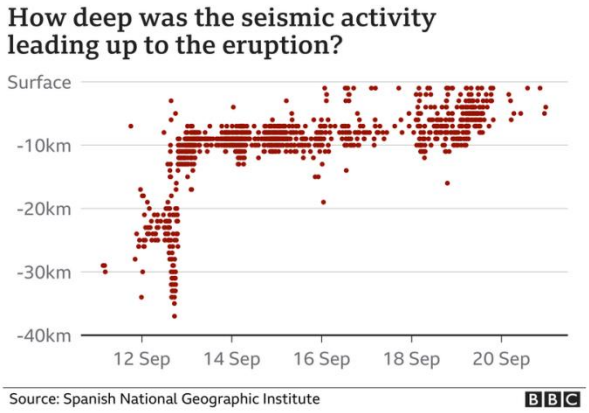
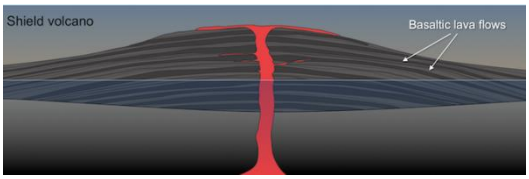
# *Earth Science eNews* 2021 Dec

## *Christmas Edition – Ho! Ho! No!*

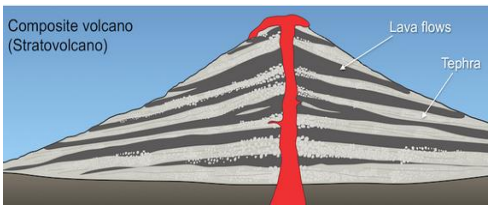
❄ At the time of writing the Cumbre Vieja volcano on the island of La Palma has fallen silent for 4 consecutive days, the first period of inactivity since it started erupting on 19th September 2021. On the 11th & 12th September, a small number of tremors were recorded at depths of 30 to 40 km. This lead scientist to believe that magma was active under the volcano. On the following days this seismic activity was tracked at progressively shallower depths, leading scientists to believe that magma was heading to the surface and enabling plenty of warning to the local population. Cumbre Vieja is a *stratovolcano*, also known as a *composite volcano*, which is a steep sided conical volcano built up by many layers (strata). The steep sides are due to the lava cooling close to the point of eruption, due to its high viscosity. Below is a brief summary of the different types of volcanoes.




- **Shield Volcanoes** – named due to their broad, shield like profiles formed by the eruption of low-viscosity lava that can flow a great distance from a vent.

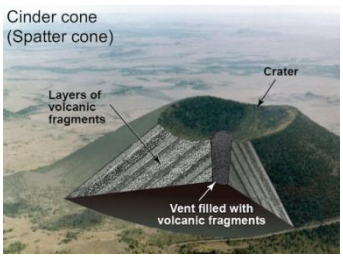



- **Stratovolcanoes** (composite volcanoes) are tall conical mountains composed of lava flows and tephra in alternate layers, the strata that gives rise to the name. They are also known as composite volcanoes because they are created from multiple structures during different kinds of eruptions.



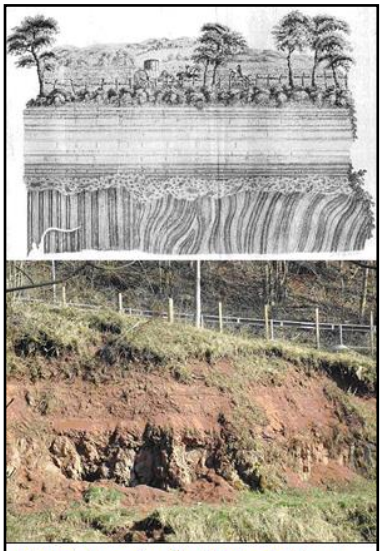

- **Supervolcano** is a volcano that has experienced one or more eruptions that produced over 1,000 cubic kilometers (240 cu mi) of volcanic deposits in a single explosive event.

- **Cinder Cones** (Spatter Cones), have straight sides, typically less than 200 m high. Made up of fragments of scoria (vesicular rock from basaltic lava) that was expelled from the volcano as gas-rich magma erupted. Because they are almost



exclusively of loose fragments, they have very little strength and can be eroded away relatively quickly.

❄ **The cliff that changed our understanding of time** - James Hutton was a polymath of some renown who finally settled as a farmer. His farm suffered from problems of soil erosion. Sutton realised that the soil eroded was eventually replaced but over a very large time scale. 18th-Century society still believed the Earth was somewhere between 4,000 and 10,000 years old, an estimate based on literal Biblical interpretations. Hutton believed that the Earth was far older but needed evidence to support his theory. He searched around Scotland and on seeing the stratified rocks at *'Siccar Point'* he realised that it proved the existence of 'deep time'. The oceanic greywacke rock (a variety of sandstone) was formed some 435 million years ago. Over time, beds of mud on the sea floor were hardened, tilted vertical, lifted above the waves and then slowly eroded to reveal the layers. This realisation changed the course of geological sciences. '*Hutton's Unconformity'* is a name given to various notable geological sites in Scotland. These are places where the junction between two types of rock formations can be seen. This geological phenomenon marks the location where rock formations created at different times and by different forces adjoin. For Hutton, such an unconformity provided evidence for his theories of uniformitarianism and the age of Earth. Uniformitarianism is the assumption that the same natural laws and processes that operate in our present-day scientific observations have always operated in the universe in the past and apply everywhere in the universe. The cliff that changed our understanding of time



