Greenfields Geophysics

Memorandum

To: Paul Roberts
Copy:
From: Bob Smith
Date: November 18, 2011 **File:**

Re: Benmara EL27426, Geophysical Program 2011

1 Introduction

Adjoining ELs 24645 and 27426, located in the Northern Territory of Australia, have been the subject of geological and geophysical investigations by Predictive Discovery Pty Ltd during 2010 and 2011. This memorandum summarises these activities in EL27426 only since April 2011, although the geophysical programs were often carried out together.

EL27426 is located on the Calvert Hills 250K map sheet in Northern Territory but close to the NT/Qld border, as shown in Figure 1. Map coordinates in Figure 1 are latitude and longitude (GDA 94) but all other coordinates used in this memorandum are MGA (GDA94) Zone 53.

Most of the EL had been covered by an airborne magnetic and radiometric survey which has been described previously. Coverage was on north south lines spaced 200 metres apart and a grid image of TMI is included in Figure 2. A number of linear features, interpreted as structural dislocations, are apparent in the magnetic images and these were used to determine areas of interest for more detailed evaluation.

One area of interest within EL27426, designated Block 9, was selected and several detailed gravity lines were surveyed to assist in interpreting the structures and possible targets for drilling. The gravity data acquisition was reported previously. The location of the gravity stations is shown in Figure 3, superimposed on the TMI RTP magnetic image.

The gravity stations were on several lines, widely separated and the data was not considered adequate for gridding, however some profiles were generated and are included here as Appendix A.

Some efforts were made to model the gravity and magnetic data to try to determine depth to (magnetic) basement and perhaps generate a rudimentary interpretation model of the subsurface geology. This modelling will be discussed further in the following notes.

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Figure 1 – Regional Locality of EL27426

Although the general stratigraphy of the area is known from regional mapping, no petrophysical measurements on samples were available to assist in constraining the modelling. Reasonable estimates could be made but the lack of hard data limits the accuracy of any models developed. This is particularly the case for magnetic properties which are complicated by the presence of obvious remanent magnetisation.

