venezuela’s political landscape on its head by ordering the abduction of its dictator, Nicolás Maduro, on 3 January this year – said: “The USA stands ready, willing, and able to help! I have instructed all agencies of our government to get ready to move quickly. We will be there for our new and great friends. Early reports are not good!!!”

The US Treasury moved to waive some sanctions until 23 October to allow transactions related to earthquake relief efforts in Venezuela that would otherwise be prohibited.

Rodríguez, Venezuela’s former vice-president who took power with Trump’s blessing after Maduro’s downfall, expressed gratitude for the global outpouring of solidarity, writing on social media: “Venezuela will never forget the helping hand extended to our people during these difficult times.”

In a televised address, she said the region worst devastated by Wednesday’s “unprecedented seismic phenomenon” was the state of La Guaira, the capital of which bears the same name. “There are dozens of collapsed buildings there and right now we are engaged in the really arduous task of rescue work in the hope of saving the lives God will allow us to.”

Rodríguez also appealed to businesses to make heavy construction equipment available for rescue operations. The first rescuers from the Dominican Republic were about to arrive and more from other countries were expected over the coming hours, she said.

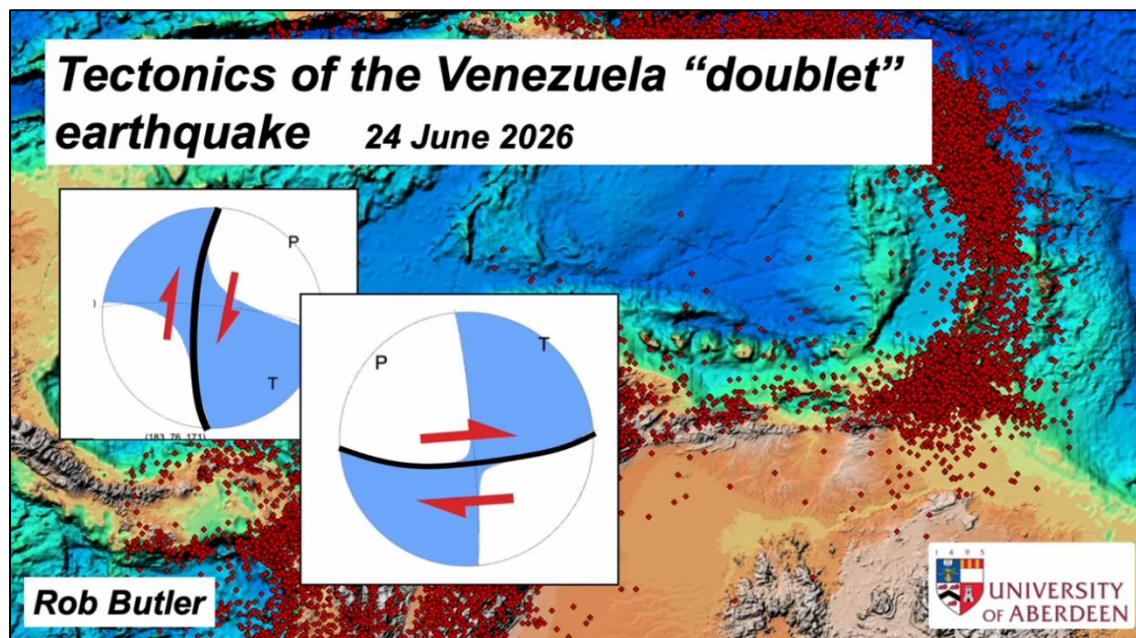
Aerial footage painted a devastating picture of the situation in La Guaira, which authorities consider the disaster’s “ground zero”. The sweep of Caribbean beach towns and resorts to the west of the airport lay in ruins, with many seafront buildings completely destroyed.

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Podcast

Suggested by Angela Snowling



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Antarctica's first dinosaur fossil belonged to a group of the largest land animals ever

Researchers have identified the first-ever dinosaur fossil discovered on Antarctica, revealing it belonged to a titanosaur.

Patrick Pester, LifeScience

1 July 2026



*The Antarctic dinosaur lived when the frozen continent was filled with forests.
(Image credit: © Andrew McAfee, Carnegie Museum of Natural History)*

The first dinosaur found in Antarctica belonged to a group that included the largest animals ever to walk the planet, a new study finds.

A backbone from the 82-million-year-old giant was discovered more than 40 years ago, but at the time, researchers assumed it came from an ancient marine reptile. Now a new study, published June 29 in the journal ***Acta Palaeontologica Polonica***, has revealed that it was actually a titanosaur — the group of long-necked sauropods that included the largest land animals on record.

"At first glance this appears to be an unremarkable fossil, but it holds an important place in the history of Antarctic exploration as the first dinosaur fossil found on the continent," study first author Paul Barrett, a palaeontologist at the Natural History Museum in London, said in a statement.

While this fossil now holds the record for the first dinosaur fossil found in Antarctica, other dinosaur fossils were identified on the continent after its discovery, so it's not the only known Antarctic dinosaur. In fact, researchers have identified a variety of dinosaurs on Antarctica, with another sauropod fossil identified as a titanosaur in 2011.

The newly identified dinosaur was around 20 to 23 feet (6 to 7 meters) long. That's very small compared with the largest-known titanosaurs, which could grow up to 123 feet (37.5 m) long. However, as the fossil is just a fragment of a vertebra, researchers are unable to narrow down which species the Antarctic titanosaur belonged to, and it's possible that the individual was only a juvenile when it died.

Mike Thomson, a British Antarctic Survey geologist, found the fossil during an expedition to James Ross Island in 1985. The island, which has been the site of multiple dinosaur discoveries, is located

off the northeastern Antarctic Peninsula, south of the 600-mile-wide (965 kilometers) Drake Passage that separates South America from Antarctica.

Antarctica is well known for its icy landscapes, but when titanosaurs roamed Earth, the continent was still attached to South America and full of temperate forests. Antarctica's dinosaurs were so far south that they would have lived in constant twilight during the winter months, according to a news article published by the **Natural History Museum**.

The authors of the new study identified the dinosaur using high-resolution CT scans, which enabled them to look inside the fossil. Dating back to the Cretaceous period (143 million to 66 million years ago), the titanosaur lived in the last age of the non-avian dinosaurs, before an enormous asteroid hit what is now Mexico's Yucatan Peninsula 66 million years ago and wiped them out.

The Antarctic titanosaur helps researchers better understand how dinosaurs spread across Earth's southern continents, which at the time were combined into a supercontinent called Gondwana. The presence of titanosaurs on Antarctica suggests that they may have used Antarctica to travel from what is now South America to New Zealand.

Other dinosaurs identified on Antarctica include small herbivores, armoured ankylosaurs and bipedal predators like *Imperobator*, which would have shared the forests with the newly identified titanosaur. While researchers are beginning to piece together Antarctica's ancient ecosystems, they still have a lot to learn about the dinosaurs that lived there.

"There are likely many more dinosaurs to be discovered on the continent," Barrett said. "As climate change causes ice to retreat we may indeed find further evidence of this past biodiversity."

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TV

Evolution

Join Chris Packham on an epic four-billion-year adventure travelling through time to uncover how life on earth evolved. His mission: to answer five questions about five iconic animals created by the unstoppable force of nature. On the journey, he discovers how the elephant, ostrich, bat, dolphin and horse came into existence from the evolution process.



The driving forces – growth, reproduction, feeding, intelligence and movement – are behind some of the biggest stories ever told on earth. The quest reveals pivotal breakthroughs as Chris guides and participates every step of the way with his trademark warm, curious and intelligent storytelling.

The series recreates moments through stunning visualisation taking viewers back to the ancient history of the natural world in cinematic scale. Every episode returns to the original animals we know today and reveals how evolution is not an abstract notion, but a tangible concept that never stops shaping life on earth.

Episodes 1 to 5

BBC2 & iPlayer

From one spark of life to a world of wonder. Chris Packham reveals the incredible story.

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Review

Evolution review – with this TV miracle, David Attenborough’s successor is well and truly crowned

The new BBC documentary is so wondrous and awe-inspiring it will make you feel like a child again – and in Chris Packham, it has a presenter for the ages

Lucy Mangan, *The Guardian*

13 July 2026

Evolution is a coronation. With this new, five-part BBC nature documentary, the presenter Chris Packham is effectively crowned the successor to David Attenborough. And a worthy one, I think most would agree.

Packham has all the great man’s passion for his subject and the willingness and ability to share his knowledge as accessibly as possible. He treads the line between assuming nothing and not infantilising his audience as nimbly as Attenborough does.

Evolution takes one animal an episode and delves into a particular aspect of it and the evolutionary journey it represents. Packham opens with elephants and, specifically, their trunks; a perfect example of a selection advantage that has, in various ways, helped us all move out of the primordial soup, on to land (and sometimes back into water – dolphins are examined in episode four) or into the air (and, in the absurd case of humans, into Teslas and trousers).

In Kenya, we watch the quadrillion or so cells that comprise an African savanna elephant frolicking around a watering hole, before CGI takes us back 4.2 Ga years to **Luca** (Last universal common ancestor) – a single-cell organism that was the progenitor of all life on Earth as we know it. Not that it was perfect: over the generations, mutations creep in. Some encourage cells to capture sunlight and

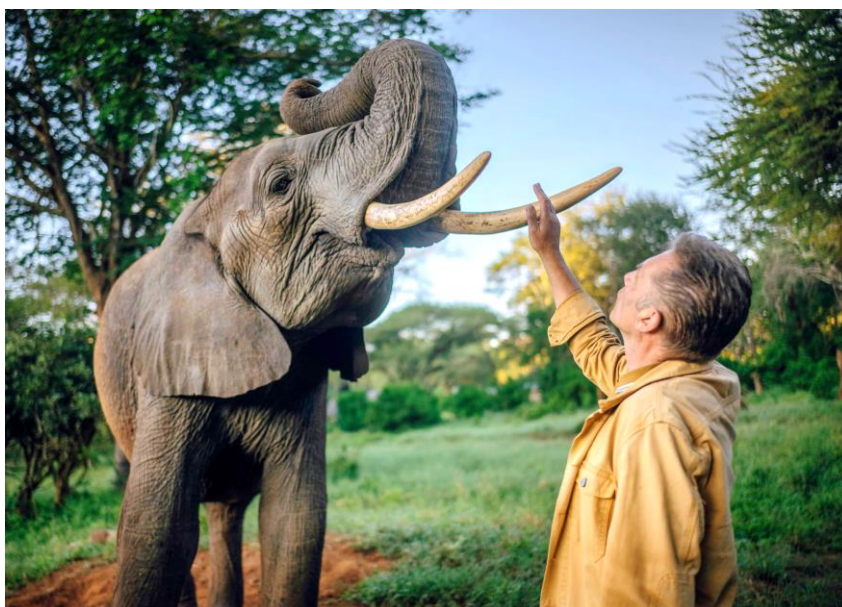


Size isn't everything ... Chris Packham checks out a tunicate in Evolution.

(Photograph: BBC Studios/Freddie Claire)

convert that to energy. These give rise, over time – so much time, but the one thing the young Earth has is time – to plants. Some develop the capacity to feed on decay and give us fungi. And some become multicellular life forms that keep growing in size and complexity and become tiny aquatic worms, then worms with limbs and proto-lungs, then dinosaurs and mammals.

A meteorite strike wipes out the dinosaurs and one of the mammals becomes the elephant's ancestor. They are small and furry at this point, but the next 66 Ma years allow more mutations to occur, and the useful ones shape the future: guts that allow the digestion of plants; different kinds of teeth; and, at some point, a longer nose that proved an advantage over having a shorter nose like everything else. And that, whatever Kipling says, is how the elephant got its trunk.



Awesome appendage ... Packham and an elephant. (Photograph: BBC Studios/Tom Hayward)

Bats are featured in episode three (episode two, about ostriches, was not available for review) to illustrate the importance of bums to us all. Thereafter, dolphins become an example of selecting for intelligence, while horses tell the story of the development of movement and how much better life becomes when you can take yourself to food rather than waiting, rooted to an ocean floor, for it to come to you.

The series is grounded in science – Packham always has a fossil on hand, or an example of a modern creature that does something similar to an old one, or an experiment demonstrating a particular principle. But the show is equally careful to avoid the suggestion that evolution is a method of design working towards a goal, rather than a selection process. Either way, Packham is never afraid to

You really should, for example, be awed at the difference the advent of retroviruses made to our world – invading a placoderm (a prehistoric fish), which then passed on the viral DNA to its offspring, where it added myelin sheaths to developing nerve cells for the first time, increasing the computing power of everything. Bodies and brains became faster and better connected until, at some point, as Packham puts it: “Thinking begins.” And now some people’s brains are big enough to work out how and put together programmes to tell the rest of us about it all. It feels like a great day to have any kind of neocortex, I must say.

Evolution is television that manages that most beautiful thing: it makes you feel like a child again. Happily bombarded with new information, mesmerised, boggling at fantastic facts, feeling the touchpaper of curiosity being lit inside you and wishing you were young again – able to follow all these new avenues of exploration opening up at every turn. And if you are a child watching? Like Attenborough, Packham was a boy obsessed. There will be youngsters watching whose flames of curiosity will be ignited and never go out. What a wonderful world.

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News

Shadowy tendrils of ancient lava have scarred a dark volcano next to a 'skull' in the Sahara — Earth from space

A 2019 astronaut photo shows off ancient lava flows that once oozed down the jet-black slopes of the Toussidé volcano in northwestern Chad. An intriguing volcanic "skull" also lurks in the aerial image.

