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Diversity of MORB genesis within the uppermost mantle from the segment center to end: an example from the northern Oman ophiolite

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Dunite bands and veins in the ophiolitic mantle peridotite are interpreted as fossil melt conduits within the suboceanic mantle. In particular, concordant dunite bands are possibly important as the melt conduits through which parental melts of MORB (mid-ocean ridge basalts) were transported to shallower mantle beneath the ridge axis. However, no detailed petrological data of concordant dunite bands and surrounding peridotites have been published. We conducted sampling of concordant dunite bands and its aureole from various "stratigraphic levels" in the mantle section from an estimated ancient-segment center and its end in the northern Oman ophiolite. They are various both in thickness (few millimeters to few meters) and in frequency of appearance. Dunite bands are almost pyroxene-free, and their orthopyroxenes, if any, are vermicular in shape.
Mineral chemistry shows systematic variations in the wall peridotites toward the dunite bands: (1) a decrease in Fo content (92 to 90.5) of olivines, (2) an increase in Cr/(Cr + Al) atomic ratio (0.5 to 0.6) and TiO_2 content (nil to 0.25 wt %) in spinels, and (3) an increase in Na2O content (almost nil to 0.2 wt%) of clinopyroxene. In ambient residual peridotites, rare earth element (REE) patterns of clinopyroxene incline from light-REE (LREE) to heavy-REE (HREE) monotonously. The REE pattern of clinopyroxene in dunites and surrounding peridotites show various shapes, depending on the position, the segment center to end: gentle slope from HREE to LREE at the segment center, and U-shaped at the segment end.
We conducted calculation for REE enrichment in clinopyroxenes by using 1-D steady state modeling, which duplicates simple fractional melting process and influx melting process. The results indicate that LREE-enriched melts (E-MORB-like) and LREE-depleted MORB melts (N-MORB-like) were involved in formation of the present-day concordant dunite bands within the Oman mantle with various ratios of LREE-enriched melt/LREE-depleted melt; the ratios are low at segment center, and are high at the segment end. The primitive MORB melts have possibly changed to MORB through interaction with peridotites en route to the uppermost mantle, however, the interaction degrees between the segment center and segment end were different.