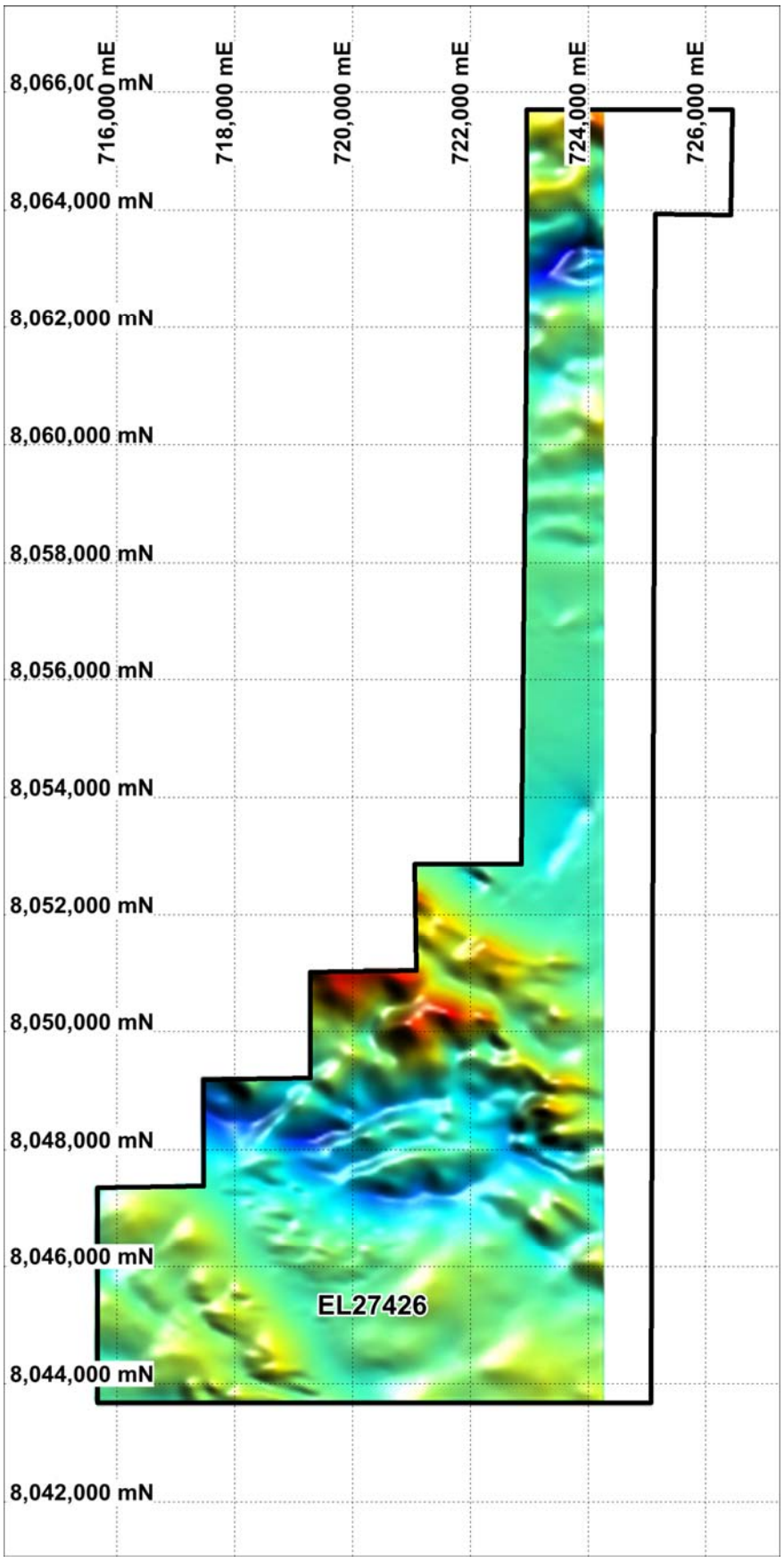


Figure 2 – TMI Image, EL27426

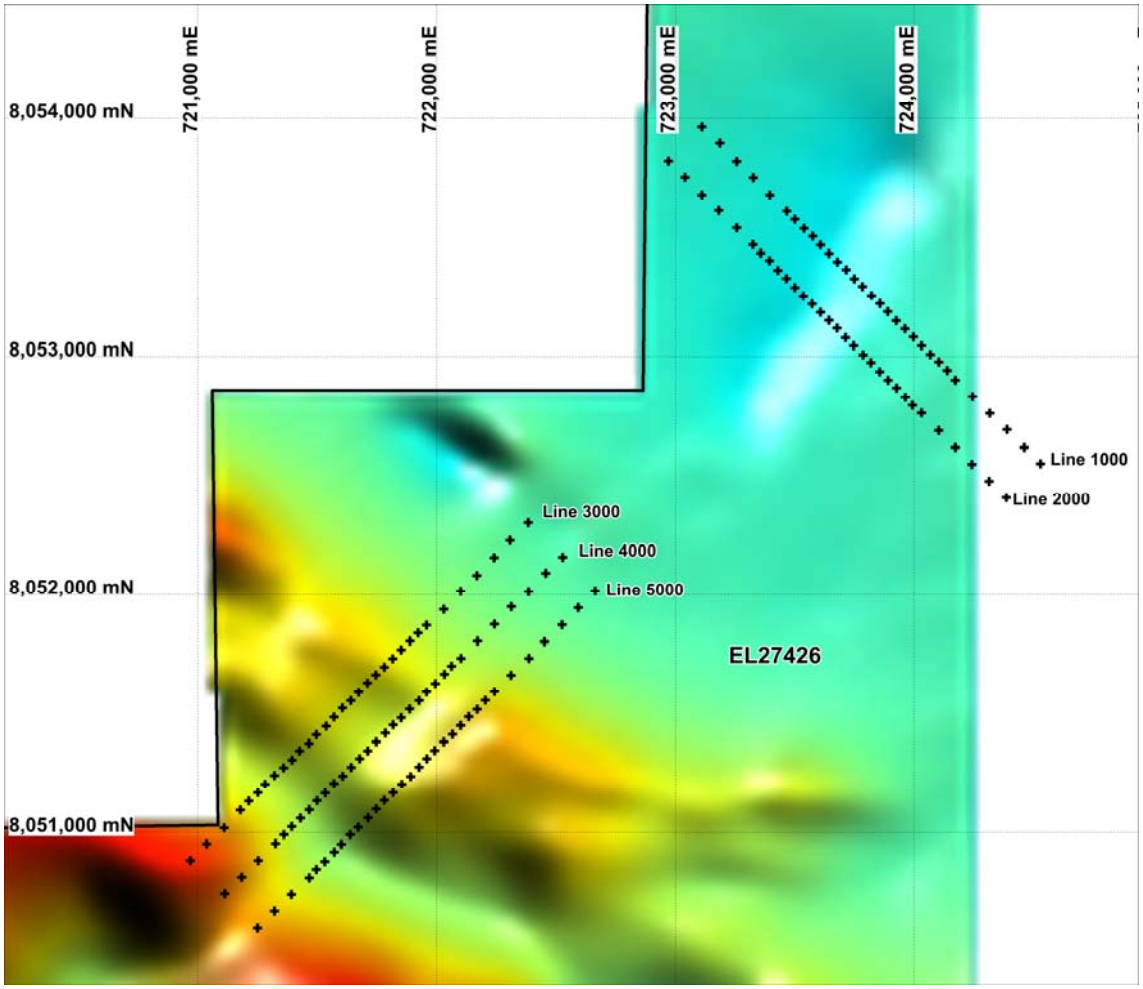


Figure 3 – Block 9, Gravity Stations on TMI Image

2. Gravity and Magnetic Modelling

2.1 PGN Geoscience

An extensive modelling exercise was undertaken by Antoinette Stryk and Peter Betts of PGN Geoscience involving several areas. In particular some modelling was undertaken at Block 9 using both gravity data along Line 3000 (designated Line 303 in their report) and a coincident magnetic profile extracted from the gridded airborne data.

The objective stated was “to forward model one x 2.5D magnetic and gravity constrained cross section through area 9” and this was attempted although few constraints were possible. Extracts from their report (Geophysical Modelling: Benmara Project by Antoinette Stryk and Peter Betts; PGN Report 27/2011 for Predictive Discovery) relevant to Block 9 are included below showing the results obtained. These extracts should be self-explanatory and the figure numbers shown are those used in the original report. Some additional comments by this author are provided within the report and at the end.