Harry Baker, LiveScience

30 May 2026



From space, the petrified remnants of ancient lava flows appear to seep away or drip down from the Toussidé volcano in northwestern Chad. (Image credit: NASA/ISS program)

This eye-catching satellite snap shows off a sprawling mass of petrified lava surrounding the jet-black slopes of a potentially dangerous volcano in the heart of the Sahara. A smaller volcanic "skull" lurks near the shadowy peak's base.

Toussidé (also known as Tarso Toussidé) is a "potentially active" stratovolcano located within the Tibesti Mountains, which cover around 40,000 square miles (100,000 square kilometers) of northern Chad and southern Libya. The dark peak stands 10,712 feet (3,265 meters) above sea level, making it the second-tallest mountain in the Tibesti region.

The name Toussidé roughly translates to "which killed the local people with fire" in the language of the nearby Indigenous people, hinting at a destructive and deadly history. However, according to the Smithsonian Institution's **Global Volcanism Program**, there is no evidence that the volcano has

QUICK FACTS

Where is it? Toussidé volcano, Chad [[21.03731548, 16.47357325](#)]

What's in the photo? The petrified remains of ancient lava and a skull-like caldera

Who took the photo? An unnamed astronaut on board the International Space Station

When was it taken? Sept. 23, 2019

erupted during the Holocene — the current geological epoch, which began around 12,000 years ago. It is unclear if it has actually killed anyone.



The massif surrounding Toussidé is made of overlapping lava flows. If you look closely at this image, you can see how they criss-cross over one another. The Trou au Natron caldera is also more clearly visible in this photo, which was captured by the European Space Agency's Copernicus satellite in September 2021. (Image credit: ESA/Copernicus)

The dark blob surrounding the volcano is known as a massif. It is made up of layers of overlapping magmatic rock left by multiple ancient lava flows that effusively erupted, or slowly poured from, the volcano's summit.

The shadowy structure, which is up to 20 miles (32 kilometres) across at its widest point, stands out against the surrounding sand-covered plateau, which has been carved into a network of crisscrossing canyons by eons of wind blasting, according to NASA's Earth Observatory.

Just southeast of the massif (in the upper right of the photo), there is a small, white circle containing several dark patches. This is Trou au Natron — a roughly 3,300-foot-deep (1,000 m) volcanic crater, or caldera, which looks eerily like a giant skull when viewed directly from above.

The cranium-like caldera likely formed during an explosive eruption more than 120,000 years ago. It was once filled with a giant salt lake that was home to ancient algae and other microorganisms. When the lake dried out, around the start of the Holocene, the receding water left behind a thick layer of white salt surrounding a pair of eyelike volcanic cones.



Trou au Natron's salty white floor and volcanic cones make it look eerily like a skull when viewed from above. The dark slopes of Toussidé can also be seen in the background of this image. (Image credit: Gerhard Holub/Wikimedia)

Toussidé is one of the youngest mountains in the Tibesti range, which formed by similar effusive eruptions long before the stratovolcano was born. The entire region likely once matched the massif's dark hue before being relentlessly bombarded by sand and wind. In another 100,000 years or so, the massif may blend in with the surrounding plateau, according to the Earth Observatory.

While the shadowy volcano has remained dormant for several millennia, it occasionally puffs out steam from small vents, or fumaroles, near its summit, suggesting that it is still technically active, according to the **European Space Agency**. However, geologists have not properly assessed its eruptive potential.

Reference:

https://www.livescience.com/planet-earth/volcanoes/shadowy-tendrils-of-ancient-lava-have-scarred-a-dark-volcano-next-to-a-skull-in-the-sahara-earth-from-space?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=9DCD3264-2AC4-414D-AD4B-B11051EDC0BD&utm_source=SmartBrief

The Etches Collection Celebrates 10 Years in style with The Big Jurassic Birthday Bash



"Hello from everyone at The Etches Collection!"

*The Museum is celebrating its **10th anniversary** with the biggest public event in the museum's history. Taking place on **Saturday the 22nd of August 2026**, The Big Jurassic Birthday Bash will bring together local businesses, charities, conservation organisations and community groups for a day of education, hands on activities, and celebrations across Kimmeridge.*

Since opening in 2016, The Etches Collection has welcomed visitors from around the world, supported internationally significant scientific research and helped establish Kimmeridge as one of the UK's most important locations for Jurassic marine fossils. Ten years on, the museum is marking the occasion by turning the spotlight on the wider community that has played such an important role in its success.

Working alongside a range of local partners, including Clavell's Restaurant and the Kimmeridge Fine Foundation Wild Seas Centre, the event will showcase the very best of Kimmeridge's natural heritage, local businesses and community spirit. Visitors will be encouraged to explore the village, discover local attractions and take part in activities throughout the day. The celebration also coincides with the 25th anniversaries of both the Jurassic Coast World Heritage Site and the Kimmeridge Wild Seas Centre, making 2026 a particularly significant year for the village and the wider Dorset coast".

Reference:

<https://www.theetchescollection.org/jurassicbirthday>

Jackdaw owner says gas field will 'not materially influence' climate change



*The Jackdaw field is owned by Adura - a joint venture by energy giants Shell and Equinor.
(Image source: Adura)*

Kevin Keane, BBC Scotland environment, energy & rural affairs correspondent 8 July 2026

Emissions from the controversial Jackdaw gas field in the North Sea will "not materially influence" global warming, according to a new report from its owner.

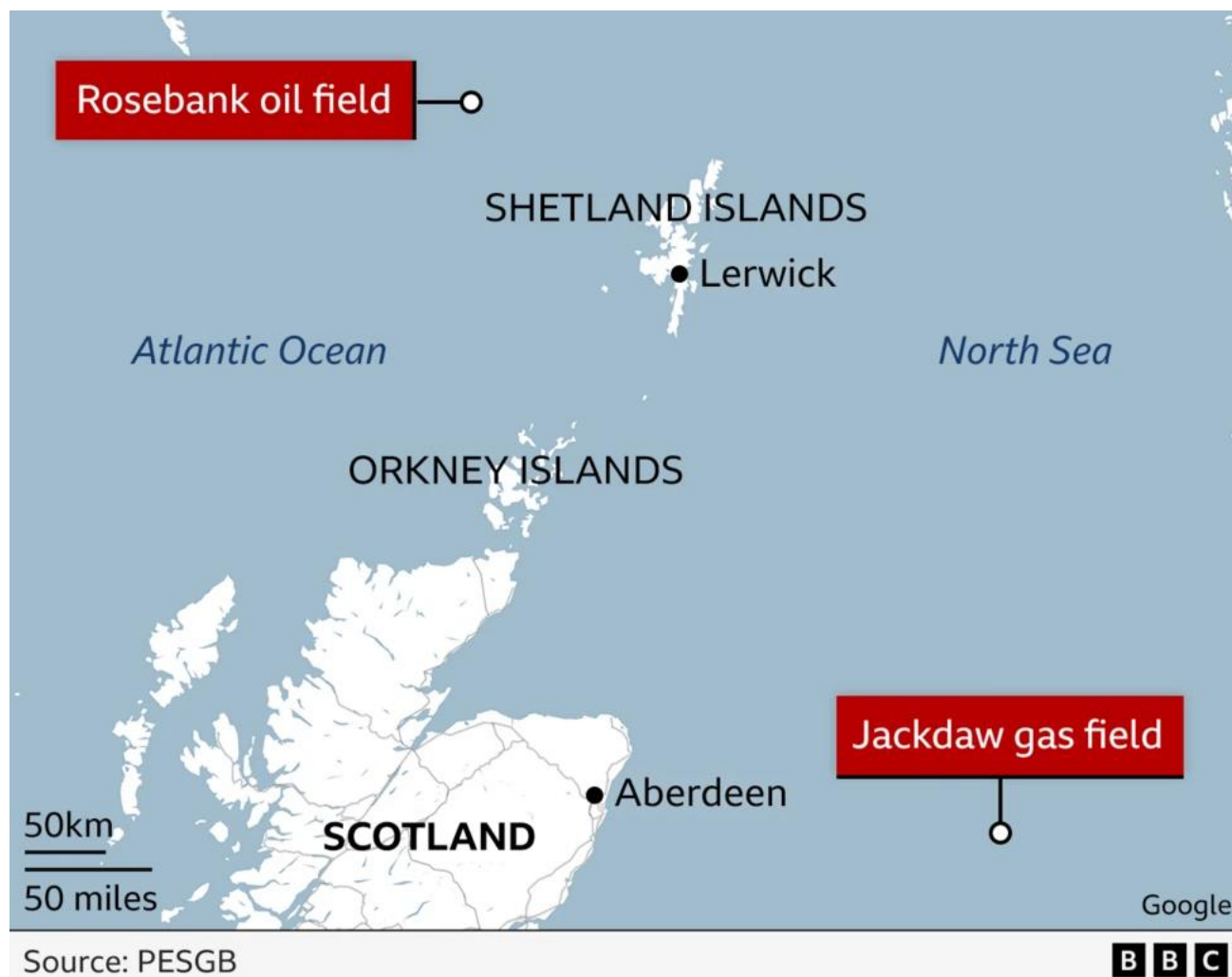
Adura's updated Environmental Impact Assessment, external (EIA) said the project would account for less than 0.02% of annual global greenhouse gases during its lifetime.

The new assessment was required by the industry regulator, after it found several areas had not been adequately addressed in a previous submission. The report was ordered by a judge who ruled that ministerial consent for Jackdaw was unlawful, following a legal challenge from environmental groups.

Campaigners had called on the UK government to reject both the Jackdaw gas field and the Rosebank oil field developments.

The previous revised EIA - submitted in November - said the Jackdaw field could produce up to 35.8 million tonnes of carbon dioxide emissions or equivalent during its lifetime, which is around 90% of Scotland's total emissions.

The updated assessment, requested by the Offshore Petroleum Regulator for Environment and Decommissioning (Oprel), required Adura to provide additional context on how emissions would affect global ambitions to limit climate change.



A map of the North Sea showing the Jackdaw and Rosebank fields relative to the mainland and other island groups.

Adura is a joint venture between UK energy giant Shell and Norwegian firm Equinor. Its 159-page submission said that displacing imported liquified nature gas (LNG) from the United States with gas from the Jackdaw field would save the equivalent of four million tonnes of CO2 equivalent. It says that could result in around 20% more emissions from imports compared with gas produced domestically. Those "losses" would principally come from eliminating the need to liquify, transport and then regasify the imported product.

It also said the climate effects would be "minor" because the UK has a "well-regulated industry, with targets and commitments that are aligned with the expectations of the Paris Agreement", a legally binding commitment to limit global warming to between 1.5° and 2.0°C.

Last year, the Court of Session in Edinburgh ruled that both Jackdaw and Rosebank had been unlawfully approved, because the government failed to take into account the climate impact of burning extracted oil and gas from the fields.

The legal case had been brought by environmental groups Uplift and Greenpeace. In his judgement, Lord Eckett required a more detailed climate assessment and fresh approval from the UK government before production could begin.

Tessa Khan, executive director of Uplift, said Jackdaw would have "no impact on our energy bills and do precious little to increase our gas supply". She added: "The reality is, after 50 years of drilling, the UK has now burned most of its gas and a relatively small gas field like Jackdaw will do next to nothing to reduce our dependence on imports."

Greenpeace said that "self-serving claims" in Adura's assessment should not be taken at face value. Doug Parr, Greenpeace UK chief scientist, said: "Any new oil and gas field approval is wholly incompatible with keeping global warming to 1.5°C, the internationally agreed limit for avoiding the worst impacts of climate breakdown. Ignoring that reality for a tiny amount of gas - which won't lower energy bills or materially strengthen the UK's energy security - is reckless and indefensible."

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From The Archives

New study finds evidence for a 'fast' dinosaur extinction

New sediment data suggests the dinosaurs were rapidly done in, strengthening asteroid impact theory

Howard Lee, *The Guardian*

15 Jun 2016

Boring is beautiful when you're studying a calamity, especially one as spectacular as the mass extinction that wiped out the dinosaurs. That's because exciting sediments, full of variations and gaps, make it hard to disentangle the extinction signal from the noise of natural variability.

So, you could say that **James Witts**, of the University of Leeds in the UK, lucked-out with an especially boring batch of sediments in Seymour Island on the Antarctic Peninsula (the part on the map that points up to South America). His study, recently published in the journal **Nature Communications**, catches the extinction of marine life in one of the most detailed records ever published for the end-Cretaceous. As Witts describes it: *"The sedimentology is consistently, remarkably boring. More than 1,000 meters of sandy silt and silty sand!"*

It took about 4 million years to deposit that sand in a sea bed over the crucial time before, during, and after the mass extinction. In all that time fossils accumulated steadily – molluscs, sharks, corals, crustaceans, marine reptiles – until suddenly they



Tyrannosaurus Rex skeleton. (Photograph: Sabena Jane Blackbird/Alamy)

all stopped. The sediments continued steadily accumulating, but all the Cretaceous fossils disappeared within a few meters of each other. Rare fossils disappeared sooner, common fossils disappeared later, but there's a fossil-free gap right below the layer that marks the end of the Cretaceous.

"It doesn't look like the environmental setting over the extinction itself changed significantly, so we can discount any rapid changes in water depth having an effect on the pattern of extinction we see from the fossil record."

Then there is a layer of dead fish.

The remarkable thing about these fish is that they are mostly whole and un-scavenged, either because the usual scavengers were extinct, or because of low oxygen conditions triggered by microbe blooms in an ocean whose food web was unbalanced by the extinction: *"The anoxia story was a surprise to us. In such a shallow setting it appears unusual. I imagine a scenario like parts of the Gulf of Mexico today, with input of material from rivers driving changes in ocean oxygen on a rapid (maybe seasonal?) scale."*

A final fossil find is very unlikely to be the last individual of that species that ever lived on Earth, so it's likely that a species lived on for some time after its last fossil was preserved. Witts used statistics on how frequently fossils of a given species show up in the sediments, to predict the likely gap between fossils if the species was still alive. He found that, in all likelihood, all the last Cretaceous species continued to live until within about 30,000 to 70,000 years of the end of the Cretaceous, and plausibly even less than that. This shows that the mass extinction was geologically "fast," rather than a drawn-out attrition of species over hundreds of thousands of years.

