

# St Barbara Limited

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Operator (if different from above)	As above
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Contact Details	Alex Mukherji (Ms)
Fax	08-9476-5500
Phone	08-9476-5577
Email for Further Technical Details	alex.mukherji@stbarbara.com.au
Email for Expenditure	kylie.price@stbarbara.com.au
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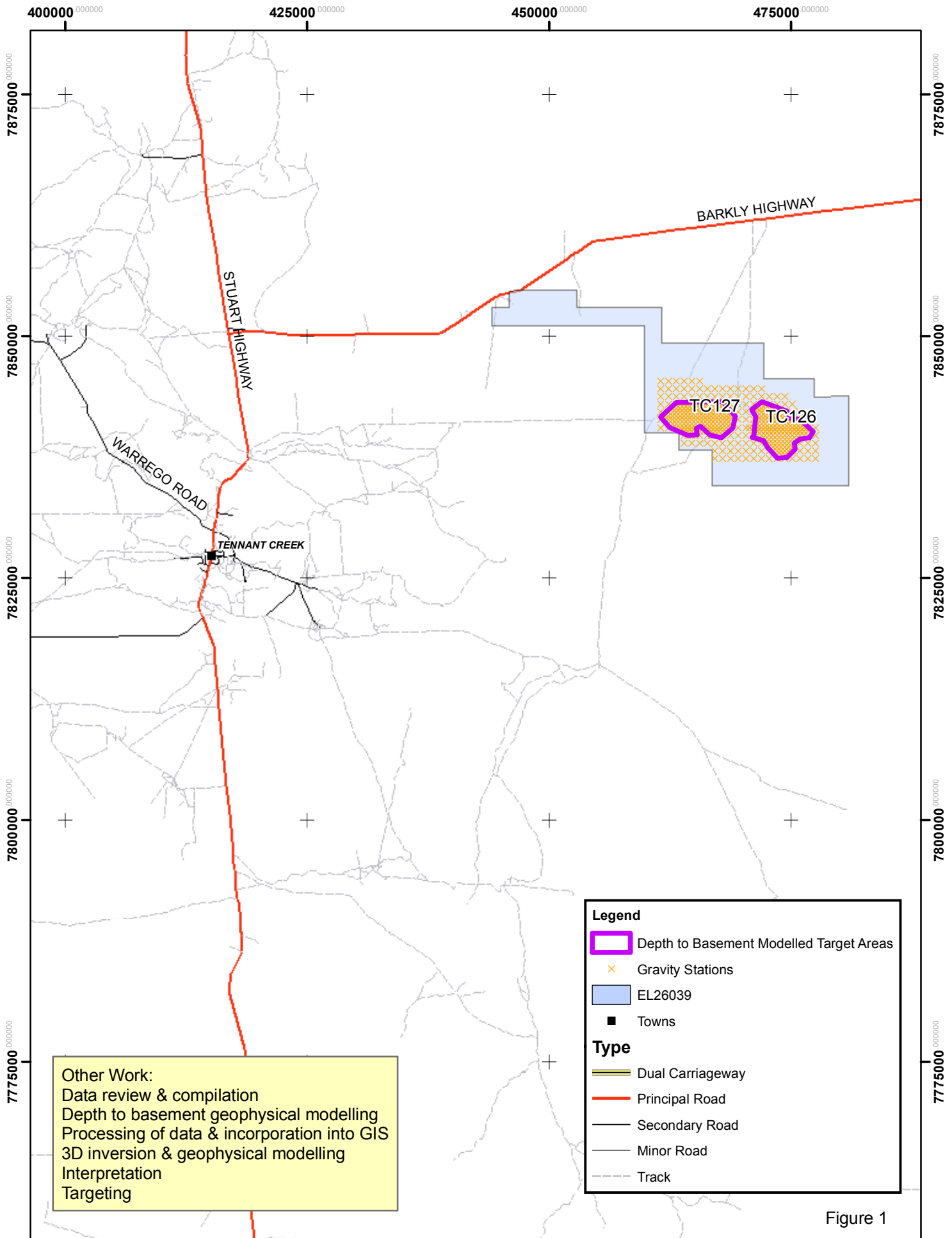
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**EXECUTIVE SUMMARY**

This report summarises gold exploration activities undertaken by St Barbara Limited (SBM) on the Tennant Creek Project EL26039 since grant on the 15<sup>th</sup> April 2008 until its surrender on the 8<sup>th</sup> February 2010. EL26039 has an approximate area of 287km<sup>2</sup> and is centred 55km east-northeast of Tennant Creek in the Northern Territory. The tenement contains an iron oxide copper-gold (IOCG) target defined by external consultants to SBM. The target occurs within concealed eastward extensions of the prospective Tennant Creek Inlier. The inlier hosts several high grade Au-rich deposits (including Juno, Geko, Warrego, Nobles Nob, Peko and White Devil), which have produced over five million ounces of gold and over 440,000 tonnes of copper in the last 60 years, ranking it within the top ten Australian goldfields.

