Global Challenges Foundation

Supervolcanic eruption

Reviewed by

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What is at stake?

The eruption of the Toba supervolcano in Indonesia, around 74,000 years ago, ejected billions of tonnes of dust and sulphates into the atmosphere. Experts estimate that it caused a global cooling of 3-5°C for several years, and led to devastating loss of plant and animal life. Some have argued that Toba caused the greatest mass extinction in human history, bringing our species to the brink of extinction.

Supervolcanic eruptions are events in which at least 400 km3 of bulk material is expelled. Eruptions of such magnitude may happen at any time in the future, with catastrophic consequences.

How much do we know?

In order to assess the likelihood of supervolcanic eruptions, we have to rely on a relatively limited set of past observations, which makes any estimates very uncertain. Existing data suggest that a supervolcanic eruption will occur every 17,000 years on average – with the last known event occurring 26,500 years ago in New Zealand. We are currently unable to anticipate volcanic eruptions beyond a few weeks or months in advance, but scientists are monitoring a number of areas, including Yellowstone in the US, which have been identified as potential sites of a future supervolcanic eruption.

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The impact of a supervolcanic eruption is directly connected to the quantities of materials ejected by the volcano. Dust and ashes will kill human populations nearby and devastate local agricultural activity. In addition, the release of sulphate and ashes in the atmosphere will affect the amount of solar energy reaching the surface of the planet and may lead to temporary global cooling and severe environmental effects.

What are key factors affecting risk levels?

There is no current prospect of reducing the probability of a supervolcanic risk, but there may be ways to mitigate its impact.

Improvements in the ability to identify volcanoes with potential for future super-eruptions and predict eruptions will increase preparedness, and ensure that food stockpiles are available to mitigate a temporary collapse of agricultural systems. Resilience building, particularly the potential to rely on food sources less dependent on sunlight – including mushrooms, insects and bacteria – could significantly reduce the death rate among humans.

Volcanic eruptions
Volcanic eruptions are measured through a magnitude scale, a logarithmic scale, ranging from 0 to 9, where each unit increase indicates an eruption 10 times greater in erupted mass. At the top of the scale, supervolcanic eruptions (M 8) release more than 400 km^3 of magma. By comparison, the largest volcano eruption recorded in human history, the 1815 Tambora eruption in Indonesia, had a magnitude of about 7:41 km^3 of magma expelled, claiming over 70,000 lives. When Mount Vesuvius erupted in 79 AD, devastating the Roman cities of Pompeii and Herculaneum, it released approximately 4 km^3 of magma, placing it at magnitude 615. More recently, the May 1980 eruption of Mount St. Helens in Washington, USA, with just over 0.5km^3 released, was a magnitude 5.1.

The largest recorded volcanic eruptions



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