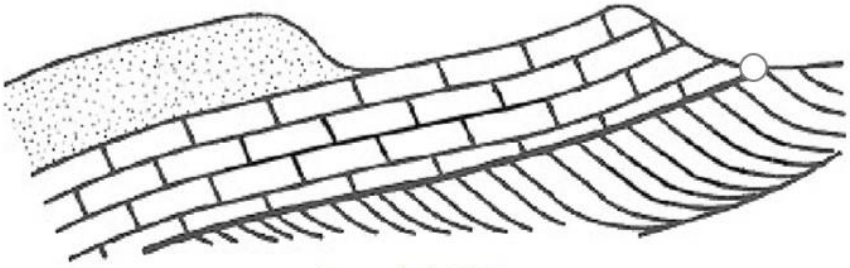
Farnham Geological Society

Farnhamia farnhamensis



Founded 1970

A local group within the GA

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Contents

Editorial

Welcome to the latest FGS Newsletter, the first since we returned to having monthly lectures in September, all be it in the virtual world of "Zoom". On behalf of us all I would like to thank Marina Barcenilla for an excellent presentation; I found it extremely interesting. I do hope as many of you as possible were able to attend.

Our next meeting is on 9th October; the lecture is entitled *Mass Accumulations of Chalk Ophiuroids in Lewes* and will be given by Dr. Tim Ewin of the Natural History Museum. It will be via "Zoom" again. Note the "meeting room" will be opened at approximately 6.50 pm. The meeting will commence sharply at 7.00 pm and everyone will be muted to avoid any noise which will disturb the introductions and the speaker's presentation. At the end of the presentation after questions and thanks by the Chair, members will be unmuted and have an opportunity to chat for about 30 minutes or so.

Please note that the FGS Committee have made the decision to have all lectures this year via "Zoom" and not in The Maltings, even if the building does reopen.

The Committee have also had to make the decision to cancel the Annual Lunch in November to prevent us from losing our deposit. It is a great shame, but we thought it was highly unlikely that we would be able to mix freely at that stage.

Colin Brash has informed us that former FGS Member Marybeth Hovenden has moved back to Canada to be closer to her family. We wish her well.

Farnham Geological Society
Meeting Programme 2020

Updated 30 September 2020

All meetings in 2020 will be conducted remotely via Zoom.

Please note the change in lecture time: 6.50 pm for 7.00 pm start.

Mass accumulations of Chalk Ophiuroids in Lewes
Dr. Tim Ewin Fri, 9 October
Dept. of Earth Sciences, Natural History Museum

The smallest things can make a difference
Dr. Liam Gallagher Fri, 20 November
Consultant

Tongan pumice raft
Dr. Isobel Yeo Fri, 11 December
National Oceanography Centre, Southampton

Geologists' Association
Lecture Programme 2020

Updated 30 September 2020

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

Presidential Address: Exploring for Hydrocarbons - a Risky Business (Part 2)
Nick Pierpoint Fri, 2 October
Senior Vice President of the GA

No lecture due to the Festival of Geology
(see page 27)
Fri, 6 November

Environmental conditions that existed during rebuilding of an Early Carboniferous ecosystem
Prof. Sarah Davies Fri, 4 December
Leicester University

Reading Geological Society
Lecture Programme 2020

Updated 30 September 2020

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

Lectures are open to all and there is no charge for admission. However, regular attendees are expected to be members of the society.

Time: 7:45pm for 8:00pm

Venue: Zoom talks *(see website for details)*

Sand!
Dr. Ian Selby Mon, 5 October
University of Plymouth

The Geology of Mercury
Prof. David Rothery Mon, 2 November
Open University

TBA Mon, 7 December

Farnham Geological Society
Committee 2020

Chair	**Liz Aston**
Treasurer	**Peter Luckham**
Secretary	**Judith Wilson**
Programme Secretary	**Janet Catchpole**
Membership Secretary	**Sally Pritchard**
Field Trip Secretary	**John Williams**
Newsletter Editor	**Mick Caulfield**
Web Manager	**Michael Hollington**
Advertising	**Peter Crow**
IT/Sound	**Mike Millar**
Without portfolio	Alan Whitehead

It Happened in October

13 October 1884

Greenwich was established as the universal time from which standard times throughout the world are calculated.

13 October 2010

The annual National Fossil Day was established in the United States to promote the scientific and educational values of fossils.

21 October 1805

The Battle of Trafalgar took place between the British Royal Navy and the combined French and Spanish fleets. The victorious British ended the threat of Napoleon's invasion of England. British naval hero Admiral Horatio Nelson was mortally wounded aboard his ship Victory.

24 October 1902

The Volcanic Explosivity Index (VEI) 6 eruption of Santa María Volcano, a large volcano in the western highlands of Guatemala, was one of the three largest eruptions of the 20th century, after the 1912 Novarupta and 1991 Mount Pinatubo eruptions. It is also one of the five biggest eruptions of the past 200 to 300 years.

25 October 1854

During the Crimean War, the Charge of the Light Brigade occurred as Lord Cardigan led the British cavalry against the Russians at Balaclava. Of 673 British cavalrymen taking part in the charge, 272 were killed.

26 October 1863

Formation of the English Football Association.

26 October 1881

The shoot-out at the O.K. Corral in Tombstone, Arizona, occurred between the feuding Clanton and Earp families. Wyatt Earp, two of his brothers and "Doc" Holliday gunned down two Clantons and two others.

27 October 1728

British navigator James Cook (1728-1779) was born in Yorkshire, England. He explored New Zealand, Australia, and the Hawaiian Islands.

28 October 1707

The 1707 Hōei earthquake (magnitude 8.7) struck south-central Japan at 14:00 local time. It was the largest earthquake in Japanese history until the 2011 Tōhoku earthquake surpassed it. It caused moderate to severe damage. The earthquake, and resulting tsunami, caused more than 5,000 casualties.

29 October 1618

British explorer Sir Walter Raleigh was executed in London for treason on orders from King James I.

If you have any ideas for improving the Newsletter … for example, have you read a geological book recently and would like to submit a review? Or have you discovered an interesting geological website or Facebook page that you would like members to know about? …. please feel free to forward them to me at caulfm@hotmail.com.

Mick Caulfield

Next Lecture …

9 October 2020

Mass accumulations of Chalk Ophiuroids in Lewes

Dr. Tim Ewin
Dept. of Earth Sciences,
Natural History Museum

Dr. Tim Ewin is a senior curator at the Natural History Museum with specific responsibilities for the fossil echinoderm collections. He is also manager of the Earth Sciences Invertebrates and Plants 'A' Division and responsible for 3 staff covering the collections of Bryozoa, Corals, Cephalopods, Brachiopods and other smaller invertebrate groups.

He is currently working on a wide range of fossil echinoderms projects, particularly Cretaceous Moroccan Asteroids, Cretaceous and Jurassic British Ophiuroids, British Jurassic Crinoids, Lower Jurassic echinoderms from Yorkshire and Silurian Canadian Edrioasteroids.

He has an interest in museology with particular interests in the promotion of curatorial expertise within the heritage sector and is an active committee member of the Geological Curators Group.

Ophiuroids or brittle stars are echinoderms in the class Ophiuroidea closely related to starfish. They crawl across the sea floor using their flexible arms for locomotion. The ophiuroids generally have five long, slender, whip-like arms which may reach up to 60 cm (24 in) in length on the largest specimens.

Lecture Summary

18 September 2020

Extremophiles: The Search for Extra-terrestrial Life

Marina Barcenilla
University of Westminster

The search for life beyond Earth is an active field of astrobiological research, but how do we decide where to look for it and what should we look for? The study of extreme environments and extremophiles on Earth is guiding current efforts to search for signs of life on Mars and on the icy moons of the outer solar system. Working with analogue soil and rock samples can inform future astrobiology missions.

Marina Barcenilla is an Astrobiology PhD student at the University of Westminster, with a First-Class Honours degree in Planetary Science with Astronomy from Birkbeck College, University of London. Her current research focus is the detection and characterisation of spectroscopic biosignatures on Mars**,** but she also has an interest in the habitability of Europa and other icy satellites.

A full summary of the lecture will be provided in our next Newsletter which will be issued before the February 2021 Meeting.

References:

1. Preston, L.J. *et al*, Infrared Spectroscopic Detection of Biosignatures at Lake Tírez, Spain: Implications for Mars. Astrobiology (2020) Vol. 20, No. 1: https://doi.org/10.1089/ast.2019.2106
2. Seager, S. *et al*, The Venusian Lower Atmosphere Haze as a Depot for Desiccated Microbial Life: A Proposed Life Cycle for Persistence of the Venusian Aerial Biosphere. Astrobiology (2021) Vol. 21, Vol. 2: https://doi.org/10.1089/ast.2020.2244
3. Greaves, J.S. *et al*, Phosphine gas in the cloud decks of Venus. Nature Astronomy (2020): https://www.nature.com/articles/s41550-020-1174-4

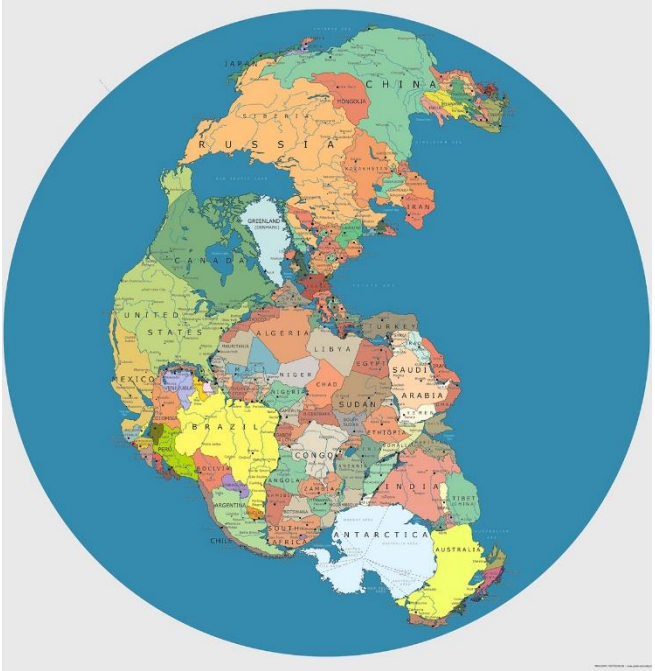
Websites

Map of Pangea with Modern-Day Borders

By Nick Routley

1 May 2020

The map of Pangea, by Massimo Pietrobon, is a look back to when all land on the planet was arranged into a supercontinent. The map is unique in that it overlays the approximate borders of present-day countries to help us understand how Pangea broke apart to form the world that we know today.



Reference:

https://www.visualcapitalist.com/incredible-map-of-pangea-with-modern-borders/?fbclid=IwAR12X2HqBDyQKlfDDplHA1XWLJIo_nLlfP58vu8wVO6jpv6oc4NKnM6N0Rw

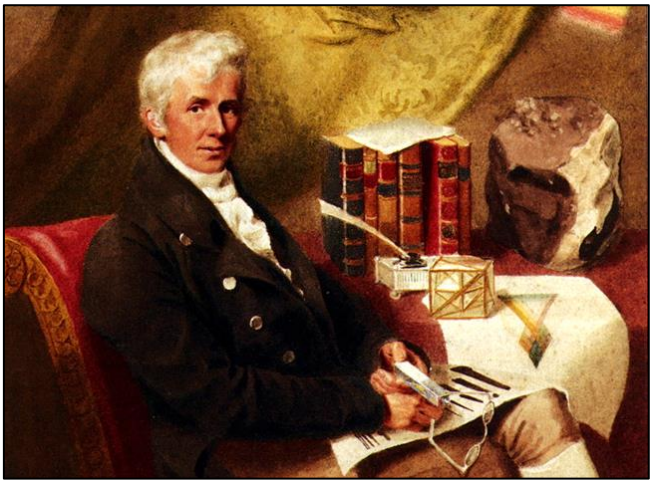
British & Exotic Mineralogy

An interesting site:

https://www.c82.net/mineralogy/

British Mineralogy and Exotic Mineralogy comprise 718 illustrations by James Sowerby in an effort to illustrate the topographical mineralogy of Great Britain and minerals not then known to it. Sowerby's plates are some of the finest examples of hand-drawn mineral illustrations ever created.

