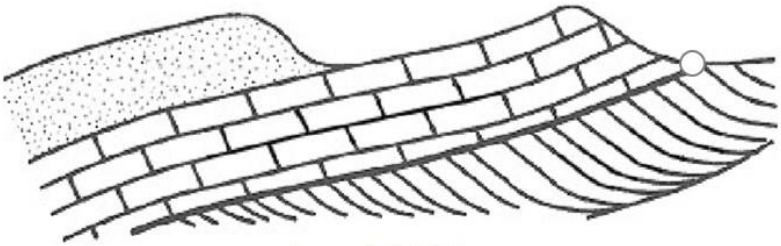
Newsletter of
The Farnham Geological Society

Volume 27, Number 4, November 2024

Sophie the Stegosaurus welcomes visitors to the Natural History Museum's Earth Hall. Sophie was a young adult when she died 150 Ma ago and is the most intact Stegosaurus fossil ever found.
Photo by Mick Caulfield

Farnham Geological Society

Farnhamia farnhamensis



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Volume 27, No. 4 **Newsletter** **November 2024**

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Editorial

Welcome to the latest FGS Newsletter. This month's edition includes, as always, articles that I hope will be of interest, together with reports from our monthly lectures.

Don't forget to join us at **The Maltings** (and hopefully **via Zoom**) on **Friday, 8 November** at **8:00pm** for **Dr. Jason Canning's** talk entitled **The UK Search for a Geological Disposal Facility – The Role of the Geosphere in Deep Nuclear Waste Disposal** which promises to be a fascinating presentation.

This will be followed by a **Zoom-only** talk entitled **The History of Oil and Gas Exploration, West of Shetland** by **Professor Nick Schofield** of the **University of Aberdeen** on **Friday, 13 December.**

The Committee would like to encourage as many members as possible to come along to The Maltings and next year to The Spire Church 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. You can find Tessa's email in the Field Trip section.

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

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

Obituary

It is with great sadness that we have to report the death of **Marybeth Hovenden** on the 19 July 2024 at her nursing home in Vancouver, Canada. Our sincerest condolences go to all her friends and family. RIP Marybeth.

One of our members ***Colin Brash*** has written a reflection of her life on page 10.

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.

Contents

Front Cover

Sophie the Stegosaurus lived about 150 million years ago during the Jurassic Period. It would have lived in present-day Wyoming, USA. The skeleton was discovered in 2003 by professional fossil hunter Bob Simon, who was digging at a site called Red Canyon Ranch in Wyoming. It was a special find, because most of the Stegosaurus skeletons that are found are incomplete.

Prof. Paul Barrett has been a dinosaur expert at the **Natural History Museum** in London for nearly 15 years. For Paul, the day Sophie came to the Museum was a momentous one. He says, 'This skeleton is very special, not just because it is complete, but also because the bones have been preserved in three dimensions instead of being squashed over time, as happens with many other fossils. So, we can get a very accurate view of how the whole body looked. We've been able to use the skeleton to really probe the biology of Stegosaurus, and this is a dinosaur that's not been studied extensively before. We've made virtual scans of the whole skeleton, using both handheld laser scanners, and also a CT scanner to peer inside the bones, to work on questions related to how this dinosaur fed and moved around.'

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

References:

https://www.nhm.ac.uk/discover/stegosaurus-brought-to-life.html

https://www.theguardian.com/science/2014/dec/04/sophie-stegosaurus-london-natural-history-museum

https://blog.everythingdinosaur.com/blog/_archives/2020/02/02/a-sunday-stegosaurus.html

Farnham Geological Society

Committee 2024-25

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Ad Hoc Member	**Liz Aston**

Meeting Programme 2024-25

Please note The Maltings and Zoom meeting times:
7.30 pm for 8.00 pm start.

The UK Search for a Geological Disposal Facility – The Role of the Geosphere in Deep Nuclear Waste Disposal
Dr. Jason Canning, Friday, 8 November
Nuclear Waste Services

The History of Oil and Gas Exploration, West of Shetland
Prof. Nick Schofield, Friday, 13 December
University of Aberdeen

200 Year Anniversary of the Naming of the First Dinosaurs
Dr. Emma Nicholls Friday, 10 January
Oxford University Museum of Natural History

Viruses - the New Frontier in Earth Sciences
Dr. Maurice Tucker Friday, 14 February
University of Durham

Field Trip Programme 2025

DAY TRIPS

- Dryhill Quarry near Sevenoaks.
- Charmouth / Lyme Regis

RESIDENTIAL TRIPS

- Mid-June … Glamorgan Coast
  - Led by John Nudds, Dept of Earth Science, Manchester. Late Triassic/Jurassic rocks. Could include a visit to the Geological Museum of Wales in Cardiff.
- Sept 2025 … Isle of Anglesey.

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

Geologists' Association Lecture Programme 2024

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

Geological considerations of landfill design
Ewan Thomas, Friday, 6 December
Geochronology

Reading Geological Society

Lecture Programme 2024 - 2025

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

Adventures in Martian deep time: tales from the Perseverance and Curiosity rovers
Prof. Sanjeev Gupta, Monday, 4 November
Imperial College, London

Scotland's Greatest Ice Age: The Neoproterozoic Port Askaig glaciation
Prof. Ian Fairchild Monday, 2 December
University of Birmingham

AGM and Members Evening
Monday, 6 January

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

Field Trips 2024

https://readinggeology.org.uk/fieldtrips.php

Mole Valley Geological Society
Lecture Programme 2024

http://mvgs.org.uk

What asteroid Ryugu tells us about ice and water in the early solar system
Dr. Matt Genge, Thursday, 14 November
Imperial College, London.

Christmas Soirée and Geo-Karaoke
Thursday, 12 December

Horsham Geological Field Club
Lecture Programme 2024-2025

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

Next Lecture

Friday, 8 November 2024

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

Jason Canning, Nuclear Waste Services

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

This talk will provide an overview of the GDF siting process and will summarise the geological investigations that NWS is undertaking in our Community Partnerships. NWS is working with three Community Partnerships (two in Cumbria and one in eastern England). The key features of the geology in the different areas will be described. Detailed evaluation of these sites commenced in 2022 but no decisions on suitability have been made.

Jason Canning is a Principal Geoscientist in Nuclear Waste Services. Jason joined NWS in July 2022 and leads the team that is responsible for the development of Site Descriptive Models.

Jason has been a professional geologist for more than 25 years, the bulk of which was in the oil and gas industry. His main skill set is in basin analysis. He is a Chartered Geologist and has served on the Council of the Geological Society.

Friday, 13 December 2024

The History of Oil and Gas Exploration, West of Shetland

Prof. Nick Schofield,
University of Aberdeen

Nick Schofield is a Professor of Igneous and Petroleum Geology at the University Of Aberdeen. He specializes in the seismic and field interpretation of intrusive and extrusive sequences in volcanic terranes and their interaction with hydrocarbon systems.

He is a multi-award winning scientist at the forefront of aiding industry in understanding challenging volcanic geology in the subsurface globally.

External roles include sitting on the IODP (Integrated Ocean Drilling Program) Science Evaluation Panel (SEP) and the UK-IODP program advisory group (PAG).

Nick is the current Director of the world-renowned Integrated Petroleum Geoscience MSc in the School of Geosciences.

Lecture Summary

Friday, 6 September 2024

On Friday, 6 September 2024, 24 members of the FGS at The Maltings welcomed Dr. Paul Kuin.

Exploration and exploitation of the Moon

Paul Kuin, MSSL

In this talk I assume that we will, in two to three decades, have established a Moon base. This likely will be at the south pole. I also assume that there will be some resources like water available for developing a permanent place to live. A place a family could live and thrive.

There has been a big gap since the Soviet Union and USA landed on the Moon, but now exploration is restarting. Currently the USA with international partners is planning to establish the **Artimis Base Camp** with a station called **Gateway** in orbit around the second Lagrangian point of the Earth-Moon system. From the Gateway station all of the Moon can be reached. China also has a Moon program called **Chang'e** and has recently landed in the Apollo crater on the far side of the Moon and returned 2 kg of samples to Earth successfully in June 2024. India surveyed the Moon using the successful **Chandrayaan** series with a landing August 2024. Japan landed its SLIM spacecraft January 2024 at a preselected location. The proposed Moon base has been compared to McMurdo Station in Antarctica to present context. It would be an "Outpost".

Despite the cost there is renewed interest in the Moon which is seen as a source of precious Helium-3 and elements that are needed in, for example, electronics, batteries and solar cells. The cost is mainly in transporting things from Earth surface to the Moon because the Earth has strong gravity to overcome. Bringing things back from the Moon is very cheap in comparison.

I asked myself, ***"What is required to have a permanent place on the Moon?"*** One that can take care of itself. I identified four items that would make it work. They point to an easy solution: **go underground**.

1. **Safety:** The Moon is a hostile environment to life like ours. Apart from the lack of air, large changes from night to daytime temperatures, walking from sunlight into

shadow there is a 10-to-20-degree change. Dust comes in many shapes including angular, sharp bits from breccia formed during meteor impacts. Dust charges and sticks to suits. The smallest particles are harmful to ingest. From the outside micrometeorites impact at high speed, typically near the orbital speed of 10km/s. The active Suns coronal mass ejections contain fields that accelerate proton and ions to high energy and those will damage tissues as does solar X-ray radiation. These CMEs are directed so usually miss the Moon-Earth system. Even higher energy cosmic rays are fewer but just as damaging. So, the plan is to cover housing in Artemis outpost with regolith, the surface rubble from the many meteoric impacts.

2. **A Proper Economy:** It is likely that no human society in the Moon would last long with just handouts from Earth. The Moon must produce a lot of things that are locally needed and trade produce for the rest. This is in a way recognised already in looking for water on the Moon, the likelihood that Helium-3 from the solar wind will have accumulated on the surface, and there are areas with a high abundance of heavy elements.
3. **A Human, Earth-like Environment:** We evolved over millions of years on Earth. Moon has a lower gravity, and that may require adapting some things, like having a rotating hospital with 1-gravity? But I think the most important is ***psychological***. We like to have good, clean air. Clean water. Large roomy spaces. Light above, day and night. Pools for swimming, fishponds, trees, plants, and grow our own food. Recycling. Music, and sports. Perhaps *Moon-ball*.
4. **Industry:** All this requires building materials, lots of power from non-polluting sources. New methods to produce things like steel, cement, ceramics, and the things that provide for the safety, economy, and human environment. With steel and aluminium spacecraft can be built to roam the Solar system, drills can be made to take advantage of the deep Moon, find resources.

A question was asked about the science that can be done on the Moon. There are discussions to establish a gravitational wave observatory which would basically measure the effect of some frequencies with the whole Moon as a resonator. Astronomical and solar observatories have been proposed since the days of the Apollo missions. We will also learn more of the functioning of our bodies in 1/7th of the Earth gravity. All that has been studied was in weightlessness.

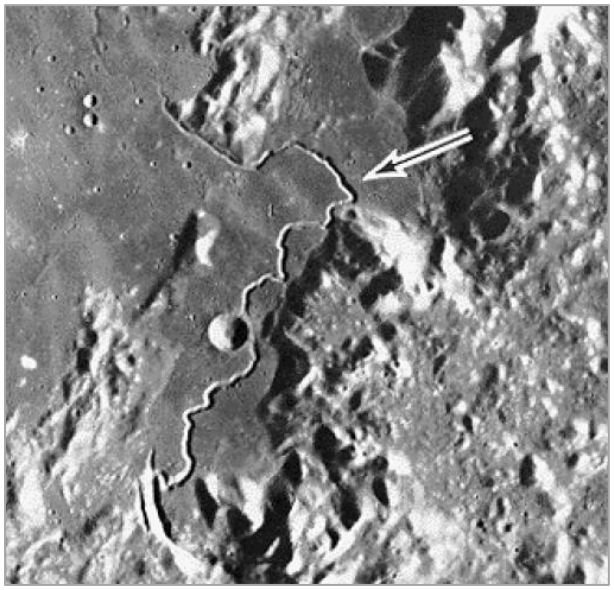
NASA has awarded funds to Austin, Texas-based ICON, to develop construction technologies that could help build landing pads, habitats and roads on the Moon using local lunar resources. (Credit: ICON/BIG-Bjarke Ingels Group)

That brought me to ask myself: ***"What do we know of the Moon"?***

A lot of information was gathered from the Russian Lunokhod and US Surveyor robot landers, and the Apollo moon missions which placed seismometers, took samples from the surface, performed heat flow measurements, and drilled cores about a meter deep. Recent re-examination of the rocks, in particular Zirconium in droplets allows new results. One was finding and dating a sample back to 4.46 GYr. That is less than 100 Myr from the age of Earth.

The front side of the Moon shows many Mare which were formed due to lava but the far side is different, only a few spots show Mare, the rest is all impacts. The south pole does not show any evidence of lava, just huge amounts of cratering. The rotation of the Moon is such that it cannot be said to have seasons. Unlike the Earth with a 23-degree angle to the orbital plane around the Sun, the Moon angle is just

over 1 degree. This means that the tops of the southern mountains are nearly the whole year in the Sun, and placing solar panels on them, or communication equipment, would help any outpost with power and contact to Earth.



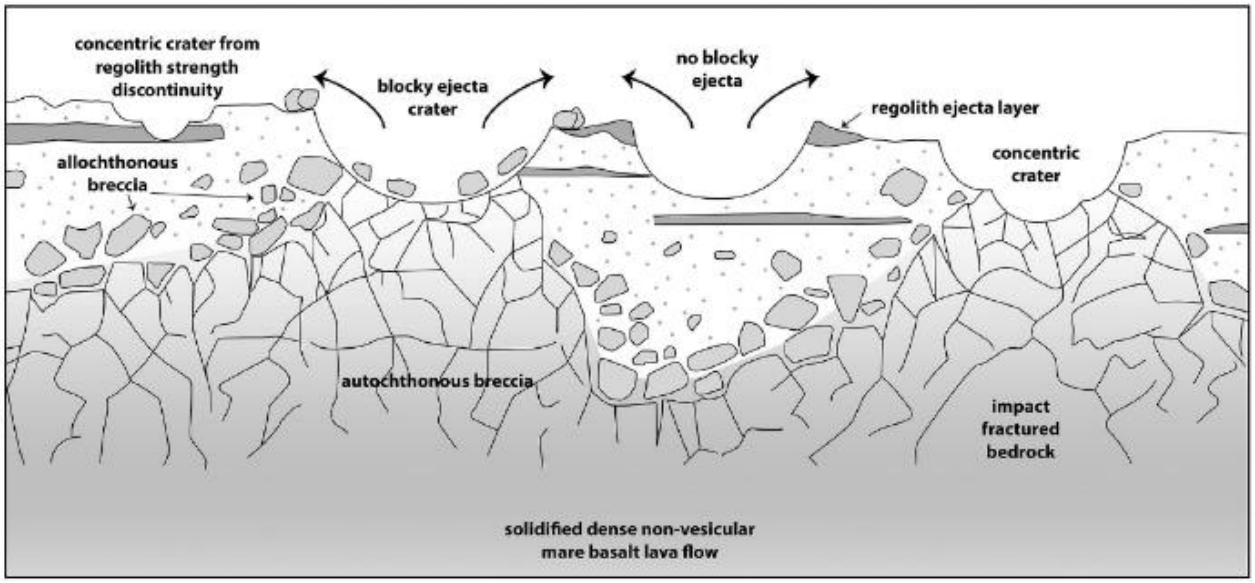
Hadley Rille (Apollo 15)

Since 1990, after the Clementine spacecraft seemed to detect water, LCross (Lunar Crater Observation and Sensing Satellite) was used to confirm that and the 2009 launched Lunar Reconnaissance Orbiter (LRO) confirmed there is water ice inside craters on the south pole that never see direct sunlight.

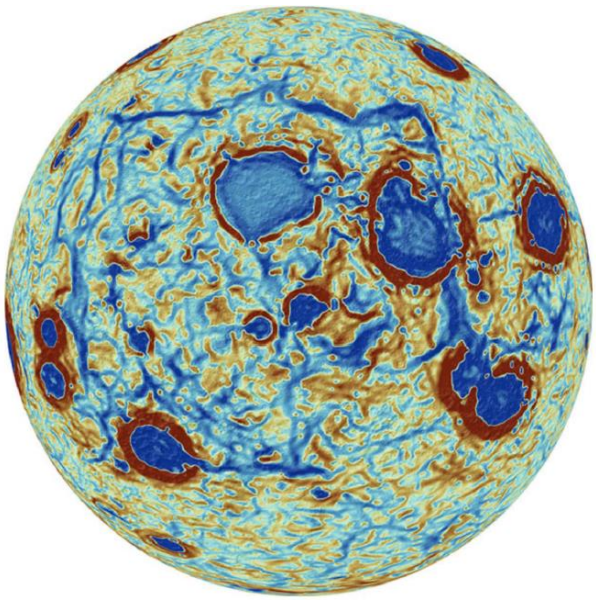
The GRAIL mission of twin spacecraft flew low over the Moon surface to determine the gravity in detail which varies due to both mass concentrations and porous volumes below the surface. The evolution of Lunar volcanism was shown in four panels. The lava flows can at times cause channels (rilles) on the surface and lava pipes are seen in multiple places as depressions. These may help establish a lunar city, or at least provide easy access to the interior.

