

## **Mineralogical, Geochemical Difference and Economic Potential of Concordant and Discordant Dunite/Chromitites in the Muslim Bagh Ophiolite, Pakistan**

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Coexistence of both high-Cr and high-Al chromitite in the same ophiolite is a hot topic of debate. The dunites (and containing chromitites) in the Muslim Bagh Ophiolite are structurally divided into 'discordant' and 'concordant' types. Fresh samples of chromitites and associated peridotite were analyzed by EPMA and LA-ICP-MS. There are prominent structural and geochemical distinctions between discordant and concordant dunites/chromitites. Spinels of concordant dunites have Cr<sub>2</sub>O<sub>3</sub> 40–61 wt.%, FeO 23–24 wt.%, MgO 9–16 wt.% and Al<sub>2</sub>O<sub>3</sub> 8–26 wt.% whereas spinels in discordant dunites have Cr<sub>2</sub>O<sub>3</sub> 28–46 wt.%, FeO 13–19 wt.%, MgO 14–18 wt.% and Al<sub>2</sub>O<sub>3</sub> 22–38 wt.%. Spinels in discordant dunite are high-Al low-Cr (Cr# 0.33 to 0.58) whereas those in concordant type are low-Al high-Cr (Cr# 0.68–0.83). Olivine associated with discordant dunites are Mg-poor and contain needle-like magnetite and microspinel inclusions whereas olivines in concordant dunites are Mg-rich and contain no magnetite inclusions. Chromian spinels are anhedral to skeletal shape in discordant dunite with chlorite and magnetite rim whereas spinels in concordant dunite are euhedral without chlorite and magnetite rim. Origin of magnetite and chlorite at rims is generally related to higher silicate/spinel ratio in host rock. Thick economical chromites occur in concordant dunites while discordant dunites contain few thin (~1-5 cm) irregular chromitites. Higher (>20% calculated) degree melting by boninitic slab derived melts is suggested for origin of high-Cr concordant dunites. Spinels of discordant dunite show lower (<20%) degree melting and compositional spread across MORB to Arc-boninites. Concordant dunites were initially formed as vertical discordant bodies in upper mantle wedge and became concordant through mantle wedge flows with foliation of host peridotites. Later discordant dunites intruded into preexisting concordant dunites during final stage of ophiolite emplacement and remain frozen as vertical dikes.