Volcanic eruptions triggered dawn of the dinosaurs

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Image of fossilized dinosaur eggs found in India, currently displayed at Indroda Fossil Park, Gandhinagar, Gujarat INDIA. Image credit: Wikimedia Commons

Huge pulses of volcanic activity are likely to have played a key role in triggering the end Triassic mass extinction, which set the scene for the rise and age of the dinosaurs, new Oxford University research has found.

The Triassic extinction took place approximately 200 million years ago, and was proceeded by the dinosaur era. One of the largest mass extinctions of animal life on record, the casualty list includes large

crocodile-like reptiles and several marine invertebrates. The event also caused huge changes in land vegetation, and while it remains a mystery why the dinosaurs survived this event, they went on to fill the vacancies left by the now extinct wildlife species, alongside early mammals and amphibians. This mass extinction has long been linked to a large and abrupt release of carbon dioxide into the atmosphere, but the exact source of this emission has been unknown.

Following the discovery of volcanic rocks of the same age as the extinction, volcanic carbon dioxide (CO_2) emissions had previously been suggested as an important contributor to this extinction event. Previous studies have also shown that this volcanism might have occurred in pulses, but the global extent and potential impact of these volcanic episodes has remained unknown. These volcanic rocks covered a huge area, across four continents, representing the Central Atlantic Magmatic Province (CAMP).

Researchers from the Oxford University Department of Earth Science worked in collaboration with the Universities of Exeter and Southampton to trace the global impact of major volcanic gas emissions and their link to the end of the Triassic period. The findings link volcanism to the previously observed repeated large emissions of carbon dioxide that had a profound impact on the global climate, causing the mass extinction at the end of the Triassic Period, as well as slowing the recovery of animal life afterwards.

By investigating the mercury content of sedimentary rocks deposited during the extinction, the study findings revealed clear links in the timing of CAMP volcanism and the end-Triassic extinction. Volcanoes give off mercury gas emissions, which spread globally through the atmosphere, before being deposited in sediments. Any sediments left during a large volcanic event would therefore be expected to have unusually high mercury content.

The team sourced six sediment deposits were sourced from the UK, Austria, Argentina, Greenland, Canada and Morocco, and their mercury levels analysed. Five of the six records showed a large increase in mercury content beginning at the end-Triassic extinction horizon, with other peaks observed between the extinction horizon and the Triassic-Jurassic boundary, which occurred approximately 200 thousand years later.

Elevated mercury emissions also coincided with previously established increases in atmospheric CO2 concentrations, indicating CO2 release from volcanic degassing.

Lawrence Percival, Lead author and Geochemistry Graduate student at Oxford University, said: "These results strongly support repeated episodes of volcanic activity at the end of the Triassic, with the onset of volcanism during the end-Triassic extinction.

"This research greatly strengthens the link between the Triassic mass extinction and volcanic emissions of CO2. This further evidence of episodic emissions of volcanic CO2 as the likely driver of the extinction enhances our understanding of this event, and potentially of other climate change episodes in Earth's history."

The full paper features in the journal *Proceedings of the National Academy of Sciences*.

More information: Lawrence M. E. Percival el al., "Mercury evidence for pulsed volcanism during the end-Triassic mass extinction," *PNAS* (2017). www.pnas.org/cgi/doi/10.1073/pnas.1705378114

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