Petrology of plagiogranite and gabbronorite in the northern Oman ophiolite

Shusaku Yamazaki[1]; Sumio Miyashita[2]

[1] Graduate school of Sci. & Tech., Niigata Univ.; [2] Dep. Geol., Fac. Sci., Niigata Univ.

Oceanic plagiogranite is the whole suite of evolved, SiO_2-enriched plutonic rocks within the lower oceanic crust in a very broad sense, including diorites and quartz diorite (Koepke et al., 2007). The origin of oceanic plagiogranite has been discussed based on four different models: extreme differentiation of MORB-like melt, liquid immiscibility of basaltic melt, partial melting of oceanic gabbro, and anatexis of altered basalt (e.g. Koepke et al., 2005). In the Oman ophiolite, oceanic plagiogranite bodies, which are tens to hundreds meters in size, are commonly distributed across from upper gabbro to sheeted dike complex (e.g. Nicolas 1989). In this study, we investigated the oceanic plagiogranites and associated gabbronorites in the northern Oman ophiolite. The result shows that SiO_2-rich plagiogranite in this area is divided into two types: high Zr and low Zr type. The origin of high Zr type is considered due to the partial melting of underlying gabbro. The origin of low Zr type is implied the highly differentiation of boninitic melt which is related to IAT late magmatism.

In the north area of Fizh block, large amount of gabbronorite is intruding into lower crustal section between layered gabbro and upper foliated gabbro. The gabbronorite has several to tens of meter scale layered gabbro blocks at some locations. The dominant rock types are olivine gabbronorite, gabbronorite, and oxide gabbronorite. In this area, most of plagiogranite is observed as ˜1 m thick dikes and sills. The frequency of plagiogranite intrusion increases toward the top of gabbronorite sequence. Some plagiogranite bodies, which are hundred-meter scale, are distributed in the top of gabbronorite and within the upper gabbro sequence. The transition from gabbronorite to plagiogranite body is observed that gabbronorite changes to quartz diorite through amphibole rich gabbronorite and diorite in some locations. These observations imply that plagiogranitic melts are generated within the gabbronorite and concentrated in the top of gabbronorite sequence. Plagiogranite dikes and sills in this area are diorite, quartz diorite, and tonalite, and commonly include many rounded or angular basaltic to gabbroic mafic enclaves.

Plagiogranite is classified into two groups based on their rock type and composition. There are high-SiO_2 tonalite (= 73-77 wt%) and low SiO2 diorite and quartz diorite (= 52-61 wt%). Furthermore, high SiO_2 tonalite is separated into high Zr (50-140ppm) and low Zr (-50 ppm) type. High Zr tonalite and low SiO_2 diorite and quartz diorite have similar trace element patterns. Their MORB-normalized REE patterns show a flat MORB-like pattern. On the other hand, low Zr type tonalite has HREE-enriched and LREE-depleted REE pattern which is semilar to boninitic dikes in this area. Olivine gabbronorite and gabbronorite have similar compositions with MOR-type layered gabbro. Oxide gabbronorite have lower SiO_2 and higher TiO_2 composition than the other gabbronorite.

Koepke et al. (2005) demonstrated by the experimental works that the low TiO_2 composition of oceanic plagiogranite is due to the hydrous partial melting of oceanic gabbro. The result shows that new plagioclases with higher-An composition than the starting material are formed at the plagioclase rims due to hydrous partial melting. Plagioclase of some gabbronorite in this area shows reverse zoning which resembles to the character of the experiment products. Additionally, this type gabbronorite includes amphiboles as clinopyroxene rim and between grain boundary. These possibly explained that some gabbronorite is the restite of hydrous partial melting due to the addition of water into hot oceanic crust, or the product of melt/rock reaction with hydrous melt impregnation within hot oceanic crust.

References:

Koepke et al., 2005. *Terra Nova*, 17, 286-291.

Koepke et al., 2007.*Contrib Mineral Petrol*, 153, 67-84.

Nicolas, 1989. Kluwer, Amsterdam.