

New U-Pb zircon age data on polyphase plutono-metamorphic complex in western Enderby Land (East Antarctica) and its implications for Neoproterozoic amalgamation of the Gondwanaland

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Western Enderby Land occupies a key position on Gondwanaland reconstructions near India – Sri Lanka – Antarctica junction and eastwards the Lützow-Holm Bay metamorphic complex commonly identified as a Cambrian suture zone. We present U-Pb zircon isotopic age determinations with SHRIMP II obtained on tonalite-to granite-gneiss samples from the Thala Hills and the Polkanova Hills. In the Thala Hills three high-temperature tectonomagmatic episodes may be distinguished at ca 980–970 Ma, ca 780–720 Ma, and ca 545–530 Ma. All of them included sin-kinematic granitic orthogneiss protolith emplacements and high-grade metamorphism. In the Polkanova Hills tonalitic to granodioritic orthogneisses, intercalated with prevailing amphibolites, were emplaced during ca 980–950 Ma episode (or at both of these ages) and subsequently metamorphosed under amphibolite facies accompanied by migmatization at ca 600–530 Ma.

The ca 980–950 Ma event corresponds to the Rayner Structural Episode which affected much of East Antarctica, including Sør Rondane Mountains to the west and Kemp Land to the east of study area. The Polkanova Hills area is underlain by basic amphibolites and tonalitic to granodioritic orthogneisses characterized by LILE enrichment and Nb–Ta troughs in a primitive mantle normalized spiderdiagram suggestive of derivation in arc-related convergent palaeotectonic environments. Co-eval orthogneisses in the Thala Hills are characterized by granitic compositions and occur in intercalation with paragneisses, which points out to more in-land palaeotectonic environments. The ca 780–720 Ma episode included two events at ca 780 Ma (high-grade anatexis) and 720 Ma (sin-tectonic granitoid emplacement) and was roughly co-eval with magmatic and/or metamorphic events in Dronning Maud Land of East Antarctica as well as in other Gondwanaland regions, like Madagascar, Sri Lanka and eastern Africa. The ca 780–720 Ma episode (Thala Episode) may be correlated with the East African Orogeny.

Our new data provide a correlation of both ca 980–950 Ma and ca 800–700 Ma events between western Enderby Land and (partly) Dronning Maud Land, thus indicating their conjugate positions in the early Neoproterozoic, which in turn argues against a late Neoproterozoic–Cambrian suture running between them (i.e. the Lützow-Holm Bay Complex). We suggest that these terrains were juxtaposed prior to final amalgamation of the Gondwanaland. The Polkanova Hills basic to intermediate protoliths may represent a Rayner-aged active continental margin. The Late Neoproterozoic – Cambrian (ca 600–530 Ma) episode was manifested by high-grade anatexis (under granulite facies in the Thala Hills and amphibolite facies in the Polkanova Hills) co-eval with the Lützow-Holm Bay metamorphic complex. However, the nature of this metamorphism yet seems to have not been understood well and we believe it was of within-plate rather than continent collision origin.

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