Generation of mafic and felsic magmas of the Iwanoyama-Iyuzan volcanic chain in the Higashi-Izu Monogenetic Volcano Field, Izu-Bonin arc, Japan

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The Higashi-Izu Monogenetic Volcano Field (HIMVF) comprises more than 70 subaerial monogenetic volcanoes on the eastern Izu Peninsula and 50 submarine volcanoes in the eastern offshore of the northern Izu-Bonin volcanic arc. Some of the volcanoes are arranged along a NW-SE trends, suggesting fissure eruptions. Petrological studies of the HIMVF have focused on the mafic volcanic rocks (e.g., Hamuro et al., 1983; Umino and Koyama, 1991; Takahashi et al., 2002; Nichols et al., 2012), whereas the felsic volcanic rocks have been investigated mainly to clarify the generation processes of felsic magmas (e.g., Miyajima, 1990; Suzuki et al., 2000; Kanai et al., 2013). In the present study, we investigated volcanic rocks from the Iwanoyama-Iyuzan chain, which represent the most recent subaerial eruptions (2.7 ka). These eruption products are bimodal in composition, comprising dacite and basaltic andesite. The dacites contain phenocrysts of orthopyroxene (Opx), plagioclase (Pl), and minor hornblende and clinopyroxene (Cpx), whereas the basaltic andesites and andesites contain Opx, Pl, Cpx, and olivine. Disequilibrium assemblages of phenocryst minerals and xenocrysts (quartz) are observed in the dacites and andesites.

Bimodal chemical compositions are apparent in Pl anorthite content (An mol. %) of An85-95 and An40-70, and in Opx Mg number (Mg#) of 76-80 and 68-72 in both the dacites and basaltic andesites. These bimodal compositions, as well as disequilibrium assemblages of phenocryst minerals and textures strongly suggest that both the mafic and felsic magmas underwent magma mixing and/or mingling. Whole rock major and trace element characteristic also show bimodality. Rare-earth element (REE) patterns differ between the felsic and mafic rocks; the dacites show enrichment in light REEs and concave down patterns of middle - heavy REEs, whereas the basaltic andesites display slightly inclined patterns from light to heavy REEs. $^{87}Sr/^{86}Sr$ ratios of the rocks show a small range (0.70328-0.70348), but differ slightly among volcanic units, indicating distinct sources for the parental magmas of each volcano.

The parental mafic magmas were probably basaltic andesite in composition, but with slight spatial variations in composition. The mafic magmas are inferred to have formed by mixing of lower crustal materials with primary basaltic magmas or by assimilation and fractional crystallization of the primary basaltic magmas. In contrast, the felsic magmas are interpreted to have been dacitic magmas, similar to the Iwanoyama and Ananoyama dacites. The parental magmas that formed these dacites may have been generated by partial melting of middle- to upper- crustal materials with some variations in $^{87}Sr/^{86}Sr$ ratios. The mafic and felsic magma types likely mixed and/or mingled to a degree and were then erupted in different locations along the fissure within a limited time interval.

Keywords: Higashi-Izu Monogenetic Volcano Field, Iwanoyama-Iyuzan Volcanic Chain, Bimodal volcanism, Northern Izu-Bonin volcanic arc

