HAWKE GEOPHYSICS PTY LTD

Report: 10TTY-1

INTERPRETATION OF PAST AND RECENT GEOPHYSICAL SURVEYS IN THE FRANCES CREEK REGION, N.T.

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1. SUMMARY

This report discusses the interpretation and target generation for hematite mineralisation from currently available geophysical and geological data over the Frances Creek Project area located near the town of Pine Creek in the Northern Territory. The main objectives of this study were to map stratigraphy to identify prospective target horizons as well as identify direct targets for iron mineralisation.

Geophysical survey coverage within the project area includes:

- Regional government magnetic surveying at a 400m line spacing.
- Detailed magnetic and radiometric survey covering the prospective Wildman Formation at a 50m line spacing and 25m flying height.
- Limited airborne EM coverage covering the historic mining area only.
- Several phases of gravity surveying, with station spacings varying from 50x250m down to 10x20m for individual surveys.

A basement geology interpretation of the area was based largely on outcrop geology in conjunction with radiometric data. Magnetic and gravity data contributed to the geological interpretation to a lesser extent.

A total of 45 targets for iron mineralisation were identified using the following criteria:

- Presence of (untested) outcropping iron mineralisation
- Strike extension of known mineralisation
- Gravity high (due to mineralisation) adjacent to gravity low (due to carbonaceous shale).
- Subtle magnetic trend (secondary criteria).

These targets were further prioritised depending on proximity to known mineralisation and secondary criteria used to define the target.

A total of 16 of these have been identified as high priority. High priority targets are generally defined where there is untested outcrop of iron mineralisation mapped by the NTGS or along strike from areas of known mineralisation.

Follow-up ground truthing of these targets, including mapping and sampling in areas of outcrop, is recommended. This should lead to drill testing of any possible mineralisation where warranted.

Assuming the testing of targets generated using gravity data in greenfields area is successful, extension of the gravity grid to cover additional prospective stratigraphy in EL24040 is recommended.

2. INTRODUCTION

The Frances Creek Project, managed by Territory Resources Limited ("Territory"), is located within the Central Province of the Pine Creek Orogen geologic domain, approximately 25km to the north of the town of Pine Creek and 150km south of Darwin. The area has a long history of small scale mining of the hydrothermal iron deposits, with historic mining activity commencing in the 1960's.

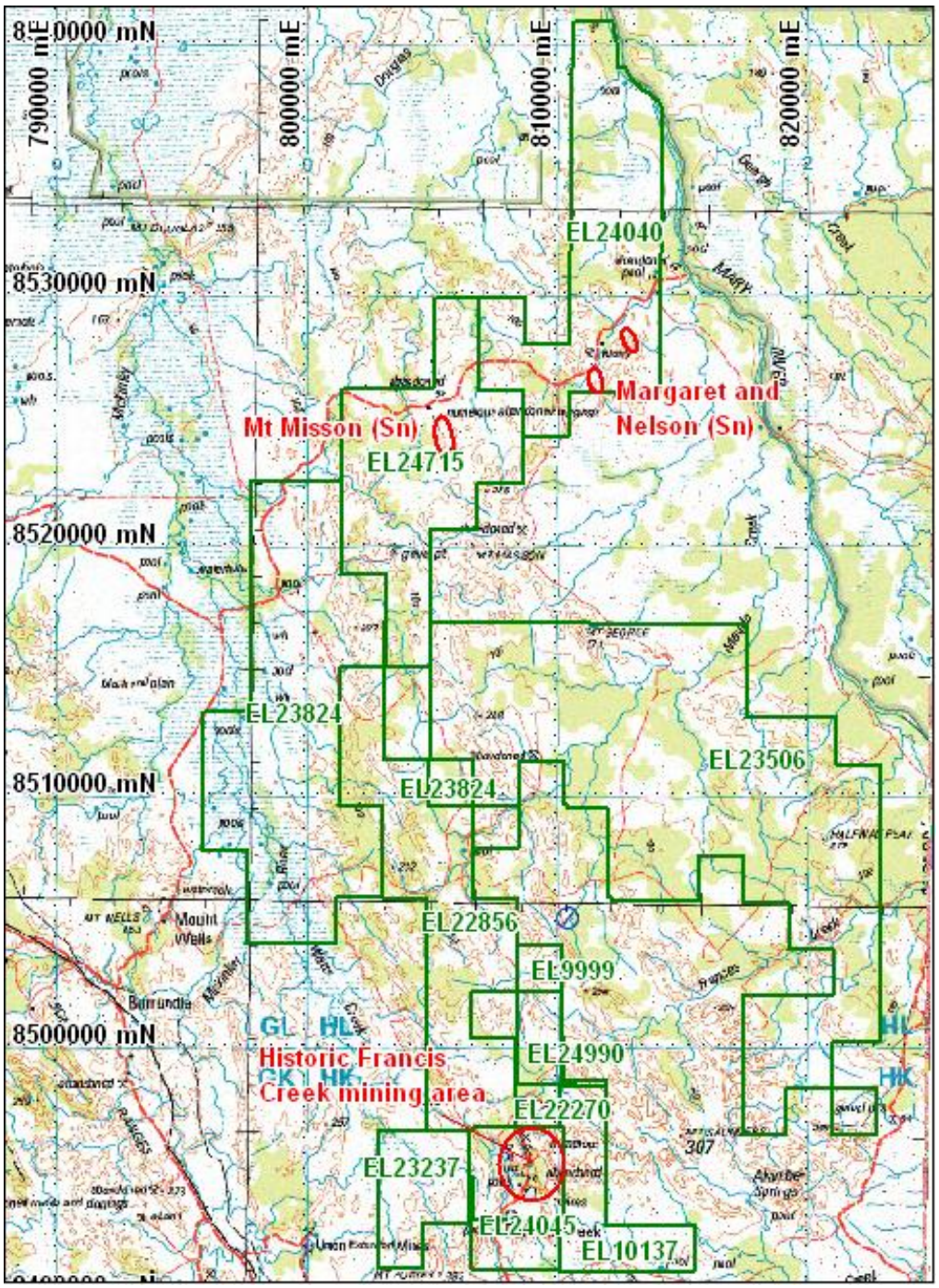

Figure 1: Tenement location map for the Frances Creek Project

Tenement coverage within the Frances Creek Project area is included in Figure 1. These tenements cover the historic iron (Frances Creek) and tin (Mt Masson, Margaret, Nelson) mining areas as well as most of prospective stratigraphy for further iron mineralisation to the north of the mining area.

The Frances Creek Project mostly overlies Meso-Proterozoic sedimentary rocks of the Mt Partridge Group including sandstones and conglomerate of the Mundogie Formation and siltstone / shale (± dolomite and breccia) of the Wildman Formation, the latter of which is the primary host of the iron mineralisation. To the east and south are granite intrusives of the Cullen Batholith, including the Allamber Springs Granite which has entirely displaced the sedimentary sequence to the south of the Frances Creek Mining Area.

Mineralisation occurs as seams of massive hematite to specularite ± minor goethite / limonite which appear to be largely conformable with bedding. Widths of mineralisation vary from a few metres up to a maximum several tens of metres.

