Geophysics and Drilling Collaborations Program 2020

“Resourcing the Territory”

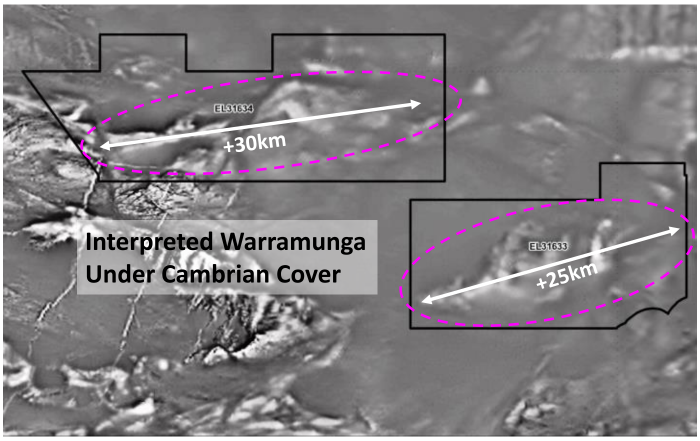
Geophysics Collaboration

CONFIDENTIAL COMMERCIAL INFORMATION

KING RIVER RESOURCES LIMITED

Epenarra, Tennant East Project

FINAL REPORT



Large Untested Isolated Magnetic Bodies Under Cambrian Cover

Tenements: EL31633, EL31634

Holder: Treasure Creek Pty Ltd

Map Sheets: 100K: Epenarra 5957; Oorradigee 5857, 5315 Coolibah 6057, Favenc 5958

250K: Frew River SF5303; Alroy SE5315, Bonney Well SF5302

Datum Zone: GDA94 MGA53

10 March 2021

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1. Abstract

King River Resources (KRR) applied for and was awarded in round 13 of the 2020 Geophysics and Drilling and Collaboration at its Epenarra Project within the Tennant East Region. The proposed programme involved a ground passive seismic survey over EL31633 and EL31634 to assess the depth of Cambrian cover followed by a region scale (433km^2) and detailed airborne magnetic survey to assess the nature of basement and the nature of any targets beneath the basin sediments. The target mineralisation is for Iron oxide copper gold deposits with magnetic signatures associated with ironstone, most likely Tennant Creek style.

KRR tenements in the NT are held by Treasure Creek Pty Ltd which is a wholly owned subsidiary of King River Resources Limited ("Company"), an ASX listed public company (ASX: KRR).

The tenements are within the East Tennant Area of the recent government "Exploring For The Future" initiative. The tenements have only been covered by semi-regional geophysical surveys data which includes 200m line spaced air borne magnetics flown in 1999 and wide spaced 4km spaced gravity and regional AUSAEM and MT (AUSLAMP). There is no other exploration over the tenement except a RAB drill programme in the western most edge of EL31634 where only one hole penetrated the Cambrian cover. It is interpreted that the +25km magnetic bodies beneath the Cambrian cover are related to Palaeoproterozoic rocks equivalent in age to the Warramunga Formation which is the main hosting stratigraphy for IOCG deposits at Tennant Creek. The depth of Cambrian cover is expected to be between 80 and 200m.

The programmes were successfully completed with the detailed airborne magnetic survey over the whole of EL31633 (100m line spacing, 30m survey height) totalling 4,336 line km and 5 Passive Seismic lines completed over EL31633 and EL31634 (10-20km line spacing, 500m stations) totalling 170 stations (182 total but some removed due to noise).

The detailed airborne magnetics provided excellent resolution of the area. The work has much more clearly defined the contrast of the main magnetic body (lensoidal complex ~20km strike) and the surrounding granites and internal positions and structures to this higher magnetic zone. Interpretation is still that the large higher magnetic zone is a raft of Warramunga Formation equivalent units surrounded by granite. It is hoped that some of these magnetic high zones are influenced by ironstone/IOCG bodies. The nature and positions of the targets identified in the 2020 application document are much more defined and details within higher zones are now evident with anomalies as small as 100-250m standing out.

Overall, the passive seismic work appears to have provided an excellent model for the base of Cambrian cover. Estimated depths range from 80 to 150m with depths varying possibly due to palaeo-topography and faulting. Interpreted depth of cover estimates from the government AusEM 2017-2018 tempest EM conductivity sections are overall similar to the depth estimates given by the passive seismic work which gives more confidence. Also, the magnetic depth estimations give similar depth ranges overall but seem to be overestimating and varying more. Passive seismic surveys are a cheap and easy alternative to other more expensive and intensive methods of estimating basin depth.

The collaboration work (airborne magnetic and passive seismic surveys) has assisted with regional geological understanding of the area (more understanding of the depth and nature of the Cambrian cover and basement contact), understanding methodologies for estimating Cambrian cover depth and King River Resources exploration/target prioritising on EL31633/31634 and their surrounding tenements.

2. Introduction

King River Resources (KRR) took part in the round 13 of the Geophysics and Drilling and Collaboration applications and was awarded a collaboration at its Epenarra Project within the Tennant East Region.

The programme was a ground passive seismic survey over EL31633 and EL31634 to assess the depth of Cambrian cover followed by a region scale (433km^2) detailed air magnetic survey to assess the nature of basement and the nature of any Iron Oxide Copper Gold (IOCG) targets beneath the basin sediments.

King River Resources tenements in the NT are held by Treasure Creek Pty Ltd which is a wholly owned subsidiary of King River Resources Limited ("Company"), an ASX listed public company (ASX: KRR).

EL31633 and EL31634 are part of King River Resources Epenarra Project and are located approximately 100 kilometres south east of Tennant Creek in the central part of the Northern Territory (Figure 1). EL31633 covers an area of 381.14 square kilometres (122 sub blocks) and EL31634 an area of 525.97 square kilometres (168 sub blocks).

Access to the area is by the sealed Stuart Highway south from Tennant Creek, and then by the Kurundi Road and unsealed station tracks. Kurundi Road leads to Epenarra station.

EL31633 is located within the boundaries of Perpetual Pastoral Lease PPL 1026 "Epenarra", NT Portion 000 – Epenarra Station. EL31634 is mostly over Crown Land (NT Por 4469)

Figure 2 and 3 shows the location of the Exploration License in relation to the main highways and cadastre.

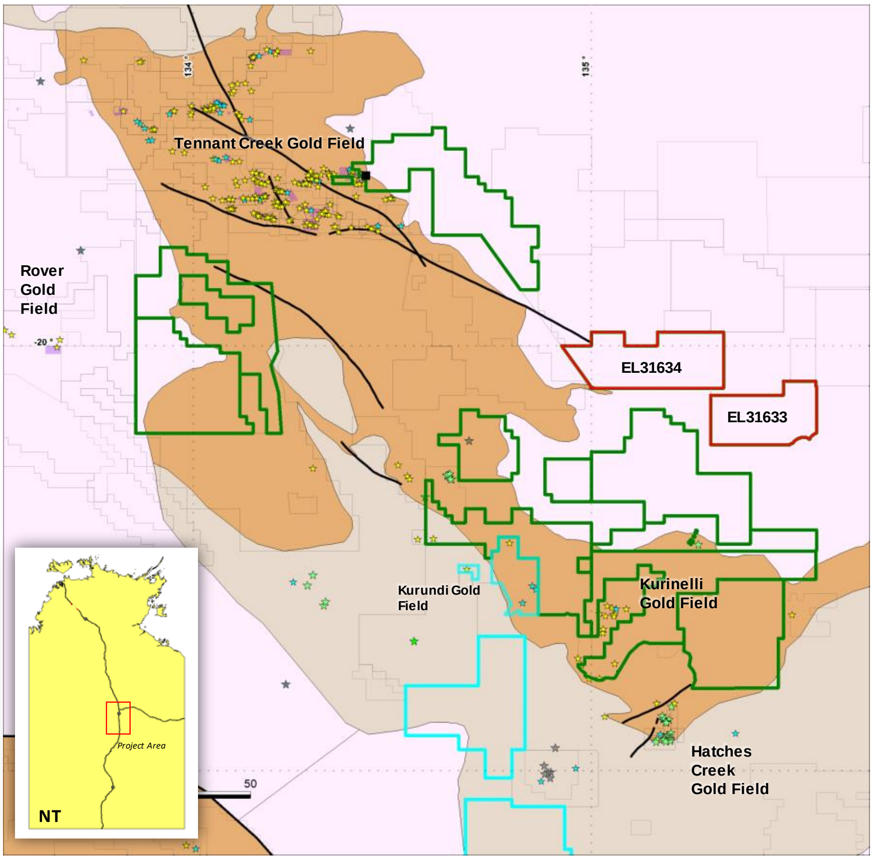


Figure 1: Project Location Plan

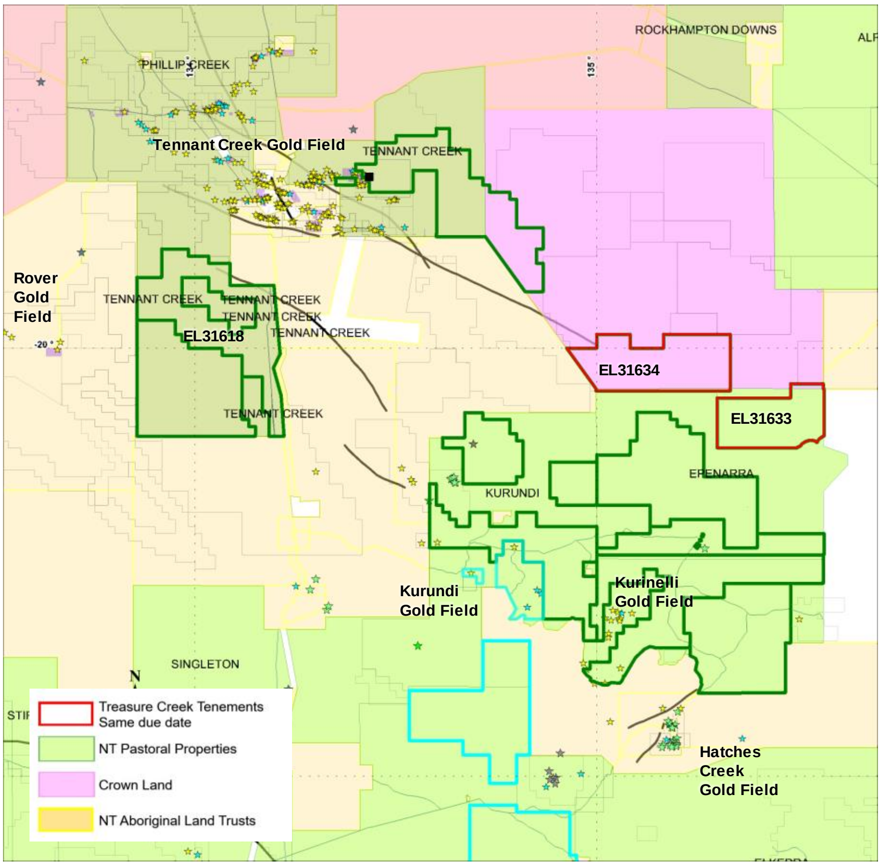


Figure 2: Tenement Location and cadastre

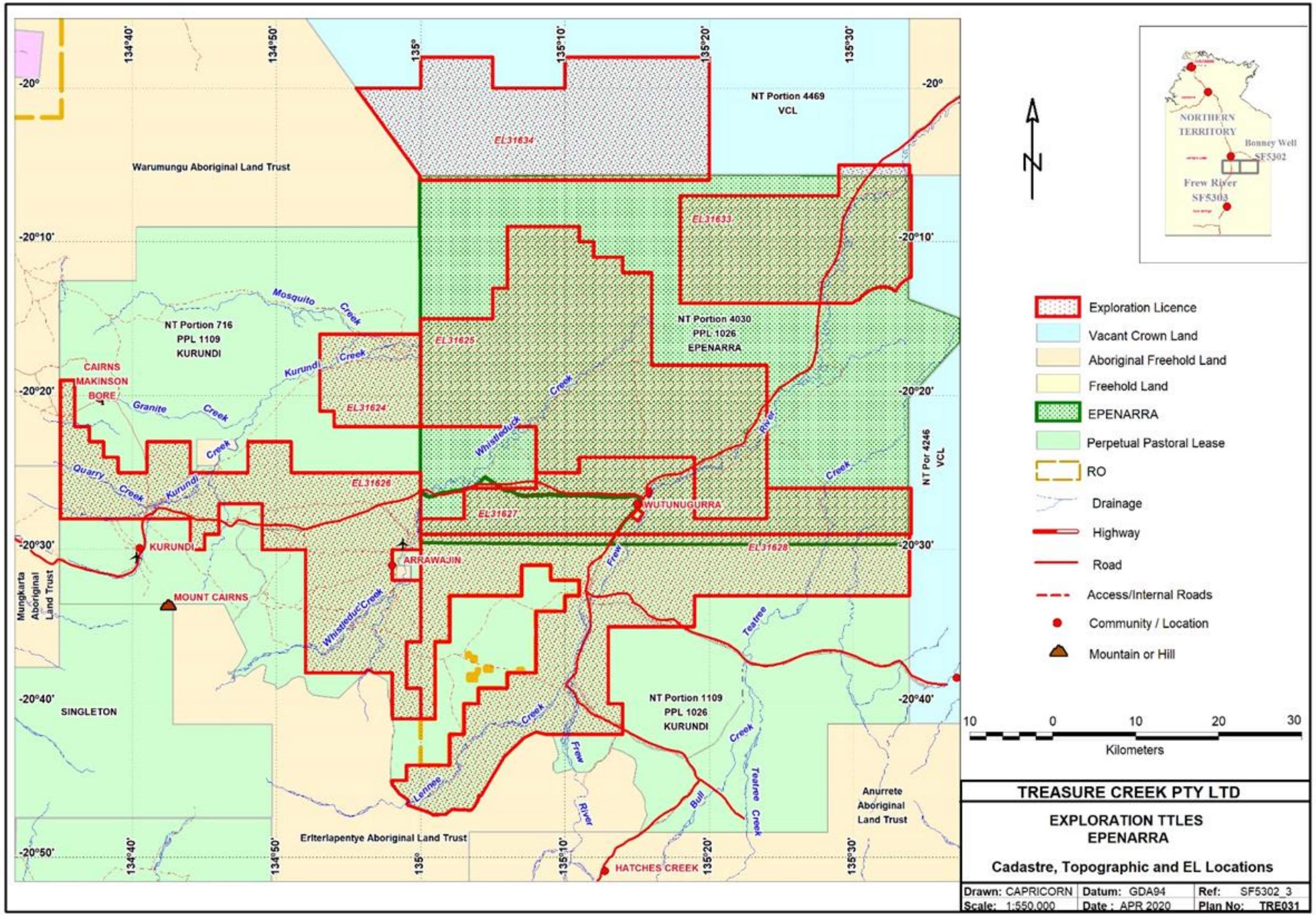


Figure 3: Tenement Location and cadastre

3. Regional Context

Regional geology

The area is located within the Tennant Creek Inlier which consists of a gneissic basement unconformably overlain by Proterozoic sediments, intruded by Proterozoic (syn-post tectonic) granites (the 1850Ma Tennant Creek Supersuite and the 1820-1810Ma Treasure Creek rocks) and subsequently overlain by Cambrian sediments. The Cambrian Georgina and Wiso Basins flank the Inlier to the east and west respectively (Figure below).

