The 1707 M8.7 HOEI Earthquake Triggered the Largest Historical Eruption of Mt. Fuji

Christine J. Chesley¹, Peter C. La Femina², Christine M. Puskas³, and Daisuke Kobayashi²

¹Department of Geological Sciences and The Rosenstiel School of Marine and Atmospheric Sciences University of Miami, 1231 Dickinson Drive, Coral Gables, FL 33146 cchesley@umiami.edu
²Department of Geosciences, The Pennsylvania State University, 406 Deike Building, University Park, PA 16802
³UNAVCO, 6350 Nautilus Drive, Boulder, CO 80301

How can an earthquake trigger a volcanic eruption?
Large magnitude earthquakes can trigger volcanic eruptions by static stress changes on magma systems or by the passage of seismic waves that may induce magma processes in magma chambers. Magma chambers that are already pressurized may be sensitive to the stress changes. Consequently, an eruption may be triggered.

We investigate the spatio-temporal correlation between two great Japan earthquakes, the 1707 Mw 8.2 HOEI and 1707 Mw 8.7 Hoei earthquakes, and the 1707 VEI 5 eruption of Mt. Fuji 49 days after the 1707 earthquake.

Eruptive history of Mt. Fuji and history of great Nankai Trough earthquakes

Stress models of the Genroku and Hoei earthquakes

We modeled the stress change and dilatational strain created by slip from the two earthquakes on Mt. Fuji’s magma system (magma chambers and dikes).

The Genroku and Hoei Earthquakes Triggered Mt. Fuji’s Magmatic System

The Genroku Earthquake Hithered Mt. Fuji’s Eruptive Activity

Increased normal stress (negative normal stress change) clamped the dike system and impeded eruption.

The Hoei Earthquake Triggered the Mt. Fuji Eruption

Decreased normal stress (positive normal stress change) unclamped the Mt. Fuji dike and facilitated magma migration and eruption.

Stress Changes, Magma Migration and Mixing, and Eruption Triggering

The stresses change and compressional strain generated by the 1707 earthquake triggered the eruption of Mt. Fuji by permitting opening of the dike and ascent of basaltic magma to the andesitic and dacitic magmatic chambers (see below). The injection of basaltic magma into the more evolved magmatic system induced magma mixing and a Phreatic eruption ensued.

Implications of this study
Understanding the mechanisms that trigger a volcanic eruption can help to further the science of eruption prediction. This, in turn, could help save money, property, and most importantly lives!

References

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