Current genesis models suggests mineralisation was largely formed by hydrothermal processes within breccias created by dissolution of favourable (possibly carbonate?) lithologies within the Wildman Formation. Iron is believed to have been sourced from either primary sulphides (pyrite) within the host lithology or driven off by fluids from the granites of the Cullen Batholith which is the most likely driver of the hydrothermal systems.

Objectives of this study are to:

- compile and image available open file geophysical survey data
- provide a basement geology interpretation mapping potentially prospective stratigraphy and structures.
- generate targets for further exploration

3. PAST STUDIES

Reports discussing the results of three past targeting studies completed for Territory Resources in the Frances Creek area were reviewed;

A structural mapping and interpretation study of the Frances Creek mine pits by ***SRK Consulting (Report TIL002, July 2007)*** concluded that:

- Iron mineralisation is stratiform and formed by replacement within a sequence of carbonaceous shale, breccia and dolerite sills within the lower Wildman Formation
- Mineralisation is interpreted to be structurally controlled and focussed within NW trending fold structures.
- Fault positions within the stratigraphic host (either parallel to folding or intersecting in an ENE to NE direction) are also identified as secondary targeting criteria.
- High radiometric anomalies, particularly in the uranium channel, were noted to be associated with the iron mineralisation. It is uncertain whether this is a direct response of the iron mineralisation or a more general response associated with the breccia along which the mineralisation has formed.

A broader targeting study covering all of the prospective Wildman Formation by ***SRK Consulting (Report TIL003, March 2008)*** identified a total of 8 prospective areas for additional iron mineralisation using the structural model defined above. In particular, SRK favoured NW trending fault structures intersecting the lower Wildman Formation in generating targets. SRK also highlighted magnetic anomalies around the margin of the Allamber Springs Granite for potential skarn magnetite deposits.

Despite concluding that no magnetite is present within the Frances Creek iron deposits, SRK recommended that inversion modelling be completed on the magnetic data. This is not seen as a sensible course of action if it is difficult to either directly or indirectly (cf stratigraphic or structural mapping) relate the magnetics to the hematite ore.

A targeting review based on geophysical data completed by Richard Tomlinson ***(Territory Iron internal memorandum, March 2009)*** identified the following targeting criteria for iron mineralisation:

- In the near mining area, high uranium channel radiometric anomalies are correlated with ironstone / breccia anomalies. These were interpreted to largely reflect high flow pathways of the (hydrothermal) mineralising fluids.
- A general correlation between high gravity anomalies (near the base of the Wildman Formation) with the iron mineralisation.
- An association between weak magnetic anomalies and some iron deposits. It is postulated that these responses may reflect dolerite sills (in the hanging wall) rather than be a direct response of the dominantly hematite iron deposits.
- On the basis of this work some 156 separate radiometric / gravity / magnetic anomalies were identified for further review. These were then ranked with coincident anomalies given a higher priority, with distance from existing infrastructure (<20 km) also used as a key targeting criteria).

4. GEOPHYSICAL SURVEYS

Most of the geophysical data used during this review was collected prior to this study. However, for completeness a brief description of all of these surveys is included here with the source datasets included on the attached CD.

In addition to this the available open file geophysical survey data covering the project area were downloaded from NTGS and Federal Geological Survey online databases. Regional magnetic data were collected at a 400m line spacing and 60m flying height.

4.1 Detailed airborne magnetic and radiometric surveys

Detailed magnetic and radiometric surveys covering the Project area were collected by Territory Resources over three individual surveys as summarised below and shown in Figure 2. All surveys were flown by UTS Geophysics in an east-west direction at 50m line spacing and 25m flying height.

- UTS survey A672, flown in August-September 2005, covering the historic mining area including tenements EL9999 , EL10137 , EL22270, EL22856, EL24045 and EL24990 (survey size: 1876 km).
- UTS survey A744, flown in April-May 2006 covers exploration tenements covering similar stratigraphy to the north of the mining area, including tenements EL22856, EL23842, EL24040 and EL24715.
- UTS survey A780, flown for Australasia Gold in April and May 2006. This survey covers part of the western extent of EL23824 (survey size: 794 km).

Magnetic grids delivered by the contractor were reimaged to produce images of TMI and the first vertical derivative (TMI_dz). While data from the three grids were not merged, they are presented with the same colour scale so the images are directly comparable between surveys.

An image of the first vertical derivative of the three surveys is shown as Figure 3.

Past work has also shown radiometric data to be a valuable tool in mapping both regional stratigraphy, with past work suggesting that the iron rich horizon (or the breccia hosting it?) is identified by peak responses in the radiometric data, particularly the uranium channel.