James Sowerby (21 March 1757 – 25 October 1822) was an English naturalist, illustrator, and mineralogist.



Painting by Thomas Heaphy, 1816

Stromboli Volcano, Italy.

By Martin Rietze

YouTube film of Strombolian eruptions from multiple vents, taken between 10-12 June 2017.

1. https://www.youtube.com/watch?v=0hb4brbxivY
2. https://www.youtube.com/watch?v=TKsBTlXkfyM

News

Earthquake hits towns in Bedfordshire and Buckinghamshire

8 September 2020

BBC

An earthquake with a **magnitude 3.5** has been felt across several towns in England.

People living in Leighton Buzzard and Dunstable, Bedfordshire, and Milton Keynes and Aylesbury in Buckinghamshire said they felt it at about 09:45 BST. The British Geological Survey said it struck just north of Leighton Buzzard.

Bedfordshire Police said there were no reports of injuries, although it had received a large number of calls.

Across the border in Buckinghamshire, Thames Valley Police tweeted that is was not a major incident, adding that "extra resources have been drafted in to clean up the mess created by the duty inspector's coffee".

Dr Richard Luckett, of the British Geological Survey, confirmed the quake, saying: "It was very minor on a global scale, but still quite large for the UK. We get about two of these a year."

He said there was a slight chance of aftershocks "but they are very likely not to be felt".

Leighton Buzzard gets second earthquake in a week

14 September 2020

BBC

Leighton Buzzard residents have felt a second earthquake within a week.

The British Geological Survey (BGS) said a **2.1 magnitude** tremor was felt in the Bedfordshire town at 23:20 BST on Sunday. It comes after a 3.5 magnitude earthquake hit the town on Tuesday.

The BGS tweeted there had been "a small number of reports" from the public with one saying this earthquake "felt slower and less intense".

The first earthquake struck just north of Leighton Buzzard. It was felt in Leighton Buzzard and Dunstable, Bedfordshire, and Milton Keynes and Aylesbury in Buckinghamshire.

Leighton Buzzard hit by two earthquakes in one day

22 September 2020

BBC

A town in Bedfordshire has experienced two earthquakes in one day. It is the third and fourth time people in Leighton Buzzard have felt tremors in the space of two weeks.

The British Geological Survey (BGS) confirmed a **3.0 magnitude** earthquake happened just north of the town at about 09:30 BST and a **2.1 magnitude** tremor occurred at about 13:40.

People reported their houses "jolting and shaking" when the larger quake struck.

Since 8 September there have been four earthquakes in the town, the BGS confirmed. A 3.5 magnitude earthquake was felt by residents on that day, followed by a 2.1 magnitude tremor on 13 September.

Glenn Ford, a BGS seismologist, said the latest two tremors were aftershocks from the first incident, but were "earthquakes in their own right".

The BGS said its provisional data suggested the earthquake originated at a depth of about 10km (6.2 miles).

'San Andreas fault of Bedfordshire'

Mr Ford said: "It's not an unusual thing to be seen in the UK... this relieves the built-up stress in the rocks." They were "nothing to do with fracking or anything like that," he said. "It's typical British tectonic activity that's been going on for hundreds of years."

Mr Ford said the UK experiences about 200 to 300 earthquakes each year, but 90% are "so minor that people can't perceive them".

Why Leighton Buzzard?

Dr Matthew Blackett, an earthquake expert from Coventry University, said the Leighton Buzzard tremors were likely caused by the fracturing of solid rock in "hidden fault lines", several hundred metres below the surface.

"What seems to have happened is that this was an initial earthquake in a hidden fault - some stress or other has caused it. These two subsequent events are a readjustment of the fault lines to come back to some sort of stability.

"If there are [further tremors], I think they will only be minor events."

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1. https://www.bbc.co.uk/news/uk-england-beds-bucks-herts-54070889
2. https://www.bbc.co.uk/news/uk-england-beds-bucks-herts-54146725?intlink_from_url=https://www.bbc.co.uk/news/science_and_environment&link_location=live-reporting-story
3. http://www.earthquakes.bgs.ac.uk/earthquakes/recent_uk_events.html
4. https://www.bbc.co.uk/news/uk-england-beds-bucks-herts-54248281

ARTICLE

UNESCO Geoparks

In this, the second article, Liz Aston describes the Geoparks recognised by UNESCO in Spain (this issue: The Canary Islands).

UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with an holistic concept of protection, education, and sustainable development. At present, there are 161 UNESCO Global Geoparks in 44 countries.

UNESCO's work with geoparks began in 2001. In 2015, the 195 Member States ratified the UNESCO Global Geoparks.

SPAIN

By Liz Aston

CANARY ISLANDS

The Canary Archipelago comprises 7 main volcanic islands forming a chain extending for ~500km across the Eastern Atlantic, with eastern edge only 100km from the northwest African coast (Fig. 1).

Figure 1: Map of the Canary Islands (Credit: Oona Raisanen).

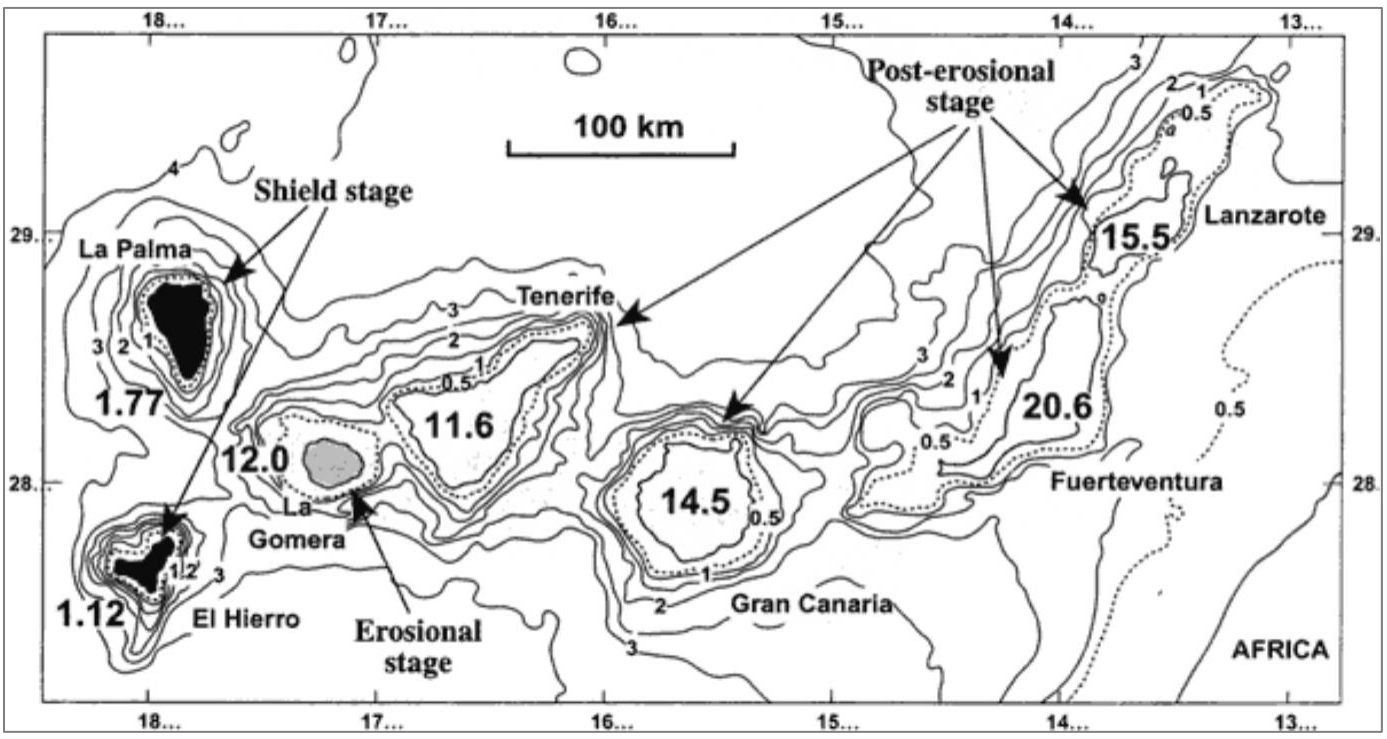

Figure 2: Oldest ages (Ma) of the subaerial volcanism in the Canary Islands (Carracedo et al., 2002).

- There is Jurassic oceanic lithosphere formed during the first stage of opening of the Atlantic (180-150 Ma); lying close to the very slow-moving passive continental margin of the African plate.
- They lie adjacent to a region of intense active deformation - the Atlas Mountains, part of the Alpine orogeny.
- The Moho is at ~13km depth beneath the islands.
- Magmatism started during the Cretaceous, ~80 Ma, with subaerial volcanism during the Miocene.
- The oldest stages have been difficult to reconstruct (Fig. 2):
    - e.g. submarine magmatism of Fuerteventura was at ~80 Ma, 70 Ma or ~35-30 Ma.
    - the submarine stage of La Palma, western part of archipelago was formed at 4-3 Ma.
    - Fuerteventura subaerial volcanism was at 20.6 Ma.
    - El Hierro subaerial volcanism was <1.12 Ma.
    - All islands, except La Gomera, have been active in last 1 Ma.
    - Tenerife, La Palma and El Hierro have records of eruptions in the last 500yrs.
    - The most recent underwater eruption was 2011-2012.

The Canary Islands differ from other volcanic oceanic islands, such as the Hawaiian Islands, in several ways - they have stratovolcanoes, compression structures and a lack of subsidence. Each island built up from seamount to island by the eruption of many lava flows. Subaerial volcanic eruptions continued on each island. Fissure eruptions dominated on Lanzarote and Fuerteventura, resulting in relatively subdued topography with heights below 1,000m. The other islands are rugged and mountainous; Tenerife volcanic edifice, Teide, rises ~7,500m above the ocean floor (about 4,000m underwater and 3,718m amsl).

From east to west, the main islands are Lanzarote, Fuerteventura, Gran Canaria, Tenerife, La Gomera, La Palma, and El Hierro (Fig.1). The 7 main islands originated as separate seamounts on the Atlantic Ocean floor, which is 1,000m–4,000m deep in this region. Lanzarote & Fuerteventura are parts of the volcanic Canary Ridge and were a single island in the past.

There are several models for the origin of the Canaries – all are contentious. Currently, a hotspot is the explanation accepted by most geologists. Volcanic ocean islands, such as the Canaries, form in deep oceans in a sequence of stages:

1. Submarine Stage – volcano forms on ocean floor; pillow lava basalts – *Las Hijas Seamount* (see Figs. 3 & 4).
2. Emergent Stage – volcano builds until it emerges above sea level (volcano is now >x000m high) standard basalts (tholeiites) - *no example.*
3. Shield Building Stage – subaerial lavas pour (as deltas) into the ocean - *El Hierro* (Fig. 7).
4. Declining Stage – alkaline basalts - *no example.*
5. Erosional Stage – Volcanism is dead, and volcano eroded; coral reefs round its rim - *La Gomera* (Fig. 5).
6. Rejuvenation, Post-erosional Stage – volcanism starts on its edge - *Fuerteventura, Lanzarote, Gran Canaria, Tenerife* (Fig. 8).
7. Atoll Stage – Coral reefs surround an eroded volcano below sea level - *no example*.
8. Guyot Stage – volcano and atolls sink below the wave - *no example*.

