Crystallization processes and primitive melt compositions estimated from pyroxenites ejected from the Ichinome-gata volcano

Satomi Kame[1]; Naoyuki Ishida[1]; Norie Fujibayashi[2]

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

Formation of pyroxenite at the depth nearby MOHO plays an important role on the evolution of arc magmas. Muntener et al. (2001) experimentally suggested that pyroxenite and pyroxene-hornblendite could be formed from hydrous basaltic and high-Mg andesitic magmas as cumulates under high pressure conditions (1.2GPa).

Major and minor element chemistry, Rb-Sr, Sm-Nd mineral isochron age, and istopic composition were analyzed for constituent minerals of pyroxenite and gabbros, ejected from the Ichinome-gata volcano, NE Japan arc.

The Ichinome-gata cumulate xenoliths are composed of seven rock types, and can be divided into Hbl-poor and -rich groups. Hbl-poor group (websterite, hornblende-gabbronorite)is characterized by low abundance in amphibole (less than 35%) and coarse-grained texture. Hbl-rich group (gabbro, hornblende-gabbronorite, hornblende-gabbro, olivine-gabbronorite, pyroxene-hornblendite, and pyroxene-hornblende-gabbro) contain amphibole more than 35%, and are in general fine-grained texture. Two groups have different characteristics in mineral chemistry. In each group, websterite and pyroxene-hornblendite have the most primitive mineral compositions.

Both olivine and clinopyroxene of websterite have high Mg#, and have high Ni and Cr contents (Mg#=85.4-86.6 and $NiO_{wt\%}$=0.24-0.51 of olivine, Mg#=88.5-90.4 and $Cr_2O_{3\ wt\%}$=0.34-0.91 of clinopyroxene), respectively. However, those of pyroxene-hornblendite show lower values (Mg#=75.3-77.0, and $Cr_2O_{3\ wt\%}$=0-0.006 of clinopyroxene). From An content of plagioclase in relation to mg# of olivine or clinopyroxene, the latter was in the range of island arc gabbros and the former was in the oceanic gabbros. However, trace element chemistry analyzed using ICP-MS for minerals showed that parental liquids for both rock types are arc origin. The calculated liquid compositions in equilibrium with pyroxene-hornblendite are quite similar to high-Mg andesite in N-MORB normalized pattern. While, those for websterite show parallel patterns to arc basalt, though they are further depleted in REE. Rb-Sr, Sm-Nd mineral isochron ages indicate that Hbl-poor group was formed ca. 450Ma, and Hbl-rich group ca. 230Ma. The initial $^{87}Sr/^{86}Sr$ ratio and $^{143}Nd/^{144}Nd$ ratio are 0.70325-0.70330, 0.51224 for Hbl-poor group, and 0.70340, 0.51288 for Hbl-rich group, respectively.

We suggest that the parental liquids of the Hbl-rich group may be the differentiates from high-Mg andesitic magma. While, the parental liquids of the Hbl-poor group may be the differentiates from primitive basaltic arc magma with very high degree of partial melting. Alternatively, the source mantle was depleted in incompatible elements. Pyroxene geothermometer and clinopyroxene geobarometer suggest that the condition of websterite formation was ca. 1000-1050^{o}C , ca.10Kbar.