Magma genesis of the acidic volcanism and association with basaltic volcanism in the intra-arc rift zone of the Izu volcanic arc, Japan

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The Izu volcanic arc extends over 550 km from the Izu Peninsula, Japan, to the Nishinoshima Trough or Sofugan tectonic line. It is the northernmost segment of the Izu-Bonin-Mariana arc system, which is located at the eastern side of the Philippine Sea Plate. The recent magmatism of the Izu arc is bimodal and characterized by basalt and rhyolite (e.g. Tamura and Tatsumi 2002). In the southern Izu arc, volcanic front (VF) from the Aogashima to the Torishima islands is characterized by submarine calderas and acidic volcanisms. The intra-arc rifting (IAR), characterized by back-arc depressions, small volcanic knolls and ridges, is active in this region. The echelon seamount chain (ESC), backarc side of the intra-arc rift zone, was active before 2.8Ma. Volcanic rocks were obtained in 1995 during a research cruise of the R/V MOANA WAVE (Hawaii University, cruise MW9507) from VF to ESC in the southern Izu arc, and that of the R/V TANSEI-MARU (University of Tokyo, cruise KT09-12) around the Myojin Depression in the intra-arc rift zone. Geochemical variation of volcanic rocks and magma genesis were studied by Hochstaedter et al. (2000, 2001), Machida et al (2008), etc. These studies focused magma and mantle dynamics of basaltic volcanism in the wedge mantle. Acidic volcanic rocks were also dredged during the cruises MW9507 and KT09-12 mainly from the IAR. However, studies of these acidic volcanics were rare. Herein, we present petrographical and chemical analyses of these acidic rocks, and compare these results with those of other acidic rocks in the Izu arc and lab experiments, and propose a model of magma genesis in a context of acidic volcanism and association with basaltic arc volcanism.

The petrographical features of rhyolites exhibit massive or flow textures, and aphyric or rare phyric. Phenocrysts are mainly plagioclase and quartz. Colored minerals are rare and observed mainly orthopyroxene. Amphibole and biotite are not observed. The phenocryst and groundmass mineral compositions of rhyolites exhibit felsic characteristics and narrow ranges. These mineral compositions are not overlapped on those of andesites and basalts. Bulk composition of rhyolite shows depleted in the VF side and enriched in the backarc side. Especially, HFSE systematics indicates the parent material of rhyolites was enriched in the backarc side.

Acidic volcanism in the Izu arc is considered to partial melting of arc middle to lower crust (e.g. Tamura and Tatsumi, 2002) because rhyolite exhibits similar composition to melting experimental results of basaltic or andesitic parental material under anhydrous, low pressure and low temperature (e.g. Shukuno et al., 2006). Compare to these experiments, we consider that volcanics in the rift zone was produced from decompressional melting of andesitic middle crust under anhydrous melting, and this crust exhibits depleted in the front side and enriched in the rearc side caused by across-arc variation of basaltic volcanism.