Looking at craters, we can see several different processes depending on the impact size. A sizeable impact can go deep and throw parts of the layers below the regolith, something the Apollo mission took care to collect samples from. The area below the impact will compress the regolith creating breccia, while below we will find impact fractured bedrock.

In order to understand the temperature inside the Moon we can use a similar technique as in the study of stars, using the radiation from the inside. The temperature just below the surface so derived is 40 degrees Kelvin, enough to liquify Nitrogen. This is also the temperature from the coldest crater bottoms seen. We can assume that the radiation equilibrates to the matter within and derive only a modest increase until we reach the core at about 370 km from the centre. The temperature in real life will depend on heating by nuclear decay and concentrations of the very heavy elements will so cause internal variations. The core itself in some models may rotate independently and even obliquely.



I was asked about the magnetic field. Early on the Moon must have had a magnetic field since the lunar samples have shown magnetisation. Currently, there is only the remaining magnetism from those times. That is not to say magnetic and electric forces are not present on the surface. They are because of charging of dust and rocks. It may even provide some protection from the energetic electrons coming from the Sun.



The near side of the Moon has a familiar dark region that is covered by titanium-rich volcanic flows. Rough circles in the gravitational map correspond to the craters of the region, but the strange, linear anomalies (blue) don't have a visual counterpart. Instead, they are the signatures of dense material beneath the surface. The presence of titanium-rich materials sinking below the surface is the first physical evidence for a key event in lunar formation. (Credit: Adrien Broquet / University of Arizona)

There were more discoveries when the Grail gravity data were combined with the seismic record and the LRO altimetry. On the nearside the presence of TiO2 is largely concentrated. Removing the main gravity features and just concentrating on the changes, the gradient in gravity, a peculiar thing was seen: there is a squarish area around the main TiO2 deposit with a high gradient. The possible explanation is that TiO2 sheets from the surface moved down and are now vertical increasing the gravity gradient. This suggests a global sized turnover, probably late in the crust formation. Also, this is on the facing side of the Moon, not the far side, suggesting that the far and near sides evolved quite differently.

So, what do we understand of the Earth-Moon formation? There are some obvious constraints. We know the current masses, orbital velocities and elemental abundances. We know the core of the Moon is not mostly iron as the Earth's core is. The pre-Earth can have been less massive, the pre-Moon (often called *Theia*) about the size of Mars. It is smaller nowadays. There is still a lot of liberty though. Some models can make a Moon but have it go through a phase where it completely vaporizes and forms a gas cloud. A recent model using similar methods as are used for studying the cosmos and galaxy evolution, and assuming the Earth surface was still liquid, was presented. One of the remaining questions is whether part of Theia never melted and thus forms part of our Moon still. Also, the initial orbit of the Moon was quite close to Earth, at least ten times closer. This means there would have been massive tidal forces on the Moon and also Earth. This is likely the reason the Moon rotation synchronised to its orbit around Earth.

All these inferences are things that we need to check against what is to be found actually inside the Moon. This also means that it is difficult to plan an optimal location to settle a city in the Moon. To me regions of high porosity seem a good choice. A question is whether during the long history and cooling, weathering occurred when there were internal liquids? For the near future, drilling on the South Pole should lead to interesting finds.

A basic requirement for establishing a permanent presence will be a clean, large supply of energy. I am hopeful some kind of fusion process will be successfully made to work. Especially since we need that on Earth as well.

Further reading

https://www.lpi.usra.edu/publications/books/lunar_sourcebook/

https://pds-geosciences.wustl.edu/dataserv/moon.html

https://www.lpl.arizona.edu/

https://science.nasa.gov/mission/lro/

https://www.lpi.usra.edu/lunar/artemis/

https://www.google.com/maps/space/moon

https://www.aanda.org/articles/aa/full_html/2020/11/aa36227-19/aa36227-19.html

https://www.helionenergy.com/polaris/

Marybeth Hovenden RIP

By Colin Brash ***1 October 2024***

Marybeth (nee Burton) Hovenden was one of Farnham Geological Society's outstanding regular members. She joined the Society in October 1981. While her great interest was Geology, prior to joining the FGS her other continuing interests included the History of Art, Archaeology and Photography.

When Marybeth had completed her studies at the University of British Columbia (UBC), she came to England where she met and married her husband Brian. They set up a small pottery business near Guildford in Surrey. Sadly, Brian died in 1993.

My late wife Jill and I were already members of the FGS when Marybeth joined, and we were delighted to make her acquaintance on Field Trips with the Society. I believe the first was to Church Stretton in 1983, followed by others such as The Ardennes in France (1985), Southwest Scotland (1988), The Auvergne, France (1990) and so on.

A great treat for my wife and I was to accompany Marybeth to Vancouver, Canada where we were to join her brother Donald before hiring a 4-wheel drive car and camping equipment to tour The Rockies. We had a wonderful time during which we joined up with FGS Programme Secretary Janet Catchpole and her friends Maureen Robertson and Mary Andrews to go on a guided trip to see The Burgess Shales on 30 August 1993, while Jill and Donald did their separate things.

Mary, Maureen, Colin, ***Marybeth*** *and Janet at Walcott's Quarry in the Burgess Shale.*

That trip was written up in the Winter 1994 FGS Newsletter (*Ref. 1*), following a talk at the July 1994 FGS members meeting. With the help of the great leap in technology since then, an updated talk was given by Janet Catchpole and me at the July 2022 FGS members meeting and reported in the February 2023 FGS Newsletter (*Ref. 2*).

It was a great delight to visit the Hovenden's at Worplesdon and always fun to be with Marybeth, even on the shorter field trips, the geological weekend lectures, etc. She was always ready with the camera to take, usually, superb photos.

Latterly, while living in central Guildford, I was able to visit Marybeth and regularly get beaten by her at Scrabble, another one of her interests. During her years in Guildford, Marybeth was supported by her eldest daughter Susan and son-in-law Patrick, who oversaw her move back to Canada.

She returned in 2020 to live with her daughter Tanis and son-in-law David. At length Marybeth's health required her to move to a Nursing Home in Vancouver. She died there on 19 July 2024 following many months of illness.

She leaves behind daughters Susan (and Patrick), and Tanis (and David). Also survived by her brother, Donald and sister, Nancy, brother-in-law David, and four loving grandsons.

References:

https://www.farnhamgeosoc.org.uk/newsletters/1991_1995/v3n13win1994.pdf

https://www.farnhamgeosoc.org.uk/newsletters/2023_2028/v26n1feb2023.pdf

https://vancouversunandprovince.remembering.ca/obituary/marybeth-nee-burton-hovenden-1090248427/

Interesting Poem

I found this rather interesting poem in the Dorset Geologists' Association Newsletter (Aug. 2009).

Janet Catchpole

In The Beginning

by Ralph A. Lewin (1977)

In the beginning the earth was all wet;
We hadn't got life - or ecology - yet.
There were lava and rocks - quite a lot of them both -
And oceans of nutrient Oparin broth.
But then there arose, at the edge of the sea,
Where sugars and organic acids were free,
A sort of a blob in a kind of a coat -
The earliest protero-prokaryote.
It grew and divided: it flourished and fed;
From puddle to puddle it rapidly spread
Until it depleted the ocean's store
And nary an acid was found any more.

Now, if one considered that terrible trend,
One might have predicted that that was the end -
But no! In some sunny wee lochan or slough
Appeared a new creature - we cannot say how.

References:

https://dorsetgeologistsassociation.org/

https://en.wikipedia.org/wiki/Ralph_A._Lewin

By some strange transition that nobody knows,
A photosynthetical alga arose.
It grew and it flourished where nothing had been
Till much of the land was a blue shade of green
And bubbles of oxygen started to rise
Throughout the world's oceans, and filled up the skies;
While off in the antediluvian mists,
Arose a few species with heterocysts
Which, by a procedure which no-one can tell,
Fixed gaseous nitrogen into the cell.
As the gases turned on and the gases turned off,
There emerged a respiring young heterotroph.
It grew in its turn, and it lived, and it throve,
Creating fine structure, genetics, and love,
And, using its enzymes and oxygen-2,
Produced such fine creatures as coli and you.

This, then, is the story of life's evolution
From Oparin broth to the final solution.
So, prokaryologists, dinna forget:
We've come a long way since the world was all wet.
We owe a great deal - you can see from these notes -
To photosynthetical prokaryotes.

Ralph Arnold Lewin *(30 April 1921 – 30 November 2008) was an Anglo-American biologist, known as "the father of green algae genetics". He was born in London and later moved to America. He was also known as a poetry author.*

Education

He studied at University of Cambridge from 1939 to 1947, graduating with a B.A. in 1942 and MA in 1946; whilst at Cambridge he focussed on Botany. He then studied at Yale University from 1947 to 1951, graduating with an M.S. in 1949 and a PhD in Botany in 1950. In 1971 (or 1972), he was made a Doctor of Science (Sc.D.) of the University of Cambridge.

Biography

Lewin spent nearly 48 years at the Scripps Institution of Oceanography at the University of California at San Diego and was considered a leading authority in multiple areas of marine biology.

Interesting Places

London Fossils and Crystals

217 Waterloo Road, Waterloo, London, SE1 8XH

References:

https://www.london-fossils-crystals.co.uk/

https://southwarknews.co.uk/area/waterloo/truly-a-hidden-gem-of-a-shop-where-i-held-a-piece-of-the-solar-system-in-the-palm-of-my-hand/

Notes on a Volcano

I thought some members might enjoy reading this - the best notice I have read which outlines the typical movements within a major volcano.

Liz Aston

USGS Volcano Notice

24 July 2024

KILAUEA - SUMMARY OF ACTIVITY

An abrupt increase in seismicity accompanied by local deformation on July 22 at 11 a.m. HST (Hawaii Standard Time) marked the initial stage of magma intruding underground in the **Upper East Rift Zone** (UERZ) of **Kīlauea**. This activity is concentrated between Pauahi Crater and Maunaulu along Chain of Craters Road in **Hawai'i Volcanoes National Park**.

A stronger pulse of seismicity and local deformation began on July 23 at 3:30 a.m. HST and was coincident with deflation of Kīlauea summit. The summit has been steadily deflating since then as magma moves into the vertical, sheet-like body (dyke) beneath the UERZ near Pauahi Crater.

A third pulse of activity began today on July 24 at 10 a.m. HST as dyke emplacement continues. Each pulse lasted approximately 2–3 hours, but seismicity and deformation continued at levels well above normal between the pulses.

In total, there have been nearly **1,000 earthquakes** located in the UERZ of Kīlauea over the past 3 days; 250 of those earthquakes exceeded magnitude-2 and the largest event was a magnitude-3.6. Earthquakes have remained 1–3 km (0.6–1.8 miles) beneath the surface. As of 4:30 p.m. on July 24, the dyke continues to grow, and unrest may continue to wax and wane with changes to the input of magma into the area. An eruption is not currently imminent, but conditions could change rapidly.

Unrest has been restricted to UERZ; no unusual activity has been noted along Kīlauea's middle and lower East Rift Zones or the Southwest Rift Zone. The **USGS Hawaiian Volcano Observatory** (HVO) continues to closely monitor Kīlauea for changes.

INTERPRETATION

The rapid onset and concentrated intensity of the July 22–24 UERZ swarm, coupled with abrupt changes in UERZ ground deformation patterns, show that an intrusion of magma is occurring in the area of **Pauahi Crater**. Deformation associated with emplacement of this dyke is apparent on a satellite interferogram of the area, confirming ground-based observations. Ongoing seismicity, local deformation, and steady deflation of the summit region indicate that magma is continuing to move underground into the UERZ. The pulsing nature of this recent activity may represent fluctuations in the amount of magma moving underground from the summit to the UERZ.

WHAT WE CAN EXPECT

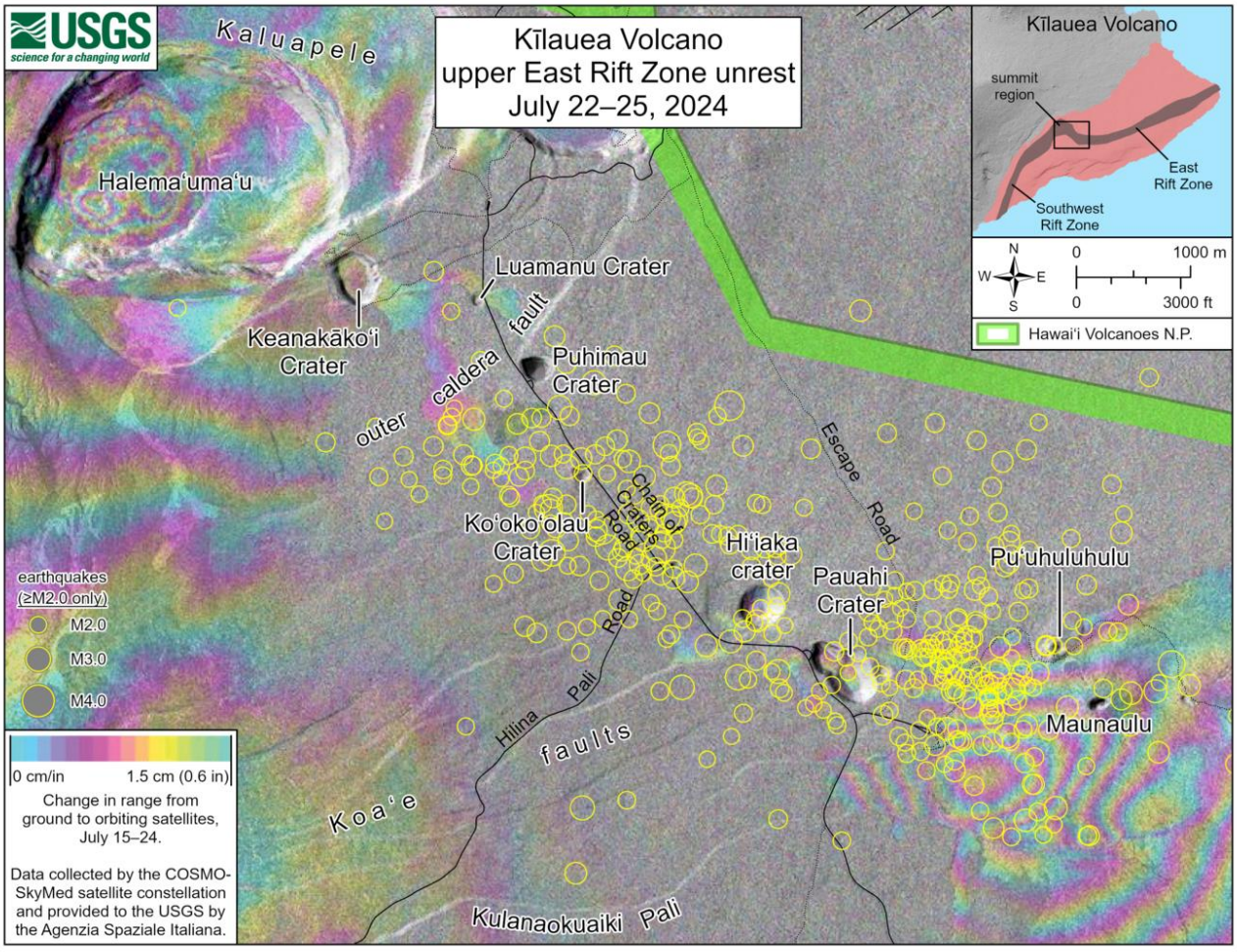
It is not possible to forecast an exact outcome of this activity. Future eruptions are possible with little warning along the upper portions of Kīlauea's East Rift Zone. Recent Kīlauea eruptions have occurred with as little as 1 hour or less of advanced warning in the form of accelerated rates of ground deformation and earthquakes.

Here are some possible scenarios that could play out in the coming days to weeks:

- **The intrusion grows:** Magma continues to accumulate below the surface near Pauahi Crater on Kīlauea's UERZ as an intrusion (similar to what occurred during the January/February 2024

intrusion southwest of Kaluapele). In this scenario, we would expect to see varying rates of ground deformation and earthquakes in the direction of the intrusion as it grows, along with summit deflation.

- **An UERZ eruption occurs:** Magma continues to accumulate below the surface near Pauahi Crater on Kīlauea's UERZ, resulting in an eventual UERZ eruption. In this scenario, we would expect to see accelerated rates of UERZ earthquakes along with increased rates of Kīlauea summit deflation and UERZ inflation before lava reaches the surface. Based on patterns of past UERZ eruptions, the area most likely for an outbreak would be located between Hi'iaka crater and Maunaulu.
- **The intrusion moves east:** Magma continues to accumulate below the surface near Pauahi Crater on Kīlauea's UERZ, eventually establishing a path to the east, in Kīlauea's middle East Rift Zone, as occurred during the Father's Day intrusion in 2007. In this scenario, we would expect to see earthquake locations migrating east of Maunaulu, followed by accelerating rates of summit and UERZ deflationary ground deformation.



