



Mapping of shallow-source magnetic anomalies at Suplejack, NT

For: Suplejack Pty Ltd

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Enclosure 3	Anomaly axes and interpreted lineaments on automatic gain control image of the first vertical derivative of RTP

Introduction

This report presents the results of mapping shallow-sourced magnetic anomalies from an aeromagnetic data set at Suplejack, Tanami, NT. The anomalies may be due variously to fracture-related magnetizations within basement, or magnetization within palaeo-drainage systems above basement. The objective of this study was primarily to map the location of the anomalies for direct ground testing, with the secondary objective of verifying the anomalies and shedding any possible light on their source.

The data sets

Aeromagnetic data

Suplejack Pty Ltd supplied 1600 line km of heli-mag data acquired in 1996 on east-west flight lines at 50 metre spacing. The station spacing is 5 metres, average ground clearance from radar altimeter is 26 metres, and there are auxiliary gps and dtm channels. Over the Suplejack area the data contain variations of 1 to 4 nT peak to trough amplitude and 100 to 200 metres wavelength which are the subject of this report.

Ground magnetic data

Suplejack Pty Ltd collected a 2.5 km line of ground magnetic data at a 5 m spacing to test the aeromagnetic anomalies. The location of the profile on an image of the aeromagnetic grid is shown in Figure 1. The line was selected to intersect some of the more prominent aeromagnetic anomalies. A comparison of the ground TMI data, a 26 metre upward continuation of the ground data, and an interpolation onto the profile of data from the aeromagnetic TMI grid are shown in Figure 2.

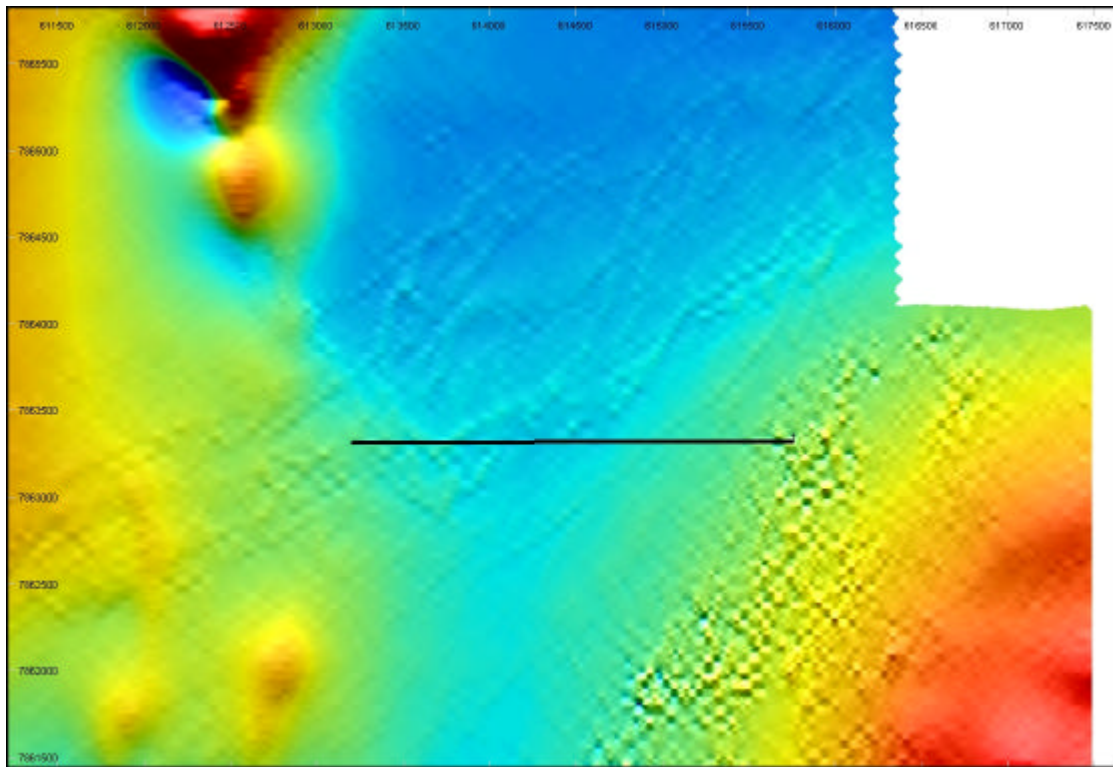


Figure 1 Location of the ground magnetic traverse on an image of the aeromagnetic TMI data

