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Contrasting settings of serpentinite bodies in the northwestern Zagros Suture Zone, Kurdistan Region, Iraq

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Abstract

Protrusions and lenses of serpentinite–matrix mélanges occur at several places along the thrust faults of the Zagros Suture Zone. They separate the lower allochthonous thrust sheet, the 'Lower Allochthon' (i.e. Walash–Naopurdan nappe), of Paleocene–Eocene age from sediments of the Arabian platform and the upper thrust sheet of Mesozoic, ophiolite-bearing terranes termed the 'Upper Allochthon' (i.e. Gemo–Qandil nappe). The serpentinite–matrix mélanges occur mostly as stretched bodies (slices) on both sides of the Lower Allochthon (Hero, Halsho and Pushtashan (HHP) and Galalah, Qalander and Rayat (GQR)). Their overall chondrite-normalized rare earth element (REE) patterns form two main groups. Group One exhibits enrichment in the total REEs (> 1 × chondrite) whereas the Group Two pattern shows depletion (i.e. < 1 × chondrite). Bulk-rock MORB-normalized profiles of Group Two are almost flat in the MREE–HREE region with flattening profiles in the Gd–Lu range (> 3 times the MORB composition). In comparison with Group One, Group Two has extremely high REE content and displays variable depletions in the moderately incompatible high-field-strength elements (HFSEs) (Zr, Hf, Y) relative to their adjacent REEs. The REEs in the GQR serpentinite–matrix mélanges have a noticeably high LREE content, and a positive Eu anomaly, and their HREE content never reaches more than 1 × chondrite (i.e. < 0.01 to 1 × chondrite). The latter indicates that the hemipelagic sedimentary, melt-like components (i.e. high LREE, U/La, La/Sm and low Ba/Th) control the geochemical peculiarities of this type of serpentinite. The HHP serpentinite–matrix mélanges, however, are either equally divided between the two REE pattern groups (e.g. Hero, Halsho) or inclined towards Group One (e.g. Pushtashan). Contrary to GQR serpentinites, the variation in HHP serpentinite–matrix mélanges spans a compositional spectrum from U/La-rich to more Ba/Th-rich. Such ratio variations reflect the large variation in these two subducted sedimentary components (i.e. carbonate and hemipelagic sediment mix). The obvious differences in the trace element signatures of the GQR and HHP serpentinite–matrix mélanges might be related to plate tectonic parameters such as convergence rate, subduction age and thickness and type of subducted slab. It is more likely that the influx of subducted components to the mantle wedge relied heavily on the composition of the sedimentary inputs. These vary considerably with time from the relatively deepwater hemipelagic sediments (Qulqula Radiolarite Formation) to platform carbonate sediments (Balambo limestone). The trace element signatures of the GQR and HHP serpentinite–matrix mélanges might suggest multi-staging of the allochthonous sheet emplacement on the Arabian platform sediments.