This reference map depicts recent unrest along Kīlauea's upper East Rift Zone. Earthquakes that occurred between July 22–25, 2024, are shown as yellow circles. Recent ground deformation in this region, over the timeframe of July 15-24, 2024, is shown as coloured fringes; data were recorded by the Italian Space Agency's (ASI) Cosmo-SkyMED satellite. More fringes indicate more deformation, and each colour cycle represents 1.5 cm (0.6 in) of ground motion. The bullseye feature southeast of Pauahi Crater on the upper East Rift Zone indicates inflation over this time period due to magma accumulation underground. (Sources/Usage: Public Domain)

RECENT OBSERVATIONS

Kīlauea erupted most recently for about 8 hours on June 3, 2024, approximately 3 km (2 miles) southwest of Kaluapele (Kīlauea caldera) within Hawai'i Volcanoes National Park. Following that eruption, patterns of seismicity and ground deformation indicated that magma re-accumulated in the storage regions beneath the summit.

Earthquake activity in the UERZ began to increase in late June, distributed between Keanakāko'i and Pauahi craters, beneath Chain of Craters Road in Hawai'i Volcanoes National Park. A swarm of approximately 1,500 earthquakes occurred in this area between June 27 and July 1, 2024, but was not accompanied by significant changes in ground deformation in the UERZ or summit.

PREVIOUSLY RECORDED ACTIVITY IN THE UPPER EAST RIFT ZONE

Pit craters and lava flows in the UERZ are evidence of a long history of magma moving along this rift zone pathway. Intrusions of new magma into this region have been monitored numerous times in the past decades, with sparse eruptions. During the past 60 years, there have been approximately 50 intrusions and 5 eruptions in the UERZ region. The most recent UERZ eruption took place in November 1979. That was a brief one-day eruption that occurred in and near Pauahi Crater and was preceded by two months of increased earthquake activity along with inflation at the summit region. Several other UERZ eruptions took place in the late 1960s and early 1970s and lasted from one day to about a month. UERZ eruptions have typically occurred near the southeast margin of Kaluapele, or where the UERZ meets the middle East Rift Zone near Pauahi Crater.

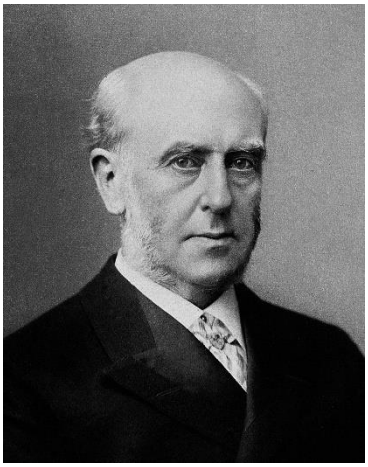
The most recent significant intrusion in this area took place in 2007. The "Father's Day" intrusion began on June 17, 2007, with an earthquake swarm centred southwest of Maunaulu. Over the next several hours, ground deformation rates accelerated and during the next two days, earthquakes propagated downrift towards Pu'u'ō'ō in the middle portion of Kīlauea's East Rift Zone. Cracks formed at multiple locations in the East Rift Zone, and steam vents formed along the western base and slope of Kāne Nui o Hamo. On the morning of June 19, HVO geologists observed a small amount of fresh lava on the north flank of Kāne Nui o Hamo, which had erupted overnight.

Reference:

https://www.usgs.gov/volcanoes/kilauea/science/

https://www.usgs.gov/maps/july-25-2024-kilauea-upper-east-rift-zone-unrest

Forthcoming Event



The Centennial Celebration of the Life and Works of Sir Archibald Geikie (1835-1924).

8 – 9 November 2024

Two-day weekend of events organised by **Haslemere Museum** (which holds his archive), includes talks on Geikie's geological work and achievements.

Details and booking at:

https://www.haslemeremuseum.co.uk/geikie/index.html

News

280-million-year-old swamp monster with 'big, flat toilet seat-shaped head' discovered in Namibia

By Jacklin Kwan, Live Science ***3 July 2024***

Giant salamander-like predator that lived 40 million years before the first dinosaurs had huge fangs and sucked up prey with its weird head.

Researchers in Namibia have discovered fossils from a huge, extinct swamp creature with a toilet seat-shaped skull.

Gaiasia jennyae existed around 280 million years ago — about 40 million years before the first dinosaurs evolved — and offers a glimpse into the early evolution of tetrapods, or four-limbed vertebrates.

Its skull was more than 2 feet (0.6 meters) long, and researchers estimate the entire animal could have been up to 8.2 feet (2.5 m) long, potentially making it the biggest creature of its kind, according to a statement.

Huge predator that lived in swampy lands of Gondwana 280 million years ago discovered in Namibia outcrop. (Image credit: C. Marsicano)

Researchers described the swamp creature in a study published on July 3rd in the journal ***Nature.***

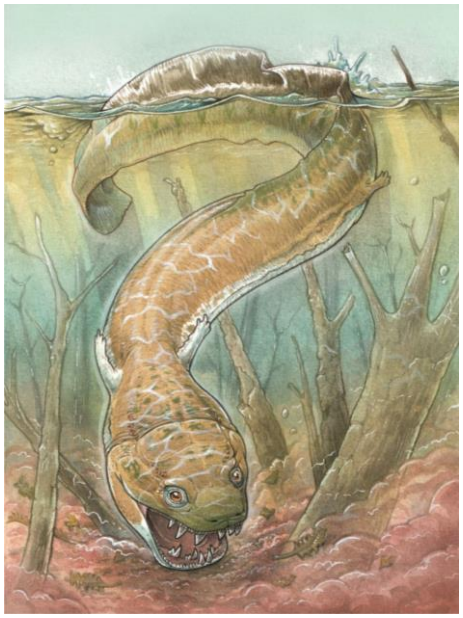
"*Gaiasia jennyae* was considerably larger than a person, and it probably hung out near the bottom of swamps and lakes," study co-lead author Jason Pardo, a researcher at the Field Museum in Chicago, said in a separate statement.

G. jennyae had interlocking jaws that enabled it to hunt for prey. The researchers believe it was likely the apex predator in its swampy ecosystem.

"It's got a big, flat, toilet seat-shaped head, which allows it to open its mouth and suck in prey," Pardo said. "It has these huge fangs, the whole front of the mouth is just giant teeth."

The researchers discovered the fossils in the Gai-As Formation in northwestern Namibia, which was the southern part of the supercontinent Gondwana when ***G. jennyae*** existed. The team discovered fossils from four individuals, including skull fragments and a vertebral column.

"When we found this enormous specimen just lying on the outcrop as a giant concretion, it was really shocking," study co-lead author Claudia Marsicano, a researcher at the University of Buenos Aires, said in the statement. "I knew just from seeing it that it was something completely different. We were all very excited."



Artist impression of G. jennyae, which lived in swamps on the supercontinent Gondwana. (Image credit: Gabriel Lio)

Around the time *G. jennyae* lived, modern-day Namibia was located further south, almost parallel to the northernmost point of Antarctica today, and an ice age was coming to an end.

While the land near the equator had begun drying up and new animals were evolving to fill niches, swamps closer to the poles remained, enabling animals to retain more primitive features.

G. jennyae is a **stem tetrapod** — an early vertebrate that exhibits intermediate characteristics between fish and the first true four-limbed tetrapods. Stem tetrapods still retained aquatic features like gills and had limbs that were not fully evolved for movement on land.

"It's really, really surprising that Gaiasia is so archaic," Pardo said. "It was related to organisms that went extinct probably 40 million years prior."

G. jennyae shows how animals that existed further south were radically different from those nearer to the equator, Pardo said in the statement. Its success during this critical geological period could shed light on how the world was changing to support different forms of life.

"The more we look, we might find more answers about these major animal groups that we care about, like the ancestors of mammals and modern reptiles," Pardo said.

Reference:

https://www.livescience.com/animals/extinct-species/280-million-year-old-swamp-monster-with-big-flat-toilet-seat-shaped-head-discovered-in-namibia?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=368B3745-DDE0-4A69-A2E8-62503D85375D&utm_medium=email&utm_content=E0F62623-31F2-4DC4-9FF9-632EAB60BCA7&utm_source=SmartBrief

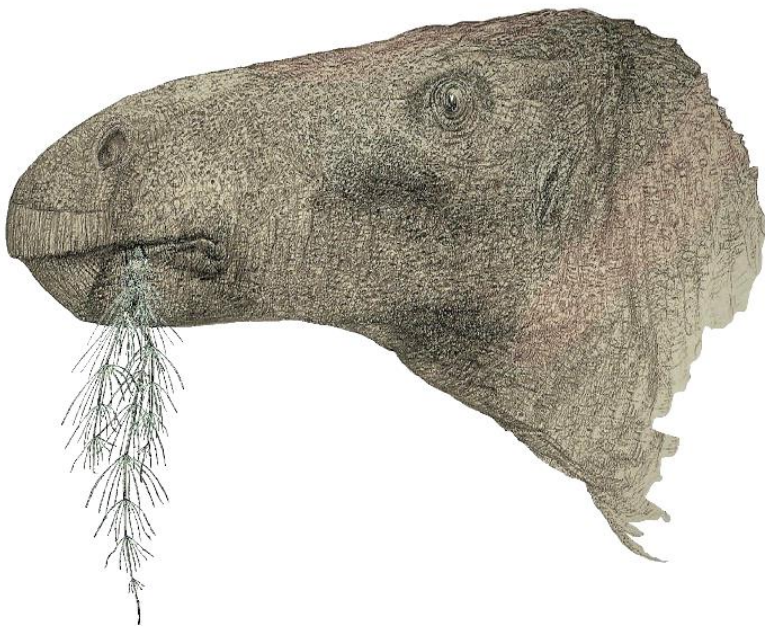
The most-complete UK dinosaur in a century has been found on the Isle of Wight

James Ashworth, NHM

10 July 2024

One of the best-preserved dinosaurs ever found in the UK has been unearthed on the Isle of Wight. Named *Comptonatus chasei*, the new species cements the island's reputation as one of the world's most important places to study dinosaurs. The newest member of the **Iguanodon family** is offering new insights into the UK's ancient past.

Found in the **cliffs of Compton Bay on the Isle of Wight**, *Comptonatus chasei* would have been part of a thriving ecosystem more than 120 million years ago. It's the latest in a flurry of new dinosaurs named from the island, revealing that the area's past was much more diverse than first suspected.



The completeness of Comptonatus' skull helped to distinguish it from its relatives. © John Sibbick.

One of the driving forces behind the island's dinosaur "renaissance" is Dr. Jeremy Lockwood, a researcher at the Natural History Museum and the University of Portsmouth. He is the lead author of the new paper describing *Comptonatus chasei* published in the **Journal of Systematic Palaeontology**.

"The description of *Comptonatus* represents the culmination of years of work," Jeremy says. "Almost 150 bones have been unearthed, making it almost certainly the most complete new dinosaur found in Britain for 100 years."

The completeness of Comptonatus could help to figure out how the iguanodontians evolved as more fossils are discovered. © Jeremy Lockwood.

"It leaves me with a mixture of excitement at having been able to deal with such a rare specimen and also a sense of relief. It's also a great pleasure to name this species after the fossil hunter Nick Chase, who had a phenomenal ability to find dinosaurs."

The life of *Comptonatus chasei*

Back in the Early Cretaceous, ***Comptonatus chasei*** would have been an unmistakable presence on the Isle of Wight. Weighing around 900 kilogrammes, or about the same as an American bison, it's likely these dinosaurs would have roamed in herds.

This behaviour is one of the reasons the *Iguanodon* family, or iguanodontians, are sometimes called 'the cattle of the Cretaceous'. Fossils from a variety of species suggest these herbivores would have stuck together as a defence against carnivores.

These could have included ambush predators like *Vectiraptor*, which may have been large enough to take on young *Comptonatus*. Larger dinosaurs like *Riparovenator milnerae* and *Ceratosuchops inferodios* may also have been a threat.

Analysis of *Comptonatus* suggests that it was about six years old and almost fully grown at the time of its death. Its body ended up lying on the ground of an ancient floodplain, which used to cover much of what is now the Isle of Wight.

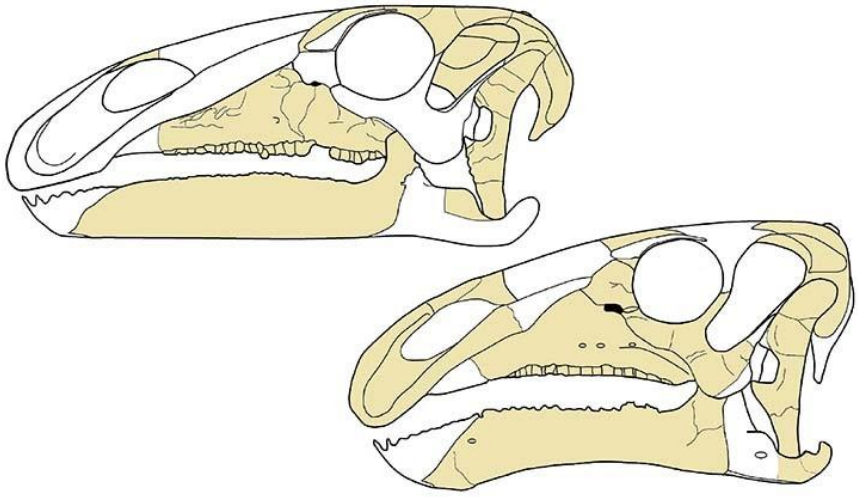
When rain rushed down steep hills to the north, it would have swept up the bones along with plants, rocks and other debris. These were rapidly buried, helping to explain why *Comptonatus* is so well-preserved.

Over time, what was once a flood plain eventually became part of a cliff, where the dinosaur would remain buried for over 120 million years.

How was *Comptonatus chasei* found?

After millions of years of erosion, *Comptonatus* finally came to light in 2013 when it was spotted by Nick Chase. Jeremy was among the team called out to excavate the dinosaur and take its bones to the **Dinosaur Isle Museum**.

"When we were digging this dinosaur out of the cliff, it was thought to be a specimen *of Mantellisaurus atherfieldensis*," Jeremy recalls. "This isn't unusual, as most iguanodontians found on the island have historically been assumed to represent either *Mantellisaurus* or *Iguanodon*. However, I thought this specimen showed some differences. This spurred me on to undertake a PhD looking at the variation in the iguanodontian dinosaurs of the Isle of Wight."



The skull of Comptonatus (left) has subtle differences from those of its relatives, the Mantellisaurus (bottom right). © Lockwood et al.

Jeremy couldn't have picked a better time to do so. Recent discoveries in Spain and the USA have revealed that the dinosaurs of the Early Cretaceous were more diverse than previously thought, suggesting the Isle of Wight might be as well.

As the bodies of the *Iguanodon* family are all quite similar, their heads are the best way to tell them apart. Unfortunately, the skull bones of these dinosaurs are fragile, and often damaged or destroyed before being discovered. This makes it hard for palaeontologists to know whether something is a new species.

However, by poring over the collections of the Dinosaur Isle Museum and Natural History Museum, Jeremy has found fossils which have previously been overlooked. In 2021, Jeremy identified a new iguanodontian from the Isle of Wight, called *Brighstoneus simmondsi*, based on a large, bulbous nose that set it apart from its relatives.

While the differences in *Comptonatus* aren't quite so obvious, its completeness means there are more characteristics to distinguish it. Its teeth have grooves extending across their tops, for instance, while its shoulders have a different structure to its relatives.

Together, these convinced the scientists that the dinosaur should be a species in its own right. This now means three similarly sized iguanodontians lived on the Isle of Wight in the Early Cretaceous, separated from each other by a few million years.

Unfortunately, the generally poor preservation of the iguanodontians means there's not currently enough evidence to know exactly how these different species evolved, or how they were related. Finding more species and better preserved fossils could help to solve this mystery once and for all.

"Recent discoveries suggest that we have been overlooking the fact that the iguanodontians were relatively diverse," Jeremy explains. "However, it's unclear whether this is because they evolved faster than previously thought, or that many species existed side by side. This is the next big question we need to try and answer to understand these dinosaurs."

Reference:

https://www.nhm.ac.uk/discover/news/2024/july/most-complete-uk-dinosaur-century-found-isle-of-wight.html

UK set on leaving fossil fuels behind and turning into clean energy superpower

Melisa Čavčić, Offshore Energy ***17 July 2024***

With climate change breathing down the world's neck alongside the cost-of-living crisis and energy security concerns, the United Kingdom (UK) is determined to accelerate its energy transformation, moving away from coal, oil, and gas to turbocharge its clean, green energy mission before the end of the decade.

Following the UK general election, which took place on July 4, 2024, leading to the Labour Party's landslide victory, the opening of Parliament and the King's Speech occurred on July 17, setting out the program of legislation that the new government will pursue in the forthcoming parliamentary session focused on bolstering the economy and improving the living standards of working people.

"Securing economic growth will be a fundamental mission. My Government will seek a new partnership with both business and working people and help the country move on from the recent cost of living challenges by prioritising wealth creation for all communities. My Ministers will establish an **Industrial Strategy Council**. It is my Government's objective to see rising living standards in all nations and regions in the United Kingdom," highlighted King Charles III, Britain's sovereign since the death of his mother Queen Elizabeth II.

