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Coexistence of compositionally heterogeneous podiform chromitites in the Antalya-Isparta ophiolitic suite, SW Turkey: a record of sequential magmatic processes in the sub-arc lithospheric mantle

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The Antalya-Isparta region in southwestern Turkey is well known for large, ophiolitic in origin, peridotite exposures hosting various chromite orebodies. These are small-sized, massive to disseminated in texture chromitites that occur in the form of lenses or veinlets and are commonly surrounded by dunite envelopes of variable thickness. Chromitite seams from the Antalya mantle suite belong to both high-Cr and high-Al varieties (Cr#: 0.56-0.83), whereas chromitites in the Isparta mantle sequence are merely Cr-rich (Cr#: 0.75-0.85). In situ minor and trace element abundances obtained by LA-ICP-MS analyses of unaltered Cr-spinel from the Cr-rich chromitites are comparable to those reported in Cr-spinel of chromitites from typical fore-arc peridotite complexes. Nevertheless, minor and trace element concentrations in Cr-spinel from the Al-rich chromitites do not bear resemblance with those acquired from Cr-spinels of chromitites from well-known back-arc basin-derived ultramafic massifs. Calculation of parental magma compositions indicates that both types of chromitites share a common parentage with progressively fractionating arc-related melts. A quite interesting dissimilarity between the unaltered Cr-spinel compositions from both Cr-rich and Al-rich chromitites is that the former display a perceptible positive Ti anomaly in Chromite^{MORB}-normalized profiles, which signifies the hidden impact of post-magmatic processes in the composition of the high-Cr chromitite bodies that otherwise seem to be unaffected by metamorphism. The studied chromitites are characterized by a systematic enrichment in IPGE [Os, Ir and Ru (41-317 ppb)] with respect to PPGE [Rh, Pt and Pd (3-49 ppb)], resulting to negatively sloping chondrite-normalized PGE patterns that are less fractionated in case of high-Al chromitites. Their noble mineral assemblage is vastly dominated by tiny (up to 10 μm), euhedral laurite crystals followed by subsidiary irarsite and trivial Os-Ir alloy grains. PGM grains were not encountered in the Al-rich chromitites, plausibly as a result of crystallization from PGE poor melt. Laurite is Os-poor and exhibits a narrow range of Os-for-Ru substitution [Ru/(Ru+Os): 0.75-0.99]. However, the concomitance of laurite and millerite in the Cr-rich chromitites of the mutual Antalya-Isparta mantle suite is in favor of their precipitation from an Os-depleted melt, characterized by local and rapid variations of fS2 prior or coevally to Cr-spinel crystallization. Moreover, the presence of amphibole inclusions in Cr-spinel indicates that the melt triggered chromitite genesis conceivably had a hydrous component. Overall data suggest that the investigated orebodies were produced by a successively fractionating arc-derived melt that had the opportunity to generate compositionally distinct chromitites at two different pseudo-stratigraphic levels within the Antalya-Isparta arc-type mantle suite.

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