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Petrology of high-Cr and high-Al ophiolitic chromitites from the Muğla, SW Turkey: Implications from composition of chromite, solid inclusions of Platinum-group mineral (PGM), silicate, and base-metal mineral (BMM), and Os-isotope geochemistry

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Ultramafic rocks around the city of Muğla in SW-Turkey are represented by various degree depleted mantle peridotites ranging from cpx-rich harzburgites to depleted harzburgite and dunite. Cpx-rich harzburgite are thought to be the residua left after extraction of MORB-type basalt, from which high-Al chromitite ($49.2 < Cr\# < 53.5$) crystallized with a higher content of $^{187}Os/^{188}Os$ (average of 0.1361). However, depleted harzburgites are assumed to be residua left after extraction of hydrous boninitic melt, produced by second stage partial melting of already depleted mantle due to subducting slab, from which high-Cr chromitites ($64.2 < Cr\# < 85.9$) with lower and heterogeneous $^{187}Os/^{188}Os$ ratio (average of 0.1324) were crystallized as a result of melt-rock interaction in a suprasubduction environment. Dunites around the chromite deposits are considered to be the product of melt-peridotite interaction. Most of the chromitites contain high-Cr chromite and display enrichment in IPGE (Os, Ir, Ru) over PPGE (Rh, Pt, Pd), with concentrations of PGE between 61 and 1305 ppb. Consistently, laurite-erlichmanite serie minerals with various Os concentrations are found to be the most abundant PGM inclusions in chromite. Os-Ir-Ru alloys, irarsite, kashinite, and Pt-Fe alloys which is not common in ophiolitic chromitites were also detected as magmatic PGM inclusions as well as pentlandite, millerite, and rare heazlewoodite as base metal sulfide. The presence of olivine and clinopyroxene as well as hydrous silicate inclusions such as amphibole and phlogopite in high-Cr chromitite support the idea that high-Cr chromitites were formed in a suprasubduction environment.