The package of more than 35 bills and draft bills is bent on growing the economy by speeding up the building of houses and infrastructure, improving transport, creating more jobs, and securing clean, green energy **to make Britain a clean energy superpower by 2030**. One of these bills is expected to assist in setting up **Great British Energy**, a publicly owned clean-power company focused on boosting energy security, creating jobs, and building supply chains across the UK. In addition, the new government plans to introduce legislation to help unlock investment in energy infrastructure, support sustainable aviation fuel production, and bolster the water regulator's powers.

King Charles III further emphasized: "My Government recognises the urgency of the global climate challenge and the new job opportunities that can come from leading the development of the technologies of the future. It is committed to a clean energy transition which will lower energy bills for consumers over time. A Bill will be introduced to set up Great British Energy, a publicly owned clean power company headquartered in Scotland, which will help accelerate investment in renewable energy such as offshore wind [Great British Energy Bill]. Legislation will be brought forward to help the country achieve energy independence and unlock investment in energy infrastructure. A Bill will be introduced to support sustainable aviation fuel production [Sustainable Aviation Fuel (Revenue

According to **Ed Miliband**, Energy Security and Net Zero Secretary, the Labour government's mission to make Britain a clean energy superpower is about investing in Britain, with National Wealth Fund expected to help create thousands of clean energy industry jobs to fortify the country's energy independence and mitigate climate change.

Paul Thwaite, CEO of NatWest Group, outlined: "The UK has led the way globally in reducing its carbon emissions in recent decades, but the next stage of the transition will require significant public and private investment. This is a major challenge and collaboration across not just the financing but also policy space is critical to deliver it in a way that supports economic growth across the UK.

"The National Wealth Fund has the potential to accelerate the transition and address some of the fundamental barriers that have existed to date. As the UK's leading bank for business, we will continue to support the government in the development of the National Wealth Fund, and ensure it delivers on its objectives to drive the green economy whilst also supporting communities, businesses and industry across the regions and nations of the UK."

In her first speech as Chancellor, **Rachel Reeves** pledged to build growth forged through a new partnership with the private sector and asked the Secretaries of State for Transport and Energy Security and Net Zero to prioritize taking decisions on critical infrastructure projects that are with them

now. To this end, the government is expected to review how it can unlock infrastructure without weakening environmental protections.

Miliband underlined the plans to make Britain a clean energy superpower with zero carbon electricity by 2030 and speed up its journey to net zero by saying: “Families and businesses across the country are still struggling with energy bills that are too high and are expected to rise again in the autumn. In an unstable world, the only way to guarantee our energy security and cut bills permanently is to speed up the transition away from fossil fuels and towards homegrown clean energy. The job of our department will be to deliver our mission so we can make the UK energy independent, bring down energy bills for good, create good jobs, and tackle the climate crisis.”

In response to the King’s Speech, the **Association for Decentralised Energy (ADE)** welcomed Labour’s drive to deliver a mass acceleration of renewable energy across the UK through GB Energy, pointing out that the time has come to push further in decarbonizing Britain’s heat and energy systems to provide a secure future.

Sarah Honan, Head of Policy at the ADE, noted: “The King’s speech has set the tone for the pace at which Labour intend to roll out policies in their first 100 days, and the decentralised energy sector is ready to take the brakes off with them. The mass acceleration of renewables is only possible if a smart and flexible optimised system is prioritised. Unlocking the potential of a demand-led system is the only way the UK can achieve true energy independence and security. Now is the time to use investment – through initiatives such as the National Wealth Fund – to deliver the green industrial revolution. This will ensure a prosperous future is secured for Britain, all whilst meeting legally binding net zero targets.”

Reference:

https://www.offshore-energy.biz/uk-set-on-leaving-fossil-fuels-behind-and-turning-into-clean-energy-superpower/?utm_source=offshore-energy&utm_medium=email&utm_campaign=newsletter_2024-07-18

Rare fossils reveal secrets of mammal evolution

Helen Briggs, BBC environment correspondent ***24 July 2024***

Two incredibly rare fossils found on Scotland's Isle of Skye are rewriting our understanding of how mammals evolved.

While modern small mammals live as little as a year, one of the first to roam the earth, alongside dinosaurs, could reach seven years and beyond, scientists have discovered.

Only a handful of fossils of the primitive shrew-like mammal, **Krusatodon**, have ever been found, including two exceptionally complete skeletons of a juvenile and an adult from Skye.

By studying fossils of the earliest mammals, scientists hope to unlock the secrets of how they rose to become super successful animals occupying every habitat on the planet.

The researchers used hi-tech X-ray imaging to peer through rock and study growth patterns in the teeth of the two fossils, much like counting tree rings.

“The juvenile was weaning – replacing its teeth – and yet it was as much as two years of age, Dr. Elsa Panciroli, Associate Researcher of Palaeobiology at National Museums Scotland told BBC News. "This is unusual and tells us a lot about how mammals' evolution took place.”

Small mammals living today have much shorter lifespans, some surviving for as little as 12 months, and maturing quickly, losing their baby teeth and weaning within months of birth.

The creature, *Krusatodon kirtlingtonesis*, lived around 166 million years ago when Skye was a sub-tropical paradise with warm shallow seas and dense forests.

In this Jurassic period, the first mammals were gaining a foothold in the shadow of the dinosaurs. Tiny, primitive and sometimes quite strange, they were the precursors of the thousands of different mammals living today, from cats to humans to whales.

Fossil treasure trove

Dr. Panciroli said Skye's fossils are putting Scotland firmly on the map when it comes to understanding mammal evolution and "this is just the tip of the iceberg in terms of what they can tell us".

The Krusatodon fossil discovered on Skye in 2016 is the only juvenile Jurassic mammal skeleton known to science, while the adult, found in the 1970s, is one of the most intact mammal skeletons from this time period in the world.

"To find two such rare fossil skeletons of the same species at different growth stages has rewritten our understanding of the lives of the very earliest mammals," said Dr. Stig Walsh, Senior Curator of Vertebrate Palaeobiology at National Museums Scotland and co-researcher on the study.

The delicate bones of the Skye fossils are still encased in rock. (Credit: Duncan McGlynn)

The study, published in **Nature**, also involved researchers from the American Museum of Natural History, University of Chicago, European Synchrotron Radiation Facility, and Queen Mary University of London.

Reference:

https://www.bbc.co.uk/news/articles/c0xj65nelv0o

Oxygen discovery defies knowledge of the deep ocean

Victoria Gill, Science correspondent, BBC News ***22 July 2024***

Scientists have discovered **"dark oxygen"** being produced in the deep ocean, apparently by lumps of metal on the seafloor. About half the oxygen we breathe comes from the ocean. But, before this discovery, it was understood that it was made by marine plants photosynthesising - something that requires sunlight. Here, at depths of 5km, where no sunlight can penetrate, the oxygen appears to be produced by naturally occurring metallic "nodules" which split seawater - H2O - into hydrogen and oxygen.

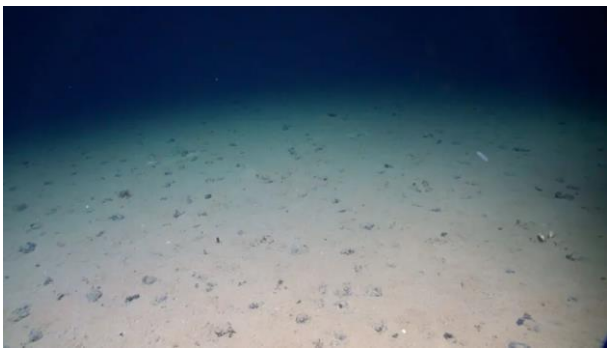
Several mining companies have plans to collect these nodules, which marine scientists fear could disrupt the newly discovered process - and damage any marine life that depends on the oxygen they make.

"I first saw this in 2013 - an enormous amount of oxygen being produced at the seafloor in complete darkness," explains lead researcher Prof. Andrew Sweetman from the **Scottish Association for Marine Science**. "I just ignored it, because I'd been taught - you only get oxygen through photosynthesis. Eventually, I realised that for years I'd been ignoring this potentially huge discovery," he told BBC News.

He and his colleagues carried out their research in an area of the deep sea between Hawaii and Mexico - part of a vast swathe of seafloor that is covered with these metal nodules. The nodules form when dissolved metals in seawater collect on fragments of shell - or other debris. It's a process that takes millions of years.

And because these nodules contain metals like lithium, cobalt and copper - all of which are needed to make batteries - many mining companies are developing technology to collect them and bring them to the surface.

But Prof. Sweetman says the dark oxygen they make could also support life on the seafloor. And his discovery, published in the journal **Nature Geoscience**, raises new concerns about the risks of proposed deep-sea mining ventures.



The potato-sized metal nodules look like rocks, littering parts of the deep seabed. (Image source, NOC/NHM/NERC SMARTEX)

The scientists worked out that the metal nodules are able to make oxygen precisely because they act like batteries. “If you put a battery into seawater, it starts fizzing,” explained Prof Sweetman. “That’s because the electric current is actually splitting seawater into oxygen and hydrogen [which are the bubbles]. We think that’s happening with these nodules in their natural state.”

“It's like a battery in a torch,” he added. “You put one battery in, it doesn't light up. You put two in, and you've got enough voltage to light up the torch. So, when the nodules are sitting at the seafloor in contact with one another, they’re working in unison - like multiple batteries.”

The researchers put this theory to the test in the lab, collecting and studying the potato-sized metal nodules. Their experiments measured the voltages on the surface of each metallic lump - essentially the strength of the electric current. They found it to be almost equal to the voltage in a typical AA-sized battery. This means, they say, that the nodules sitting on the seabed could generate electric currents large enough to split, or electrolyse, molecules of seawater.

The researchers think the same process - battery-powered oxygen production that requires no light and no biological process - could be happening on other moons and planets, creating oxygen-rich environments where life could thrive.

The **Clarion-Clipperton Zone**, where the discovery was made, is a site already being explored by a number of seabed mining companies, which are developing technology to collect the nodules and bring them to a ship at the surface.

The US National Oceanic and Atmospheric Administration (NOAA) has warned that this seabed mining could “result in the destruction of life and the seabed habitat in the mined areas”.

More than 800 marine scientists from 44 countries have signed a petition highlighting the environmental risks and calling for a pause on mining activity.

New species are being discovered in the deep ocean all the time - it is often said that we know more about the surface of the Moon than we do about the deep sea. And this discovery suggests that the nodules themselves could be providing the oxygen to support life there.

Prof. Murray Roberts, a marine biologist from the University of Edinburgh is one of the scientists who signed the seabed mining petition. “There’s already overwhelming evidence that strip mining deep-sea nodule fields will destroy ecosystems we barely understand,” he told BBC News. “Because these fields cover such huge areas of our planet it would be crazy to press ahead with deep-sea mining knowing they may be a significant source of oxygen production.”

Prof. Sweetman added: “I don't see this study as something that will put an end to mining. [But] we need to explore it in greater detail, and we need to use this information and the data we gather in future if we are going to go into the deep ocean and mine it in the most environmentally friendly way possible.”

Reference:

https://www.bbc.co.uk/news/articles/c728ven2v9eo

NASA's Perseverance Mars rover finds possible signs of ancient Red Planet life

By Sharmila Kuthunur, Space.com **25 July 2024**

"On Earth, these types of features in rocks are often associated with the fossilized record of microbes living in the subsurface."

NASA's Perseverance rover has discovered a rock on Mars that may have once hosted microbial life. The rock, nicknamed Cheyava Falls, has chemical compositions and structures that could have been formed by ancient life, although non-biological processes cannot yet be ruled out. (Image credit: NASA/JPL-Caltech/MSSS)

NASA's Perseverance rover may have found **signs of ancient life** in a rock on Mars; the mission team's scientists are ecstatic but remain cautious as further analysis is needed to confirm the discovery.

The rover has come across an intriguing, arrowhead-shaped rock that hosts chemical signatures and structures that could have been formed by microbial life billions of years ago, when Mars was significantly wetter than it is today. Inside the rock, which scientists have nicknamed "**Cheyava Falls**," Perseverance's instruments detected organic compounds, which are precursors to the chemistry of life as we know it. Wisping through the length of the rock are veins of calcium sulfate, which are mineral deposits that suggest water — also essential for life — once ran through the rock.

The rover also found dozens of millimetre-sized splotches, each surrounded by a black ring and mimicking the appearance of leopard spots. These rings contain iron and phosphate, which are also seen on Earth as a result of microbe-led chemical reactions.

"These spots are a big surprise," David Flannery, an astrobiologist and member of the Perseverance science team from the Queensland University of Technology in Australia, said in a statement. "On Earth, these types of features in rocks are often associated with the fossilized record of microbes living in the subsurface."

"We've never seen these three things together on Mars before," Morgan Cable, a scientist on the Perseverance team, said in a video NASA posted to YouTube today (July 25).

Cheyava Falls sits at the edge of an ancient, 400-meter-wide (437-yard-wide) river valley named **Neretva Vallis**. Scientists suspect this ancient channel was carved out long ago due to water gushing into Jezero Crater; Neretva Vallis runs along the inner wall of this region. In one possible scenario, mud that already possessed organic compounds got dumped into the valley and later cemented into the Cheyava Falls rock, which Perseverance sampled on July 21. A second episode of water oozing into the formed rock would have created the object's calcium sulfate veins and black-ringed spots the team sees today.

To be clear, the rock's visible features aren't irrefutable evidence of ancient microbial life on Mars — not yet at least. It is possible, for instance, that the observed calcium sulfate entered the rock at uninhabitably high temperatures, perhaps during a nearby volcanic event. However, whether such non-biological chemical reactions could have resulted in the observed black-ringed spots is an open question, the scientists say.

"This trip through the Neretva Vallis riverbed paid off as we found something we've never seen before, which will give our scientists so much to study," Nicola Fox, the associate administrator of NASA's Science Mission Directorate, said in the statement. "We have zapped that rock with lasers and X-rays and imaged it literally day and night from just about every angle imaginable," Ken Farley, Perseverance project scientist of Caltech in California, said in the statement. "Scientifically, Perseverance has nothing more to give."

To fully grasp what really unfolded in the ancient river valley billions of years ago, scientists are keen to get the Cheyava Falls sample to Earth, where it can be scrutinized with powerful instruments that Perseverance's limited suite doesn't have.

The complex **Mars Sample Return** effort, however, has run into many snags in recent months after its costs spiked to $11 billion. In its current form, the program requires multiple launches to Mars to place a vehicle on the Red Planet, after which either Perseverance will travel to the vehicle and drop off its collected samples or pop those samples over to a retrieval helicopter that can complete the handoff. Then, an ascender would launch the samples into orbit, where a spacecraft would collect them and return them to Earth.

NASA assessed various simpler alternatives from industry and academic groups and awarded $1.5 million contracts to seven companies looking into the endeavour; three of the agency's own research centres are carrying out studies as well.

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ka	**(kilo-annum) =**	**thousand years**	**One thousand seconds =**	**16.67 minutes**
Ma	**(mega-annum) =**	**million years**	**One million seconds =**	**11.57 days**
Ga	**(giga-annum) =**	**billion years**	**One billion seconds =**	**31.71 years**
			One trillion seconds =	**31,709.79 years**

South London Press **26 July 2024**

The famous dinosaur statues, as seen in Crystal Palace Park Picture: Joe Coughlan

Dinosaurs to be upgraded with park improvements

Plans to renovate Crystal Palace Park in a £24million project have moved forward including updates to the park's famous dinosaur statues and a new themed play area for children.

Bromley council has approved plans to increase the budget on the scheme by nearly £20million, with the details of the project for the historic park set to be approved by the authority next week.

The project will reportedly cost £24million and include updates to the Grade I listed dinosaur statues and their setting, the Tidal Lakes. A new dinosaur themed play area is also planned, alongside a revised information centre and improvements to the Penge Gate.

Work is also planned to restore the walls of the Grade II listed Italian Terraces, as well as improvements to the drainage to prevent further water damage and allow the possibility for events to be held at the space. Repair works are planned for the bust of Sir Joseph Paxton, the designer of the original Crystal Palace.

Bromley council agreed at a meeting on July 15, to increase the budget for the regeneration programme by over £19million. The additional funding comes from a National Lottery Heritage Fund grant and the sale of two areas of council-owned parkland.

Councillor Ruth McGregor, representing the Crystal Palace and Anerley ward, said she and her fellow ward councillor Ryan Thomson were very supportive of the scheme. Conservative Councillor Colin Smith, leader of the council, responded by saying the project represented the end of a 'very long road'.

Cllr Smith said at the meeting: "Unfortunately the park, being right up there on the north end of the borough where five boroughs meet, just has never had the amount of money many of us would like to have seen it have.

"We're very pleased for yourself, your neighbourhood and indeed the nearby boroughs as well, many of whom will now hopefully see it as the regional treasure it has always been."

Crystal Palace Park is reportedly visited by 1.4million people per year. T

he Crystal Palace Park Trust took on a lease to manage the park in September 2023 as part of the regeneration scheme. The listed building consent applications for the works on the park will be discussed at a Bromley council meeting on July 25.

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'Spectacular and definitely hazardous': Yellowstone geyser erupts, firing steam and debris over nearby tourists

By Sascha Pare, Live Science ***24 July 2024***

A hydrothermal eruption Tuesday (July 23) morning surprised visitors walking among the colourful hot springs in Yellowstone National Park's Biscuit Basin, near the famous Old Faithful geyser.