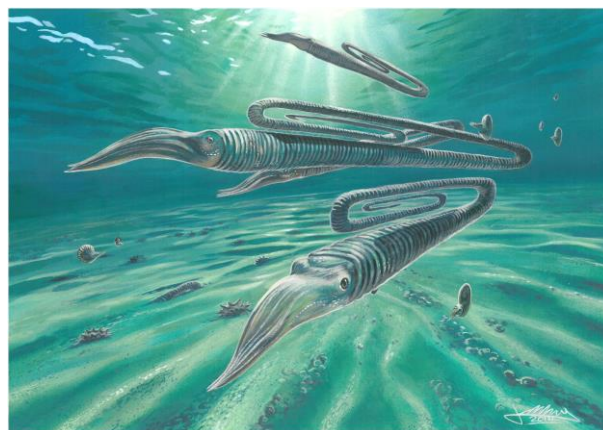
"Ultimately, one of the problems with studies on the end-Cretaceous extinction is that we are pushing the limits of the resolution of many fossil records, as well as the proxies for environmental change."

Recent rock dating has put the Chicxulub asteroid impact at the same time as massive eruptions in India and shows that the main eruptions were also geologically rapid. So even though Witts' study used a combination of magnetic field reversals, strontium isotope values, and fossil population changes to tie down the dates for his sediments, each of those has an uncertainty too big for a precise match to either the impact or the eruptions.

Also, the iridium measurements at Seymour Island used to mark the time of the asteroid impact date back to 1994, and come from a different location than Witts' study, which may add further date uncertainty.

But dates aside, Witts' catalogue of over 6,000 fossils shows no hint of increasing environmental stress before the extinction, despite an episode of climate warming that lasted over a million years, before cooling at the end of the Cretaceous. This is in contrast to studies elsewhere, which found signs of a deteriorating environment for a few hundred thousand years before the extinction; in Antarctica, life seems to have been boringly oblivious until the end.

In the ongoing debate over the ultimate killer of Cretaceous life, these findings support a geologically rapid cause (anything from tens of millennia to instant), rather than slowly building environmental stress:



Antarctic marine life in the late Cretaceous, including the paperclip-shaped ammonite "Diplomoceras." (Illustration: James McKay)

"The fact that the fossil disappearances occur directly below the interval containing the iridium anomaly suggests the link between impact and extinction is still the key to understanding the pattern we see in the fossil record. I would also argue that we still simply don't know enough about whether the eruptions could have produced environmental change significant enough to cause the extinction."

Further twists in the dinosaur extinction story are likely as scientists analyse samples from the just-completed Chicxulub Crater Drilling Project, while others have discovered traces of volcanic mercury that link the eruptions to the extinction. Scientists are going to need more boring sediments to sort all of that out.

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News

Palaeontologists make 'one in a million' discovery of soft tissue preserved in 450-million-year-old fossil

Alexander Mann, University of Oklahoma, PhysOrg

6 July 2026

Before the oldest dinosaur, before animals or even plants had expanded onto dry land, ancient relatives of starfish called **crinoids**, resembling stalked sea flowers, were among the first creatures to flourish in Earth's earliest coral reefs more than 450 million years ago. The study of fossilized crinoids helps scientists understand how these animals evolved and offers rare insight into the origins of complex life.



Crinoid soft tissue fossil. (Credit: University of Oklahoma)

However, typical fossilization preserves only the hardest parts of an animal, like shells or skeletal plates, leaving soft tissues and much of their biology a mystery. Now, an extraordinarily rare discovery by University of Oklahoma palaeontologists provides a nearly unprecedented look at some of the ocean's first animals.

"After an animal dies, soft tissues like skin, eyes or internal organs are the first things to decay," said Dr. Lena Cole, OU palaeontologist and assistant curator of invertebrate paleontology at the Sam Noble Oklahoma Museum of Natural History. "Most fossils are only made up of hard parts like bones, teeth or shells. Soft tissues are only preserved when the environment acts almost like a natural refrigerator or vacuum-sealer - conditions that are incredibly rare."

The nearly impossible natural conditions required to preserve soft tissue as fossils mean the preserved tube feet of *Dendrocrinus simcoensis*, described by Cole and her colleagues in a groundbreaking new study, represent one of only two known examples of fossilized soft tissue in crinoids. It's also the oldest example discovered to date.

"Preservation like this is truly one in a million," Cole added. "Crinoid fossils number in the millions, and this is only the second time soft tissues have ever been found."

The oldest crinoid soft tissue ever found

"It's incredible these soft tissues have survived more than 450 million years," said Dr. David Wright, another OU palaeontologist and assistant curator of invertebrate palaeontology at the Sam Noble Oklahoma Museum of Natural History, who co-authored the study with Cole. "For reference, these soft tissues are more than 200 million years older than the oldest dinosaur."

Tube feet are essential for how crinoids feed, interact with currents and occupy ecological niches. Their size, spacing and structure vary depending on habitat and feeding strategy - much like how the shape of a mammal's tooth reflects its diet.

"Since crinoid tube feet are used for feeding, you can think of them in a similar way to how we think about teeth in mammals," Wright explained. "Differences in their structure tell us about what kinds of environments a species lived in and how it fed."

"Comparisons with living crinoids show that the anatomy of this ancient species was very different," Cole added. "This gives us new insight into how crinoids evolved and how their feeding strategies changed over hundreds of millions of years."

Insights into ancient oceans

While the discovery is an invaluable contribution to our understanding of ancient crinoids, its true value may be the clues it provides about the ecology of early Palaeozoic oceans, when crinoids were among the many early animals to flourish in reef environments.

"Fossilized remains of long-extinct species can show features well outside the range of variation we see in living species," Wright said. "By comparing ecological ways of life for extinct and modern species, we can understand how patterns of adaptive evolution have changed through time and what factors shaped the modern biosphere."

Because so few soft tissues are preserved in early echinoderms, each new discovery dramatically expands what scientists can deduce about ancient ecosystems, feeding strategies and evolutionary pathways.

A discovery made possible by museum collections

Breakthroughs in palaeontology are often thought to happen outdoors during field expeditions. While this is sometimes the case, many of the most important discoveries are made among specimens already collected, catalogued and preserved in museum collections.

"New fossil discoveries ultimately come from fieldwork, but museum collections play a significant role in this kind of integrative research," Wright said. "We don't always know the full significance of the specimens we collect. New technologies, ideas or expertise often find surprising ways to use existing specimens to make new discoveries."

The fossilized soft tissue of *Dendrocrinus simcoensis* had been preserved for years at Montréal's Musée de paléontologie et de l'évolution, a small institution supported entirely by community donations. However, when crinoid specialists Cole and Wright examined it closely during a research visit, the specimen's true scientific importance became clear.

"This discovery highlights the importance of museum collections and the community support that keeps them alive," Cole said. "Without the dedication of many people caring for these collections, this research would never have been possible."

The invertebrate palaeontology collections curated by Cole and Wright at the Oklahoma Museum of Natural History are home to more than a million specimens, with new fossils added every year. With

so much material at hand, it becomes clear why new species and discoveries are still waiting to be found within museums.

"This is why we work to make our collections accessible to researchers around the world," Wright said. "There are simply too many fossils to study over one person's career. There's more than a lifetime's worth of discoveries waiting to be found."

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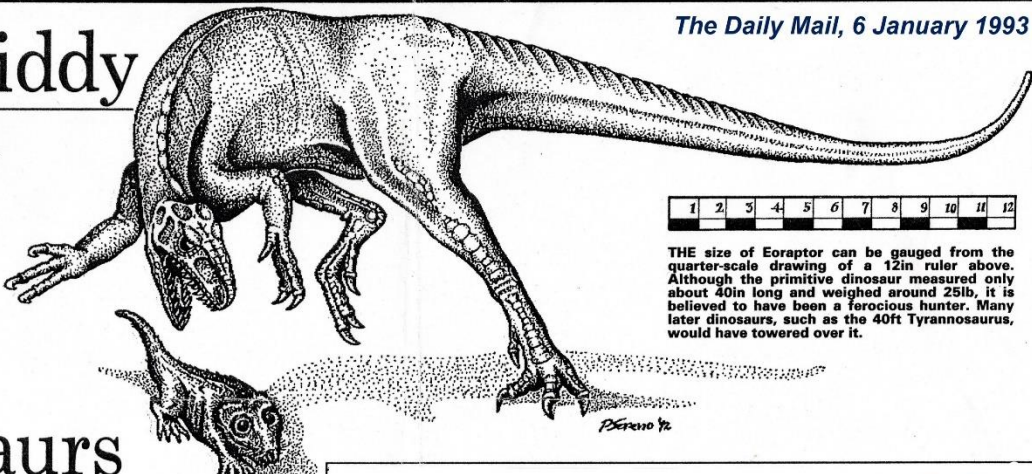
From The Archives

Provided by Janet Catchpole

INTRODUCING EORAPTOR — 100 MILLION YEARS OLDER THAN T REX

The Daily Mail, 6 January 1993

The diddy daddy of all the dinosaurs



THE size of Eoraptor can be gauged from the quarter-scale drawing of a 12in ruler above. Although the primitive dinosaur measured only about 40in long and weighed around 25lb, it is believed to have been a ferocious hunter. Many later dinosaurs, such as the 40ft Tyrannosaurus, would have towered over it.

IT WOULD have been dwarfed by Hollywood's favourite dinosaur, Tyrannosaurus Rex.

But Eoraptor was yesterday making an enormous impression on experts, who were hailing it as one of the most important dinosaur discoveries in history.

Scientists found the perfectly-preserved bones of the meat-eater in a lost valley at the foothills of the Andes.

'It's the most primitive dinosaur ever found,' said Chicago University professor Paul Sereno, who led the expedition into the desert region of Argentina known as the Valley of the Moon.

'There was a common ancestor that gave rise to all dinosaurs and this comes very close in size and form to what the common ancestor was.'

It is thought Eoraptor lived 225million years ago — 100million years before Tyrannosaurus — when the valley was covered in vegetation.

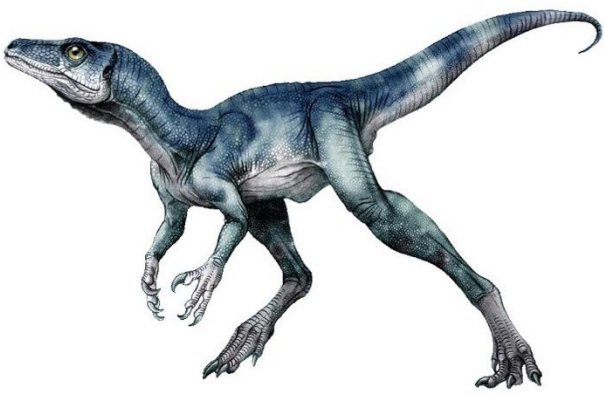
It thrived on tiny reptiles and the young of its prehistoric rivals, racing after them on its hind legs, grabbing them with its powerful three-fingered hands, and tearing them to pieces before devouring them. Professor Sereno, 35, named it Eoraptor — which translates as Dawn Stealer — because it was born at the dawn of the dinosaurs and stole to keep alive.

He was on a dinosaur hunting expedition in October, 1991, when Argentinian student Riccardo Martinez stumbled on the find. 'We were walking away when Riccardo spotted an unusual piece of rock and picked it up,' recalled Professor Sereno. 'He was about to chuck it away when he saw two little teeth embedded in it.'

'He laid it down on the ground and before we knew it, we were brushing away the earth from a jawbone.'

At first the scientists thought the skull was from an early crocodile, but then they unearthed the skeleton, which was perfect apart from a couple of missing tail bones. It is now on show at the National Geographic Society in Washington.

By BILL MOULAND



<https://www.extinctanimals.org/eoraptor.htm>

News

A massive asteroid slammed into the North Sea and triggered a 330-foot tsunami

GeologyPage.com

15 July 2026

A long-running debate about a mysterious crater hidden beneath the North Sea has finally been settled. Researchers have confirmed that the **Silverpit Crater** was created when an asteroid or comet slammed into the region roughly 43 to 46 million years ago.

The finding resolves a scientific argument that has lasted for more than two decades and identifies Silverpit as one of Earth's relatively rare impact craters, geological scars left behind when space rocks strike the planet at tremendous speeds.

The research team, led by **Dr. Uisdean Nicholson** of **Heriot-Watt University in Edinburgh** and funded by the Natural Environment Research Council (NERC), combined advanced seismic imaging, microscopic analysis of rock samples, and computer simulations to build the strongest case yet for an extraterrestrial impact. Their results were published in the journal ***Nature Communications***.

A Hidden Crater Beneath the North Sea

The Silverpit Crater lies about 700 meters (2,300 feet) beneath the floor of the southern North Sea, approximately 80 miles from the Yorkshire coast.

Since its discovery in 2002, the structure has puzzled geologists. The crater itself spans about three kilometers (1.9 miles) across and is surrounded by a much larger ring of circular faults extending roughly 20 kilometers (12 miles). Faults are fractures in rock layers that form when the Earth's crust is stressed or displaced.

Many scientists believed Silverpit was created by a hypervelocity impact, the term used for collisions involving asteroids or comets traveling at several miles per second. The crater's circular shape, central peak, and distinctive surrounding fault pattern resembled features seen at known impact sites around the world.

Not everyone agreed. Some researchers proposed that the structure formed when underground salt deposits shifted over time. Others suggested it resulted from volcanic processes that caused part of the seabed to collapse.