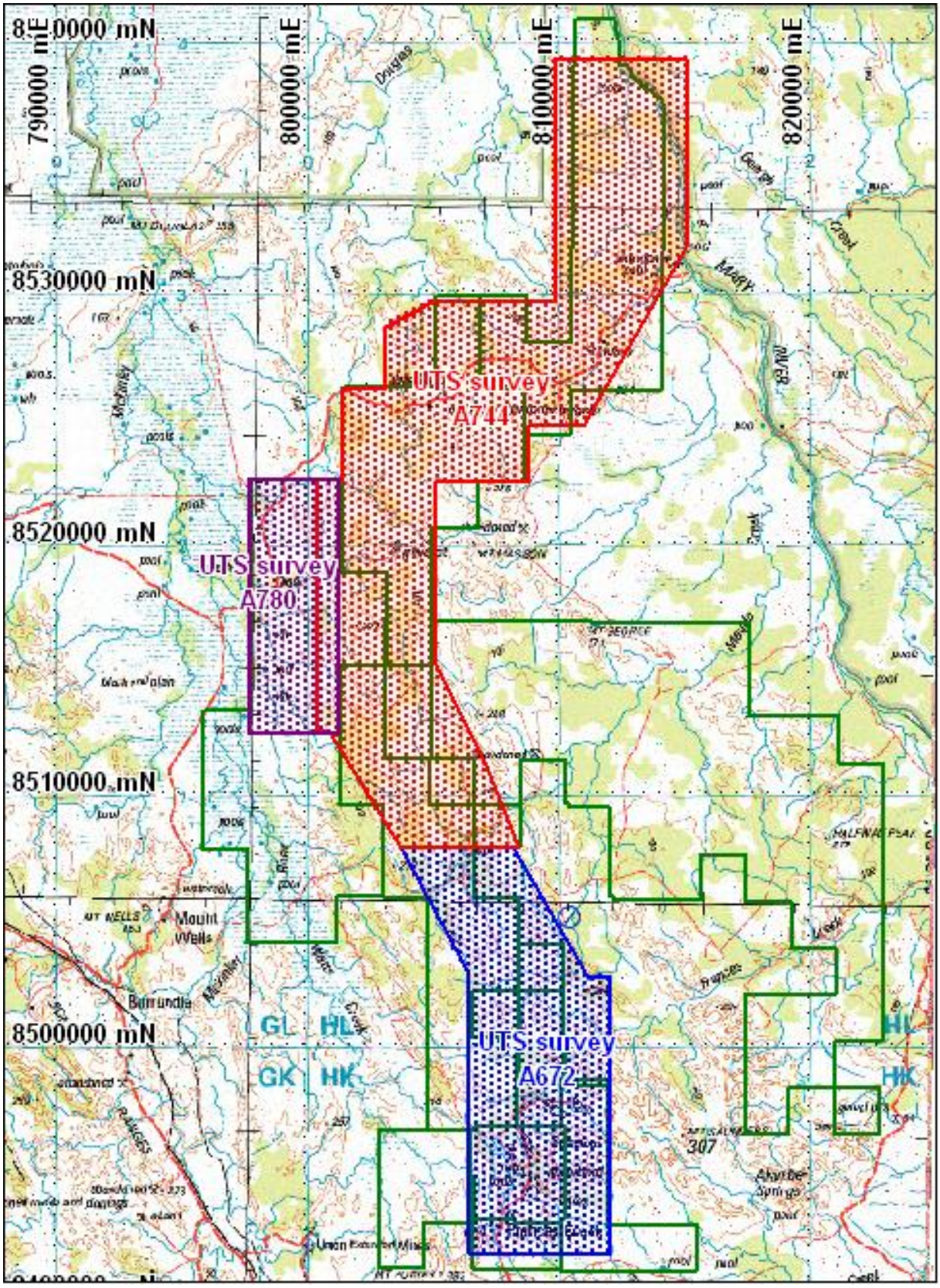

Figure 2: Locations of detailed airborne geophysical surveys.

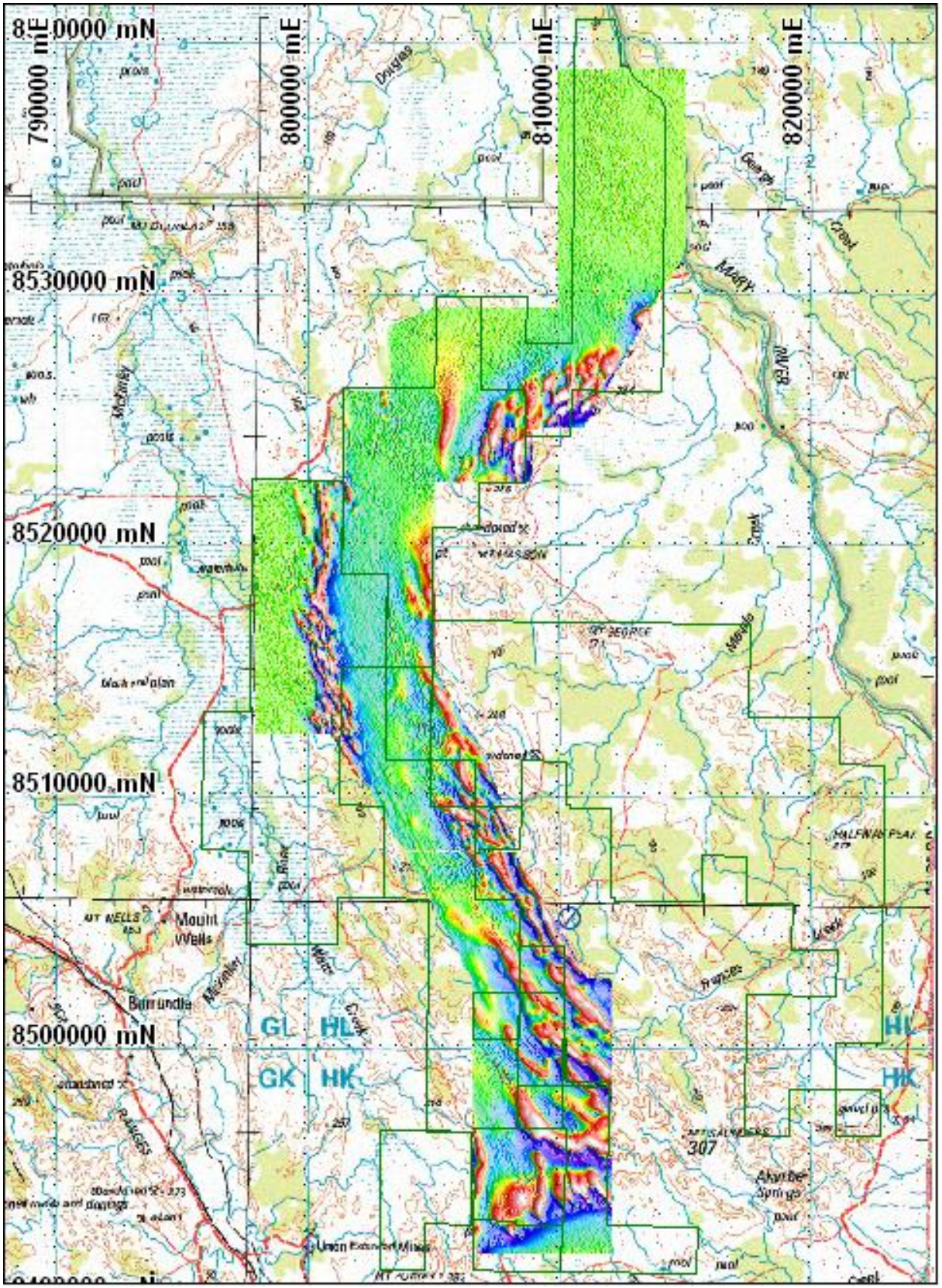

Figure 3: Image of first vertical derivative of the combined high resolution magnetic surveys completed in the Frances Creek Project area.

Pseudocolour images of each of the three channels of radiometric data potassium (K), thorium (Th) and uranium (U) have been produced, along with an RGB composite image of the three (red = K, green = Th, U = blue).

An image of the uranium channel from the three surveys is shown in Figure 4.