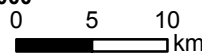
Exploration comprised open file data review and compilation, depth to basement geophysical modelling, a 373 station gravity survey, data processing and incorporation into GIS, 3D inversion and geophysical modelling and interpretation.

Depth to basement modelling revealed 2 target areas (TC126 and 127) however they appear to overlie magnetic basement of considerable depth, greater than the 250m limit typically used as a cut-off in other SBM "Big Gold" projects. Further work is warranted for EL26039 which will likely comprise re-processing of gravity and magnetic data and 2D modelling. However, due to changed corporate priorities during 2009 and its consequent effect on SBM's exploration strategy in Australia, a decision was made to relinquish EL26039 early in 2010.



Date : April 2009  
 Drawn by : AXM  
 Ref : 0545-2009-03

**Tennant Creek EL26039  
 Exploration Index Plan**



1:500,000

Projection : Map Grid of Australia Zone 53  
 Datum : Geocentric Datum of Australia 1994 (GDA94)



St Barbara Limited

## 1 INTRODUCTION

This report summarises gold exploration activities undertaken by St Barbara Limited (SBM) on the Tennant Creek Project EL26039 since grant on the 15<sup>th</sup> April 2008 until its surrender on the 8<sup>th</sup> February 2010. EL26039 has an approximate area of 287km<sup>2</sup> and is centred 55km east-northeast of Tennant Creek in the Northern Territory.

The Project area is accessed by sealed road via the Barkly Highway from Tennant Creek then by pastoral tracks onto the tenement itself.

## 2 TENURE

EL26039 is held and managed by SBM and tenement details are shown below:

**Table 1 Tennant Creek Project – Tenement Details**

Lease	Current Area	Lease Status	Grant Date	Surrender Date	Project
EL26039	89 Blocks	Granted	15/04/08	08/02/10	Tenant Creek

## 3 WORK COMPLETED AND RESULTS

### 3.1 DEPTH TO BASEMENT GEOPHYSICAL MODELLING

Following extensive open file data evaluation as part of SBM's Australia-wide "Big Gold" project by external consultants to SBM, several Iron Oxide Copper Gold (IOCG) targets were defined near Tennant Creek including ground underlying EL26039. The targets occur within concealed eastward extensions of the prospective Tennant Creek Inlier. The inlier hosts several high grade Au-rich deposits (including Juno, Geko, Warrego, Nobles Nob, Peko and White Devil), which have produced over five million ounces of gold and over 440,000 tonnes of copper in the last 60 years, ranking it within the top ten Australian goldfields.

Studies indicate that all targets within SBM's current tenure lie under Cainozoic cover at significant and variable depths. The range of depths is uncertain as there is a paucity of drillhole data over the areas of interest. As

such, depth to basement modelling of currently available potential field data was deemed prudent in order to determine which targets occur at explorable depths (ie: <200m). Appendix 1 contains the results of the depth to basement geophysical modelling over EL26039.

