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Petrological constraints on the mantle peridotites from the Cretaceous ophiolites in southern Turkey and northern Cyprus

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In this study we present geochemical variations of peridotites from the ophiolite suites exposed within the Tauride Belt of southern Turkey and in Northern Cyprus with an aim to document the nature of mantle melting and possible effects of melt movement on element behavior in supra-subduction zone (SSZ) mantle. The ultramafic rocks representing the mantle sections of these ophiolites are variably serpentinized spinel–bearing harzburgites and dunites with major element compositions indicating variable depletions in basaltic components. Major and trace element systematics of primary mantle minerals indicate that the peridotites are likely the residual products left behind after relatively high-degree of mantle melting (16 – 23%). These mantle relicts, however, display also compositional and textural evidence indicative of extensive melt-rock interaction. Olivine–orthopyroxene–spinel equilibria indicate that the peridotites are characterized by high oxygen fugacity (QFM+2), which may be indicative of extensive interaction of the peridotites with highly oxidized melts. Precise determination of trace elements from in situ measurements of primary mantle minerals by laser-ablation ICP-MS reveals important features about the petrogenetic evolution of these mantle representatives. Trace element signatures in clinopyroxenes indicate that the peridotites are strongly depleted in Ti and HREE relative to Zr and MLREE, respectively. Uneven distribution of REE among coexisting opx – cpx pairs in the peridotites reflects chemical disequilibrium, which can be interpreted to have resulted from either diffusive exchange during melt movement or interaction with metasomatizing agents. Based on Ga concentrations and Ga–Ti–Fe^{+3}# variations in chrome-spinels the peridotites have been inferred to have experienced significant compositional modification through melt-solid interaction following partial melting. Overall, mineral chemical variations in the peridotites indicate that the compositions of these depleted mantle relicts cannot be explained solely by simple mantle melting, but require metasomatic processes with likely involvement of subduction-related oxidizing melts. Precise compositions of the mantle and melt components involved, however, differ from one locality to another, potentially providing opportunity to develop models in understanding the geodynamic models of melt generation in distinct parts of SSZ environment.