Petrological study of the crust-mantle boundary using CM2B cores from the ICDP Oman Drilling Project.

*Natsuki Oyanagi[1], Eiichi TAKAZAWA[1,2], Sayantani Chatterjee[1], Oman Drilling Project Phase 2 Science Party

1. Faculty of Science, Niigata University, 2. VERC, IMG, JAMSTEC

In this study, a petrological and geochemical study was carried out on the origin of the crust-mantle boundary using the cores from Hole CM2B drilled by ICDP Oman Drilling Project in the Wadi Zeeb of the Wadi Tayin massif, southern Oman ophiolite. Many studies have been done on the origin of the crust-mantle transition zone (MTZ) in the Oman ophiolite, and various models have been proposed [1-9]. However, the process that created the boundary between the MTZ dunite and the mantle harzburgite has not been understood yet. This study aims to investigate the petrographic characteristics and mineral compositions of the cores from Hole CM2B, and to clarify the process forming the boundary between the MTZ and the mantle section.

Analytical results of mineral compositions revealed the presence of dunite with NiO content of olivine below the range of the olivine mantle array [10], indicating reactional fractional crystallization of olivine from a melt. There is also a dunite with a lower olivine Fo value than the range of olivine spinel mantle array (OSMA) [11], indicating the possibility of cumulus olivine crystallized from the melt. Furthermore, TiO_2 and Na_2O contents of clinopyroxene increased near the boundary between the MTZ dunite and the mantle harzburgite. Furthermore, clinopyroxenes in the dunites and harzburgites near the boundary between the MTZ and the mantle section are highly enriched in incompatible elements including rare earth elements (REEs).

We consider that the enrichment of incompatible elements at the boundary as a result of the zone melting of mantle harzburgite. The boundary between the MTZ and the mantle harzburgite is a kind of active reaction front where the dissolution of orthopyroxene (Opx) and precipitation of olivine continuously proceed to make dunitic MTZ thicker. For most of the incompatible elements the partition coefficients between Opx and melt are greater than those between olivine and melt. If the dissolution of Opx and precipitation of olivine continued for a long time to create a thick MTZ, the melt at the boundary becomes highly enriched in incompatible elements. This phenomenon is consistent with the presence of harzburgite, which has high spinel Cr# (=atomic Cr/[Cr + Al] ratio) and low olivine Fo value at the top of the mantle section.

On the other hand, the decrease in spinel Cr# in harzburgite at a depth of 260 m may be the result of a reaction with a melt flowing from the outside because of high Al_2O_3, TiO_2 and Na_2O contents and enrichment in REEs in the clinopyroxene at the corresponding depth compared to the surroundings.

[1] Pallister and Hopson, 1981, *J. Geophys. Res.*, **86**, 2593-2644.
[2] Kelemen et al., 1995, *Nature*, **375**, 747-753.
[3] Korenaga and Kelemen, 1997, *J. Geophys. Res.*, **102**, 27729-27749.
[4] Koga et al., 2001, *G-cubed*, **2**, 2000GC000132.
[5] Collier and Kelemen, 2010, *J. Petrol.*, **51**, 1913-1940.
[6] Abily and Ceuleneer, 2013, *Geol.*, **41**, 67-70.
[7] Rospabé et al., 2017, *Geol.*, 2017139.

[8] Rospabé et al., 2018, *Geochem. Cosmochim. Acta*, **234**, 1-23.
[9] Rospabé et al., 2019, *Earth Planet. Sci. Lett.*, **516**, 108-121.
[10] Takahashi and Uto, 1986, *Bull. Vol. Soc. Japan*, Sec. Ser., **30**, S17-S40.
[11] Arai, 1994, *Chem. Geol.*, **113**, 191-204.

Keywords: Oman ophiolite, crust-mantle boundary, Moho transition zone, mantle section, ICDP Oman Drilling Project