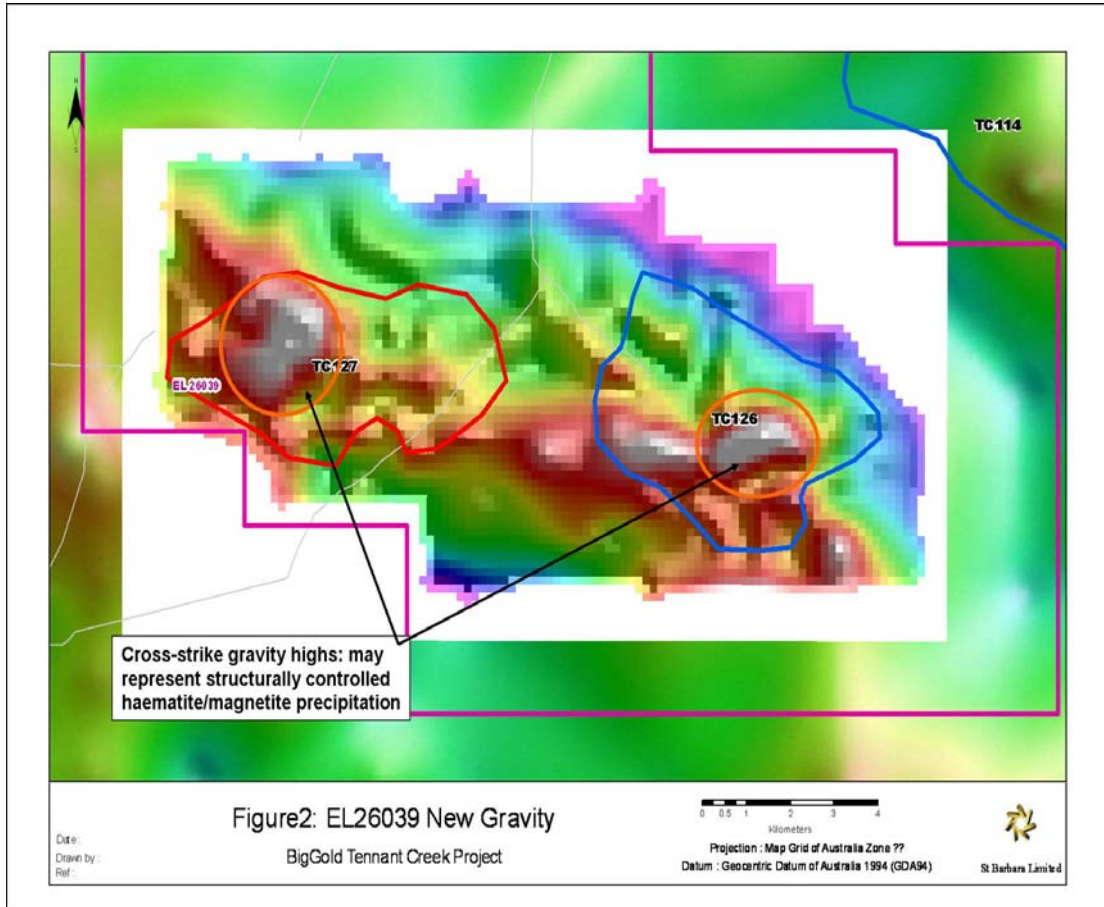
This modelling revealed 2 target areas (TC126 and 127) however they appear to overlie magnetic basement of considerable depth, greater than the 250m limit typically used as a cut-off in other SBM “Big Gold” projects. Further work is warranted for EL26039 which will likely comprise re-processing of gravity and magnetic data and 2D modelling.

### **3.2 GRAVITY SURVEY**

After completing depth to basement modelling to identify whether these targets are at an explorable depth, the logical first phase in geophysical exploration of the area was to acquire higher-resolution data over the tenement. Gravity data coverage is particularly poor in some areas at present and was viewed as the first priority.

Gravity is an integral tool when exploring for mineralisation in the Tennant Creek district, in particular when searching for low-temperature “high-level” haematite-predominant IOCG systems that do not manifest so clearly in magnetic datasets as magnetite systems. As current gravity station coverage over EL26039 is approximately 2-4km, a program of 800m with infill 400m station spacings (for a total of 373 stations) was completed by Daishat Geodetic Surveys during August 2008. Survey data is appended under the folder “*EL26039 gravity data*”.

Preliminary results from the gravity survey are encouraging, with gravity highs seen to cross cut the stratigraphic strike and may represent Fe metasomatised and/or mineralised structures. Also highlighted are areas where “thickening” of gravity highs along strike, which may also represent Fe metasomatism and/or mineralisation.



Further work is warranted for EL26039 which will likely comprise re-processing of gravity and magnetic data and 2D modelling. However, due to changed corporate priorities during 2009 and its consequent effect on SBM's exploration strategy in Australia, a decision was made to relinquish EL26039 early in 2010.

**APPENDIX 1**  
**REPORT OF DEPTH TO BASEMENT**  
**MODELLING OVER EL26039**





# BigGold Tennant Creek Project – Naudy Depth to Basement Modelling

## Executive Summary

Naudy depth to basement modelling has been conducted on SBM applications and granted tenure overlying interpreted concealed extensions of IOCG prospective Proterozoic rocks east of Tennant Creek. Modelling indicates that several of the targets contained within SBM tenure (namely TC126 and 127) appear to overlie magnetic basement of considerable depth, greater than the 250m limit typically used as a cut-off in other SBM BigGold projects.

Table 1 shows the depth range within each of the target areas over EL26039 (within the 80<sup>th</sup> percentile), as well as a degree of confidence with which those depths should be accepted. The level of confidence is affected by both the amount of solutions that occur within a given target area and the distribution of depths within that area.

Economic analysis suggests that it would be feasible to explore for high grade Tennant Creek style deposits under cover depths of up to 400m, however while grades required are often present in deposits within the Tennant Creek field the tonnages required rarely are. It is noted however that the SBL targets are prospective for larger ore systems than the larger Tennant Creek deposits such as Warrego and White Devil, and are also prospective for larger breccia style systems analogous to Chilean Mesozoic deposits such as Manto Verde and Mantos Blancos. As such depths indicated by this modelling should not preclude further exploration work being performed by SBL on these targets.



