Petrogenesis and Tectonic evolution of Madras Block, southern India

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Madras Block, one of the least studied crustal domain in southern India, has an important role in palaeo geographic reconstruction because of its geographical position. The block lies towards the south-eastern part of Archean Dharwar Craton and north-eastern margin of Archean to Proterozoic Southern Granulite Terrain, separated from the Namakkal Block by Salem - Attur Shear Zone (SASZ) in the south, and from Shevaroy Block by Nallamali Shear Zone (NMSZ)in the west. Its eastern part is covered with younger sediments. Extensive studies have been made on adjacent regions such as north eastern Dharwar Craton and Palghat Cauvery Shear Zone correlating them with Napier complex and Lützow-Holm complex (in Enderby Land, Antarctica), whereas there have been no significant studies of the Madras Block so far. A detailed petrological, geochemical, geochronological, and isotopical study ofthe Madras block will help us to understand the crustal evolution of thisregionand also give us an idea about the connections with Rayner Complex, East Antarctica.

The Madras Block consists mainly of a massif charnockite. Few locations have been examined so far regarding its geochemical and geochronological signatures (Howie, 1955; Subramanian, 1959; Sen, and Sahu, 1970; Sen, 1970; Sen, et al., 1970, Glorie et.al., 2014). From a recent field survey carried out in this region, it is observed that the east to central part of the block mainly consist charnockite exposures. Other than charnockite, this region also has significant exposures of Hbl–Bt gneiss/Quartzofeldspathic gneiss/Bt-gneiss/TTG, Ep–Hbl Gneiss, 2–Px granulite, Amphibolite and Metagabbro intruded by younger dolerite dykes and granites. These ortho-gneiss are also associated with meta-pelites, Grt–Bt Gneiss, and calc-silicates. The northern side of the region consists mainly of amphibolites. The west and southern side consists mainly of Hb-Bt gneiss and granitic plutons. Pink granitic plutons can be found along the centre of the block, intruded into the charnockite.2-Px granulites co-exist with charnockite. Contact zones between charnockite - granite, charnockite –TTG, and TTG- amphibolites are very evident.

From this block, we can see three types of charnockite: high-grade Opx bearing granulite (Charnockite), Cpx and Opx bearing granulite (Cpx Charnockite), and Grt–Opx bearing granulite (Grt charnockite). Grt bearing charnockite are observed around Palar river and NSZ region, Cpx-rich charnockite is also exposed along the northern side of the block. The presence of hemo-ilmenite in these samples indicates these rocks are highly oxidized. The charnockite is present along the east to central part of the block. Charnockite from the type area (St. Thomas Mount -Pallavaram) are Cpx-bearing charnockite and are gabbroic in nature. Po, Ccp and Py are common in all the charnockite samples. These sulfides have been remobilized along the Plg grain boundary. Ilm and Mag are also present in these samples. Samples from the shear zone show a linear orientation and gneissic texture rich in Bt and Amph. The shear zone rocks are well hydrated such Opx is rehydrated back to odel for the genesis and evolution of Madras blockof precise radiometric dating techniques.graph Bt.

The whole rock chemistry of the charnockite gives: SiO_2: 62.75; TiO_2: 0.89; Al_2O_3: 14.68; Fe_2O_3: 7.97; MnO: 0.10; MgO: 2.42; CaO: 4.46; Na_2O: 3.78; K_2O: 2.04; P_2O_5: 0.28.From the Harker Variation Diagrams, MgO, CaO, TiO_2, and Fe2O3 indicates a negative trend with SiO_2 whereas K_2O shows a positive trend. Na_2O and Al_2O_3 show only scatter. Based on the EPMA analysis of the charnockite, Opx has the X_{Mg} of 0.306, Cpx have X_{Mg} of 0.43, and the Grt is Fe rich. From the petrography and geochemistry, there are clear indications for a metamorphic grade zoning in Madras Block.

Keywords: MADRAS BLOCK, SOUTHERN INDIA, CHARNOCKITE, ORTHOPYROXENE

