Geophysical Research Abstracts
Vol. 15, EGU2013-4407, 2013
EGU General Assembly 2013

3D Geophysical Modelling of the Beattie Magnetic Anomaly and Karoo Basin, South Africa

Stephanie Scheiber-Enslin (1,2), Jörg Ebbing (3,4), Detlef Eberle (1), and Susan Webb (2)

(1) Council for Geoscience, Pretoria, South Africa (sscheiber@geoscience.org.za), (2) School of Geoscience, University of the Witwatersrand, Johannesburg, South Africa, (3) Geological Survey of Norway, Trondheim, Norway, (4) Department for Petroleum Engineering and Applied Geophysics, Norwegian University of Science and Technology, Trondheim, Norway

The Karoo Basin, the broad arid plateau that covers much of the interior of South Africa, is supported by the stable Archean Kaapvaal Craton in the north and several surrounding Proterozoic basement blocks in the south, and formed within the continental interior of Gondwana during the Late Carboniferous (300 Ma) to Middle Jurassic (125 Ma). No clear tectonic model exists for the Karoo Basin, with several hypotheses regarding the nature of the subsidence resulting in basin formation. To the southern edge of the Karoo basin the enigmatic Beattie magnetic anomaly (BMA) is seen, which stretches east to west for $\sim$1000 km across a large portion of South Africa, and for which a variety of explanations have been proposed.

Here we present detailed 2D gravity and magnetic models across the southwestern Karoo along with a combined first-order regional 3D model. The models presented here are based on seismic and potential field data, along with geological and structural information that cover the entire basin. Information about the Moho structure was derived from teleseismic data. The models have been further constrained using deep boreholes, as well as on- and off-shore seismic lines, Magnetotelluric data, and magnetic depth-to-basement estimates. Density and susceptibility values are based on borehole and hand sample data, as well as on the conversion of p-wave seismic velocity to densities.

In order to produce an accurate potential field model of the Karoo basin and to understand the evolution of the basin, a clear understanding is needed of the source of the Beattie. Seismic data over the western section of the Beattie magnetic anomaly place the source in the mid-crust (10-15 km). Earlier studies have attributed the anomaly to partially serpentinized oceanic lithosphere possibly linked to a suture zone, or to massive disseminate magnetite-sulphide bodies within the basement. However, our analysis lets us support the idea that the BMA is part of the tectono-metamorphic Namaqua-Natal Mobile Belt and associated shear zones.