Geochemical Characteristics of Peridotites from Guleman and Kizildağ Ophiolites, SE Turkey: Investigating Subduction Initiation Magmatism

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Ophiolites from SE Turkey has long been recognized as Suprasubduction Zone (SSZ) type and interpreted as oceanic lithosphere remnants of the Neotethys fore arc. In this study, the mineral chemistry and geochemistry of peridotites from Kizildağ (KZD) and Guleman (GLM) ophiolites were investigated and compared with literature values of abyssal peridotites and harzburgites from SSZ settings, followed by numerical modeling. The ultimate goal is to constrain their petrogenesis and trace-element behavior therein. The studied peridotites are all porphyroclastic harzburgites with little residual clinopyroxene. Mineral chemistry data, along with bulk-rock trace element variation diagrams and REE patterns, mostly surpass the field of abyssal peridotites and show a closer affinity towards SSZ-harzburgites, indicating that their chemical composition cannot be produced in pure MOR settings.

Trace element modeling reveals various behavior among different groups of elements. The HREE, Y and Ti content are well modeled by anhydrous non-modal fractional melting, demonstrating a ~20% depletion from depleted MORB mantle (DMM) for KZD and 24~27% for GLM harzburgites, respectively. The content of HFS elements (Zr, Hf, Nb), though often recognized immobile during melting, are more enriched than the calculated values, suggesting the existence of an additional petrogenetic process, most likely melt-rock interaction. Different trends between abyssal and SSZ peridotites imply the involvement of melt with different compositions. MREE, LREE and other highly incompatible elements are also higher than calculated.

The high degrees of depletion, coupled with other geochemical signatures, such as U-shaped REE patterns and Zr-Hf enrichment, suggest that these harzburgites are likely involved in boninite magmatism during subduction initiation within an intra-oceanic subduction zone. Ti and Cr# of spinels could be perfectly modeled numerically, indicating little post-magmatic metasomatism.