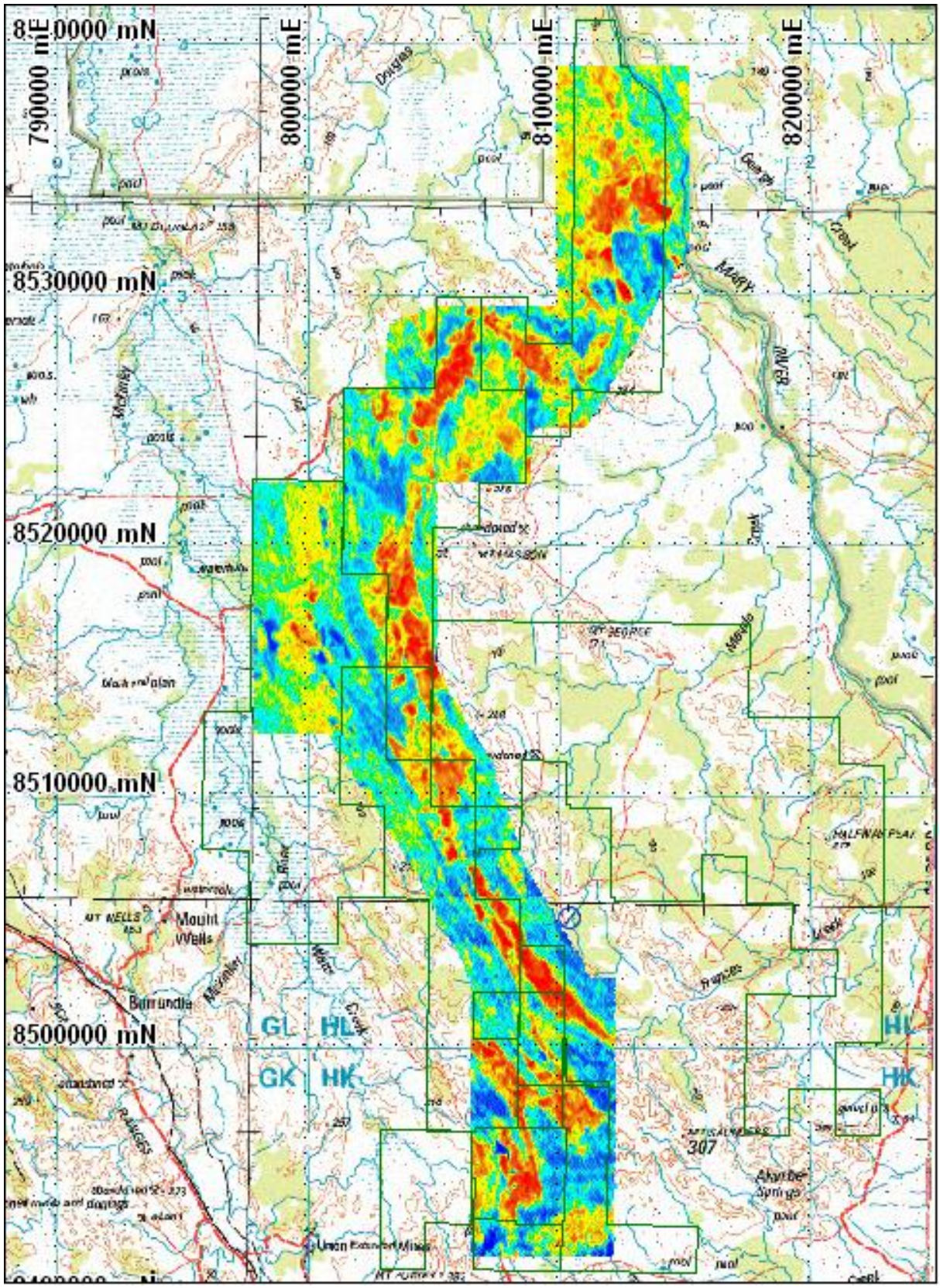

Figure 4: Uranium channel image from the combined detailed airborne surveys in the Frances Creek area.

4.2 Airborne EM survey

Airborne EM was collected over the Frances Creek mining area by GPX Airborne using their RepTEM system during November 2007 (Job 2237). Data were collected using a standard RepTEM configuration on east-west lines spaced 100m apart.

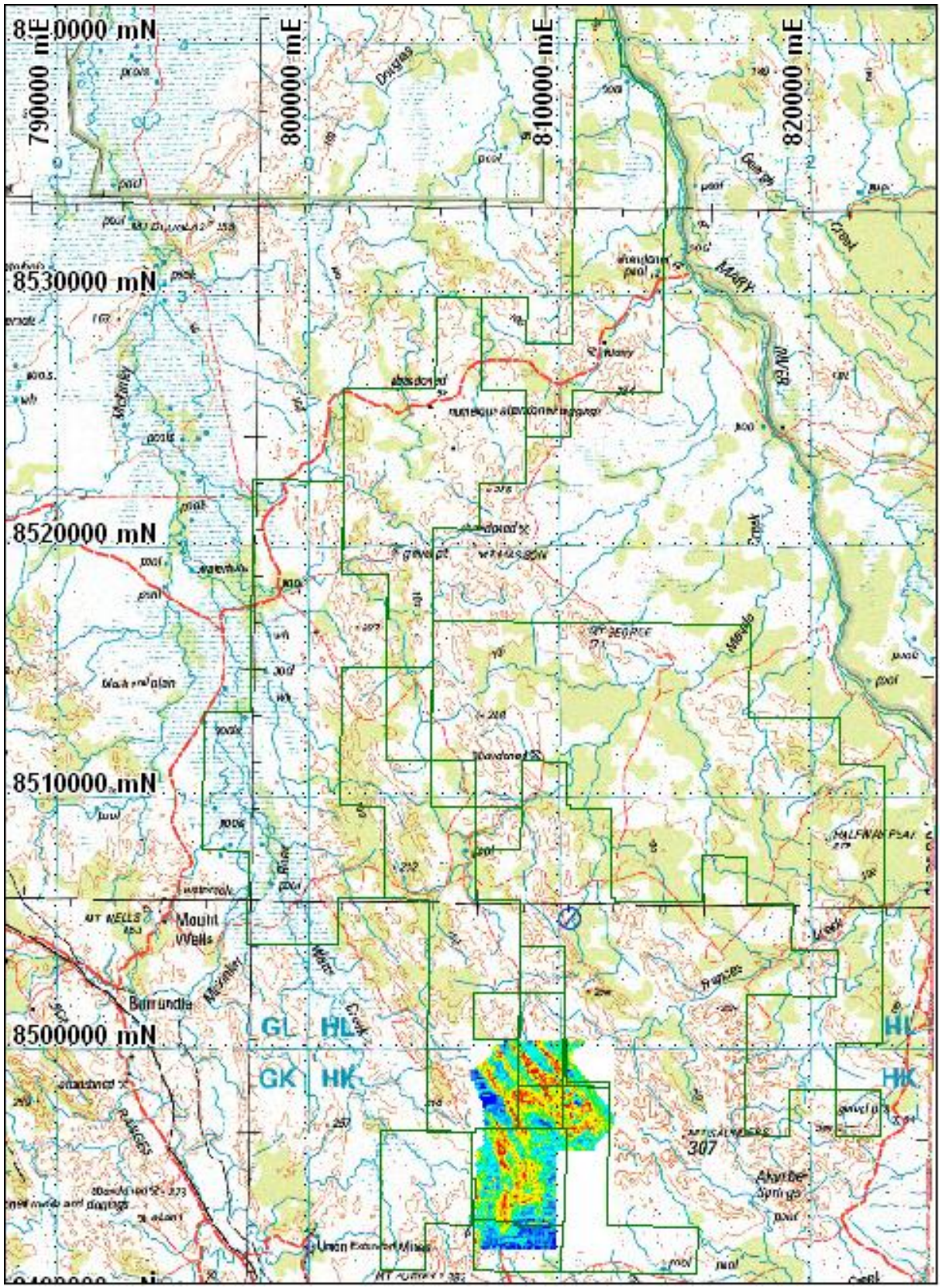

Figure 5: Maximum conductivity response image from the Frances Creek RepTEM survey.

Final EM data were levelled and compiled, with final inversion modelling of the data completed by GPX using the EmaxAIR algorithm developed by Fullagar Geophysics. Output results of this modelling were a series of conductivity-depth sections (CDIs). Images were also made of the output inversion results at a series of depth "slices", labelled as a depth below surface. Many of these slices tended to suffer from slight level shifts in the data depending on the flying direction of the aircraft; hence the output result appears "stripey".

