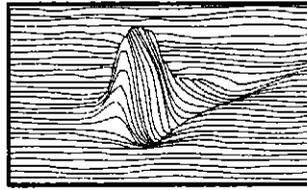


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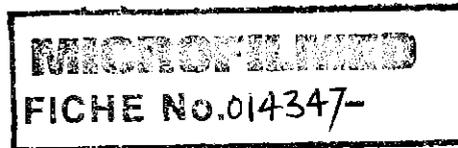


EL 20/94
13 JUL 1997
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GRI Project Report No: 97128

A High Definition Magnetometer Survey for Gold Exploration

Beaconsfield, Northern Tasmania.



Prepared For



Beaconsfield Mines Joint Venture.

By

Ben Payne B.Sc. (Hons.)

May 1997.

97-4027

MAGNETOMETER SURVEY FOR GOLD
EXPLORATION-B'FIELD MINE J/V
EL 20/94 - BEN PAYNE

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FIGURE 2. CONTOURED IMAGE OF TOTAL MAGNETIC INTENSITY - SALISBURY HILL GRID, BEACONSFIELD, TASMANIA. THE DATA HAVE BEEN LOW PASS FILTERED (WAVELENGTH CUT-OFF 25 METRES) AND GRIDDED TO 10 METRES. SCALE 1:2500.

FIGURE 3. COLOUR IMAGE OF TOTAL MAGNETIC INTENSITY - SALISBURY HILL GRID, BEACONSFIELD, TASMANIA. THE DATA HAVE BEEN LOW PASS FILTERED (WAVELENGTH CUT-OFF 25 METRES) AND GRIDDED TO 10 METRES. SURFACE FEATURES RECORDED DURING SURVEYING ARE INCLUDED. SUN ANGLE ILLUMINATION: INCLINATION 30 DEGREES, DECLINATION 325 DEGREES. SCALE 1:2500.

INTRODUCTION

This report describes a high definition ground magnetometer survey conducted at the Salisbury Hill Grid, Beaconsfield, approximately 50 kilometres north west of Launceston, Tasmania. This survey was conducted in May 1997, under the supervision of Richard Keele, on behalf of the Beaconsfield Mines Joint Venture.

The primary objective of the High Definition Magnetic (HDM) survey was to determine the extent and position of a magnetic anomaly detected in a previous aeromagnetic survey. Principal interest was in providing optimally sampled east-west profiles.

LOCATION OF THE SURVEY GRID.

The bounding corners of the grid are given by the following AMG grid coordinates:

485900mE, 5433450mN
485900mE, 5434250mN
487400mE, 5434250mN
487400mE, 5433450mN

The grid comprised 17 flagged east-west lines, 50 metres apart and varying from 1250 metres to 1400 metres in length. Each line was flagged at 50 metre, slope corrected intervals. Grid north corresponds to 346° magnetic.

Vehicular access to the grid was very good and the layout and precision of the grid co-ordinates were excellent. The topography of the survey area, coupled with dense bush, would have made surveying extremely difficult. However, the survey lines were well cleared, allowing completion of the data acquisition within the allotted time.

SURVEY TECHNICAL SUMMARY

Instrumentation

The Geophysical Technology model TM-4 caesium vapour magnetometer system was used to record the survey data. The TM-4 system has been designed to record the total magnetic field intensity to a resolution of 0.1 nT (approximately 2 parts per million of the Earth's field). The hand carried system has an in-built positioning device which is accurate to approximately 0.1% (about 1 metre on a 1 kilometre survey line). Measurements of the magnetic field (and its position) can be made at up to 400 times per second. This permits extremely detailed data sets to be collected rapidly. The TM-4 magnetometer has a unique, in-built filter for rejecting 50 Hz electromagnetic interference. This filter was used for the duration of this project as the south east corner of the survey area was intersected by 33000 volt electricity supply lines.

A Geometrics G-856 proton precession magnetometer was set up as a base station. The base station sampled the magnetic field every 10 seconds.

Survey Procedure

It has been shown that the magnetic field surface in a plane one metre above the ground can be completely defined at 0.5 metre sample intervals in both directions (Stanley, 1988). However, adequate sampling in both directions is impractical in the majority of mineral surveys, so an acceptable compromise is sought. The compromise strategy employed consisted of adequately sampling along lines so that high frequency components of the waveform could be removed by filtering.