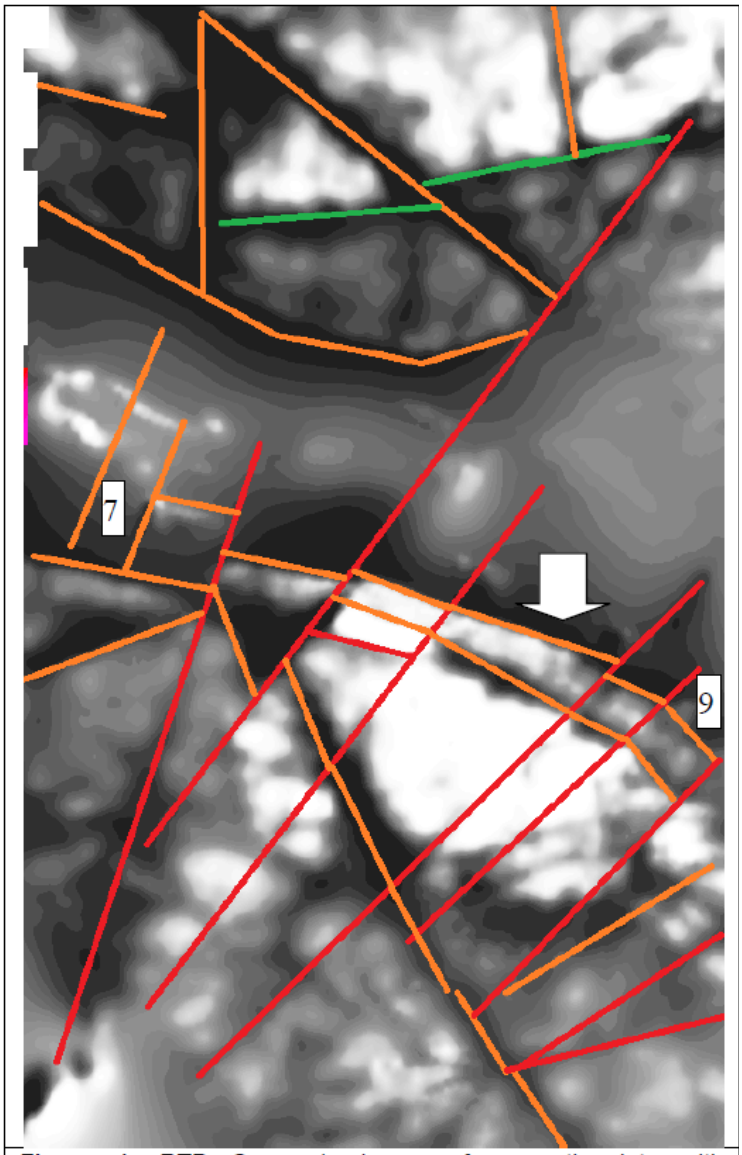


Figure 1: RTP Greyscale image of magnetic data with superimposed Fault Interpretation of Area 9 and Area 7,. Possibly three generations of faulting. Arrow indicates Area 9 where faults that might be younger than indicated as they are E-W trending, potentially the same generation as the green faults.

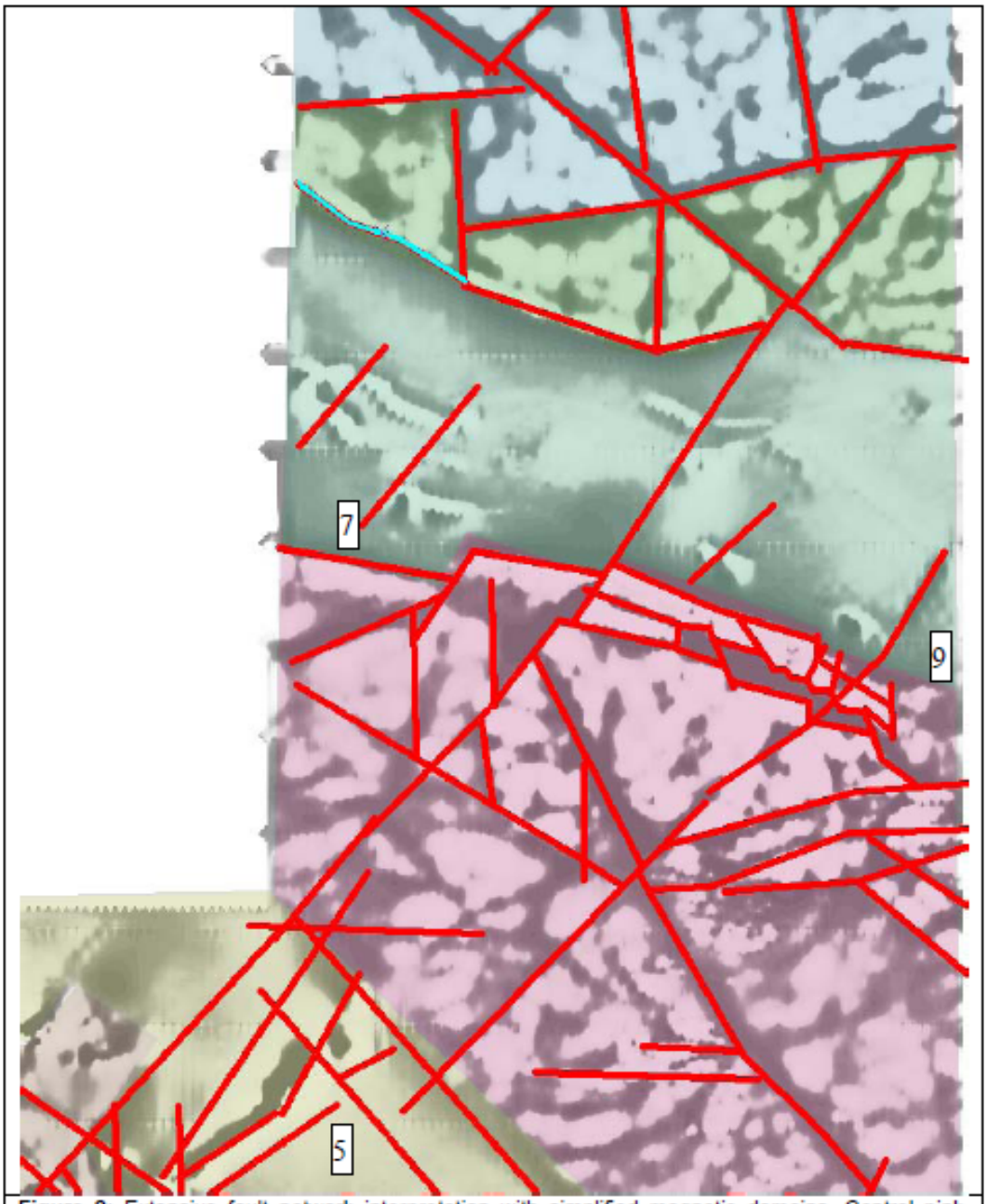


Figure 2: Extensive fault network interpretation with simplified magnetic domains. Central pink, northern blue and northern green all have a similar magnetic texture however central pink (Seigal Volcanics?) can be divided further by strength of magnetic response. Middle green and south-western yellow possibly Westmoreland conglomerate or significant neutral cover over Seigal Volcanics as these regions have a distinctly smoother response.

Initially, various images of filtered magnetic and gravity data were used to try to generate a map of interpreted faults and magnetic domains. Quantitative magnetic interpretation was complicated by the obvious presence of remanent magnetisation in many of the magnetic units and images of Vector Residual Magnetic Intensity (VRMI) were used to assist in mapping magnetic units. The widely spaced areas of detailed gravity data limited its application for structural interpretation but it was used in detailed modelling along a profile.