This effect is effectively removed from the data by compiling a grid based on the maximum conductivity value recovered by the inversion modelling for each point in the survey (maxcond). The results of this are shown in Figure 5.

While magnetic data were also collected and processed during this survey, the results are inferior to the detailed magnetic surveys discussed above and these have not been used in this study.

4.3 Gravity surveys

Gravity data has been collected over the mining areas and northern exploration tenure over a series of campaigns. All data were collected by Haines Surveys. In summary, these surveys covered the following areas;

- Frances Creek 1, October 2003. A total of 1252 stations collected at a 50x250 m station spacing. Data collected over a 4.25 x 6.5 km area centred over the Frances Creek mining area.
- Millers, May-June 2005. A total of 337 collected at a 25x50 m station spacing over a 500 x 700 m area centred on the Millers pit.
- Thelma, May-June 2005. A total of 900 stations collected at a nominal 25x50 m station spacing over 1000 x 700 m area covering the Thelma deposits.
- Frances 3, March 2007. A total of 455 infill stations closing coverage over the Helene deposits to a 25 x 50m station spacing.
- Frances 3A/3B, March 2007. 802 stations of microgravity data collected collected over a 10x20 m station spacing over selected targets to the west of Helene.
- Frances North, July-August 2010. A total of 3279 stations of gravity data at a 50x200m station spacing covering the lower Wildman Formation over a strike length of 21.2 km to the north of the historic mining area.

All data collected to date were compiled and reprocessed to Bouguer Anomaly values using formulas supplied by Geoscience Australia to a density of 2.67 g/cc. Terrain corrections have been calculated for various individual surveys in a piecemeal fashion. As the results of these modelling studies are not consistent between surveys, they have not been included in the imagery generated for the project area.

Compiled gravity data were gridded to a 40m cell size, which is designed as an appropriate trade-off between the larger wide spaced surveys and smaller detailed high resolution surveys over selected prospect areas. An image of the first vertical derivative of the gridded gravity data is shown in Figure 6.

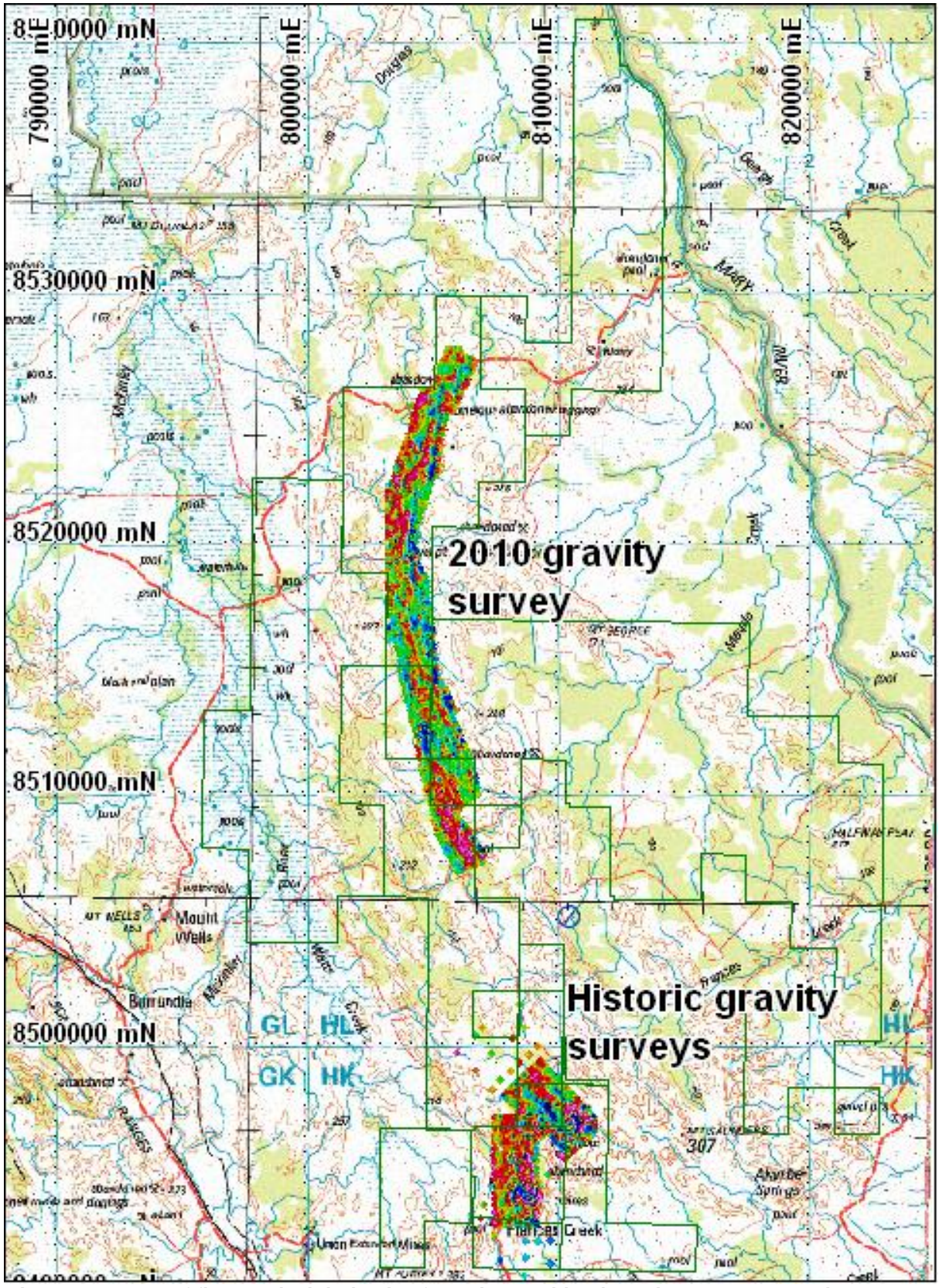

Figure 6: Image of first vertical derivative from the combined gravity surveys over the Frances Creek project area.

5. INTERPRETATION

A basement geology interpretation was completed at a scale of 1:50,000 scale over the Frances Creek Project area. In addition to images from the various geophysical surveys, the interpretation utilised government 1:100,000 mapping to provide geological control on the area. The locations of collars from Territory's drillhole database was also used as a means of determining the level of testing of various targets as well as locations of occurrences of iron mineralisation not identified in the regional government maps.

A simplified stratigraphic column used for the interpretation is shown in Figure 7. A summary diagram of the interpretation is shown as Figure 8, and included in digital format (scanned hardcopy and digitised for ArcGIS) as attachments on the enclosed CD. The geophysical data was primarily used to define the stratigraphic boundaries and structures, with targets generated from identifying similar responses to those observed in the known deposits within the current mining area.

A (geophysical) stratigraphy defined for the Project has been characterised as;

Figure 7: Summary stratigraphic column used in this geophysical interpretation

Granite basement – Proterozoic granite of the Cullen Batholith is identified in the regional and detailed geophysical imagery by a low magnetic character and high to moderate radiometric response (particularly in the potassium channel). While few gravity stations have been collected over the granite, it would be expected to have a low gravity response.