A surprise hydrothermal eruption at Yellowstone National Park coughed up huge clouds of steam and dust on Tuesday (July 23), according to the National Park Service (NPS), prompting visitors to flee and staff to close the area.

Yellowstone National Park staff assess the damage to Biscuit Basin boardwalks after a hydrothermal explosion on Tuesday (July 23). (Image credit: National Park Service)

Videos posted online show dozens of people along a boardwalk running away from a 100-foot-tall (30 meters) plume of debris in **Yellowstone's Biscuit Basin**, located just north of the Old Faithful geyser. Biscuit Basin is known for its collection of colourful geysers and thermal pools, including Sapphire Pool, which is close to the eruption site.

No one was injured by the eruption, which took place at 10:19 a.m. Mountain Time (12:19 p.m. EDT), but the nearby boardwalk "will need a few repairs," representatives of the U.S. Geological Survey (USGS) wrote in a post on the social platform X. Pictures taken after the eruption showed rocky debris and silt strewn across the boards and guardrails.

"What we saw today was spectacular and definitely hazardous," Michael Poland, a research physicist and scientist-in-charge of the Yellowstone Volcano Observatory, told the Associated Press. The eruption, which was "relatively small" compared with past eruptions in Yellowstone, was nevertheless "a very good reminder of an underappreciated hazard," Poland said.

Clogs in the natural plumbing system underlying Yellowstone may have triggered the eruption, Poland said. Blockages may have fuelled a buildup of heat and pressure in a passageway beneath Biscuit Basin, which in turn may have flashed water into steam, causing a sudden expansion in volume that sparked an explosion, he said.

"We saw more steam coming up and within seconds it became this huge thing," Vlada March, a real estate agent from California who was visiting Yellowstone with her family at the time, told the AP. "It just exploded and became like a black cloud that covered the sun."

The eruption doesn't mean volcanic activity beneath Yellowstone is ramping up, according to the NPS. "Today's explosion does not reflect a change in the volcanic system, which remains at normal background levels of activity," representatives wrote.

The explosion is small compared with past hydrothermal events at Yellowstone, including a series of eruptions 13,800 years ago in the Mary Bay area on the northeastern side of Yellowstone Lake. Those eruptions blew out a crater measuring 1.5 miles (2.4 kilometres) across — the largest known from a hydrothermal explosion on Earth, Poland said.

Yellowstone staff and USGS geologists are monitoring the area and will reopen it to visitors once it is safe to do so, according to the NPS.

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Heavy rains in Brazil unearth what could be world's oldest dinosaur fossil

Findings could reveal origin of all dinosaurs, scientists say

Vishwam Sankaran, The Independent ***6 August 2024***

Torrential rains in Brazil have eroded parts of a fossil site, revealing what scientists think could be the world's oldest known dinosaur skeletons. The "almost fully preserved" dinosaur fossil, discovered next to a reservoir in Brazil's southernmost state of Rio Grande do Sul, could be **around 233 million years old**, researchers say. They suspect the fossil creature lived during the **Triassic Period**, when all of the Earth's continents were a single landmass called Pangaea, and dinosaurs had just emerged.

Researchers suspect the unearthed fossil belongs to a member of the ***Herrerasauridae*** family of carnivorous dinosaurs that grew to about 2.5m in length. These two-legged dinosaurs are known to have wandered across vast sections of present-day Brazil and Argentina.

"It's among the oldest in the world," Rodrigo Müller from the **Federal University of Santa Maria** told local news agency Agência Brasil. "Initially it seemed like just a few isolated bones, but as we exposed the material, we were able to see that we had an almost complete skeleton," Dr Müller told the Associated Press.

Currently, **the oldest dinosaur specimen** conclusively known to humans is a collection of fossils from different species dated to **about 231 million years ago**.

There are also more disputed fossils that date back as far as 240 million years.

If the yet-to-be peer-reviewed findings are found to be true, they could shed more light on the origin of dinosaurs, scientists say.

Picture released by the Federal University of Santa Maria (UFSM) on 18 July 2024, showing palaeontologist working on a dinosaur fossil discovered in Sao Joao do Polesine, Rio Grande do Sul, Brazil. (Credit: Federal University of Santa Mar)

The 'dinosaur age' is known to have begun in the 50-million-year Triassic Period following the Permian extinction event when about 90 per cent of the planet's species perished.

"It's already important because of the role it's likely to play in helping us understand the origin of the dinosaurs," Dr. Müller said.

However, the region where the fossil site is located in Southern Brazil is subject to increasingly devastating torrential rains each year. In June, the state received three months of rain within just two weeks causing floods that killed nearly 200 people, according to Brazil's civil defence.

Researchers are in a race against time to unearth remaining fossils in the region before further rains destroy them as they found that a "leg bone and a pelvis bone" were already destroyed by the floods.

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(see also Further Reading "One of world's oldest dinosaur fossils revealed by heavy rains in Brazil" on page 48)

Sapphires form inside the fiery hearts of volcanoes, not deep in the mantle like we thought

By Stephanie Pappas, Live Science ***6 August 2024***

A new study of sapphires found in volcanic fields in Germany reveals that these beautiful blue stones form where magma and rocks from Earth's crust mix.

Brilliant-blue sapphires look like bits of sky brought down to Earth — but a new study finds these gemstones are from a different boundary: the one between the planet's crust and magma welling up from the mantle, Earth's middle layer.

Sapphires have been thought to form in the mantle itself or in the lower sections of the crust, study senior author Axel Schmitt, a geologist at Curtin University in Australia who conducted the work while

at Heidelberg University in Germany, told **Live Science**. But the new research finds that, instead, sapphires are born higher in the crust, in the hearts of volcanoes where magma rises to only about 3 miles (5 kilometres) below the surface.

"We can pinpoint this region as the 'crucible' where sapphire formed" Schmitt said.

Gem-quality sapphires typically come from placer deposits, which are river sediments that wash minerals out of their original source rock. Without those source rocks, it's tough to get information on how the gems formed. Schmitt and his colleagues turned to the Eifel Formation in western Germany, which was created by volcanoes over a long period stretching from the Cretaceous period (145 million to 65 million years ago) to the most recent eruption 13,000 years ago.

A sapphire from sediment in the Kyll, a river in the western Eifel. The crystal measures approx. 0.9 mm in diameter.
(Image credit: © Sebastian Schmidt)

"The Eifel volcanic field shares many similarities with basaltic volcanic fields that are often identified as the sources for sapphire placer deposits," Schmitt said. "However, it is much younger," making it a promising place to investigate the chemistry and age of sapphires found there.

Sapphires are made of the mineral corundum, which is made mostly of pure aluminium and oxygen. But the stones also contain imperfections called inclusions, which are incorporated into the gem when it forms. Using ratios of radioactive uranium and lead in these inclusions, the researchers determined the ages of the sapphires. The team also looked at different versions of oxygen in the sapphires, which reveal where the chemical building blocks of the sapphires came from. They studied 223 tiny sapphire grains, which were not gem-quality.

Together, these trace elements revealed that the sapphires formed less than 2.5 million years ago, meaning they formed in the tail end of the volcanic activity that formed the Eifel field. Their oxygen molecules were similar to those found in magmas brought to the surface, Schmitt said. This meant the sapphires formed at the boundary between surface rock — the crust — and magma.

"The likely environment for this is the edge of a subsurface magma intrusion, where the surrounding rocks are heated, melted and intermingled in contact with magma," Schmitt said.

Because the researchers knew the depth of the magma in the Eifel field, they were able to pin down this formation depth to between 3.1 and 4.3 miles (5 and 7 km). Schmitt's next goal is to find mineral "fingerprints" that will help determine the origins of sapphires as a way to trace gemstone supply chains and ensure ethical business practices, particularly because many sapphires are mined in developing countries where environmental regulation and human rights protections are not always stringent.

While sapphires have not been known to fuel and fund conflict in the same way as "blood diamonds," there have been occasional allegations of human right abuses by gemstone mining companies.

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New hope of finding life on Mars after indication of water, scientists say

Liquid amounting to a 1-2km-deep ocean may be frozen up to 20km below surface, calculations suggest

Nicola Davis, Guardian Science correspondent ***12 August 2024***

Vast amounts of water could be trapped deep within the crust of Mars, scientists have said, raising fresh questions about the possibility of life on the red planet. Scientists say that more than 3 Ga ago, Mars not only had lakes and rivers but oceans on its surface – however, as the planet lost its atmosphere these bodies disappeared. All that is visible today is permafrost ice at the planet's poles.

While it is thought some of the water was lost to space, research has suggested that is not the full story, and that water could have been incorporated into minerals, buried as ice, or even exist in liquid form deep within the planet's crust.

Now scientists say their calculations suggest vast quantities of liquid water are to be found trapped within rocks about 11.5 – 20.0km below the Martian surface.

"Our liquid water estimate is more than the water volumes proposed to have filled possible ancient Martian oceans," said Dr. Vashan Wright, a co-author of the study from Scripps Institution of Oceanography at the University of California San Diego.

Writing in the **Proceedings of the National Academy of Sciences**, Wright and colleagues report how they made calculations based on gravity data for Mars and measurements recorded by Nasa's **InSight** lander. The latter reveal how the speed of seismic waves – created by Mars quakes and meteorite impacts – change with depth inside the crust of the red planet.

"A mid-crust whose rocks are cracked and filled with liquid water best explains both seismic and gravity data," Wright said.

Wright added that if the measurements at the Insight lander location were representative of the whole planet, the amount of water trapped in the rock fractures would fill a 1-2km-deep ocean on Mars.

"On Earth, groundwater underground infiltrated from the surface, and we expect this process to have occurred on Mars" he said. "The infiltration must have happened during a time when the upper crust was warmer than it is today."

While the results do not rule out the possibility that water has also been lost to space or trapped in minerals, Wright said the work allowed scientists to re-assess the relative contributions of these different mechanisms to the loss of past Martian surface water.

The study also raises a tantalising possibility. "The presence of water does not signify that there is life, but water is thought to be an important ingredient for life" said Wright. "We know that life can exist in the deep subsurface of the Earth, where there is water. The mid-crust of Mars at least contains a key ingredient for habitability and life as we know it."

Bethany Ehlmann, a professor of planetary science at the Keck Institute for Space Studies, who was not involved in the work, said it was now necessary to make a definitive measurement that shows whether or not there is deep liquid water on Mars – and, if so, exactly where it is.

"On Earth, where there is liquid water, there is life, so if liquid water aquifers are present on Mars now, they are a prime target in the search for life" she added.

Dr. Jon Wade of the University of Oxford said he would not be surprised by life on Mars. "Early in its history, Mars would be as conducive to simple life as Earth, if not more so" he said.

Dr. Steven Banham of Imperial College London added that identifying liquid water in the mid-crust would also help geophysicists and geologists understand the internal structure of Mars and how it behaves. However, Banham raised doubts such water could provide a resource for crewed missions

to Mars. “Yes the amount of water down in the crust is potentially vast, but it will be difficult to access or utilise” he said. “It might not make much difference to human exploration, at least initially.”

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Stonehenge megalith came from Scotland, not Wales, ‘jaw-dropping’ study finds

Monument’s largest ‘bluestone’ moved more than 450 miles – a discovery researchers say rewrites relationships between Neolithic populations

Esther Addley, The Guardian ***14 August 2024***

A team of scientists tested the chemical composition and the age of minerals within one of the monument’s stones. Photograph: Heritage Image Partnership Ltd/Alamy

For more than a century, archaeologists have known that some of the stones at Stonehenge came from Wales and were transported – somehow – about 125 miles (200km) to the site of the Neolithic monument on Salisbury Plain.

Now, a **“jaw-dropping” study** has revealed that one of Stonehenge’s central megaliths is not Welsh at all – it is actually Scottish.

In a discovery described by one of the scientists involved as “genuinely shocking”, new analysis has found that **the largest “bluestone” at Stonehenge** was dragged or floated to the site from the very **north-east corner of Scotland** – a distance of at least 466 miles (about 750km).

The astonishing finding that the megalith, which is known as the **“altar stone”**, was transported by prehistoric people from at least as far as present day Inverness, and potentially from the Orkney islands, “doesn’t just alter what we think about Stonehenge, it alters what we think about the whole of the late Neolithic”, said Rob Ixer, an honorary senior research fellow at University College London (UCL) and one of the experts behind the study, which was published in **Nature** on Wednesday.

“It completely rewrites the relationships between the Neolithic populations of the whole of the British Isles” he told the Guardian. “The science is beautiful and it’s remarkable, and it’s going to be discussed for decades to come … It is jaw-dropping.”

Guardian graphic. Image: Almy. Source: Nature. Note: bluestone is a generic term for rock types not found locally.

The altar stone is not one of Stonehenge’s famous trilithons – the immense, lintel-topped sarsen stones, which originate from a mere 16 miles (25km) away, and which today form its outer circle. Instead, the huge sandstone block, 5 metres long and weighing 6 tonnes, lies flat and semi-buried at the heart of the monument, trapped under two fallen sarsens and barely visible to visitors.

Made of a sedimentary rock called **old red sandstone**, the altar stone is classed as a non-local bluestone and was long thought to have been brought from somewhere in Wales, just as a separate group of Stonehenge’s bluestones are now known to have been quarried in the Preseli Hills in Pembrokeshire.

The altar stone was an outlier, however, and research in recent years led archaeologists, including Ixer, to question whether its origins were Welsh at all.

The new study, which involved experts from Curtin University in Perth, Australia; the University of Adelaide; Aberystwyth University; and UCL, aimed to find out more by examining the stone’s chemical composition and the age of minerals within it.

Taken together, these give a characteristic “age fingerprint” to the sandstone, said Nick Pearce, a professor of geography and earth sciences at Aberystwyth who is another of the report’s co-authors. “With that age fingerprint, you can match it to the same sort of rocks around the UK – and the match for the age fingerprint was a **dead ringer for the Orcadian Basin in north-east Scotland**” he said. “It was completely unexpected to us.”

While identifying the exact site will take further work, the experts have narrowed the potential source area to encompass Orkney; a triangle of land around present-day John o’Groats in Caithness; and a narrow coastal strip stretching south as far as the Moray Firth around Inverness and east to present-day Elgin. Small areas of old red sandstone on Shetland are also theoretically possible sources but were considered unlikely, Ixer said.

The finding may be astonishing, but the science is not controversial, said Pearce. “It’s very, very well-established science. It’s not something that people can look at say: ‘Oh no, that can’t be right.’”

The odds of the stone coming from elsewhere are "fractions of a percent" he said.

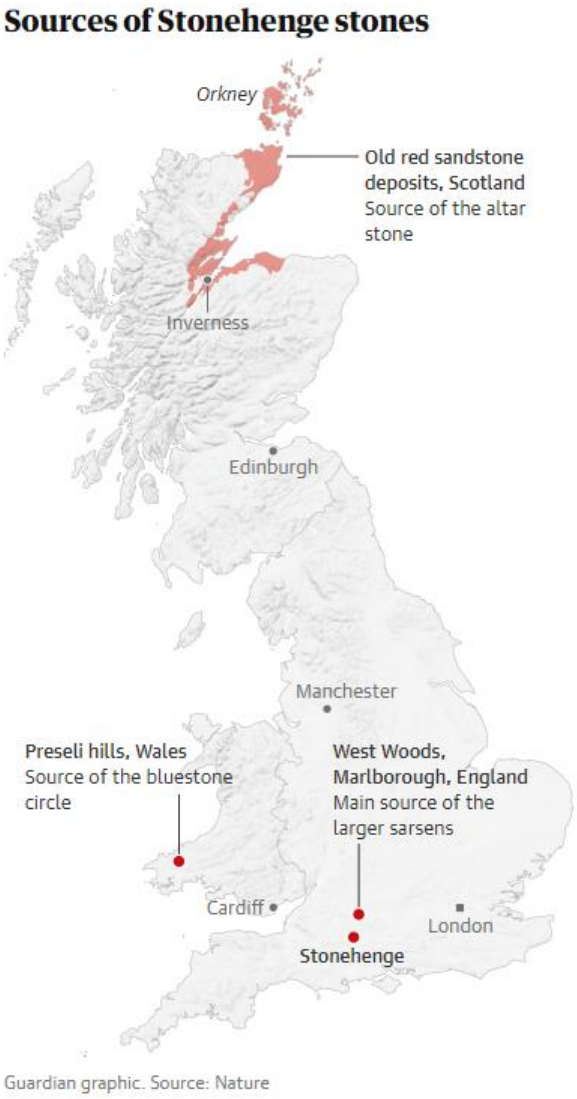
For many, the biggest question will be one not explored in detail in the scientific paper: how on earth did Stonehenge's builders transport the giant stone from Scotland to Wiltshire?

"Given major overland barriers *en route* from north-east Scotland to Salisbury Plain, marine transport is one feasible option" said the lead author, Anthony Clarke, of Curtin University.

But the archaeologist and writer Mike Pitts, who was not involved in the research but whose work on Neolithic monuments includes the book **How to Build Stonehenge**, said he believed it was more likely the stone was dragged overland than floated by sea.