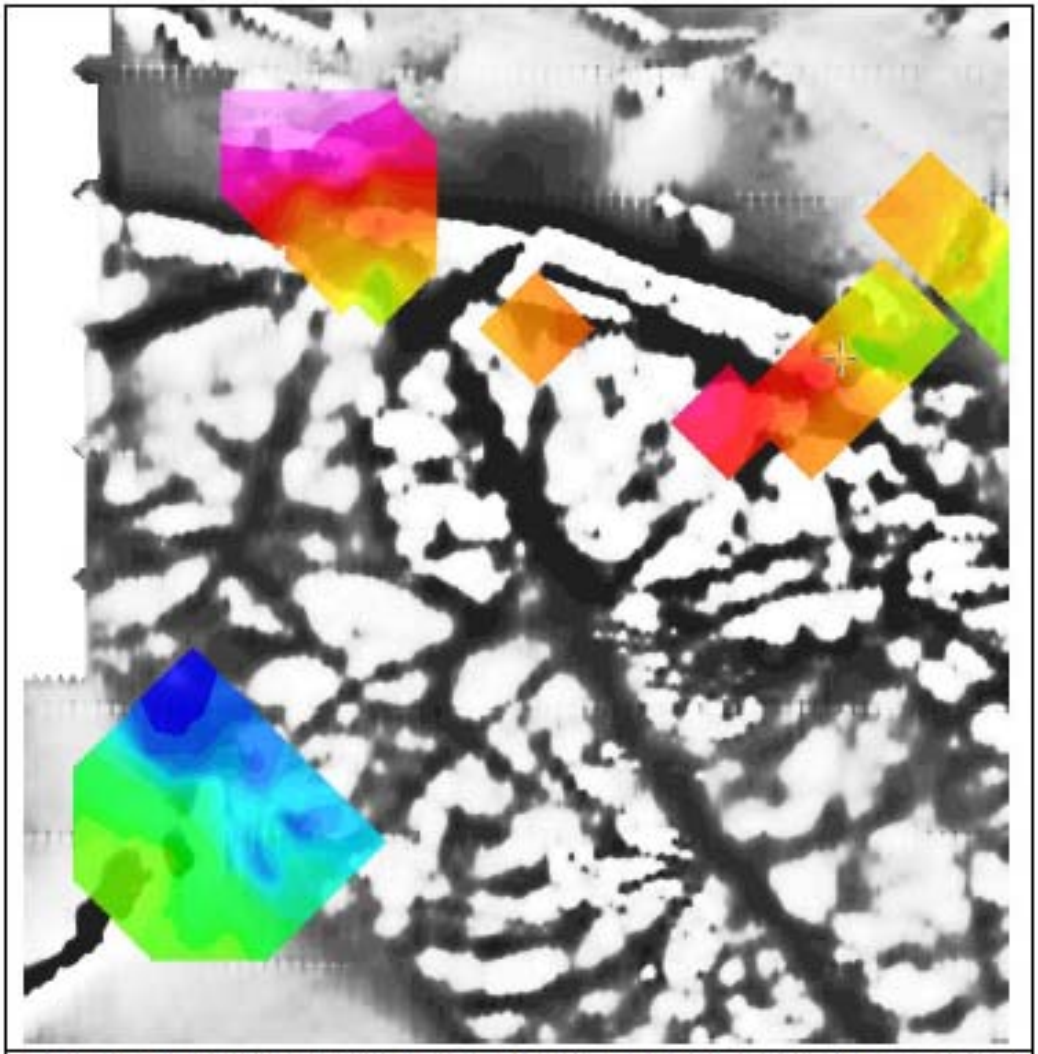


Figure 3: Detail image of the Bouguer gravity data grid krigged at a cell size of 25m superimposed of over 1st vertical derivative of the RTP magnetic response in greyscale. Suggests that while the texture of the central domain is consistent the density changes significantly. Blocks to the north with high magnetic response also display a high density. (Area 9), while the south of the domain displays moderate magnetic and low density (Area 5). It is possible this block (Seigal Volcanics?), shallows to the south. In the northwest, Area 7, shows a magnetite rich, dense block is bounded by faults.

The structural interpretation shown here covered a much larger area than Block 9, and also used data in the adjoining EL24645 which will be reported separately. The gravity line numbering system used in the next section of the report is related to the line numbers shown in Figure 3, but not identical. Line 3000 in Figure 3 equates to Line 303 in the PGM report, Line 4000 equates to Line 304 and so on.

This was a complex area to interpret with magnetic data complicated by remanence, sparse gravity data and few realistic geological constraints. The magnetic modelling used profiles extracted from a TMI RTP grid and this is likely to be distorted by remanence. Nevertheless it was an attempt to construct a plausible geological model, consistent with the known stratigraphy and interpreted structure.

Objective 5 – Area 9

- Gravity lines 304 and 305 discarded due to proximity to NE-SW fault
- Gravity line 303 utilised for gravity and magnetic modelling.