The disagreement became so intense that geologists formally voted on the crater's origin in 2009. According to a report in the December 2009 issue of **Geoscientist** magazine, most participants rejected the impact explanation. The latest evidence now overturns that conclusion.

New Evidence Reveals an Ancient Asteroid Strike

To re-examine the mystery, scientists turned to newly available seismic data. Seismic imaging works somewhat like an ultrasound scan for the Earth, allowing researchers to create detailed pictures of underground rock layers using reflected sound waves. The new images provided an unprecedented view of the crater's internal structure.

The team also examined rock fragments collected from an oil exploration well near the site. Dr. Uisdean Nicholson, a sedimentologist in Heriot-Watt University's School of Energy, Geoscience, Infrastructure and Society, said: "New seismic imaging has given us an unprecedented look at the crater. Samples from an oil well in the area also revealed rare 'shocked' quartz and feldspar crystals at the same depth as the crater floor.

"We were exceptionally lucky to find these — a real 'needle-in-a-haystack' effort. These prove the impact crater hypothesis beyond doubt, because they have a fabric that can only be created by extreme shock pressures."

Shocked minerals are considered some of the strongest evidence for an asteroid impact. The microscopic structures inside these crystals form only when rocks experience enormous pressures far beyond those produced by normal geological activity.

A 160-Meter Asteroid and a Towering Tsunami

Based on the team's analysis, the object that struck the North Sea was about 160 meters (525 feet) wide and approached from the west at a shallow angle. Although relatively small compared to the asteroid linked to the extinction of the dinosaurs, it was still large enough to unleash extraordinary destruction.

Dr. Nicholson said: “Our evidence shows that a 160-meter-wide asteroid hit the seabed at a low angle from the west. Within minutes, it created a 1.5-kilometer-high curtain of rock and water that then collapsed into the sea, creating a tsunami over 100 meters high.”

A tsunami of that size would have towered more than 330 feet above sea level, higher than many modern skyscrapers. The impact would have instantly excavated the crater while blasting huge volumes of rock, sediment, and seawater into the atmosphere.

The Search for the “Silver Bullet”

One of the researchers involved in the new study was Professor Gareth Collins of Imperial College London, who also attended the debate over Silverpit’s origin in 2009.

Collins developed the numerical models used to simulate the impact and compare its effects with the crater’s observed structure.

Professor Collins said: “I always thought that the impact hypothesis was the simplest explanation and most consistent with the observations. It is very rewarding to have finally found the silver bullet. We can now get on with the exciting job of using the amazing new data to learn more about how impacts shape planets below the surface, which is really hard to do on other planets.”

Why Impact Craters Are So Rare

Despite the countless asteroids and comets that have struck Earth throughout its history, surprisingly few impact craters remain visible today. Earth’s surface is constantly being reshaped by erosion, weathering, volcanic activity, and the slow movement of tectonic plates. Over millions of years, these processes erase many traces of ancient impacts.

Dr. Nicholson said, “Silverpit is a rare and exceptionally preserved hypervelocity impact crater. These are rare because the Earth is such a dynamic planet — plate tectonics and erosion destroy almost all traces of most of these events. Around 200 confirmed impact craters exist on land, and only about 33 have been identified beneath the ocean. We can use these findings to understand how asteroid impacts shaped our planet throughout history, as well as predict what could happen should we have an asteroid collision in future.”

Joining the Ranks of Famous Impact Craters

The confirmation of Silverpit’s origin places it among a select group of known impact structures. These include Mexico’s Chicxulub Crater, which is widely linked to the mass extinction that wiped out the non-avian dinosaurs 66 million years ago, and the Nadir Crater off the coast of West Africa, another underwater impact site that was only recently confirmed.

With the debate finally resolved, scientists can now use Silverpit as a valuable natural laboratory for understanding how asteroid impacts affect both Earth and other worlds across the solar system.

The research was funded by the Natural Environment Research Council (NERC).

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Further Reading



Mammal ancestors laid eggs—and this 250-million-year-old fossil proves it

Wits University, PhysOrg

9 April 2026



Egg photographed in the control room of the ESRF in France. (Credit: Professor Julien Benoit)

A remarkable new discovery is shedding light on one of the greatest survival stories in Earth's history, and answering a decades-old scientific mystery. *Lystrosaurus*, a hardy, plant-eating mammal ancestor, rose to prominence in the wake of the End-Permian Mass Extinction some 252 million years ago, the most devastating extinction event our planet has ever experienced.

While countless species vanished, *Lystrosaurus* not only survived but thrived in a world marked by extreme environmental instability, intense heat, and prolonged droughts.

Now, groundbreaking research published in **PLOS ONE** reveals a discovery that transforms our understanding of this iconic survivor. An international team led by Professor Julien Benoit, Professor Jennifer Botha (Evolutionary Studies Institute, University of the Witwatersrand, South Africa),

and Dr. Vincent Fernandez (ESRF—The European Synchrotron, France) has identified, for the first time, an egg containing an embryo of *Lystrosaurus*, dating back approximately 250 million years.

This extraordinary fossil represents the first-ever egg discovered from a mammal ancestor, finally answering a long-standing question: Did the ancestors of mammals lay eggs? The answer is yes.

https://phys.org/news/2026-04-mammal-ancestors-laid-eggs-million.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Yellowstone's magma source may be closer than thought, reshaping hazard models

Li Yali, Chinese Academy of Sciences

PhysOrg

10 April 2026

Supereruptions are extremely large volcanic eruptions that eject more than 1,000 cubic kilometers of magma, rock and ash. They are among the most hazardous geological events on Earth and have profound impacts on the environment, climate, and human society. For this reason, understanding the subsurface processes behind supereruptions is essential for improving volcanic hazard assessments and mitigating risks.

Now, a research team from the Institute of Geology and Geophysics of the Chinese Academy of Sciences (IGGCAS) has developed a comprehensive three-dimensional geodynamic model of western North America that simulates the present-day dynamics of both the lithosphere and the underlying convecting mantle, revealing a mechanism for magma generation beneath supervolcanoes.

Their findings are published in **Science** on April 9.

<https://phys.org/news/2026-04-yellowstone-magma-source-closer->

[thought.html?utm_source=nwletter&utm_medium=email&utm_campaign=weekly-nwletter](https://www.science.org/doi/10.1126/science.ady2027)

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https://phys.org/news/2026-04-yellowstone-magma-plumbing-tectonic-deep.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Super magma reservoirs discovered beneath Tuscany

University of Geneva

PhysOrg

14 April 2026



Renowned for its geothermal activity (here, the Larderello power plant, the oldest in the world), Tuscany also hides vast magma reservoirs beneath its landscapes, similar to those found at Yellowstone in the United States. (Credit: UNIGE, Matteo Lupi)

How can magma buried 5, 10, or even 15 km underground be detected without any surface indicators? The answer lies in ambient noise tomography, a technique that analyzes natural ground vibrations with high precision. A team from the University of Geneva (UNIGE), the Institute of Geosciences and Earth Resources (CNR-IGG), and the National Institute of Geophysics and Volcanology (INGV) has identified a vast reservoir containing approximately 6,000 km³ of magma beneath Tuscany.

Beyond its scientific significance, this breakthrough paves the way for faster and more cost-effective exploration methods to locate resources such as geothermal reservoirs, lithium, and rare earth elements, whose formation is closely linked to deep

magmatic systems. The study was published in the journal **Communications Earth & Environment**.

https://phys.org/news/2026-04-super-magma-reservoirs-beneath-tuscany.html?utm_source=nwletter&utm_medium=email&utm_campaign=weekly-nwletter

Ancient process that created rare earth elements discovered — and it could help us locate desperately needed deposits

A new study suggests rare earth elements form in magma above ancient subduction zones, as that magma reacts with substances that are released when one tectonic plate dives beneath another.

Sascha Pare, LiveScience 17 April 2026

Researchers may have found a new way to locate deposits of rare earth elements that are vital to the tech and energy industries.

Rare earth elements crystallize in Earth's mantle inside blobs of magma that are rich in alkali metals, such as sodium and potassium, and carbonate minerals, such as calcite and dolomite. In a new study, scientists found that these types of magma, known as alkaline and carbonatite magmas, form above ancient subduction zones, where one tectonic plate dives beneath another.

"This research shows that the ingredients for these critical mineral deposits were put in place many million[s] to even billions of years ago," study lead author Carl Spandler, a professor of mineralogy, petrology, geochemistry and economic geology at Adelaide University in Australia, said in a statement. "By identifying where these ancient processes occurred, we can significantly narrow down the search areas for future discoveries."

https://www.livescience.com/planet-earth/geology/ancient-process-that-created-rare-earth-elements-discovered-and-it-could-help-us-locate-desperately-needed-deposits?utm_term=8DEBC9E5-6C7F-4337-AFFF-

[D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=FF02F775-ECCA-45B7-8F53-390FEA96B2FC&utm_source=SmartBrief](https://www.geologybites.com/alec-brenner)

Meet the 19-metre octopus that prowled the ancient seas

Helen Briggs, BBC Science correspondent
23 April 2026

Giant octopuses may have ruled the ancient oceans 100 million years ago, when dinosaurs roamed, according to new research.

Some of the earliest octopuses are believed to have been powerful predators equipped with strong arms for grabbing prey and beak-like jaws for munching on the shells and bones of other animals.

A new study of some remarkably well-preserved jaws suggest they reached up to 19 metres, potentially making them the largest invertebrates ever known to scientists.

<https://www.bbc.co.uk/news/articles/cyv1rgm16r2o>

Podcast



Alec Brenner on When Tectonic Plates First Moved

30 April 2026

A key development in the history of the early Earth is the formation of lithospheric plates that move independently of one another. In this episode, Brenner describes how he used paleomagnetic methods to detect relative motion between two ancient cratons, the East Pilbara and the Kaapvaal, 3.5 billion years ago. This is a full billion years earlier than any

previous such detection, and it enables us to narrow down the kind of tectonics operating in the Paleoproterozoic. Of the candidate regimes, episodic subduction models fit his data best.

Brenner is a Postdoctoral Associate in the Department of Earth & Planetary Science at Yale University.

<https://www.geologybites.com/alec-brenner>

Steve Brusatte on the Dinosaurs That Survived the Asteroid

28 May 2028

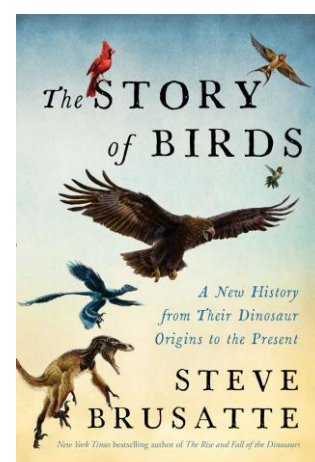
Birds are the only dinosaurs alive today. How do we know that birds are dinosaurs? Why did this one branch survive when so many others, including most birds themselves, did not? And what does the fossil record actually tell us?

Steve Brusatte has traced the evolutionary transition from ground-living theropod dinosaurs to modern birds, drawing on the spectacular feathered fossils unearthed over the past three decades in northeastern China. He is the author of **The Story of Birds**, published earlier this year and is Professor of Palaeontology and Evolution at the University of Edinburgh.

<https://www.geologybites.com/steve-brusatte>

The story of birds: a new history from their dinosaur origins – Steve Brusatte's new book

28 April 2026



https://theconversation.com/the-story-of-birds-a-new-history-from-their-dinosaur-origins-extract-of-steve-brusattes-new-book-281562?utm_medium=email&utm_campaign=

[Latest%20from%20The%20Conversation%20for%20April%2028%202026%20-%203752338426&utm_content=Latest%20from%20The%20Conversation%20for%20April%2028%202026%20-%203752338426+Version+A+CID_e9a48b6a17444fa87f7c11e35e2db05d&utm_source=campaign_monitor_uk&utm_term=The%20story%20of%20birds%20a%20new%20history%20from%20their%20dinosaur%20origins%20%20extract%20of%20Steve%20Brusattes%20new%20book](https://www.bbc.com/news/science-55488666)

https://theconversation.com/theres-a-reason-we-dont-have-birds-the-size-of-elephants-the-mysterious-story-of-how-dinosaurs-evolved-expert-ganda-280960?utm_medium=email&utm_campaign=Latest%20from%20The%20Conversation%20for%20April%2028%202026%20-%203752338426&utm_content=Latest%20from%20The%20Conversation%20for%20April%2028%202026%20-%203752338426+Version+A+CID_e9a48b6a17444fa87f7c11e35e2db05d&utm_source=campaign_monitor_uk&utm_term=Theres%20a%20reason%20we%20dont%20have%20birds%20the%20size%20of%20elephants%20the%20mysterious%20story%20of%20how%20dinosaurs%20evolved%20%20expert%20QA

Finding the world's most complete T-rex fossil

World Service

6 May 2026

This programme was first broadcast in 2015.

On 12 August 1990, the world's most complete skeleton of a Tyrannosaurus rex was found in South Dakota.

Deena Newman speaks to Peter Larson whose team made the landmark discovery.

Eye-witness accounts brought to life by archive. Witness History is for those fascinated by and curious about the past. We take you to the events that have shaped our world through the eyes of the people who were there.



https://www.bbc.co.uk/sounds/play/w3ct9881?at_mid=nTS0AwS110&at_campaign=Witness_History_T_Rex_Fossil&at_medium=display_ad&at_campaign_type=owned&at_nation=NET&at_audience_id=SS&at_product=sounds&at_brand=p004t1hd&at_ptr_name=bbc&at_ptr_type=media&at_format=image&at_objective=consumption&at_link_title=Witness_History_T_Rex_Fossil&at_bbc_team=BBC

The fossil that revealed the first dinosaur feathers

World Service

12 May 2026

In 1996, a fossil unearthed in China became the first confirmed record of a dinosaur covered in feathers.