The Warramunga Formation (1860Ma) hosts the gold-copper-bismuth mineralisation of the Tennant Creek goldfield. The mineralisation is associated with ironstone. Gold mineralisation is still known to occur in younger units of the Ooragadigee Group but it is less common.

The Davenport Province, to the southeast, is a sub-tectonic unit of Tennant Creek Inlier and comprises of highly folded Proterozoic sediments and volcanics rocks of the Hatches Creek Group intruded by late Proterozoic granites.

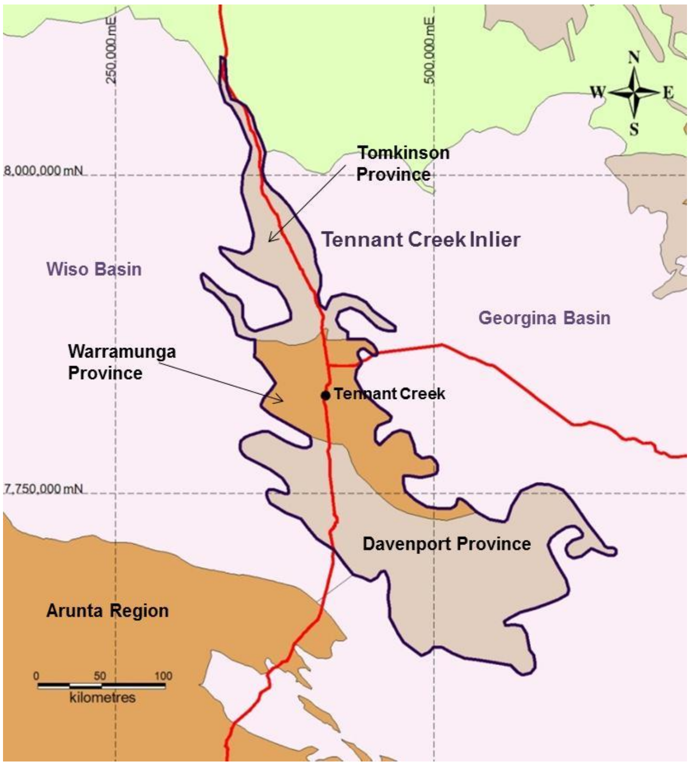


Figure 4 Tennant Inlier Provinces and Basins.

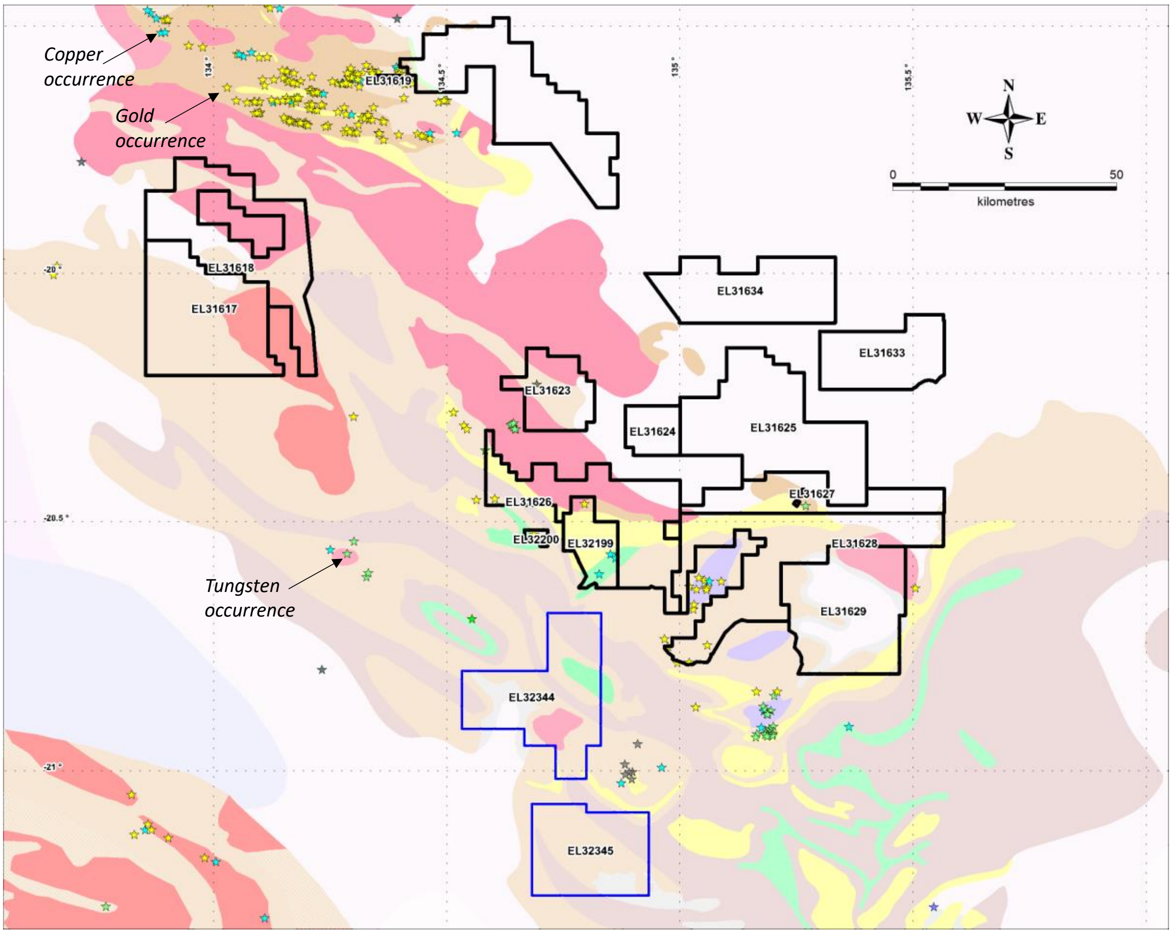


Figure 6 Regional Geology, KRR tenements and Mineral Occurrences

EL31633 and EL31634 are situated within the Tennant Creek to Mount Isa focused integrated study area ((Figures 6) defined by an approximately northeast-trending corridor extending for 350 km and to the Queensland border (Figures 6 and 7). The area is almost completely covered by the Georgina Basin which obscures its potential to host mineral systems. The East Tennant area has been selected as an area for ongoing detailed geoscientific investigation through integration of new multi-disciplinary and multi-scale geoscience data (Australian Government Geoscience Australia, Exploring the future website https://www.ga.gov.au/eftf/minerals/fis/east-tennant.

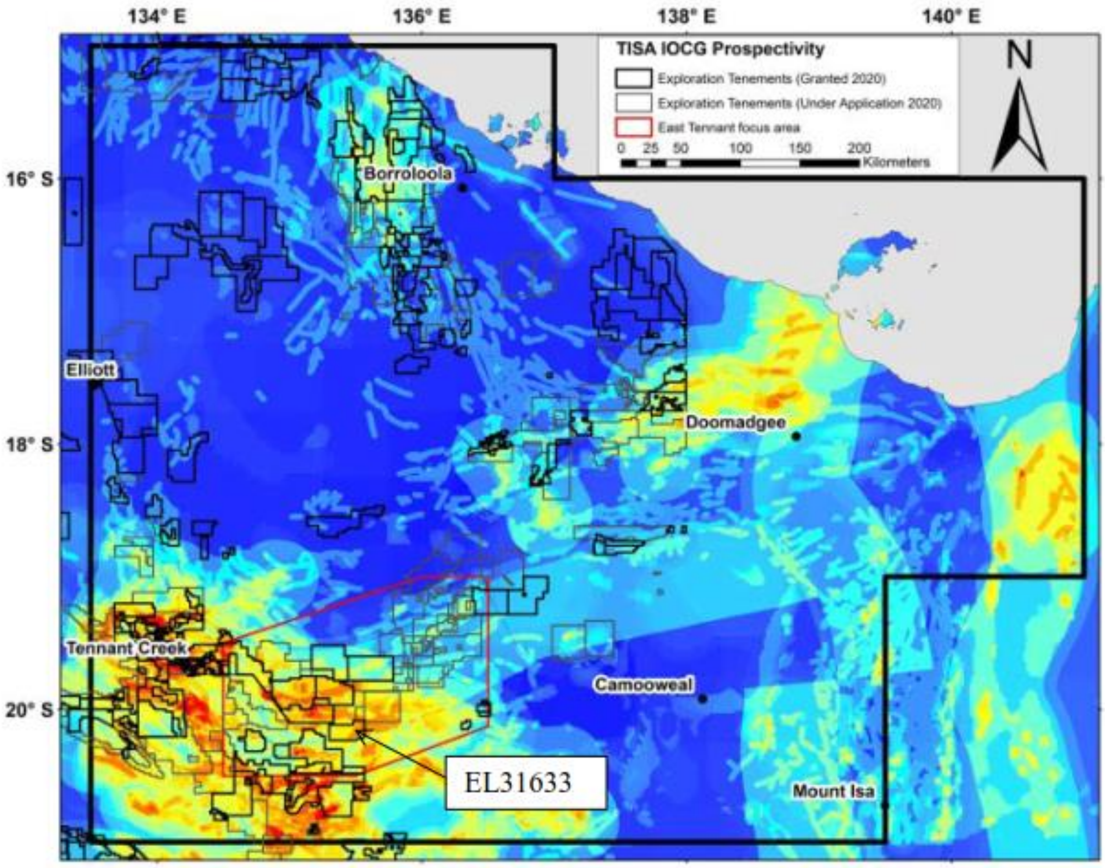


Figure 5: EFTF region IOCG mineral systems potential map with East Tennant Area shown in red (Hackney et al, 2020). EL31633 indicated.

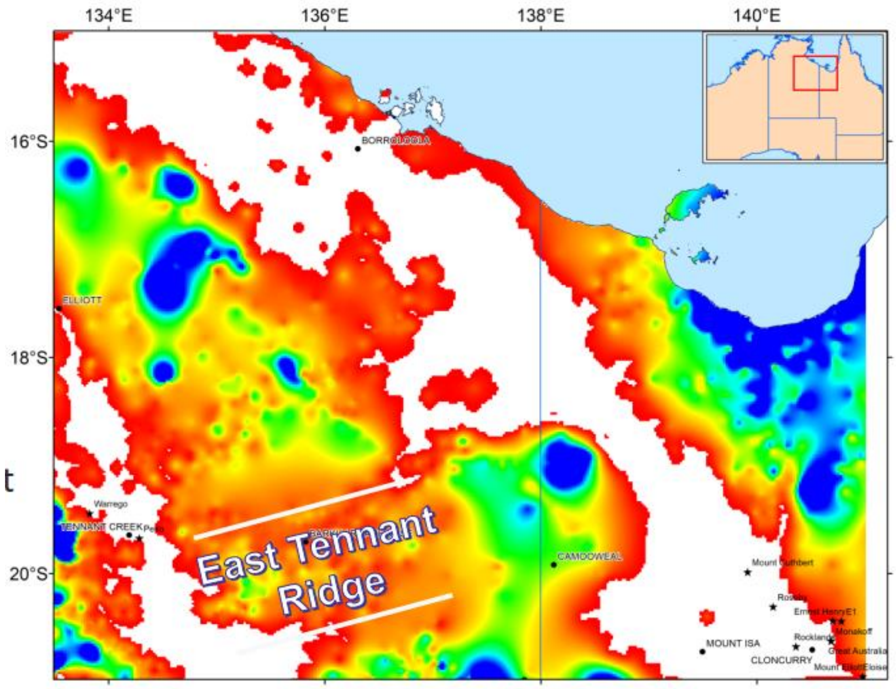


Figure 6 Tennant East Ridge undercover (Schofield 2019).

The prospectivity model was created using prioritised layers of input data (sources of ore metals, hydrothermal fluids, energy sources, crustal and mantle architecture, fluid/magma pathways and physiochemical gradients - figure 8), (Schofield 2019).

Igneous and sedimentary ages of the palaeo Proterozoic rocks under the Cambrian cover within the East Tennant area have been found to be of similar ages to Tennant Creek (Schofield 2109).

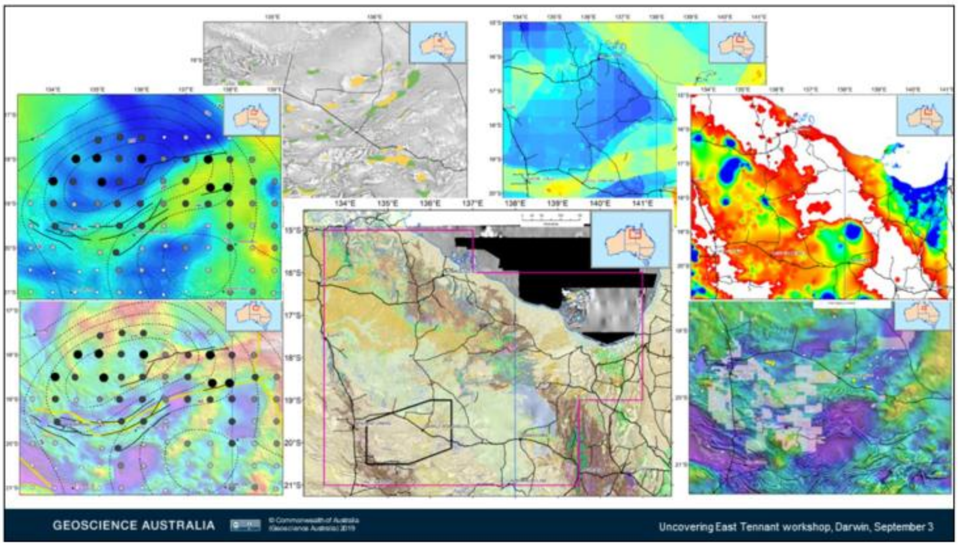


Figure 7 Tennant East Uncovering potential – combining layers of information (Schofield 2019).