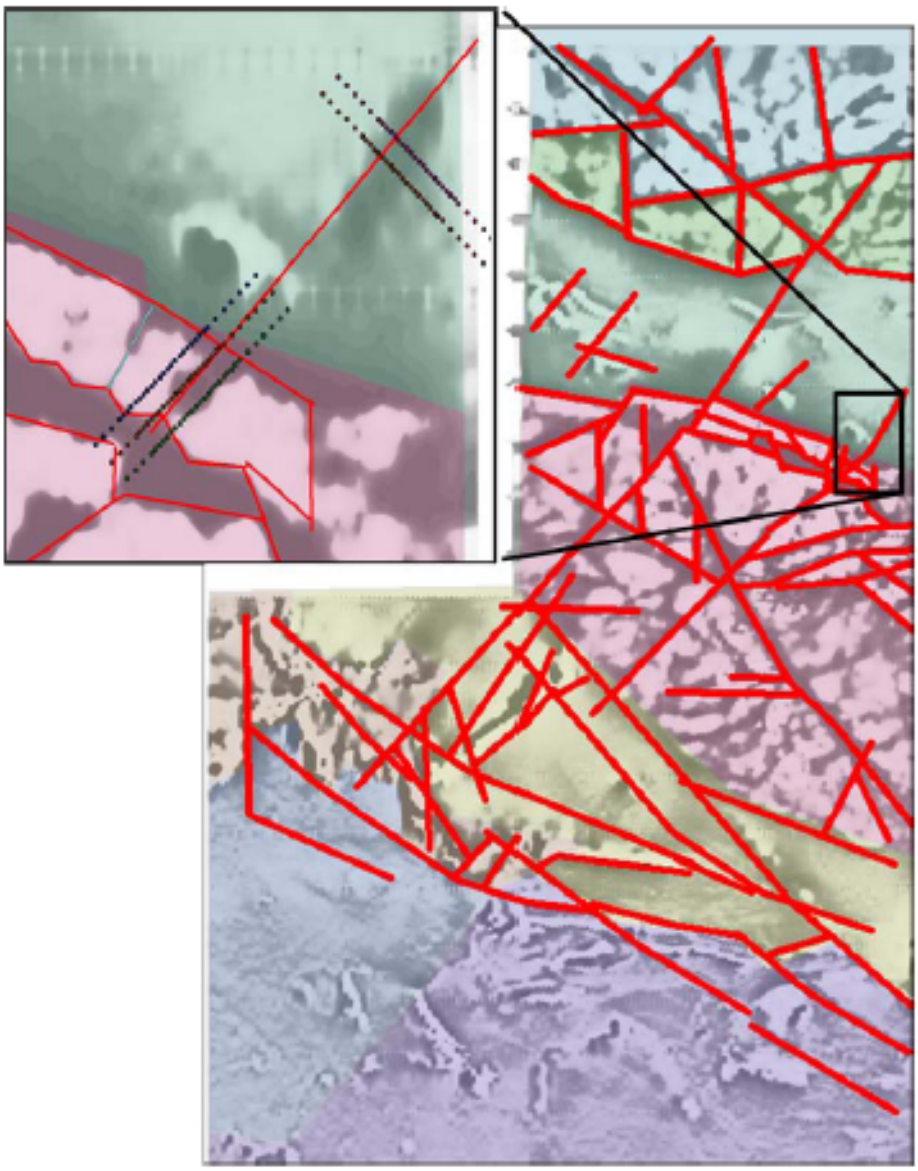


Figure 26. Greyscale RTP image of the magnetic data highlighting the location of area 9. Inset shows detailed greyscale image of aeromagnetic data

Area 9 poses a challenge as there isn't significant gravity data in the region to determine a regional trend. The gravity data does indicate a domain trend with the southern domain showing a higher density and the northern domain showing a lower density. Unfortunately the position of the gravity stations suggests is that lines 305 and 304 (the southernmost northeast striking lines) are parallel to and on top of a significant fault line so not beneficial for use in modelling as the fault has destroyed local magnetite and due the low angle, the feature will have a negligible apparent dip. Line 303 was chosen for modelling as is perpendicular to major block boundary was deemed significantly distant from the NE-SW fault. The results of the 2.5D gravity and magnetic modelling (Figure 27) indicate the fault separating the Seigal Volcanics in the south (orange) from the northern block is north dipping. The northern block shows a low density with a moderate-low magnetic response. This block may be a thin block of Seigal Volcanics under significant cover or Westmoreland Conglomerate.

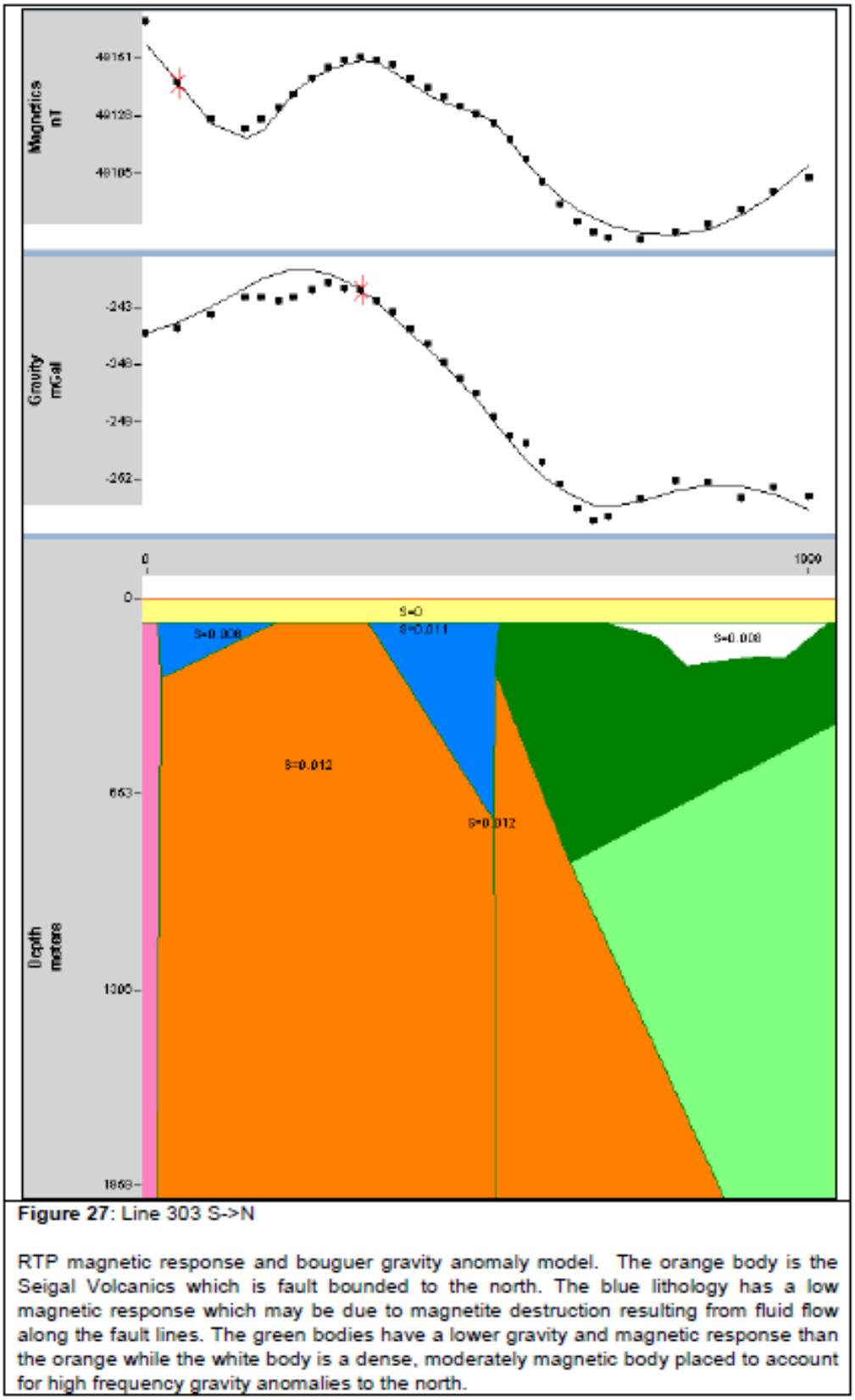


Figure 27: Line 303 S->N

RTP magnetic response and bouguer gravity anomaly model. The orange body is the Seigal Volcanics which is fault bounded to the north. The blue lithology has a low magnetic response which may be due to magnetite destruction resulting from fluid flow along the fault lines. The green bodies have a lower gravity and magnetic response than the orange while the white body is a dense, moderately magnetic body placed to account for high frequency gravity anomalies to the north.

