

THE *Current*

April 23, 2003

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UCSB Professor Says Volcanic Eruptions in Costa Rica 'Inevitable'

It might be 500,000 years or five years, but the Central Valley of Costa Rica will definitely experience major volcanic activity again, according to Phillip B. Gans, professor of geology at the University of California, Santa Barbara. He presented a study of volcanic rocks of Costa Rica in his recent talk at the annual meeting of the Geological Society of America.

"The Costa Ricans were not around for the last big one, but it's inevitable," said Gans. "Another pyroclastic flow like the last big one in Costa Rica will make the Mount St. Helens eruption look like nothing." Pyroclastic flows are high-speed avalanches of hot ash, rock fragments, and gas that roar down the sides of volcanoes during explosive eruptions or when the steep edge of a dome breaks apart and collapses. These pyroclastic flows, which can reach 1000 degrees Fahrenheit and move at 100-150 mph, are capable of knocking down and burning everything in their paths.

Volcanoes are unpredictable beasts, said Gans. However, the eruption of Mount St. Helens gave us a four-month warning. Due to careful monitoring of the small earthquakes inside the volcano, and the bulging of the surface of the volcano, the residents of the area were prepared. (Although 25 people died in this eruption, it is still considered a success story in terms of evacuation.)

"We don't know if we will get a similar warning for a very large eruption like the ones that have occurred prehistorically in the Central Valley of Costa Rica," said Gans. The Central Plateau of Costa Rica is home to more than half of Costa Rica's population and is flanked by several large volcanoes, some of which are still active.

Gans came upon his work in Costa Rica when a colleague asked him to determine the ages of some volcanic rocks from Costa Rica. He found that very little was known about the volcanic history of Costa Rica, and so he engaged in a several year study of volcanic rocks, collecting and studying 450 samples from the whole country.

Gans has a laboratory that is known for its precision in dating volcanic rocks. He was able to put together a detailed history of volcanic activity as well as a geologic map of the country. To date volcanic rocks, he used the natural radioactive decay of potassium as a clock to determine the age. This radiometric age is a measure of how long since that material formed, which gives the age of the eruption. Using this method, Gans can measure a rock that is 10 million years old to a tenth of a percent accuracy.

The volcanoes in Costa Rica are formed by subduction. That is, there is an oceanic tectonic plate diving under the country which then causes melting in the deeper parts of the Earth, and these melts (or magmas) then rise and erupt to form volcanoes. It is similar to a process occurring in the Northwest United States, where a Pacific Ocean plate is diving beneath Washington and Oregon and causing volcanism in the Cascades volcanoes: Mt. Ranier, Mt. Hood, Mt. Shasta, and Mt. Jefferson.

Gans determined that subduction-related volcanism in Costa Rica has been occurring for at least 24 million years. He discovered that major pyroclastic eruptions have occurred many times over the past million years in the vicinity of the Central Valley of Costa Rica, with the most recent about 324,000 years ago. The cities and towns of the Central Valley, including San Jose, the capital, are built on the vast pyroclastic flow deposit that was produced by that eruption. If the same eruption were to occur today, within a matter of minutes to hours the entire Central Valley and all of the major cities of Costa Rica would be overrun by a hot pyroclastic flow of ash and pumice that would end up covering the entire area with a new pyroclastic deposit up to several hundred feet thick.

Gans was assisted in this work by G. Alvarado-Induni and W. Perez, both of the University of Costa Rica in San Jose, Costa Rica; I. MacMillan of UC Santa Barbara; and A. Calvert of the U.S. Geological Survey in Menlo Park, Calif.

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