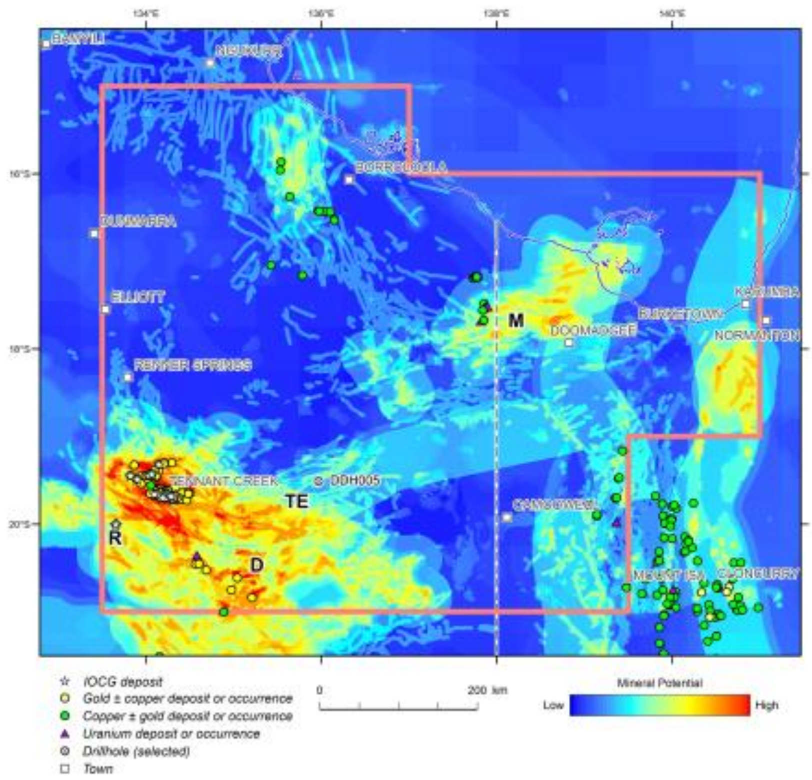
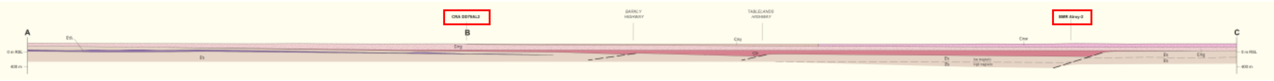


Fig. 10. Potential for pre-1800 Ma IOCG deposits in the Tennant Creek – Mt Isa study area (pink outline). Locations of significant IOCG deposits and Cu, Au and U mineral occurrences are shown to illustrate spatial correlations with the prospectivity results; deposits of other commodities such as Zn, Pb, not shown. Abbreviations: D – Davenport Province area; M – Murphy Inlier area; R – Rover area; TE – area east of Tennant Creek; DDH005 – location of studied drill hole. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Figure 8 IOCG Potential Map for Tennant Creek East (Skirrow et Al. 2019).

Project Area Geology

The project area lies in the Tennant East area. It is mapped to be entirely covered by Cambrian sediments (1:250K Frew River). The nearest exposed Palaeo-Proterozoic rocks are 25km to the south and 30km to the west of EL31633. These rocks are mapped as Warramunga Equivalent. Interpretation of depth of Cambrian cover suggests depths of up to 200m. This is based on 1:250k geological cross sections to the north of the project area (figure below), drilling at the western end of EL31634 (intersected the Paleo-Proterozoic at 67m). Government Regional EM sections suggests depths of less than 200m across both tenements (section 4, Figure 14).



DrillHole ID	Hole Name	Drilling Method	Drilling Type	Total Depth	Date Completed	Title ID	Report ID	Open File	HyLogged
8487937	DD79AL2	Diamond Drill	Exploration	310	00:00.0	EL2043	CR1980-0157	Yes	Yes
8487933	DD80AL3	Diamond Drill	Exploration	346		EL2043	CR1981-0125	Yes	Yes

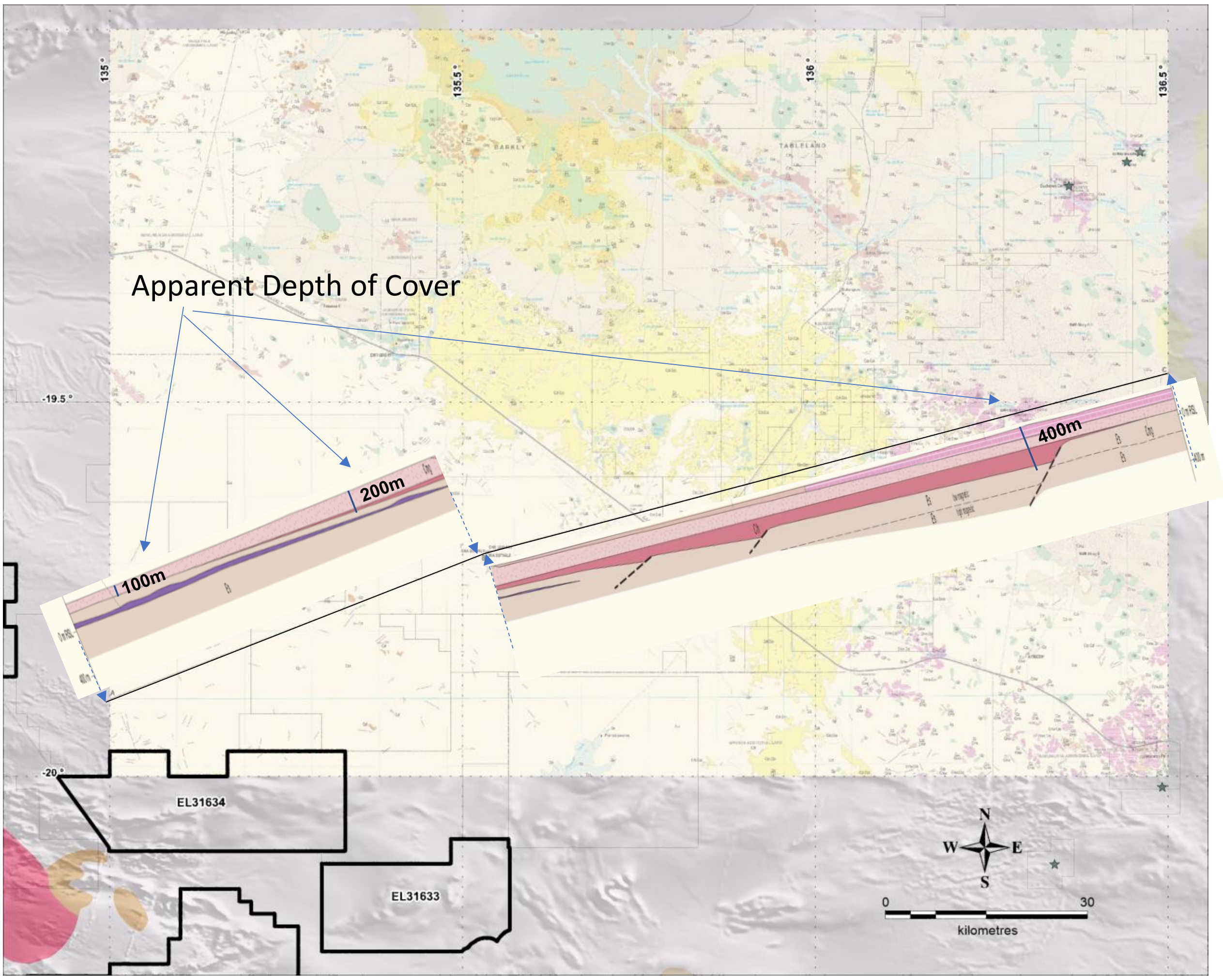


Figure 9 1:250K geological sections north of EL31633 and EL31634 suggest basin depth is approximately 100 to 200m deep.

Interpretation of magnetics and gravity data within EL31633 show a lensoidal magnetic complex and coincident gravity high region with a strike of +20km that strikes ENE through the centre of the tenement. This is likely to be a 'raft' of Palaeoproterozoic, Warramunga equivalent rocks between two felsic intrusives. The 'raft' is cut and bounded by NNE trending fault zones (Figure 10, Figure 11 and Figure

19), that are along strike of a major NE trending fault. Structural complexity is evident within the 'raft' with preferential rotation of magnetic bodies and also arcuate magnetic responses indicating intrusive bodies. EL31634 covers a magnetic body of +30km interpreted to be the continuation of Warramunga formation sediments outcropping to the west, under Cambrian Cover (Figure 11). There are no Modat mineral occurrences with 20km of the tenements (Figure 5).

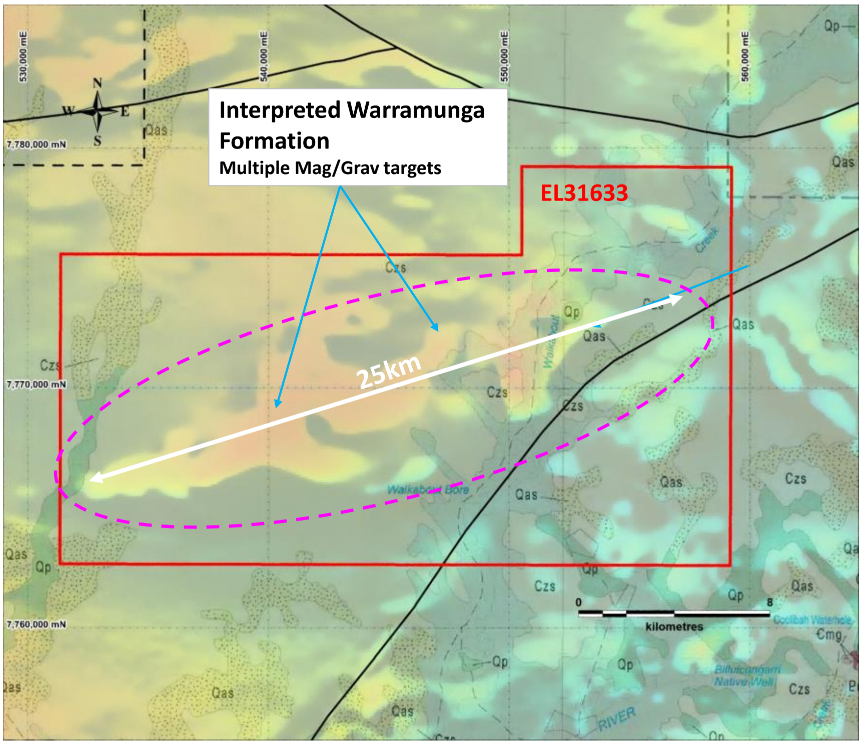


Figure 10 Magnetic body within EL31633 interpreted to be Warramunga Formation equivalent stratigraphy under Cambrian cover.

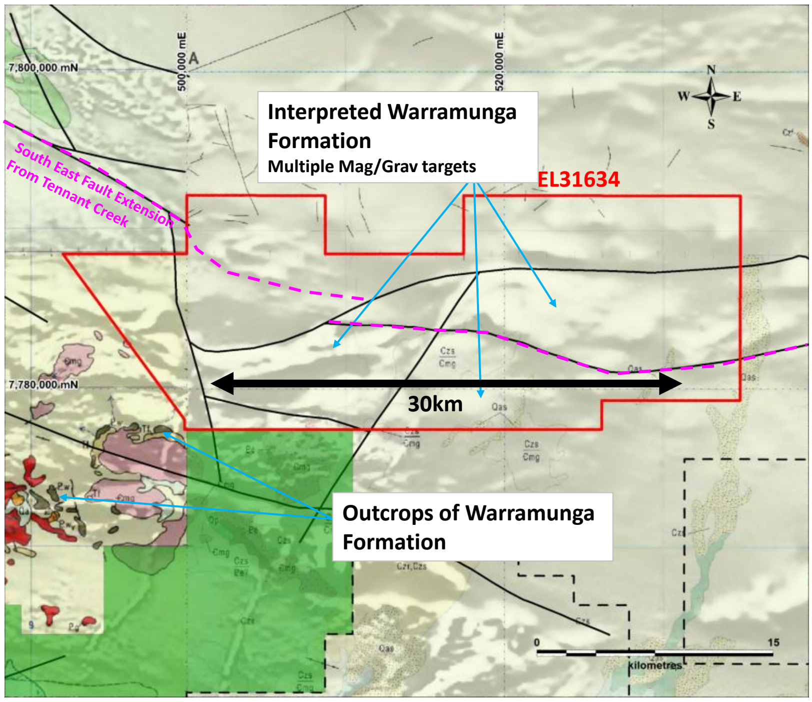


Figure 11 Magnetic high area within EL31634 interpreted to be Warramunga Formation equivalent stratigraphy under Cambrian cover

4. Previous Exploration

The tenements are within the East Tennant Area of the recent government "Exploring For The Future" initiative (Figure 5). The tenement has only been covered by semi-regional geophysical surveys data which includes 200m line spaced aeromagnetics flown in 1999, wide spaced 4km spaced gravity and regional AEM (AUSAEM) and MT (AUSLAMP).

