# Economic geology of Heroshah chromite mines, Skhakot Qila Complex, NW Pakistan

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**Abstract**

Heroshah chromite deposits are part of Skhakot-Qila ultramafic complex associated with ophiolitic sequence in the vicinity of Main Mantle Thrust Zone (MMTZ) in NW Pakistan. The Heroshah chromite deposits are being mined regularly for chromite ore for the last five years at a rate of 70 to 80 tones per day. About eight mines were investigated in the current study, among which five mines are in operation while 3 have been abandoned due to ponding. 30-40 people are working in these mines out of which most are local. Ores are extracted through open pit and various underground mining techniques, e.g. adits, shafts, raises, winzes and crosscuts. However, the mining methods adopted in the area are unsatisfactory as they have badly affected the various other resources like land, water and biota in the study area.

Samples of ore and host rocks were collected from each working mine, and were studied in terms of petrographic features and geochemical characteristics. Field relationships and petrographic studies lead to identification of four types of lithologies i.e. chromitite, dunite, serpentinite and talc-serpentinite. Dunite, serpentinite and talc-serpentinite serve as host rocks for chromitite, among which dunite is the most dominant. Massive chromitite occurs as irregularly shaped layers, lenses and pods that are 2 cm to 2-3 m thick and 5 to 10 m long. Chromite also occurs in the form of disseminations and as an accessory mineral in the host rocks. One of the chromitite bodies is exceptionally large; whose average horizontal and vertical dimensions are 20 and 80 m, respectively. As such, it may be the largest among the known individual chromite bodies in Pakistan. Chromite is coarse to medium-grained, and the grains are subhedral to anhedral as well as amoeboidal and show alteration to ferritchromite along margins and intragranular cracks. Chromite bodies with nodular structure and pull-apart textures also occur.

The bulk chemical composition of chromite (wt.%) may be summarized as: $Cr_2O_3$ (21.56-32.00), $Fe_2O_3$ (8.57- 9.12 ) MgO (6.91-11.50) $Al_2O_3$ (11.60-16.40). Among other components, Zn, Ni, Co and Ti occur in trace amounts. The average value of Cr/Fe ratio is 2.6:1. On the basis of these geochemical features, the chromite ores are classified as beneficiable to refractory-grade. The alumina richer character of these chromite ores is also confirmed by mineral analysis through SEM.

In accordance with their distinctive tectonic setting, the structure, petrography and chemical characteristics suggest that the studied chromite deposit is podiform (Alpine) in nature and equivalent to the chromite deposits located at Shangla, Bajauar and Pranghar. It is further concluded that these deposits are minable at a profit and hence a beneficiation plant may be installed so as to uplift the socio-economic conditions of the area.