Geophysical Research Abstracts
Vol. 20, EGU2018-16473-2, 2018
EGU General Assembly 2018

A connection between interior grabens in the Wilkes Subglacial Basin and the continental shelf region of East Antarctica?

Fausto Ferraccioli (1), Egidio Armadillo (2), Duncan Young (3), Jamin Greenbaum (3), Antonia Ruppel (4), Andreas Läufer (4), Donald Blankenship (3), and Martin Siegert (5)

(1) NERC/British Antarctic Survey, Geological Sciences, Cambridge, United Kingdom (ffe@bas.ac.uk), (2) DISTAV, University of Genoa, Genoa, Italy, (3) The University of Texas at Austin, Jackson School of Geosciences, USA, (4) Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover, Germany, (5) Imperial College London, The Grantham Institute for Climate Change, UK

The Wilkes Subglacial Basin (WSB) is one of the most extensive tectonic elements in East Antarctica. It stretches for 1,400 km from the George V Coast towards South Pole and may link to the Pensacola-Pole Subglacial Basin further south, which in turn connects to the Jurassic Weddell Sea Rift. The origin of the WSB has been a matter of considerable debate for over three decades. Early models favoured an extensional origin and a several km thick sedimentary infill of Mesozoic to Cenozoic age within the basin. In contrast, later models suggested that the WSB formed in response to Cenozoic lithospheric flexure induced by the uplift of the Transantarctic Mountains (TAM), and contains no significant post-Jurassic sedimentary infill. Detailed 3D process-oriented models quantifying the relative roles of possible extension, erosion and flexure in the WSB induced by TAM uplift remain to be more fully developed.

Irrespective of the uncertainties surrounding the tectonic origin of the broader WSB, aerogeophysical observations collected as part of the WISE-ISODYN project clearly indicate that the northern WSB adjacent to the Northern Victoria Land (NVL) segment on the TAM contains deep structurally controlled sub-basins, namely the Eastern, Central and Western basins. 2D magnetic models (Ferraccioli et al., 2009, Tectonophysics) suggest that the Central basins represent post-Jurassic grabens linked to as yet un-quantified amounts of upper crustal brittle extension. Additionally, the characteristic mesa-like subglacial topography within the inferred grabens, likely reflects Beacon sediments intruded by Jurassic sills, forming part of the Ferrar Large Igneous Province. Airborne gravity data suggest however that there is no significant Moho upwarp beneath the upper crustal grabens, in contrast e.g. to crustal-scale rifts in West Antarctica.

Airborne radar observations collected as part of the more recent ICECAP surveys suggest that similar graben-like features may also underlie the eastern and western Cook ice streams at the seaward margin of the East Antarctic Ice Sheet (EAIS). To further test this hypothesis we analyse aeromagnetic and residual airborne gravity anomaly patterns over the Central basins and the inferred Cook grabens and compare them with the Rennick Graben region in NVL, where higher resolution German-Italian aeromagnetic and land gravity data are available. We propose that these grabens could be kinematically connected and further hypothesise that they may link to putative grabens in the largely un-surveyed continental shelf region. If this hypothesis holds true, it could imply that extension and/or transtension leading to the separation between Australia and East Antarctica in the late Mesozoic and Cenozoic was, at least in part, accommodated within the continental crust of East Antarctica.

We conclude that, establishing the connectivity (or lack thereof) between interior grabens and the continental shelf in the WSB region is an important priority for future airborne geophysical exploration, as it has implications for linking tectonic process in the continental and oceanic lithosphere, and for constraining ice sheet-ocean interactions, including the role of geological boundary conditions in modulating these.