



Control of deep lithospheric roots on crustal scale GOCE gravity and gradient fields evident in Gondwana reconstructions

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The GOCE gravity field is globally homogeneous at the resolution of about 80km or better allowing for the first time to analyze tectonic structures at continental scale. Geologic correlation studies based on age determination and mineral composition of rock samples propose to continue the tectonic lineaments across continents to the pre-breakup position. Tectonic events which induce density changes, as metamorphic events and magmatic events, should then show up in the gravity field. Therefore gravity can be used as a globally available supportive tool for interpolation of isolated samples. Applying geodynamic plate reconstructions to the GOCE gravity field places today's observed field at the pre-breakup position. In order to test the possible deep control of the crustal features, the same reconstruction is applied to the seismic velocity models, and a joint gravity-velocity analysis is performed. The geophysical fields allow to control the likeliness of the hypothesized continuation of lineations based on sparse surface outcrops. Total absence of a signal, makes the cross-continental continuation of the lineament improbable, as continental-wide lineaments are controlled by rheologic and compositional differences of lithospheric mantle. It is found that the deep lithospheric roots as those found below cratons control the position of the positive gravity values. The explanation is that the deep lithospheric roots focus asthenospheric upwelling outboard of the root protecting the overlying craton from magmatic intrusions. The study is carried out over the African and South American continents.

The background for the study can be found in the following publications where the techniques which have been used are described:

Braitenberg, C., Mariani, P. and De Min, A. (2013). The European Alps and nearby orogenic belts sensed by GOCE, *Boll. Bollettino di Geofisica Teorica ed Applicata*, 54(4), 321-334. doi:10.4430/bgta0105

Braitenberg, C. and Mariani, P. (2015). Geological implications from complete Gondwana GOCE-products reconstructions and link to lithospheric roots. *Proceedings of 5th International GOCE User Workshop*, 25 - 28 November 2014.

Braitenberg, C. (2015). Exploration of tectonic structures with GOCE in Africa and across-continent. *Int. J. Appl. Earth Observ. Geoinf.* 35, 88-95. <http://dx.doi.org/10.1016/j.jag.2014.01.013>

Braitenberg, C. (2015). A grip on geological units with GOCE, *IAG Symp.* 141, in press.