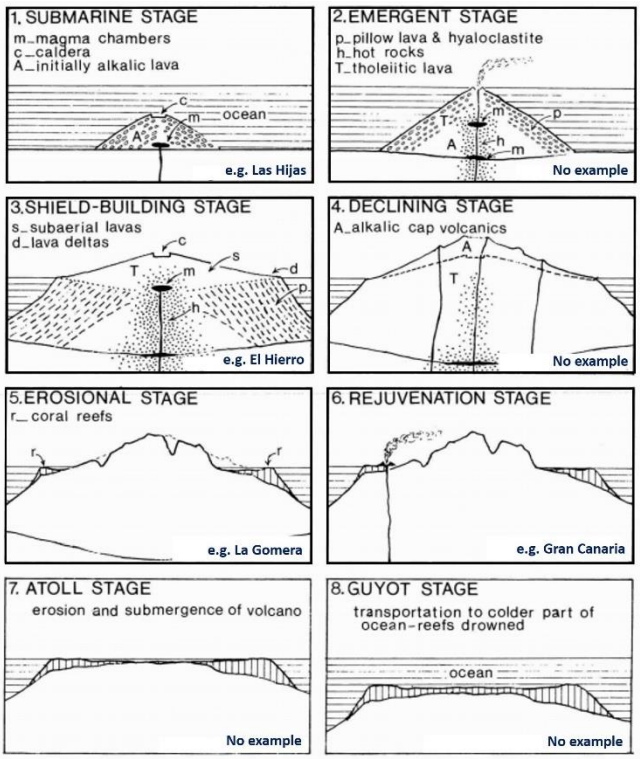

Figure 3: Formation stages of volcanic islands associated with "hot spots" (modified from Walker, 1990).

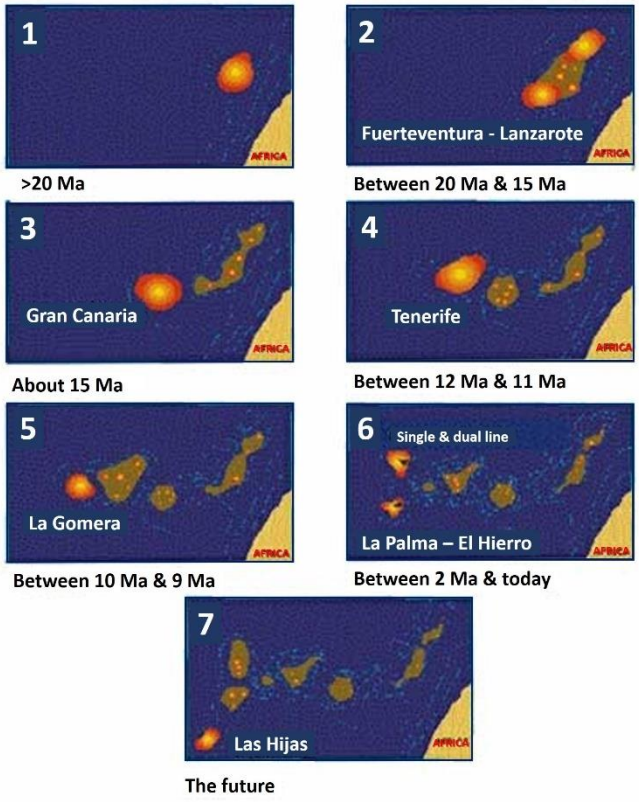

Figure 4: Genetic evolution of the Canary Islands from Miocene to present (Carracedo, 1999).

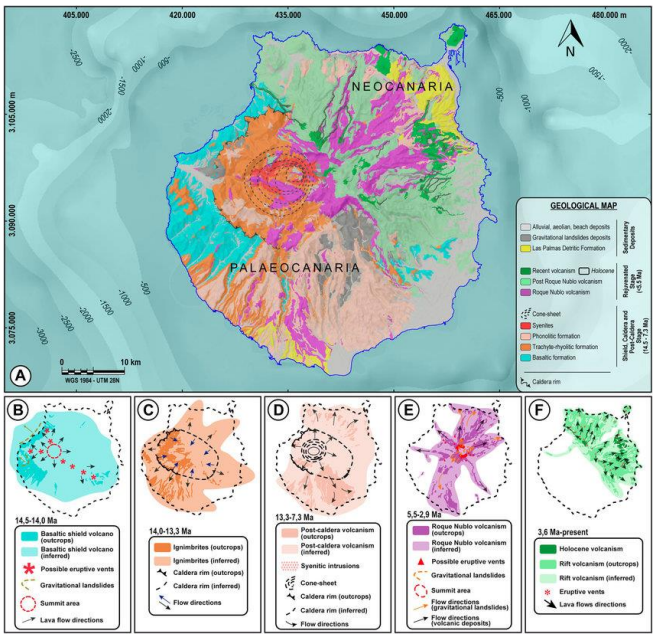

Figure 5: (A) Geological map of Gran Canaria (modified from Barrera & García Moral, 2011) with bathymetry data derived from Global Multi-Resolution Topography (GMRT) in GeoMap (Ryan et al., 2009). (B) Distribution of volcanic products corresponding to the initial stage of the shield building, marking both the possible rift alignments and the landslides that occurred at this stage. (C) Distribution of trachytic-rhyolitic deposits emitted in the first phase of caldera resurgence and delimitation of the Caldera de Tejeda. (D) Distribution of trachytic-phonolithic materials in the intra- and extra-calderic domains and intrusive magmatism. (E) After the volcanic quiescence stage, volcanic activity was reactivated with the formation of the stratovolcano Roque Nublo. (F) Distribution of Post-Roque Nublo volcanism linked firstly with a rift type NW-SE structure and later with dispersion of temporal space (B, C, D, E and F modified from Rodriguez-Gonzalez, 2009).

The volcanic rocks of the Canaries are typical of oceanic islands - alkali basalts, trachytes, nepheline rich rocks, andesites, feldspar rich lavas & rhyolites. Outcrops of plutonic rocks (syenites, gabbros) occur on Fuerteventura, La Gomera, La Palma (Fig. 6). There are shield volcanos, stratovolcanos, collapse caldera, cinder, scoria cone & tuff cones, tuffs, maars, lava flow fields, dykes, plugs.

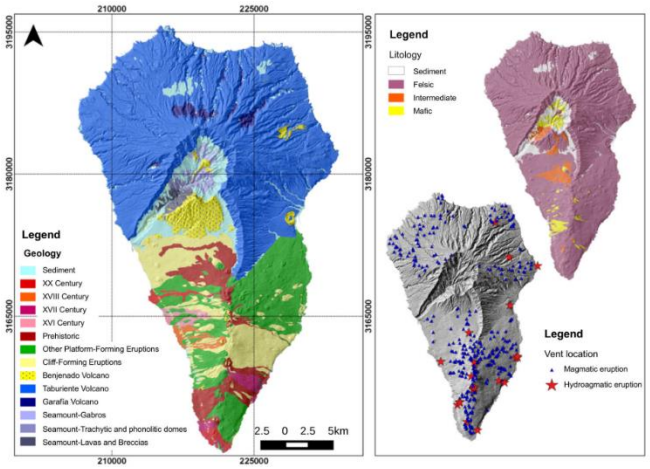

Figure 6: Geological map of La Palma (map on the left) according to Carracedo et al. (2001). The top-right map is a simplified version of the geological map showing the main lithological units. The bottom-right map represents the distribution of cinder cones (Marrero et al., 2019, Journal of Applied Volcanology).

El Hierro Geopark covers the whole of El Hierro Island (278km^2) and includes a marine area around it (about 312 km^2); a total area of 595 km^2.

El Hierro is the smallest of the larger Canary Islands. It is located in the southwest and is ~ 30km long. It is the last volcanic Island to emerge above sea level 1.2 Ma ago and is in the early stage of construction with the greatest density of volcanoes in the chain (>500 open craters + 300 recently covered by flows). The most recent volcanism was on 10 Oct 2011, when an underwater eruption occurred at a depth of 300m, 1.5km from the south coast; this underwater heritage is part of the Geopark. The instability of the young rocks means there are several giant landslides.

Figure 7: Ropy lava, El Hierro.

Figure 8: Mt Teide, Tenerife.

Figure 9: Eroded remains on Lanzarote.

The Geopark includes the whole island of Lanzarote, the islets La Graciosa, Montaña Clara, Roque del Este, Roque del Oeste y Alegranza, known as 'Chinijo Island'.

Lanzarote, (Fig. 9) known as "Island of the Volcanoes", has a large central oval and two appendices (north & south), called Famara and los Ajaches. The average height is modest by comparison with the other islands - the maximum elevation is Peñas de Chache at 670m.

Lanzarote and Chinijo Islands were built almost entirely of basalts in 3 volcanic stages, 1 submarine and 2 subaerial. The basement was constructed in the Oligocene of submarine lavas, plutonic rocks and sediment. During the Miocene-Pliocene and Pleistocene-Holocene there were 2 stages of volcanic activity separated by a gap of >2.5 Ma. Identified historical eruptions were in 1824 and Timanfaya (1730-1736) with volcanic vents along a very long fissure – this makes it one of the largest historic lava fields in the world.

Since the end of volcanic activity 4.0 Ma ago, La Gomera has been intensively eroded by gradual fluvial denudation and secondary rock failures.

La Palma (Fig. 6): the north of the island is dominated by the giant Caldera de Taburiente, from which the Cumbre Nueva and Cumbre Vieja ridges run south to the sea. The many historical eruptions include Tahuye/Tacande, 1585; Martin, 1646; San Antonio, 1677; Charco, 1712; Nambroque/San Juan/Las Manchas, 1949. The most recent volcanic eruption was that of Teneguia in 1971.

The Caldera de Taburiente, dominates the northern part of the island, 5km across, with an area of 30km^2, 2km deep. Formed 2 Ma ago, in a shield volcano ~20km diameter. However, the Caldera was not formed by volcanic activity, but by subsequent erosion. All historical eruptions on La Palma are associated with the Cumbre Vieja rift zone, with ~120 volcanic vents - it is possible to walk the Cumbre Vieja ridge, the so-called 'route of the volcanoes'.

Figure 10: La Palma

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4. Walker, G.P.L., 1990. Geology and volcanology of the Hawaiian Islands. Pacific Sc., 44, 315-347.
5. Rodriguez-Gonzalez, A. et al, 2018, The Holocene volcanism of Gran Canaria (Canary Islands, Spain). Journal Of Maps, Vol. 14, No. 2, 620–629

(additional comments by Mick Caulfield)

News

Penarth 'dinosaur footprints' investigated by museum

By Nick Hartley

BBC Wales News

26 August 2020

The "footprints" have been found on the beach in Penarth near Cardiff (Credit: BBC).

Newly revealed "footprints" thought to be Wales' latest dinosaur find are being investigated by researchers from the Natural History Museum. They are imprinted on rock at the beach in Penarth, Vale of Glamorgan.

Prehistoric finds have already been unearthed on the same section of coastline, including that of a distant cousin of Tyrannosaurus rex in 2014.

If confirmed, researchers said the discovery would be "really, really exciting".

The prints are embedded in a section of rock previously thought to contain other fossilised tracks of a prehistoric creature.

If confirmed, they would be the third set of dinosaur tracks in Wales and a huge boost to the area's archaeological heritage, according to palaeontologist Cindy Howells, of the National Museum of Wales.

Cindy Howells believes the potential discovery could be hugely significant.

"If these are indeed dinosaur footprints it's going to be really, really exciting," she said.

"The beds that we were seeing a few years back have been increased, there is even more of them now than when we first saw them a few weeks back.

