Petrological and petrochemical investigations of Iwanoyama-Iyuzan volcanic chain in Higashi-Izu monogenetic volcano group, Izu-Bonin volcanic arc, central Japan

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Higashi–Izu monogenetic volcano group consists of more than 75 volcanoes in northeastern part of Izu Peninsula northern Izu–Bonin volcanic arc. These monogenetic volcanoes were interpreted to have formed mainly under the tensional stress regime due to the several block movement (Koyama and Umino, 1991). Some of these monogenetic volcanoes forming volcanic chains (NW–SE in direction) with different space, time are somewhere distributed (e.g., Hayakawa and Koyama, 1992; Koyama et al., 1995). These eruptions are thought to have occurred in 142.5 ka–2.7 ka (e.g., Hayakawa and Koyama, 1995). Erupted products of these monogenetic volcanoes have wide compositional variations, from basalt to rhyolite, and SiO2 wt.% of 48–73. Some generation processes have been provided for those variations. Andesitic magmas were formed by differentiation from basaltic magma, or crustal contamination, while dacite–rhyolite magmas were by partial melting of granitic crustal materials (e.g., Hamuro, 1985; Miyajima, 1990; Suzuki, 2000). Recent melt inclusion study proposed a model that the chemical variability was attributed to the crystallization within magma chamber (Nichols et al., 2012).

Iwanoyama–Iyuzan volcanic chain is the youngest one in this region (2.7 ka), and also has wide compositional variations from basaltic andesite to dacite, even within one monogenetic volcano (e.g., Kurasawa, 1984; Suzuki, 2000). These variations in this volcanic chain are not yet fully discussed with enough data. Therefore, the purpose of this study is to clarify their magma genesis, origin and evolution of magma in this volcanic chain based on detailed petrographic, petrological and geochemical investigations.

The Iwanoyama, Ananoyama, Yahazuyama and Ananokubo in this chain are mostly composed of dacite and have some different petrography and mineral chemistries. The dacites of former three volcanoes are characterized a bimodal plagioclase anorthite content (An). High An group of plagioclases (An=92–96) indicates normal chemical zoning, but low An group (An=56–70) are dominated, in most cases, by dusty–zoned, or reversely zoned texture. Clinopyroxene has Mg# of around 80 both in core and rim, while orthopyroxenes are grouped into two: 70–72 and 76–80. Major and trace element characteristics give similar bimodal data distributions, which suggest some mixing including crustal materials as important process. Measured Sr isotope ratios (87Sr/86Sr) of Ananoyama and Yahazuyama dacites range in 0.70325–0.70349, indicating inhomogeneous magma and exclude simple crystal fractionation model. They probably reflect the mixing of basaltic magma and crustal material, or mixing of basaltic magma and crustal–derived felsic magma. We will focus our discussion on the generation mechanism and compositional variability within single volcano, or within 2.7 ka volcanic chain, and possibly the relationship with regional tectonics.