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Microchemistry and magnesium isotope composition of the Purang ophiolitic chromitites (SW Tibet): New genetic inferences

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Abstract

New petrographic and microanalytical studies of mineral inclusions in the Purang ophiolitic chromitites (SW Tibet) are used to scrutinize the evolution of the associated Cretaceous sub-oceanic lithospheric mantle section. Silicate inclusions in the chromite grains include composite and single-phase orthopyroxene, clinopyroxene, amphibole, and uvarovite. Most inclusions are sub-rounded or globular, whereas a few inclusions exhibit cubic/octahedral crystal morphologies. The latter are randomly distributed in the large chromite grains, though discrete aggregates are consistently confined to the grain centers. Abundant micrometer-scale, clinopyroxene inclusions are topotaxially aligned along crystallographic planes. Less-abundant sulfide, wüstite, apatite, and uvarovite inclusions are observed in some samples.

The trace element geochemistry of the Purang chromitite evoke parental MORB- and boninite-like melts, consistent with the supra-subduction zone setting. The δ^{26}Mg values of the high-Cr and high-Al chromitites range from –0.25 to –0.29‰ and –0.05 to –0.32‰, respectively. The associated harzburgite has nearly overlapping δ^{26}Mg values of –0.13 to –0.37‰, but pyroxenite sills show distinct δ^{26}Mg values (–0.61 to –0.67‰). The variable Mg isotope signatures, combined with abundant exotic, ultrahigh-pressure and super reduced (UHP-SuR) mineral inclusions in the chromite grains, suggest that recycling and recrystallization under different mantle conditions played an important role in the genesis and evolution of these rocks. Furthermore, discrete silicate, sulfide, and metal alloy inclusions in the Purang chromitites are comparable to those reported in other Tethyan ophiolites, and collectively suggest a common geodynamic evolution.

Keywords: Purang ophiolite, SW Tibet, UHP-SuR mineral inclusions, high-Cr and high-Al chromitites, deep mantle recycling, SSZ processes