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Petrology of gabbroic rocks from the Niijima Island, northern Izu-Ogasawara arc

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Niijima Island is the subaerial portion of the northern extremity of arcuate structural high, the Izu-Ogasawara island arc. It is composed of thirteen rhyolitic monogenetic volcanoes, one or two andesite and a basalt volcano (Isshiki, 1987). Each volcanic activity consist of pyroclastic flow or surge deposits, pyroclastic cones and a lava dome, and the latest eruption occurred in 886 A.D. Isshiki (1987) reported that Lithology of the volcano changed from hypersthene-cummingtonite-hornblende rhyolite through cummingtonite rhyolite to biotite rhyolite with some exceptions, as time elapsed. Olivine basalt of high-alumina basalt clan magma was erupted at 3ka during the activity of biotite rhyolite in the Northern part of the island. Rhyolite lavas often carry mafic inclusions which are thought to be products of mixing and/or mingling with basaltic magmas (Koyaguchi, 1986).

Xenoliths of gabbroic rocks are widely recognized in Quaternary mafic (basalt to basaltic andesite) volcanoes, in the northern part of Izu-Ogasawara arc (e.g. Oshima volcano, Miyakejima volcano). Such kind of rocks provides us important information for the structure and compositions of the underlying crust and mantle. Gabbroic rocks are also identified from silicic volcano.

In this study, we will report the newly observed gabbroic xenoliths from Niijima Volcano. Gabbroic xenoliths were collected from 2 localities, 8 samples from Wakago pyroclastic surge deposits (host rock is olivine basalt; bulk SiO_2 wt% = 49.5-51.0) and 2 samples collected from Attiyama lava dome (host lava is biotite rhyolite; bulk SiO_2 wt% = 76.8-78.0). Most of these were enclaved by thin basaltic envelopes. They are classified into amphibole absent type; leucocratic gabbro, gabbro (Streckeisen, 1976) and amphibole present type; leucocratic hornblende gabbro (Streckeisen, 1976). Petrological features of each type as shown below:

Amphibole absent (B) type: This type has relatively coarse grained (0.5-3 mm) equigranular texture and it has miarolitic cavities. This type consists of plagioclase (An mol % = 58-90) and clinopyroxene (Mg# = 76-80), orthopyroxene (Mg# = 73-78), Fe-Ti oxide and olivine (Fo = 75-80). Most of the Pl crystals show normal zoning.

Amphibole present (B) type: This type has relatively fine grained (0.3-2 mm) equigranular texture. It consists of plagioclase (bimodal compositions in An mol % = 45-55, 70-88), hornblende (Mg# = 68-73), cummingtonite (Mg# = 69-73), quartz and Fe-Ti oxide. Using amphibole-plagioclase thermometry (Holland & Blundy, 1994) and Al-in-hornblende barometry (Anderson & Smith, 1995), P-T conditions will be estimated.

A types are depleted in trace elements and REE contents (bulk compositions) compared with host basaltic rocks. N-MORB-normalized (Pearce, 1983) trace elements patterns of these rocks are similar to that of gabbroic rocks from Tanzawa plutonic complex (Kawate & Arima, 1998). B types have less evolved compositions in mineral chemistry compared with Niijima rhyolite. Hornblende compositions in that types overlap with that of gabbroic suites in Tanzawa rocks.

As proposed by Nakajima & Arima (1998), above evidences suggest a possibility that the rhyolitic magmas in Niijima volcano could be formed by partial melting of amphibolite crust.

Keywords: gabbro, xenolith, rhyolite, amphibole, Izu-Ogasawara arc