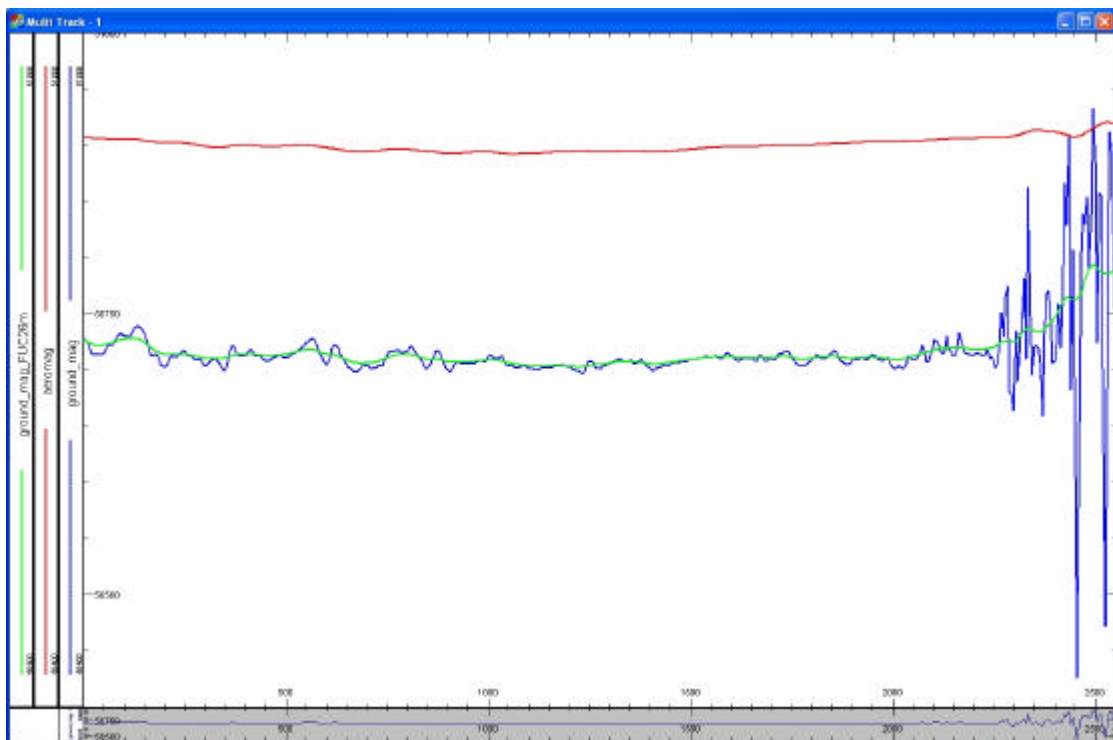


Figure 2 Ground TMI (blue), upward continued ground TMI (green) and aeromagnetic TMI (red)

The high amplitude variations at the eastern end of the line are due to laterite, and are of such short wavelength that they are heavily attenuated by the 26 metre upward continuation. The further attenuation of these anomalies in the aeromagnetic data may be due to smoothing associated with gridding of the data. The base-level shift between the ground and aeromagnetic data is of no significance, as the definition of the absolute value of the field is dependant on various processing options.

