Paper Number: 451

# Occurrence of PGE and their characterisation in 3.35 Ga Sargur greenstones of Western Dharwar Craton, Karnataka, India

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In the Western Dharwar craton older Sargur-type (3.35 Ga) ultramafic sequences occur as dismembered enclaves in a narrow (<500m) linear ( >250 km long) belt within the vast expanse of 3.0 Ga Peninsular Gneissic Complex (PGC) of TTG composition. It dominantly comprises of a layered intrusive sequence of komatiite and tholeiitic affinity with well preserved spinifex texture and pillow structure in certain sections attesting its subvolcanic nature. Three phases of deformation, amphibolite facies metamorphism and pervasive duteric alteration have transformed the primary rock assemblages to mixtures of talc- chlorite- serpentine- tremolite– actinolite– hornblende in varying proportions and birbiritisation of serpentinite. Geochemically, the rocks show Archaean High- Mg basalts of komatiite to boninitic affinity. Overall proportion of magmatic sulfides is very low and mostly occur as disseminations of tiny inclusions within silicates in gabbro and its variants. In the central part of the Sargur belt at Nuggihalli, two zones of 1 m width with average 1.7 ppm Pt+Pd have been delineated. The strike length of these zones up to 75 m is established by trenching at 25 m interval and channel sampling (1 m length) of gabbro-anorthositic gabbro at the contact of titaniferous vanadiferous magnetite (TVM) band. The PGE rich zone also contains up to 270 ppb Au. Chromite bearing serpentinite contains 300-400 ppb Ru+Ir. However, the TVM containing stringers, disseminations and patchy occurrences of base metal sulphides (BMS) lack significant PGE.

SEM-EDS and EPMA studies reveal the presence of three types of PGM, viz. 1) Pt-Rh-Pd-Os-Fe (3-5µm), 2) Au-Pt and Au-Pd alloy phases along with gold grains and 3) Ru-Os-Ir sulphides in the sequence. The Os-bearing Pt-Rh-Pd-Fe phases (Pd: 0.32 – 1.47%) occur either in interstitial spaces of plagioclase and hornblende or as spongy grains along the rims of Cr-bearing magnetite (Cr: 1.5%) in gabbro. This either represents a variant of primary ($Pt_3Fe$) or altered product of Pt bearing sulphides and arsenides during hydrothermal alteration. The Au-Pt ± Cu alloy phases ($Cu_{max}$: wt10% and Pt-2.5%) along with Pd-Au (Pd: 4.65%; 8µm) occupy the fractures of plagioclase/amphibole grains in tremolite-chlorite schist. Their low Au content, restricted occurrence within intercumulus silicates favours a hydrothermal origin. Tiny (4 µm) anhedral laurite (Ru-Os-Ir sulphide) grains having dominantly Os (26.44 and 46.49 wt%), along with Ru (24.35 and 4.69 wt%) and Ir ( 9.69 wt%) occur as inclusions in amphibole in metagabbro. Gold grains varying in size from 1 to <10µ and having Au values ranging from 77.86 to 95.12 wt%, with up to 8.74 wt% of Fe and 2.46 wt% of Ag occur within the matrix of the chromitite.

Very low sulphide content with only minutely disseminated sulphide in the sulphide-poor Sargur mafic-ultramafic rocks is possibly caused by the delay in attaining S-saturation and absence of external supply of sulphide. Thus S-saturation in advanced stage of magmatic differentiation coincided with the onset of magnetite crystallisation in gabbro that triggered primary PGM precipitation in the form of Pt-Fe alloys (isoferroplatinum). The close association of PGM with

gabbro and magnetite reefs in Sargur rocks (3.35 Ga) is comparable with the Stella Intrusion (3.03 Ga) of South Africa and the Rio Jacaré Intrusion, Northeastern Brazil.