Summary:

Area 9 straddles the boundary between a thick succession of magnetite rich Seigal volcanics and a lighter block with lower magnetite. This may be Westmoreland Conglomerate or a thinner layer of Seigal volcanics under thicker cover.

2.2 Greenfields Geophysics

In addition to the modelling undertaken by PGM, this author also attempted to generate 2D models on specific flight lines to estimate depth to magnetic basement as a guide for drilling. Since modelling was only attempting to estimate depth to basement, the models used measured TMI profiles (and the first vertical derivative of TMI) only, while recognising that remanence would probably distort the apparent dip and susceptibility.

The TMI image surrounding Block 9 shows two sub parallel bands of magnetic highs trending WNW – ESE and dislocated by apparent faulting and possible demagnetising alteration in the immediate area of interest. These dislocations make magnetic modelling difficult and prone to errors, particularly since the most useful models are 2D. Consequently it was decided to try to develop 2D models for these same features further west, away from these dislocations, where the 2D approximation seems more reasonable. The flight line chosen for modelling (Line 301061) is shown in Figure x. It extends beyond the boundary of EL27426, into the adjacent EL24645, and data from both tenements was used to develop 2D models. Although the models are centred a significant distance west of the main area of interest it was hoped that the depth to magnetic source could be extrapolated to guide drilling in Block 9.

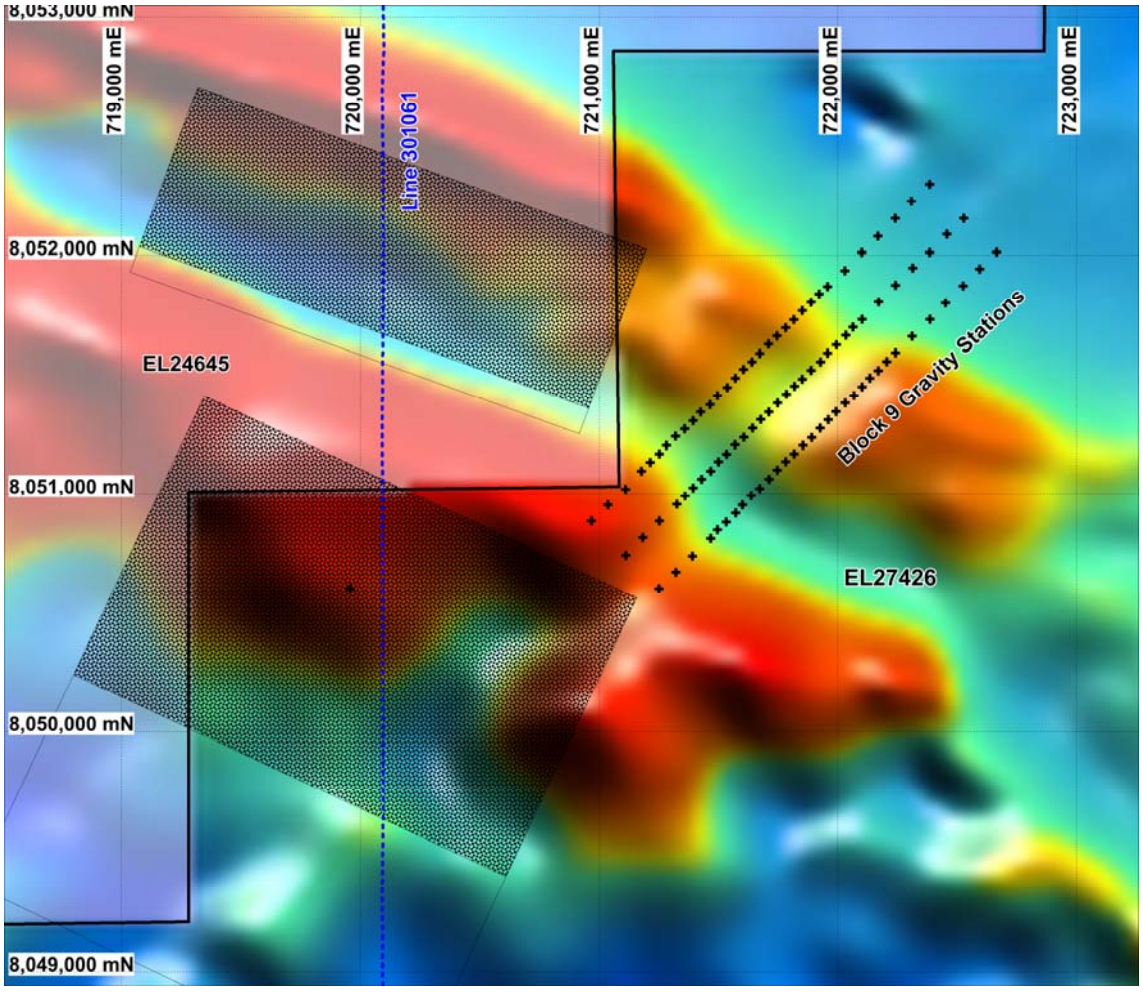


Figure 4

Models were developed which fitted both TMI and the 1st vertical derivative (FVD) along Line 301061 to a reasonable approximation. Figure 4 also shows the location of the tops of

the models developed, both dipping steeply to the south and with depths to top in the range 50 to 100 metres. The models are not ideal but they should give some idea of the general depth of cover in this area.

The model is illustrated in section in Figure 5. The southern body has a depth to top of 100 metres and the northern body has a depth to top of 65 metres but the fit is less than ideal so these should be considered indicative only. The dips are unlikely to be correct as no allowance has been made for remanent magnetisation.

