Mineral chemistry and geochemistry of ophiolitic metaultramafics from Um Halham and Fawakhir, Central Eastern Desert, Egypt

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Abstract

This study is focused on ophiolitic metaultramafics from Um Halham and Fawakhir, Central Eastern Desert of Egypt. The rocks include serpentinized peridotites, serpentinites together with talc– and quartz–carbonates. The primary spinel relict is Al–chromite [Cr# > 60], which is replaced by Cr–magnetite during metamorphism. The high Cr# of Al–chromites resembles supra-subduction zone (SSZ) peridotites and suggests derivation from the deeper portion of the mantle section with boninitic affinity. These mantle rocks equilibrated with boninitic melt have been generated by high melting degrees. The estimated melting degrees (~ 19–24%) lie within the range of SSZ peridotites. The high Cr# of spinel and Fo content of olivine together with the narrow compositional range suggest a mantle residual origin. Serpentinized peridotite and serpentinites have low Al_2O_3/SiO_2 ratios (mostly < 0.03) like fore-arc mantle wedge serpentinites and further indicate that their mantle protolith had experienced partial melting before serpentinization process. Moreover, they have very low Nb, Ta, Zr and Hf concentrations along with sub-chondritic Nb/Ta (0.3–16) and Zr/Hf (mostly 1–20) ratios further confirming that their mantle source was depleted by earlier melting extraction event. The high chondrite normalized $(La/Sm)_N$ ratios (average 10) reflect input of subduction-related slab melts/fluids into their mantle source.