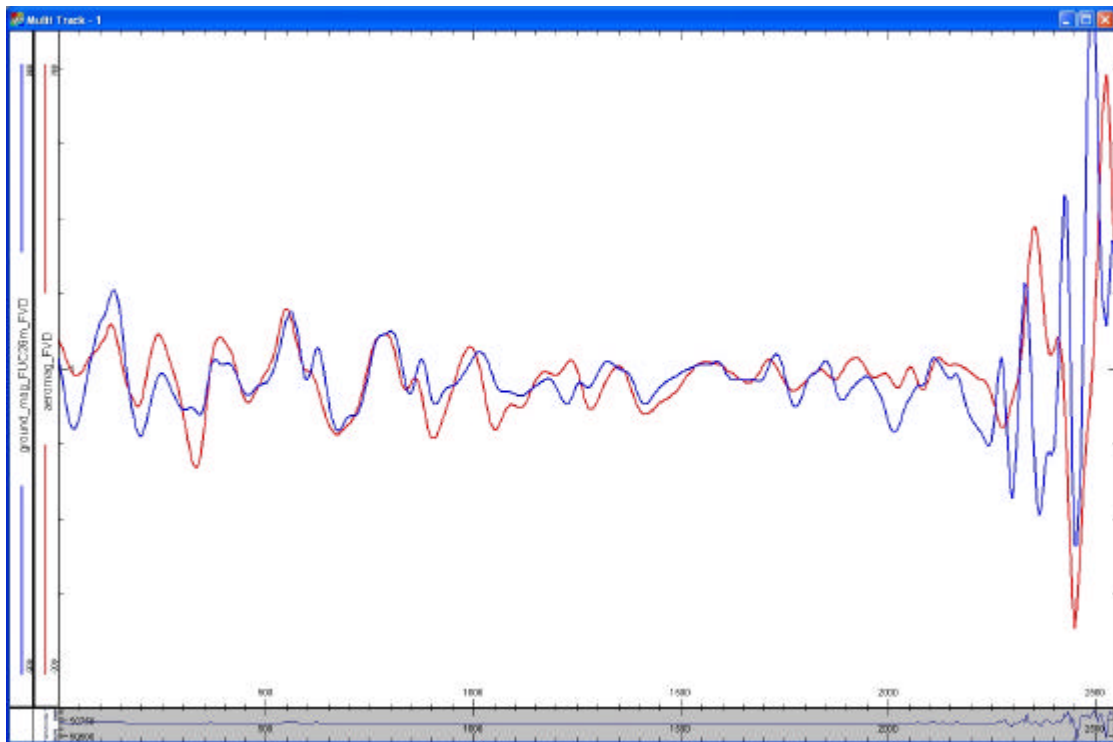


Figure 3 First vertical derivative of the aeromagnetic and upward continued ground magnetic data

It is difficult to compare the ground and airborne magnetic data from the raw TMI variations. Figure 3 shows the two data sets after application of an in-line first vertical derivative filter. Minor amplitude adjustments have been applied to best-match the filter tracks. The filtered output shows a good spatial correlation between the ground and aeromagnetic data. Details of the anomalies vary considerably between the data sets however, as should be expected for field variations of these short wavelengths and low amplitudes. Unfortunately it is these details of the anomalies which are critical in any attempt to estimate the source body shape and depth.

Mapping the anomaly axes

The anomalies are of small amplitude compared to the background field variations, but have such different wavelength characteristics that they can be mapped from the field variations without enhancement and the concerns of data distortion. However the moderate inclination of the geomagnetic field at the site produces dipolar anomalies, and so an RTP transform was applied to the data to create images from which the anomaly axes could be mapped. The axes were mapped from features which could be traced over at least 4 lines, and which had amplitudes in excess of one nT as determined by offset of the RTP contours. The anomaly axes are mapped at 1:20,000 scale in Enclosure 1, and are superimposed on the RTP image in Enclosure 2.

Enhancement of the aeromagnetic data

Lower amplitude variations of short wavelength can be can be imaged from the data by application of suitable enhancement filters. First vertical derivatives were applied both to the line and the grid data, and an automatic gain control filter was applied to the FVD outputs to normalize the response of anomalies of different peak amplitude. The resulting images show both linear anomalies and terminations and dislocations of anomalies. These interpreted features are shown as a lineament overlay on the AGC image of FVD in Enclosure 3.

The enhancements reveal many laterally extensive linear anomalies with a variety of trends. This anomaly pattern is interpreted to be caused at least in part by magnetizations within basement fractures. These anomalies may be complimented by magnetite concentrations within overlying palaeo-drainage systems, but it is not feasible to make diagnostic interpretation of the geological source of individual anomalies. .

Model studies

Three sections of anomalies were modeled on individual aeromagnetic flight lines. These models confirm that the top of the causative bodies are no more than 50 metres below surface. The shape of the individual model bodies are not reliable, because these details of the anomalies are of low reliability, and because the anomalies are not well separated, but overlap. Despite this the models do suggest that many of the anomalies are best explained as due to bodies of considerable depth extent, suggesting that these are intra-basement features of moderate to steep inclination. Some of the bodies however are best-fitted by shallow bodies of limited depth extent, which may alternatively be explained as due to magnetite within the section above basement. The model sections are shown in Figures 4 to 6.

