Geochemical features of Quaternary rhyolitic magma and xenolith from Hime-shima volcanic group

*Takehiro Hirayama[1], Tomoyuki Shibata[1], Masako Yoshikawa[1], Yasutaka Hayasaka[1], Keiji Takemura[2]

1. Department of Earth and Planetary Systems Science, Graduate School of Science, Hiroshima University, 2. Kyoto university

The Hime-shima volcanic group is composed of seven volcanoes; Oomi, Yahazudake, Kane, Ukisu, Shiroyama, Darumayama and Inazumi volcano, and is located offing of Kunisaki Peninsula, western Seto Inland Sea. The Philippine Sea Plate (PSP) is subducting under this island. It is thought that the volcanic rocks of the Himeshima volcanic groups were formed by magma mixing of dacite magma and rhyolitic magma, on the bases of disequilibrium amphibole in rhyolite and the linear trends of major element contents with the increasing in SiO_2 contents. According to their high Sr/Y ratios (some 100), low Y contents (< 14.3 ppm) and low $^{87}Sr/^{86}Sr$ rations (0.7037), the source material for dacitic endmember was inferred as partial melt of subducted PSP (Shibata et al. 2014). On the other hand, contributions of crustal materials are suggested from the existence of crustal xenoliths in the dacite (Shibata et al., 2014, 2016) and residual material of metapelite in the rhyolite (Hirayama et al., 2018). However, quantitative discussion for genesis of rhyolitic endmember have not been made. Therefore, we determined trace element compositions of rhyolites and major and trace element compositions of the crustal xenoliths in order to discuss the genesis of rhyolite magma. Additionally, we determined the U-Pb zircon age of the xenoliths to know their origin.

Trace element Primitive Mantle (PM)-normalized patterns of rhyolite from Hime-shima volcanic group is characterized by negative Sr, Zr and Eu anomalies and liner trend of Nb. According to their relationship between Sr/Y ratio and Y content, rhyolite from Hime-shima volcanic group have Sr/Y ratio (< 10) and Y content (< 15 ppm). Rhyolite from Hime-shima volcanic group cannot be classified as adakite and island-arc andesite-dacite-rhyolite. Geochemical features of the rhyolite have high Rb/Sr ratio (> 1.0), low Zr content (30 ppm) and high Nb content (15 ppm).

Petrography of xenoliths from Hime-shima volcanic group is similar to that of basement rocks of Ryoke metamorphic rocks and granites from Kunisaki peninsula. U-Pb ages of zircon grains from metapelite are ca. 100 –110 Ma. These ages show agreement with ages of U-Pb zircon in metamorphic rocks from Ryoke metamorphic belt. Geochemical features of these xenoliths have wide Zr contents (20 –100 ppm), low Nb contents (< 10 ppm), high Y contents (> 15 ppm) and low Sr/Y ratios (< 40 ppm), although the xenolith of basaltic andesite shows high Sr/Y ratio of 90. As results of comparing the geochemical compositions between rhyolite and xenoliths from Hime-shima volcanic group, we think that there is no genetic relationship between the xenoliths and rhyolite.

We examined the genesis of xenoliths from Hime-shima volcanic group are from rocks composed with Ryoke metamorphic belt, because Ryoke metamorphic belt, which is composed of metamorphic rocks, diorites and granites, is under Hime-shima. We compared geochemical features of granites from Ryoke metamorphic belt (Ryoke granites, Yuhara, 1994) with rhyolites from Hime-shima. Trace element PM-normalized patterns of the granites have similar to those of rhyolite from Hime-shima volcanic group, which are characterized by negative Sr, Zr and Eu anomalies and liner trend of Nb. Geochemical compositions of the Ryoke granites have high Rb/Sr ratios (0.5 - 1.5), low Sr/Y ratios (10 - 20), wide

composition range of Y contents (12 - 35 ppm) high Nb concentrations (10 - 20 ppm) and wide composition range of Zr contents (50 - 250 ppm). The chemical features of the rhyolite from Hime-shima volcanic group have high Nb (> 15 ppm), high Rb/Sr ratio (> 1.0), low Y content (< 10 ppm), low Sr/Y ratio (< 10) and low Zr content (< 50 ppm). These chemical features share rhyolites in Hime-shima volcanic group with the Ryoke granites. Therefore, it is interpreted that the rhyolites from Hime-shima volcanic group was derived from crustal material, which compositions is similar to the Ryoke granites.

Keywords: Hime-shima volcanic group, Xenolith, Rhyolite

