First geochemical and mineralogical results of Oman Crust-Mantle transition: holes CM1A and CM2B characterization aboard DV-Chikyu_ Oman Drilling Project, Phase 2 Leg3

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The transition from the crust to the mantle of Oman ophiolite was drilled at Holes CM1A and CM2B (Wadi Tayin Massif) during Phase 2 of the Oman Drilling Project (Nov. 2017-Jan. 2018). The 400m-long Hole CM1A core crosses from the lower crust, through the crust-mantle transition zone, into residual upper mantle peridotites. The 300m-long Hole CM2B core samples the crust-mantle transition zone and underlying residual mantle peridotites. The main logged lithological units are olivine gabbro, gabbro, dunite, harzburgite and wehrlite, associated with minor gabbronorite, troctolite, websterite, anorthosite, and chromitite. During Oman-DP Phase 2 Leg 3 (ChikyuOman; July-Aug. 2018), 95 and 67 samples of core from CM1A and CM2B, respectively, were analyzed for whole-rock major and minor elements (XRF) as well as CO_2 and H_2O concentrations (CHNS). XRD measurements were performed on the 69 onsite samples. Furthermore, whole-rock (pressed powder pellets) and mineral trace element contents were determined for selected samples onboard the D/V Chikyu, using the NewWave Research UP-213 Nd:YAG deep UV (213 nm) laser ablation system coupled with an Agilent 7500ce quadrupole ICP-MS.

Samples from holes CM1A and CM2B have a large petrological and chemical variability, mainly reflecting the different rock types, especially across the crust-mantle transition. CM1A and CM2B volatile element contents reflect extensive serpentinization linked to interaction with H_2O-rich fluids, and abundant carbonate veins downhole, suggesting an association between CO_2-rich fluids and serpentinization. Whole-rock and ortho- and clinopyroxene trace element abundances are similar to Oman ophiolite compositions described in previous studies. All gabbroic domains display nearly parallel REE patterns with a strong depletion in HFSE relative to REE. Dunites display variable trace element contents and REE patterns, negative or positive anomalies in Eu and commonly moderate to strong positive anomalies in U, Pb, Sr and Ti. The variation of REE concentrations and patterns observed in Oman dunites could be explained by melt-rock reactions leading to dunite formation, after the dissolution of orthopyroxene in harzburgite and interaction with interstitial melt.

Keywords: Oman crust-mantle transition, gabbros, dunite, harzburgite, Oman ophiolite, XRF, XRD, ICP-MS, LA-ICP-MS, Chikyu_OmanDP

