

## **Morphology and chemistry of Cr Spinel from the peridotites of the Spontang Ophiolite Complex, Ladakh: insights into the petrogenesis of mantle peridotites**

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### Abstract:

The Spontang Ophiolite Complex in north-western Ladakh represents a fragment of oceanic lithosphere emplaced after the closure of the Neo-Tethyan Ocean. This Ophiolite Complex, one of the more complete sequences observed lies 30 kms south of the Indus Tsangpo Suture Zone (ITSZ). It forms the highest tectonic thrust slice above the Mesozoic – Early Tertiary continental margin of the north Indian plate in the Ladakh – Zaskar Himalaya. The ophiolite complex consists of a well-preserved mantle sequence dominated by peridotites, gabbros and ultramafic cumulates along with highly tectonized sheeted dykes and pillow lavas. Based on petrographic features, the peridotite varieties in the Spontang mantle suite are represented by dunites, harzburgites and few lherzolites. Harzburgites exhibit textural transition from protogranular to porphyroclastic and consist of olivine (65-78 vol. %), orthopyroxene (11–30 vol. %), clinopyroxene (< 5 vol. %) and chromian spinel ( $\leq$  1 vol. %). Lherzolites are porphyroclastic to equigranular in texture, contain olivine (80-85 vol. %), orthopyroxene (8- 12 vol. %), clinopyroxene (10-12 vol. %) and chromian spinel (1–3 vol. %). Dunite is coarse grained constituting  $\geq$ 90% olivine accompanied by  $\leq$ 5% orthopyroxene and upto 1-2% spinel. Chromian spinel is brown to reddish under the microscope and its morphology and textural relationship with coexisting silicates varies with strain, occurring as blebs and vermicular exsolutions present within orthopyroxene to spherical inclusions within olivine crystals through different transitional steps, most important of which is the characteristic elongate holly leaf shape. Cr# in chromian spinel  $[\text{Cr}/(\text{Cr} + \text{Al})]$  shows a restricted range from 0.20 to 0.33 in harzburgites whereas higher Cr# ranging between 0.45 and 0.53 is observed in lherzolite samples. Dunite samples contain chromian spinel with highest Cr# (0.53 – 0.57). Mg# ( $\text{Mg}/\text{Mg} + \text{Fe}^{2+}$ ) is observed to be higher in the harzburgite (0.61-0.74) samples when compared with lherzolite (0.41 -0.70) and dunites (0.48-0.61). High Cr# (>0.6) in the chrome spinels are consistent with residual mantle rocks that experienced high degrees of partial melt extraction. The high Cr# and low  $\text{TiO}_2$  contents (0.01–0.20 wt. %) of the chrome spinels are most consistent with modern highly refractory fore-arc peridotites and suggest that these rocks probably developed in a supra-subduction zone environment.

Keywords: chromian spinel, partial melting, peridotites, Spontang ophiolite, Ladakh.