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Origin and evolution of porphyritic granitoid in the Eastern Ghats province: Implications for Indo-Antarctic amalgamation during the formation of Rodinia supercontinent

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The amalgamation of India and East Antarctica during the formation of the Rodinia supercontinent is manifested through Neoproterozoic (1.13 to 0.9 Ga) metamorphic events in parts of the Eastern Ghats mobile belt of India and Rayner complex of the Antarctica [1,2]. However, the style and timing of the metamorphism and the eventual amalgamation remains debatable [1]. Current study reports the geochemical and petrological features of a suite porphyritic granitoid from Eastern Ghats province. The rock has been locally deformed and metamorphosed, evident from alignment of stretched and augen shaped feldspar clasts and extensive development of large garnet grains. Enclaves of older meta- sedimentary rocks indicate that the porphyritic granitoids were emplaced after the early ultra-high temperature (UHT) metamorphism that culminated at ~1000°C and 8-10 kbar during ca. 1.13 Ga in an inferred compressional setting [1,2]. Large orthopyroxene grains, devoid of any inclusions, occurring in association with plagioclase, suggestive of magmatic origin. Whole rock geochemistry classifies the rocks as ferroan, calc-alkalic, peraluminous, A-type granitoid, emplaced in an extensional setting. Phase equilibrium modelling in NCKFMASHTO system constrain the maximum depth of magma emplacement between 2-4 kbar, significantly lower than the preceding metamorphism. Post-emplacement deformation and metamorphism lead to the development of large anhedral garnet grains via biotite breakdown evident from the numerous biotite and quartz inclusions within garnet. Conventional thermobarometry and the phase equilibrium modelling in NCKFMASHT system constrain the P-T at ~8 kbar and ~750°C. It, therefore, suggest that the late Stenian (1.13Ga) UHT metamorphism culminated at 8-10 kbar was followed by crustal thinning when the granitoids emplaced at ca. 4 kbar in an extensional setting and were subsequently buried to a depth corresponding to a pressure of ~8 kbar, presumably in a compressional setting that eventually led to the amalgamation of Indo-Antarctic landmass during the mid Tonian period (0.93 Ga).

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[2] C. J. Dobmeier and M. M. Raith, Geol. Soc. London, Spec. Publ. **206**, 145 (2003).