Mechanics of volcanic eruptions

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Of the world's 600-1000 historically active volcanoes, about 30-50 are in eruption each year. Added to these are eruptions from volcanoes, which have no historical record of activity (about 5-10 per decade) and so are often considered extinct by surrounding communities. Hundreds of millions of people live within sight of an active volcano, and at least 10% of these are economically vulnerable to an eruption.

Although sophisticated techniques are available for monitoring volcanoes, there are no quantitative physical models for determining whether or not a sequence of precursory phenomena will end in an eruption and, if an eruption is expected, for forecasting the time at which it will begin. As a result, short-term eruption forecasts (for time intervals of weeks or less) rely almost exclusively on empirical analyses. This approach is plagued by large uncertainties and has only a restricted value when applying observations from one eruption to another example. Such a situation invariably foments confusion during a volcanic crisis and heightens the possibility of issuing false alarms. Vulnerable populations may thus lose confidence in decision-making bodies and refuse to respond during later emergencies when an eruption is truly imminent.

The advertised project will investigate common signals observed before eruptions, focussing on increases in seismic activity. The key objectives include:

- Experimental evaluation of the fracture-mechanical properties of rock under the pressures and temperatures relevant to volcanoes.
- Developing physical models of volcano structure and dynamics.

The project will involve applying geological constraints to theoretical models of seismicity, as well as exchange visits to volcano observatories and field studies to collect samples for laboratory experiments. The field work is likely to be on volcanoes in Italy (Etna, Vesuvius and Campi Flegrei), although other locations may also be chosen as appropriate.

A driving licence and some knowledge of Italian would be helpful, but are not essential.

Background Reading:


