

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

FAHUI XIONG^{1,2,*}, BASEM ZOHEIR^{3,4,†}, PAUL T. ROBINSON¹, RICHARD WIRTH⁵, XIANGZHEN XU^{1,2},
TIAN QIU^{1,2}, AND YI SUN⁶

¹Center for Advanced Research on the Mantle (CARMA), Key Laboratory of Deep-Earth Dynamics of Ministry of Land and Resources, Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China

²Southern Marine Science and Engineering Guangdong Laboratory, Guangzhou, 511458, China

³Department of Geology, Faculty of Science, Benha University, 13518 Benha, Egypt

⁴Institute of Geosciences, University of Kiel, Ludewig-Meyn Str. 10, 24118 Kiel, Germany

⁵Helmholtz Centre Potsdam, GFZ (German Research Centre for Geosciences), 14473 Potsdam, Germany

⁶School of Geosciences and Resources, China University of Geoscience (Beijing), Beijing 100083, China

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 $\delta^{26}\text{Mg}$ 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 $\delta^{26}\text{Mg}$ values of -0.13 to -0.37% , but pyroxenite sills show distinct $\delta^{26}\text{Mg}$ 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