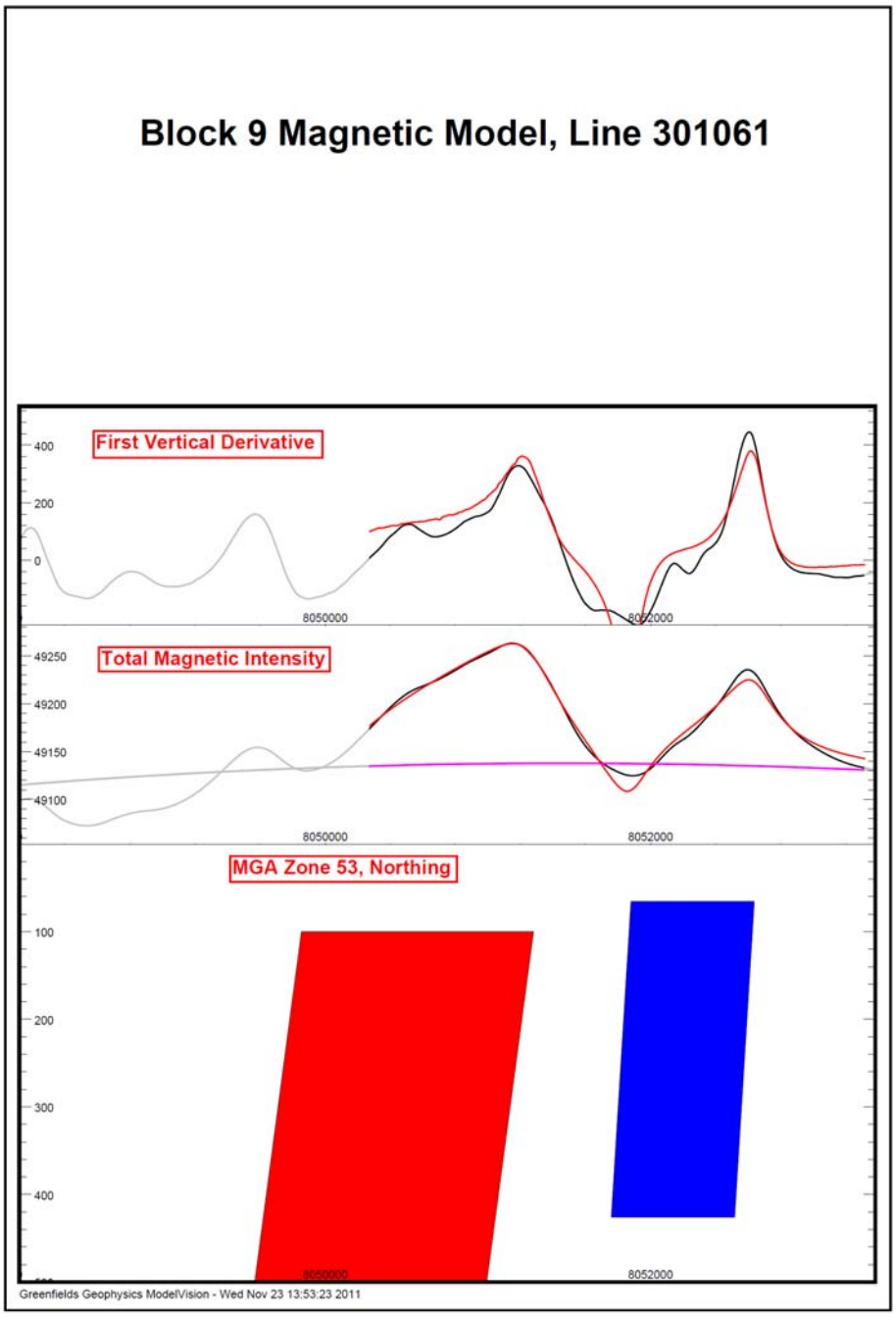


Figure 5 – 2D Magnetic Model along Line 310061

3. Conclusions

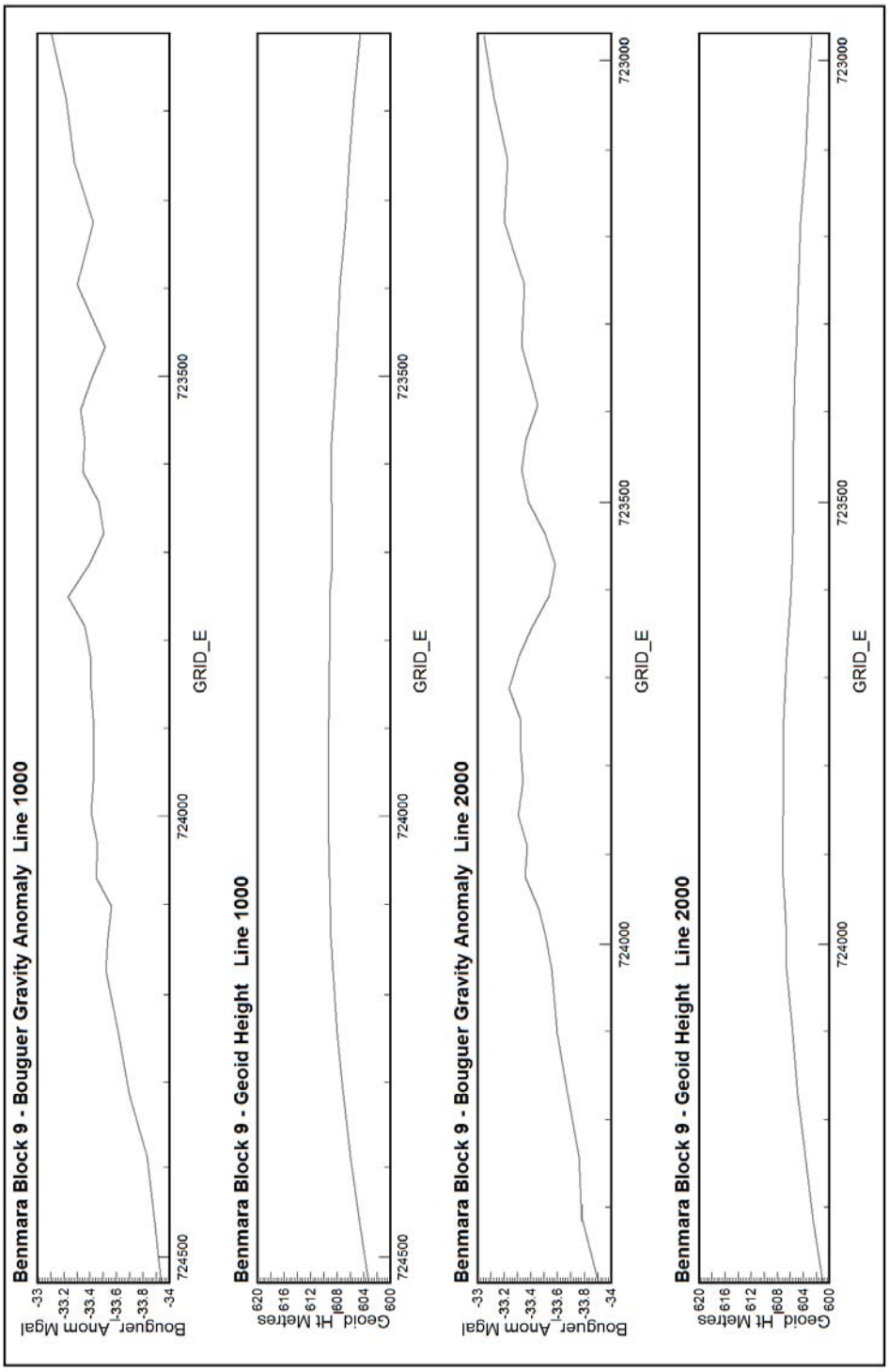
A rudimentary geological model has been developed for the area around Block 9 and indicative depths to the magnetic sources have been estimated in the range of 50 to 100 metres.