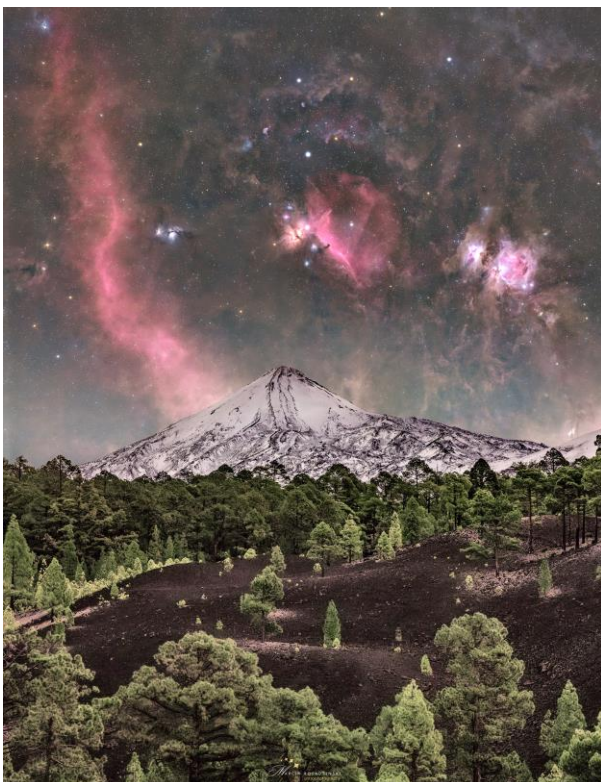
Before this discovery, some palaeontologists had suggested that dinosaurs might have developed feathers and eventually evolved into modern birds, but the idea remained controversial due to the lack of concrete evidence.

Canadian palaeontologist Philip Currie was among the first experts to examine the specimen and recognise it as a feathered dinosaur. He tells Stefania Gozzer about the scientific debate the fossil ignited, as well as the challenges of accessing the specimen at a time when it was still difficult for Western researchers to study fossils in China.



<https://www.bbc.co.uk/sounds/play/w3ct985t>

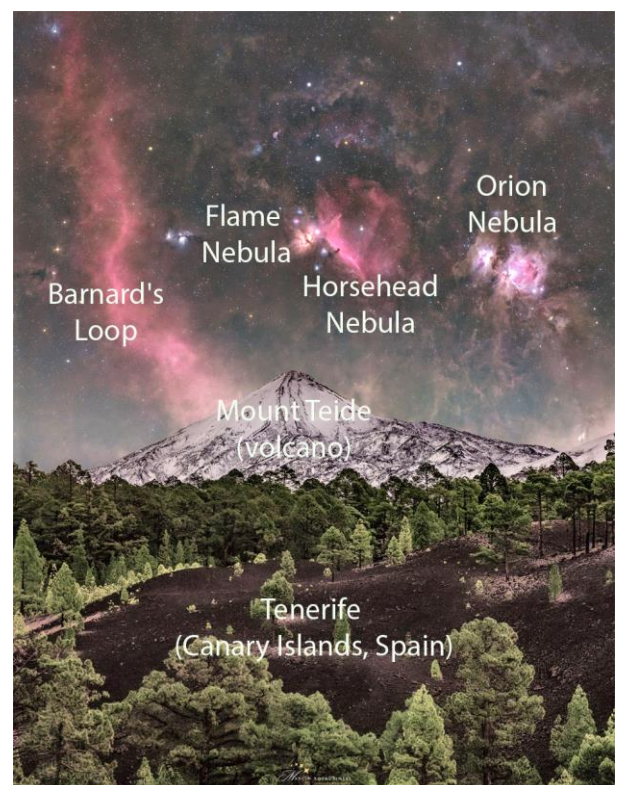
Astronomy Picture of the Day



Orion over Mount Teide (Image Credit & Copyright: Marcin Rosadziński)

Explanation: Orion is rarely seen like this. To achieve this majestic vista, you need a camera capable of taking such long duration exposures that faint features in the night sky become

revealed. Iconic nebulas that appear include the Orion Nebula, the Flame Nebula, and Barnard's Loop. For contrast, it also helps to have a volcano on the foreground, in this case the Teide volcano on Tenerife on the Canary Islands of Spain. But if you want your Teide volcano snow-covered, you also need good timing -- because that only happens, typically, for a few days each year. Good timing also includes waiting for Orion to appear just behind Teide, which occurred late last year after sunset. The featured image is the result of a series of images taken consecutively with the same camera from the same location.



<https://apod.nasa.gov/apod/ap260505.html>

Quote of the day

“While creativity in naming is a cherished part of taxonomy, a touch of orthographic restraint may ultimately benefit both science and the species themselves.”

Species with longer names — such as the mouthful myxobacterium *Myxococcus lanfairpwillgwyngyllgogerychwyrndrobwilllantysiliogogogochensis*, which has the longest scientific name of any organism — seem to get

fewer literature mentions and Wikipedia reads than those given pithier monikers. (*Reference: bioRxiv preprint, not peer reviewed* https://www.biorxiv.org/content/10.64898/2026.04.07.716944v1.full.pdf?utm_source=Live+Audience&utm_campaign=bf7de720f8-nature-briefing-daily-20260409&utm_medium=email&utm_term=0_-33f35e09ea-500911261)

News

Yellowstone's volcano may be fuelled in a very different way than we thought

Yellowstone eruptions may be driven by shifts in Earth's crust, rather than a deep well of magma, study finds.

Sarah Wild, Live Science

2 May 2026



New research suggests Yellowstone's magma plumbing system doesn't work the way we thought it did. (Image credit: evenfh via Getty Images)

Yellowstone's famous supervolcano is likely being fuelled in a completely different way from what many scientists assumed. New research suggests that Yellowstone's volcanic activity is actually driven by shifts in Earth's crust, rather than a deep well of magma underground as previously thought.

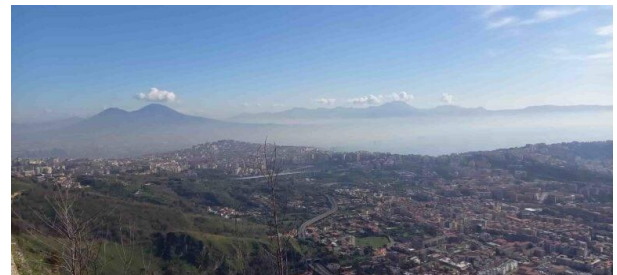
This finding could help scientists predict future volcanic activity and better understand how the volcano will behave.

<https://www.livescience.com/planet-earth/volcanoes/yellowstones-volcano-may-be-fueled-in-a-very-different-way-than-we-thought>

New model finds complex earthquake patterns of the Phlegraean Fields near Naples

Geology page

27 March 2026



View of Naples from the Hermitage of Camaldoli with Mt. Vesuvius, Gulf of Naples, Sorrento Peninsula and the Eastern edge of Campi Flegrei. Taken while setting up measuring stations. (Credit: Simone Ceska, GFZ)

The Phlegraean Fields volcanic complex, located beneath the metropolitan area of Naples - a city of 900,000 inhabitants in Italy - has been rising increasingly since 2005, accompanied by a growing number of small earthquakes. This development has been attracting increasing attention in the densely populated region for years. Although such phases of uplift and subsidence have occurred there for over a thousand years, the relationship between ground uplift and seismic activity is complex and not yet fully understood.

A recent study in the journal **Communications Earth and Environment** now shows that the long-term trend in earthquake activity can be well explained by combining changes in stress within Earth's crust with the friction behaviour of geological faults. The additionally observed swarms of earthquakes can be explained, at least in part, by interactions between individual earthquakes and successfully modelled as superimposed sequences of aftershocks.

https://www.geologypage.com/2026/03/new-model-finds-complex-earthquake-patterns-of-the-phlegraean-fields-near-naples.html?fbclid=IwY2xjawRv1BBleHRuA2FlbQIxMQBzcnRiBmFwcF9pZBAyMjlwMzkxNzg4MjAwODkyAAEe_OvEuuHNz6CKR6IFoc

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This volcano didn't just erupt—it triggered a hidden atmospheric cleanup scientists never expected to see

Kristian Granov, ScienceX 7 May 2026

When the submarine volcano Hunga Tonga–Hunga Ha'apai in the South Pacific erupted in January 2022, it was not only one of the most violent volcanic eruptions in modern times. The volcano also did something completely unexpected: it helped clean up some of the methane pollution it released. This phenomenon could potentially be key to how humans can slow global warming.



The Hunga Tonga–Hunga Ha'apai volcanic eruption on 15 January 2022. Image taken from a video of the eruption. (Credit: Tonga Geological Services)

https://sciencex.com/news/2026-05-volcano-didnt-erupt-triggered-hidden.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

THE CONVERSATION

Academic rigour, journalistic flair

What it would have been like to experience the dinosaur-killing asteroid armageddon: a blow-by-blow account

Michael J. Benton & Monica Grady
11 May 2026



https://theconversation.com/what-it-would-have-been-like-to-experience-the-dinosaur-killing-asteroid-armageddon-a-blow-by-blow-account-271786?utm_medium=email&utm_campaign=Latest%20from%20The%20Conversation%20for%20May%2011%202026%20-%203765738566&utm_content=Latest%20from%20The%20Conversation%20for%20May%2011%202026%20-%203765738566+CID_92f4420b1aefbabf7422125f5c236405&utm_source=campaign_monitor_uk&utm_term=What%20it%20would%20have%20been%20like%20to%20experience%20the%20dinosaur-killing%20asteroid%20armageddon%20a%20blow-by-blow%20account

Perseverance rover uncovers the role of water in Mars's mineral past

Sam Jarman, ScienceX 14 May 2026

NASA's Perseverance rover has spent more than three and a half years exploring Mars's Jezero Crater, building up a remarkable catalog of mineral discoveries.

In a new study published in the **Journal of Geophysical Research: Planets**, an international team of planetary scientists led by Elise Clavé at the Institute of Space Research in Berlin has used Perseverance's data to show that three chemically distinct rock formations in the crater share a surprisingly similar mineral fingerprint - whose origins appear to be closely tied to the presence of liquid water on ancient Mars.

https://sciencex.com/news/2026-05-perseverance-rover-uncovers-role-mars.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

The asteroid that wiped out the dinosaurs may have triggered a global fungal bloom

Paul Arnold, *ScienceX*

18 May 2026

The asteroid that smacked into our planet about 66 million years ago at the Cretaceous-Paleogene (K/Pg) boundary may have been bad news for dinosaurs, but it was good news for fungi. According to new research published in the **Proceedings of the National Academy of Sciences**, after this mass extinction event, one of the most significant in Earth's history, fungi may have proliferated across the globe.

https://sciencex.com/news/2026-05-asteroid-dinosaurs-triggered-global-fungal.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Why meat-eating dinosaurs like T. rex evolved tiny arms

University College London, *Phys.org*

19 May 2026

The evolution of tiny arms in several groups of meat-eating dinosaurs was likely driven by the development of strong, powerful heads, which were used to attack prey, according to a new study led by researchers at UCL (University College London) and Cambridge University.

The study, published in the journal **Proceedings of the Royal Society B**, looked at data for 82 species of theropod (two-legged, mainly meat-eating dinosaurs), finding that shortening of forelimbs occurred across five groups, including tyrannosaurids, the family that included *Tyrannosaurus rex*.

The team, including Dr. Elizabeth Steell at Cambridge and Professor Paul Upchurch at UCL, found that smaller arms were closely linked to the development of large, powerful skulls and jaws, more so than to larger overall body size, indicating that tiny arms were not just a by-product of bodies getting bigger.

The researchers suggested that the increasing size of prey, in the form of gigantic sauropods

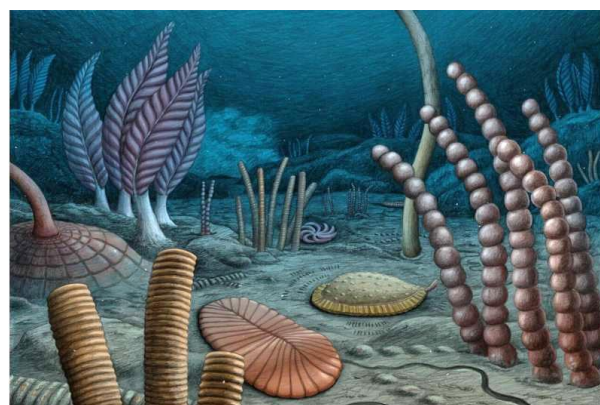
(long-necked, long-tailed plant-eaters) and other large herbivores, may have resulted in a shift to hunting using jaws and head instead of claws.

https://phys.org/news/2026-05-meat-dinosaurs-rex-evolved-tiny.html?utm_source=nwletter&utm_medium=email&utm_campaign=weekly-nwletter

Discovery of new fossils in Northwest Canada changes view of early animal evolution

American Museum of Natural History,
PysOrg

20 May 2026



Reconstruction of a hypothetical deep-water palaeocommunity from the new fossil site in Canada's Northwest Territories, based on fossils recovered by the researchers. (Credit: Alex Boersma)

Researchers have uncovered a remarkable fossil site in a remote part of Canada's Northwest Territories, offering unprecedented insight into the earliest evolution of complex animal life on Earth. Findings from the site represent life from the **Ediacaran biota**—soft-bodied organisms that lived on the seafloor more than 500 million years ago — and push back the origins of animal movement and sexual reproduction by 5 – 10 million years.

The work is published in the journal **Science Advances** and led by researchers at the American Museum of Natural History and Dartmouth.