Measurements were automatically triggered using the TM-4's cotton-thread, electronic odometer. As close as practically possible, the magnetic sensor was held at constant elevation of 0.75 metre above the ground and sampling was set at a nominal sample interval of 0.50 metres. Whilst this sampling interval adequately recorded the total magnetic field along east-west profiles, it was inadequate for sampling the short wavelength component of the magnetic profile perpendicular to the survey lines.

Appendix A contains a general summary of the TM-4 magnetometer system and Appendix B is a technical summary of the survey specifications.

DATA PROCESSING

The magnetic intensity data were corrected for diurnal variation using data recorded by the base station.

The objectives of the survey and the constraints imposed on spatial resolution required consideration of the following issues when determining the processing strategy:

1. Vegetation and topography constraints determined that the data acquisition line separation would be 50m.
2. Intense, short wavelength magnetic interference due to the presence of surface metallic refuse from previous mining activity was uncommon, however, distinctly high frequency geological signal was detected.
3. The target of interest (a magnetic anomaly detected in a previous aeromagnetic survey) was anticipated to present a strong, long wavelength magnetic signature.

The problems specific to these issues were:

1. A 50 metre survey line spacing will only adequately sample wavelengths greater than 100 metres in the direction perpendicular to the survey lines.
2. Inadequately sampled, short wavelength features such as the interference from surface metallic refuse or near surface geological influences, such as scree or alluvial sediment, can significantly affect interpretation.
3. Colour imaging or contouring of aliased data will be unsatisfactory.
4. Imaging and contouring strategies that compensate for improperly sampled data may be effective at the expense of filtering out short wavelength information, some of which may contain the information essential to a successful exploration program.

The processing of the Salisbury Hill data has addressed the issues above in order to minimise the compromises necessary. The data has been properly sampled along the survey lines and this has permitted theoretically sound processing to enable identification of magnetic features of interest.

The field measurements were first recovered to a file as position corrected and base-station levelled data. Figure 1 contains a plot of profiles of this "raw" magnetic data. The scale chosen was such that features of geological interest were clearly presented, while the intense interference from cultural sources was often clipped. Of particular note, in Figure 1, is the large, low frequency anomaly in the centre of the grid, and the change in frequency content of the profiles between the eastern and the western halves of the grid. In the eastern half of the grid, the profiles display a considerable, high frequency, "noisy" component whereas in the western half of the grid, and in the north-eastern corner, this high frequency component is missing.

Unlike traditional magnetic surveys, the TM-4 magnetometer survey records samples sufficiently often along lines so that all of the high frequency information can be recorded. As the data was collected at 50 metre line spacing, the minimum wavelength that is sampled completely in two dimensions is 100 metres. Applying a low pass filter of wavelength 100 metres along lines would provide the optimally sampled image for 50 metre line spacing, however, with all the low wavelength information below 100 metres removed, little meaningful information remains.

By applying a low pass filter along the profiles with a shorter cut-off wavelength, more information remains in the profiles, the trade off being the fact that aliasing occurs perpendicular to the profiles. An acceptable ratio for minimum wavelengths sampled along profile to perpendicular to profile is 1:4. Figure 2 contains a plot of magnetic intensity contours derived from the raw data displayed in Figure 1 by applying an along profile, frequency domain low pass filter with a cut-off wavelength of 25 metres. Figure 2 fully defines the target (a magnetic anomaly detected in a previous aeromagnetic survey, in the centre of the present survey), however, as

described above, the high frequency information seen in the profiles of Figure 1 has been removed.

The application of a low pass filter with a cut-off wavelength of 25 metres along the profiles removed the short wavelength components along lines, with the result that some aliasing occurred in the north-south direction. The aliasing effect is noticeable on the western side of Figures 2 and 3 as the “knotted” texture of the continuous, north-south trending fence lines. Figure 3 displays the gridded magnetic intensity information from Figure 2 in a colour image, including the surface features noted whilst surveying.

CONCLUSION

The data acquisition and processing strategies used enabled adequate sampling of high frequencies along profile lines. The high frequency information from the profiles (Figure 1) enabled identification of discrete magnetic signatures.

Filtering of the profiles reduced the effect of aliasing and enabled the production of high quality contour maps and images (Figure 2 and Figure 3). The strategy employed was found to be optimal for the survey objective. The target magnetic intensity anomaly at Salisbury Hill, previously detected in an aeromagnetic survey, was completely defined.