He said: "If you put a stone on a boat out to sea, not only do you risk losing the stone – but also nobody can see it." Instead, a land journey, perhaps taking many years, would engage people *en route*, with the stone "becoming increasingly precious … as it travels south" he added. Impossible as it may seem today, an overland journey "was easily within the reach of Neolithic technology".

"[The study] is exciting and it's so significant" said Pitts. "It's long been known that the bluestones come from Wales, but this identifies links with a quite different part of Britain, and significantly more distant from Stonehenge. So, it suggests that the site was known not just to people in the south, but over a much wider area – and that opens suggestions for the whole way we think about Neolithic Britain."



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Scottish isles may solve mystery of 'Snowball Earth'

Pallab Ghosh, Science Correspondent @BBC Pallab ***16 August 2024***

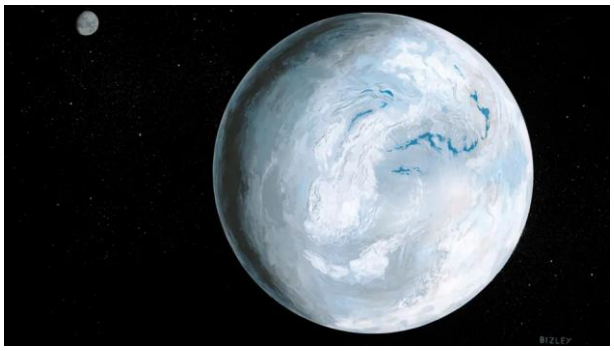
A cluster of Scottish islands could help solve one of our planet's greatest mysteries, scientists say. The **Garvellach islands** off the west coast of Scotland are the best record of Earth entering its biggest ever ice age around 720 million years ago, researchers have discovered.

The big freeze, which covered nearly all the globe in two phases for 80 million years, is known as **"Snowball Earth"**, after which the first animal life emerged.

Clues hidden in rocks about the freeze have been wiped out everywhere - except in the Garvellachs. Researchers hope the islands will tell us why Earth went into such an extreme icy state for so long and why it was necessary for complex life to emerge.

Layers of rock can be thought of as pages of a history book – with each layer containing details of the Earth's condition in the distant past. But the critical period leading up to Snowball Earth was thought to be missing because the rock layers were eroded by the big freeze.

Now a new study by researchers at **University College, London,** has revealed that the Garvellachs somehow escaped unscathed. It may be the only place on Earth to have a detailed record of how the Earth entered one of the most catastrophic periods in its history – as well as what happened when the first animal life emerged when the snowball thawed hundreds of millions of years ago.



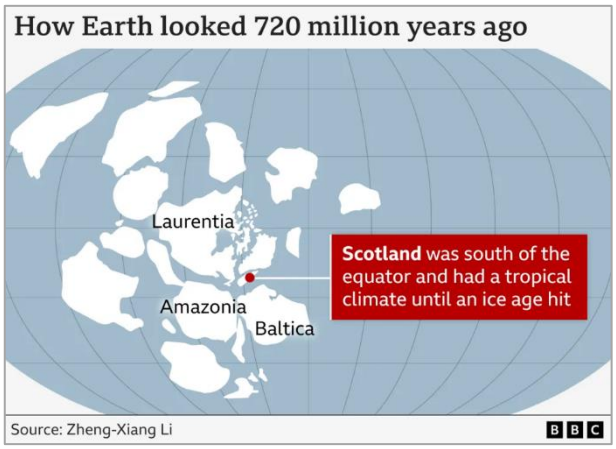
The Earth became almost completely covered in ice during the longest and most severe ice age in the planet's history.
(Image source: SPL)

Back then Scotland was in a completely different place because the continents have moved over time. It was south of the Earth's equator and had a tropical climate, until it and the rest of the planet became engulfed in ice.

"We capture that moment of entering an ice age in Scotland that is missing in all other localities in the world," Prof. Graham Shields of University College London, who led the research, told BBC News.

"Millions of critical years are missing in other places because of glacial erosion – but it is all there in the layers of rock in the Garvellachs."

The islands in the Inner Hebrides of Scotland are uninhabited, apart from a team of scientists working out of the main island's solitary building, although there are also the ruins of a 6th Century Celtic monastery.



The breakthrough was made by Prof. Shield's PhD student, **Elias Rugen**, whose results have been published in the ***Journal of the Geological Society of London***. Elias is the first to date the rock layers and identify them as from the critical period that is missing from all other rock formations in all other parts of the world.

His discovery puts the Garvellachs in line for one of the biggest accolades in science: **the golden spike** hammered in at locations identified as the best record of planet-changing geological moments – though to ward off thieves the spike is not actually made of gold.

Elias has taken many of the judges of the golden spike, formally known as members of the "Cryogenian sub-commission", several times to the rock faces to press his case. The next stage is to allow the wider geological community to voice any objections or to come up with a better candidate. If there are none, then the spike could be hammered in next year.

The prize would raise the scientific profile of the location and attract further research funding. If it does earn the prize it would delight the man who first identified the significance of the formation as a young researcher 60 years ago, Dr. Tony Spencer.

"There are about fifty places in where we could choose for this golden spike," he told BBC News, "but this is the one where the rocks are thickest, and the sedimentation is the most continuous. So, it appears to preserve the very earliest point in time when there is a record of this particular ice age."

Reference:

https://www.bbc.co.uk/news/articles/cj9l2mrn43jo

Rig mobilizes for ‘UK’s first CO2 well injection’

Nadja Skopljak, Offshore Energy ***16 August 2024***

A 1981-built non-propelled self-elevating cantilever jack-up rig has mobilized for the commencement of what will be the UK’s first CO2 well injection test.

Source: Carbon Catalyst Limited

Perenco UK and Carbon Catalyst Limited secured a license to progress the **Poseidon CCS project** at the Leman gas fields in the UK southern North Sea in August 2023. In November, Wintershall Dea came on board the project by buying a 10% interest from Carbon Catalyst, marking the company’s entry into a second UK CCS project, including the Camelot license.

The partners announced the mobilization of the **Petrodec HAEVA offshore workover rig** on August 15, which is on location at the Leman Hotel wellhead platform in the UK Southern North Sea.

This marks the beginning of preparatory well operations, setting the stage for the commencement of **“the UK’s first CO2 well injection test later this year”**, Carbon Catalyst Limited said.

The operation that is expected to take around 30 days includes the workover of the Leman 27H gas production well and the completion of the well into a CO2 injector.

The HAEVA rig was built in 1981 by Hitachi-Zosen in Osaka Works, Japan, and is designed for operations in up to 65 meters of water depth with a drilling depth of approximately 30,000 feet. The unit was originally designed as a drilling rig, mobile offshore drilling unit (MODU), before being converted to a mobile offshore decommissioning unit.

Leman is said to be the largest reservoir complex in the UK Continental Shelf (UKCS), offering a mixture of depleted gas reservoirs and saline aquifers in which to permanently store recovered CO2. The ultimate storage capacity is around 1,000 Mt (Metric ton). The field is connected to the PUK Bacton Terminal, which will receive and process CO2 offshore.

The project is due to come online by 2029. Initial CO2 injection rates will be circa 1.5 million tonnes per annum (Mtpa), ramping up to ~10 Mtpa by 2034, and with further geological potential to peak up to ~40 Mtpa, over a 40-year period.

Reference:

https://www.offshore-energy.biz/rig-mobilizes-for-uks-first-co2-well-injection/?utm_source=offshoreenergytoday&utm_medium=email&utm_campaign=newsletter_2024-08-19

Girl discovers dinosaur footprints on beach walk

"We were just out looking to see what we could find, we didn't think we'd find anything," says Tegan, on the beach where the discovery was made

Nick Hartley, Director, The Dinohunters & Peter Shuttleworth, BBC News 17 August 2024

When 10-year-old Tegan went for a summer holiday beach stroll with her mum, she had no idea they would actually be walking in the footsteps of dinosaurs. The schoolgirl spotted five enormous footprints that dinosaur experts believe are the mark of a **camelotia** that was there more than 200 million years ago.

The aerial shot of the footprints found by Tegan shows experts the possible stride pattern of the dinosaur across this spot more than 200 million years ago. (Image source, House 7 Creative)

Palaeontologists think the footprints, which are up to 75cm (30in) apart, were made by a huge herbivore from the late Triassic period, and now there are efforts to get them verified. Tegan and mum Claire have been told by the National Museum Wales palaeontology curator that she is "fairly certain they are genuine dinosaur prints".

"We've got five footprints and we're talking about half-to-three-quarters of a metre between each one," Cindy Howells told the BBC's **The Dinohunters** programme. "These footprints are so big, it would have to be a type of dinosaur called a ***sauropodomorpha***."

"It was so cool and exciting," said Tegan, who had travelled from Pontardawe near Swansea to the Vale of Glamorgan looking for fossils. "We were just out looking to see what we could find, we didn't think we'd find anything. We found these were big holes that looked like dinosaur footprints, so mum took some pictures, emailed the museum and it was from a long-necked dinosaur."

Claire emailed Cindy a few days after the find in the red siltstone at Lavernock Point between Cardiff and Barry on a stretch of the Glamorgan Heritage Coast known to be a prehistoric hotspot.

Cindy, the go-to dinosaur expert of 40 years in this part of the UK, said what convinced her they were genuine was the consistent stride pattern. "If they were random holes, we'd be wary but because we have a left foot, a right foot and then a left and another right... there's a consistent distance between them," she said. "It's quite a significant find - the buzz you get when someone contacts us with a definite dinosaur find, it's amazing."

Claire was chuffed their hunch was right and has invigorated her junior dino hunter daughter. "It's hard to comprehend you're walking on the same beach that hundreds of millions of years ago some massive prehistoric animal was here," she said. "You can spend a lifetime looking for dinosaur treasures so for it to happen for Tegan at this age is great."

What is a camelotia dinosaur?

The latest prehistoric find on this stretch of coast is a print from the sauropod family of dinosaurs - including the brachiosaurus and diplodocus, distinctive by their very long necks, long tails, big body and small head.

Cindy believes the footprint is from a *camelotia*, that lived across parts of Europe. Little is known about them - compared what experts know about stegosaurus, triceratops and the mighty T-rex - but it is thought they walked on their front feet and their hind limbs, were herbivorous and from the late Triassic period.

"We think these prints were made by a reasonably large, herbivorous dinosaur, added Cindy. "While we haven't any bones here, bones of similar dinosaurs were found on the other side of the Bristol Channel.

"A ***camelotia*** would have stood about 3m (10ft) tall, 4-5m (13-16ft) long and is an early sauropodomorph with a relatively long neck, long tail and walked on two legs but could walk on all four when grazing for food."

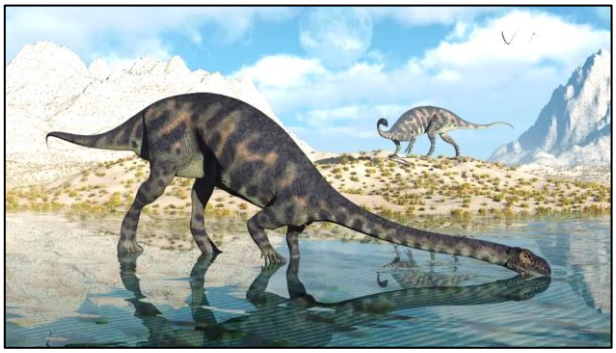
Is Wales a dinosaur find hotspot?

Cindy is pretty certain "Tegan's footprints" are linked to the first dinosaur prints found in Wales in 1879 in nearby Porthcawl.

Bones were then unearthed in Cowbridge in the Vale of Glamorgan before more footprints were found at The Bendricks near Barry and Sully - now a site of special scientific and paleontological interest.

A full dinosaur skeleton was unearthed in 2014 on the same beach near Penarth where Tegan found her footprints - although that was a 201-million-year-old **dracoraptor** and a meat-eating cousin of the T-rex.

Four-year-old Lily found a well-preserved dinosaur footprint at The Bendricks three years ago and now Tegan has spotted some more just down the coast.



Illustrations of what a camelotia may have looked like are rare, but experts think it closely resembled the massospondylus, shown here. (Getty Images)

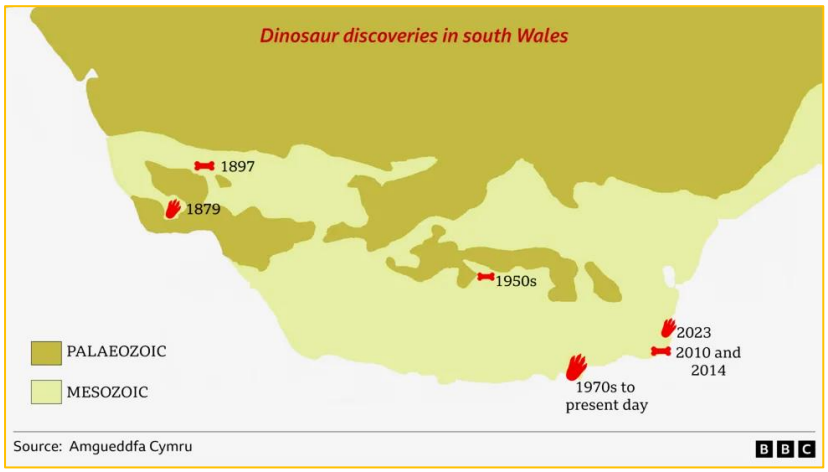
"It's amazing as up until recently, we had so few dinosaurs finds in Wales we didn't think we had much in the way of dinosaurs here," said Cindy. "Now we're getting a footprint or bone find every five to six years and we now know we've a continuous sequence of dinosaurs living in Wales over 15 million years or so - it's amazing.

The south Wales group of the Geologists' Association, of which Cindy is vice-president, believes it is "the best site in Britain for dinosaur tracks, external of the Triassic period".

What was Wales like when dinosaurs roamed?

Cindy has said Wales, whose geolological history dates back 700 million years, was a hot desert subject to flash floods when the dinosaur that formed the footprints found by Tegan roamed. She was keen to quickly analyse the prints as she knew it as a well-known spot for prehistoric finds.

"The rocks around this area are Triassic rocks, formed in the deserts and we know we've got dinosaur footprints in them," added Cindy. "Some 220 million years ago, Wales looked like what the Middle East does now so very hot, dry with deserts, and the sea was hundreds of miles away. But sea level started to change and continents breaking apart, it was getting damper, the sea was flooding the deserts, and the environment was more favourable for dinosaurs. Then 200 million years ago, Wales was like the Mediterranean is now, with shallow, warm tropical seas and little islands."



A map showing many of the discoveries in south Wales.

Cindy has now written a report for other palaeontologists on her view they are from a dinosaur, to verify for the find. "It's brilliant to say to people we have dinosaur footprints on our coast in south Wales" she added. "You've just got to be in the right place at the right time. In museums, we don't have time to go out and do that exploration ourselves, so we rely on people like Tegan doing it for us. We can't do our job without it."

The Geologists' Association has told amateur dino hunters that footprints can be "difficult to see" as many are covered at high tide. "It is best to go after high tide when the tracks may retain small puddles of water" the group advises. "It is also easier to spot the footprints when the sun is low in the sky as longer shadows will help throw the footprints into relief."

Reference:

https://www.bbc.co.uk/news/articles/c049pe7gx6do

*(see also **The Dinohunters** on **page 45**)*

North Sea emissions cut for a fourth year in a row, but operators warned not to be complacent

NSTA ***10 September 2024***

- ***Industry delivers 4% decrease in emissions in 2023, a fourth consecutive year of reductions***
- ***But oil and gas production must get cleaner and electrify to safeguard the sector's future***
- ***Emissions reduction plan will put operators on long-term pathways to net zero***

The North Sea oil and gas industry made further progress on its transition to net zero by **cutting production emissions 4% last year**, contributing to an overall reduction of 28% between 2018 and 2023. This includes a 49% reduction in flaring in the same five-year period – due to more efficient operations, stricter controls and fines for unpermitted activity.

North Sea industry has committed to reaching net zero by 2050, and a 90% emissions reduction by 2040, while also agreeing interim targets with government, including a halving of emissions by 2030. The latest Emissions Monitoring Report from the North Sea Transition Authority (NSTA) shows that progress has been made and the 2030 target is within reach, but more work is needed to ensure that industry meets and surpasses key emissions targets and gets on long-term reduction trajectories.

Half of the reductions achieved between 2018 and 2023 were through active emissions reduction measures and the decrease reflects a combination of the NSTA's robust and proactive approach and industry efficiencies and investment in cleaner technologies.