"For 3 billion years, life on Earth was dominated by microbes. Then, all the sudden,

we get these strange-looking marine animals big enough to see and capable of behaviours we would find familiar today," said the study's lead author Scott Evans, assistant curator of invertebrate paleontology at the American Museum of Natural History.

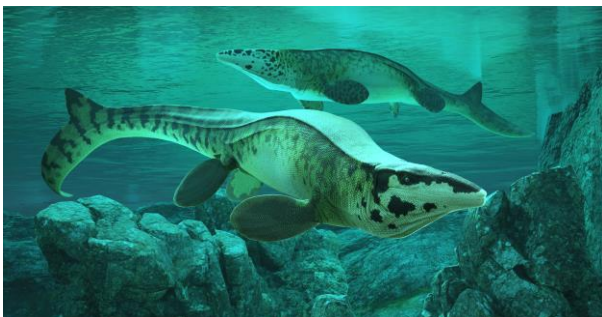
"If we want to understand this transition, when life first became large, complex and unmistakably animal, this new site has tremendous potential.

https://phys.org/news/2026-05-discovery-fossils-northwest-canada-view.html?utm_source=nwletter&utm_medium=email&utm_campaign=weekly-nwletter

https://www.livescience.com/planet-earth/evolution/complex-animals-evolved-up-to-10-million-years-earlier-than-previously-thought-fossil-discovery-shows?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=9509E6B4-0DD5-4D00-9C42-4808DBB65D11&utm_source=SmartBrief

"Ancient seas get a new T. rex as massive mosasaur emerges from Texas fossils

American Museum of Natural History, PhysOrg
21 May 2026



A reconstruction of Tylosaurus rex in the Cretaceous-era Western Interior Seaway of North America. (Credit: Courtesy of Alderon Games—Path of Titans)

There's a new T. rex in the fossil record, only this one terrorized the ancient seas. New research led by scientists at the American Museum of Natural History, the Perot Museum of Nature and Science in Dallas, and Southern Methodist University uncovers a new, massive species of mosasaur, a marine reptile that lived during the age of the dinosaurs. One of the largest mosasaurs known to date - stretching up to 43 feet long - this top predator was described from 80-million-year-old fossils that were found primarily in northern Texas decades ago. It was named *Tylosaurus rex*, or *T. rex* for short, meaning "king of the tylosaurs."

"Everything is bigger in Texas and that includes the mosasaurs, apparently," said Amelia Zietlow, lead author of the new study, which was published today by the ***Bulletin of the American Museum of Natural History***.

https://phys.org/news/2026-05-ancient-seas-rex-massive-mosasaur.html?utm_source=nwletter&utm_medium=email&utm_campaign=weekly-nwletter

https://www.livescience.com/animals/extinct-species/theres-a-new-t-rex-from-the-dinosaur-age-and-it-ruled-the-seas-with-a-skull-crushing-bite?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=F741B36C-00D2-4D54-B57C-B3483B7D1307&utm_source=SmartBrief

New Velociraptor cousin was a '4-winged' dragon that hunted prey from the trees of ancient China, fossil find hints

A new microraptor from Cretaceous China likely preyed on ancient birds.

Kenna Hughes-Castleberry, LiveScience
25 May 2026

A newly discovered feathered dinosaur with four wing-like limbs may have prowled the

lakeside forests of what is now northwestern China, gliding between trees like a flying squirrel and snatching some of the earliest birds out of the Cretaceous sky.



An illustration of *Jianchangmaensis* (left) attacking the ancient bird *Gansus yumenensis* (right) in the Changma Basin of northwestern China around 120 million years ago. (Image credit: Illustration by Lewis LaRosa, colored by Jão Canola.)

The predator, named *Jianchangmaensis*, was a close cousin of Velociraptor and belonged to a strange group of small birdlike dinosaurs called microraptors. Unlike the large and scaly "Jurassic Park" version of raptors, these animals were feathered, lightweight and glided to get around. Based on fossil evidence, *J. changmaensis* had long feathers on both its arms and legs, giving it the look of a tiny dragon with four wings.

https://www.livescience.com/animals/dinosaur/new-velociraptor-cousin-was-a-4-winged-dragon-that-hunted-prey-from-the-trees-of-ancient-china-fossil-find-hints?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=1DAA1B2C-E37E-425B-955E-A97C17FBDB4B&utm_source=SmartBrief

Earth's oxygen-rich atmosphere may owe its existence to cold subduction

Krystal Kasal, Phys.org

27 May 2026

Earth was mostly devoid of oxygen for much of its 4.5 billion year lifetime. That is, until certain processes started to allow for the eventual buildup of oxygen up to the levels we have now (around 21% of the atmosphere). While scientists have found evidence of the approximate timescales of rises in oxygen over time and are aware of some of the mechanisms behind it, the main driver behind Earth's long-term oxygenation is still unclear.

A new study explores whether changes in subduction style - how tectonic plates sink - influenced oxygen levels over time. The study, published in **Proceedings of the National Academy of Sciences**, points to a process called cold subduction as the main driving factor behind Earth's rise in oxygen levels, which ultimately led to a more habitable Earth.

https://phys.org/news/2026-05-earth-oxygen-rich-atmosphere-owe.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Heron-like, fish-eating dinosaur from 70 million years ago discovered in Argentina

Taylor & Francis, PhysOrg

28 May 2026



A reconstruction of *Kank*. (Credit: Gabriel Díaz Yantén)

A new raptor-like dinosaur from some 70 million years ago that ate fish and behaved like modern herons has been unearthed from southern Patagonia. The new species, which has been named *Kank australis*, was identified based on the discovery of fossil remains including teeth, vertebrae, and toe bones.

https://phys.org/news/2026-05-heron-fish-dinosaur-million-years.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

How a lost road helped rewild a rare landscape

Lewis Mason & Danielle Malgwi, BBC
31 May 2026

When the **Hindhead Tunnel** opened in 2011 it was said to have "surpassed expectations" by finally removing one of the worst bottlenecks on the A3.

But its more significant legacy may be environmental - by taking the road under the landscape instead of through it, the project sparked one of the most successful rewilding projects in southern England.



*The Hindhead Tunnel construction removed a significant bottleneck on the A3.
(Image source, Getty Images)*

<https://www.bbc.co.uk/news/articles/cdepj87pjwxo>

Some 'extinct' volcanoes may just be going through a growth spurt, before they 'wake up in this catastrophic stage,' emerging research suggests

A volcano that erupted after being asleep for more than 100,000 years is leading more volcanologists to say we must redefine volcano activity to ensure eruptions don't surprise us.

Chris Simms, LiveScience **4 June 2026**

The "extinct" Methana volcano, near Athens, was once quiet for nearly 110,000 before awakening and erupting energetically. Volcanoes like Methana have caused scientists to question the classification of extinct volcanoes.

A volcano that slept for more than 100,000 years before erupting is blowing up our understanding of when volcanoes should be defined as active or extinct.

Volcanologists officially classify sleeping volcanoes as extinct if they haven't erupted in the past 10,000 years or so, or in the past 11,700 years since the start of the current geological epoch, the Holocene.

And yet, an analysis of the active volcano Methana, near Athens, Greece, recently found that it once slept for nearly 110,000 years before bursting back to life. The finding could be the final straw for volcanologists, many of whom were already questioning the current definition of what makes a volcano extinct.

"The take-home message," said study co-author Răzvan-Gabriel Popa, a volcanologist at ETH Zürich in Switzerland, "is that extinct volcanoes around us might not really be extinct."

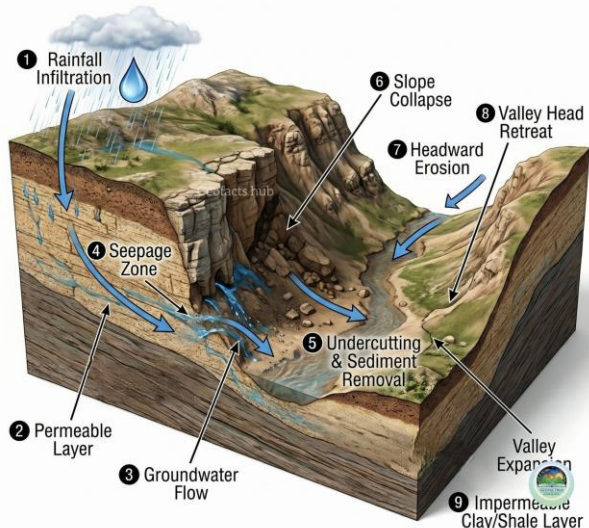
https://www.livescience.com/planet-earth/volcanoes/some-extinct-volcanoes-may-just-be-going-through-a-growth-spurt-before-they-wake-up-in-this-catastrophic-stage-emerging-research-suggests?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=E05A80EA-3B42-4FD2-9C2F-D1345506FB15&utm_source=SmartBrief

The Geologist GeoFacts Hub

Sapping (Groundwater Erosion) — when hidden groundwater slowly reshapes the landscape from below. Rainwater infiltrates permeable rocks, flows underground, emerges

as seepage, removes sediment, and triggers slope collapse and valley head retreat over time.

Sapping (Groundwater Erosion)



<https://www.facebook.com/groups/1781247198611372>

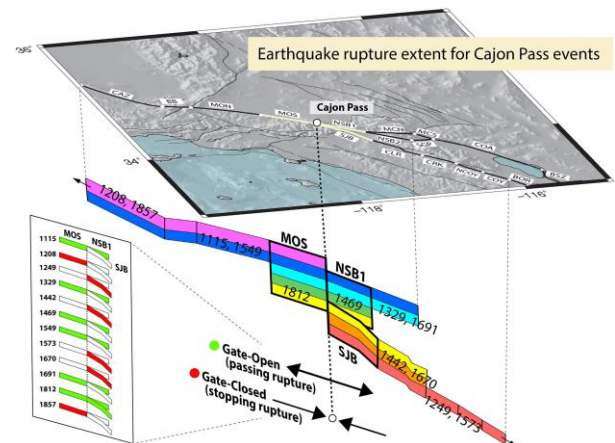
California's tectonic stress has reached record level, earthquake model reveals

University of Bern, PhysOrg 8 June 2026

Earthquakes usually occur along fracture zones in Earth's crust, where large tectonic plates slide past one another and become locked. Stress builds up over long periods and is suddenly released in the form of an earthquake. In Southern California, the San Andreas and San Jacinto faults are among the most significant of these zones, accommodating most of the plate motion in the region.

Where the two fault systems approach each other northeast of Los Angeles lies the Cajon Pass - a tectonically complex junction where a rupture on one fault could potentially cross onto the other. Since the last major earthquake to affect the wider Los Angeles region, the Fort Tejon earthquake of 1857, with a magnitude of 7.9, tectonic stress along the fault segments has built up continuously during a prolonged quiet period that has long concerned

researchers, given the potential for a large future rupture.



Earthquake rupture extents for events passing and stopping at Cajon Pass based on the Maximum Rupture Model of Scharer and Yule (2020) and modelling by Rodríguez Padilla et al. (2021). Colours show earthquakes with the same rupture extent, with the mean age (CE) indicated. Small arrows indicate extent of ruptures beyond map excerpt. Left inset: timeline of "Gate-Open" or "Gate-Closed" events of Cajon Pass, that is, ruptures stopping/passing the intersection of MOS, North San Bernardino, and San Jacinto Bernardino. (Credit: Journal of Geophysical Research: Solid Earth (2026). DOI: 10.1029/2025jb033213)

In a new study led by Dr. Liliane Burkhard of the Division of Space Research and Planetary Sciences (WP) at the Physics Institute of the University of Bern, an international research team modelled 1,000 years of earthquake history along the southern San Andreas and San Jacinto fault systems to estimate the present-day stress loading at Cajon Pass. Researchers from the University of Hawai'i at Mānoa, the U.S. Geological Survey Earthquake Science Center in Pasadena, and the Scripps Institution of Oceanography at UC San Diego were involved.

The results show that tectonic stresses in the region have reached and, in some cases, exceeded the highest levels of the last millennium.

<https://phys.org/news/2026-06-california-tectonic-stress-earthquake->

[reveals.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter](https://www.energyvoice.com/oilandgas/north-sea/599073/aberdeen-developer-ups-the-ante-of-unconsented-rosebank-development-as-production-vessel-arrives/?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter)

Aberdeen developer 'ups the ante' of unconsented Rosebank development as production vessel arrives

The controversial oil and gas project still awaits approval from the UK Labour government.

EnergyVoice

10 June 2026

One of the clearest signs yet that the controversial Rosebank oilfield is preparing for production has arrived west of Shetland.

Aberdeen-headquartered developer Adura has confirmed Petrojarl Rosebank, the project's massive floating production, storage and offloading vessel (FPSO), is now at the field.



The Petrojarl Rosebank FPSO, which Aberdeen-headquartered Adura will use to produce the Rosebank oilfield in the West of Shetland area. (Image: Adura)

This comes as Rosebank continues through a key regulatory process.

Environmental groups oppose the development, arguing it is incompatible with the UK's climate commitments.

The arrival marks a significant milestone for the UK's largest undeveloped oil and gas field and is likely to be viewed as a major vote of confidence in the future of the project.