"The new ones, they look better. They look more convincing to be dinosaur footprints. It's going to be incredibly exciting if they are proved."

The process for confirming their provenance will centre on several factors for researchers from the museum, including their regularity, stride pattern and the geological area in which they were found.

But one of the key indicators that may point towards the prints being genuine is the pattern of so-called "squelch marks".

"If you can't see the specific shape, quite often you'll look for other features, like the fact that you get one or two footprints in a left-right pattern," Ms Howells said.

"You also look for the size and shape of these holes and you'll look for things like the rounded rims you've got on these, [which] we call 'squelch marks'. So as the animal is putting its feet into the clay, into the mud, the mud is rolling up around the foot.

“It's a very rare thing to find new footprints."

Uncovering evidence of prehistoric life around the cliffs in the Vale of Glamorgan is not necessarily a surprise. Similar areas with footprints have already been verified further down the coast, near Barry and Porthcawl.

And in 2014, Wales' fossil-hunting community was treated to the discovery of Wales' first theropod skeleton at Lavernock Point by brothers Nick and Rob Hanigan.

The Welsh specimen discovered in 2014 was a juvenile, measuring about 2m from nose to tail tip

It is an area that is primed for further discovery too, according to geologist John Nudd, from the University of Manchester, due to its prevalence of eroding cliffs from the fossil-rich Jurassic period.

"There are huge numbers of fossils," he said. "Anywhere on the beach here you're bound to find bits of Jurassic rocks and you can't fail to find fossils. Every bit you look in almost has bits of fossils.

“There must be others. They will turn up one day."

The Natural History Museum declined to comment on the research.

Reference:

https://www.bbc.co.uk/news/uk-wales-53893502

Extraordinary fossil shows ancient marine reptile swallowing huge prey

New Scientist, LIFE 20 August 2020

By Michael Le Page

Image credit: JOHN SIBBICK / SCIENCE PHOTO LIBRARY

Don't bite off more than you can chew, goes the saying. But one ancient ichthyosaur did just that.

The 5m long marine reptile has the body of a 4m long animal in its stomach – but apparently injured its neck in the process of consuming the massive meal and died soon afterwards. The prey is the largest found in the stomach region of a fossil.

"It's the biggest ever," says Ryosuke Motani at the University of California, Davis.

Ichthyosaurs, which resemble dolphins, thrived from around 250 to 90 Ma ago. The shape of their teeth suggests that some of the larger specimens were top predators that tackled big prey, but there is little direct evidence of what they ate.

In 2010, a team including Motani found a large ichthyosaur fossil in a quarry in southwestern China, identified as belonging to the genus *Guizhouichthyosaurus*. It took another two years to remove the fossil and prepare it – which revealed a surprise.

"There was something in its stomach that was protruding," says Motani.

The researchers continued excavating the site – which has been turned into a museum – as they tried to identify the prey. Seven years on, they have finally published their conclusions.

The ichthyosaur, which lived during the Middle Triassic, took on another marine reptile called a thalattosaur. This lizard-shaped animal was nearly as long as the ichthyosaur, but much skinnier, says Motani. Its mass was probably just a sixth or an eighth that of the ichthyosaur.

At the time of the discovery, this thalattosaur was an unknown species. Since then, another individual has been found on the same site and the species named *Xinpusaurus xingyiensis*.

The ichthyosaur bit off the head and tail of the thalattosaur, probably by shaking it. It then swallowed the decapitated, tailless body whole. "It's a big chunk," says Motani.

But at some point, perhaps during the initial attack, the ichthyosaur injured its neck. This injury may have been made much worse while shaking and swallowing the thalattosaur.

"The neck was broken to the extent that it could not hold its skull," says Motani. "It could not breathe."

The reason the team think this is the mostly likely scenario is that while the head of the ichthyosaur separated slightly from the rest of the body where the neck was injured, the rest of the body is intact. There is no reason to think, say, that another predator attacked the ichthyosaur.

The body of the thalattosaur shows no sign of being broken down by digestive juices and its bitten off tail was found just 23m away in the same rock layer. That suggests the ichthyosaur died almost immediately after swallowing it.

The thalattosaur might have been unusually large, says Motani. The other *X. xingyiensis* individual and related species are smaller, just 1 to 2m long. Perhaps the ichthyosaur didn't realise quite how large its prey was.

There are modern examples of predators misjudging their prey, such as the dolphin suffocated by the giant octopus it tried to eat.

It is exceedingly rare for fossils to give us such a detailed glimpse into the lives and deaths of animals. Only a few other examples are known.

Journal reference: iScience, DOI: 10.1016/j.isci.2020.101347

Reference:
https://www.newscientist.com/article/2252470-extraordinary-fossil-shows-ancient-marine-reptile-swallowing-huge-prey/#ixzz6W9mU78v3

Thanks to John Stanley, FGS Member for this article.

Greenpeace documents North Sea methane leak caused by oil industry blow-out

by Greenpeace International

14 August 2020

Activists on board the Greenpeace ship Esperanza documented a large methane leak located in the British exclusive economic zone in the North Sea. Using an ROV (Remotely Operated Underwater Vehicle), they were able to film two of the gas-emitting craters at about 100m water depth on the seafloor, which are between 50m and 15m in diameter and up to 20m and 9m deep, respectively. The leak was caused by a major blow-out during an oil drilling operation 30 years ago (in UKCS Block 20/4a) and is still emitting methane.

“Like many places across the North Sea, climate-destroying methane has been leaking here for decades, yet the oil and gas industry, instead of closing the leak and monitoring it, continues to drill holes in the sea bed, while decision-makers turn a blind eye. We are in the middle of a climate crisis fueling fires, floods and inequality across the world and this leaking methane is a climate change multiplier!” said Dr Sandra Schöttner, marine biologist and oceans campaigner with Greenpeace Germany, who is leading the scientific work on board the Esperanza.

In 1990, the Swedish Stena Drilling Company, on behalf of Mobil North Sea (now Exxon Mobil), accidentally tapped a gas pocket with the drilling rig High Seas Driller while searching for oil, causing a blowout that resulted in several craters on the seabed. An international team of scientists had previously been to this site and estimated in 2015 that up to 90 litres of methane per second were being released. The leaking borehole has been returned by Exxon Mobil to the British state who in 2000 determined that further monitoring was not required, believing that the reservoir would soon be depleted. But 30 years later the greenhouse gas keeps escaping into the atmosphere.

According to a recent independent study, an estimated total of 8,000–30,000 tonnes of methane per year escape from gas leaks from more than 15,000 boreholes in the North Sea – adding to the 72,000 tonnes of methane that normal operations of platforms in the North Sea release every year.

The Greenpeace ships Esperanza and Rainbow Warrior are on a month-long documentation and peaceful protest tour to document the impacts the extraction of fossil fuels is making in the North Sea. Teams on board will gather evidence of the extreme industrialisation of the region by the oil and gas industry, which has been polluting the ocean, fuelling the climate crisis, and exacerbating inequality with its “business as usual” operation model.

“The oil and gas industry has been fuelling the climate crisis and polluting our oceans for decades. This industry does not belong in the new green world we need to build after the pandemic. We need a rapid change to renewable energies and a just shift of fossil fuel workers to industries with a future. We need governments to bail out the climate and workers, not the polluters,” Schöttner added.

Reference:

1. https://www.greenpeace.org/international/press-release/44638/greenpeace-documents-north-sea-methane-leak-caused-by-oil-industry-blow-out/
2. https://expronews.com/wells/expert-would-like-to-see-more-evidence-on-shallow-gas-origin-of-gas-leaks-in-north-sea/

Dwarf planet Ceres is an 'ocean world' with sea water beneath surface, mission finds

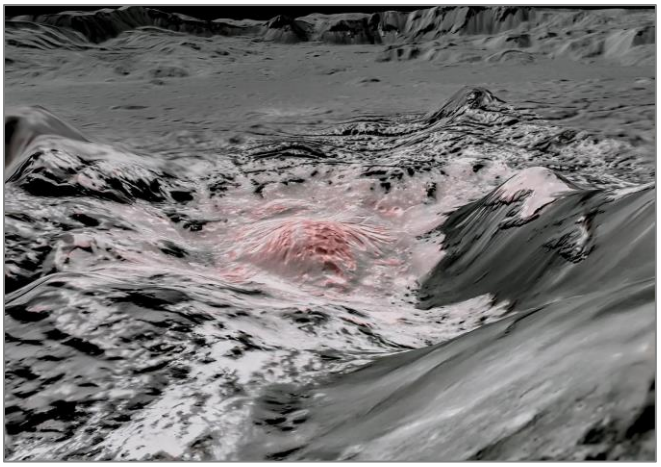
Ceres, believed to be a barren space rock, has an ‘extensive reservoir’ of brine beneath its surface, images show

Agence France-Presse

10 August 2020

The dwarf planet Ceres – long believed to be a barren space rock – is an ocean world with reservoirs of sea water beneath its surface, the results of a major exploration mission showed on Monday.

Ceres is the largest object in the asteroid belt between Mars and Jupiter, massive enough to be shaped by its gravity, enabling the Nasa Dawn spacecraft to capture high-resolution images of its surface.



Mosaic image using false colour to highlight the recently exposed brine, or salty liquids, that were pushed up from a deep reservoir under the crust of the dwarf planet Ceres.
(Photograph: Nasa/Reuters)

Now a team of scientists from the United States and Europe have analysed images relayed from the orbiter, captured about 35km from the asteroid.

They focused on the 20 Ma Occator crater and determined that there is an "extensive reservoir" of brine beneath its surface.

Several studies published in the journals *Nature Astronomy*, *Nature Geoscience* and *Nature Communications* also shed further light on the dwarf planet, which was discovered by the Italian polymath Giuseppe Piazzi in 1801.

Using infrared imaging, one team discovered the presence of the compound hydrohalite – a material common in sea ice but which until now had never been observed beyond Earth.

Maria Cristina De Sanctis, from Rome's Istituto Nazionale di Astrofisica said hydrohalite was a clear sign Ceres used to have sea water.

"We can now say that Ceres is a sort of ocean world, as are some of Saturn's and Jupiter's moons," she told AFP.

The team said the salt deposits looked like they had built up within the last 2 Ma – the blink of an eye in space time. This suggests that the brine may still be ascending from the planet's interior, something De Sanctis said could have profound implications in future studies.

"The material found on Ceres is extremely important in terms of astrobiology," she said. "We know that these minerals are all essential for the emergence of life."

Writing in an accompanying comment article, Julie Castillo-Rogez, from the California Institute of Technology's Jet Propulsion Laboratory, said the discovery of hydrohalite was a "smoking gun" for ongoing water activity.

"That material is unstable on Ceres' surface, and hence must have been emplaced very recently," she said.

In a separate paper, US-based researchers analysed images of the Occator crater and found that its mounds and hills may have formed when water ejected by the impact of a meteor froze on the surface.

The authors said their findings showed that such water freezing processes "extend beyond Earth and Mars and have been active on Ceres in the geologically recent past".

Reference:

https://www.theguardian.com/science/2020/aug/10/planet-ceres-ocean-world-sea-water-beneath-surface

New dinosaur related to T. rex discovered on Isle of Wight

12 August 2020

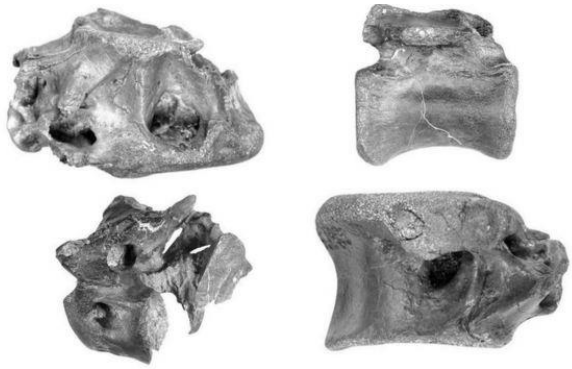
A new species of dinosaur has been discovered on the Isle of Wight. Palaeontologists at the University of Southampton believe four bones found at Shanklin last year belong to a new species of theropod dinosaur. It lived in the Cretaceous period, 115 Ma ago, and is estimated to have been up to 4m long.

