



New aerogeophysical and satellite views of lithospheric architecture and tectonics in Antarctica

Fausto Ferraccioli (1), Joerg Ebbing (2), Folker Pappa (2), Tom Jordan (1), and Rene Forsberg (3)

(1) NERC British Antarctic Survey, Geology & Geophysics, Cambridge, United Kingdom (ffe@bas.ac.uk), (2) Christian-Albrechts-Universität Kiel, Institute of Geosciences, Kiel, Germany (joerg.ebbing@ifg.uni-kiel.de), (3) Technical University of Denmark - Space Kongens Lyngby, Denmark (rf@space.dtu.dk)

Determining the architecture of the Antarctic crust and its deeper lithosphere is critical in order to derive new assessments of solid earth influences on the overlying East and West Antarctic ice sheets- including, for example, estimating geothermal heat flux. Establishing the fundamental linkages between tectonic processes that shaped Antarctica's architecture is also important because this underexplored continent represents a key missing piece of the puzzle to reconstruct the evolution of the supercontinent cycle from Precambrian to Cenozoic times.

Here we present selected highlights from three international projects supported by the European Space Agency (ESA) that are providing tantalising new views of the lithosphere and tectonic processes in Antarctica, by using GOCE satellite gravity gradient, airborne gravity and aeromagnetic data, and developing new 2D and 3D potential field models, further constrained via seismological and petrological modelling approaches.

We show that the GOCE satellite gravity gradient data augment previous seismological studies by enhancing our knowledge of crustal and lithosphere thickness variations, revealing further complexity in the architecture of distinct lithospheric provinces, in particular within the composite East Antarctic craton, and providing new views into effective elastic thickness variations. In East Antarctica, thick crust is imaged beneath the Transantarctic Mountains, the Archean to Mesoproterozoic Terre Adelie craton, the Gamburtsev Province and the Tonian Oceanic Arc Superterrane in interior Dronning Maud Land. A broad distributed region of thin crust and lithosphere underlies the Cretaceous to Cenozoic West Antarctic Rift System and the Jurassic Weddell Sea rift system, while more detailed insights into the narrower rift basins result from airborne gravity imaging.

New PolarGAP aerogravity and aeromagnetic data, combined with airborne radar imaging unveil crustal architecture in the South Pole frontier by revealing, for example, the subglacial extent of proposed rift basins related to the Jurassic Weddell Sea Rift System and several distinct basement terranes of the East Antarctic craton, as well as its margin with the southern sector of the Ross Orogen.

A recent magnetic anomaly compilation that includes 3.5 Ml line km of magnetic data (Golynsky et al., 2018, GRL) is also being analysed within ESA's current 3D Earth project (2018-2020). This novel dataset is helping re-define crustal architecture and tectonic evolution at continental scale, and hence promises to transform our ability to link Antarctica with formerly adjacent continents in Gondwana, Rodinia and Nuna/Columbia.