Magma system of the submarine volcanic chain extending from the frontal arc volcano -Hachijo NW volcanic chain-

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Magma transport in a long distance has been proposed as a trigger of the formation of summit caldera and northwestward migration of the hypocentre of earthquakes during the volcanic event of the Miyakejima in 2000. Hoping to obtain direct evidences of the magma transport, i.e., transported magma, submarine volcanic chains around the frontal volcanoes in the northern Izu arc were investigated in 2003 and 2004 using surface ships (R/V Tanseimaru and Kairei) and a ROV (Hyper Dorphin).

A volcanic chain (Hachijo NW chain) is extending about 15 km in NNW direction from Hachijo Nishiyama volcano. The volcanic chain is composed of ridges and many small cones generally with basal diameters of less than 2km. Dredge sampling recovered basaltic lavas and spatters mainly from the upper slope of these cones. Diving survey using ROV revealed the occurrence of pillow lava flows on the steep slope and accumulation of spatters and agglutinates near the eruption center. Large number of hornblende-bearing pumices were also recovered. Based on their mode of occurrence and the wide distribution of this type of pumice with effectively the same chemical composition, we interpreted that these pumices did not erupt from the Hachijo NW chain, but possibly from a submarine caldera such as Kurose hole and Kurosenishi hole.

Compared to the basaltic rocks from the Nishiyama, basalts from the Hachijo NW chain generally have more primitive composition (up to nearly 7% of MgO). While the trend of major element composition of the Nishiyama volcano and its ssubaerial satellite cones can be explained mainly by plagioclase accumulation (and fractionation), Hachijo NW chain shows compositional trend controlled by crystal fractionation of cpx, ol and plagioclase.

Trace element ratios unaffected by melting or crystal fractionation (e.g., Nb/Zr, Ba/La) are not significantly different between the Nishiyama and the Hachijo NW chain. This implies that the sources of magma for these volcanic systems are basically identical. However, ratios affected by melting process are significantly different between the two. Hachijo NW chain shows lower LREE/HREE and Zr/Y, implying difference in degree of partial melting of the source. Other possible processes for producing these differences in trace element characteristics include crustal assimilation.

The results obtained so far appear to indicate that the magmatic system of the Hachijo NW chain is independent from that of the Nishiyama volcano, even though there are some transitional lavas implying the interaction between the two systems. Magma erupted from the Nishiyama volcano seem to have plagioclase accumulation after crystal fractionation of plagioclase and mafic minerals possibly in the shallow crustal magma chamber. Magmas erupted in the Hachijo NW chain, however, experienced much less crystal fractionation in the crust during ascent. They erupted without having plagioclase accumulation.

The observed difference in magma source preclude the possibility that the Hachijo NW chain magma was transported from the Nishiyama volcano before the Nishiyama magma was affected by crystal fractionation and plagioclase accumulation. However, if the crustal assimilation was the cause of the difference in trace element chemistry, possibility of magma transport in deep crustal level still cannot be totally rejected. The Nishiyama magma might have more influence of assimilation.