BIBLIOGRAPHY

Stanley, J.M. (1988), The Use of Magnetics in Engineering Site Investigation. ASEG Conference, Feb. 1988.

APPENDIX A

THE TM-4 MAGNETOMETER SYSTEM.

A model TM-4, optically pumped magnetometer was used for this survey. This instrument may be either hand-carried, vehicle-mounted on a 4WD quadcycle ATV or operated from a marine vessel or aircraft.

When hand-carried, the magnetometer system involves two operators. One operator is required to hold the sensor while the other controls the data acquisition system. The sensor is connected to the control electronics by a 5 metre coaxial cable. Separating the sensor from the control electronics by this distance insures that the sensor is free from magnetic and electromagnetic interference originating from the electronics. The TM-4 has an in-built, cotton thread type odometer which electronically triggers the magnetometer to take readings at preset nominal sample intervals. When the start and end coordinates or intermediate control points of a traverse line are known, the actual sample interval is calculated during data recovery. By this method, it is normally possible to obtain positional accuracy along survey lines which is better than 0.2% of the distance between control points.

In vehicle-mounted operation measurements are initiated by an attachment to the vehicle's odometer. Odometer corrections may be performed as above if the survey has been conducted along straight grid-lines. Optional, differential GPS can be used to relieve the necessity to survey along a regular grid pattern. Differential GPS allows an absolute positional accuracy of approximately 2 metres to be achieved. A relative accuracy of just a few millimetres in the sample interval is obtained from the odometer. Real time heading, pitch and roll compensation and navigation is performed through the use of a triaxial fluxgate magnetic sensor, rigidly mounted to the vehicle platform. The multi-tasking operating system of the TM-4 allows compensation and navigation computations to be performed during data acquisition.

Operation of the TM-4 from a boat or aircraft involves the recording of measurements at preset time intervals. Positional information may be obtained from differential GPS or existing navigational equipment. When the sensor is operated from a towed bird or fish, advantage can be taken of the extreme portability of the TM-4 compared with conventional marine and airborne instrumentation.

The TM-4 is capable of sampling up to 100 measurements per second with an accuracy of 0.005 nT, or of up to 400 measurements per second to 0.05 nT. A 480 x 128 pixel graphics display provides a comprehensive monitor of the data acquisition process. Both digital and graphic displays of survey parameters and data profiles are available. An audio tone at selectable sensitivity ranges provides an alternative monitor enabling the operators to hear magnetic anomalies and relate these to observed geology or cultural objects that might be a source of magnetic interference. The data logging system is interactive and permits the operator to record notes during the survey. Cultural features such as fences or scrap metal may be permanently recorded in the data file in order to assist interpretation.

The very fast data measurement rate enables electromagnetic interference from power lines to be filtered in real time. The filtered data is then resampled at regular distance increments along each traverse and this data is recorded.

