Paper Number: 92

The gravity derived Moho depth of Botswana and its implications in the recent geodynamic activities

Chisenga, C.[1], 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.

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.

In this study we utilise the ground and airborne gravity data of Botswana to produce the crustal thickness map of Botswana. We assume a two layer model of earth crust and upper mantle, the lithospheric mantle, with a density contrast in between and model our crustal thickness using the parker-Oldenburg equation [3]–[5]. The inversion result from the model was constraints against seismic depth estimates in Botswana [6]. We added ETOPO1 data to the Moho depth values to produce the crustal thickness map. The final model was compared to the crustal thickness extracts of both satellite gravity and seismic derived models [7]–[9] of Botswana to see the improvement and how our model fairs against existing models.

Overall, our model produces a good crustal thickness map of Botswana. Despite that no other crustal thickness of Botswana exists. We used an extract from the crustal thickness map of Africa for comparison. Our model, considering the parameters and inversion parameters, compares well with Tugume et al. (2013) model. A new insight into the structure, tectonic and geodynamic underneath Botswana is understood. The failed incipient rift in the Okavango area, major faulting that resulted into dykes swarms and tectonically active areas that represent recent dynamic activities of Botswana are well defined by the thickness and thinning of the crust underneath Botswana. Uncertainty in seismic inversion is also highlighted which defines the southern African earth structure.

Reference

[1] Schluter (2006), Springer Berlin Heidelberg.
[2] Begg G.C. (2009), *Geosphere*, vol. 5, no. 1, pp. 23–50.
[3] Oldenburg, D.W (1974) *Soc. Explor. Geophys.*, vol. 39, no. 4, pp. 526–536.
[4] Parker, R.L. (1973) *Geophys. J. R. Astron. Soc.*, vol. 31, no. 4, pp. 447–455
[5] Gomez-Ortiz D. and Agarwal, B.N.P (2005) *Comput. Geosci.*, vol. 31, no. 4, pp. 513–520
[6] Youssouf, et al (2013) *Tectonophysics*, vol. 609, pp. 267–287
[7] Laske, G. (2013) *Geophysics*, vol. Abstract E, no. Res. Abstracts, 15
[8] Tugume F. et al (2013) *Tectonophysics*, vol. 609, pp. 250–266

[9] Tedla G.E. (2011) *Geophys. J. Int.*, vol. 187, no. 1, pp. 1–9