Neoproterozoic Reworking of Mesoproterozoic Crust : Tectono-metamorphic Evidence from the Rocks of the Northern Part of the Eastern Ghats Belt, Orissa, India

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Eastern Ghats Belt (EGB) of India and Rayner Province of Antarctica exposing deep seated metamorphic rocks represent a Grenvillian collisional suture zone between the cratonic fragments of India and Antarctica leading to the formation of a supercontinent, Rodinia. The granulites and granitic gneisses exposed in the northern part of Eastern Ghats Belt near the boundary with Archean craton of Singhbhum, bear imprints of reworking of earlier crust and amalgamation of granulites with the rocks of Archean Craton along an E-W trending shear zone. The granulites consist of garnet-sillimanite (± cordierite and orthopyroxene-alkali feldspar gneiss, quartzite, calc-silicate gneiss, pyroxene granulite and voluminous orthopyroxene bearing felsic granulite intrusive. These rocks are extensively deformed (D_1), metamorphosed and migmatised (M_1). Garnet (± cordierite)-bearing leucosomes segregated parallel to the foliation give the rocks a stromatic appearance. This event is also associated with syn-kinematic emplacement of felsic granulites. M_1 is characterized by ultra-high-temperature metamorphism at 8.5-9 kbar pressure and $950^o \pm 50^o$ C temperature with an anticlockwise (ACW) P-T path having an IBC retrograde segment. This high temperature induced extensive partial melting in pelitic rocks to form migmatite during the Mesoproterozoic time (~1.26 Ga) [1]. The UHT metamorphism in the studied area is dated to be the oldest UHT occurrence in the EGB. The granulite facies rocks were intruded by voluminous granitic rocks at 1.15 Ga [2] which was subsequently deformed (D_2-D_4), migmatised and metamorphosed (M_2) to tonalite gneiss, garnetiferous augen gneiss and garnet-biotite bearing quartzofeldspathic gneiss during 980-970 Ma [1, 2, 3]. The granulite facies rocks were retrograded and the intrusive granites were metamorphosed to amphibolite facies. Either during intrusion of the granitic melts or before the intrusion, the granulites were partly exhumed (7-11km) to the upper level of the crust where amphibolites facies mineral assemblages were stable. This decompression event might have triggered the melting to produce the granitic melt. The P-T conditions of M_2 metamorphism associated with migmatization of granites are constrained at 6 (±1) kb and 800 (±50) °C. M_2 is characterized by the near isothermal decompressive P-T path from the peak condition which could induce partial melts in the granitoids and help in developing the M_2 migmatite. The whole complex then suffered a nearly isobaric cooling to 550-650°C at 6 (±0.5) kb. The geometry of deformational features developed during D_2-D_4 accompanying M_2 indicates a NNW-SSE compression. D_4 event is marked by a large dextral drag of lithological units at the northern part of the area near the boundary with

the Archean Singhbhum craton which is consistent with the NNW compression. Syn- to post-D_4 emplacement of porphyritic granites indicates that the suturing of the EGB with the Singhbhum Craton was completed at least before the onset of the D_4 shearing. Existing age data from the porphyritic granite fixes the time of this shearing to be 0.95 to 0.96 Ga. The M_1 UHT metamorphism documented from the study area and other parts of EGB mark the amalgamation of Eastern Ghats Belt with Proto-India during ~1.2Ga [4]. This Mesoproterozoic crust was infiltrated by felsic magmas in several phases and tectonically reworked during M_2 metamorphism at 1000-950 Ma. The ca. 0.9 – 1.0 Ga tectonothermal event in the EGB-Rayner Complex would represent the time of amalgamation of the Eastern Ghats with the Archean Singhbhum craton as a part of the globally extensive Grenvillian orogeny. During this orogeny the northern boundary of EGB was a northerly verging thrust, which acted as a lateral ramp of during the Pan-African thrusting of EGB over Indian shield along the western boundary [5].

Keywords : Eastern Ghats, Deformation events, P-T path, Crustal reworking

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