Geophysical Research Abstracts
Vol. 15, EGU2013-8095, 2013
EGU General Assembly 2013

Characterising East Antarctic Lithosphere and its Rift Systems using Gravity Inversion

Alan P.M. Vaughan (1), Nick J. Kusznir (2), Fausto Ferraccioli (1), Phil T. Leat (1), Tom A.R.M. Jordan (1), Michael E. Purucker (3), A.V. (Sasha) Golynsky (4), and Irina Rogozhina (5)

(1) British Antarctic Survey, Environmental Change and Evolution, Cambridge, United Kingdom (a.vaughan@bas.ac.uk), (2) University of Liverpool, Liverpool, UK, (3) Raytheon at Planetary Geodynamics Laboratory, Greenbelt, MD, USA, (4) VNIIOkeangeologia, St Petersburg, Russia, (5) GFZ German Research Centre for Geosciences, Potsdam, Germany

Since the International Geophysical Year (1957), a view has prevailed that East Antarctica has a relatively homogeneous lithospheric structure, consisting of a craton-like mosaic of Precambrian terranes, stable since the Pan-African orogeny ∼500 million years ago (e.g. Ferracioli et al. 2011). Recent recognition of a continental-scale rift system cutting the East Antarctic interior has crystallised an alternative view of much more recent geological activity with important implications. The newly defined East Antarctic Rift System (EARS) (Ferraccioli et al. 2011) appears to extend from at least the South Pole to the continental margin at the Lambert Rift, a distance of 2500 km. This is comparable in scale to the well-studied East African rift system. New analysis of RadarSat data by Golynsky & Golynsky (2009) indicates that further rift zones may form widely distributed extension zones within the continent. A pilot study (Vaughan et al. 2012), using a newly developed gravity inversion technique (Chappell & Kusznir 2008) with existing public domain satellite data, shows distinct crustal thickness provinces with overall high average thickness separated by thinner, possibly rifted, crust. Understanding the nature of crustal thickness in East Antarctica is critical because: 1) this is poorly known along the ocean–continent transition, but is necessary to improve the plate reconstruction fit between Antarctica, Australia and India in Gondwana, which will also better define how and when these continents separated; 2) lateral variation in crustal thickness can be used to test supercontinent reconstructions and assess the effects of crystalline basement architecture and mechanical properties on rifting; 3) rift zone trajectories through East Antarctica will define the geometry of zones of crustal and lithospheric thinning at plate-scale; 4) it is not clear why or when the crust of East Antarctica became so thick and elevated, but knowing this can be used to test models of Cenozoic ice sheet formation and stability.

References

Chappell, A.R. & Kusznir, N.J. 2008. Three-dimensional gravity inversion for Moho depth at rifted continental margins incorporating a lithosphere thermal gravity anomaly correction. Geophysical Journal International, 174 (1), 1–13.

Ferraccioli, F., Finn, C.A., Jordan, T.A., Bell, R.E., Anderson, L.M. & Damaske, D. 2011. East Antarctic rifting triggers uplift of the Gamburtsev Mountains Nature, 479, 388–392.

Golynsky, A.V. & Golynsky, D.A. 2009. Rifts in the tectonic structure of East Antarctica (in Russian). Russian Earth Science Research in Antarctica, 2, 132–162.

Vaughan, A.P.M., Kusznir, N.J., Ferraccioli, F. & Jordan, T.A.R.M. 2012. Regional heat-[U+FB02]ow prediction for Antarctica using gravity inversion mapping of crustal thickness and lithosphere thinning. Geophysical Research Abstracts, 14, EGU2012–8095.