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Recent advances in understanding the 3D geometry of the Bushveld Complex using geophysical data

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The Bushveld Complex has been extensively studied since its discovery more than 110 years ago but many questions remain concerning the geometry of its mafic component, the emplacement mechanism, post emplacement subsidence etc. Potential field modelling is well suited to investigating these aspects. This study focusses on the role of the Thabazimbi-Murchison Lineament (TML) during the emplacement of the Bushveld Complex. The TML is a large structure that runs along the northern boundary of the central Bushveld Complex and separates it from the northern lobe.

Various authors consider the TML to have been exploited by a feeder to the northern lobe [1] and also to the whole Bushveld Complex [2], [3], [4]. Geophysical models focussing on the northern lobe show the presence of a feeder underneath the 110 mGal gravity high west of Mokopane and just to the north of the TML [1], [2]. Finn et al. [2] also modelled thicker Rustenburg Layered Suite (RLS) along the TML further westward towards Thabazimbi. Potential field data that focuses on the TML and the central Bushveld Complex to the south was modelled in three dimensions to study the distribution of the RLS along this structure, and investigate the role of the TML in the emplacement of the mafic rocks (Figure 1).

Densities akin to those of the Lower Zone of the RLS (3200 kg/m^3) had to be assigned to the modelled Bushveld feeder west of Mokopane in order to model the high gravity values. This concurs with the work of Van der Merwe [5] who modelled a feeder composed entirely of the Lower Zone. Boreholes drilled into the Lower and Marginal Zones in the northern part of the eastern lobe revealed the presence of an additional 750 m of ultramafic material underneath the Marginal Zone that was previously unknown [6]. This Basal Ultramafic Sequence (BUS) has a density of about 3100 kg/m^3. It is therefore possible that this material may also constitute part of the feeder, supporting the modelled values.

Positive magnetic anomalies and high gravity values occur all along the TML in the western lobe. In most instances the magnetic highs can be explained by banded iron formation (BIF) of the Penge Formation that has been brought close to the surface along the Droogekloof Thrust along the TML, but the BIF is too thin to account for the gravity high. The gravity data therefore indicate a possible deeper seated source for these anomalies. It was possible to model these anomalies by including very dense material similar to the Mokopane feeder (Lower Zone and BUS) in the thrust zone. The Droogekloof Thrust was active during the emplacement of the RLS [7] and the modelling suggests it may have been exploited as a feeder.

In the eastern lobe magnetic and gravity anomalies are clearly associated with the RLS, but other than vertical

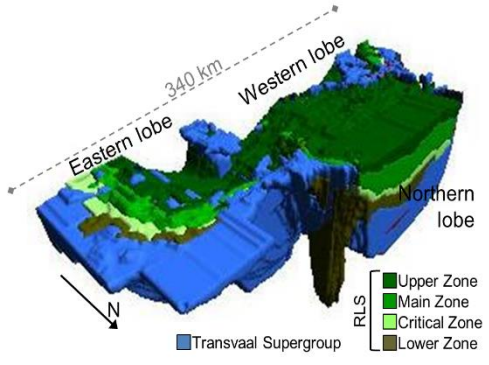

Figure 1. Perspective view of the 3D model

displacement along the TML the models do not show the presence of mafic material within the fault itself.

References:

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