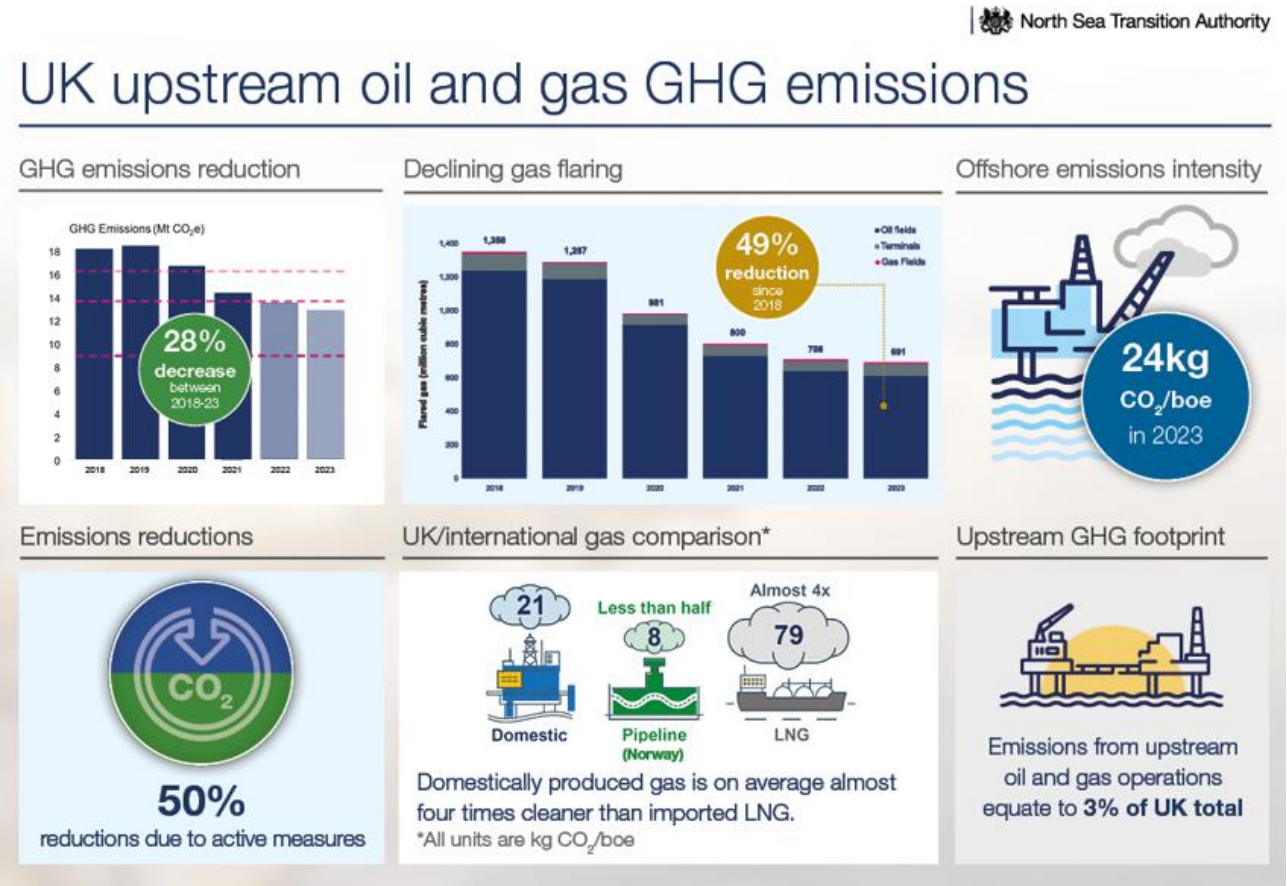
On the other hand, even as overall emissions have gone down, **emissions intensity** – greenhouse gases emitted for every barrel produced – **is projected to have increased**, as production has also fallen.

Higher emissions intensity is common in more mature basins, but this should not be used as an excuse to let performance slip. It is important that UKCS production continues to compare favourably with other nations to retain industry's social licence to operate.

The NSTA continues to hold industry to account on its net zero commitments and published its emissions reduction plan, or OGA Plan, in March to put operators on track to reach net zero.

Hedvig Ljungerud, the NSTA's Director of Strategy, said: "Cutting greenhouse gas emissions by more than a quarter in five years is an impressive achievement in the North Sea, where operators have taken real action and made substantial investments. However, for domestic production to be justified, it must continue to become cleaner. The NSTA will hold industry to account on emissions reductions, including on decisions today that could have an impact for decades to come, to ensure the nation can benefit from its domestic resource even as we transition."

North Sea industry can play a vital role in accelerating the transition while supporting the nation's energy security. **The UK still needs oil and gas** and, even as demand declines, **is likely to remain a net importer out to 2050.** The carbon intensity of producing gas in the UKCS is on average almost four times lower than importing LNG, making a case for continued domestic production, in addition to the wider economic benefits. The industry also has much of the expertise and infrastructure needed to deliver carbon and hydrogen storage projects which are pivotal to meeting net zero.



However, the sector's production emissions still account for just over 3% of overall UK emissions, and gas imported from Norway via pipeline is cleaner than UK production, despite similarities between the two basins, indicating there are opportunities to improve.

Industry has been developing proposals **for more than a dozen major decarbonisation projects**, mostly involving platform electrification and flaring reduction. For example, TotalEnergies recently committed to a significant investment in a flare gas recovery system at the Elgin-Franklin field. Also, since last year's report was published, the potential first-power date for a major, full-electrification scheme has been moved forward and a partial electrification project has been sanctioned. An electrification-ready development also received consent.

Operators should quickly press ahead with decarbonisation proposals, as the volume of emissions which can be avoided is diminished the longer it takes to commission a project. Electrification, or an alternative source of low-carbon power, has the greatest potential for emissions reductions, as fuel combustion for power generation makes up four-fifths of production emissions, and so it is important that operators make final investment decisions on more of these projects.

Reference:

https://www.nstauthority.co.uk/news-publications/north-sea-emissions-cut-for-a-fourth-year-in-a-row-but-operators-warned-not-to-be-complacent/

Weird striped rock 'unlike any seen on Mars' found by Perseverance rover.

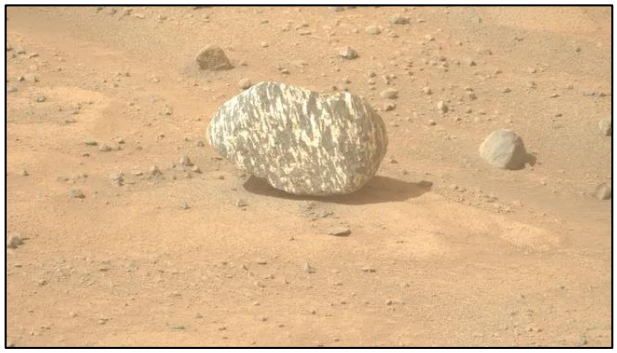
Keith Cooper, Space.com ***26 September 2024***

The stripy rocky may be volcanic in origin, but where did it come from?

A striped rock that looks out of place in its surroundings on the slopes of the inner wall of Jezero crater has scientists excited about what it may reveal about the Red Planet's history.

NASA's Perseverance Mars rover spotted the striped rock, and the rover's initial measurements suggest it could be volcanic in origin. The rock, which has been nicknamed **'Freya Castle'**, may originate from an outcropping of more of this strange material further up the slopes of Jezero.

Freya Castle looks quite unlike any rock seen on Mars before. But Perseverance could not stick around at Freya Castle to examine it for long before continuing its journey up the inner wall of the mighty Jezero crater, the interior of which the rover has been exploring since landing on Mars in February 2021.



NASA's Mars Perseverance rover captured this image of a black-and-white striped rock using its Left Mastcam-Z camera. This image was acquired on Sept. 13, 2024 (Sol 1268) at the local mean solar time of 12:40:29. (Image credit: NASA/JPL-Caltech/ASU)

Perseverance spotted the rock and imaged it while taking measurements with its Mastcam-Z instrument on Sept. 13, 2024 (*sol 1,268 of the mission; a sol is a Martian day, which is 37 minutes longer than a day on Earth*). MastCam-Z serves as the primary "eyes" of Perseverance, providing high-resolution stereo and zoom capabilities.

However, MastCam-Z's multispectral observations of Freya Castle, which is just 7.9 inches (20cm) across, have already provided significant clues as to the rock's origin.

"Our knowledge of its chemical composition is limited, but early interpretations are that igneous and/or metamorphic processes could have created its stripes," wrote Athanasios Klidaras, who is a PhD student in planetary science at Purdue University, in a statement on NASA's Science website.

While a volcanic or metamorphic (wherein one type of rock is transformed into another, usually under excess temperature and/or pressure) origin may explain its stripes, it doesn't explain how Freya Castle arrived at where Perseverance found it, standing out like a sore thumb against all the other nondescript pebbles and rocks. One possibility is that it rolled down from an outcropping of similar rock higher up the slopes.

"The possibility has us excited, and we hope that as we continue to drive uphill, Perseverance will encounter an outcrop of this new rock type so that more detailed measurements can be acquired," wrote Klidaras.

Finding strange rocks on the slope of the crater's inner wall is not unexpected; mission scientists had been hoping for as much. So far they have not been disappointed.

Besides Freya Castle, in May 2024 Perseverance came across a boulder field nicknamed Mount Washburn. Most of the rocks appeared dark, typical of many other similar rocks found on Mars, but one rock in the middle of the boulder field was different.

Appearing bright with a speckled texture, the rock was nicknamed Atoko Point and measured 18 inches by 14 inches (45cm by 35 cm). Mastcam-Z and the rover's SuperCam, which fires a laser at a target rock to vaporize some of its outer material so spectroscopic instruments in SuperCam can analyse its composition by studying the resulting plasma from a distance, learned that Atoko Point is composed of pyroxene and feldspar. Both materials are commonly found in volcanic and metamorphic rocks on Earth. Atoko Point also probably originated elsewhere further up-slope, and mission scientists expect to find many other odd rocks that have rolled down the Martian hills, perhaps after weathering off from large outcroppings.

The rock discoveries are coming as part of Perseverance's fourth science campaign, which is primarily dedicated to searching for evidence of carbonate and olivine deposits in what mission scientists are referring to as the 'Margin Unit' — the big geological unit that forms the inner wall of the 28-mile-wide (45km) Jezero crater.

Carbonate rock such as limestone should have formed in Mars' ancient past when it was warmer and wetter, but so far carbonate rocks have been few and far between in our exploration of the Red Planet. Olivine is a more common mineral on Mars and is associated with water on the surface in the past. By climbing up the crater walls, the hope is that Perseverance will chance upon outcroppings of these precious rock types that have been unearthed in the mighty impact that formed Jezero 3 to 3.7 billion years ago.

Reference:

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See also* Further Reading *"Perseverance Mars rover digs into intriguing 'Bright Angel' rock formation"

'Many more ancient structures waiting to be discovered': Lost chunk of seafloor hidden in Earth's mantle found off Easter Island

Sascha Pare, Live Science ***4 October 2024***

Researchers created a seismic map of Earth's interior beneath the southeastern Pacific Ocean and discovered an ancient slab of oceanic crust that appears to be stuck midway through the mantle.

Scientists have discovered the "fossilized fingerprint" of a chunk of seafloor that was hiding beneath the Pacific Ocean in Earth's mantle.

A new study shows that this fingerprint corresponds to a slab of Earth's crust that began sinking into the mantle approximately 250 million years ago (Early Triassic), at the dawn of the age of dinosaurs (252 million to 66 million years ago). This slab once formed part of the seafloor in the southeastern Pacific and could help explain a strange gap in the lowermost sections of the mantle — the middle layer of Earth's crust that wraps around the planet's core.

"It's giving us a glimpse into Earth's past that we've never had before," study lead author Jingchuan Wang, a seismologist and postdoctoral associate at the University of Maryland, said in a statement.

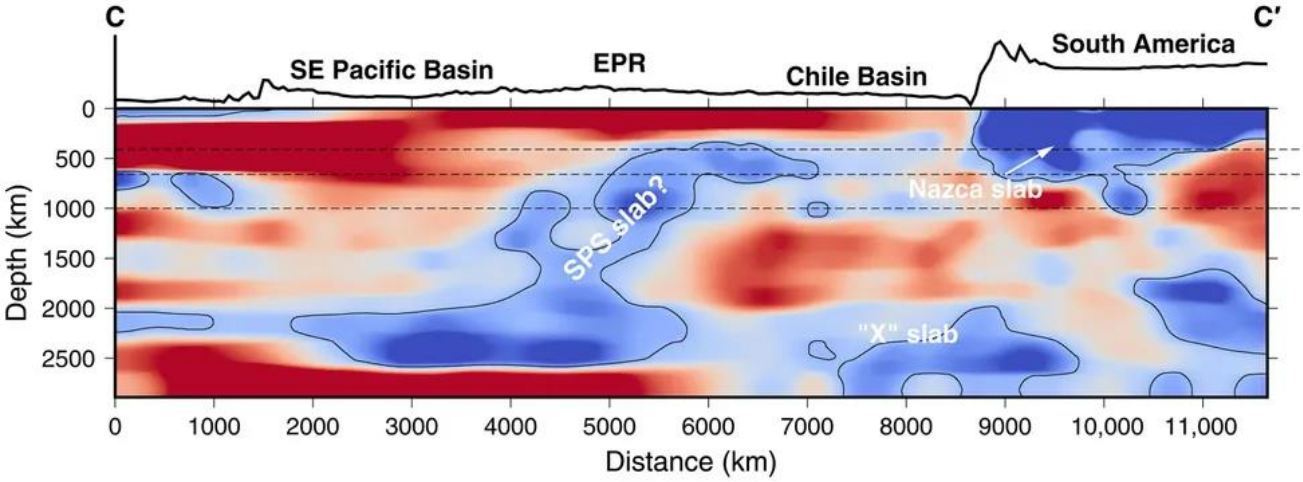
The **sunken slab** now sits sandwiched between the upper and lower mantle, in the mantle transition zone. This transition zone stretches between 255 and 410 miles (410 to 660 kms) deep beneath Earth's surface, although it can expand and contract depending on heat currents circulating in the mantle, according to the statement.

Wang and his colleagues found the slab while exploring the mantle beneath the East Pacific Rise, a fast-spreading mid-ocean ridge located 2,000 miles (3,200 km) off the coast of South America. The

researchers used seismic waves to examine the types of rock beneath the seafloor and create a digital cross-section of Earth's crust and mantle. The team published its findings on Sept. 27 in the journal **Science Advances**.

The cross-section revealed an unusually thick mantle transition zone beneath a portion of the East Pacific Rise roughly 220 miles (350 km) east of Rapa Nui, which is also known as Easter Island. "This thickened area is like a fossilized fingerprint of an ancient piece of seafloor that subducted into the Earth" Wang said.

Subduction occurs when two tectonic plates collide, and one dives beneath the other. Material from the subducting plate usually disintegrates in the mantle, where blazing temperatures recycle the rocks into magma. Remarkably, the newly discovered slab somehow escaped that fate. "Usually, oceanic slabs of material are consumed by the Earth completely" Wang said.



A diagram showing a slab of Earth's crust that sank into the mantle roughly 250 million years ago. SPS stands for Southeastern Panthalassa Subduction, the name given to the newly discovered subduction zone. EPR stands for East Pacific Rise. The diagram is orientated west-east.
(Image credit: Wang et al. Science Advances, 2024.)

The slab's position indicates it travelled through the mantle at about half the speed researchers would normally expect for a subducting plate, according to the statement. This in turn suggests the mantle transition zone can act as a viscous barrier and slow the movement of sinking material, Wang said.

The slab could help explain a strange gap in a region of the mantle directly beneath the thickened portion of the transition zone. The study site sits atop an area of Earth's lower mantle called the Pacific Large Low Shear Velocity Province (LLSVP), where seismic waves slow down considerably.

The mass of the slab stuck inside the transition zone could be pushing the zone's lower boundary into the LLSVP, creating a gap in the LLSVP as material relocates to accommodate the shape of the slab.

The discovery also offers a new lens through which to investigate plate tectonics. "This is just the beginning" Wang said. "We believe that there are many more ancient structures waiting to be discovered in Earth's deep interior. Each one has the potential to reveal many new insights about our planet's complex past — and even lead to a better understanding of other planets beyond ours."

Reference:

https://www.livescience.com/planet-earth/geology/many-more-ancient-structures-waiting-to-be-discovered-lost-chunk-of-seafloor-hidden-in-earths-mantle-found-off-easter-island

Scientists discover there wasn't just one asteroid which killed dinosaurs – after 66 million years

Evidence of a second asteroid found off coast of West Africa

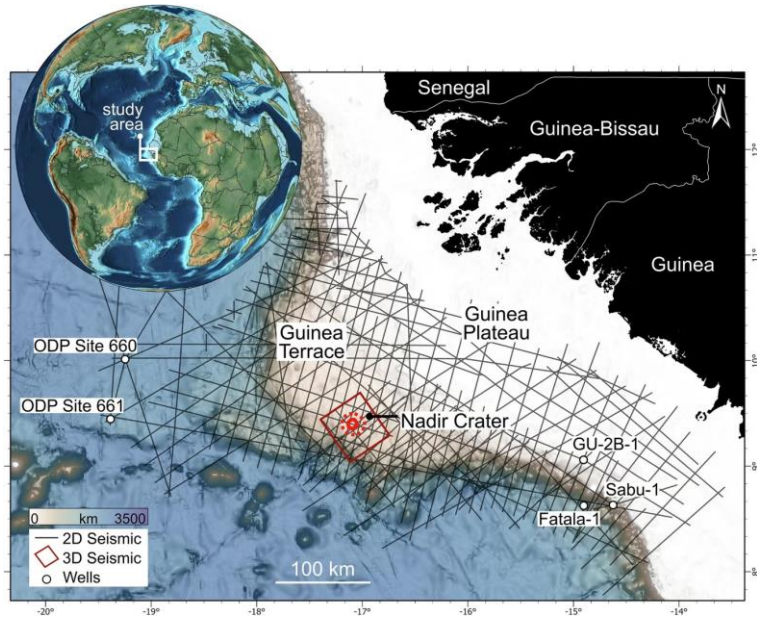
Julia Musto, The Independent ***8 October 2024***

A six-mile-long asteroid, which struck Earth 66 million years ago, wiped out the dinosaurs and more than half of all life on Earth. The impact left a 124-mile-wide crater underneath the Gulf of Mexico's Yucatán Peninsula.

