Paper Number: 93

Integrating Magnetic and Gravity for mapping the Earth Structure using color scheme: a case study of Botswana

Chisenga, C.[1], Kamanga, T.[3], Van Der Meidje, M.[2], and Fadel, I.[2]

[1]Malawi university of Science and Technology, P.O.Box 5196 limbe, Malawi, cchisenga@must.ac.mw
[2]University of Twente, Faculty ITC, P.O box 6, 7500 AE, Enschede, Netherlands.
[3]Geological survey department, P.O. box 46, Zomba, Malawi

Botswana remains one of the least understood countries despite having diamond and other resources underneath its crust [1]. The country comprises of some of the interesting cratons e.g. Congo craton, Zimbabwe craton and Kaapvaal craton, cratonic margins and intra-cratonic boundaries. A supposed buried micro craton called Maltahohe craton is also found in the western Botswana within the Rehoboth belt [2]. The 3D structure of Botswana remains not well understood. The SH body wave tomography of the area did not provide any significant insight into the area which up to date remain unresolved [2]. Important information like crustal thickness, Moho depth, and geodynamic of the crust as well as tectonic activities is still poorly understood in Botswana.

The area around Botswana is complex tectonically. This complexity is fingerprinted in the physical properties of different rocks and tectonic regimes. The earth structure underneath Botswana is modelled using different physical signatures of rocks, in our case the magnetic responses and density of rocks. We introduce a new method of mapping the earth structure in a covered environment. The method, called apparent physical mapping, combines the magnetic susceptibility and density distribution of the earth crust calculated from the magnetic and gravity data to predict the geodynamic activities using colour scheme. The apparent physical mapping is based on the ground variation of densities and depth estimate to the geological units and the distribution of magnetic minerals, i.e. their magnetic susceptibility. However, gravity and magnetic data measure different physical properties of rocks which make it difficult to correlate and jointly use in the interpretation of the geology of an area. We constrained the physical mapping to the already known geology and their physical parameters to map the unknown areas based on the colour combination of density and magnetic susceptibility.

The results of the modelling were compared to the existing crustal thickness variation and epicentre distribution of Botswana. The different tectonic regimes and terranes mapped using this method correlates well with other dataset. The footprint of crust movement and geodynamic of Botswana is seen from the results of this modelling. However, this method is only applicable to the crust and not the upper mantle as no magnetic signal comes from the mantle based on the spectral analysis of the magnetic signal. The method also works in understanding the geology of a covered environment like desert.

Reference

[1] Schluter (2006), Springer Berlin Heidelberg.
[2] Begg G.C. (2009), *Geosphere*, vol. 5, no. 1, pp. 23–50.