Target	Number of Solutions	Dominant Depth Range (m)	Median Depth (m)	Confidence Level
TC127	43	100-450	330	<i>Medium/Low – wide range of depths</i>
TC126	40	170-615	385	<i>Low – very wide range of depths</i>

Table 1: Summary of Naudy depths and confidence levels

## Background - Naudy Automated Depth to Basement Modelling

The Naudy Automatic Model routine has been developed by Intrepid Geophysics to provide rapid, automated determination of depths to magnetic bodies. The routine is based upon Naudy's (1971) automatic depth-determination routine for application to magnetic profile data, with subsequent enhancements by Shi and Boyd (1991, 1994).

The routine scans a magnetic profile dataset for dyke-like geological bodies. The routine examines the Total Magnetic Intensity (TMI) profiles along traverse lines of a dataset. It proposes geological bodies at a range of depths and calculates the TMI profile that would result from them. It then selects the set of proposed bodies that would produce a TMI profile that most closely matching the observed TMI profile in the input dataset. This set of inferred geological bodies is the Naudy model. The routine also calculates the strike of each inferred body using an inbuilt automatic depth-dependent trend estimation process, and the depth, width, dip, susceptibility and similarity coefficient (closeness of match between observed and calculated data) are also outputs of the routine.

The routine is widely applicable as most aeromagnetic datasets will contain features that are more likely to be caused by dyke-like bodies than other body geometries. However, certain caveats must be considered when dealing with the results. The application of the method depends on the nature of the bedrock and will give useful results only where the bedrock is magnetic. The most accurate estimate of bedrock



depth will be from anomalies with significant strike length and with a strike at a high angle to the flight direction. Also if the strike of the inferred geological body is markedly different to the strike of the local geology, the error in the indicated depth is generally 20% or greater. Interpretation of Naudy solutions must also take into account anomalies caused by the presence of magnetic material in cover/overburden (e.g. maghaemite in palaeochannel sediments), as the Naudy routine will provide depth solutions for these features.

## Results

Modelling was performed on aeromagnetic data over concealed extensions of the Flynn Group about the Tennant Creek Inlier. Three areas were modelled, each encompassing IOCG target areas defined by Doug Haynes that fall within SBL tenements (EL26036-EL26039), as well as IOCG target areas that occur close to but not within current tenure. As the Naudy routine provides a huge volume of results for a given area, the results were interpolated using an inverse distance squared algorithm, employing minimum curvature. Figures 1 and 2 show modelled depths to basement over EL26039. Two images have been prepared: the first has the colour map stretched to show all depths to basement greater than 250m as blue, while the second has been stretched to show all depths to basement greater than 400m as blue.

Black areas that occur within the bounds of the data coverage represent areas where the Naudy routine could not find a solution; on a regional scale this usually occurs within magnetically “quiet” areas with no anomalous behaviour, generally representing areas of thick, non-magnetic sediments, but also occurs anywhere in the absence of a relatively high-frequency magnetic anomaly. There is a notable high frequency variation in the images. This is a product of the significant number solutions that are produced by the Naudy routine, over areas where (a) the observed magnetic feature does not possess the ideal characteristics for Naudy modelling (i.e. not striking at a high angle to the orientation of the observed magnetic data profile and/or does not have a significant strike length), (b) the Naudy solutions may have calculated strikes which do not match the strike of the observed magnetic feature and



(c) the observed magnetic feature cannot be approximated by a dyke-like body. As a result such solutions are somewhat unreliable and contribute to the variability seen in the image. Removal of these solutions (~25% of the dataset) would need to be done on an individual basis; an extremely time consuming task which has not been attempted here. A reasonable estimation of the depth distribution within the data can be ascertained by careful analysis of the Naudy results and their relationship to the underlying magnetic feature, as well as looking at the regional distribution of depth to basement solutions.

