

Sea die-out blamed on volcanoes

Undersea volcanic activity has been blamed for a mass extinction in the seas 93 million years ago.

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In the so-called "anoxic event" of the late Cretaceous Period, the ocean depths became starved of oxygen, wiping out swathes of marine organisms.

Researchers from the University of Alberta, Canada, found a tell-tale signature of underwater volcanism in rocks dating to the period.

Their findings have been published in the journal *Nature*.

At the time of the anoxic event, the average temperatures were higher than those of today, researchers say.

Palm trees grew in what would later become Alaska and large reptiles roamed northern Canada. The Arctic Ocean was ice-free and scientists think it would have had a temperature we might describe today as lukewarm.

However, the oceans were also hit by a mass extinction which wiped out a type of large clam common at the time as well as tiny ocean creatures known as foraminifera, which live on the sea floor.

Ocean chemistry

Helped by a sudden sluggish shift in ocean circulation, the remains of these minuscule organisms littered the sea bed in thick layers, and over geological time became transformed into oil.

After the extinction, levels of greenhouse gases in the atmosphere dropped and Earth lurched into a sudden, but short-lived, period of cooling.

Geologists have pondered for years as to the cause of this extraordinary event.

According to Steve Turgeon and Robert Creaser from Alberta's department of Earth and atmospheric sciences, the answer to the cataclysm lies in volcanic eruptions which took place on the ocean floor.

These appear to have altered the chemistry of the sea and possibly of the atmosphere also.

The clue can be found in levels of two forms, or isotopes, of osmium found in black shale rocks.

The sedimentary rocks they analysed came from cores drilled from the sea bed off the coast of South America, and from mountains in Italy.



Different colour sediments represent oxygenated versus anoxic conditions



Giant clams were among the organisms killed off

Future warming

The bed of the present-day Caribbean was formed by the huge lava flows thought to have been involved. However, the researchers say the flows would have preceded the extinction by up to 23,000 years.

Two theories, which are not mutually exclusive, have emerged to explain the chemistry of what happened next, says Tim Bralower, a geologist at Pennsylvania State University, US, who reviewed the paper.

One possibility is that the volcanoes spewed out metal-rich fluids that seeded the upper level of the ocean with micronutrients, he says.

Tiny life forms on the sea surface, called phytoplankton, gorged on the food, and storing up carbon as they grew. They then sank to the sea floor and decayed, stripping the ocean of oxygen.

The other is that the volcanoes disgorged clouds of CO₂ to the atmosphere, warming the climate to the extent that Earth's ocean circulation system ground to a near-halt.

Beyond the surface layers, water was no longer turned over and anoxia (lack of oxygen) was the result.

Dr Bralower says that figuring out the post-volcanism scenario could help scientists wrestling with some of the unknowns of climate change today.

These include the impact of higher temperatures on marine circulation and whether controversial schemes to sow the ocean with iron filings, to spur phytoplankton growth and thus soak up CO₂ from the atmosphere, would ease warming or cause oxygen starvation in the ocean depths.

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