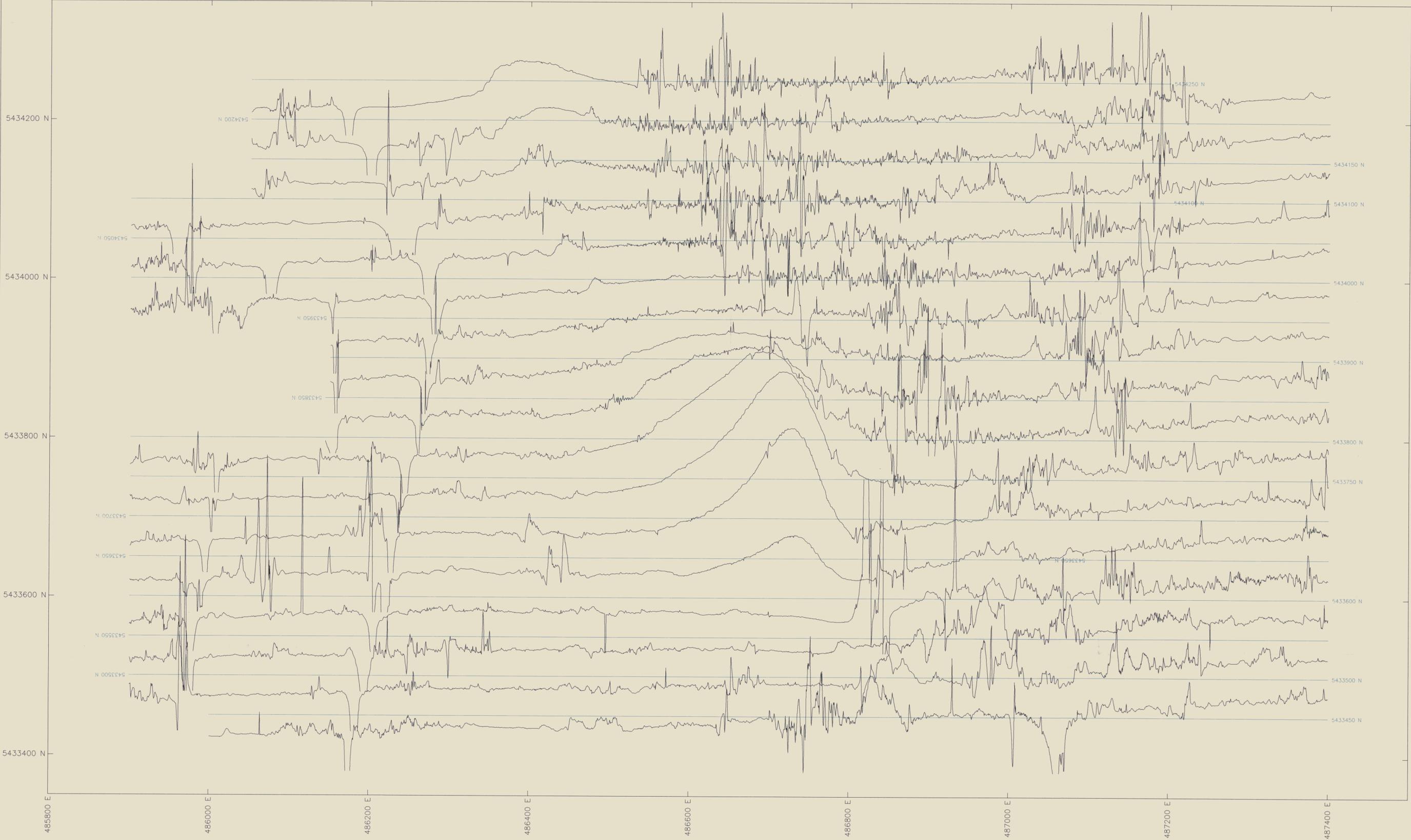
APPENDIX B

Survey Technical Summary.

Project No. 97128.

Location: Salisbury Hill, Beaconsfield, Tas.

OBJECTIVE:	Geological mapping for mineral exploration	
CLIENT:	Beaconsfield Mines Joint Venture.	
CONTACT:	Richard Keele	
SURVEY DATES:	19-21 May 1997.	
SURVEY DURATION:	3 day	
DOWN TIME:	Nil	
SURVEY TYPE:	TM-4 Cs Vapour High Definition Total Field Ground Magnetics.	
OPERATORS:	BP	
SUPERVISOR:	MKC	
ACCOMMODATION:	Provided on site.	
SURVEY SPECS:	Survey Mode:	ASCII Grid, Distance
	Line Bearing:	256 Degrees / 76 Degrees.
	Line Spacing:	50 metres.
	Sample Interval:	0.50 metres
	Total Line Km:	24.25 km.
GRID SPECIFICATIONS:	Grid Type:	Local
	50 Hz Filter:	On (Double).
SURVEY POSITIONING:	East - West control lines (AMG Grid) were established.	



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Base Level: 61700 nT
 Vertical Scale: 25 nT/cm
 Positive Clip: 61850 nT
 Negative Clip: 61630 nT

Filtering Strategy

All data corrected for diurnal variation
 and recorded with double 50 Hz electromagnetic
 noise reduction filter activated

The data has not been filtered in post
 processing.

