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Petrogenetic and tectonic interpretation of Wadi Zikt Chromitite, Khor Fakkan block, United Arab Emirates: Evidence from major and trace mineral chemistry

Mabrouk Sami[1], Bahaa Mahmoud[1], Xun Zhao[1], Amr El-Awady[2], Theodoros Ntaflos[3], Rainer Abart[3], and Douaa Fathy[4]

[1]United Arab Emirates University, College of Science, Geosciences Department, Al Ain, 15551, United Arab Emirates (mabrouksami@uaeu.ac.ae)

[2]Geology Department, Faculty of Science, Zagazig University, Zagazig 44519, Egypt

[3]Department of Lithospheric Research, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria

[4]Geology Department, Faculty of Science, Minia University, El-Minia 61519, Egypt

This study investigates the mineral chemistry of olivine, orthopyroxene, clinopyroxene, and chromite phases from the Wadi Zikt high Al-chromitite within the Khor Fakkan massif of the UAE ophiolites. The ophiolites, part of the well-preserved Semail ophiolite complex, represent mantle sections formed in a supra-subduction zone (SSZ) environment. Detailed analyses reveal that the olivine exhibits high forsterite contents (Fo > 90), elevated NiO concentrations (up to 0.6 wt%), and low MnO (< 0.2 wt%), indicating significant partial melting under hydrous conditions. Orthopyroxenes display high Mg# (> 90), low Al□O□ (< 1.2 wt%), and elevated Cr□O□ (up to 0.62 wt%) contents, consistent with residues of extensive melt extraction. Clinopyroxenes are characterized by high Mg# and low TiO□, Al□O□, Dy, and Yb contents suggesting a forearc setting. Chromite analyses show high Cr# (51–67), low TiO□ (< 0.8 wt%), and low $Ga/Fe^{3}_{\#}$ ratio, reinforcing a fore-arc origin. The studied chromites are analogues to those of the fore-arc peridotite, indicating high degrees of partial melting (25–35%). The geochemical signatures of the studied phases, including low Ti, high Cr#, and high Mg#, suggest that the Wadi Zikt chromitite formed in a depleted mantle wedge influenced by subduction-derived fluids and boninitic melts during the early stages of subduction initiation. These findings provide critical insights into mantle wedge processes, arc magma genesis, and ophiolite formation in SSZ settings. This study underscores the significance of the Wadi Zikt chromitite as a key example of SSZ mantle dynamics and melt evolution, contributing to the broader understanding of ophiolite complexes worldwide.