Melt inclusion study on the eruption process of Izu-Omuroyama monogenetic volcano, Japan

Risako Hatada[1], *Hidemi Ishibashi[1], Yusuke Suzuki[2], ATSUSHI YASUDA[3], Natsumi Hokanishi[3]

1. Faculty of Science, Shizuoka University, 2. Izu Peninsula Geopark, 3. Earthquake Research Institute, University of Tokyo

Izu-Omuroyama is one of monogenetic volcanoes in Izu-Tobu volcanic field, which is the largest pyroclastic cone formed by ~4ka eruption with ~450 million tons of tephra and lava (Koyano et al., 1996). Because a monogenetic volcano such as Omuroyama is built by the first eruption of a newly-formed magma plumbing system, phenocrysts and melt inclusions (MIs) in its volcanic products may record information about the initial process of formation of the magma plumbing system. In this study, textural and chemical analyses were performed for phenocrysts and MIs in Strombolian scoria of the Omuroyama eruption to clarify the eruption process of the monogenetic volcano.

According to Koyano et al. (1996), Omuroyama eruption started from sub-plinian phase (stage-A), followed by weak ash-eruption phase (stage-B), and then shifted to the main phase of Strombolian eruption (stage-C). Omuroyama pyroclastic cone was built during the stage-C. In this study, we performed textural and chemical analyses for phenocrysts and MIs in the fall scoria erupted during the stage-C, by using FE-EPMA and EPMA at ERI, Univ. Tokyo, Japan.

The scoria contain ~3.3 vol.% of olivine and ~5.4 vol.% of plagioclase as phenocrysts, and their groundmass include olivine and plagioclase microphenocsyts (MPs) of several tens-100 microns sizes embedded in almost glassy or microlite-rich matrix. Olivine phenocrysts are homogeneous (Fo~74-83 with concentration at 83-84) in each grain except for normal zoned rim. Olivine MPs has compositions similar to Fo-poor phenocrysts. Most of plagioclase phenocrysts show reverse zoning with cores of An~30-60 and rims of An~84 and dusty zones are often found. Plagioclase MPs have compositions identical to those of phenocryst rims. Olivine- and plagioclase-hosted MIs have SiO_2 contents of ~52-60 wt.% and 57-78 wt.%, respectively. Compositions of both olivine- and plagioclase-hosted MIs with SiO_2~57-60 wt.% are identical with glass in microlite-poor groundmass, indicating that the melt was saturated with olivine and plagioclase. Based on the olivine-plagioclase-melt compositional relation, temperature and H_2O content conditions of the melt is estimated to be ~1080ºC and ~2 wt.% (H2O-saturated depth of ~2km), respectively. Majority of MIs in plagioclase phenocrysts are rhyolitic with SiO2~70-74wt.%. FeO content of host plagioclase crystals are consistent with those in equilibrium with the MIs. H_2O contents of the MIs are estimated by melt-plagioclase hygrometer to be ~6.2-9.2 wt.% (H_2O-saturated depth of ~8-14km), under assumption of temperature of 800-850 ºC. In addition, olivine-hosted MIs with $SiO_2 < 57$ wt.% are enriched in SO_3 (~0.3-0.5 wt.%), indicating their origin deeper than those of more evolved MIs ($SO_3 < 0.1$ wt.%).

Present results suggest that (1) deep-derived, olivine-bearing mafc melt ascent, captured plagioclase phenocrysts and rhyolitic melt and mixed with them at 11km depth, and crystallized MPs at 2km depth before the eruption, and (2) rhyolitic melt existed at ~11km depth beneath the volcanic field at ca. 800 years before the first eruption of rhyolitic magma at Kawagodaira volcano.

Keywords: melt inclusion, monogenetic volcano, rhyolite, Izu-Omuroyama, plagioclase