And, until now, it had been assumed that the asteroid acted alone.

This week, scientists at **Scotland's Heriot-Watt University** have published new three-dimensional images of a crater made by a **second asteroid that hit Earth** at around the same time off the coast of West Africa.

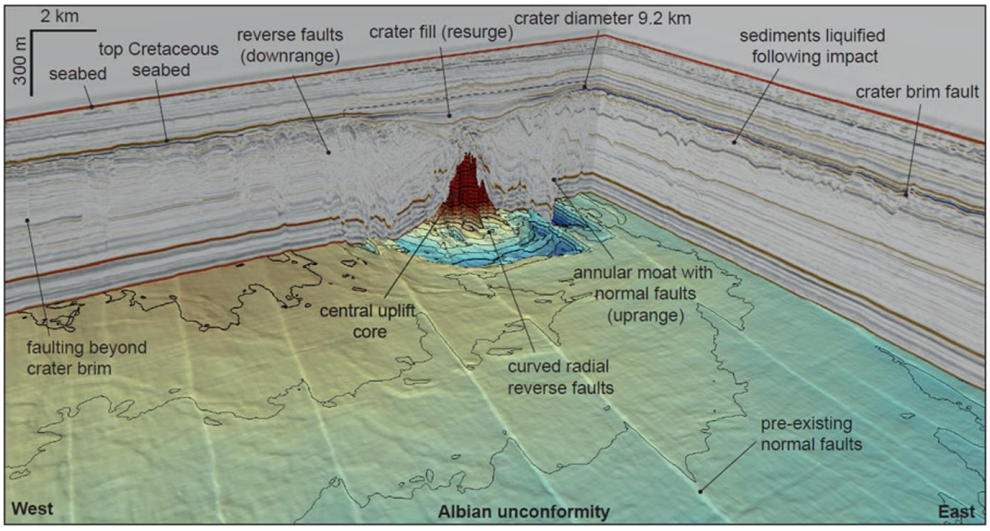
The 5-mile-wide **Nadir Crater** was found nearly a thousand feet under the floor of the Atlantic Ocean. Dr. Uisdean Nicholson was part of the group that first found it a little over **five years ago** but needed seismic data from the images to confirm what had made it.



A map shows the location of Nadir Crater off the coast of West Africa. (Uisdean Nicholson)

"It reveals this crater in three dimensions for the first time – the first time we've ever been able to see inside an impact crater," he told ***The Independent*** on Friday. The study was published Thursday in the journal ***Nature Communications Earth & Environment***.

Craters are often destroyed or deformed by erosion and can be tricky to find because they've been buried for millennia. The data provided to Nicholson's team, from the global geophysical company **TGS**, allowed them to see all of the crater's characteristics.



A three-dimensional view gives a look inside the Nadir Crater, including at its core and brim. (Uisdean Nicholson)

"So, the crater itself is about 9,200m – that's what we call the rim. That's the main central part of the crater," Nicholson explained. "And then there's a wider set of concentric features, or circular features, around it that we call the brim. That's, I think, about 22,000m in diameter. So, that's where the sea … bed got collapsed back in."

The asteroid that made the crater would have been larger than 1,300 feet wide, the scientists say. The closest that humans have come to seeing an asteroid this large crashing to Earth was in 1908, when a 164-foot-wide asteroid exploded over Siberia.

“We haven’t had anything like this in human history” Nicholson said.

Entering Earth’s atmosphere, the asteroid would become a fireball approximately 24 to 25 times the size of the sun *(from Earth)*, generating an enormous explosion in the air that was about a thousand times larger than the 2022 volcanic eruption in Tonga. It also would have caused a 7.0 magnitude earthquake, creating a “train” of tsunamis emanating from the centre of the impact.

Still, compared to the Mexican “Chicxulub” asteroid, the one responsible for wiping out the dinosaurs, it’s not as large in terms of the energy released.

Now, Nicholson hopes to test ideas about how the energy of the asteroid hit the area and what happened, as well as reconstruct the strike in more detail. The researchers want to drill down in the ocean floor to get samples of the crater to try to understand all of this and more.

Until then, having the data in 3D helps tremendously. Nicholson compared these images to newer generation medical scans. “It’s like going from one old x-ray to having a full CT scan of your entire body” he said.

Reference:

https://www.independent.co.uk/news/science/earth-asteroid-dinosaurs-extinction-nadir-crater-b2625743.html?fbclid=IwY2xjawFzKCJleHRuA2FlbQIxMAABHeuRYkM2CVjB5MThQJ6--PX_lJ0CR4rJxKRqrScYZTDnFP0tcYDWd5kLmw_aem_NFmdwmAFlcwPz0fFuA1npQ

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TV Review

Professor Brian Cox offers a guided tour of space in BBC Earth series Solar System

Stephen McCarty, South China Morning Post ***16 Oct 2024***

Professor Brian Cox believes “we have to go to Mars eventually” – although not as a refuge after ruining planet Earth. “Mars is the only planet in the solar system we can go to. But this is extremely important – I interviewed Jeff Bezos once and he said this – our planet is the best planet in the universe for us, because we evolved on it and are entirely reliant on its ecosystem. Mars is not a second chance; we can’t take everything from this planet, essentially destroy it, then move, *en masse*, to another,” says Cox, a British TV presenter and professor of particle physics at the University of Manchester. “Compared to the earth, Mars isn’t very nice.”

A “huge” fan of science fiction films, including *Alien* and *Interstellar*, he adds: “It’s not that we should go to Mars because we made a mess of the Earth; but it’s the natural and only – in the conceivable future, I would say – next frontier.”

Cox is our guide through the five-part TV series **Solar System**, a mind-warping trip from Venus to beyond the frigid sweep of Pluto. But the solar system has been around for a while; so why this series, now? “We’ve made series about the planets before, but we now have more than 40 spacecraft in the solar system – more than ever – so there’s this avalanche of new data coming in. You start to build up a different picture,” says Cox. “The idea was to make a series about the solar system as seen now; that captured my imagination, because it tells you something about science that’s current. Then you build out and say, ‘I want more than that, I want some deeper scientific and philosophical structure around the series; I don’t want to make films that are just snapshots of data.’”

Solar System deals in incomprehensible timescales and distances; incomprehensible, that is, until Cox conducts some simple experiments using, among other items, eggs, rocks, a camping stove,

That accessibility is heightened by the decision to retain a few humorous, egg-on-face experimental misfires. That "lightness of touch", as Cox calls it, harks back to some of his earlier series. It counters the weightiness of his subjects, he says, because "if you make cosmology films, serious, deep and terrifying philosophical questions emerge". He expands on the importance of experiments, particularly at school. "They teach us how to observe nature to acquire reliable knowledge," Cox says. "Richard Feynman, one of my scientific heroes, said that the thing about science, perhaps the most valuable, transferable skill, is that you learn how to be wrong, because you're wrong most of the time when you're a theoretical physicist. You make up ideas and you're usually wrong, because nature is telling you you're wrong: that's character-building. You learn to acquire knowledge by being wrong – and acquiring reliable knowledge is a skill we all need to develop, one perhaps in short supply in the modern world."

Solar System is available on BBC iPlayer and airs on BBC Two on Mondays at 9pm.

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https://www.scmp.com/lifestyle/entertainment/article/3282526/professor-brian-cox-offers-guided-tour-space-bbc-earth-series-solar-system

TV Documentary

The Dinohunters

The latest series of **Our Lives**, the documentary strand celebrating remarkable stories from across the UK, continues with a story of a momentous discovery in Wales.

Whilst out walking on the beach during the summer holidays, 10-year-old Tegan and her mother Claire spotted **five giant footprints** in the rocks that they believed might belong to a dinosaur.

The exciting discovery led them to make contact with Cindy Howells, the go-to person for the local fossil-finding community, who looks after the growing collection of dinosaur fossils at the **National Museum of Wales**. She meets them at the site of their find on the Vale of Glamorgan coastline. Upon initial investigation and measurements of the footprints, Tegan and Claire's instincts appear to be correct. A lengthy process will now need to take place in order to verify the footprints' legitimacy, but Cindy is pretty convinced this is a new find for Wales.

Cindy speaks of the importance of amateur enthusiasts: "Geology is the ultimate activity for anybody of any age. You can find minerals, you can find rocks, you can even find dinosaur footprints. In museums, we haven't got the time to go out and do that exploration ourselves, so we rely on people like Tegan to do this sort of work. We can't do our job without it."

The rocks along the Vale of Glamorgan coastline date back to the late Triassic period and dinosaur bones have been found previously nearby. In 2014, on the very same beach as Tegan's find, the discovery of a 200-million-year-old dinosaur fossil – christened **Dracoraptor** - put Wales on the map as a destination of choice for fossil hunters. Since then, the fossil has been a star attraction at the National Museum of Wales. But now, the opportunity has arisen for further research into the fossil via special high-tech scanning in Manchester, which leads to new images of previously unseen bone buried within the rock.

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Interesting Photographs

This striking image of the **Supermoon Blue Moon** rising over the Longquan Mountain Observation Deck on August 19, 2024, in Chengdu, Sichuan Province of China was captured by photographer Yang Qitian.

Reference:

https://www.space.com/supermoon-blue-moon-2024-photos?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=D849F322-1BA5-4233-8D1A-87C5B594A00E&utm_source=SmartBrief

Perseid meteor shower rains 'shooting stars' over Stonehenge in glorious astrophotography image

A UK-based astrophotographer captured this stunning composite image of the Perseid meteor shower raining "shooting stars" over Stonehenge.

The Perseids, one of the year's most prolific meteor showers, peaked this week, raining dozens of "shooting stars" per hour through Earth's skies.

Some lucky stargazers caught a double feature of meteors and dazzling auroras, which were triggered by a spree of powerful solar eruptions earlier in the week. Others, like U.K.-based astrophotographer Josh Dury, hunted for meteors at thematically appropriate locales — namely, the prehistoric astronomical monument Stonehenge in Wiltshire, England.

Stonehenge, built about 5,000 years ago to align with the sun on the summer solstice, is one of the most popular and intriguing astronomical monuments in the world.

To capture his stunning composite image of Perseid meteors streaking over the famous stones, Dury snapped photos from the monument grounds for three and a half hours. He then combined 43 individual exposures of shooting stars with a deep image of the background sky, where the central band of the Milky Way slashes toward the horizon.

https://www.space.com/perseid-meteor-shower-stonehenge-astrophotography?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe4763876a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=ECA00BC4-7F09-4C93-AE4C-21985ECD283F&utm_source=SmartBrief

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Perseverance Mars rover digs into intriguing 'Bright Angel' rock formation

Rahul Rao, Space.com ***23 June 2024***

https://www.space.com/perseverance-mars-rover-bright-angel-science?utm_term=8DEBC9E5-6C7F-4337-AFFF-D9A51CC6C2C0&lrh=840a98cbe34ba22d824f6df096d90a0be8fe47638765a779b0361304855882d8f&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_medium=email&utm_content=C027802A-872A-4D9F-A7E3-EB5073277D31&utm_source=SmartBrief

North Sea oil decline: 'We can't have a repeat of what happened to 80s miners'

Unlikely alliance of unions and climate groups call for 'clear and funded' transition plan for communities reliant on dwindling industry

Matthew Taylor, Helena Horton & Jillian Ambrose, The Guardian ***1 July 2024***

https://www.theguardian.com/environment/article/2024/jul/01/north-sea-oil-transition-plan

The fossil finder: one man's lifelong search for fragments of Britain's Jurassic past – photo essay

Lisa Bachelor, The Guardian ***2 July 2024***

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'Dragon' and 'tree of life' hydrothermal vents discovered in Arctic region scientists thought was geologically dead

Harry Baker, Live Science ***8 July 2024***

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UK set on leaving fossil fuels behind and turning into clean energy superpower

Melisa Čavčić, Offshore Energy ***17 July 2024***

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One of world's oldest dinosaur fossils revealed by heavy rains in Brazil

The researchers believe this discovery holds great promise for shedding light on the early days of dinosaurs and their

Mrigakshi Dixit, Interesting Engineering
19 July 2024

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UK player gets its hands on one of 'largest remaining oil resources' offshore Scotland

Dragana Nikše, Offshore Energy
19 July 2024

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X-rays reveal tiny half-billion-year-old creature

Victoria Gill, Science correspondent, BBC
31 July 2024

https://www.bbc.co.uk/news/articles/cgxqdygpn09o

Volcano in Tanzania with weirdest, runniest magma on Earth is sinking into the ground

Tanzania's outlandish Ol Doinyo Lengai volcano, the only volcano on Earth that is currently erupting carbonatite lava, has been sinking at a rate of 1.4 inches per year for the past decade.

Sascha Pare, Live Science 2 August 2024

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UK's oil & gas windfall tax hike – Coup de grace or boon for North Sea jobs and upstream investment?

Melisa Čavčić, Offshore Energy
5 August 2024

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Gargantuan waves in Earth's mantle may make continents rise, new study finds

Dramatic cliffs and high plateaus are caused by the same wave triggered in Earth's middle layer when continents pull apart, a new study finds.

Tia Ghose, Live Science 7 August 2024

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'This could be the origin of the Atlantis legend': Mountain that sank beneath the waves discovered off Canary Islands

A large seamount with three inactive volcanoes that sank into the ocean millions of years ago off the coast of Lanzarote may have inspired the legend of Atlantis.

Hannah Osborne, Live Science
12 August 2024

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Peat: So hot right now

Offshore wind requires geoscience to bring energy onshore in the most cost-effective way

Henk Kombrink, GeoExpro 12 August 2024

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Dinosaur-killing asteroid was a rare rock from beyond Jupiter, new study reveals

Scientists have uncovered the "genetic fingerprint" of the dinosaur-killing Chicxulub impactor, potentially revealing the fateful rock's origins in the outer reaches of our solar system.

Sharmila Kuthunur, Space.com
18 August 2024

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What was the first animal on Earth?

Using fossil evidence and genetic dating, geneticists and palaeontologists have backed strikingly different candidates for the world's first animal.

Katherine Irving, Live Science
19 August 2024

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Weird mystery waves that baffle scientists may be 'everywhere' inside Earth's mantle

Structures that scatter seismic waves deep in Earth's mantle seem to be everywhere researchers look.

Stephanie Pappas, Live Science
22 August 2024

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Giant oil & gas projects on thin ice as UK pulls out of court battle: Will Shell and Equinor get cold feet or take a stand against legal challenges?

Melisa Čavčić, Offshore Energy
30 August 2024

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Earthquakes can trigger quartz into forming giant gold nuggets, study finds

Geologists have known for decades that gold forms in quartz with the help of earthquakes, but now they have worked out exactly how the setting and seismic waves combine to form large nuggets.

Sascha Pare, Live Science
2 September 2024

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Deep-sea diver and fossil fan: meet Manchester United's new No 1 keeper

Phallon Tullis-Joyce is ready to fills the boots of Mary Earps and is planning a post-career doctorate in marine ecology

Tom Garry, The Guardian
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'Mountain of God' volcano in Tanzania is bulging, study finds

Satellite data suggest a volcano in Tanzania that expels extremely runny lava could be creeping toward an eruption.

Sascha Pare, Live Science
13 September 2024

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80-million-year-old sea monster jaws filled with giant globular teeth for crushing prey discovered in Texas

Rare fossils of the mosasaur Globidens alabamaensis — a 20-foot predator with strange, mushroom-shaped teeth — unearthed in northeastern Texas.

Richard Pallardy, Live Science
18 September 18, 2024

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Duck-billed dino with absolutely enormous honker unearthed in Mexico

The newly named dinosaur is unique to Mexico, and it's helping change scientists' understanding of dinosaur ranges across the Americas.

Sierra Bouchér, Live Science
24 September 2024

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Earth will capture 'second moon' this weekend, scientists say

Earth will get a "second moon" this weekend, but it won't be sticking around for long.

Robert Lea, Space.com 26 September 2024

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FESTIVAL OF GEOLOGY

GEOLOGISTS' ASSOCIATION 1858

Saturday 2 November 2024

10:30am to 4:30pm *Free admission*

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The Geological Society

For everyone interested in the story of the Earth

Children and families welcome!

Opportunity to view the Geological Society's historic apartments

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- Talks
- Books
- Activities for children

ROCKWATCH
The UK's Nationwide Geology Club for Children

Also: Field trips on Sunday 3 November to the Crystal Palace dinosaurs, Lesnes Abbey Woods and City of London geology.

See website for full schedule

Burlington House is a short walk from Green Park station and on the same site as the Royal Academy.

www.geologistsassociation.org.uk