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Petrogenesis of incipient charnockite from Ihosy area in southern Madagascar

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Incipient charnockite (Pl+ Qtz + Kfs + Bt + Grt + Opx + Ilm + Mag) from Ihosy area in southern Madagascar occurs as patches of 20 to 50 cm in length within host orthopyroxene-free garnet-biotite gneiss (Pl + Qtz + Kfs + Bt + Grt + Ilm + Mag). The application of mineral equilibrium modeling on charnockite assemblage in NCKFMASHTO system to constrain the conditions of charnockitization defines a P-T range of 8-10.5 kbar and 820-880C, which is broadly consistent with the results from the conventional geothermobarometry (820-880C at 9 kbar) on Grt-Bt gneiss. The result of T versus mole H2O (M(H2O)) modeling demonstrated that orthopyroxene-free assemblage in Grt-Bt gneiss is stable only at M(H2O) >0.1 mol.%, while orthopyroxene in charnockite occurs as a stable mineral at very low M(H2O) condition of <0.1 mol.%, which is consistent with the petrogenetic model of incipient charnockite related to the lowering of water activity and stabilization of orthopyroxene through dehydration reaction/melting of biotite. The dominant occurrences of CO2-rich fluid inclusions in charnockite compared to host Grt-Bt gneiss indicate that the dehydration could have been caused by infiltration of CO2-rich fluid possibly from external sources.

Keywords: charnockite, pseudosection, granulite, fluid