It has been named *Vectaerovenator inopinatus* and belongs to the group of dinosaurs that includes Tyrannosaurus rex and modern-day birds.

The name refers to the large air spaces found in some of the bones - from the neck, back and tail of the creature - which is one of the traits that helped the scientists identify its theropod origins.

These air sacs, also seen in modern birds, were extensions of the lung, and it is likely they "helped fuel an efficient breathing system while also making the skeleton lighter", the University of Southampton said.

The fossils were found in three separate discoveries in 2019 and handed in to the nearby



The four bones were found in three separate discoveries in 2019. (Image: UNIVERSITY OF SOUTHAMPTON)

Dinosaur Isle Museum at Sandown, where they are being displayed.

Robin Ward, a regular fossil hunter from Stratford-upon-Avon, was visiting the Isle of Wight with his family when they made their discovery.

"The joy of finding the bones we discovered was absolutely fantastic," he said.

James Lockyer, from Spalding, Lincolnshire, was also visiting the island when he found another of the bones.

"It looked different from marine reptile vertebrae I have come across in the past," he said. "I was searching a spot at Shanklin and had been told, and read, that I wouldn't find much there. However, I always make sure I search the areas others do not, and on this occasion it paid off."

Paul Farrell, from Ryde, added: "I was walking along the beach, kicking stones and came across what looked like a bone from a dinosaur. I was really shocked to find out it could be a new species."

'Delicate skeleton'

Chris Barker, who led the University of Southampton study, said: "We were struck by just how hollow this animal was - it's riddled with air spaces. Parts of its skeleton must have been rather delicate.

"The record of theropod dinosaurs from the 'mid' Cretaceous period in Europe isn't that great, so it's been really exciting to be able to increase our understanding of the diversity of dinosaur species from this time.

"You don't usually find dinosaurs in the deposits at Shanklin as they were laid down in a marine habitat. You're much more likely to find fossil oysters or driftwood, so this is a rare find indeed."

It is likely that the Vectaerovenator lived in an area just north of where its remains were found, with the carcass having washed out into the shallow sea nearby.

The university findings are due to be published in the journal *Papers in Palaeontology* and co-authored by those who discovered the fossils.

Reference:

https://www.bbc.co.uk/news/uk-england-hampshire-53738762

Volcanic carbon dioxide emissions helped trigger Triassic climate change

Study offers sobering warning on the impact of rising carbon dioxide levels in the atmosphere

17 April 2020

Article taken from http://www.geologypage.com/

A new study finds volcanic activity played a direct role in triggering extreme climate change at the end of the Triassic period 201 Ma ago, wiping out almost half of all existing species. The amount of carbon dioxide released into the atmosphere from these volcanic eruptions is comparable to the amount of CO^2 expected to be produced by all human activity in the 21st Century.

The end-Triassic extinction has long been thought to have been caused by dramatic climate change and rising sea levels. While there was large-scale volcanic activity at the time, known as the Central Atlantic Magmatic Province eruptions, the role it played in directly contributing to the extinction event is debated. In a study for *Nature Communications*, an international team of researchers, including McGill professor Don Baker, found evidence of bubbles of carbon dioxide trapped in volcanic rocks dating to the end of the Triassic, supporting the theory that volcanic activity contributed to the devastating climate change believed to cause the mass extinction.

The researchers suggest that the end-Triassic environmental changes driven by volcanic carbon dioxide emissions may have been similar to those predicted for the near future. By analysing tiny gas exsolution bubbles preserved within the rocks, the team estimates that the amount of carbon emissions released in a single eruption —

comparable to 100,000km^3 of lava spewed over 500 years — is likely equivalent to the total produced by all human activity during the 21st Century, assuming a 2°C rise in global temperature above pre-industrial levels.

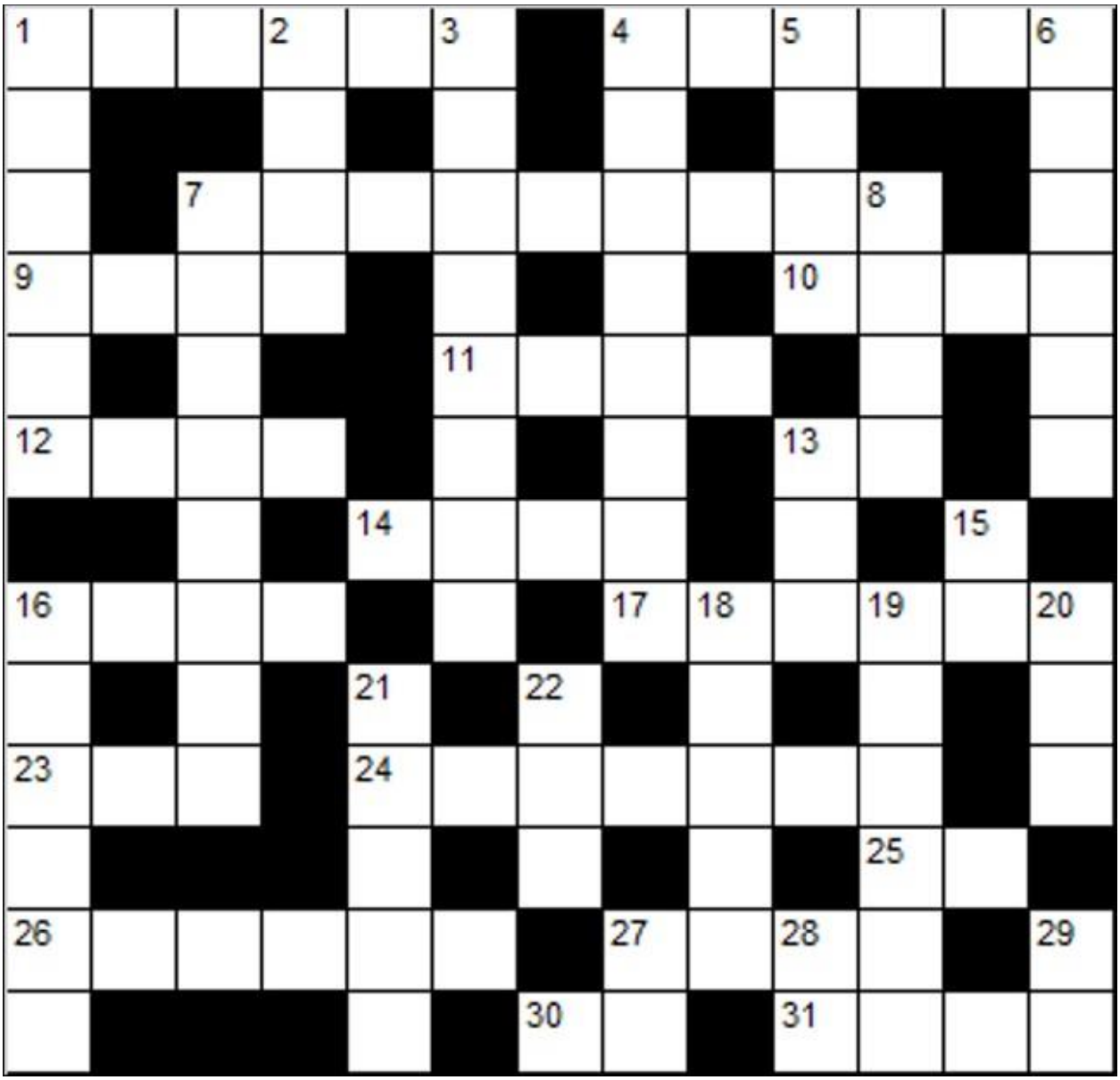
"Although we cannot precisely determine the total amount of carbon dioxide released into the atmosphere when these volcanoes erupted, the correlation between this natural injection of carbon dioxide and the end-Triassic extinction should be a warning to us. Even a slight possibility that the carbon dioxide we are now putting into the atmosphere could cause a major extinction event is enough to make me worried," says professor of earth and planetary sciences Don Baker.

Reference:

Manfredo Capriolo, Andrea Marzoli, László E. Aradi, Sara Callegaro, Jacopo Dal Corso, Robert J. Newton, Benjamin J. W. Mills, Paul B. Wignall, Omar Bartoli, Don R. Baker, Nasrrddine Youbi, Laurent Remusat, Richard Spiess, Csaba Szabó. Deep CO2 in the end-Triassic Central Atlantic Magmatic Province. Nature Communications, 2020; 11 (1) DOI: 10.1038/s41467-020-15325-6

Note: The above post is reprinted from materials provided by McGill University.

From the archives … Geological Crossword



Note * denotes a chemical symbol, e.g. Au for gold.

ACROSS

1. Igneous rock, normally less than 50% silica (6)
4. Radial partition in cup of rugose coral (6)
7. Flint and chert are this type of rock (9)
9. Low hill of drifted sand *(anagram)* (4)
10. Form of agate containing green coloured mineral of iron or chrome (4)
11. A richly fossiliferous ____ delights a field trip! (4)
12. Some trilobites had large compound ones (4)
13. Blocky lava (2)
14. Clastic sediment of fine particles (4)
16. Crystals made up of two crystals of the same mineral differently orientated (4)
17. Between the Palaeocene and the Oligocene (6)
23. ___-Cambrian time is eight and a half times as long as all subsequent time (3)
24. The Mesozoic era was their 'Age' (7)
25. *Not in a stable free state in nature, but abundant compounds such as calcite and gypsum (2)
26. Palaeozoic corals, having bilateral symmetry; solitary or colonial (6)
27. Trade name for diamonds too flawed or poor in colour for jewellery (4)
30. __gradation lowers the neighbourhood! (2)
31. Vertical inclination of vein or fault (4)

DOWN

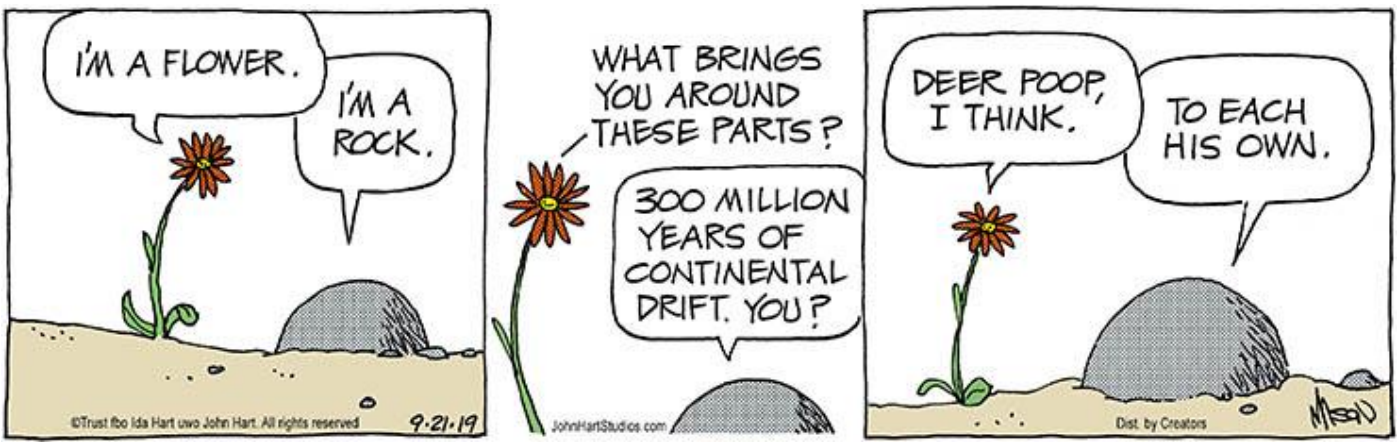
1. Sphalerite is often called zinc _____ (6)
2. Describes igneous rocks rich in silica (4)
3. About 250 Ma to 200 Ma (8)
4. Massive talc (soapstone) (8)
5. Graphite used to be called ____bago (4)
6. The blue or common _____ *(Mytilius edulis L.)* form dense colonies in shallow, saline water (6)
7. Crystalline variety of gypsum (8)
8. A ____ lake contains large amounts of salts of sodium and magnesium sulphates (4)
13. Mountains or islands set in a great curve (3)
15. *Bluish-white, brittle metal of crystalline structure melting at 520°C (2)
16. Collective term for all fragmentary volcanic material blown from a vent through the air (6)
18. The ____cene epoch saw a rise of mammals (4)
19. A virtual synonym of 16 down (6)
20. Point on the Earth's surface directly above the focus of an earthquake is the ___centre (3)
21. The common form of crystalline quartz is a hexagonal _____ (5)
22. So-called "man___s" appeared in Africa at the close of the Pliocene (3)
27. *The emerald element (2)
28. *Silvery white metal, in native platinum and in copper ores of Sudbury, Ontario (2)
29. *Not however a constituent of 7 down! (2)

