Mineral and isotope geochemistry of the mafic inclusions in the Pliocene Umikawa volcanic rocks.

Makiko Yamaguchi[1]; Yoshiaki Yamamoto[1]; Norie Fujibayashi[2]

[1] Graduate Edu.,Niigata Univ.; [2] Geol. Edu. Niigata Univ.

Hornblende gabbroic inclusions are often observed calk alkaline andesites distributed in the back-arc area of the northeast Japan arc. The genetic relation to high-almina basalt has been discussed (e.g.Takeshita,1968).The Pliocene Umikawa volcanic rocks,Itoigawa city,Niigata prefecture include hornblende gabbroic cumulates(Umikawa gabbroic inclusions), whose $^{87}Sr/^{86}Sr$ ratio widely ranges from 0.7040 to 0.7060. This range is distinctly higher than those show by gabbroic inclusions from the other localities. This study aims to verify the liquid compositions using the mineral geochemistry and to discuss about the isotopic variations in the Umikawa gabbroic inclusions.

The Umikawa gabbroic inclusions are classified into hornblende pyroxenite(HCOOL), hornblende gabbro (HOP, HCOP, HCP and HP),and gabbro (CP), with variation in the mineral assemblage, where H=hornblende, C=clinopyroxene, O=orthopyroxene, P=plagioclase, Ol=olivine. Mineral compositions in hornblende pyroxenite and hornblende gabbro exhibit a series of variation with decrease in modal abundance of pyroxenes. The mg# of clinopyroxene in hornblende pyroxenite, hornblende gabbro and gabbro ranges from 81 to 76,from 80 to 65 and from 87 to 83 ,respectively. Clinopyroxene and amphibole in the hornblende gabbros show higher abundance of trace elements than those in the hornblende pyroxenites. The chondrite-normalized trace element patterns of these minerals are almost in parallel,with higher abundance of LILE,HFSE, and REE. The mg# of clinopyroxene in gabbro ranges from 87 to 83. The clinopyroxenes show stronger enrichment in Sc,Rb and Ba and depletion in REE, especially in LREE compared to those of hornblende pyroxenite. As for isotopic compositions, hornblende pyroxenite and HOP and HCOP type of hornblende gabbro have similar and the lowest $^{87}Sr/^{86}Sr$ (0.7040).HCP and HP types show higher $^{87}Sr/^{86}Sr$,up to 0.7052.Gabbro (CP type) has high $^{87}Sr/^{86}Sr$ (0.7060). In $^{87}Sr/^{86}Sr$-$^{143}Nd/^{144}Nd$ diagram, HOP and HCOP types lie on the mantle array and HCP and HP types shift from the array with high $^{87}Sr/^{86}Sr$ and similar $^{143}Nd/^{144}Nd$ ratios.

Trace element compositions of the parental liquids were calculated from clinopyroxene and amphibole geochemistry using mineral/liquid partition coeffients (Hauri,1994;Zajacz,2006;Dostal,1983;Sisson,1994). All the N-MORB normalized patterns are similar to the continental arc basalt. In order to interprete the variation in calculated liquid compositions, we examined possibility of AFC in the Sr-$^{87}Sr/^{86}Sr$ relation, assuming various primary liquids; high-almina basalt,high-Mg adakite,Umikawa basalt and tholeiitic basalt,fractional crystallization of HCOP, and granite and granulite as contaminants. As a result,three possible candidates were high-Mg adakite and granite, Umikawa basalt and granulite, and tholeiitic basalt and granite.