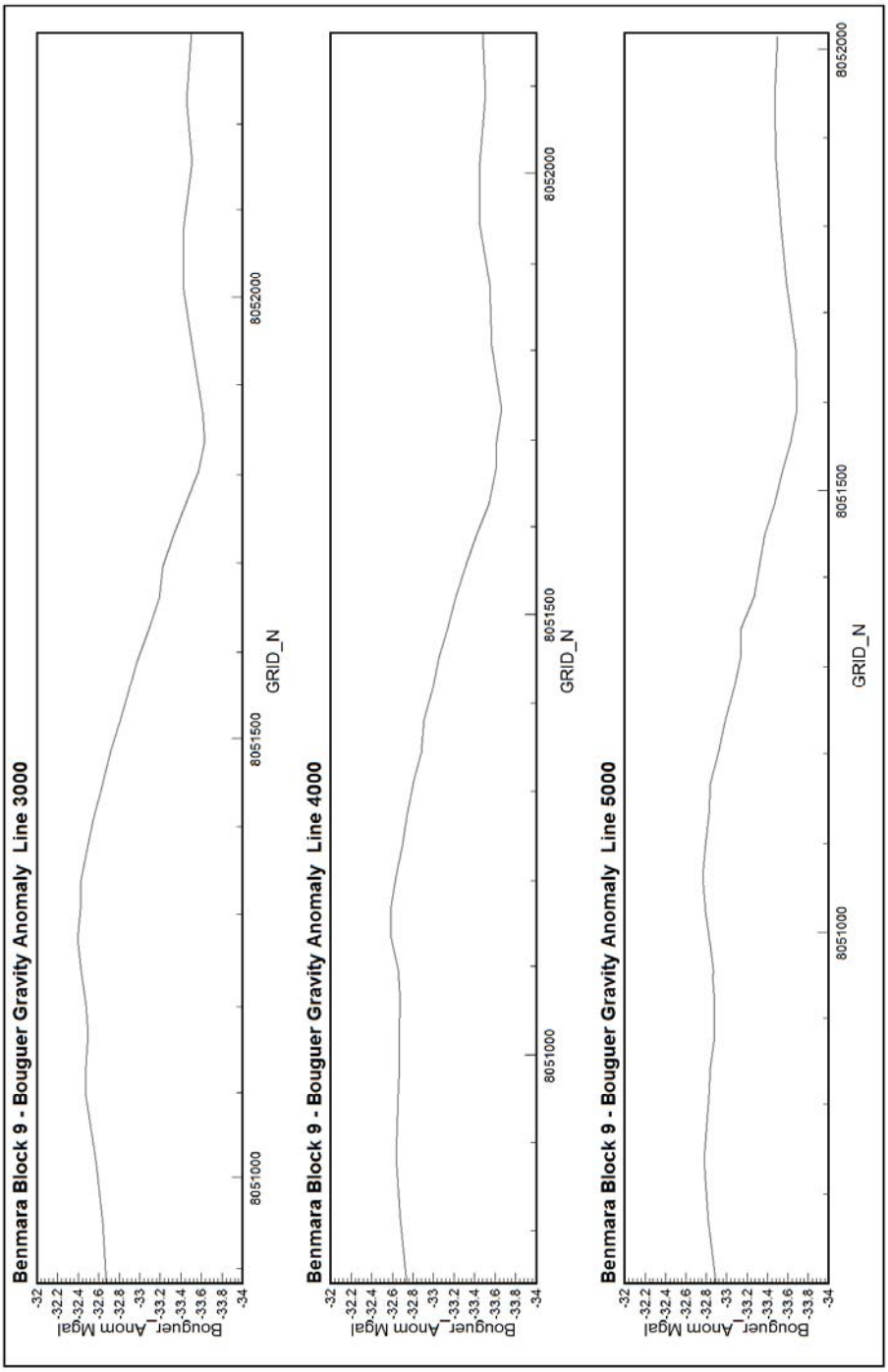
The model is not considered reliable in detail but it may provide some assistance in siting drillholes to test the area defined primarily by interpreted structures and possible signatures of demagnetising alteration.

Robert J Smith

Appendix A

Block 9 - Gravity Profiles




Benmara Block 9 - Bouguer Gravity Anomaly Line 3000
Bouguer_Anom Mgal
-32
-32.2
-32.4
-32.6
-32.8
-33
-33.2
-33.4
-33.6
-33.8
-34
8051000
8051500
8052000
GRID_N
Benmara Block 9 - Bouguer Gravity Anomaly Line 4000
Bouguer_Anom Mgal
-32
-32.2
-32.4
-32.6
-32.8
-33
-33.2
-33.4
-33.6
-33.8
-34
8051000
8051500
8052000
GRID_N
Benmara Block 9 - Bouguer Gravity Anomaly Line 5000
Bouguer_Anom Mgal
-32
-32.2
-32.4
-32.6
-32.8
-33
-33.2
-33.4
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-33.8
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