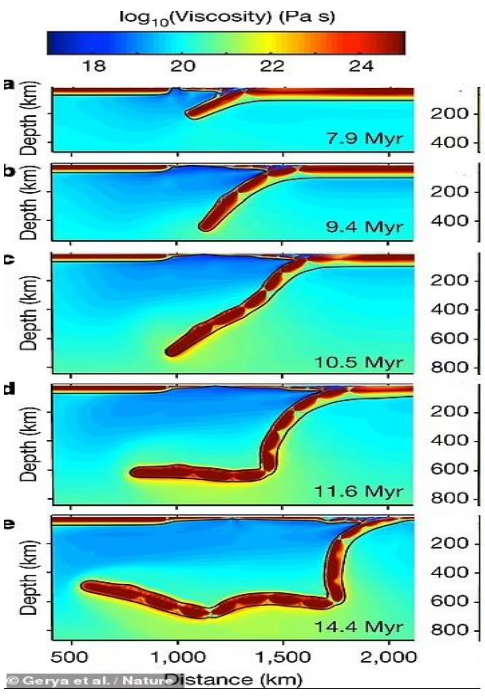
Hutton's Unconformity at Jedburgh. Above: John Clerk of Eldin's 1787 illustration

❄ **The Winchcombe meteorite –** You may remember earlier in 2021, reports of a rare meteorite crashing onto the front drive of a house in the small Cotswold town of Winchcombe. UK scientists have now determined that the meteorite material dates back to the very beginning of our Solar System around 4.6 billion years ago and originated from the asteroid belt between Mars and Jupiter. This makes it the most valuable and important space rock to be recovered in Britain. The find is deemed so important that the indented section of driveway, where the meteorite landed, was removed and is now on display in the Natural History Museum. The meteorite is thought to be a carbonaceous chondrite, the first collected on impact in Britain. Carbonaceous chondrites are probably the oldest and most primitive extra-

terrestrial materials available to study. They are remnants of the building material that came together to make the planets in our Solar System. The Winchcombe Meteorite

❄ **The Origin of the Earth's water –** There appear to be two leading fields of thought as to how the Earth obtained its water. Some researchers believe that water has always been here, having coalesced out of swirling clouds of dust and gas 4.5 billion years ago. An alternative view is that when the Earth was formed it was waterless and the oceans were created later when ice and water rained down on our world from extraterrestrial sources. The reality probably lies somewhere in the middle. The *Hayabusa* space probe was launched on 9 May 2003 and rendezvoused with small near-Earth asteroid named *25143 Itokawa*. In November 2005, the probe landed on the asteroid and collected samples in the form of tiny grains of asteroidal material, which were returned to Earth aboard the spacecraft on 13 June 2010. Examination revealed that the sample brought back from the asteroid contained significant amounts of water. This water was most likely created by the solar wind, a stream of particles that flows out from the Sun. These particles would have interacted with oxygen atoms in the clouds of dust that float through the solar system to create water molecules. These grains of water containing dust would have been swept up by the Earth as it orbited the sun as did *25143 Itokawa*. The water on Earth has a particular Deuterium hydrogen isotope signature which indicates that is must have been produced by a combination of water from *'comets and asteroids'* (contain relatively high amounts of the hydrogen isotope deuterium) and *'solar dust'* (contains relatively low levels of deuterium). In combination, the two sources balanced each other out to provide an isotopic signature that matches that of water presently on Earth.

❄ **The fate of sinking tectonic plates** - the motion of Earth's plates is driven by the weight of cold, dense ocean crust sinking into the mantle — dragging the rest of the plate behind it. Geophysical evidence has indicated that the plates are destroyed but the subducting slabs must remain intact as they descend into the mantle, otherwise they would be unable to keep pulling along the attached crust. Computer modelling has revealed that as plates enter the mantle they are abruptly bent downwards — causing its cold, brittle back to crack as the fine-scale grain structure along its underbelly changed, leaving it weakened but intact but nevertheless segmented — much like a 'slinky snake'. In this way, the descending slab can continue



to pull the rest of the plate despite becoming distorted and folded. [Fate of the sinking tectonic plates.]

## The Best Geology Christmas Jokes of 2021

I'm still looking!!!!!

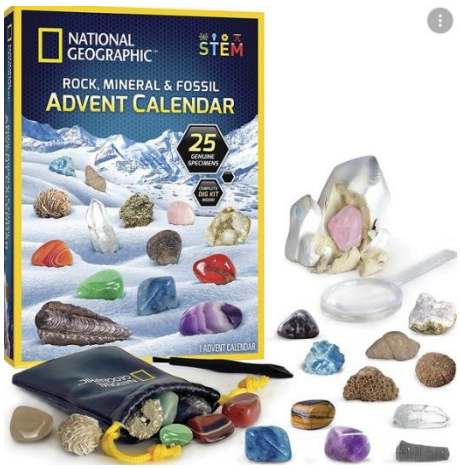
# Quiz

- **Geology Trivia Quiz On Earth's Interior And Pangaea!**


- **Fundamental Geology Questions?**


## Cool Christmas presents for Geologists – really??







*Wishing you all an enjoyable and safe Christmas and New Year*

## Acknowledgements