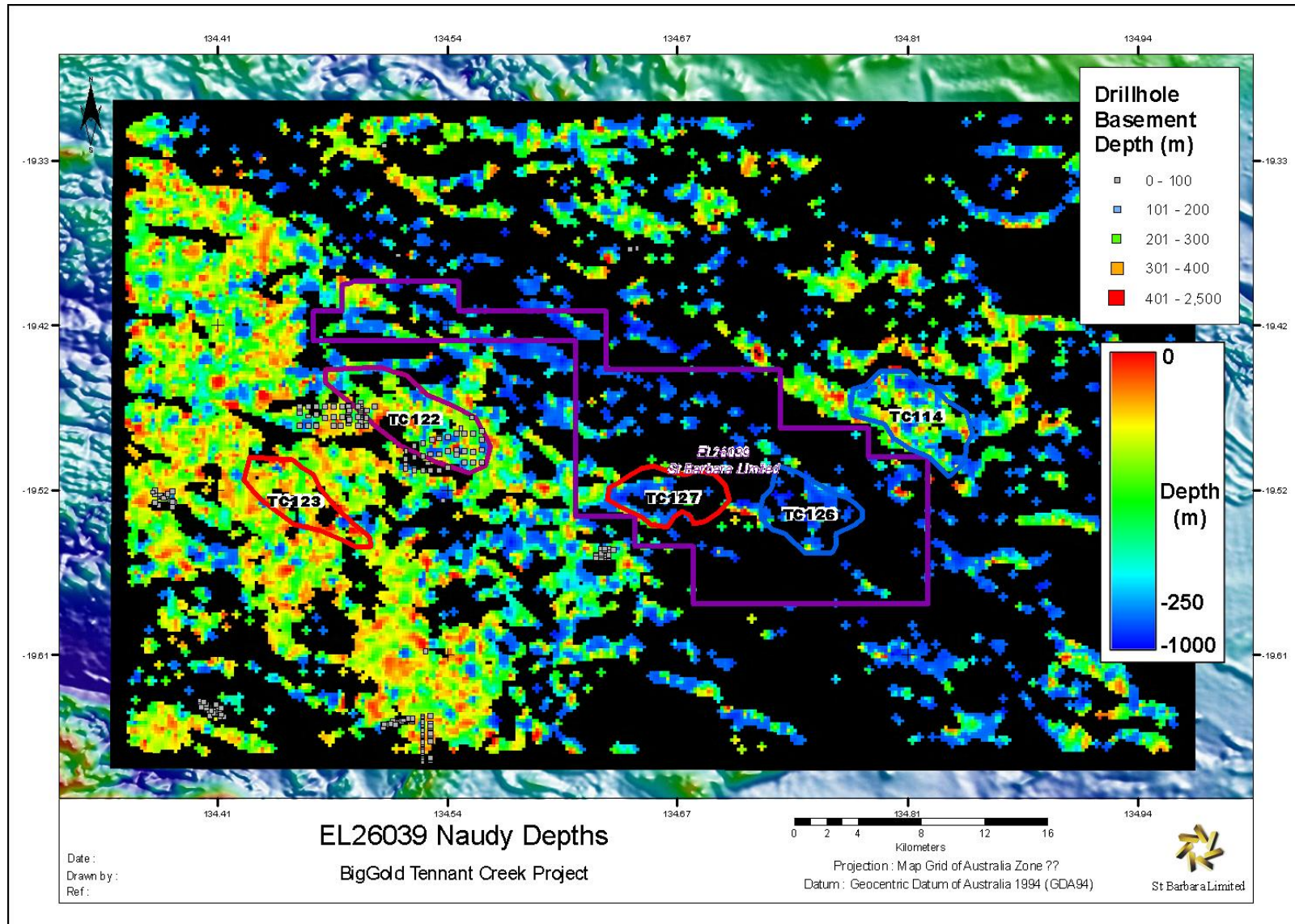


Figure 1: Interpolated Naudy depths to basement over EL26039. Blue colours indicate depths greater than 250m.