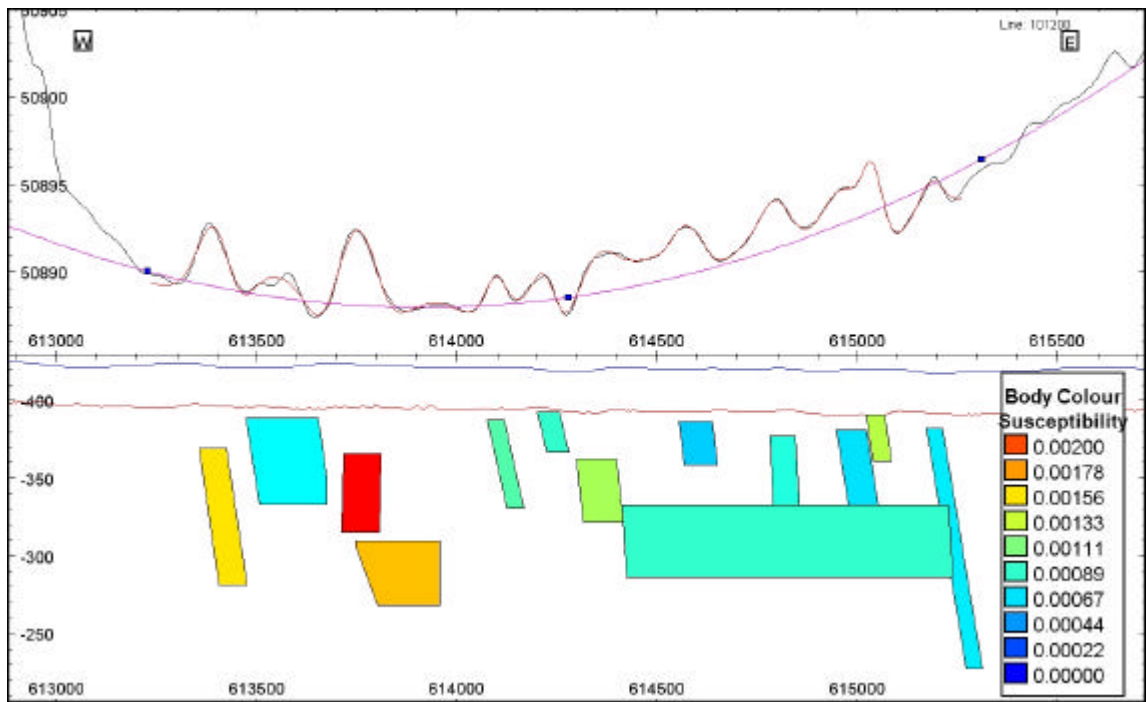


Figure 4 Line 101200 model section

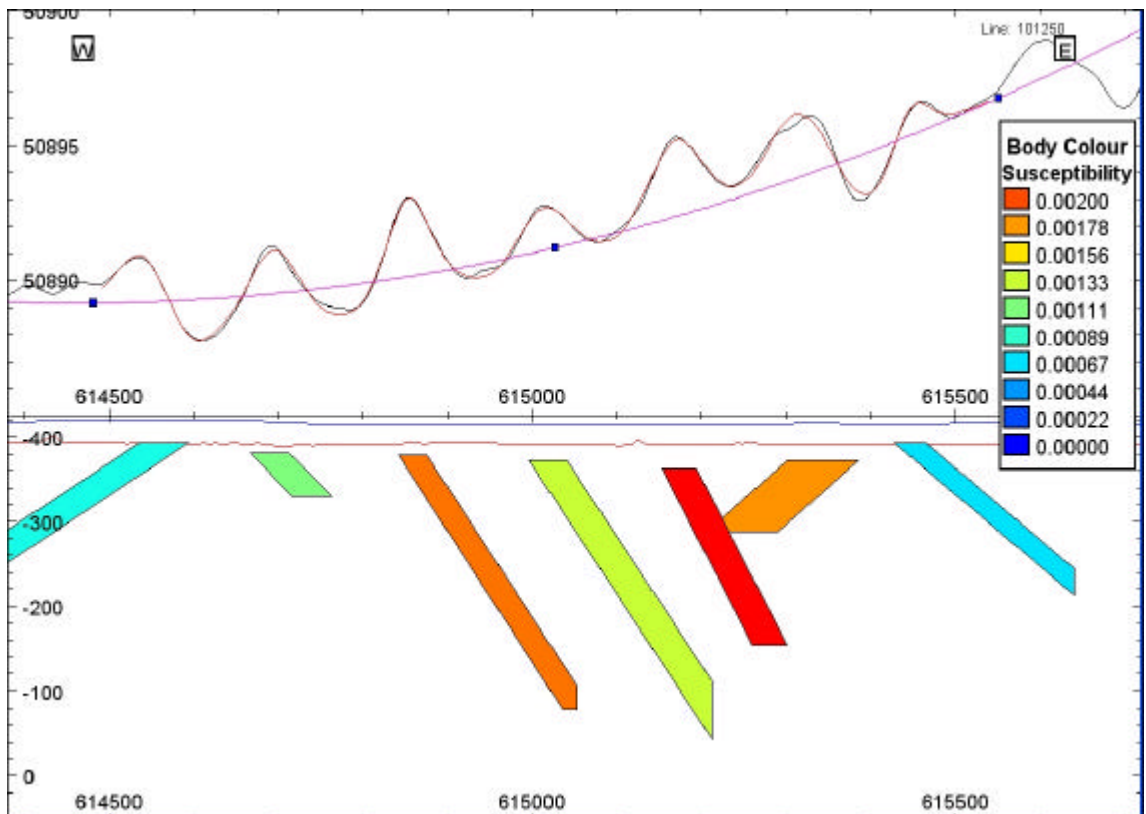


Figure 5 Line 101250 model section

