An Investigation into the Polyphase Anatectic Evolution of the Eastern Ghats Belt, India through the Application of Mineral Equilibria Modeling and *in situ* Geochronology

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The Eastern Ghats Belt (EGB) of peninsular India represents a composite orogenic belt that preserves several phases of deformation, metamorphism and melting associated with the evolution of Columbia, Rodinia and Gondwana. Residual high Mg–Al granulites, migmatites and granites exposed in the central portion of the EGB record a history of ultra-high temperature metamorphism and crustal anatexis, although the timing and nature of this evolution remain poorly constrained. We integrate the results of microstructural observations, mineral equilibria modeling and *in situ* monazite geochronology of sapphirine-absent high Mg–Al granulites, and whole rock geochemistry of leucosomes and granites to investigate the anatectic evolution preserved in this sector of the EGB.

Calculated *P–T* pseudosections and Al-in-orthopyroxene thermometry from a suite of high Mg–Al granulites in the central portion of the EGB constrain peak conditions to 930–960°C and 8.5–9.5 kbar. The growth of cordierite corresponds to near-isothermal decompression from peak conditions to ~7 kbar, followed by near-isobaric cooling. The absence of plagioclase constrains the cooling path to pressures above 5.5 kbar at 750°C. The results of preliminary *in situ* SHRIMP monazite geochronology suggest that the granulite facies metamorphism occurred at *ca*. 990 Ma. Leucosome components from the host pelitic migmatites and intrusive garnetiferous granites have compositions consistent with biotite-breakdown melting of a metasedimentary source with entrainment of residual garnet + plagioclase. Melting along the prograde segment of a clockwise *P–T* path and subsequent melt loss would account for the preservation of these UHT metamorphic assemblages, and is broadly consistent with the emplacement of voluminous porphyritic granites in the EGB between 985 and 955 Ma as documented in previous studies[1]. A protracted and polyphase history spanning the late Paleoproterozoic to the Early Phanerozoic is not recorded in the samples from this study, and our results suggest that the major melting event recorded in the central EGB may have been associated with a granulite facies metamorphic event at *ca*. 990 Ma. Future work will

investigate current models[1] that invoke earlier UHT metamorphic events and potential implications on subsequent melt production during the protracted evolution of the EGB.

Keywords: Eastern Ghats Belt, India, ultra-high temperature (UHT) metamorphism, crustal anatexis, mineral equilibria modeling, monazite geochronology, high Mg–Al granulites

References

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