5 cm

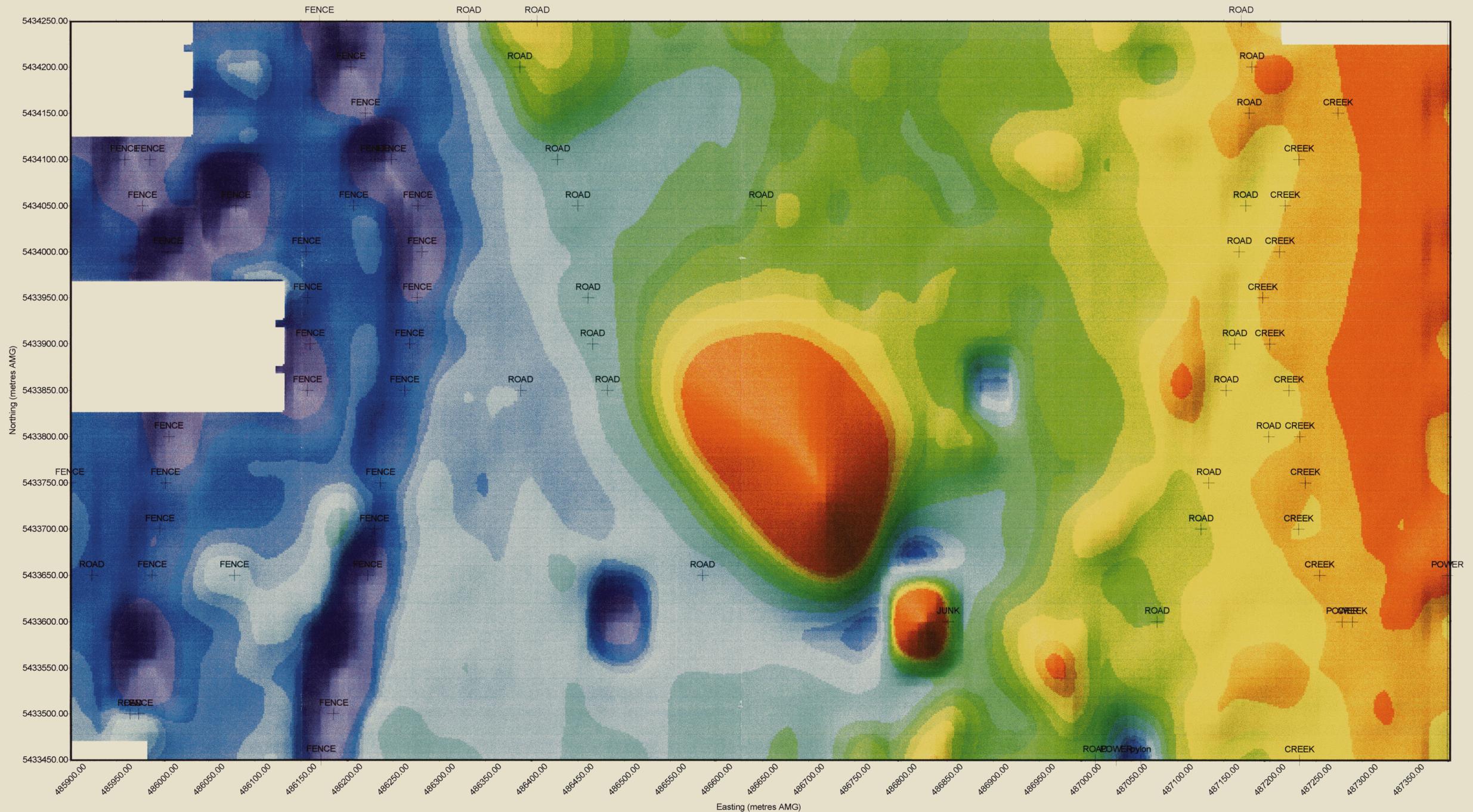


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FIGURE 1
Salisbury Hill, Beaconsfield, Tas
Client: Beaconsfield Mine Joint Venture
Total Magnetic Intensity - Stacked Profiles
May 1997 Plotted by B Payne



Northing (metres AMG)

Easting (metres AMG)

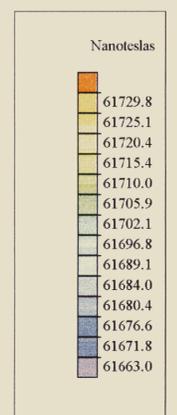


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Scale 1:2500

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**Figure 3: Colour Image of Total Magnetic Intensity
Salisbury Hill Grid, Beaconsfield, Tasmania**

Filtering Strategy: 50 Hz Electromagnetic Noise Removal (during survey)
Low Pass Filtered (wavelength 25 metres)
Upward Continued 1 metre
Surface Features Included

Sun Angle Illumination: Inclination 30°, Declination 325°



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High Definition Magnetics
May 1997
Plotted by B Payne.

Surveyed for Beaconsfield
Mines Joint Venture.