Experimental simulation of the processes at volcano reservoirs triggered by earthquakes

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Evidence is increasing that tectonic earthquakes may trigger volcanic activity. Some volcanoes erupt immediately after an tectonic earthquake occurred. Other volcanoes show merely signs of unrest, but no eruption. Even other volcanoes do not show any response, even though being in a state of a generally high activity.

The problem in volcano-earthquake interaction research is that the physical processes of the triggering are only poorly understood, however. Some recent studies suggest a combination of (quasi)static and dynamic triggering, associated with the permanent displacement and the short term passing of seismic waves, respectively. However, no consensus exists concerning the type of waveform most effective for the triggering process, or about the time delays often observed between the passage of the seismic waves and unrest occurrence.

In order to better understand the way earthquakes may trigger volcanoes, we first collected empirical data and re-evaluate the empirical database. Second, we design laboratory experiments aiming to simulate selected real scenarios as recorded by geophysical instruments. Our reservoir is simulated on an earthquake simulator, constructed to allow systematic exploration and scenario simulation of empirical observables. For instance, we evaluate how the frequency and amplitude of seismic waves affects a bubbling fluid, leading to fluid mobilization, mixing and ultimately to the increase of a reservoir pressure. The implications of the results are wide, and may apply to volcanoes triggered by earthquakes, as well as other fluid reservoirs containing different fluid and/or gaseous phases.