

Petrological characteristics and evolution of magma plumbing systems of Niijima volcano, Izu islands

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Niijima is one of the Quaternary volcanic island belonging to the Izu islands, located on northern portion of the Izu-Bonin-Mariana Arc. The island is composed of more than twelve rhyolite monogenetic rhyolitic volcanoes and one basaltic volcano (Isshiki, 1987). The latest eruption occurred in A.D. 886 and formed Mukaiyama lava dome. Recently, the end of June 2000, the island and adjacent volcanic islands (Shikinejima and Kozushima) became active in seismicity accompanied by the volcanic eruption of Miyakejima volcano, about 30 km southeast of Niijima. Partly due to the lack of syneruptive geophysical observation, we know little of its subvolcanic structures. In this study we have carried out a petrographic study on the rhyolitic eruptive materials in order to understand the origin and generation of the magma, and also magma feeding systems of the Niijima volcano.

In this study, we collected 40 rock samples from 8 rhyolitic volcanoes and one basaltic volcano. We confirmed that the phenocryst assemblage varies systematically with time as reported by previous studies (e.g., Isshiki 1987; Matsui et al., 2009); plagioclase(Pl) + quartz(Qtz) + cummingtonite(Cum) + Fe-Ti oxide(Opq), Pl + Qtz + biotite(Bt) + Cum + Opq and Pl + Qtz + Bt + Opq. Various zoning patterns of plagioclase phenocryst can be observed, for example; pathy zoning, honeycomb structure, oscillatory zoning (cf. Anderson, 1984). These zoning patterns indicate the homogenization processes of heterogeneity in a magma chamber, associating with the crystal growth or dissolution processes (Tsune and Toramaru, 2004). The compositions of some characteristic plagioclase crystals were determined by EPMA. Based on these results, we discuss about relationships between zoning patterns and chemical compositions, and the physical and chemical environment of magma chamber.

Whole rock major and trace element compositions were determined by XRF. SiO₂ content (wt%) of rhyolites are 70-78%, and basalts are 50-52%. The Sr and Nd isotopic compositions of representative samples are determined by TIMS. ⁸⁷Sr/⁸⁶Sr ratios of rhyolitic rocks are from 0.70318 to 0.70330 and, basaltic rocks are from 0.70330 to 0.70335. ¹⁴³Nd/¹⁴⁴Nd ratios of rhyolites and basalts are scattered in a narrow range 0.51300 - 0.51305. Now, with compilation of available chemical, petrographical, and isotope compositions, we discuss about the origin and generation process of several units of magmas in Niijima volcano.

Keywords: Niijima volcano, rhyolite, biotite, cummingtonite, magma plumbing systems, Sr and Nd isotopic ratios