Mundogie Sandstone – the Mundogie Sandstone is characterised by low radiometric and, where acquired, EM responses. Moderate magnetic anomalies in the south / east of the detailed magnetic survey are probably due to magnetic marker(s) within the Mundogie, with the linear NNW trends in the pattern reflecting regional fold (anticlinal) axes. While both high and low gravity responses occur within the Mundogie, a high marker tends to define the upper contact of this unit.

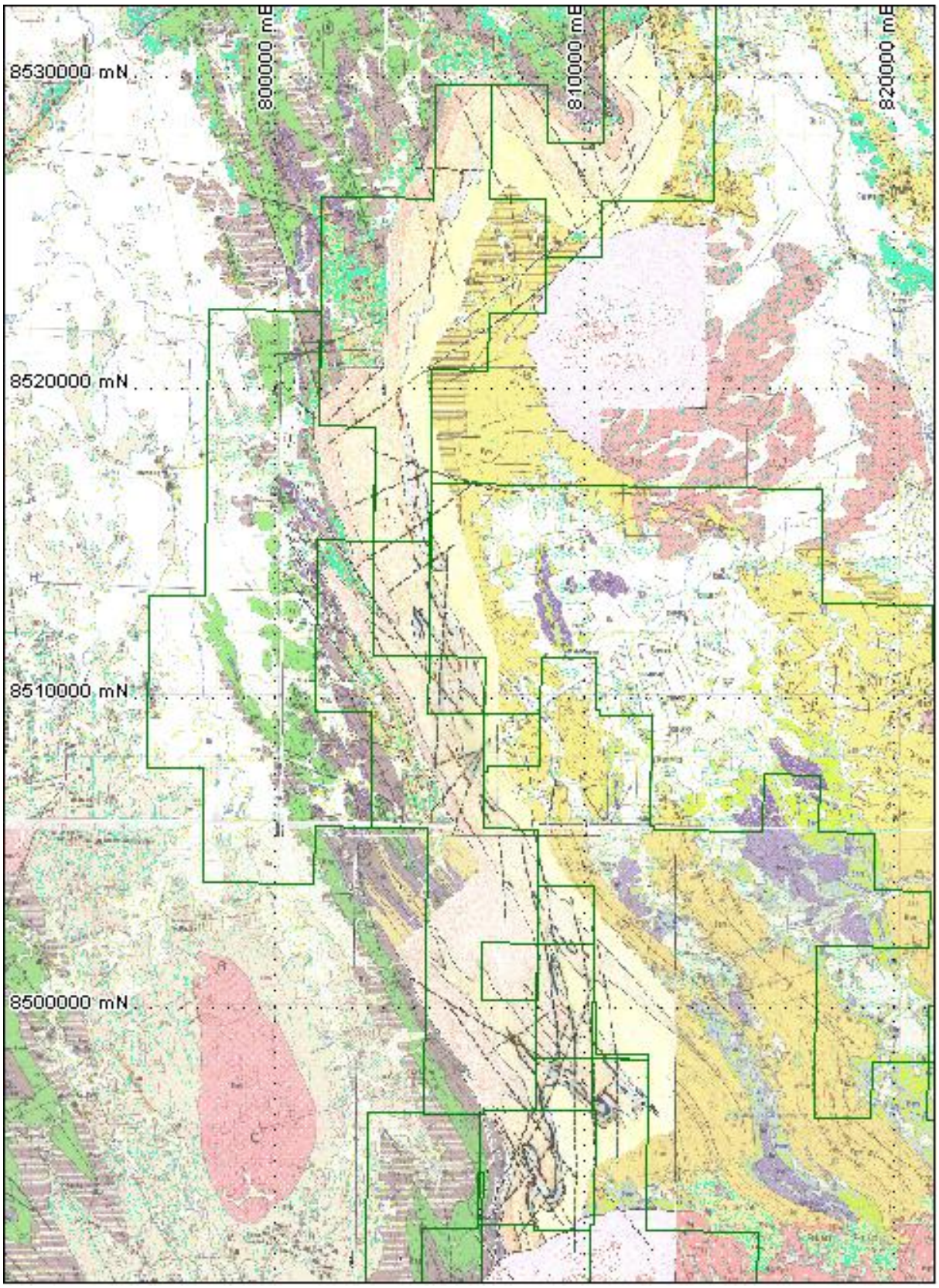

Figure 8: Summary map showing extend of solid geology interpretation overlain on government 1:100000 geological mapping.

lower Wildman Formation – meta-siltstones of the lower Wildman Formation are characterised by high radiometric (potassium and uranium) and conductivity responses. The unit typically has a weak magnetic response, with occasional subtle magnetic markers. A low gravity marker at the base of the sequence is interpreted as carbonaceous shales which

are believed to be related to (footwall) of the iron mineralisation. Low gravity markers elsewhere within the lower Wildman Formation have *not* been identified in this interpretation but may represent possible repeat stratigraphic targets prospective for iron mineralisation.

upper Wildman Formation – the upper part of the Wildman Formation is easiest defined by a sharp drop in the radiometric response. This is sometimes difficult to define in the northern half of the interpretation area where the radiometric responses have been muted by overlying lacustrine deposits associated with the low-lying, swampy terrain.

While not discussed further in this review, iron formations have been identified in the ***Koolpin Formation*** which overlies the Wildman Formation. The may be the cause of the moderate magnetic trends observed in the western part of the detailed survey areas.

While the main iron mineralised horizon (c.f. Helene, Jasmine) is located near the base of the Wildman Formation, the stratigraphic interpretation suggests there is at least one additional mineralised horizon located further up the sequence. This horizon is interpreted to host a repeat of the mineralisation at the Millers and Saddle Extended deposits.

Interpretation of the iron mineralisation horizon has been divided into three categories in this interpretation:

- *Confirmed*: where iron mineralisation has been mapped at surface by the NTGS or identified from drilling.
- *High priority*: generally identified as areas along strike from confirmed mineralisation, with good secondary evidence (radiometric, gravity anomaly) to support the interpretation.
- *Low priority*: located further from known mineralisation or where the geophysical anomalies are not as conclusive.

Trends in the gravity and EM data are largely interpreted to reflect bedding. While some trends in the magnetic data also reflect bedding, many prominent NNW trending magnetic ridges also define anticlinal fold axes.

Several generations of faulting are also interpreted from offsets and disruptions of trends in the geophysical data. At least three stages of faulting can be identified from the data:

- NNW trending faults, essentially in parallel with the folding in this direction.
- NE trending faults
- North-south trending faults. These appear to be the youngest, truncating structures trending in other directions.

6. TARGETS

By comparison of the geophysical signatures with the locations of iron occurrences from government mapping as well as past exploration and mining activities by Territory it is possible to identify a number of characteristic signatures for the mineralisation. Many of these characteristics were also noted by Tomlinson (2009) and were used extensively in the generation of ~150 targets in the Frances Creek area. Examples of these characteristic responses are shown in Figure 9.

- ***Radiometrics***: While the Wildman Formation is generally characterised by an elevated radiometric response, a local peak response particularly in the uranium channel data was previously reported (Tomlinson, 2009) to correlate closely with the position of the iron deposits. However, close examination of the response over the known deposits at Helene and Rosemary suggests that this peak response is slightly offset from the iron mineralisation and probably reflects carbonaceous shale in the host.