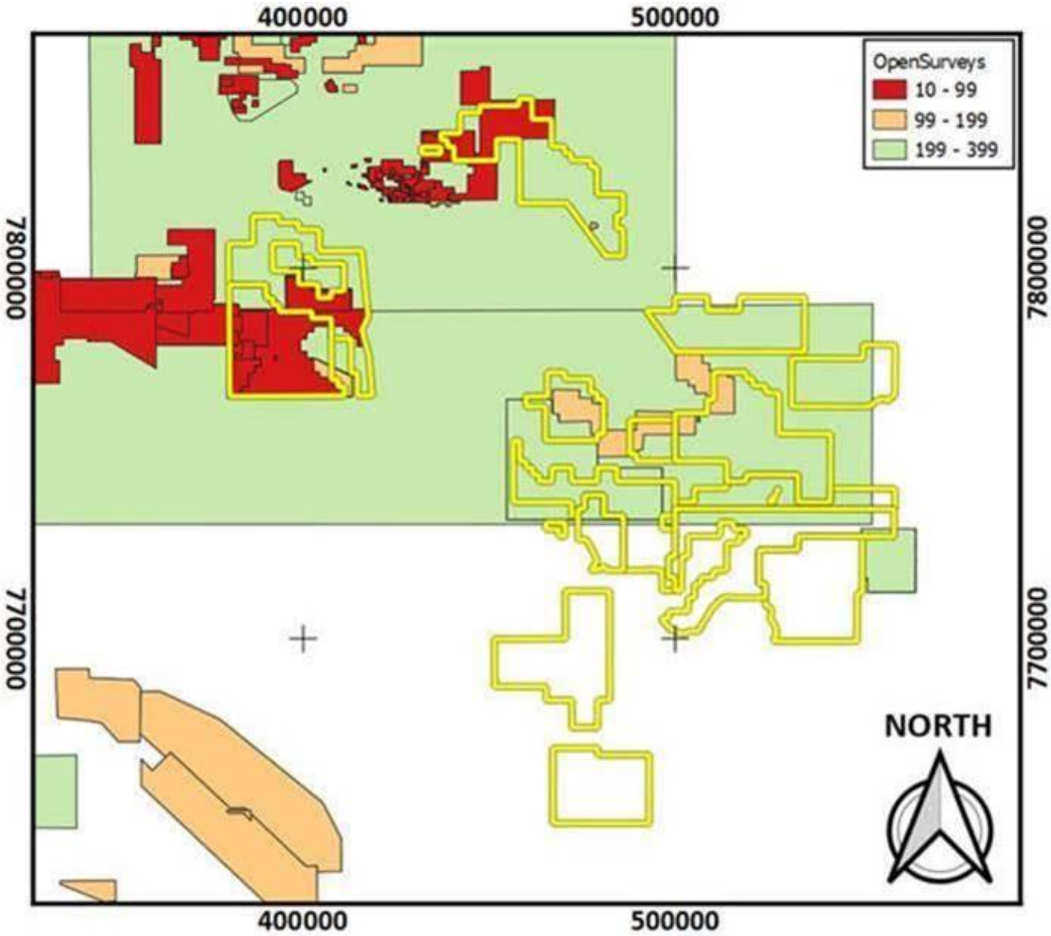


Figure 12 Geophysical Survey Line Spacing in Project Area

The tenement location is outside recently commissioned East Tennant 2km gravity and infill MT surveys, Figure below, with no higher resolution company airborne or ground survey data collected over the tenement.

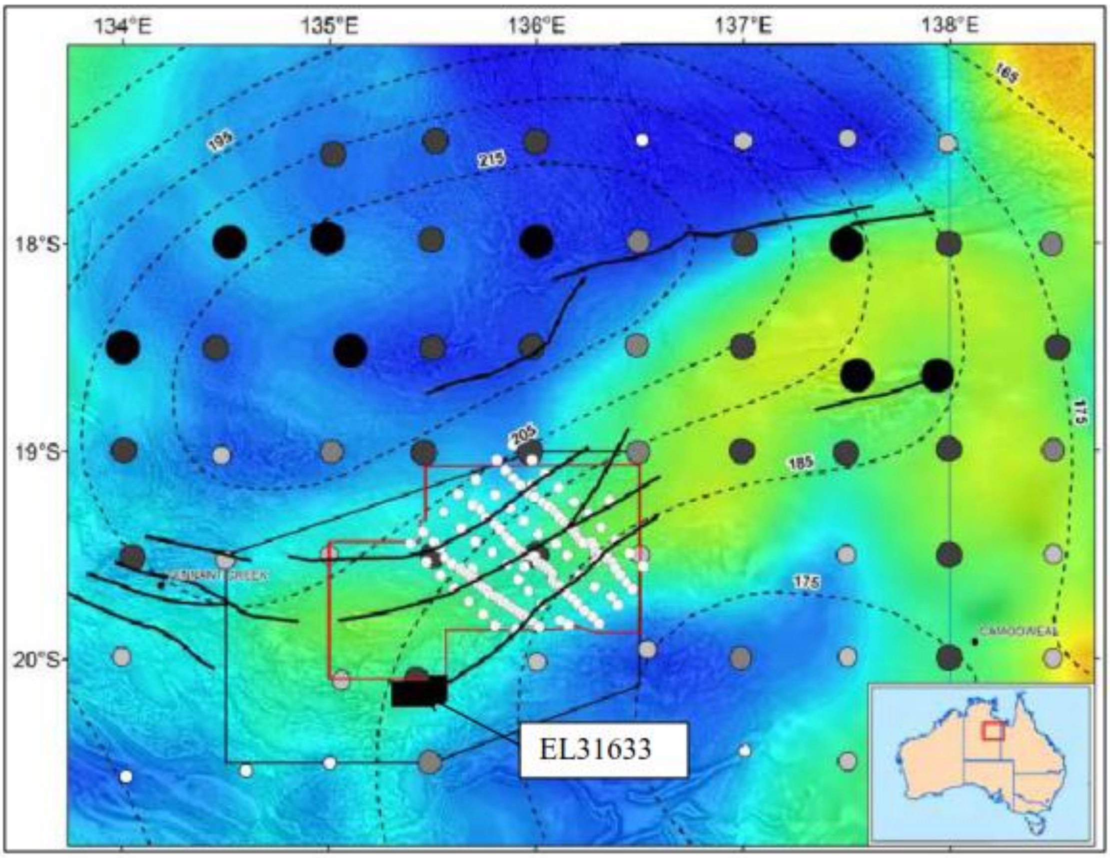


Figure 13 East Tennant Area infill gravity and MT survey locations (Hackney et al, 2020).

Government AusEM 2017-2018 Tempest Airborne EM surveys also cover the tenements and although it is not clear what is indicated by the conductivity highs, they suggest the depth of cover is less than 200m (Figure below).

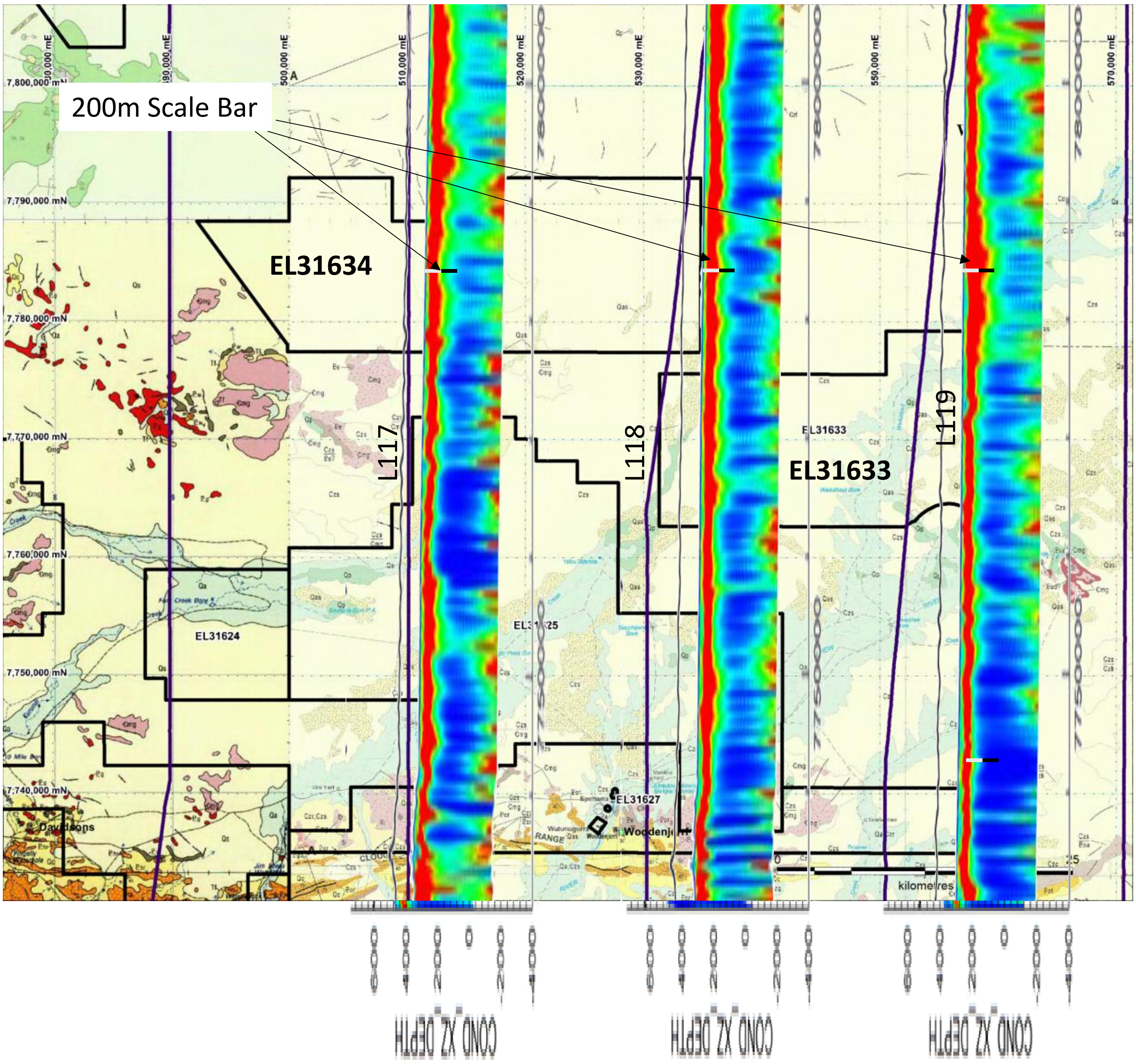


Figure 14 EM Surveys that cross EL31633 and EL31634 interpretation suggest cover depth is less than 200m.

Review of historic water bores in the area showed drilling failed to penetrate cover (figure below):

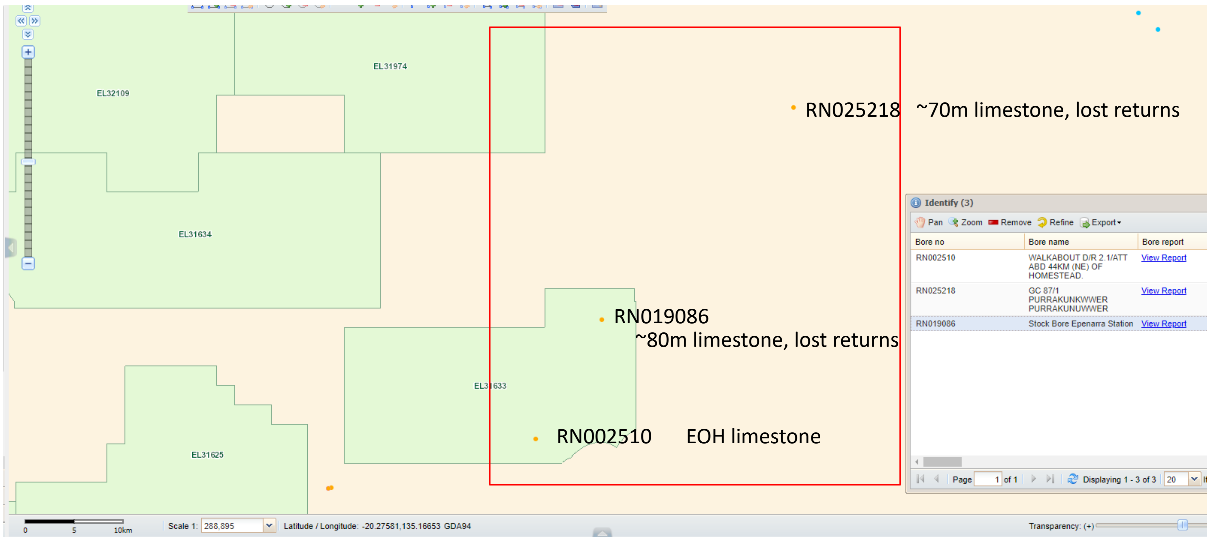


Figure 15 Map showing location of water bores, all ended in Cambrian cover units.

There has been little or no historical exploration over EL31633 with only 4 tenements granted between 2003 and 2013 that partially covered the tenement area. The table below lists the tenements and reports.

Table 1 Historical Reports over EL31633

Title ID	Reports	Link to Report/s	Holder	Grant Date	Cessation Date	Title status	Comments
EL27554	CR2013-0259, CR2012-1194, CR2012-0572, CR2011-1169, CR2010-1052	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL27554	NORTHERN MINERALS LIMITED	12/04/2010	22/03/2013	Historical	No exploration, pegged for Phosphate
EL23778	CR2005-0170	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL23778	ASIAN MINERALS PTY LTD	9/09/2003	19/11/2004	Historical	No exploration, pegged for IOCG
EL26775	CR2013-0001, CR2012-1194, CR2011-1169, CR2010-1052, CR2010-0051	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL26775	NORTHERN MINERALS LIMITED	6/02/2009	8/01/2013	Historical	No exploration, pegged for Phosphate

EL31634 has had 9 tenements granted between 1977 and 2013 (table below). Full exploration review revealed that a small RAB drill programme covered the western most corner of the tenement (EL8272, CR19980261). A single drill hole penetrated the Cambrian cover at 67m depth intersecting what is interpreted to be Warramunga equivalent sediments (Figure below).

