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Metamorphic constraints on crustal evolution between the Archean Grunehogna Craton and the Pan-African to Mesoproterozoic Maud Belt, Western Dronning Maud Land, Antarctica

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A petrological and metamorphic comparison of Mesoproterozoic metabasic rocks on the eastern margin of the Archaean Grunehogna Craton and the adjacent Maud Belt in western Dronning Maud Land, East Antarctica, revealed a difference in peak metamorphic conditions from T = 290 $\pm$ 50oC to 690 - 748oC and P = 3.0 $\pm$ 0.8 to 8.5 - 10.7 kbar over a distance of only 30 km across a major glacial valley. The lower grade constraints were derived from thermodynamic modelling of chlorite crystallization temperature in a greenschist assemblage, together with pseudosection modeling in PERPLEX using bulk rock compositions. The high-grade P-T constraint (P = 9 $\pm$ 2 kbar and T = 700 $\pm$ 40oC) for the western extreme of the Maud Belt, derived from hornblende-plagioclase thermometry, geobarometric calculations and pseudoscetion modeling in PERPLEX with a garnet amphibolite assemblage, is very similar to that reported for the eastern Maud Belt and, therefore, does not support the concept of a westward decreasing metamorphic field gradient within the Maud Belt as previously proposed. This new data is compared and combined with published mineral chemical, metamorphic and geochronological data in the eastern Maud Belt (Board et al., 2004). The metamorphic results presented here indicate a large-scale crustal discontinuity, and suggests that the inferred sub-glacial boundary between the Grunehogna Craton and the Maud Belt, known as the Pencksökket-Jutulstraumen Discontinuity (PJD), might reflect a major Pan-African thrust fault. In turn, this implies a new geographical location for the westernmost extent in the Maud Belt for the continuation of the Pan-African Mozambique Belt into Dronning Maud Land of East Antarctica. This new petrological and field data challenges previous interpretations that argue for only Mesoproterozoic lower amphibolite facies tectono-thermal metamorphism in the westernmost Maud Belt or only localized and limited Pan-African thermal metamorphism. In conjunction with bulk rock geochemical and Sm-Nd isotopic data (Grosch et al., 2007), a new geodynamic model is proposed for the crustal evolution of western Dronning Maud Land, that differs markedly from previous scenarios. This new crustal evolution model also demonstrates differences between the Maud Belt and the oceanic island-arc accretion models proposed for the Mesoproterozoic Namaqua-Natal metamorphic mobile belt along the south-southeastern margin of the Kaapvaal-Grunehogna Craton of Southern Africa. Final stages of crustal evolution along the PJD was marked by reactivation during Mesozoic extension that led to the break-up of Gondwana.