



Unveiling the border of a craton by the gravity gradient with examples from the Parana' basin

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The aim of our study is to investigate to what extent the Gravity Gradient Field is a useful tool of investigation for the study of the Paraná basin and the transition to the adjoined craton, the São Francisco and to the Rio Apa and Rio de La Plata terrains.

The Paraná basin is a large Paleozoic sedimentary basin that has been affected by sedimentation and subsidence from the Paleozoic up to the lower Cretaceous. Moreover during the Cretaceous an important basalt effusion has been deposited that covers almost the entire area of the basin. This volcanism is part of a LIP (Large Igneous Province), and in particular of the LBS hierarchy (Large Basaltic Provinces) and includes tholeiitic basalts (Serra Geral Formation) and acid volcanics and carbonatites of the Lower and Middle Cretaceous. At the edge of the basin it is characterized by quaternary cover rocks and the metamorphic and volcanic intrusions belonging to the basement and fold belts.

We analyze the signal of the gravity field using the spherical harmonics expansion, corrected for the topographic effect. We adopt the EGM2008 model, complete to degree and order 2160 and we compare this field with the GOCE derived model, complete to degree and order $N=210$. The GOCE derived model has the great advantage that it is purely based on satellite observations, and therefore is independent from the availability and quality of terrestrial data. In particular we map the gravity anomaly, the Bouguer anomaly, the geoid undulation, the deviation from the vertical and the second derivative tensor and its invariants. In particular we analyze the properties of the second vertical derivative T_{zz} which bears some advantages with respect to the gravity field in the investigation of superficial structures. We correlate the gravity signal with the main geologic structures as cratons, fold belts and sedimentary basins, and we show how the tensor T_{zz} can outline the structures, also in places where they are concealed by younger sediments. We find very good correlation in the definition of the cratonic margin through the gravity field with recent results from magnetotellurics (Bologna et al., 2010 in press) which indicates a major electrical conductivity change across the suture between the São Francisco craton and the Paraná basin. We show that the spectral analysis of the T_{zz} component is a means to characterize different lithologies that belong to the Paraná province and allow to better understand the complex geological sectors .

Reference:

Bologna M.S., Padilha A.L., Vitorello I., Pádua M.P., (2010). Signatures of continental collisions and magmatic activity in central Brazil as indicated by a magnetotelluric profile across distinct tectonic provinces. *Precambrian Res.* (2011), doi:10.1016/j.precamres.2010.12.003