Magma reservoir processes estimated from the temporal variation of lava compositions of Kaimondake volcano

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Physico-chemical processes in the magma reservoirs were estimated from the compositional variations of lavas and scoriae erupted during the 3000 year period of Kaimondake volcano activities. Kaimondake is a perfect cone shaped stratovolcano with lava dome at the summit. Fujino and Kobayashi (1997) reported age estimation of the volcano; initiation of activities at 4,000 y.b.p. and cessation at 1,100 y.b.p., with more than 10 large eruptions between these two ages. During this period, the magma eruption volume decreased with time. We collected samples between 3,600 y.b.p. and 1,100 y.b.p. and analyzed them for major and trace elements.

Analyzed samples range from basalt to andesite with low concentrations of MgO and high concentrations of total iron. These characteristics were notable when compared with samples from Kirishima volcano group and Sakurajima volcano. A series of lavas show typical tholeiitic compositional trend with a small increase of silica accompanied by a large increase of FeO*/MgO ratio. Temporal compositional variations do not follow fractional crystallization trend with an increase of silica and large lithophile elements. Instead, the composition goes back and forth on the silica variation diagrams. As the ratios of trace elements are nearly constant for all the lavas and scoriae, magmas were probably derived from the common source materials for the 3,000-year period. When the behavior of compatible elements such as Fe, Mg and Cr were observed in combination with incompatible trace elements, at least four rejuvenation events characterized by unfractionated magma eruptions were estimated. Calculation of solidification using trace elements with zero bulk distribution coefficients showed 40% solidification of summit dome lava from the initial magma. Estimated solidification indicates repeated solidifications and rejuvenations in the magma reservoir.