High-Cr chromitites from Nidar Ophiolite Complex: Petrogenesis and tectonic implications

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Abstract

The Nidar ophiolite from southeastern Ladakh Himalaya is a well-preserved ophiolitic sequence occurring along the Indus Yarlung-Zangbo Suture Zone (IYZSZ). This sequence is thrusted onto the Indus formation in the north and Zildat Ophiolitic mélange in the south. The chromitite ore bodies in this ophiolite sequence occur as a massive, semi-massive form in dunite and disseminated form in harzburgite and dunite. Within chromite grains, there are silicate inclusions; occur as secluded grains or as multiphase mineral grains along with base metal sulfides or PGE minerals. A very little variation of Cr# [Cr/(Cr+Al)] was observed that ranges from 0.78 to 0.86. The chromitites from Nidar ophiolite are high-Cr (Cr#>0.78), which may have associated with high-Mg tholeiitic or boninitic magma. The calculated value of $(Al_2O_3)_{melt}$ and $(FeO/MgO)_{melt}$ ranges from 9.29 to 11.50 and 0.49 to 0.10 respectively. Trace element compositions in chromites (Ga 14–27 ppm, Ni 440–1301 ppm, V 612–802 ppm, Sc 2–6 ppm, Co 207–542 ppm) are comparable to chromitite hosted in the mantle sections of ophiolite complexes. The estimated chemical composition from Al_2O_3 contents and FeO/MgO ratio of the primitive parental magma of high-Cr chromitites indicate island arc tholeiite melts of boninitic affinity, which is in equilibrium with podiform chromitites within the ultramafites of the complex. The distribution pattern of the minor and trace elements also bear a resemblance to chromitites of boninitic magma. Evidences suggests that the melt-rock interaction and subsequent melt-melt interaction was a most possible mechanism for the precipitation of the high-Cr chromitites from Cr-rich and Al, Ti-poor boninitic melt in an island arc setting.