Table 2 Historical Reports over EL31634

Title ID	Reports	Link to Report/s	Holder	Grant Date	Cessation Date	Title status
EL8272	CR1998-0570, CR1998-0261, CR1997-0178, CR1997-0033, CR1996-0335, CR1996-0121, CR1995-0131	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL8272	ANDROMEDA METALS LIMITED	15/12/1993	14/12/1999	Historical
EL8920	CR1998-0021	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL8920	ANDROMEDA METALS LIMITED	19/08/1996	30/07/1997	Historical
EL10178	CR2004-0239, CR2003-0012	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL10178	IMAGE RESOURCES NL	23/01/2002	12/01/2004	Historical
EL1184	CR1980-0233, CR1980-0028, CR1979-0062	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL1184	Not Recorded	19/12/1977	28/12/1980	Historical
EL5024	CR1990-0258, CR1989-0277, CR1989-0124, CR1988-0031	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL5024	Not Recorded	16/01/1987	17/01/1990	Historical
EL24887	CR2010-0986, CR2010-0669, CR2010-0437, CR2009-0748, CR2009-0529, CR2008-0380, CR2007-0363	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL24887	CASTILE RESOURCES LTD	08/08/2006	19/11/2010	Historical
EL24258	CR2005-0414	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL24258	RED METAL LIMITED	24/11/2004	21/10/2005	Historical
EL26818	CR2013-0001, CR2012-1194, CR2011-1169, CR2010-1052, CR2010-0052	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL26818	NORTHERN MINERALS LIMITED	06/02/2009	08/01/2013	Historical
EL26775	CR2013-0001, CR2012-1194, CR2011-1169, CR2010-1052, CR2010-0051	https://geoscience.nt.gov.au/gemis/ntgsjspui/simple-search?query=EL26775	NORTHERN MINERALS LIMITED	06/02/2009	08/01/2013	Historical

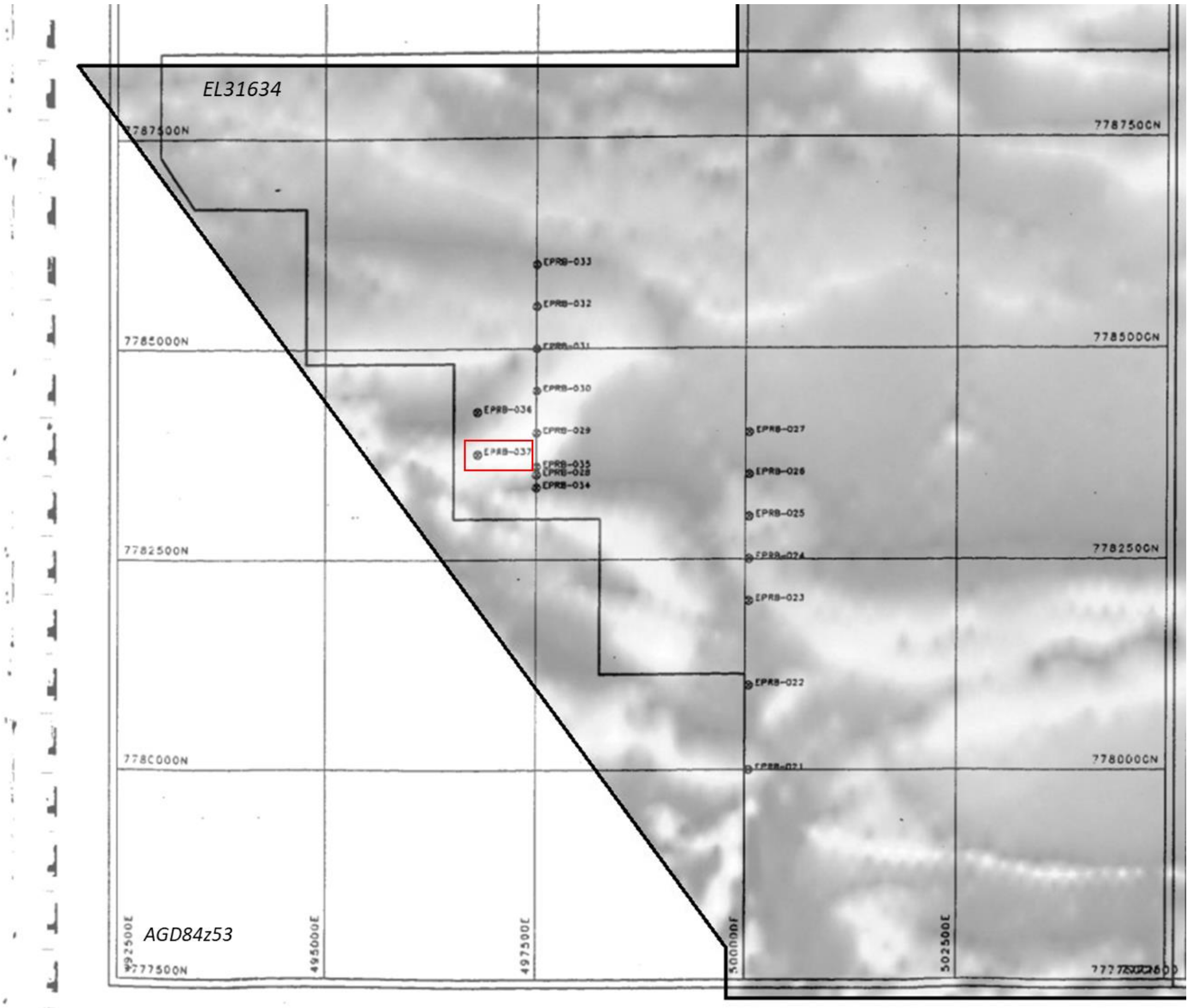


Figure 16 Location of historical drilling western most end of EL31634, to be used for an orientation line for the Tromino Passive Seismic.

5. Exploration Concept

Exploration Model

King River Resources is exploring for IOCG style mineralisation, most likely of the Tennant Creek Style. For this collaboration application exploration is targeting the classic magnetite rich ironstone model.

Traditional exploration methods for Tennant Creek IOCG deposits have targeted coincident magnetic and gravity highs where dense ironstone and magnetite bodies have formed (Figure below) but copper-gold mineralisation may also be associated with hematite bodies with little/no magnetite (a gravity high without a magnetic high). Known deposits such as Nobles Nob, Troy and Marathon (discovered in 1990s) had very weak if no magnetic signature.

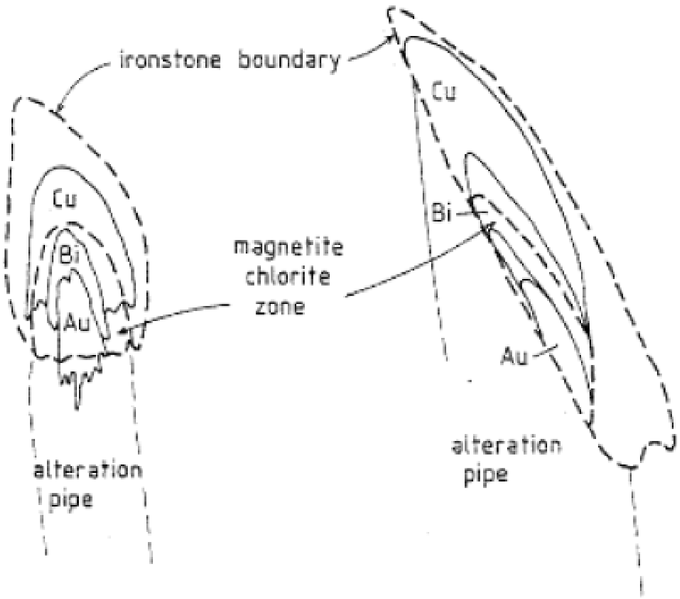


Figure 17 Traditional Tennant Creek Model, metal zonations in Typical Tennant Creek Ironstone (Large 1991).

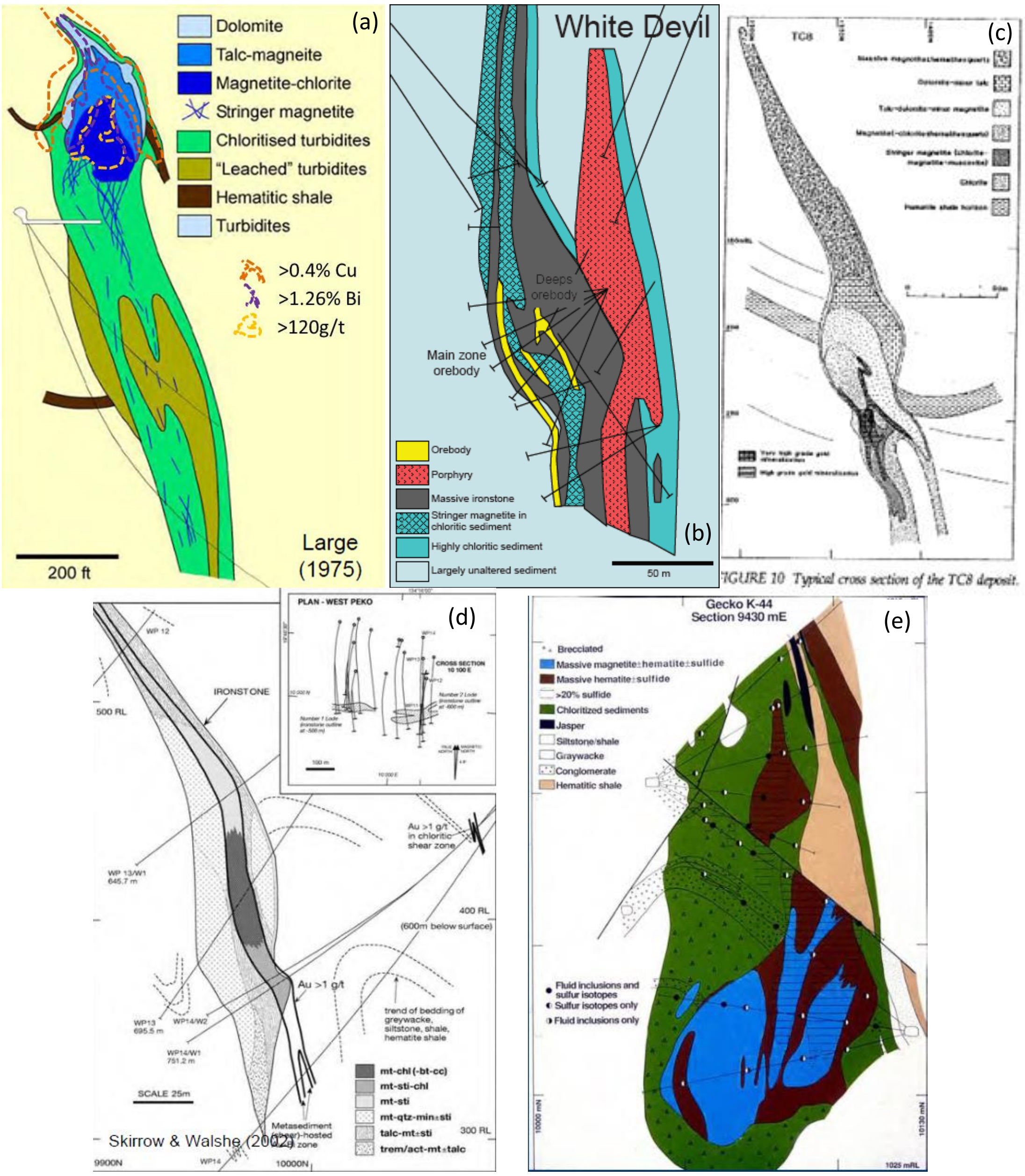


Figure 18 Different Tennant Creek Style IOCG deposits (a) Juno (Hudson et al. 2006), White Devil Deposit Section (Huston et al. 2006), TC8 Deposit Section (Large 1991), Peko Deposit Type Section (Huston et al. 2006), Gecko Type Deposit Cross section (Huston et al. 2006).

Stratigraphically, all the Tennant Creek IOCG deposits are within the Warramunga Formation making it the primary target stratigraphy, however there are indications that potential exists for significant gold mineralisation to be hosted in younger units, evidence includes the younger age of the quartz vein gold mineralisation at Tennant Creek, younger age of Hatches Creek and Kurinelli gold mineralisation, and the theory that the younger Treasure Suite granites are the main mineralising source (Wyborn et al 1998).

Interpretation of magnetic and gravity imagery indicates that EL31633 and EL31634 cover large areas of Warramunga Formation (the stratigraphy that is host to the Tennant Creek Gold Field) adjacent to granite units of the Tennant Creek and Treasure Creek Suites, under cover sediments of the Cambrian Georgina Basin.

The project offers excellent IOCG exploration potential with the following factors:

- The granitic bodies (evident in the magnetics) could have provided energy sources/driving mechanisms for mineralisation and possibly also the source of mineralising fluids.
- The major structures and internal structural complexity of the lensoidal magnetic complex provides excellent fluid flow regimes and trap sites for mineralisation.
- The host stratigraphy is interpreted to be Warrramunga formation or stratigraphically equivalent units.
- The depth of cover is interpreted to be less than 200m which means a discovery would be of drillable and of reasonable economic depths (dependant on discovery size).
- The area is untested

Main Targets

Four strong magnetic anomalies ranging in strike length from 500m to 3km are evident within EL31633 and are considered prospective IOCG targets for follow up work, see - Figure below.

