Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SVC070-P35 Room:Convention Hall Time:May 23 16:15-18:45

Estimation of magma flux during the 2011 eruption of Shinmoedake volcano based on tilt data

Tomofumi Kozono[1*], Hideki Ueda[1], Taku Ozawa[1], Eisuke Fujita[1], Motoo Ukawa[1], Toshikazu Tanada[1]

[1]NIED

Magma flux of volcanic eruption is a key parameter which controls the type of the eruption (explosive/effusive) and eruption intensity such as eruption column heights. During the 2011 eruption of Shinmoedake volcano, the type and the intensity of the eruption drastically changed within a week: several sub-Plinian eruptions on January 26 and 27, and a continuous lava effusion from January 28 to 31. In response to this eruption sequence, borehole tilt measurements by NIED showed a deflation of magma chamber caused by magma outflux to the surface. In this study we investigated how the magma flux changed during the eruption of Shinmoedake volcano on the basis of the tilt data.

Analyses of the tilt data revealed that a spherical deflation source, which is inferred to be a magma chamber, is located at the northwest of Shinmoedake volcano with a depth of about 7 km. The tilt data shows a linear deflation during the eruptions: three rapid deflations on January 26 and 27 during the sub-Plinian eruptions, and a slow deflation from January 28 to 31 during the continuous lava effusion. On the basis of the tilt data, we estimated an average deflation rate for each deflation event. Results show that the deflation rate of each sub-Plinian phase is about 6 to 10 times higher than that of the lava effusion phase. Here, the magma flux during the lava effusion phase is well constrained from the observations of the lava growth inside the crater such as by SAR analysis (about 50-80 m^3/s). Multiplying this magma flux by the ratio of the deflation rates of the sub-Plinian phase to the lava effusion phase, we can calculate the magma flux during the sub-Plinian phase: the estimated fluxes are about 330-480, 570-820 and 450-650 m^3/s for the three deflation events.

Comparison of the estimated flux with compilations of magma flux data for various types of eruptions in the world shows that the magma flux of the sub-Plinian phase in the Shinmoedake eruption is around the minimum of the flux range for sub-Plinian or Plinian eruptions, wheras the flux of the lava effusion phase is around the maximum of the flux range for lava dome eruptions. This implies that the Shinmoedake eruption was a critical state for the transition between explosive and effusive eruptions.

Keywords: Shinmoedake volcano, magma flux, tilt data, eruption style, magma chamber