Reference

FGS Newsletter Vol.1 No.14 September 1978

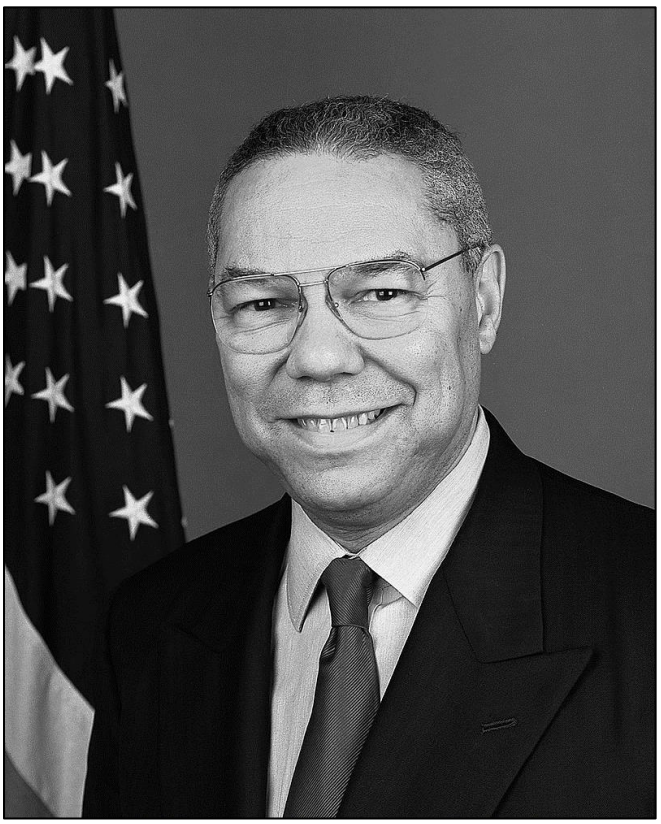
Answers on page 21.

Cartoon Corner



https://johnhartstudios.com/bc/2019/09/

A few interesting people who trained as geologists

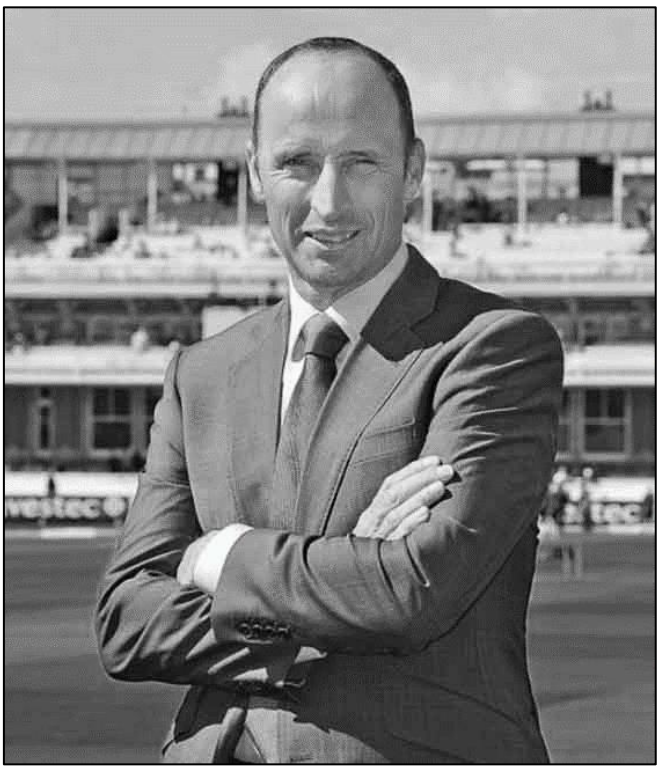


Colin Luther Powell (born April 5, 1937) is an American politician, diplomat and retired 4-star general who served as the 65th United States Secretary of State from 2001 to 2005. A member of the Republican Party, Powell was the first African American Secretary of State. Powell served as the 16th United States National Security Advisor from 1987 to 1989 and as the 12th Chairman of the Joint Chiefs of Staff from 1989 to 1993.

Powell was born in New York City in 1937 and was raised in the South Bronx. His parents, Luther and Maud Powell, immigrated to the United States from Jamaica. Powell was educated in the New York City public schools, graduating from the City College of New York (CCNY), where he earned a bachelor's degree in **Geology**. He also participated in ROTC at CCNY and received a commission as an Army second lieutenant upon graduation in June 1958. Powell was a professional soldier for 35 years, during which time he held many command and staff positions and rose to the rank of 4-star general. He was Commander of the U.S. Army Forces Command in 1989.

Reference:

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



Nasser Hussain OBE (born 28 March 1968) is a British cricket commentator and former cricketer who captained the England cricket team between 1999 and 2003, with his overall international career extending from 1990 to 2004.

A pugnacious right-handed batsman, Hussain scored over 30,000 runs from more than 650 matches across all first-class and List-A cricket, including 62 centuries. His highest Test score of 207, scored in the first Test of the 1997 Ashes at Edgbaston, was described by Wisden as "touched by genius".

He played 96 Test matches and 88 One Day International games in total. In Tests he scored 5,764 runs, and he took 67 catches, fielding predominantly in the second slip and gully.

Born in Madras in India, Hussain was led into cricket by his father, and his family moved to England when Hussain was a young child.

Hussain studied **Natural Sciences** at the University of Durham – a strong cricketing university – where he belonged to the College of St Hild and St Bede. He graduated in 1989 with a Bachelor of Science (BSc) degree.

Reference:

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

Herbert Clark Hoover (August 10, 1874 – October 20, 1964) was an American engineer, businessman, and politician who served as the 31st president of the United States from 1929 to 1933. A member of the Republican Party, he held office during the onset of the Great Depression.

Hoover entered Stanford University in 1891, its inaugural year, despite failing all the entrance exams except mathematics. During his freshman year, he switched his major from mechanical engineering to **Geology** after working for John Casper Branner, the chair of Stanford's geology department. Hoover was a mediocre student, and he spent much of his time working in various part-time jobs or participating in campus activities. Though he was initially shy among fellow students, Hoover won election as student treasurer and became known for his distaste for fraternities and sororities. During the summers before and after his senior year, Hoover interned under economic geologist Waldemar Lindgren of the United States Geological Survey; these experiences convinced Hoover to pursue a career as a mining geologist and he graduated from Stanford in 1895.

Reference:

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

Kathryn Dwyer Sullivan (born October 3, 1951) is an American geologist and a former NASA astronaut. A crew member on three Space Shuttle missions, she was the first American woman to walk in space on October 11, 1984. On June 7, 2020, she became the first woman to dive to the Challenger Deep in the Mariana Trench, the deepest part of the Earth's oceans. She was Under Secretary of Commerce for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration after being confirmed by the U.S. Senate on March 6, 2014. Sullivan's tenure ended on January 20, 2017 with the swearing in of President Donald Trump. Following completion of her service at NOAA, she was designated as the 2017 Charles A. Lindbergh Chair of Aerospace History at the Smithsonian Institution's National Air and Space Museum and has also served as a Senior Fellow at the Potomac Institute for Policy Studies.

Sullivan was born in Paterson, New Jersey. She is a 1969 graduate of William Howard Taft High School in the Woodland Hills district of Los Angeles, California. She was awarded a Bachelor of Science degree in **Earth Sciences** from the University of California, Santa Cruz in 1973, and a Ph.D. in **Geology** from Dalhousie University in 1978.

Reference:

https://en.wikipedia.org/wiki/Kathryn_D._Sullivan

Geological Crossword: Solution

B	A	S	A	L	T	■	S	E	P	T	U	M
L	■	■	C	■	R	■	T	■	L	■	■	U
E	■	S	I	L	I	C	E	O	U	S	■	S
N	U	E	D	■	A	■	A	■	M	O	S	S
D	■	L	■	■	S	I	T	E	■	D	■	E
E	Y	E	S	■	S	■	I	■	A	A	■	L
■	■	N	■	S	I	L	T	■	R	■	Z	■
T	W	I	N	■	C	■	E	O	C	E	N	E
E	■	T	■	P	■	A	■	L	■	J	■	P
P	R	E	■	R	E	P	T	I	L	E	■	I
H	■	■	■	I	■	E	■	G	■	C	A	■
R	U	G	O	S	E	■	B	O	R	T	■	S
A	■	■	■	M	■	D	E	■	H	A	D	E

News

Newly proven Zechstein source rock further de-risks Mid North Sea High petroleum play

In an article published in *Marine and Petroleum Geology*, a team of researchers prove the existence of a mature Zechstein source rock in the UK North Sea

25 August 2020

By HENK KOMBRINK, expronews.com

It's autumn 2018 and Jon Gluyas from Durham University and Mirek Słowakiewicz from Warsaw University are preparing for a visit to the Boulby mine in Yorkshire to look at some oil staining reported in the interval of polyhalite that is being mined for fertilisers. Just before they are heading off, they get a phone call from the mining company saying that an active seep had been hit and oil is flowing out of the roof of the gallery.

"This was a once in a life-time opportunity," Jon recalls, "as it presented us with the opportunity to sample the fresh oil for further analysis." Based on the biomarker study they carried out using the sampled oil, the team could subsequently rule out that the oil was derived from established source rocks in the area such as Upper Carboniferous Namurian black shales and coals or Upper Jurassic Kimmeridge Clay mudstones.

"The biomarkers clearly point to a restricted carbonate-evaporite depositional environment, which strongly resembles the Upper Permian Kirkham Abbey Formation," Mirek adds. The Kirkham Abbey Formation is the onshore equivalent of the Hauptdolomit, which is the main carbonate of the second Zechstein evaporitic cycle in the Southern North Sea. It was deposited mainly on a carbonate ramp and associated slope, with more restricted conditions developing in lagoonal settings.

The Hauptdolomit (or Main Dolomite) is a well-known source rock in Germany and Poland – the eastern parts of the Southern Permian Basin (SPB), but to date it had never been proven in the western part of the SPB.

