

REE, isotope chemistry and P-T conditions of charnockites south of the transition zone, S. India

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Granulite-grade charnockite terrains south of the transition zone, from parts of the MM, Br and Nilgiri hills, were investigated for their REE and isotope chemistry. Metamorphic P-T conditions, especially for pelitic bands, indicate an increasing grade of metamorphism, from about 5.5 kb to 7.8 kb and to 10.5 kb in the Nilgiris. Retrogressive pressures of 4.5 kb are common. The overall P-T-t path is anticlockwise.

The charnockites of these hills range in composition from ultrabasic and basic to intermediate members. Runs of metapelites and BIF bands are common. Barring these, the protoliths of the charnockites have an igneous parentage of two series — tholeiitic and calc-alkaline. The latter, being the more abundant, has a tonalite to trondhjemitic composition. The REE pattern of this acid protolith could be derived by partial melting of quartz eclogite or amphibolite, a mafic source rich in hornblende and/or garnet. Significant Rb, U, Th depletion is attributed to granulite-facies metamorphism.

Isotope data from the literature and new data (Sm-Nd, Pb-Pb and Rb-Sr provided by Paul Taylor of Oxford) give an age of 3.46 Ga for the protoliths of BR hills charnockites. This contrasts with the 2.65 Ga age for the protoliths of Nilgiri charnockites. Several significant conclusions emerge: the time gap between the protolith age and the granulite metamorphism is small in the Nilgiris. There is a large time gap, between 3.4 and 2.6 Ga, in the BR hills for the same event.

Chemical, P-T and geophysical data argue for a tectonically thickened crust at 2.6 Ga. The tectonic implications of two different units of different ages occurring adjacent to each other but separated by a prominent lineament is discussed.