Proterozoic evolution of central Dronning Maud Land (East Antarctica) from Rodinia to Gondwana

CHENGCHENG WANG[1]*, JOACHIM JACOBS[1], MARLINA A. ELBURG[2], ANDREAS LÄUFER[3]

[1] Department of Earth Science, University of Bergen, Allégaten 41, N-5020 Bergen, Norway.
* correspondence: Cheng-Cheng.Wang@uib.no
[2] Department of Geology, University of Johannesburg, Auckland Park 2006, Johannesburg, South Africa
[3] Federal Institute for Geosciences and Natural Resources (BGR), Stilleweg 2, 30655 Hannover, Germany

Central Dronning Maud Land (CDML) in East Antarctica is an important region for understanding Rodinia and Gondwana supercontinent cycles. Zircon U-Pb dating and Hf-O isotopic data revealed by extensive sampling across CDML provide constraints on the timing and source of main magmatism and new insights into the crustal composition and evolution. SIMS zircon U-Pb ages indicate multi-stage magmatic activities from Mesoproterozoic to Cambrian times at 1160-1130 Ma, 1115-1100 Ma, 1090-1070 Ma, 780-750 Ma, 645-600 Ma and 530-485 Ma, as well as Mesoproterozoic metamorphism at 1085-1050 Ma recorded by zircon rims. This region was subjected a large-scale and long-lasting high-grade metamorphism during 600-500 Ma.

Most 1160-1080 Ma granitic rocks exhibit ε_{Hf} (t) values ranging from +5 and +8 and $\delta^{18}O$ slightly higher than mantle value (6-7 ‰), indicating a main derivation from juvenile crust. The involvement of Paleoproterozoic continental materials, which were most likely from adjacent Kalahari Craton, is attested by minor samples with negative to neutral ε_{Hf}(t) and significantly elevated $\delta^{18}O$ values (8-10 ‰). The late Neoproterozoic (750-600 Ma) rocks, including anorthosite, charnockite and granite, display an evolved Hf isotopic composition and high $\delta^{18}O$ values (7.5-9 ‰), suggesting a significant addition of crust-derived materials into the source. The data imply that in CDML, late Mesoproterozoic (Grenville-age) magmatism during the assembly of Rodinia is dominated by the addition of new crust with subordinate reworking of ancient crust. Subsequent subduction process associated with the break-up of Rodinia and assembly of Gondwana largely witnessed recycling of previous continental components. Combined with whole-rock geochemistry, it is speculated that the accretionary process along the Maud margin of Kalahari Craton lasted from the Mesoproterozoic, across the late Tonian (750 Ma) until Ediacaran to suture west and east Gondwana blocks.