



Mid-Neoproterozoic extensional tectonics in the Larsemann Hills, East Antarctica: Implications for Indo-Antarctic correlation in Rodinia

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ABSTRACT

The supercontinents Rodinia and Gondwana are believed to have assembled through orogenic events at ~1000 Ma and ~550 Ma, respectively. The Larsemann Hills, part of the extended Rayner Complex of East Antarctica, is a Neoproterozoic granulite terrane that was a part of both supercontinents. The tectonic evolution of the terrane in the Rodinia to Gondwana interval remains uncertain. This study integrates new field, microstructural, metamorphic and geochronological information to unveil a previously undocumented mid-Neoproterozoic thermo-tectonic event in the Larsemann Hills. Granulite facies metamorphism (M_1), synchronous with the deformation, D_1 , is interpreted to have occurred in the Larsemann Hills at ~1000 Ma, followed by a crustal shortening (D_2) event that continued from ~990–900 Ma, signifying the incorporation of the Rayner crustal unit into Rodinia. Subsequent mid-Neoproterozoic extensional deformation (D_3), characterized by NW-SE trending S_3 shear zones, reoriented pre-existing structural fabrics. The extensional deformation operated under amphibolite facies metamorphic conditions (M_2) and resulted in a post-peak decompressive P-T trajectory. U–Pb LA-ICPMS dates on zircons separated from metapelites within high D_3 strain zone yield clusters at ~700 Ma; zircons immediately adjacent to the shear zone yield ages around ~990–900 Ma. A thermal overprint at ~550 Ma is evident but weakly manifested in the western Larsemann Hills, with no unambiguously correlatable structural or metamorphic evidence, suggesting distance from the Gondwana orogenic front. The extensional deformation documented here is contemporaneous with extension in the northern Eastern Ghats Province, India that was contiguous with the Rayner Complex in the Neoproterozoic. This suggests that a major terrane-wide extensional event was associated with the disintegration of Rodinia. In the Neoproterozoic, the EGP-Rayner unit was therefore a tectonic entity distinct from cratonic India, with only the former being an integral component of Rodinia.

1. Introduction

Supercontinents comprise multiple continental nuclei that were amalgamated into a singular, continuous crustal unit by plate tectonics (Hoffman, 1999; Murphy and Nance, 2013). Their genesis was facilitated by gradual convergence of cratonic fragments along intensely deformed and metamorphosed mobile belts (Rivers et al., 1989; Van

Reenen et al., 1990), while their fragmentation was initiated under the influence of extensional tectonic forces (Murphy and Nance, 2013). Processes related to the amalgamation and break-up of the supercontinent Rodinia dominated terrestrial tectonics during the early Neoproterozoic (Dalziel, 1991; Hoffman, 1999). Rodinia assembly is attributed to a sequence of orogenic events that occurred between ~1250–900 Ma (Li et al., 2008); the supercontinent is largely believed

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