

Pre-eruptive conditions of rhyolitic magma from Kawagodaira Volcano, Izu Peninsula

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Kawagodaira volcano is a rhyolitic monogenic volcano located in the Higashi-Izu monogenic volcano field at Izu Peninsula. The volcano erupted at ca. 3060~3190. During the eruption, transition of eruption style was occurred from Plinian explosion to obsidian extrusion. Such transition often occurred in silicic magma, and depend on pre-eruptive condition and outgassing during magma ascent in the vent. However, detailed mechanism is still under study. In this study, we collect volcanic products of 3 eruption style which are plinian eruption, pyroclastic flow, and lava flow. We conducted petrography and analysis of chemical compositions of glass and phenocryst minerals for these volcanic products, and we estimated the pre-eruptive condition of temperature and pressure and water content to examine mechanism in transition of eruption style.

All samples in this study include ca. 15 vol. % of phenocrysts chiefly composed of hornblende and plagioclase with minor amount of orthopyroxene and magnetite, and include ca. 85 vol. % of groundmass composed of glass. Hornblende phenocrysts show chemical zoning with obvious gap of Al content near rim. Al content is higher in core part (ca. 1.7 atoms per formula unit (apfu)) than rim part (ca. 1.2 apfu).

The estimated pressure using hornblende Al content geobarometer shows bimodal distribution with ca. 100 MPa and 200-300 MPa in each sample. The former and the latter correspond to the crystallization pressure of rim and core part of hornblende, respectively. The estimated temperature using plagioclase-hornblende geothermometer indicate constant in all samples, and average to be 1132K. The water content is estimated to be 5wt. % by using plagioclase-melt geohydrometer, and this value coincident with H₂O solubility in rhyolitic melt at 100MPa.

The estimated P-T conditions show that magma decompressed from 200~300MPa to 100MPa without change of magma temperature. This indicates that transition of eruption style occurred less than 100MPa. The coincidence between water content and the H₂O solubility at 100MPa suggest that bubbles were already formed at this pressure. And, we think that magma stopped at 2.5~3km depth until growth of hornblende and plagioclase phenocrysts finished. During cessation of magma ascent, bubbles rised to upper part of magma chamber, forming bubble zoning in magma chamber. This zoning might relate to transition of eruption style.

Keywords: Higashi-Izu monogenetic volcanic field, rhyolitic magma, eruption style, hornblende