

Evolution of magmatic charnockites of the Eastern Ghats Province, India and its implication on the tectonic evolution of the ca. 1000-900 Ma Rayner-Eastern Ghats orogeny

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Charnockite constitutes a major rock type in many Proterozoic orogenic belts and the Meso-Neoproterozoic Eastern Ghats Province (EGP) is no exception to this. A vast geographical area of this province is occupied by magmatic charnockite as a significant component of granulite facies rock suite. The present study is focused on charnockite samples from many localities of the EGP where metamorphic histories are well-constrained. The coarse-grained charnockite bodies are found to intrude aluminous granulite and calc-silicate granulite. Rafts and enclaves of the latter rocks are also found within the charnockite. The rock is variably deformed and there is a complete spectrum of nearly undeformed variety to highly deformed mylonitized variety. Field relationships indicate that the charnockite magmatism occurred after the peak UHT metamorphism (M_1 ; ca. 1030-990 Ma); the emplaced magma subsequently cooled, deformed and metamorphosed during the second cycle of metamorphism (M_2 ; ca. 950-900 Ma). The rock contains orthopyroxene + quartz + K-feldspar + plagioclase + ilmenite \pm garnet \pm clinopyroxene as primary while hornblende and biotite as secondary phases. Relatively undeformed charnockite samples preserve magmatic textures like subhedral plagioclase (with primary zoning) and orthopyroxene. Deformed samples show a dynamically recrystallized fabric which locally changes to a mylonitic fabric having quartz ribbons. The garnet-orthopyroxene-plagioclase-quartz assemblage suggests the metamorphic peak condition as $\sim 910^\circ\text{C}$, 9.0 kbar. Geochemical signatures suggest peraluminous to metaluminous character of the magma having calc-alkalic to shoshonite affinities. Fractionation of HFSE, flat HREE and enriched LREE distributions imply emplacement of the magma in a post-collisional arc setting. This history resembles that of the last phase of Mawson charnockite of the East Antarctica and we argue that the Rayner-Eastern Ghats (R-EG) orogeny witnessed widespread charnockite magmatism during ca. 990-950 Ma. Based on emplacement ages, the magmatism could be interpreted to have occurred in multiple pulses during a sustained period of high heat flow across the R-EG belt. This charnockite magmatism could be envisaged as an important time marker between two successive metamorphic cycles of the R-EG orogenic system and confirms the veracity of the subduction-accretion-collision processes at the margin of the Indian continent.