

Geochemical Signatures of Platinum Group Elements in Ultramafic Rocks of Chotanagpur Gneissic Terrain, Eastern India and Their Genetic Control

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Abstract

Ultramafic rocks occur as intrusives in the form of lensoid bodies in the northwestern part of Chotanagpur Gneissic Terrain and consist mainly of olivine, orthopyroxene and clinopyroxene and are devoid of plagioclase. Based on distinct geochemical characteristics, the rocks have been identified as komatiites. The rocks are geochemically analogous to Al-undepleted Munro type ($Al_2O_3/TiO_2=17.88-54.73$) with distinctly high MgO (26.2-35.62 wt%), Ni (958-1902 ppm) and Cr (21.32-3320 ppm) contents. These rocks are characterised by low CaO/Al_2O_3 , $(Gd/Yb)_n$, $(La/Yb)_n$ with positive Zr, Hf, Ti anomalies suggesting high degree partial melting of mantle under anhydrous conditions at shallow depth with garnet as a residual phase in the mantle restite. These high MgO volcanic rocks having elevated concentrations of Ni and Cr are potential hosts for Platinum Group Elements (PGE) owing to their primitive mantle origin and eruption at high temperatures. These rocks have low ΣPGE (29-269.02ppb) content with Ir (0.1-0.8ppb) and Ru (1.05-5.78ppb) among Iridium group PGE (IPGE); and Pt (5.04-18.72ppb), Pd(3.5-18.0ppb), Rh (0.22-0.84ppb) among Platinum group PGE (PPGE). The PGE abundances in komatiites were controlled by olivine fractionation. The Major, trace, REE and PGE composition of the rock suggest melting under anhydrous condition at shallow depth above the garnet stability field under S-undersaturated condition. Anhydrous melting associated with mantle plume activity gave rise to the rock which subsequently contaminated by lower crustal materials during magma ascent and emplacement.

Keywords: Chotanagpur Gneissic Terrain, Komatiite, Platinum Group Elements, Sulphur Undersaturation, Plume

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