[https://www.energyvoice.com/oilandgas/north-sea/599073/aberdeen-developer-ups-the-ante-of-unconsented-rosebank-development-as-production-vessel-](https://www.energyvoice.com/oilandgas/north-sea/599073/aberdeen-developer-ups-the-ante-of-unconsented-rosebank-development-as-production-vessel-arrives/?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter)

[arrives/?utm_campaign=402430177-Energy%20Voice%20%7C%20Daily%20New%20sletter&utm_medium=email&hsenc=p2ANqtz-iY8qf50lt5EbnL46DOpkltiWbY7idlcZrG9btt2fKFLJR8mHupyVMjMjvwBN-ozLQyDMziyc0rFKuYE_mQ&hsmi=135376940&utm_content=135376940&utm_source=hs_automation](https://www.energyvoice.com/oilandgas/north-sea/599073/aberdeen-developer-ups-the-ante-of-unconsented-rosebank-development-as-production-vessel-arrives/?utm_campaign=402430177-Energy%20Voice%20%7C%20Daily%20New%20sletter&utm_medium=email&hsenc=p2ANqtz-iY8qf50lt5EbnL46DOpkltiWbY7idlcZrG9btt2fKFLJR8mHupyVMjMjvwBN-ozLQyDMziyc0rFKuYE_mQ&hsmi=135376940&utm_content=135376940&utm_source=hs_automation)

Powerful seismic waves from Japan's 2011 earthquake struck Earth's core and bounced back up, moving the island eastward

Louise Lerner, University of Chicago PhysOrg

19 June 2026



Japan rests at the intersection of four different tectonic plates. (Credit: K. Cantner/American Geosciences Institute)

In 2011, Japan reeled from the effects of a devastating magnitude 9.0 earthquake. But unnoticed in the chaos resulting from the quake, its major aftershocks and the tsunami it caused, something strange happened. About 16 minutes after the earthquake, but before the aftershocks hit, Japan's GPS stations registered an eastward lurch - across the entire country - but unconnected to any specific quake or aftershock.

A new analysis of data from the quake, led by University of Chicago geophysicist Sunyoung Park, suggests an extraordinary answer: The waves from the earthquake travelled downward to the Earth's core and then back up, displacing the tectonic plates further. This

permanently moved the entire island of Japan eastward by up to 6 millimetres.

Seismologists knew that large waves from earthquakes can travel through the Earth and even reverberate off the core. But this is the first time the phenomenon has been identified as causing tectonic plates to slip near the Earth's surface. "It's striking because this is both an unprecedented length and area for a seismic event, and it is a previously unrecognized source of seismic hazard," said Park.

The study was published in **Science** on June 18.

https://phys.org/news/2026-06-powerful-seismic-japan-earthquake-struck.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Geology Today

May/June 2026



<https://onlinelibrary.wiley.com/toc/13652451/2026/42/3?campaign=woletoc>

Aberdeen geothermal well to be drilled by end of month

'Our plan is to drill down to about 500m on the university campus.'

Ryan Duff, EnergyVoice 22 June 2026

A well is set to be drilled in Aberdeen for a geothermal test case project after a university 3D subsurface mapping initiative was launched in February.

A 164ft (50m) well will be drilled near Aberdeen University's library building in as scholars seek to examine the feasibility of using geothermal to slash emissions from heating homes, businesses, and hospitals in the Granite City.

As part of the Aberdeen Geothermal Feasibility Pilot (AGFP), the university previously installed 100 nodes "across a mix of public and private green spaces," which covered residential and commercial properties and council-owned municipal spaces.

This initiative was planned to provide the AGFP with the information needed to create a map of Aberdeen's subsurface granite and structures to a depth of just over three miles.

https://www.energyvoice.com/renewables-energy-transition/geothermal/599562/aberdeen-geothermal-well-to-be-drilled-by-end-of-month/?utm_campaign=402430177-Energy%20Voice%20%7C%20Daily%20Newsletter&utm_medium=email&hsenc=p2ANqtz-8nil39ES_6_MPIS7AnpxS6f6oFRAfXX8VvqgPO6CJvsXdI1l6r_b0NIWbsNYjRXtpxiL0hnlcv_c_P31T4t2YU-D3GPrA&hsmi=135376940&utm_content=135376940&utm_source=hs_automation

What is this rock?

Not natural, not quite unnatural, the strange new rocks of the Anthropocene stretch the boundaries of geology

John MacDonald, Aeon 16 June 2026

I'm standing on a beach at Workington, on the western edge of the Lake District in England. Here I find myself contemplating a very unnatural object, while pondering a pretty fundamental question: what, exactly, is a rock? For a geologist like me, this should be easy to answer, but what I'm looking at has made me think otherwise.



Workington in Cumbria, England. (Photo provided by the author)

At Workington, all seems natural – the sounds of the waves lapping the shore, the call of seabirds, the smell of the ocean, the sight of the stony beach and high cliffs. At first glance, the beach is made largely of a rock platform, which is not a particularly unusual phenomenon – many coastal areas are 'rock coasts' made of sandstone, basalt or granite. These rocks are ancient in human years – often millions or even billions of years old – and have been sculpted into their current cliff or platform shapes over hundreds to thousands of years.

Yet among the waves is an object that shouldn't be there: a wheel and tyre, embedded in the rock that makes up the shore. It's not stuck in a crevice – the rock has actually formed around it. How can this have happened? The wheel and tyre are of a mid-20th century style, but rocks are ancient, often millions of years old. Aren't they?

Closer inspection of this hard rock platform shows it is what geologists call conglomerate: a sedimentary rock made of rounded pebbles and cobbles deposited on the Earth surface. Over thousands to millions of years, this material is buried and heated causing minerals to form and fill in the gaps between the pebbles and cobbles, fusing them together into a hard rock mass. At Workington though, this can't

have happened: as well as the tyre, my colleagues and I found several other human-made objects, under 100 years old. The pebbles and cobbles in the conglomerate aren't natural either: they are all made of slag, a solid by-product of the iron- and steel-making process.

https://aeon.co/essays/the-strange-rocks-that-wouldnt-exist-without-us?utm_source=Live+Audience&utm_campaign=37188488c5-nature-briefing-daily-20260619&utm_medium=email&utm_term=0_-33f35e09ea-500911261

Podcast

World Service Discovery



Dinosaurs and a meteor falling from the sky in back background. (Credit: ugurhan/Getty Images)

04 Jun 2018

What's the Tiniest Dinosaur?

Our hunt takes us from the discovery of dinosaurs right up to the present day, which is being hailed as a 'golden age' for palaeontology. Currently, one new species of dinosaur is unearthed on average every single week. But what's the smallest dino? And what can size reveal about the life of extinct animals?

Hannah Fry goes underground at the Natural History Museum in London to look through their vaults in search of the tiniest dinosaur with palaeontologist Susie Maidment. Meanwhile Adam Rutherford chats to dinosaur expert Steve Brusatte from Edinburgh University about why size really does matter, especially when it comes to fossils.

The Baffled Bat

"Why don't thousands of bats in a cave get confused? How do they differentiate their own location echoes from those of other bats?" This puzzling problem was sent in by Tim Beard from Hamburg in Germany.

Since eco-location was first discovered, this question has perplexed biologists. Hannah turns bat detective to try and track down these elusive creatures at The Queen Elizabeth Olympic Park in East London. This is where zoologist Kate Jones from University College London is using a network of smart sensors to find, identify and track wild bats.

Bat researcher and impressionist John Ratcliffe from Toronto University explains how bats use sonar to find their way around, and the clever tricks they've developed along the way. It's an unlikely tale involving gruesome early experiments, cunning electric fish and some surprising bat maths.

<https://www.bbc.co.uk/sounds/play/w3csxgn0>



Sonia Tikoo on the Moon's Magnetic Field

27 June 2026

We have known for decades that the Moon once generated a strong magnetic field — comparable in strength to Earth's — throughout the period from about 4.25 to 3.5 billion years ago. Only in the past few years have we learned that the field didn't simply switch off then: it weakened dramatically but

lingered on, faintly, until as recently as 1.5 billion years ago, before disappearing entirely. As Sonia Tikoo explains in the podcast, we don't really understand either how the early field grew so strong or how any field could last so long — and no single mechanism seems able to account for both the intense early epoch and the long, weak tail that followed.

Sonia Tikoo studies the history of magnetic fields on the Moon and other small solar system bodies using paleomagnetism and fundamental rock magnetism. She is an Assistant Professor in the Department of Geophysics at Stanford University.

<https://www.geologybites.com/sonia-tikoo>



Bernhard Steinberger on Whether Hot Spots Are Fixed

16 July 2026

Volcanic island chains like Hawaii record the passage of a plate over a hotspot — a plume of hot rock rising from deep within the mantle. For decades, hotspots were assumed to be fixed, providing a stationary frame of reference against which we could measure the absolute motions of the plates. But are they really fixed? And what would that even mean — fixed relative to what? In the podcast, Bernhard Steinberger explains how we can combine paleomagnetic measurements, hotspot tracks, and relative plate motions to answer these questions, and how his own modelling of mantle flow showed that plumes are blown about by the very currents they rise through.

Steinberger is a geophysicist at the GFZ Helmholtz Centre for Geosciences in Potsdam.

<https://www.geologybites.com/bernhard-steinberger>

Nasa rover detects potential signatures of ancient microbial life on Mars

Perseverance identifies organic carbon molecules in rocks on riverbed that carried water billions of years ago

Ian Sample, Guardian Science editor

24 June 2026

Nasa's Perseverance rover has detected complex carbon molecules in Martian rocks that are already in the spotlight for bearing potential signatures of ancient microbial life.

Measurements taken by the rover's Sherlock instrument identified organic carbon in mudstones from the Bright Angel outcrop as it trundled along Neretva Vallis, a dried-up river that carried water into the planet's Jezero crater billions of years ago.

The form of carbon detected, known as macromolecular carbon or MMC, can originate from living organisms. Geological processes can also produce the material, meaning its detection does not amount to proof of past Martian life.

Dr Ashley Murphy at the Planetary Science Institute in Arizona said MMC can be found in different settings and types of rocks. "It may originate from biological sources such as fossilised organic matter found in microbial mats and coal," she said, but could also form in reactions between rocks and water or arrive on impacting meteorites.

<https://www.theguardian.com/science/2026/jun/24/nasa-rover-detects-potential-signatures-ancient-microbial-life-mars>

https://www.space.com/astronomy/mars/did-nasa-just-find-evidence-of-ancient-life-on-mars-perseverance-rover-spots-complex-carbon-in-red-planet-rocks?utm_term=.8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-

[609994E2C5A9&utm_medium=email&utm_content=2156A0D6-DF4F-420B-8412-CD8507310A9D&utm_source=SmartBrief](https://www.theconversation.com/megalodons-legendary-life-revealed-by-fossil-rediscovery-286375?utm_medium=email&utm_content=2156A0D6-DF4F-420B-8412-CD8507310A9D&utm_source=SmartBrief)

THE CONVERSATION

Megalodon's legendary life revealed by fossil rediscovery

David Hone

1 July 2026

Senior Lecturer in Zoology, Queen Mary University of London

Museums are supposed to be havens for the collective cultural and scientific heritage of the planet, but specimens sometimes go missing.

Happily, they can also be rediscovered, as a new study shows, with the vertebrae of the legendary predatory shark known to the world under its old name of Megalodon (now properly *Otodus megalodon*) turning up on a museum shelf decades after they were seemingly lost.

The new paper takes another look at the size and growth of this giant shark that lived between 15 and 3.5 million years ago. The study confirms previous estimates that these animals might have been longer than 24 metres. To put that in context, even the most unnaturally exaggerated sharks in the Jaws franchise topped out at 10.5 metres. These were seriously big fish.

The work is based on an analysis of several 11-million-year-old vertebrae from one animal, found in Denmark. Apart from the jaws and teeth, shark skeletons are mostly cartilage, so vertebrae are rare and important. Compared to a tooth, they give a much better indication of the size of the owner and here these are the largest known of any *O megalodon* (23cm in diameter).

https://theconversation.com/megalodons-legendary-life-revealed-by-fossil-rediscovery-286375?utm_medium=email&utm_campaign=Latest%20from%20The%20Conversation%20for%20July%202%202026%20-%203840039195&utm_content=Latest%20from%20The%20Conversation%20for%20July%202%202026%20-%203840039195+CID_3ccd72a7a9bb1b00fe

[b7df96130c9f26&utm_source=campaign_monitor_uk&utm_term=Megalodons%20legendary%20life%20revealed%20by%20fossil%20rediscovery](https://www.linkedin.com/feed/update/urn:li:activity:6637b7202/?skipRedirect=true)



LinkedIn

John Underhill,
University Director for
Energy Transition and
Professor of Geoscience
at Aberdeen University

5 July 2026

"Now for something a little different from an energy-related post..."

As some may know, I've led the scientific tests of the theory that the western peninsula of Kefalonia, Paliki, may have been Odysseus' Homeland, Ancient Ithaca.

Today sees the publication a paper in the Classics Journal, Antigone, co-authored with the Professor of Classics at Cambridge University, James Diggle, in which we show that new literary evidence is entirely consistent with the geological results.

A link to the paper is provided:

<https://lnkd.in/eirQi-Yf>

The publication is especially timely given the impending release of Christopher Nolan's Hollywood Blockbuster, Odysseus on Friday July 17th, something the Sunday Times have picked up on with an article:

<https://lnkd.in/eYQ4hQMx>

The results of the interdisciplinary research have been strongly endorsed by Sir Stephen Fry, who described the work as "scrupulous" and "unimpeachable"

For more details about the geoscientific contribution to the project, please visit the Aberdeen University website link:

<https://lnkd.in/ey6dk8cw>

<https://www.linkedin.com/in/john-underhill-6637b7202/?skipRedirect=true>

<https://www.sci.news/archaeology/odysseus-ithaca-14912.html>

https://theconversation.com/can-we-map-the-odyssey-how-ancient-geographers-and-modern-researchers-have-traced-odysseus-travels-287312?utm_medium=email&utm_campaign=Latest%20from%20The%20Conversation%20for%20July%2010%202026%20-%203863339344&utm_content=Latest%20from%20The%20Conversation%20for%20July%2010%202026%20-%203863339344+CID_b03a834b367ca29ee1f8f9d0443996da&utm_source=campaign_monitor_uk&utm_term=Can%20we%20map%20The%20Odyssey%20How%20ancient%20geographers%20and%20modern%20researchers%20have%20traced%20Odysseus%20travels

Weird English Facts

1. There is no English word that rhymes perfectly with **"month"**, **"orange"**, **"silver"** or **"purple"**.
2. **"Dreamt"** is the only English word that ends with **"mt"**.
3. The word **"girl"** originally meant any young person, not specifically a female.
4. The word **"facetious"** contains all the vowels ... **a, e, i, o, u** ... in order.
5. **"Bookkeeper"** has three consecutive double letters.
6. The sentence **"The quick brown fox jumps over the lazy dog"** uses every letter in the English alphabet.

