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Using Gravity Inversion to Estimate Antarctic Geothermal Heat Flux

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New modelling studies for Greenland have recently underlined the importance of GHF for long-term ice sheet behaviour (Petrunin et al. 2013). Revised determinations of top basement heat-flow for Antarctica and adjacent rifted continental margins using gravity inversion mapping of crustal thickness and continental lithosphere thinning (Chappell & Kusznir 2008), using BedMap2 data have provided improved estimates of geothermal heat flux (GHF) in Antarctica where it is very poorly known. Continental lithosphere thinning and post-breakup residual thicknesses of continental crust determined from gravity inversion have been used to predict the preservation of continental crustal radiogenic heat productivity and the transient lithosphere heat-flow contribution within thermally equilibrating rifted continental and oceanic lithosphere. The sensitivity of present-day Antarctic top basement heat-flow to initial continental radiogenic heat productivity, continental rift and margin breakup age has been examined. Recognition of the East Antarctic Rift System (EARS), a major Permian to Cretaceous age rift system that appears to extend from the continental margin at the Lambert Rift to the South Pole region, a distance of 2500 km (Ferraccioli et al. 2011) and is comparable in scale to the well-studied East African rift system, highlights that crustal variability in interior Antarctica is much greater than previously assumed. GHF is also important to understand proposed ice accretion at the base of the EAIS in the GSM and its links to sub-ice hydrology (Bell et al. 2011).

References

Bell, R.E., Ferraccioli, F., Creyts, T.T., Braaten, D., Corr, H., Das, I., Damaske, D., Frearson, N., Jordan, T., Rose, K., Studinger, M. & Wolovick, M. 2011. Widespread persistent thickening of the East Antarctic Ice Sheet by freezing from the base. Science, 331 (6024), 1592–1595.

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.

Petrunin, A., Rogozhina, I., Vaughan, A. P. M., Kukkonen, I. T., Kaban, M., Koulakov, I., Thomas, M. (2013): Heat flux variations beneath central Greenland's ice due to anomalously thin lithosphere. - Nature Geoscience, 6, 746-750.