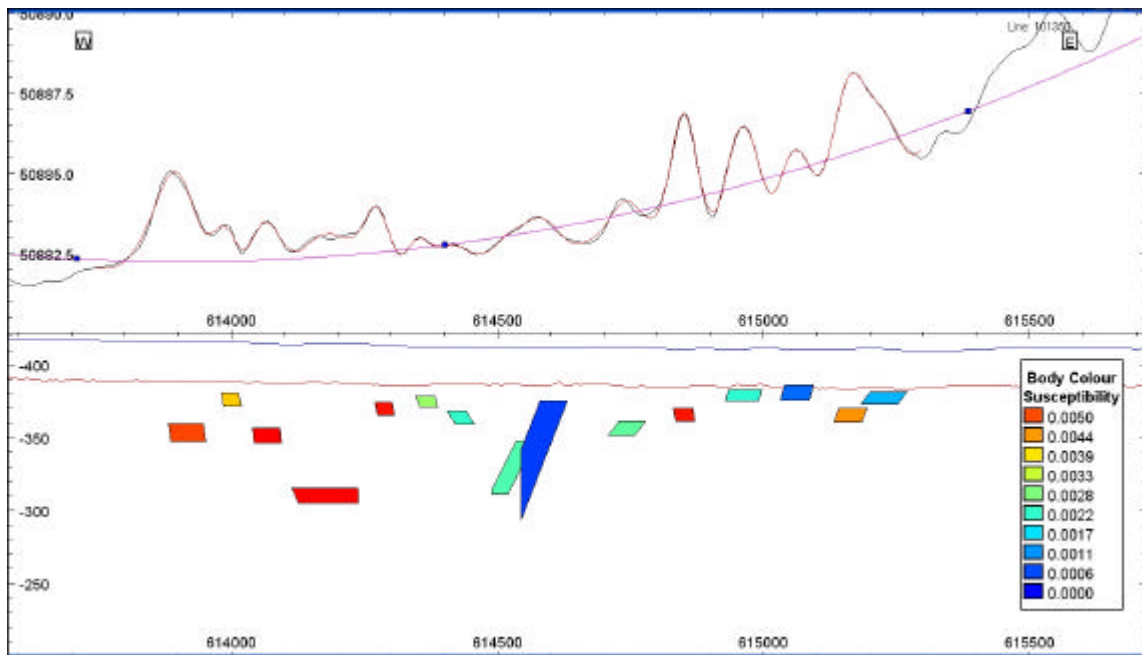


Figure 6 Line 101350 model section

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