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Petrology and chemistry of lherzolites above metamorphic sole in North Oman (Sarami): evidence for mantle metasomatism

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The basal lherzolites above the metamorphic sole (mainly amphibolites) are scattered in several exposures from south to north Oman (e.g., Wadi Sarami). We recognized two types of lherzolites (A, B) based on the field occurrence, mineralogy and chemistry. The type-B lherzolite, rarely in occurrence and highly serpentinized, lies directly above the amphibolites and is underlain by the type A. Porphyroclastic textures are dominant in both types, but the type-B lherzolite sometimes shows cataclastic and mylonitic textures. Clinopyroxene (Mg#, 0.9-0.94) in the type-B lherzolite has high contents of Al2O3 (5.0-7.5 wt%), Na2O (0.6-1.2 wt%), Cr2O3 (0.7-1.4 wt%) and TiO2 (0.25-0.4) relative to that in the type A, reflecting the different origins for the two types of lherzolites from Sarami. There is no difference in chemical composition of orthopyroxene (Mg#, 0.89-0.92) and olivine in the studied lherzolites. The Opx is enriched in Al2O3, (up to 7.0 wt%), CaO (up to 3.0 wt%) and Cr2O3 (<1.0 wt%) in both types. The olivines (Fo89.5-Fo91) plot in the mantle olivine array, and indicate the residual character of these lherzolites. The Cr# of spinel (<0.18) in the type-B lherzolite is slightly lower than spinel (Cr#, 0.18-0.3) in the type A and lies in the lower end of abyssal peridotite field, suggesting that the former is more fertile than the latter. The degree of melting using Cr# versus TiO2 of chromian spinels is around 5-10% for the typ-B lherzolite and 10-15% for the type A, confirmed by spinel-Cr# versus olivine-Fo (<10% melting). There are two possibilities for the lherzolite origin; the Sarami lherzolites represent fertile abyssal peridotites along oceanic fracture zones where the type B lherzolite is more fertile than the type A or the former may be formed from the latter (type A) during refertilization (Na, Al, Ti-bearing fluid/melt metasomatism) processes by MORB-type melt. The formation of hornblende (Na2O, 2.5 wt%) inside and along the Cpx in the type-B lherzolite is evidence for Na-Al metasomatism affected on the type B. The Fe, S, Ni, Co-bearing phases as pentlandite, awaruite, heazlewoodite and violarite were formed in a late stage during serpentinization by hydrothermal solution. The assemblage of hornblende + chlorite + ferritchromite in Sarami lherzolites suggests that their rocks have been suffered from metamorphism under amphibolite facies during subduction stage.

Keywords: basal lherzolites, metasomatism, clinopyroxene, Wadi Sarami, Oman