- ***Gravity***: within the historic mining area where the gravity survey coverage closes down to a very detailed station spacing (better than 25 x 50m) the iron mineralisation is frequently associated with a local gravity high. While this response would intuitively be expected for dense iron mineralisation, in places the high gravity response is offset slightly (towards the hanging-wall). A dolerite sill, which often forms the hanging-wall of the iron mineralisation, could also be a plausible cause for this high gravity anomaly.

  A prominent low gravity marker frequently underlies the mineralisation. This marker is interpreted to reflect carbonaceous shale.

- ***Magnetics***: while the Frances Creek mineralisation is generally reported to be hematite dominant and contain little magnetite, a subtle magnetic anomaly appears to coincide with certain deposits, for instance at Saddle Extended.

- ***EM***: A slightly elevated EM response with the overall high due to the Wildman Formation seems to correlate with known occurrences of iron mineralisation. While massive hematite mineralisation is normally expected to have a low conductivity, this response may reflect enhanced fluid flow within the host breccia / mineralisation envelope. Carbonaceous shale within the host sequence would also be expected to have a high conductivity response.

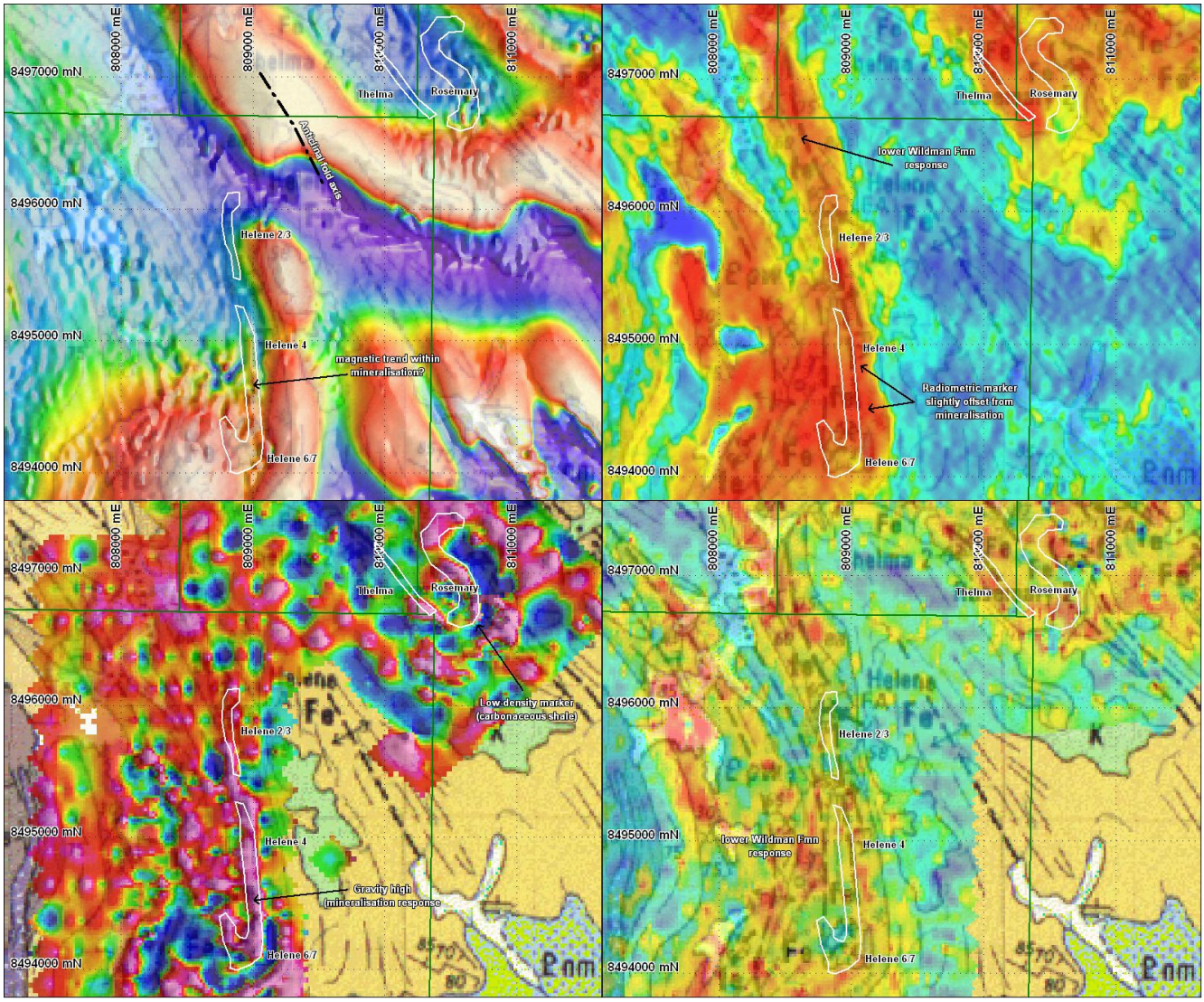

Figure 9: Geophysical responses of iron mineralisation (top-left) magnetic, (lower-left) gravity, vertical derivative, (top right) radiometric uranium, (lower right) EM max cond.

A total of 45 targets for iron mineralisation were identified in this review using outcrop geology in conjunction with the radiometric data to identify the target stratigraphic horizon and the gravity (thin gravity high adjacent to gravity low) and magnetic (subtle magnetic trend at target horizon) data in areas of poor outcrop.

ID	Target Name	East_MGA	North_MGA	length	outcrop*	gravity	mag	priority	comments
1	Helena Extended	807940	8493100	1000	ext.			2	
2	Helena South	808300	8493180	900	ext.	x		2	
3		808080	8493900	600	x	x		1	partially drilled
4		808310	8494600	300	ext.	x		1	
5		808080	8495100	480		x		3	possibly dolerite
6		808500	8494960	460	ext.	x		1	
7		808880	8495370	300	ext.	x		1	
8		808450	8497480	350	x	x		1	
9		808280	8497940	480	x	x	x	1	
10		807640	8499020	720			x	3	
11		807950	8498920	580			x	2	
12		808510	8498270	320	ext.			2	
13		808980	8498100	300		x		2	
14		809800	8497320	350	ext.	x		1	
15		809930	8497440	460		x		3	possibly dolerite
16		810850	8497160	460		x		2	
17	Rosemary	810720	8498200	540	x	na.		1	partially drilled
18	Beryl	810390	8498730	580	x	na.		1	untested outcrop
19		808930	8501060	540	ext.	na.		3	
20		809250	8500200	1200	x	na.		2	
21		808420	8503620	650	x	na.		2	
22		807520	8504050	280	x	na.		2	
23	Saddle Extended	806830	8506150	370			x	1	
24		806130	8507490	500		x	x	2	
25		805660	8508310	930		x	x	1	
26		804930	8509890	900		x	x	3	
27		804900	8511210	200		x	x	2	partially drilled
28		805700	8511490	1100		x		3	
29		805580	8512230	400		x		2	
30		805180	8512960	710	ext.	x		1	
31		804310	8515270	860	ext.	x	x	3	
32		804820	8515130	330		x		3	
33		804010	8516130	420		x	x	2	partially drilled
34	Big Hill North	804570	8516000	1050		x		3	
35		804480	8517380	1000		x		3	
36		804020	8519070	820		x		1	partially drilled
37		803980	8519780	500		x	x	2	
38		804430	8521930	500		x		3	
39		804940	8523610	560		x		3	
40	Mt Misson	805110	8524690	1430		x		2	
41		805950	8526920	800	x	x	x	1	
42		809750	8527160	560	x	na.		1	
43		810040	8527770	400	x	na.		1	
44		811240	8527130	500	x	na.		1	
45		811510	8527780	360	x	na.		1	

Table 1: Summary of hematite targets identified in the Frances Creek project area.
(*) x implies ironstone outcropping, ext. implies target along strike from outcrop.

