Geologists Reveal Secrets Behind Supervolcano Eruption

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A piece of supervolcano and extracted quartz crystals analyzed for titanium. Credit: Rensselaer Polytechnic Institute/David Wark

Researchers at Rensselaer Polytechnic Institute have discovered what likely triggered the eruption of a “supervolcano” that coated much of the western half of the United States with ash fallout 760,000 years ago.

Using a new technique developed at Rensselaer, the team determined that there was a massive injection of hot magma underneath the surface of what is now the Long Valley Caldera in California some time within 100 years of the gigantic volcano’s eruption. The findings suggest that this introduction of hot melt led to the immense eruption that formed one of the world’s largest volcanic craters or calderas.

The research, which is featured in the March 2007 edition of the journal *Geology*, sheds light on what causes these large-scale, explosive eruptions, and it could help geologists develop methods to predict such eruptions in the future, according to David Wark, research professor of earth and environmental sciences at Rensselaer and lead author of the paper.

The 20-mile-long Long Valley Caldera was created when the supervolcano erupted. The geologists focused their efforts on Bishop Tuff, an expanse of rock that was built up as the hot ash cooled following the eruption. The researchers studied the distribution of titanium in quartz crystals in samples taken from Bishop Tuff.

A team from Rensselaer previously discovered that trace levels of titanium can be analyzed to determine the temperature at which the quartz crystallized. By monitoring titanium, Wark and his colleagues confirmed that the outer rims of the quartz had formed at a much hotter temperature than the crystal interiors. The researchers concluded that after the interiors of the quartz crystals had grown, the magma system was "recharged" with an injection of fresh, hot melt. This caused the quartz to partly dissolve, before starting to crystallize again at a much higher temperature.

Analyses of titanium also revealed that the high-temperature rim-growth must have taken place within only 100 years of the massive volcano's eruption. This suggests that the magma recharge so affected the physical properties of the magma chamber that it caused the supervolcano to erupt and blanket thousands of square miles with searing ash.

"The Long Valley Caldera has been widely studied, but by utilizing titanium in quartz crystals as a geothermometer we were able to provide new insight into the reasons for its last huge eruption," Wark said. "This research will help geologists understand how supervolcanoes work and

what may cause them to erupt, and this in turn may someday help predict future eruptions."

Source: Rensselaer Polytechnic Institute