

Two-stage metamorphism of the Angul-Tikarpada area, Eastern Ghats Belt and its implications on the India-East Antarctica correlation

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Proterozoic mobile belts are the onlookers of the tectonic history of the Earth's middle age and the Eastern Ghats Belt of India is one such orogenic belt from where the present study is carried out. The high-grade rocks of the Angul-Tikarpada area of the Eastern Ghats Province (EGP) are dominated by felsic gneiss which is intercalated with charnockite, pelitic gneiss, mafic granulite, and meta-gabbro. Pelitic gneiss occurs either as regionally extensive khondalite (type A; garnet-sillimanite-K-feldspar-quartz-ilmenite gneiss) or as smaller enclaves (few tens of meters to about a hundred meter) and these are strongly migmatitic containing cordierite-garnet-sillimanite-quartz-K-feldspar-biotite-spinel-hematite-magnetite-spinel-ilmenite (type B). Textural, phase chemical, and phase equilibria analyses from both varieties of metapelites show a contrasting history. The peak assemblage (M_1) of the type A metapelite was stabilized >800 °C while that of the associated mafic granulite was stabilized at ~ 820 °C. The post-peak cooling stage stabilized the hornblende-bearing assemblage. The type B metapelite shows a prograde evolution from biotite-bearing to garnet + magnetite + quartz peak assemblage (up to ~ 760 °C) during a second (M_2) cycle. The latter cycle progressed with the formation of cordierite + biotite + sillimanite assemblage during the retrogressive stage. Monazite (U-Th-total Pb) petrochronology from both types of pelitic gneiss yields two distinct group ages. Relatively older group ages (M_1 : 1210 ± 21 Ma, 1207 ± 16 Ma) were estimated from the matrix monazite while the younger group ages (M_2 : 1004 ± 22 Ma, 1001 ± 22 Ma) were estimated from the monazite included in porphyroblastic garnet grains. Zircon U-Pb dating (LA-ICPMS) from the type B metapelite yields 1168 ± 32 Ma as the age of M_1 event. This M_1 event (~ 1200 Ma) has been characterized from the EGP recently, but this has long been reported from its erstwhile neighbor East Antarctica (Rayner Province). The M_2 event (~ 1000 Ma) is coeval with the high-grade metamorphism in the EGP (UHT) and the Rayner Province. Notably, the presently studied rocks do not show any evidence of UHT metamorphism in either metamorphic cycle. The Angul-Tikarpada area was juxtaposed to the Prydz Bay area of East Antarctica and later became part of the EGP during the