Targets have been assigned a priority ranking from 1 (highest) to 3 (lowest). Most of the highest priority targets either overlie or are directly along strike from known iron mineralisation.

The locations and strike extent of these targets have been summarised into a targets layer in the “interpretation” folder on the attached CD. This layer is composed of ellipses showing the extent of the anomalies and further distinguished by colour, where red is assigned to high priority targets, orange to medium and green to low, as shown in Figure 10.

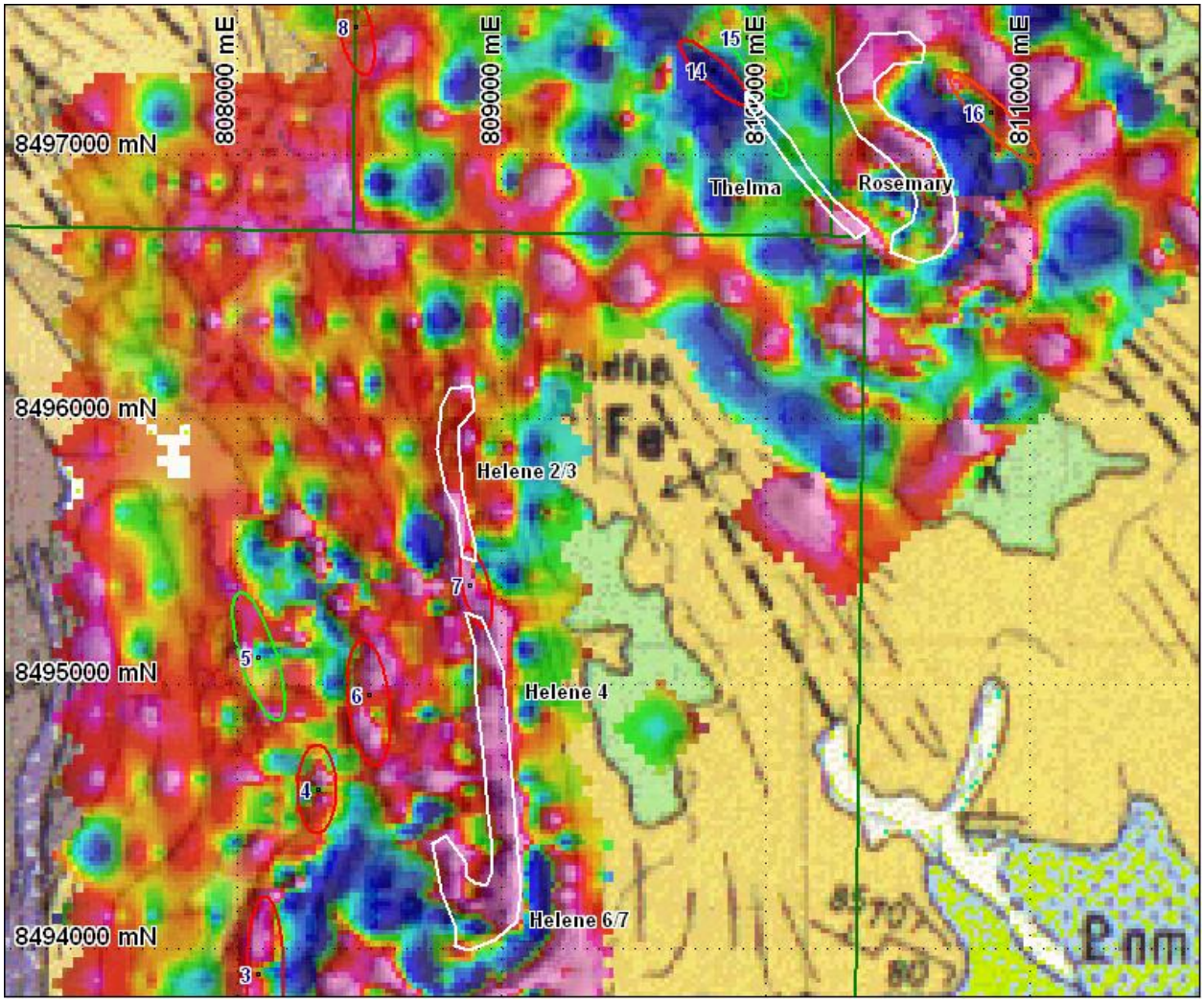

Figure 10: Frances Creek targets (near the current mining area) shown as coloured ellipses to indicate priority (red=high, orange=medium, green=low).

The criteria used in generating these targets are similar to those used by Tomlinson, 2009. Consequently it is unsurprising that many of these targets coincide with one or more of the 156 generated during his review.

7. CONCLUSIONS AND RECOMMENDATIONS

The Frances Creek Project area is considered to have excellent potential for the discovery of additional (concealed) iron mineralisation, both close to the existing mining area as well as in greenfields target areas.

This interpretation focussed on defining:

- prospective stratigraphy within the overall geological framework of the area.
- Direct or indirect (c.f. footwall response) of the iron mineralisation.

The primary stratigraphic target within the Frances Creek Project area is the lower Wildman Formation. Within this unit at least two stratigraphic horizons have been identified which have potential to host iron mineralisation; a lower unit near the base of the Wildman Formation which is host to most of the deposits in the current mining area and a second horizon higher up in the sequence which is interpreted to host the Millers and Saddle Extended deposits.

In addition to location within the Wildman Formation, the following targeting criteria were used to identify 45 targets within the interpretation area:

- Presence of (untested) outcropping iron mineralisation
- Strike extension of known mineralisation
- Gravity high (due to mineralisation) adjacent to gravity low (due to carbonaceous shale).
- Subtle magnetic trend (secondary criteria).

Targets have been ranked high, medium, low priority depending on proximity to known mineralisation and secondary criteria used to define the target.

Follow-up ground truthing of these targets, including mapping and sampling in areas of outcrop, is recommended. This should lead to drill testing of any possible mineralisation where warranted.

Assuming the testing of targets generated using gravity data in greenfields area is successful, extension of the gravity grid to cover additional prospective stratigraphy in EL24040 is recommended.

Given the significantly better imaging of the mineralisation using the detailed 25x50m ground gravity data over the Helene and Rosemary deposits, there may be merit in considering infill of selected targets prior to drill testing, particularly low-lying areas where the basement stratigraphy is largely concealed by swamp.