ABSTRACT

Lithologic-cum-structural mapping along a 60 km long corridor across the western margin of the Eastern Ghats Mobile Belt (EGMB) reveals that polymigmatitic, multiply folded granulite facies gneisses are juxtaposed against granites and sedimentary supracrustals of the Bastar craton. The easterly dipping contact between the two units is tectonized, and the sense of movement inferred from S-C structures in quartzofeldspathic gneisses of the EGMB and the vergence of asymmetric folds in underlying cratonic gneisses is consistent with westward thrusting of the granulites on to the craton. The footwall response to thrusting in initially isotropic granites (quartz-K-feldspar-plagioclase-hornblende-ilmenite-apatite-titanite) is manifested by episodic anatexis and polyphase folding with sequential fabric formation (S_{1B}, S_{2B} and S_{3B}) in marginal parts of the cratonic "windows" exposed within the Eastern Ghats lithologies. By contrast, non-migmatitic cores of windows and foreland cratonic gneisses are characterized by biphase (S_{2B} and S_{3B}) and monophase (S_{3B}) cleavages respectively. The intensity of the S_{3B} cleavage in the foreland progressively weakens westwards, varying from mylonitic through gneissose to wispy. Heterogeneous structural development across the cratonic footwall is interpreted to be a consequence of a single regional shortening event. Sequential fabric formation is explained by extreme strain focusing in melt-bearing ductile zones proximal to the contact. The eastward increase in structural complexity in the craton coincides with an easterly increase of metamorphic grade in deformed granite gneisses evidenced by the stabilization of chlorite + biotite ± clinozoisite ± calcite ± quartz (chlorite-biotite zone), clinozoisite + biotite ± amphibole ± calcite (clinozoisite-biotite zone), amphibole + biotite + quartz ± calcite (amphibole-biotite zone) and hornblende + biotite (hornblende-biotite zone) assemblages. A syn-S_{3B} melt-in isograd separates the melt-free and migmatitic zones within the hornblende zone. The

net transfer reactions involve chemical modifications of reactant (igneous) phases especially hornblende along the pargasite exchange vector ($Na_1Al^{VI}_1Al^{IV}_2O_{-1}Mg_{-1}Si_{-2}$), albitization of plagioclase and consumption of K-feldspar and opaque phases. P-T values retrieved from metamorphic Hbl-Bt-Kfs-Pl-Qtz assemblage common to all metamorphic zones are 7.7 kb, 790°C (Hbl-Bt zone), 9 kb, 750°C (Amph-Bt zone), 8.7 kb, 710°C (Czo-Bt zone) and 6.8 kb, 670°C (Chl-Bt zone). By contrast, syn to post S_{3E} P-T condition (~950°C, ~9 kb) estimated from Opx-Grt-Pl-Qtz assemblages in hanging wall granulites are higher compared to the retrieved footwall P-T conditions at the thrust plane. Textural relations in lithologies within the EGMB attest to hydration and cooling at granulite facies conditions broadly synchronous with the thrusting event.

Based on parameterized heat flow models, the retrieved P-T conditions across the craton-mobile belt contact can be best explained by a combination of conductive as well as dissipative heating at the thrust plane synchronous with emplacement of 'hot' granulites over a 'cold' cratonic basement. The corollary effects of metamorphic inversion - seemingly continuous along the >1200km margin of the Eastern Ghats granulite belt - and structural development in the cratonic footwall are consequences of crustal shortening and thermal front migration inwards from the thrust plane related to craton – mobile belt amalgamation. Available age data along the frontal thrust along the western margin of the EGMB strongly favor a Pan-African granulite facies orogeny relating to accretion of the Meso/Neoproterozoic ultra-high temperature EGMB with the Archean/Paleoproterozoic cratonic nucleus of India. The Paleozoic suture is arguably continuous in the east with the temporally equivalent suture at Prydz Bay and in the west with the Rayner – Napier complex boundary in east Antarctica.