An andesitic melt-bearing gabbroic xenolith of Izu-Oshima 1986 eruption: a preliminary result

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Izu-Oshima 1986 eruption started at Nov. 15 from strombolian eruption of basaltic magma at the central cone (A vent), followed by sub-plinian fissure eruption of andesitic magma at Nov. 21 from the caldera floor (B vent). Glass-bearing gabbroic xenoliths are rarely included in fall deposits from B vent. The gabbro xenoliths may have information about pre-eruptive process of andesitic magma erupted from B vent. In this study, we report the results of textural observation and chemical analysis of minerals and glass in the gabbro xenolith and discussed about pre-eruptive process of andesitic magma from B vent.
In this study, we investigate a glass-bearing gabbroic xenolith collected at ca. 1km NE from B vent. This gabbroic xenolith is chiefly composed of euhedral-subhedral grains of plagioclase and olivine embedded by interstitial glass. The glass is brown and vesicular. Fine clinopyroxene and magnetite grains are found in the glass. Overgrowth rims of <10 microns thickness are observed at melt-plagioclase and melt-olivine interfaces. Overgrowth rims of plagioclase and olivine are respectively lower An [=100Ca/(Ca+Na)] and lower Fo [=100Mg/(Mg+Fe)] values compared to inner parts. Glassy melt inclusions are found in plagioclase and olivine.
We measured major element compositions of minerals and glass in the gabbroic xenolith using EPMA at Earthquake Research Institute, University of Tokyo. Interstitial glass is almost homogeneous and have an andesitic composition with SiO2 ~ 56.6 wt.%. Composition of the glass is very similar to those of volcanic ejecta from B vent. Overgrowth rim of plagioclase shows narrow range of An value of ca. 83, which is in equilibrium with interstitial melt under wide range of melt H_2O content condition. By combining plagioclase- and olivine-liquidus thermometers of putirka (2008), we estimated equilibrium temperature-melt H_2O content conditions of the interstitial melt to be ~1057 deg. C and ~3.4 wt.% H_2O. The estimated temperature is almost identical to those estimated for lava and ejecta from B vent (Fujii, 1988). The estimated melt H_2O content is similar to saturation solubility at pressure of ~118 MPa, corresponding to ~4.4 km depth. This depth is almost the same as that of the shallower magma reservoir beneath the volcano, inferred from Ida (1995). Although melt inclusions in plagioclase and olivine are also andesitic (SiO2 ~ 55-56 wt.%), their compositions are slightly different from that of interstitial melt. Plagioclase-hosted melt inclusions are enriched in MgO, and olivine-hosted melt inclusions are enriched in Al2O3 and CaO and depleted in FeO compared to interstitial melt. These differences may be attributed to post-entrapment re-equilibrium between melt inclusions and host minerals.
Andesitic melt inclusions in plagioclase and olivine with compositions slightly different from interstitial melt indicate that the gabbro is a cumulate from andesitic melt. The estimated equilibrium depth of ~4.4 km is similar to that of magma reservoir inferred for basaltic magma from A vent (e.g., Hamada et al., 2011). This suggests that andesitic magma reservoir was located near the basaltic magma reservoir, and fissure eruption from B vent might be triggered by pressure increase in basaltic magma reservoir. Thin overgrowth rims of plagioclase and olivine suggest that physic-chemical conditions of interstitial melt changed immediately before the eruption. In further work, the mechanism triggered B fissure eruption will be clarified by detailed investigation of the overgrowth rim texture in the gabbro xenolith.

Keywords: Izu Oshima, xenolith, gabbro, magma reservoir, andesitic magma, pre-eruptive condition