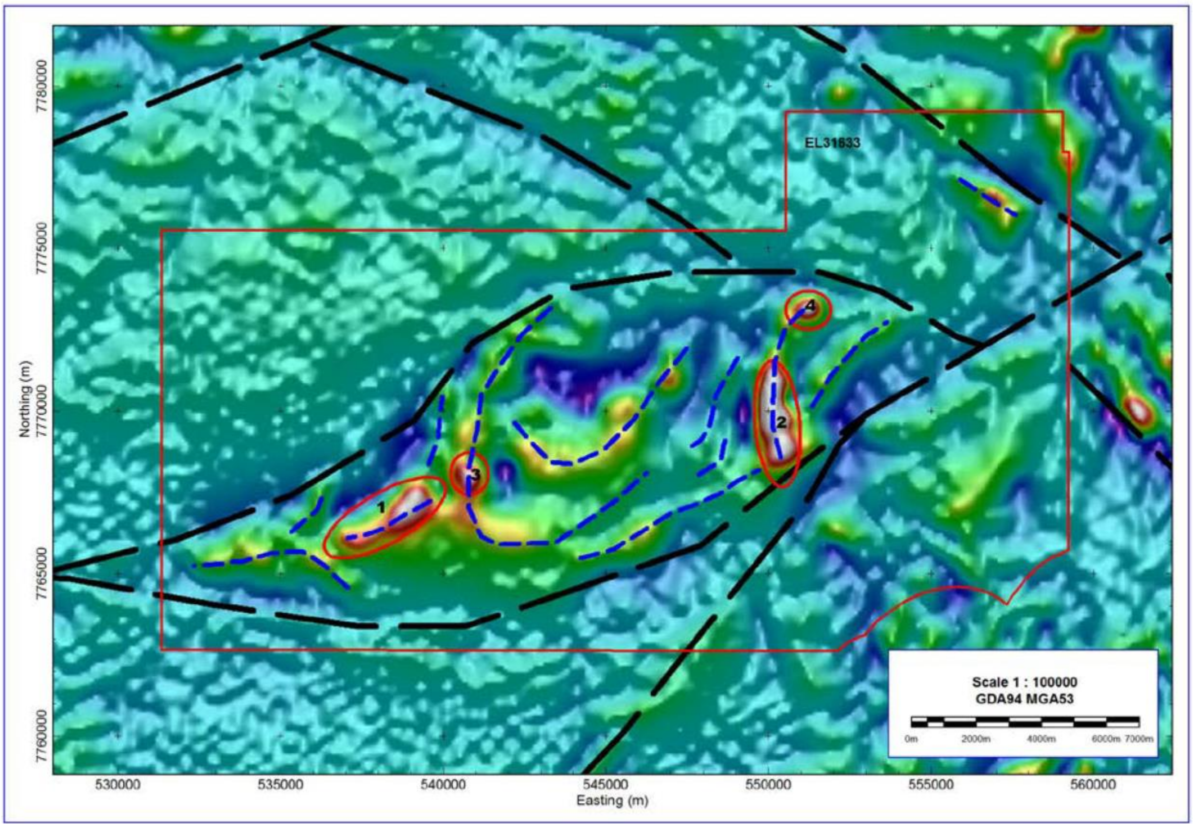


Figure 19 Total Magnetic Intensity 1st VD image with interpreted major structures and magnetic anomalies of interest

The magnetic amplitudes and estimated depth to basement for each are summarised in the Table below. The magnetic amplitudes correspond to published values for IOCG deposits such as Carapateena of 200-300nT (Vella, 2007).

Table 3 Target anomaly dimensions.

Anomaly	Magnetic Amplitude	Length	Width	Depth*
1	275nT	2.75km	600m	300-500m
2	300nT	3km	600m	300-500m
3	250nT	500m	500m	250-400m
4	200nT	500m	500m	250-400m

**The depth has been estimated from the rule of thumb method "half width of peak at half of the amplitude". A more accurate depth estimate would be achieved through profile modelling, however this has not been undertaken here.*

Rationale

King River Resources proposed a combined geophysical approach in preparation for drill testing of the magnetic bodies with detailed airborne magnetics and a ground passive seismic survey.

The goal of the proposed programme was to assess:

- The depth of Cambrian cover over the two +30km magnetic bodies (interpreted to be Warramunga formation rocks).
- The nature of the strongest magnetic highs within the lensoidal complex in EL31633.

As there has been no IOCG exploration over this tenement other than the historic air magnetic surveys in 1999 it is reasonable to initially target the more magnetite rich bodies of the tenant Creek style IOCG deposits. Tennant Creek IOCG deposits are relatively small bodies and the most effective exploration method for such targets over such a large area is a detailed airborne magnetic survey.

It can be demonstrated that even at 200m line spacing the main magnetite rich Tennant Creek ironstone bodies are identifiable in airborne magnetics (figure below), however structural details, peaks of response and smaller deposits are subdued or not visible making prioritisation of targets ineffective at 200m resolution. Also, positionally the targets are not drillable at 200m line spacing as the modelled body can significantly move (as much as 150m in the case from 200 to 100m spacing) as more detailed surveys are completed.

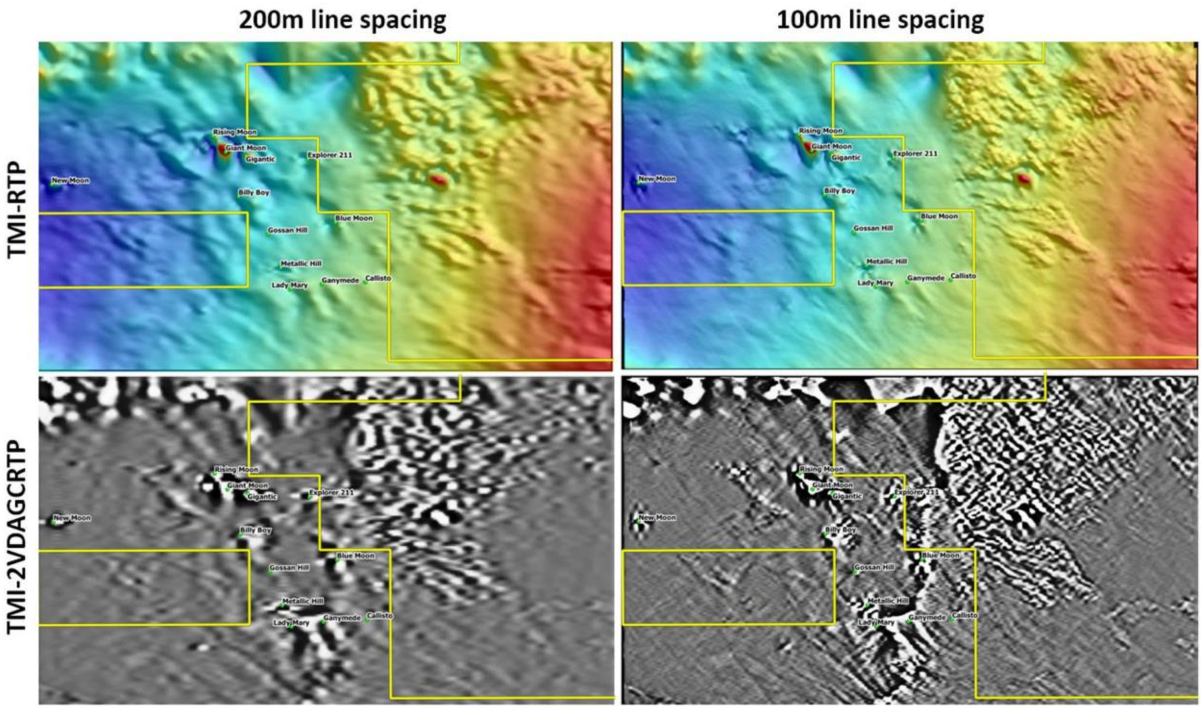


Figure 20 Reduction of airmag data from 100m to 200m lines pacing over the Tennant Creek Lonestar Area..

Given the expected and unknown depth of cover (which would supress geophysical details required for effective targeting), the small nature of the targets, the large untested area (+20km strike length) and the reliance on the interpretation that the magnetic bodies are Palaeo- Proterozoic Warramunga equivalent rock sequences then a combined geophysical approach including a Tromino Survey (to test Cambrian cover depth) and detailed 100m magnetic survey (to identify/characterise and locate magnetic bodies) is warranted prior to drill testing.

The programme was designed to help identify a new area of Warramunga equivalent rocks previously untested and to better delineate the eastern extension of major NNE structures clearly evident where cover is absent to the west. Also to allow comparison of geophysical methods of evaluating depth of Cambrian cover using Tempest EM, passive seismic and magnetics. This knowledge can then be applied to other KRR tenements such as EL31619, EL31623 and EL36124 which are also in the Tennant East Area as well as EL31617/18 east of Rover.

6. Program Details

The proposed collaboration application was for geophysical work in preparation for and to allow the effective drill testing of the interpreted Palaeo-Proterozoic rocks beneath Cambrian cover sequences over EL31633 and EL31634.

The programme included a Tromino Passive Seismic Survey (over EL31633 and EL31634) and a regional scale, detailed, airborne magnetic survey (over EL31633).

- Detailed airborne magnetic survey over the whole of EL31633 (100m line spacing, 30m survey height). 4,336 line km
- Passive Seismic survey over EL31633 and EL31634 to assist in evaluating the depth of Cambrian cover (10-20km line spacing, 500m stations) 170 stations (182 total but some removed due to noise).

Details of each survey are given below, and maps/data are provided in Appendix B and C:

Airborne Magnetics Survey:

Acquisition of high resolution airborne magnetic, radiometric and DEM data was carried out using a fixed-wing platform (eg. Cessna 210 or similar). The aircraft was fitted with a tail mounted ‘stinger’, housing a Caesium vapour magnetometer (Geometrics GR823), and 2x RSX-4 gamma-ray spectrometer detector packs (32L) was housed in the aircraft (details attached in Appendix A).

The magnetic data was corrected for diurnal magnetic variations by acquiring magnetic data at a base station near the survey area using a Geometrics G-856 base station magnetometer. Radar and laser altimeters are also fixed on the aircraft

Details below and flight lines in Figure 21.

- Airborne magnetic, radiometric and DEM using a fixed wing platform.
- Line spacing: 100m
- Tie-line spacing: 1,000m
- Bearing: 150/330
- Flying height: 30m
- Total line km: 4,336 km

Figure 21 Map showing flight lines over satellite imagery (flight lines faint NW trending, tie lines bold NE trending)

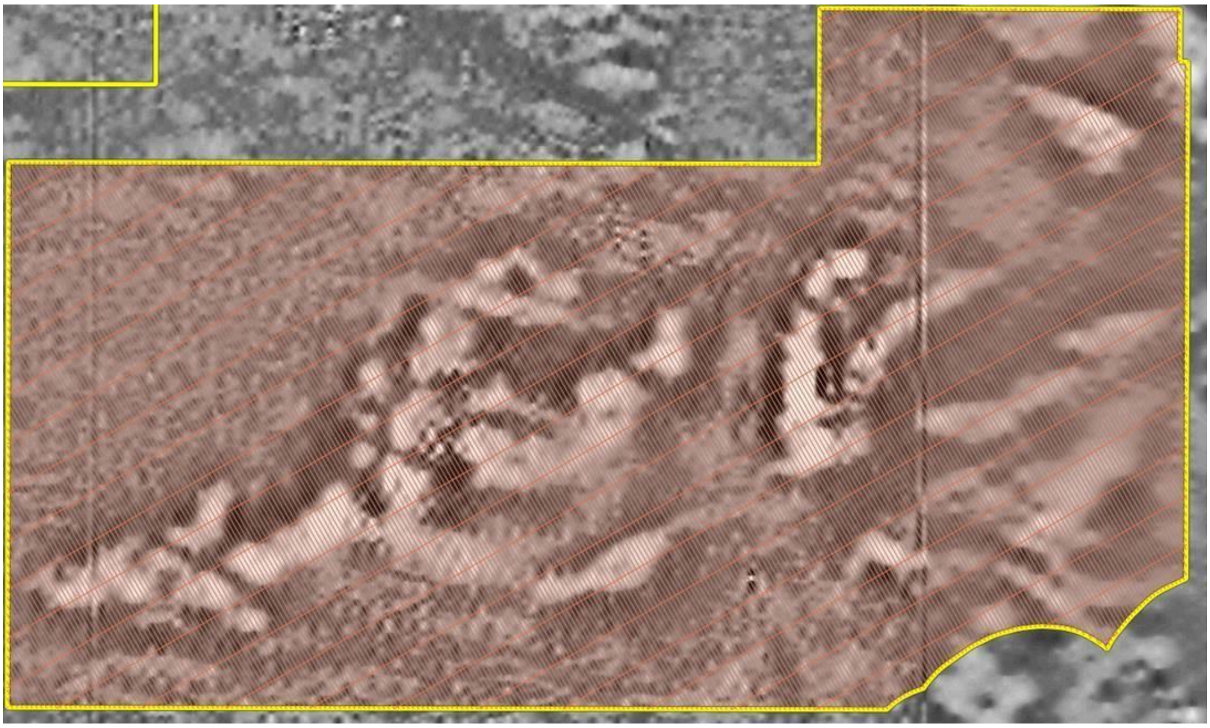


Figure 22 Map showing flight lines over magnetics (flight lines faint NW trending, tie lines bold NE trending)

Passive Seismic Survey

- Ground based acquisition of passive seismic HVSR data using Tromino seismometer units.
- Line spacing: ~10-20km
- Tie-line spacing: NA

- Station spacing: 500m
- Bearing: Roughly N-S
- Total number of stations: 170 (182 taken but some not used due to noise) for 82.5 survey line km.

Acquisition of passive seismic data was carried out between the 25th of November to the 2nd of December 2020 using 4x Tromino TEB seismometers hired from Resource Potentials Pty Ltd (ResPot). and on completion of the survey carried out final data processing and depth conversion on all passive seismic data to generate normalised and raw HVSR amplitude-depth cross sections.

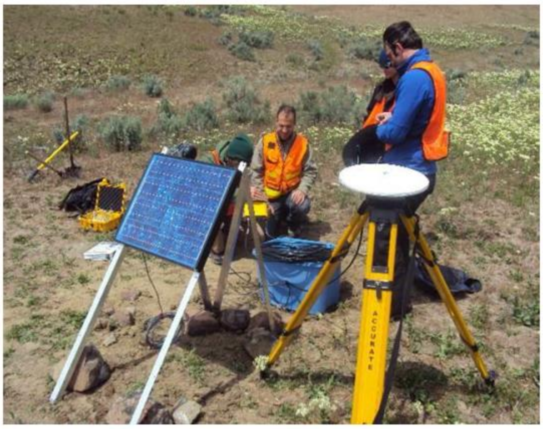
A total of 170 HVSR stations were acquired along 5x irregular spaced survey lines using a nominal along line station spacing of 500m, for a total of 82.5 survey line kilometers (see figure to the right).

The passive seismic survey data were acquired using 4x Tromino® TEB seismometers, and the seismometer technical specifications and processing details are included in Appendix B. Passive seismic HVSR time series data files, GPS locations and field notes were provided to ResPot via email. ResPot staff downloaded and then manually assessed station locations, data quality, noise levels and stuck vibration receiver components. The peak frequency HVSR response and manual removal of noisy time window recordings were then computed on a station-by-station basis.

