Geochemistry and Origin of the Archean Anorthosites from Khammam Region, A.P.: Implications for PGE Metallogeny

PARIJAT ROY* and V.BALARAM

*Geochemistry Division, NGRI (CSIR), Hyderabad-5000606 *email: parijatroy@yahoo.co.in*

Anorthosites rocks consisting predominantly of plagioclase feldspar have figured prominently in at least two distinct intervals of Earth history: the late-Archaean and mid-Proterozoic. Archaean anorthosites are a key component of high-grade gneissic terranes, where they typically form laterally extensive deformed sheets or sills up to a km thick. Anorthosites from Sripuram, south of Wyra in Khammam district have been studied for the first time in detail for its implication for the PGE mineralization together with its geochemistry. Very little work has been done yet on these anorthosites to understand there chemistry and origin and their relation to any metallic deposits. Sripuram anorthosite bodies are smaller in size and comparable to archaean anorthosites in terms of their petrology, mineralogy and geochemistry. It is intruded into the amphibolite enclaves of Khammam schist belt. The gabbro and anorthosite are syn-to-late-kinematic intrusions and are metamorphosed along with the country rocks under P-T conditions of granulite grade metamorphism. Sripuram anorthosites outcrops exhibit primary and alternate banding defined by plagioclase feldspar and mafic minerals (Fig1). These rocks are mainly characterized by the presence of plagioclase together with subordinate amounts of amphibole and minor amounts of clinopyroxene and epidote. Plagioclase typically occurs as subhedral to anhedral as well as elongates grains ranging from 0.5 to 1 mm size. Deformation is evident in the form of bent twin lamellae and the development of sub grain boundaries (Fig.2). The rock shows granoblastic polygonal to hypidiomorphic-granoblastic textures. The plagioclases makes different contact relations mainly straight to curved boundaries, triple point grain boundaries, and with asymmetric high boundaries.

This anorthosite typical shows (1) equant plagioclase megacrysts (2) highly calcic compositions (9.03% to 12.53%)-low Na_2O (0.66% to 2.76%) (3) amphibole as the dominant mafic mineral; (4) the presence of chromite, locally in ore-grade layers (5) low levels of Sr, Rb and Ba (Sr~182.59ppm, Rb > 1ppm and Ba~80.64 ppm) (6) Ga/Al values typical of basaltic plagioclase and (8) moderately fractionated REE patterns{$(\sim Ce/Yb)_N$ ratio in these anorthosites are found to be in the range of 4.99}, strong Eu anomaly (~ 2.7), flat or slightly depleted heavy REE, with REE abundances varying in nearly one order of magnitude but less than 10X chondrites which is typical for archaean anothosites and distinguished them from Proterozoic anortosites.(Fig.3). The average individual elemental concentrations of platinum group of elements in these anorthosites are found to be very low (Ru~1 ppb, Rh~0.64 ppb, Ir~ 0.05 ppb, Pd~7.15 ppb, Pt~2.48 ppb and Au~10.6 ppb). The total PGE in these samples is around 12 ppb. Pd is higher than Pt in all samples. The chondrite normalized PGE pattern of Sripuram anorthosites are shown in Fig. 4

The petrological and geochemical characteristics suggest a primitive character for these anorthosites in similarity with Archean anorthosites world over and distinctly distinguishing them from the Proterozoic massif-type anorthostites. It appears that the only property Archean anorthosites and Proterozoic anorthosites share is their plagioclase-rich nature, suggesting that there must be more than one process (and probably multiple processes) capable of producing these anorthosites.

Fig.1 Field Photograph of Sripuram anorthosite showing primary alternate banding of plagioclase and amphibole

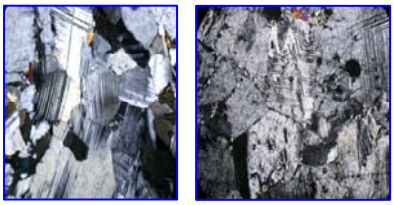

Fig.2 Photomicrograph showing cumulates of plagiocl feldspar in Sripuram anorthosites

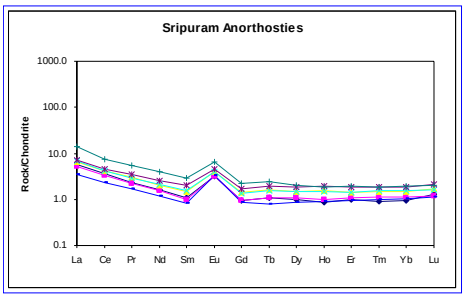

Fig. 3 REE pattern of Sripuram Anorthosites showing positive Eu anomaly

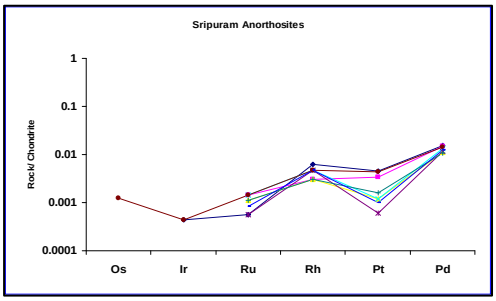

Fig. 4 Chondrite normalized PGE distribution patterns of Sripuram anorthosite