Paper Number: 376

Chemistry of Chrome-Spinel in serpentinite of the Taka, Central India: Its genetic significance.

Meshram, R. R.[1], Malviya, V. P.[2] and Chore, S. A[1].

[1] Geological Survey of India, Nagpur-440 006.email:rajkumar_meshram@rediffmail.com.

[2] Geological Survey of India, Northern Region, Aliganj Sector O, Lucknow-226 024.

Chrome-spinel occur as accessory grains or layers in a ultramafic- mafic rocks of different geological environments and have distinct chemical composition, linked primarily to their parental magmas. Chromite in mafic-ultramafic rocks reveals the magma chemistry and source rock characteristics as well as mechanism of operative mantle processes viz., tectonic provenances [1] and [2]. The ultramafic rocks of Taka belong to Sukma Group and occur as enclaves within basement Amgaon gneiss. The ultramafic rocks are represented by serpentinite, talc-tremolite-chlorite schist, chromitite and talc-serpentine schist. Chrome spinels are black, euhedral to subhedral,equant crystals they are highly fractured. The fractures are filled by secondary quartz-carbonate, talc and serpentine matrix. Petrographically, serpentinite is medium grained and show mesh texture and hour glass texture. Mesh rims are made up of fibrous serpentine (lizardite) and magnetite. Serpentinite is traversed by quartz-carbonate veins and usually altered into green, shades of yellow to buff colored dense rocks (birbirite) with siliceous, ferruginous and calcified capping. The magnetite released during serpentinisation of mafic minerals. The intercumulous spaces between Cr-spinels are occupied by bastite,tremolite, chlorite and clinopyroxene.

The XRD and SEM-EDS analysis of selected samples reveals presence of Cr-spinel within serpentine ground mass. Relict clinopyroxene along with accessory magnetite, zircon, monazite, baryte and galena besides native phases of Cu, Pb and Zn. Cr-Spinels are extensively oxidized to ferritchromite to magnetite, but the chrome spinel retains their primary composition. In EPMA study, Chrome-spinel contain high Cr (Cr# = atomic ration of Cr/ [Cr+Al], 0.46 to 0.95) and Mg# values has two clusters one is ranging from 0.25-0.63 while another show very low Mg# (0.014-0.051). Sulphide association is represented by pentlandite millerite, chalcopyrite and pyrite. They are occurs as anhedral grains and scattered in the rock. The mineral chemistry of chrome spinel in Al_2O_3 vs TiO_2 diagram suggests suprasubducion zone (SSZ) peridotite field.

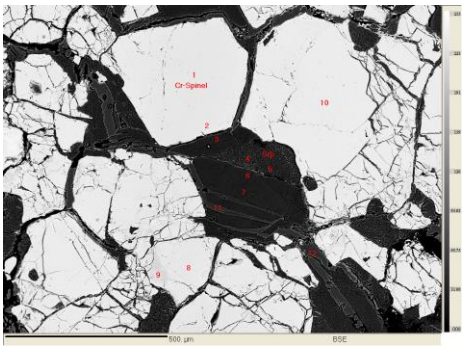

Figure1: Euhedral crystals of Cr-spinel showing cumulous texture and brecciated nature.

The chemistry of the parental melt for studied Cr-spinel by using the equation $(Al_2O_3\ wt\%)_{Sp} = 0.035\ (Al_2O_3\ wt\%)_{Lquid}^{2.42}$ [3] suggests melt had an average Al_2O_3 content of 13.37 %, which is very similar to Mid Ocean Ridge and Back Arc Basin basalts [4]. The degree of partial melting (F) using equation F=10 ln (Cr#) + 24, suggesting partial melting up tp 15 to 40 %, which is within the range of periotite from suprasubduction zone peridotite [5]. So chrome spinel suggests subduction related tectonic setting for Taka serpentinite. IPGE minerals (Hollingworthite-Irarsite) are recorded from the serpentinite by SEM-EDS. The association and occurrence of PGM in chromite could be attributed to serpentinisation process.

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