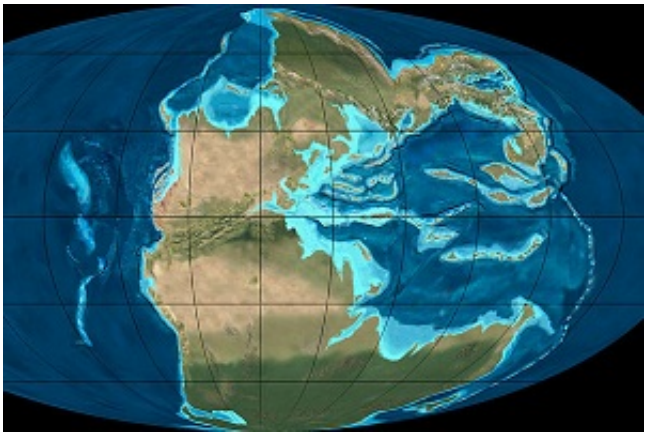
An isotopic analysis of two mass extinction events

December 10 2013, by Geoff Vivian



An impression of the supercontinent Pangea at the end of the Permian epoch, about 252 million years ago. Credit: Wikimedia Commons

An international research team has analysed two of the earth's mass extinction events, finding markedly similar conditions between the two.

Curtin University's Kliti Grice says both the Permian-Triassic and the Triassic-Jurassic events began when increasing atmospheric carbon dioxide – which ultimately reached at least four times the current level – triggered massive global warming.

There was a single continent, Pangea, at the end of the Permian epoch, about 252 million years ago.

She says high volcanic activity released carbon dioxide gas, and the melting of frozen methane probably released more.

During the Permian-Triassic event there were no polar ice caps.

The oceans were warm and sluggish, with very little movement between the upper and lower water columns, and there was a massive algal bloom.

"There was too much biomass to be recycled by bacteria which existed through the water column and the algae died, so the bottom waters became anoxic ," Professor Grice says.

Green sulfur bacteria proliferated, resulting in toxic hydrogen sulfide toxic levels in the upper water body.

Ninety per cent of marine and seventy per cent of terrestrial species died, producing some of the earth's present-day petroleum reserves.

This includes the oil in Western Australia's Perth Basin.

"What we found are molecular fossils, indicative of the organisms that use hydrogen sulfide instead of water as an electron donor to fix CO2 in light to do photosynthesis," she says.

"Those molecules were found in the shales which gave rise to the oil.

"They were also found in the oils of the Perth Basin, so we have a nice correlation of oil to the rock which generated it."

To see into the past with such detail, the team used compound-specific isotope analysis to measure biomarkers in mixtures.

"So if you've got a mixture of compounds – say there are some from

algae, some from plants – you can actually measure them individually to get their individual signals."

Prof Grice says similar carbon dioxide levels 200 million years ago triggered a less-severe extinction event at the end of the Triassic period.

As there are similarities between conditions that produced at least two of the five known mass-extinction events, the team has been investigating two of the others, looking for the same characteristics.

She says the end-Cretaceous extinction, which killed most of the dinosaurs about 65 million years ago, was probably related to a bolide, such as a comet or large meteorite, impacting the Earth.

"What prompted this was the similarity or the potential similarity of global warming events which are associated with the deposition of petroleum," Prof Grice says.

More information: geology.gsapubs.org/content/ea … 10/G34183.1.abstract

Provided by Science Network WA