Hydrothermal alteration of lower crust around lithological contact between gabbro and dunite: Insite from Oman DP drilling cores in Samail ophiolite, Oman

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Hydrothermal alteration within the oceanic crust affects a large effect on the Earth, including water flux into the subduction zone, biological activity in the seafloor, seismicity in the oceanic crust and subduction zones. Hydrothermal alteration within oceanic crusts involves a significant mass transport through fluid infiltration; therefore, alteration mineralogy have spatial variation. However, due to the limited sample availability, spatial variation of hydrothermal alteration is unclear. The Oman drilling project (DP) drilled rocks in the Samali ophiolite, Oman, and continuous lithologies from the crustal section to the mantle section were collected. Therefore, the core may record hydrothermal alteration history around paleo Moho, which gives us an opportunity to analyze the along-depth variation of alteration mineralogy.

In this study, we investigated mineralogical/petrological characteristics across the boundary between altered olivine gabbro (lower crustal section) and serpentinized dunite (mantle section) taken from Oman DP CM1A drilling cores. Metasomatic reaction zone (~30 cm width) has been observed within the lower crustal section in contact with the mantle section, whereas no metasomatic zone are found within the mantle section. The metasomatized olivine gabbro are composed of vesuvianite (Vsv), hydrogrossular (Grs), diopside (Di), chlorite (Chl), corundum (Crn), xonotlite (Xo), titanite (Ttn), and tobermorite (Tob). Textural observation suggests that Vsv+Grs+Di+Chl+Crn were formed in the early stage (stage I), and xonotlite was subsequently formed (stage II), which followed by further replacement of xonotlite by tobermorite (stage III).

Based on the simple thermodynamic calculation, the existence of corundum roughly suggests that the formation conditions of stage I was estimated as 1-2 kbar and >400 ˚C. Temperature of stage III was estimated by the tobamorite-stability conditions as to be < 150 ˚C (Shaw et al., 2000). We will conduct further petrological/mineralogical observation, and discuss timing of hydrothermal alteration and structure of lower crust.

Reference

Shaw, S., Clark, S. M., & Henderson, C. M. B. (2000). Hydrothermal formation of the calcium silicate hydrates, tobermorite ($Ca_5Si_6O_{16}(OH)_2 \cdot 4H_2O$) and xonotlite ($Ca_6Si_6O_{17}(OH)_2$): an in situ synchrotron study. *Chemical Geology,* 167(1-2), 129-140.

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