Passive seismic surveying is a near-surface geophysical survey method which can be used to rapidly and cheaply define thickness of regolith and / or sedimentary deposit cover sitting above lithified sedimentary deposits or hard crystalline bedrock as “acoustic bedrock” corresponding to the saprock or fresh rock boundary, where this boundary can be between 2m to 700m deep depending on geological setting (Riley et al. 2019).

Passive seismic is the measurement of natural or ambient seismic vibrations that exists everywhere and are sourced from far-field crustal microtremors, wind, ocean waves, manmade sources, etc. Measuring surface waves, which are considered noise (‘ground-roll’) in conventional seismic reflection surveys, but for the passive seismic technique this is signal (Riley et al. 2019).

The passive seismic surveys are not new but the application using a small hand held unit is a relatively new innovative approach (case study - Figure 24).



1 seismometer station set up as part of a passive seismic array survey recording for hours
Image reproduced from Earth.boisestate.edu

Miniaturised Tromino® seismometer set up for a single passive seismic HVSR station recording for 20 minutes

Figure 23 Previous way of measuring passive seismic vs Tromino equipment (Riley 2019)

The Tromino line orientation was planned approximately oblique to the basin margin. Line spacing is broad as variation is expected to be very slight on a basin scale (Figure 25).

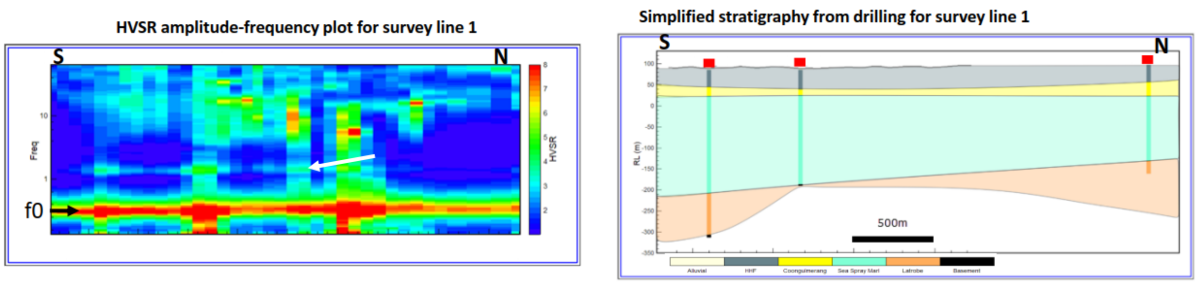


Figure 24 Tromino section versus drilling section for cover over 500m thick (Gippsland Basin) – Riley 2019.

It is possible that the passive seismic surveys may pick up denser bodies and King River Resources tested this concept over a known ironstone body at its Commitment Prospect near Tennant Creek prior to the Collaboration survey.

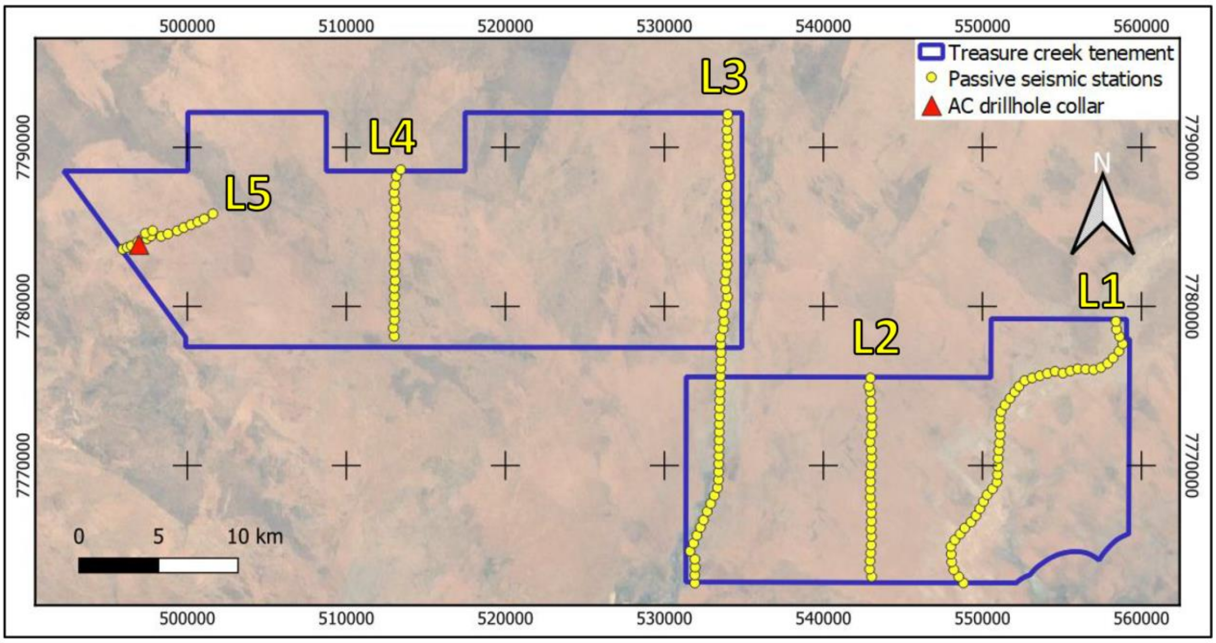


Figure 25 Tromino Stations over satellite imagery

The western most line on EL31634 was an orientation line over an area where a single drill hole of a historic drill programme (EL8272, CR19980261) penetrated the Cambrian cover at 67m depth (Figure 16) to provide a known depth to assist with interpretation and analysis of the survey data.

7. Results and Interpretations

All data, images and method/survey reports are included in Appendix A for the airborne magnetic survey and Appendix B for the passive seismic survey.

Airborne Magnetics

The detailed airborne magnetics have provided excellent resolution of the area. The Work has much more clearly defined the contrast of the main magnetic body (lensoidal complex ~20km strike) and the surrounding granites and internal positions and structures to this higher magnetic zone.

Interpretation is still that the large higher magnetic zone is a raft of Warramunga Formation equivalent units surrounded by granite. It is hoped that some of these magnetic high zones are influenced by ironstone/IOCG bodies.

Comparison of the pre-100m survey images of magnetic bodies versus images of the new data can be seen in the figures below. The nature and positions of the targets identified in the application document (Figure 26) are much more defined and details within higher zones are now evident (Figure 27-32).

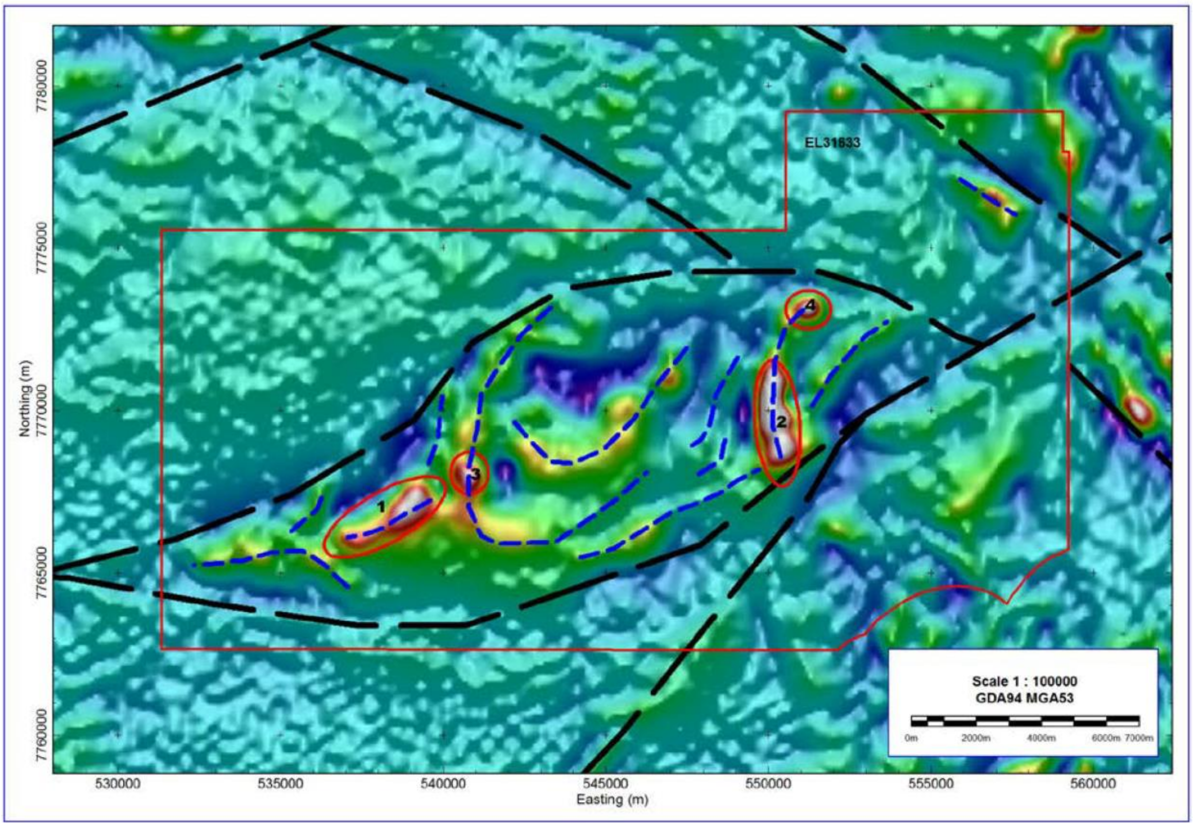


Figure 26 Pre 2020 200m line spaced data Total Magnetic Intensity 1st VD image with interpreted major structures and magnetic anomalies of interest

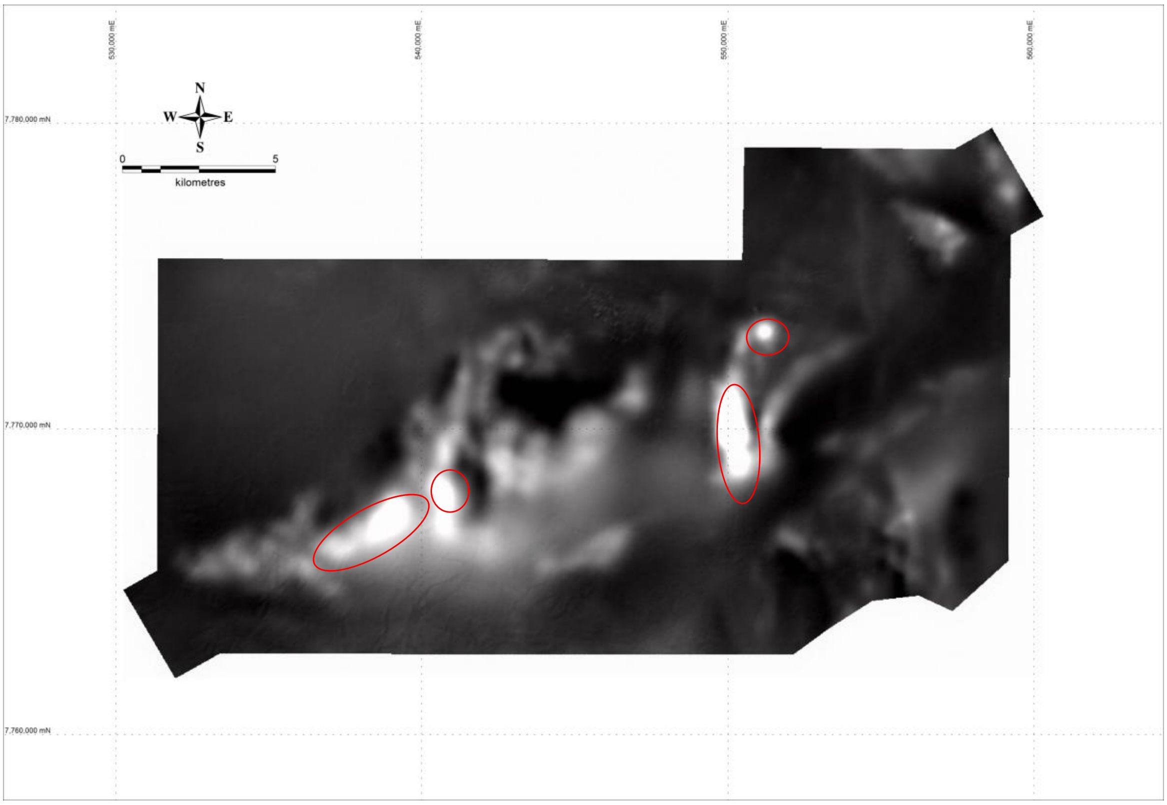


Figure 27 Total Magnetic Intensity 1st VD, 2021 survey.

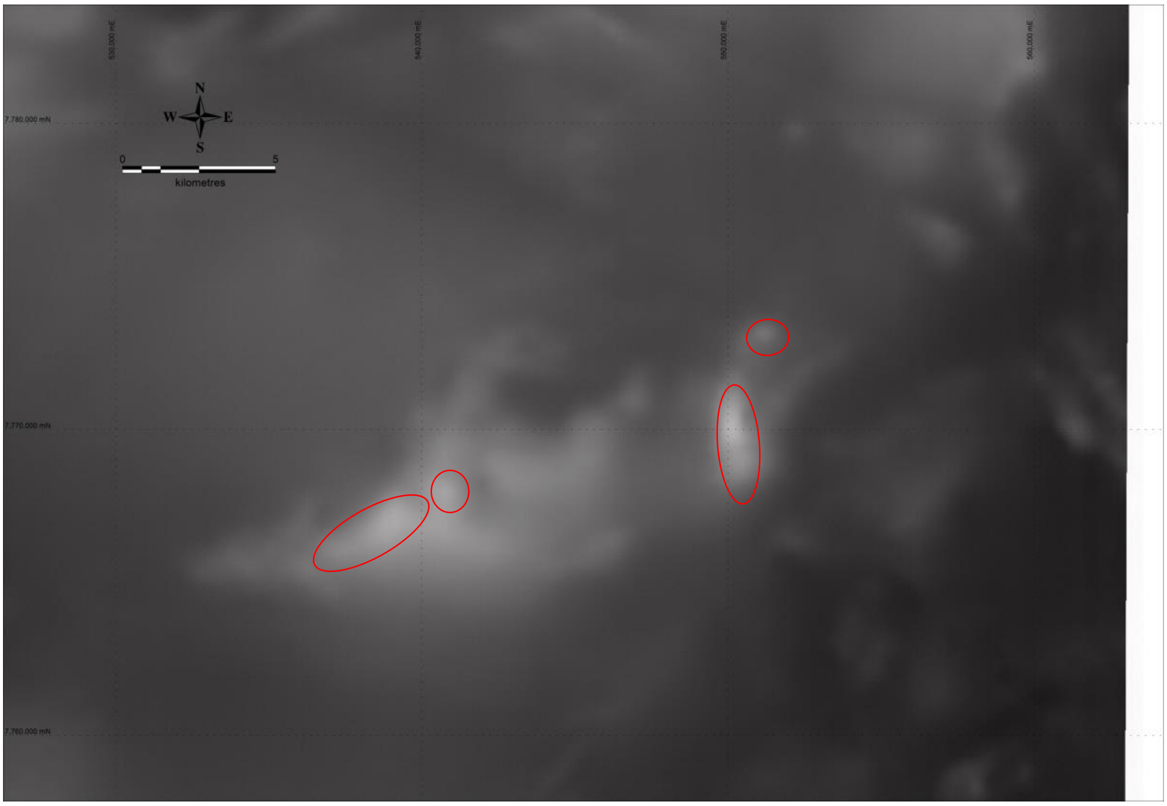


Figure 28 Total Magnetic Intensity 1st VD image prior to 2021 survey.

