Relationship between the ultramafic complex and boninite in the Salahi block, the Oman ophiolite

*Tamaki Fujino[1], Eiichi TAKAZAWA[1,2]

1. Department of Geology, Faculty of Science, Niigata University, 2. Japan Agency for Marine/Earth Science and Technology

Oman ophiolite is the world's largest ophiolite, located at the eastern tip of the Arabian Peninsula, and is thought to be an ophiolite transformed from spreading ridge to subduction zone setting (Umino et al., 1990; Arai et al., 2006). The ultramafic complex consisting of peridotites and pyroxenites exists in the basal part of the Salahi mantle section, located in the northern part of Oman ophiolite. This peridotite contains spinel with high Cr# (=Cr/[Cr+Al] atomic ratio). In particular, the spinel in dunite has a composition similar to that of spinel in boninite, and is compositionally different from the spinel in the peridotite that forms the main part of the Salahi mantle section and the Moho Transition Zone. During the formation of the subduction zone, fluids liberated from the metamorphic sole entered the mantle section and reacted with the residual harzburigte to form boninite as well as high Cr# spinel-bearing dunite as the residue (Nomoto and Takazawa, 2013).

Therefore, the purpose of this study is to clarify how peridotites and pyroxenites, including the ultramafic complex dunite, are related to boninite formation. This will lead to a better understanding of melt formation and reaction with mantle peridotites in subduction zone environment. The main subjects of the study were dunite, harzburgite, wehrlite, pyroxenites, and boninite. In addition, boninite data from Ishikawa et al (2005), Kusano et al (2014), and Yamazaki (2013MS) are used for comparison. We conducted observation of thin sections under polarized-microscope, major elemental analysis (spinel, olivine, clinopyroxene and orthopyroxene) using SEM-EDS and trace element analysis of clinopyroxene using LA-ICP-MS.

The dunites in the ultramafic complex have similarities to forearc peridotites and boninites with respect to spinel composition, as well as some that are inferred to be cumulate crystallized from a melt. Wehrlite, orthopyroxenite, and some harzburgite also have similarities to boninite in the Cr#, Mg# (=Mg/[Mg+Fe]), and TiO2 compositions of spinel. Magma produced by flux melting of lherzolite was saturated with olivine and clinopyroxene, which may have crystallized wehrlite and pyroxenite to form boninite magma. In this case, dunite and harzburigte in the ultramafic complex are considered to be residues produced by flux melting of lherzolite.

Clinopyroxene phenocrysts in boninites show LREE-depleted chondrite-normalized REE pattern. Clinopyroxenes in dunite, wehrlite, clinopyroxenite, orthopyroxenite and some harzburgite have REE patterns similar to those of boninite. The deference in spinel Cr# observed in these rocks are due to a difference in the degree of melting for producing primary boninite magma in equilibrium with harzburgite and dunite. Therefore, the entire rocks in the ultramafic complex is considered to be genetically related to boninite. In addition, wehrlite, pyroxenites were formed by crystal differentiation from primary boninite magma.

Keywords: Oman ophiolite, Ultramafic complex, Boninite