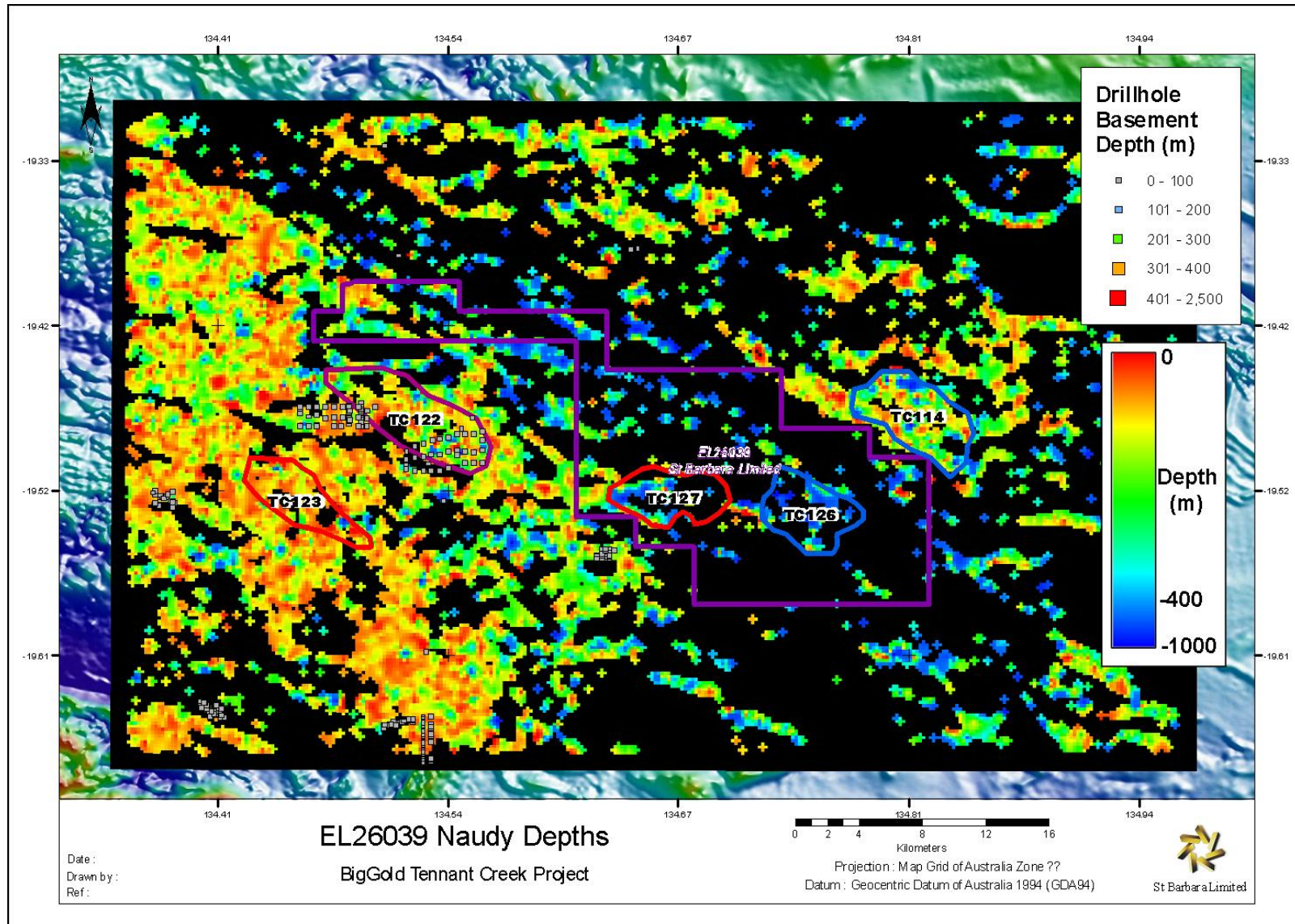
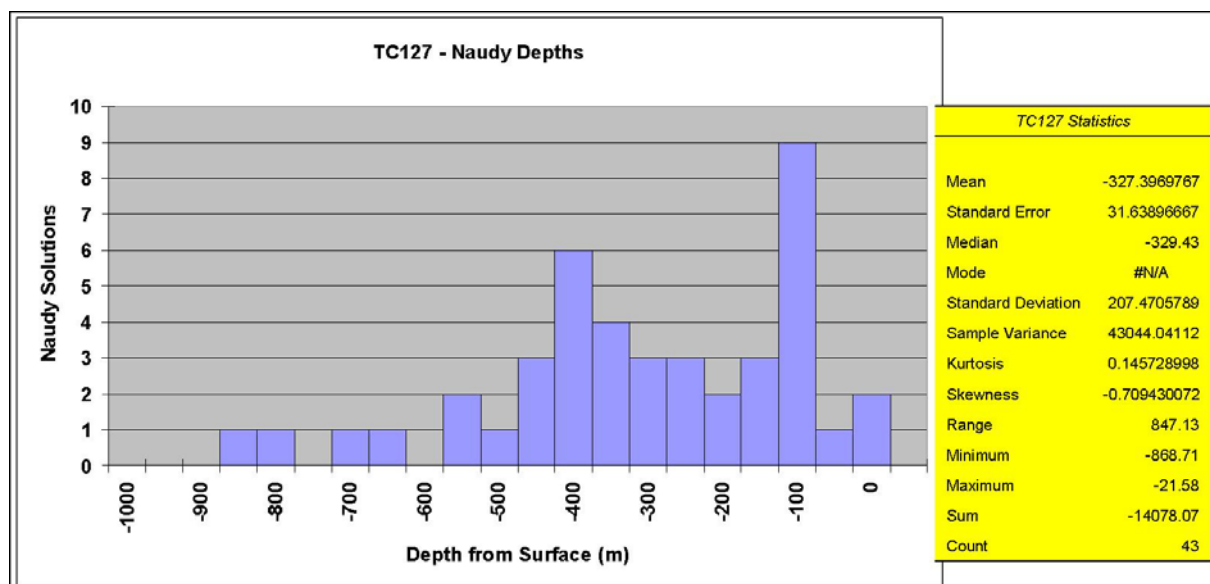


Figure 2: Interpolated Naudy depths to basement over EL26039. Blue colours indicate depths greater than 400m.