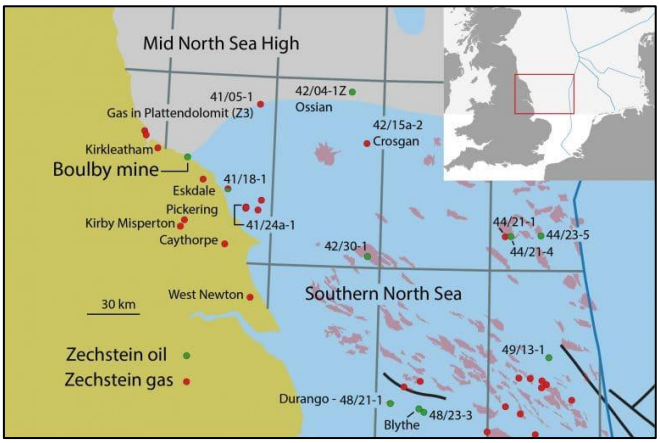


Figure 1: Zechstein oil and gas finds in the Southern North Sea. No distinction was made between fields, discoveries, extended hydrocarbon columns or shows. Source: OGA SNS Regional Maps.

An interesting aspect of the oil find in the Boulby mine is the fact that the oil must have somehow migrated through halite. Whereas halite is generally believed to be the ultimate seal, if the oil is from the Kirkham Abbey Formation, which is around 200m deeper than the mine, the oil must have been migrating upward through an interval of salt. The authors believe that transient faults form a conduit, i.e. faults that heal quickly through the mobility of the salt.

Relevance for Mid North Sea High prospectivity

Given recent developments around the Mid North Sea High, the conclusion that a working Zechstein source rock is present in this part of the Southern Permian Basin, is good news. Although oil and gas have previously been found in the Zechstein of the

Southern North Sea (Fig. 1), so far it was not clearly demonstrated that it could have been sourced from the Zechstein itself.

Only last year, ONE Dyas completed wells 42/04-1 and 42/04-1Z on the Ossian (Zechstein) and Darrach (Carboniferous) prospects. The 42/04-1 well proved oil in 44.2m gross Zechstein limestone, with the Carboniferous targets believed to be water-wet. The sidetrack proved oil in 3.7m gross Zechstein reservoir. The well flowed a maximum 3,500 barrels per day (bpd) with a 79% water cut. 62 tonnes of oil and 15,000 Sm^3 gas were recovered during clean-up but the test was abandoned without completing the planned extended well test (EWT). Operatorship of the licence has since been transferred to Spirit Energy.

In addition, oil and gas were found in the Kirkham Abbey Formation (Hauptdolomit) in the West Newton onshore well in 2019, drilled by Rathlin Energy. The company is now actively working on further appraising the discovery and handed in plans to drill two more wells.

Other companies such as Egdon Resources, Ardent Oil and Draupner Energy are also actively pursuing the Zechstein play in the area, which further adds to importance of this finding.

Although the Southern North Sea for many people is a synonym for the gas basin, one of the first exploration wells drilled in the area encountered oil in Zechstein carbonates: 48/22-1 (Blythe in Fig. 1), drilled by Burmah Oil in 1966. Good shows were observed in the Hauptdolomit interval and the interval tested 2000 bpd. However, production decreased during the test and the conclusion was drawn that the accumulation was not viable. The well nowadays underlies the Dudgeon windfarm. In 1967, well 48/21-1 also tested oil in the Zechstein.

Reference:

1. https://expronews.com/exploration/newly-proven-zechstein-source-rock-further-de-risks-mid-north-sea-high-petroleum-play/
2. A new and working petroleum source rock on the UK Continental Shelf (Upper Permian, offshore Yorkshire) – Mirosław Słowakiewicz, Jon Gluyas, Adam Kowalski, Thomas Edwards, Samuel Słama, Mike Mawson, Maurice E. Tucker, Paul Scovell, Israel Polonio. https://doi.org/10.1016/j.marpetgeo.2020.104605

Trilobites living 429 million years ago had eyes like modern insects

New Scientist, LIFE 13 August 2020

By Michael Marshall

An animal that lived 429 Ma ago had compound eyes almost identical to those of modern insects like bees and dragonflies. The finding implies that the compound eye evolved very early in the history of animals.

“I am quite sure that its roots lie far back in the Precambrian somewhere,” says Brigitte Schoenemann at the University of Cologne in Germany. The Cambrian period, when many of the major animal groups appeared, began about 540 Ma ago.

With Euan Clarkson at the University of Edinburgh, Schoenemann re-examined a fossil of a 1.2cm long animal called *Aulacopleura koninckii*. It was a trilobite: a marine animal a bit like a woodlouse, related to insects and shrimp.

Trilobites dominated the oceans for 300 Ma, beginning about 520 Ma ago. The last ones died out 252 Ma ago. Studying trilobites offers clues to the origins of related groups like insects and crustaceans.

Schoenemann and Clarkson found that one *A. koninckii* specimen still had its left eye. It was a compound eye like those of modern insects, which contains many tiny receptors called ommatidia, each with light-sensitive cells and a lens to focus light. Each ommatidium contributes a single “pixel” to create a mosaic-like image.

The internal structures of its ommatidia were almost identical to those of modern insects. The only difference was that they weren’t quite as densely packed into the eye, probably reducing the amount of detail the animal could see. But to all intents and purposes, it was a modern compound eye, says Schoenemann.

The oldest known compound eye with preserved internal structures belonged to another trilobite, which lived in the early Cambrian over 500 Ma ago; Schoenemann’s team described it in 2017. That eye was more primitive though. “There were no distinct lenses,” says Schoenemann. The ommatidia were topped with “a kind of translucent window, without any capacity of focusing”. Also, the eye only had about 100 ommatidia.

It isn't clear how long compound eyes existed before the Cambrian trilobite, says Schoenemann. Such eyes may have appeared only once, in the earliest ancestors of insects and trilobites.

Reference:

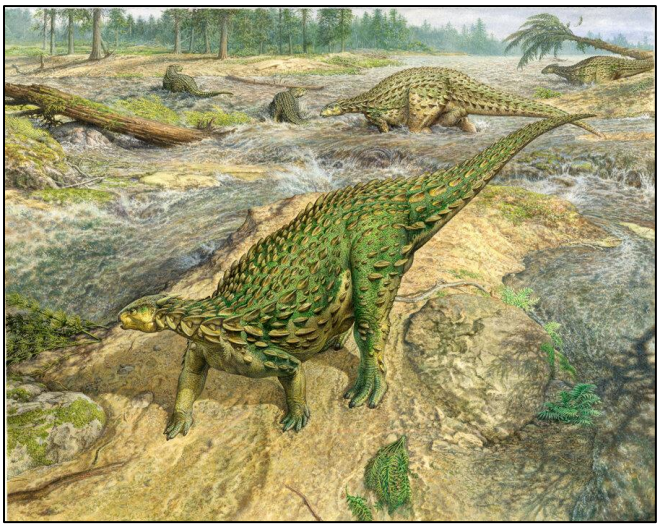
1. Journal reference: Scientific Reports, DOI: 10.1038/s41598-020-69219-0
2. https://www.newscientist.com/article/2251851-trilobites-living-429-million-years-ago-had-eyes-like-modern-insects/#ixzz6WKBDTogY

Thanks to John Stanley, FGS Member for this article.

First complete dinosaur skeleton ever found is ready for its closeup at last

by University of Cambridge

27 August 2020



The first complete dinosaur skeleton Scelidosaurus. Image credit: John Sibbick

The first complete dinosaur skeleton ever identified has finally been studied in detail and found its place in the dinosaur family tree, completing a project that began more than a century and a half ago.

The skeleton of this dinosaur, called Scelidosaurus, was collected more than 160 years ago on west Dorset's Jurassic Coast. The rocks in which it was fossilised are around 193 Ma, close to the dawn of the Age of Dinosaurs.

This remarkable specimen — the first complete dinosaur skeleton ever recovered — was sent to Richard Owen at the British Museum, the man who invented the word dinosaur.

So, what did Owen do with this find? He published two short papers on its anatomy, but many details were left unrecorded. Owen did not reconstruct the animal as it might have appeared in life and made no attempt to understand its relationship to other known dinosaurs of the time. In short, he 're-buried' it in the literature of the time, and so it has remained ever since: known, yet obscure and misunderstood.

Over the past three years, Dr. David Norman from Cambridge's Department of Earth Sciences has been working to finish the work which Owen started, preparing a detailed description and biological analysis of the skeleton of Scelidosaurus, the original of which is stored at the Natural History Museum in London, with other specimens at Bristol City Museum and the Sedgwick Museum, Cambridge.

The results of Norman's work, published as four separate studies in the *Zoological Journal of the Linnean Society of London*, not only reconstruct what Scelidosaurus looked like in life, but reveal that it was an early ancestor of ankylosaurs, the armour-plated 'tanks' of the Late Cretaceous Period.

For more than a century, dinosaurs were primarily classified according to the shape of their hip bones: they were either saurischians ('lizard-hipped') or ornithischians ('bird-hipped').

However, in 2017, Norman and his former Ph.D. students Matthew Baron and Paul Barrett argued that these dinosaur family groupings needed to be rearranged, re-defined and re-named. In a study published in *Nature*, the researchers suggested that bird-hipped dinosaurs and lizard-hipped dinosaurs such as Tyrannosaurus evolved from a common ancestor, potentially overturning more than a century of theory about the evolutionary history of dinosaurs.

Another fact that emerged from their work on dinosaur relationships was that the earliest known ornithischians first appeared in the Early Jurassic Period. "Scelidosaurus is just such a dinosaur and represents a species that appeared at, or close to, the evolutionary 'birth' of the Ornithischia," said Norman, who is a Fellow of Christ's College, Cambridge. "Given that context, what was actually known of Scelidosaurus? The answer is remarkably little!"

Norman has now completed a study of all known material attributable to Scelidosaurus and his research has revealed many firsts.

"Nobody knew that the skull had horns on its back edge," said Norman. "It had several bones that have never been recognised in any other dinosaur. It's also clear from the rough texturing of the skull bones that it was, in life, covered by hardened horny scutes, a little bit like the scutes on the surface of the skulls of living turtles. In fact, its entire body was protected by skin that anchored an array of stud-like bony spikes and plates."

Now that its anatomy is understood, it is possible to examine where Scelidosaurus sits in the dinosaur family tree. It had been regarded for many decades as an early member of the group that included the stegosaurs, including Stegosaurus with its huge bony plates along its spine and a spiky tail, and ankylosaurs, the armour-plated 'tanks' of the dinosaur era, but that was based on a poor understanding of the anatomy of Scelidosaurus. Now it seems that Scelidosaurus is an ancestor of the ankylosaurs alone.

"It is unfortunate that such an important dinosaur, discovered at such a critical time in the early study of dinosaurs, was never properly described," said Norman. "It has now - at last! - been described in detail and provides many new and unexpected insights concerning the biology of early dinosaurs and their underlying relationships. It seems a shame that the work was not done earlier but, as they say, better late than never."

Reference:

1. David B Norman, Scelidosaurus harrisonii (Dinosauria: Ornithischia) from the Early Jurassic of Dorset, England: biology and phylogenetic relationships, Zoological Journal of the Linnean Society (2020). DOI: 10.1093/zoolinnean/zlaa061
2. https://phys.org/news/2020-08-dinosaur-skeleton-ready-closeup.html?fbclid=IwAR1HrmjNTk3lPYyl-i2Is2KRZ7ZiD3oWuhTdmKUIk2R-FeUvczsL57UrN1g

It Happened in September

1 September 1923: Great Kanto Earthquake and Great Tokyo Fire, Japan

The Great Kantō earthquake struck the Kantō Plain on the main Japanese island of Honshū at 11:58:44 JST on Saturday, September 1, 1923. Varied accounts indicate the duration of the earthquake was between four and ten minutes. Extensive firestorms and even a fire tornado added to the death toll.

The earthquake had a magnitude of 7.9 on the moment magnitude scale (Mw), with its focus deep beneath Izu Ōshima Island in Sagami Bay.

