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Global explosive eruption record

Deep ocean holds clues about explosive volcanic events



University of Bristol researchers are putting together a global record of tens of millions of years of volcanic activity using ash layers found in ocean sediments. The database is providing insight into the frequency of explosive volcanism over the long term and **informing hazard risk assessment**.

Extreme volcanic events over millions of years have deposited ash throughout the oceans, which is captured in the layers of sediment on the ocean floor. Over 414 km of sediment core has been extracted from the deep ocean since the late 1960s as part of an international collaborative research programme - now called the International Ocean Discovery Program (IODP). Whilst individual studies have looked at subsets of these

cores, these data have never been studied on a global scale.

Dr Sue Mahony, Research Associate, and **Professor Stephen Sparks**, Professorial Research Fellow, both in Bristol's School of Earth Sciences, have completed the monumental task of **bringing the ash layer data together into a single database**.



Over 30,000 volcanic ash layers were recorded from 3,582 IODP drill holes.

Data collected by Mahony and Sparks, which is not yet published, suggests that most of the ash layers were formed from very large magnitude eruptions, typically greater than six on the volcanic explosivity index. Eruptions of this size are described as colossal and have plumes 20 km or more in height, but thankfully only a few of this magnitude happen each century.

This is too infrequent to build an adequate historic record of these events, yet eruptions of this size have global effects on climate change that can last for several years.

The global database of ocean sediment cores extends the records of major explosive eruptions back many millions of years.

While the results of this research are still forthcoming, it is already informing some industries where **assessing the hazard risk** of such massive events is critical to their business.



NUMO
原子力発電環境整備機構

Japan's Nuclear Waste Management Organization (NUMO) is responsible for siting, developing and operating a **deep geological repository for high-level nuclear waste in Japan**. These repositories need to contain the waste for tens of thousands of years and while it is relatively easy to avoid areas of current and recent volcanism, NUMO must also look forward at the probability that new volcanism could affect the area under consideration. This is where the core data can help.



The offshore data provided by this project extend and complement the often patchy and constrained onshore datasets considerably.

As Japan moves closer to identifying possible repository sites in the next few years, both the developers and the national regulatory authorities will be looking to hazard forecasts to give confidence in site selection...The role of the offshore sediment ash layer data will become very important."

Professor Neil Chapman



partner in MCM International, a radioactive waste management consultancy working with NUMO.



The research has also helped to inform models used by the insurance industry, which look at the likelihood of extreme events, such as explosive volcanism, to better **prepare for the financial impact**.

By extending the database for major eruptions from thousands of years to tens of thousands of years (or more), the industry can get a more precise value for the recurrence of these events. ■



Additional Information

■ This research has been funded by the **Natural Environment Research Council (NERC)** and the **Leverhulme Trust**.



■ Some of the findings of this research were published in a paper titled: 'Quantifying uncertainties in marine volcanic ash layer records from ocean drilling cores' in the journal *Marine Geology* (2014; 357: 218-224).

■ A case study using a subset of the data has been published in a paper titled: 'Increased rates of large-magnitude explosive eruptions in Japan in the late Neogene and Quaternary' in the journal *Geochemistry, Geophysics, Geosystems* (2016; 17: 2467–2479).

■ The International Ocean Discovery Program is a continuation of over five decades of international collaboration to recover geological data and samples from beneath the ocean floor to study the history and dynamics of Planet Earth. The UK is a member of the IODP as part of the European Consortium for Ocean Research Drilling (ECORD). The UK IODP is a NERC directed research programme that supports UK participation in IODP. www.iodp.rocks





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