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Investigating East Antarctic basement provinces from the Shackleton Range to Dronning Maud Land with new magnetic and gravity compilations

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The sector of East Antarctica between the Shackleton Range and Dronning Maud Land is key for geological reconstructions of the tectonic evolution of Antarctica. In the Shackleton Range ~500 Ma ophiolites (Talarico et al., 1999), high-P metamorphism, including eclogite facies rocks (Schmädicke and Will, 2006), and thrust faults suggest the occurrence of a major suture zone separating the Coats Land Block (Loewy et al., 2011) from the proposed northernmost edge of the Mawson Continent (Will et al., 2010). The ca 1130 to 1040 Ga Maud Belt lies in between the Coats Land Block and the Grunehogna Craton that in turn link with the Namaqua-Natal and Kalahari craton of South Africa respectively. The 650-500 Ma East African-Antarctic Orogen reworded older crustal domains and is thought to be responsible for reactivating major shear zones and triggering indentation tectonics similar to modern collisional systems (Jacobs and Thomas, 2004).

Here we combine extensive aeromagnetic (e.g. Mieth and Jokat, 2014) and airborne gravity datasets collected over the Dronning Maud region including the latest surveys performed in 2013 and 2014 to the south over the largely ice-covered Recovery and Slessor glacier catchments to provide novel geophysical perspectives on this part of East Antarctica.

Aeromagnetic anomaly patterns enable us to trace the extent of Grenvillian-age arc terranes in the interior of East Antarctica. They also reveal widespread rift-related Keweenawan-age igneous rocks known so far only from small exposures in Coats Land, and that have been interpreted as possible remnants of the Mid-Continent Rift System of Laurentia (Loewy et al., 2011). The combination of enhanced aeromagnetic and gravity images reveals that the proposed Shackleton Range suture extends at least 500 km into the interior of East Antarctica and suggests that it may change orientation from E-W to ca N-S in the Recovery Lakes region. Aerogeophysical data coverage is poor further in the interior but satellite gravity data suggest that a major lithospheric boundary separates thicker crust underlying the recently proposed Tonian Oceanic Arc Superterrane of eastern Dronning Maud Land (Jacobs et al., 2015) from the thinner crust of the Recovery block (Ferraccioli et al., 2011). Our interpretation maps derived from enhanced potential field imaging suggest the occurrence of complex anastomising crustal-scale shear zones (similar for example to Pan-African-age shear zones like the Anza Shear Zone) that separate weaker and more rigid East Antarctic crustal blocks rather that single collisional suture zones.

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