This earthquake devastated Tokyo, the port city of Yokohama, and the surrounding prefectures of Chiba, Kanagawa, and Shizuoka, and caused widespread damage throughout the Kantō region.

Estimated casualties totalled about 142,800 deaths, including about 40,000 who went missing and were presumed dead.

The damage from this natural disaster was one of the greatest sustained by Imperial Japan. In 1960, the government declared September 1, on the 37th anniversary of the quake, as an annual "Disaster Prevention Day".

https://en.wikipedia.org/wiki/1923_Great_Kant%C5%8D_earthquake

2 September 1666: The Great Fire of London

The Great Fire of London began in a bakery in Pudding Lane near the Tower. Over the next three days more than 13,000 houses were destroyed, although only six lives were believed lost.

30 September 2009: Sumatra earthquake

The first of the 2009 Sumatra earthquakes occurred on 30 September off the coast of Sumatra, Indonesia with a moment magnitude of 7.6 at 17:16:10 local time. Government and local authorities confirmed 1,115 dead, 1,214 severely injured and 1,688 slightly injured.

Did you know?...

- The deepest borehole in the word is the Z-44 Chayvo well in Russia. Drilled in 2012 by Exxon Neftegas it achieves a depth of 12,376m (40,502 ft). That's 15 times the height of the Burg Khalifa skyscraper in Dubai and higher than a cruising aeroplane.
- The Eiffel Tower can be 15cm taller during the summer!

A Glimpse from the 1950s

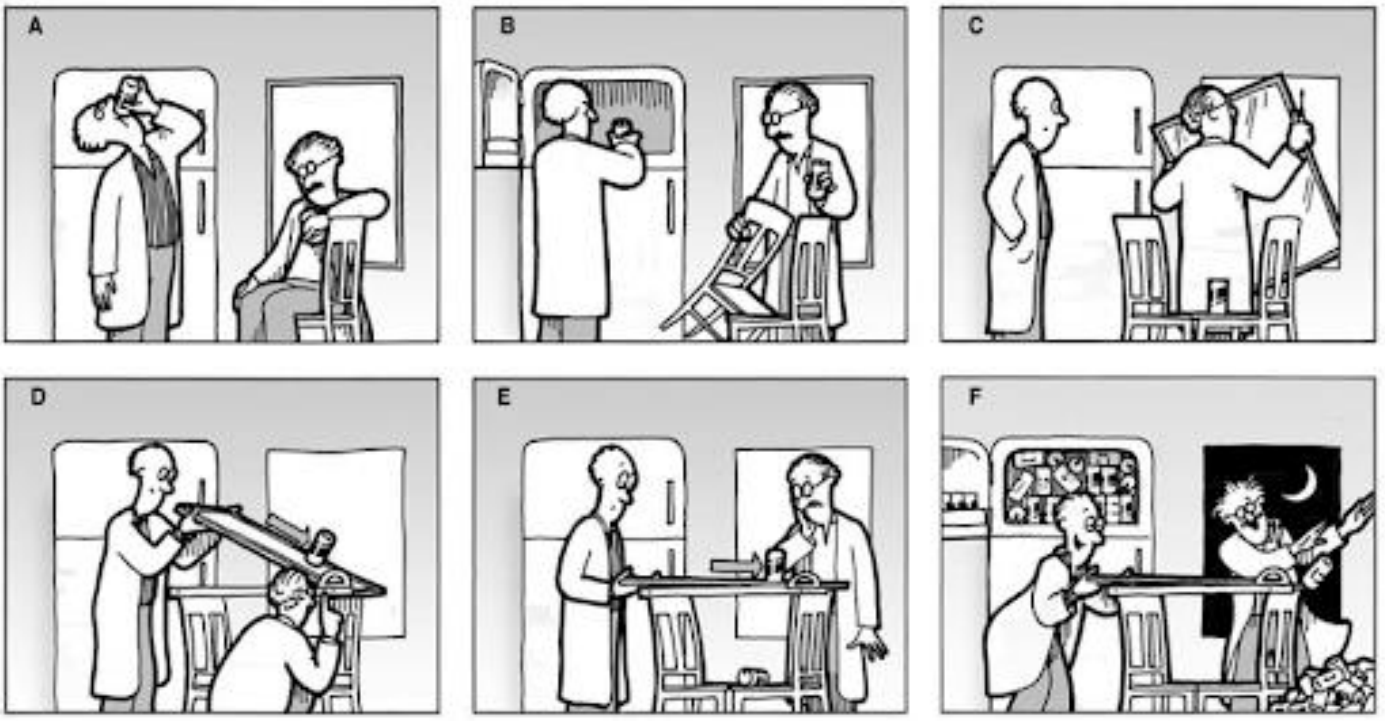
"The Role of Fluid Pressure in Mechanics of Overthrust Faulting" by Hubbert and Rubey … a "ground-breaking" article.

This article in the 1950s explained how fluid pressure aids low-angle tectonic transport of massive sheets of rock. Given that the magnitude of the force needed to translate rock sheets would exceed the compressive strength of most rocks in the crust, large thrust sheets should not exist. But they do, and the authors show that high elevated fluid pressures in rock pores at kilometric depths are close to the pressure of the overlying cover (i.e. lithostatic stress). Fluid can thus initiate motion by introducing a strength contrast and thus reducing the overall strength along the fault plane.

Glarus thrust fault at the Tschingelhoren (© https://geoscience-meeting.ch/sgm2017/)

M. King Hubbert and William W. Rubey were inspired by the beautiful Glarus Thrust in the Swiss Alps and their question was *"how is it mechanically possible to do something like this?"* (https://whc.unesco.org/en/list/1179). This famous thrust sheet has a near horizontal plane and the following joke and explanation helps us to understand thrusting mechanisms.

Hubbert's and Rubey's experiment:



Artwork by D. A. Fischer, in Davis, Reynolds, Kluth (2011) Structural geology book.

(A) Drink a beer;

(B) Put the empty can in the freezer to obtain a thin cover of ice on the can;

(C) Build "an apparatus" (a table top) while drinking a second beer;

(D) Observe that you need a high angle to make the room temperature beer slide on the table;

(E) Observe that you need a much lower angle to make the ice-cold beer slide on the table;

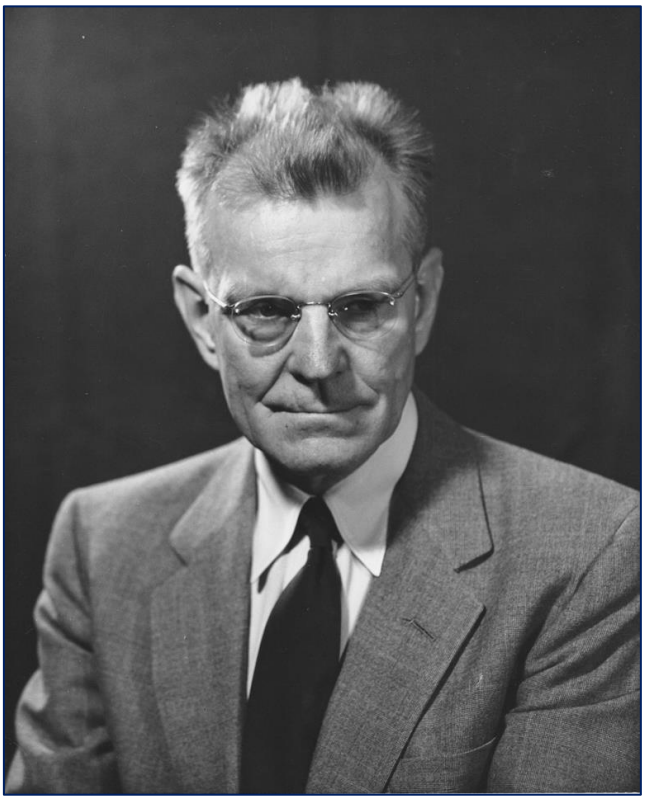
(F) Repeat the experiment but be careful not to drink too much beer!

Fluid overpressure is still considered one of the prime mechanisms to explain fault weakness. However, we know now that there are other fault weakening mechanisms:

- Bulk mineralogy characteristics (e.g. abundance of phyllosilicates or presence of serpentine);
- The efficiency of structure localization (e.g. change in grain size or influence of melt) during deformation are other prime candidates (e.g. Collettini et al., 2019, Beyond Byerlee friction, weak faults, and implications for slip behavior, EPSL).

Reference:

Summary by Liz Aston of article from: https://blogs.egu.eu/divisions/ts/2020/08/13/must-read-papers-in-tectonics-and-structural-geology-hubbert-and-rubey-1959/



Marion King Hubbert (October 5, 1903 – October 11, 1989) was an American geologist and geophysicist. He worked at the Shell research lab in Houston, Texas. He made several important contributions to geology, geophysics, and petroleum geology, most notably the Hubbert curve and Hubbert peak theory (a basic component of peak oil), with important political ramifications. He was often referred to as "M. King Hubbert" or "King Hubbert".

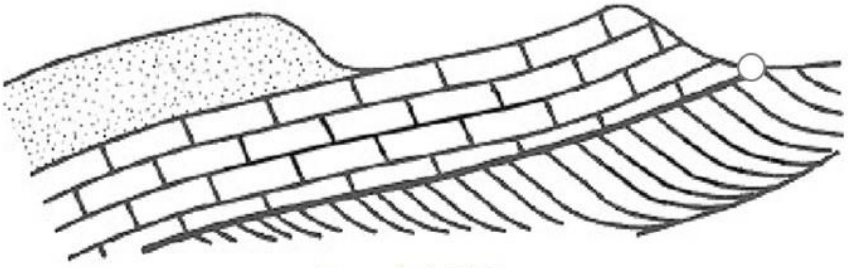
https://en.wikipedia.org/wiki/M._King_Hubbert

William Walden Rubey (December 19, 1898 – April 12, 1974) was an American geologist. During his career he made multiple contributions to the science of geology, including studies of the hydrology of streams, the geology of western Wyoming, seismic energy, mountain building from overthrust faulting, the growth of continents, the origins of the Earth's atmosphere and oceans, and the evolution of terrestrial planets.

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


GEOLOGISTS' ASSOCIATION 1858
UCL
ROCKWATCH
SATURDAY 7TH NOVEMBER
From 10:30 am
2020
VIRTUAL FESTIVAL OF GEOLOGY
Enjoy the FREE virtual Festival of Geology from the comfort of your home
Join us at www.festivalofgeology.org.uk
SATURDAY 7TH ACTIVITIES
An exciting virtual Discovery Room featuring live workshops, experiments, downloads and the Passport Challenge!
Discover cutting edge Earth Science by joining in with the live talks held throughout the day.
Uncover hidden gems in the vendors' and traders' stalls.
Explore the exhibits and festival activities from societies, universities and museums from all across the UK.
SUNDAY 8TH ACTIVITIES
Come along to a real Festival Field Trip or enjoy a virtual field trip from the comfort of your sofa.
Background Image credit: Graham Bull

Farnhamia farnhamensis



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FGS plans to offer an introduction to geology via a series of informal and friendly lectures.

Geology is a vast subject and lecture topics will include:

- **The Formation of Solar System and the Earth**
- **The Structure of the Earth**
- **Magnetic Properties of the Earth**
- **The Significance to Geology & Life**
- **Plate Tectonics**
- **Earthquakes**
- **Volcanicity**
- **Fossils**
- **Mass Extinctions**
- **Ice Ages**
- **Landscapes**
- **Meteorite Impact Sites**
- **Deserts**
- **Geological Processes**

Lectures will be held monthly via a combination of Zoom meetings and face-to-face sessions, commencing in March 2021. Details of how to join to follow.

All are welcome and no previous knowledge of geology is required.