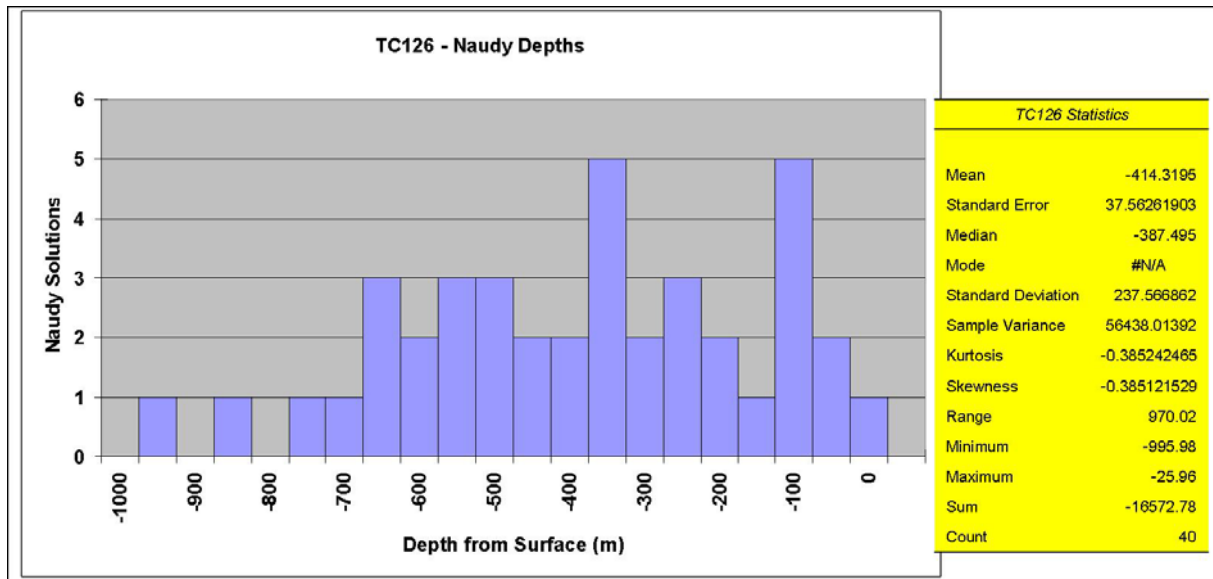


## EL26039

EL26039 appears to overlie a relatively narrow (~10km wide), south-easterly trending palaeovalley (Figures 1 and 2). To the south west of the tenement, basement is shallow, as evidence by numerous exploration drillholes in which basement depths range from outcrop (Warramunga Formation) to 30-40m. Drillholes just to the south west of TC127 have basement depths of 30-40m. Based upon the Naudy modelling, depths appear to increase rapidly in the palaeovalley, getting up to and over 400m over much of the tenement area. In TC127 Naudy solutions show a median depth of ~330m (Figure 3), while in TC126 Naudy solutions show a median depth of ~390m (Figure 4). It is important to note that the target areas do suffer from a lack of data points, making interpretation of the depths problematic. No drillholes occur within the target areas to support the Naudy depths. Basement appears to shallow to the north-east of the tenement (e.g. over TC114 – off our tenure).



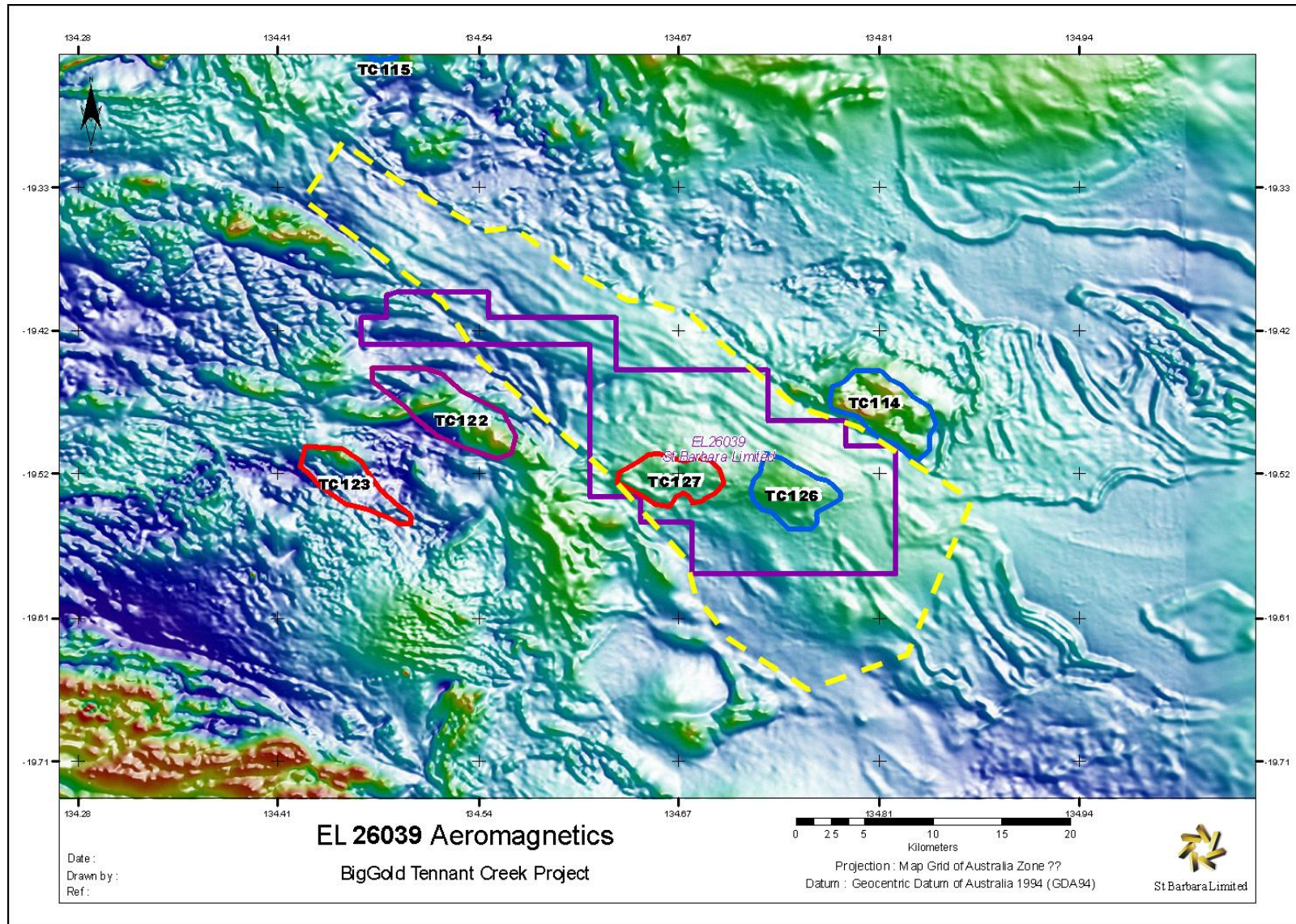
**Figure 3:** Distribution and statistics of Naudy depths within target TC127.



