ABSTRACT

In this study, an attempt is made to constrain the thermal history and geodynamic significance of c. 1.6 Ga orogenesis using granulites and associated magmatic rocks from the Bhandara-Balaghat Granulite (BBG) terrain, at the southern margin of Central Indian Tectonic Zone.

Integrated petrographic, mineral chemical, metamorphic reaction history and geothermobarometric studies were carried out for three different areas of BBG terrain. Of these, two areas have recorded lower crustal UHT granulite facies metamorphism (e.g. Dongargaon locality, P = 8.1 ± 1.3 kbar, T = 930 ± 30 ^{o}C) or metamorphism, approaching UHT conditions (e.g. Larsara locality, P = 8.7 ± 0.6 kbar, T = 880 ± 35 ^{o}C). Whereas the Pipariya metamorphic domain reveals a medium-pressure granulite facies metamorphism (T_{Max} < 900 ^{o}C), and a post-peak cooling to temperatures ≤700 ^{o}C.

The chronological constraints from monazite and zircon, when integrated with the metamorphic reaction history allow recognitions of three episodes of granulite-facies metamorphism in the CITZ at c. 1658 Ma (pre-BM_1 event), between c. 1612 and c. 1574 Ma (BM_1 event), and between c. 1572 and c. 1539 Ma (combined BM_2 and BM_3 events), as part of a latest Paleoproterozoic to Early Mesoproterozoic orogenic event. Monazite chemical data and zircon U-Pb ages for the granite gneiss revel that the felsic magmatism in the area was coeval with the peak granulite facies metamorphism. Additionally, Zircon Hf isotope ratios [εHf(t) between -12.5 and -21.9] and model ages [range of T^{c}_{DM}(Hf) from c. 3051 to c. 3630 Ma] suggest a mature crustal source of Palaeoarchaean age for BBG granite gneisses. The bulk geochemical (major, trace and REE) and Nd-isotopic studies of selected samples of mafic magmatic rocks appear to indicate their derivation from a reservoir of mixed MORB and arc chemical signatures.

Combined metamorphic, geochronological and geochemical data suggest the development of an active continental margin setting at the southern margin of the CITZ at c.1.6 Ga. It is proposed that the final closure of the back-arc basin and amalgamation of arc, back-arc and South Indian Block gave rise to a Proto-Greater Indian landmass at c. 1.54 Ga.

The study provide a strong support for the development of a Late Palaeo-proterozoic to Early Mesoproterozoic landmass, akin to a Proto supercontinent in the Indian shied, between the two supercontinent assembly events (Paleoproterozoic Columbia and Late Mesoproterozoic and Early Neoproterozoic Rodinia).

Keywords: Bhandara-Balaghat Granulite terrain, Central Indian Tectonic Zone, Proto-Greater Indian landmass, Columbia, Rodinia