

A fluid-filled crack propagation model to explain migration of earthquake swarm activities

Tomohiko Sasaki¹, KATSUMATA, Kei^{1*}

¹Hokkaido University

We investigate a migration of epicenters of an earthquake swarm activity in and around Shari-dake volcano in the eastern Hokkaido. The earthquake swarm activity started on April 27, 2004 (Ichianagi et al., 2009), and the epicenters migrated 2 km for 2 months toward two direction: southeast and southwest. The migration speed is the same for the two directions, fast for the first 10 days, and gradually decreases. We apply a fluid-filled crack propagation model (Spence and Turcotte, 1985) to the earthquake migration data. As a result we find that the migration distance as a function of time is well-explained by the model, which predicts that the crack length is proportional to the $2/3$ rd power of time with assumption of the viscosity of water. We also find that if the viscosity of magma is assumed, the crack will open 6 to 20 m, which is not consistent with the observation that no crustal deformation was observed by a GPS network around the Shari-dake volcano. Therefore the fluid in the crack is possibly not magma but water.

Ichianagi et al., Seismic activity of the 2004 Syari-dake Earthquake swarm by dense temporary seismic observation network in the eastern part of Hokkaido, Japan, Geophysical bulletin of Hokkaido University, 72, 299-314, 2009.

Spence, D. A., and D. L. Turcotte, Magma-Driven Propagation of Cracks, J. Geophys. Res., 1985.

Keywords: earthquake swarm, Shari-dake, earthquake migration, fluid, crack propagation model