*Figure 4: Distribution and statistics of Naudy depths within target TC126.*

The palaeovalley evident in the Naudy depth image correlates well with a narrow south-easterly trending zone of low frequency, moderate amplitude magnetic signal (see Figure 5). Signal of this character is generally indicative of magnetic features at significant depths that are overlain by weakly to non-magnetic material. In this case it most probably represents a thick sequence of Cambrian Georgina Basin sediments (possibly including thin basalt flows) overlying prospective Lower Proterozoic lithologies.





*Figure 5: Aeromagnetic data over EL26039, with area of relatively low frequency moderate amplitude magnetic signal highlighted.*



## Discussion/Conclusions

Several of the targets contained within SBM tenure (namely TC126 and 127) appear to overlie magnetic basement of considerable depth, greater than the 250m limit applied to other SBM BigGold project areas. Other targets appear to overlie basement shallower than 250m and should be considered well within the range of drilling, allowing for the possible presence of thin 20-30m thick Cambrian basalt flows.

In the case of Tennant Creek, interpretation of Naudy depth data has several caveats. The magnetic signature of the region is extremely complex (see Figure 5). The effects of remnant magnetisation and alteration are well known in the area (e.g. Clark et al. 2004) and unlike other parts of Australia it is difficult to define lithological units by their magnetic signature. There are several lithologies other than Proterozoic Warramunga Group that have a significant magnetic signature (e.g. Cambrian Antrim Plateau Basalt); therefore Naudy solutions may be picking up depths to these lithologies rather than prospective ones. Another factor is that the ironstone bodies that host Tennant Creek deposits vary in magnetic intensity. Haematite end member or “high level” targets are predominant (Haynes 2007) and have a lower magnetic intensity; therefore they may not be delineated by the Naudy routine.

These caveats point to the fact that the Naudy routine may not be resolving the depth to prospective Warramunga Formation and that several other causative lithologies are present. This is especially applicable to targets over EL26038 (as part of a separate annual report for this tenement) that sit on the margins of interpreted Antrim Plateau basalt, a rock type which is probably responsible for the high-frequency magnetic signature seen in the area and the resultant relatively shallow depth solutions. Antrim Plateau basalt can range up to 200m in thickness; therefore depths to prospective Warramunga Formation in these areas could be up to 200m greater than indicated by the Naudy results.

In order to determine a viable depth of exploration for Tennant Creek, an investigation was made into the economic viability of exploring for and mining various



styles of discreet, high grade Tennant Creek deposits. The study concluded that such deposits are viable to explore for at depths of up to 400m. For example a tonnage and grade required to make exploration viable at a depth of 400m would be approximately 5Mt @ 12-15g/t Au, including Cu credits. While several deposits in the Tennant Creek field contain the required grade (e.g. Nobles Nob, Juno, White Devil), only one contains the required tonnage (Warrego).

## References

Clark, D A, Guena, S and Schmidt, P W, 2004: Predictive magnetic exploration models for porphyry, epithermal and iron oxide copper gold deposits: implications for exploration – short course manual for AMIRA P700. *CSIRO Exploration and Mining Report 1073R*.

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