Geology: Seafloor crust formation caught in the act (Nature)

9 July 2026

The first-known direct observations of a seafloor spreading event at a mid-ocean ridge in the Indian Ocean are presented in **Nature**. The observations offer insight into how new oceanic crust is created.

Mid-ocean ridges are submarine networks of tectonic boundaries where new oceanic crust is formed from cooling magma and added to the seafloor. While two-thirds of Earth's surface has been created at these ridges, little is known about how they behave during discrete spreading events.

Jean-Yves Royer and colleagues set up an autonomous observatory to collect seismic and seafloor mapping data from the Southeast Indian Ridge, which forms the boundary between the Australian and Antarctic plates in the Indian Ocean. They were fortunate to have deployed their instruments in time to capture the seafloor near the ridge move a total of 4.2 metres across 6 days following an episode of earthquakes on 26 April 2024. The authors propose that the deformation was due to the deflation of a 2.5-kilometre-wide magma reservoir located 3.6 kilometre beneath the crust. The researchers estimate that this event released upwards of 160 million cubic metres of lava to the seafloor. Seafloor movement peaked directly after the earthquake event at 5 centimetres per minute, before slowing to 1.2 centimetres per day 7 days later.

The findings offer a more comprehensive picture of how mid-ocean ridges behave during the short duration of seafloor spreading events. The authors suggest that such events release strain accumulated along the tectonic plate boundary over several decades. Future research should include analysis of different mid-ocean ridge systems, such as those without magma that are dominated by earthquakes. In an accompanying News & Views, Ingo Grevemeyer and Lars Ruepke note that the spreading of tectonic plates on the ocean floor is less well understood than on land, as it is harder to make observations at depth. They write: "The work of Royer and colleagues shows that it is now possible to perform surveys of this sector, as have been achieved on land."

Published: 08 July 2026

Royer, JY., Olive, JA., Bazin, S. et al. Anatomy of a seafloor spreading event captured by in situ seismogeodesy. **Nature** (2026). <https://doi.org/10.1038/s41586-026-10785-0>

<https://www.natureasia.com/en/info/press-releases/detail/9383>

Tiny Jurassic bird reveals a key step in bird evolution

Paul Arnold, *Phys.org*

8 July 2026

The transition from a lumbering, heavy dinosaur body to the flight-adapted bird body plan is one of many fascinating episodes in evolutionary history. Working out how this massive transformation took place relies heavily on fossil records, especially of transitional species. A study of a newly identified Jurassic bird published in the journal **Science Advances** is providing fresh insights into a tail adaptation that helps birds fly.



Life reconstruction of Zhengheornis buyu (front) and Fujianvenator prodigiosus (back) from the Zhenghe Fauna. (Credit: Chung-Tat Cheung)

https://phys.org/news/2026-07-tiny-jurassic-bird-reveals-key.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Min Wang et al, Jurassic avialan reveals stepwise evolution of bony tail in birds, *Science Advances* (2026).

DOI: 10.1126/sciadv.aeb5202

<https://www.science.org/doi/10.1126/sciadv.aeb5202>

Obituary

Robert Maurer
(1935 – 2024)

Bob aspired to transform an initial hobby into a lasting legacy.



Liz Chiu, HHGS

3 June 2025

<https://geoscientist.online/sections/obituaries/robert-maurer/>

Ancient fossil may reveal animal kingdom's earliest right-handedness at 550 million years old

American Museum of Natural History, PhysOrg
9 July 2026



*A fossil of *Spriggina floundersi* collected in South Australia. Because these fossils preserve mirror-image impressions of the original animals, a leftward bend in the rock represents an animal that bent to the right in life. (Credit: Scott Evans / AMNH)*

Scientists have uncovered what may be the earliest evidence of "right-handedness" in the animal kingdom, dating back more than half a billion years. The discovery comes from the fossil record of *Spriggina floundersi*, an organism from the Ediacaran Period that lived about 550 million years ago.

New research published in the journal **Scientific Reports** and led by researchers at the American Museum of Natural History, Florida State University, Harvard University

and the University of California, Riverside, indicates that *Spriggina* showed a consistent preference for bending to the right.

The findings provide a remarkable glimpse into the origins of left-right asymmetry in animals, suggesting that behavioural preferences associated with one side of the body emerged far earlier in evolutionary history than previously recognized.

"When we talk about being right- or left-handed, most people likely think about how they hold a pencil or kick a soccer ball. But our research shows that an animal without hands or feet, living over 500 million years ago, may have had its own version of handedness," said lead author Scott Evans, assistant curator of invertebrate paleontology at the museum.

https://phys.org/news/2026-07-ancient-fossil-reveal-animal-kingdom.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

<https://www.nature.com/articles/s41598-026-53857-x>

New Jurassic dinosaur species identified in Thailand from a single bone

Krystal Kasal, Phys.org

10 July 2026



*Life reconstruction of a herd of five individuals of *Urugasaurus kalasinensis* inhabiting a Late Jurassic forest in Thailand, accompanied by a pair of rhamphorhynchoid pterosaurs and a metriacanthosaurid theropod.*

(Artwork by Pakorn Chotchaiyaporn (Jæsica Bababi). Credit: Scientific Reports (2026).)

DOI: 10.1038/s41598-026-49822-3)

A new study published in **Scientific Reports** describes the identification of a new species of long-necked dinosaur found in the Phu Kradung Formation in Thailand. The team calls the dinosaur *Uragosaurus kalasinensis* and says it is the first formally named *mamenchisaurid* dinosaur from Thailand.

https://phys.org/news/2026-07-jurassic-dinosaur-species-thailand-bone.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

<https://www.nature.com/articles/s41598-026-49822-3>

Sale of multimillion-dollar T rex skeleton is big headache for scientists

Palaeontologists warn before auction at Sotheby's in New York that super-rich collectors are harming research

Nicola Davis, *The Guardian Science* correspondent 14 July 2026



'Gus', a 3.8-metre-tall *Tyrannosaurus rex* skeleton, at Sotheby's in New York. (Photograph: Timothy A Clary/AFP/Getty Images)

With its dagger-like teeth, bone-crushing bite and behemoth size, the fearsome *Tyrannosaurus rex* ruled western North America during the late Cretaceous period. Now its fossilised remains are about to

dominate the auction house, with a price tag to terrify punters.

On Tuesday, one of the largest and most complete *T rex* skeletons discovered to date is to be auctioned by Sotheby's in New York with an estimated sale price of \$20m-\$30m (£15m-£22.4m).

It could even fetch more: a stegosaurus called Apex currently holds the record, selling at a Sotheby's auction in 2024 for \$44.6m – 11 times its listing price.

Nicknamed "Gus", the *T rex* is thought to be about 67Ma years old and stands – ready mounted in a predatory pose – at about 3.8 metres (12.5ft) tall. "The huge teeth are displayed within the gaping jaws," the auction listing notes.

Thought to be the remains of a large, robust adult, it was discovered – and excavated over a three-year period from 2021 – on a ranch in Harding County, South Dakota, by the commercial outfit Theropoda Expeditions, with permission from the owner of the land, Gary "Gus" Licking.

<https://www.theguardian.com/science/2026/jul/14/t-rex-skeleton-sothebys-auction-new-york-scientists>

'Another dinosaur has entered the luxury collectibles market': Gus the T. rex just sold for \$50 million. Here's what its loss means to science.

Gus, a *Tyrannosaurus rex* unearthed in South Dakota, just sold for \$50 million at auction. But it's unknown if the specimen will ever be made available to science.

Kristi Curry Rogers, *LiveScience* 16 July 2026

On July 14, 2026, "Gus," one of the most complete specimens of *Tyrannosaurus rex*, went to an as yet unidentified buyer for US\$50.1 million. This auction at Sotheby's set a record for most valuable fossil ever sold. Another dinosaur has entered the luxury

collectibles market, a reminder that even Earth's deepest history can be sold to the highest bidder.

To palaeontologists like me, however, a fossil like "Gus" — excavated from the Hell Creek Formation in South Dakota over three years starting in 2021 by commercial collector Thomas Heitkamp and his team — is not a trophy or a work of art. It is an irreplaceable scientific archive. Fossils preserve evidence of evolution, extinction, growth, disease, injury and ancient ecosystems. They are finite, nonsubstitutable records of life's history on Earth.

Science depends on independent verification of claims and healthy debate. Researchers must be able to revisit specimens, test earlier conclusions and ask new questions.

https://www.livescience.com/animals/dinosaurs/another-dinosaur-has-entered-the-luxury-collectibles-market-gus-the-t-rex-just-sold-for-usd50-million-heres-what-its-loss-means-to-science?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=86362976-7C7A-4643-BA4D-15A6D037B898&utm_source=SmartBrief

'This was one of the most arduous expeditions I've ever done': Scientists confirm that 15-mile-wide pit found on Google Maps is ancient meteor crater

Joël Lapointe was using Google Maps to plan a camping trail through Quebec's Côte-Nord region when he stumbled across a large indentation. Now, scientists have confirmed that the pit was indeed a meteor impact crater that dates back roughly 390 million years.

Pandora Dewan, LiveScience 16 July 2026

A large pit discovered by an amateur astronomer on Google Maps in 2024 is actually a 390 million-year-old meteor impact crater, scientists have confirmed.



The large pit, discovered on Google Maps in 2024, is actually a 390 million-year-old meteor impact crater. (Image credit: Gordon Osinski via Google Earth)

Joël Lapointe was planning a camping trail through Quebec's Côte-Nord region when he stumbled upon a large indentation in the terrain, CBC reported at the time. The pit, centred around Lake Marsal, was about 25 kilometres (15.5 miles) in diameter and a near-perfect ring — it didn't seem like a normal ditch. Lapointe eventually got in touch with French geophysicist Pierre Rochette, who said that the surrounding topography was "very suggestive" of an impact crater.

https://www.livescience.com/planet-earth/geology/this-was-one-of-the-most-arduous-expeditions-ive-ever-done-scientists-confirm-that-15-mile-wide-pit-found-on-google-maps-is-ancient-meteor-crater?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=3531E35B-22F5-4C17-95DA-AB9A040C8B26&utm_source=SmartBrief

Heaven Lake: China's deepest lake sits atop a colossal volcano and belongs mostly to North Korea

Heaven Lake is a body of water located 7,200 feet above sea level at the top of a volcano. It is the deepest lake in China as well as the highest and largest crater lake in Northeast Asia.

Sascha Pare, LiveScience 17 July 2026



Heaven Lake occupies a volcano caldera straddling the border between China and North Korea. (Image credit: Waitforlight/Getty Images)

Heaven Lake is a crater lake at the top of Mount Changbaishan (also called Changbai Mountain) — a colossal, dormant volcano on the border between China and North Korea that formed through successive eruptions over the past 2.6 million years.

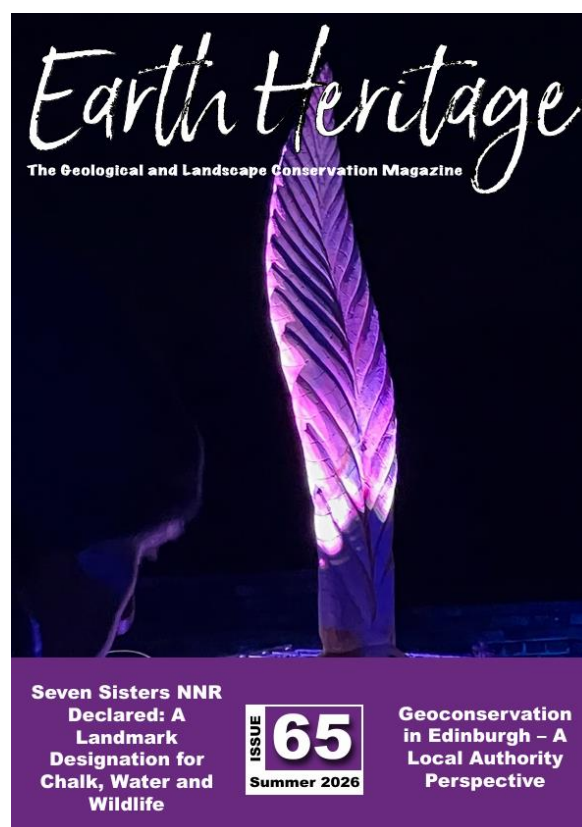
Known in China as Tianchi, the lake is the highest and largest crater lake in Northeast Asia, according to UNESCO. It is also the deepest lake in China, according to a study published in March. The lake sits at an elevation of around 7,200 feet (2,200 meters), covers roughly 3.6 square miles (9.2 square kilometres), and has a maximum depth of 1,224 feet (373 m), according to the study.

https://www.livescience.com/planet-earth/geology/heaven-lake-chinas-deepest-lake-sits-atop-a-colossal-volcano-and-belongs-mostly-to-north-korea?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=60742F0A-7C5E-46B8-A3DE-1BE402D2ABA8&utm_source=SmartBrief

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https://www.earthheritage.org.uk/wp/wp-content/uploads/EH-65_final-v2.pdf



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