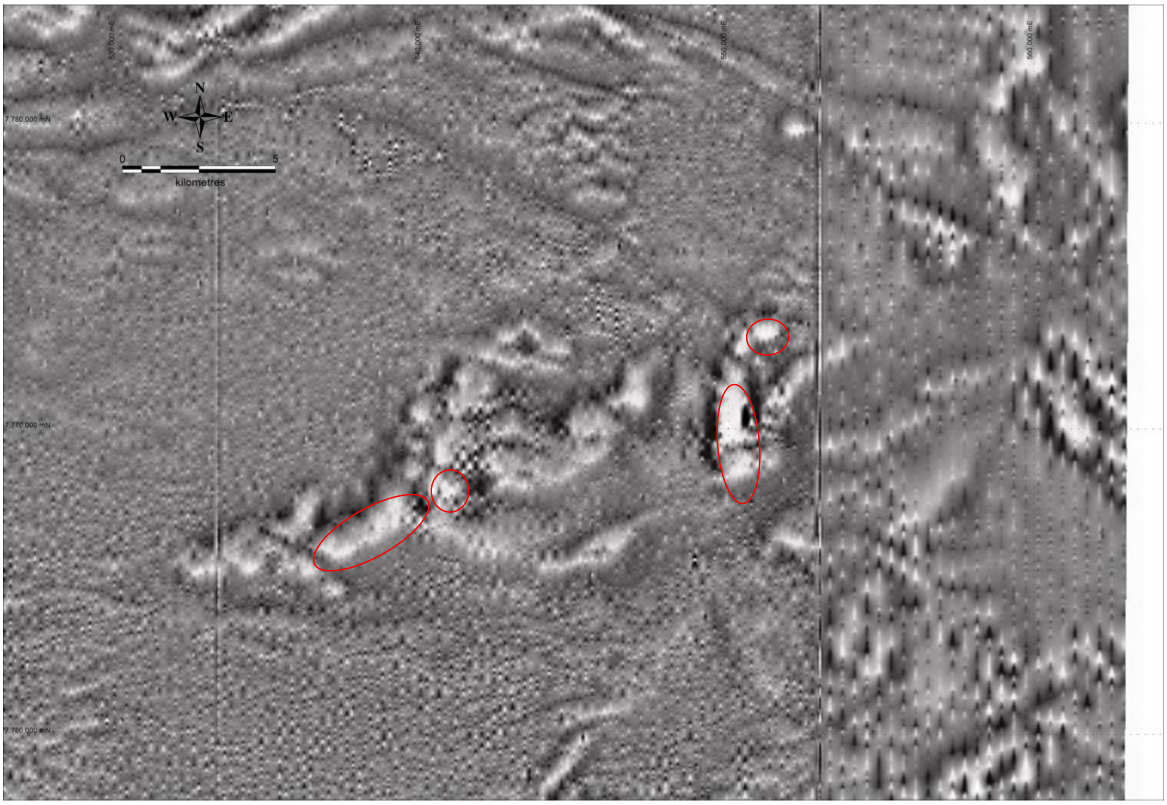


Figure 29 Total Magnetic Intensity 2nd^t VD image prior to 2021 survey

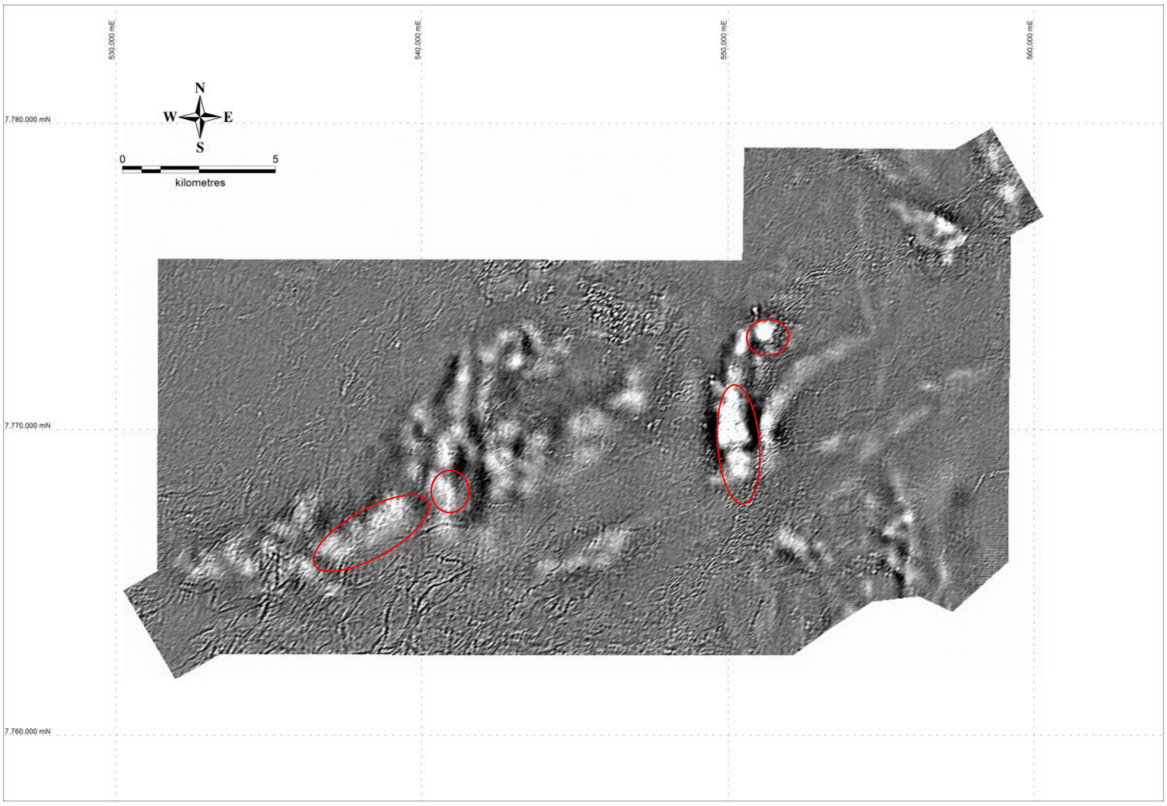


Figure 30 Total Magnetic Intensity 2nd^t VD image 2021 survey

The image below shows a closer view of target areas 2 and 4. With the new spacing there is a lot more detail and definition to the shapes and smaller anomalies of 100-200m become evident that were not seen at the previous spacing. This is important given the typical small size of Tennant Creek style IOCG's.

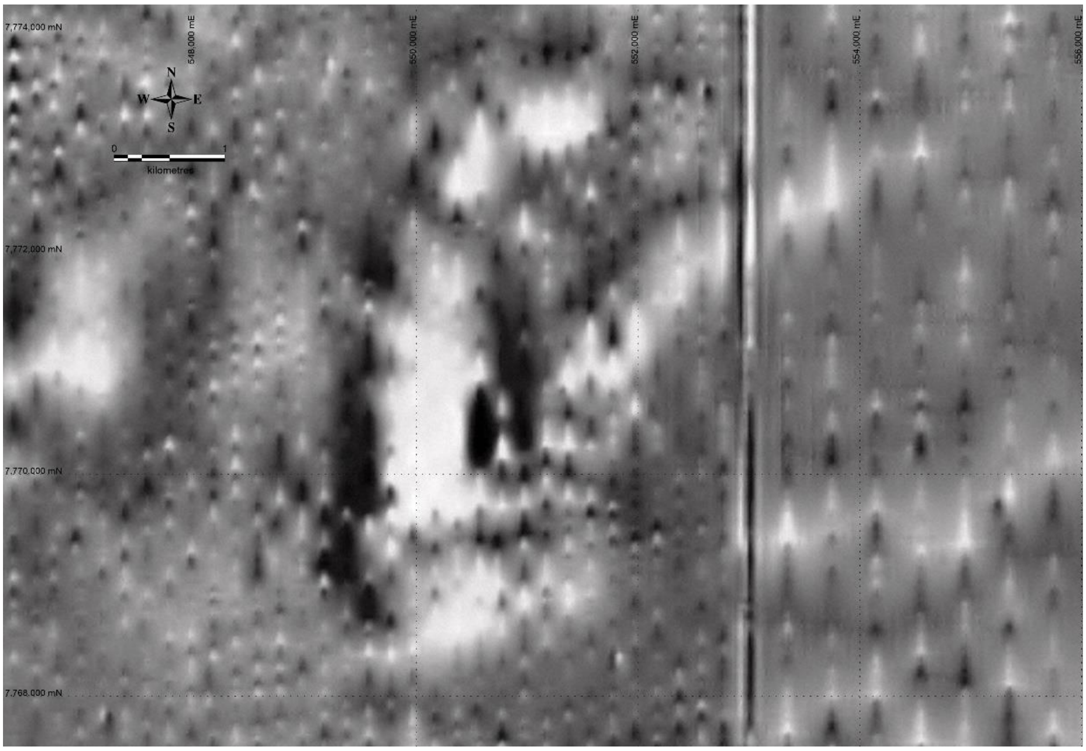


Figure 31 Total Magnetic Intensity 2nd[t] VD image close up of anomaly 2 and 4 – prior to 2020 survey

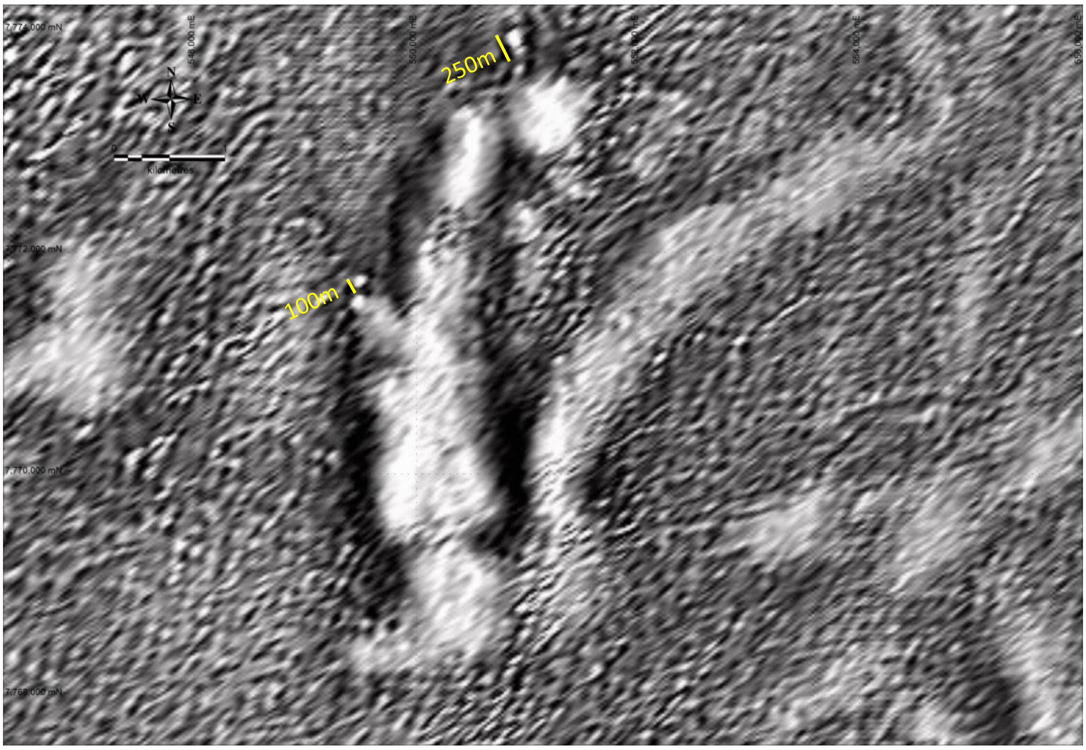


Figure 32 Total Magnetic Intensity 2nd[t] VD image close up of anomaly 2 and 4 – 2020 survey

Passive Seismic

Overall, the passive seismic work appears to have provided an excellent model for the base of Cambrian cover. Estimated depths range from 80 to 150m with depths varying possibly due to palaeo-topography and faulting. Below is a discussion of the results from the Respot Report (Appendix B)

The figure below shows the normalised HVSR cross-section for passive seismic survey line 05, overlaid by traces from the two historic drillholes (ERPB-037 and ERPB-029) along the survey line. The drillhole lithology is coloured to show transported cover in yellow and weathered regolith cover in orange. The blue coloured section at the base of drillhole EPRB-037 is a siltstone unit of the Warramunga Formation. Drillhole ERPB-029 ended at 71m downhole (vertical hole) but did not intersect the Warramunga Formation. Areas of high acoustic impedance contrast are represented by hot colours and areas of little to no acoustic impedance contrasts are represented by cool colours. The interpreted bedrock topography is highlighted by a sub-horizontal dashed black line.

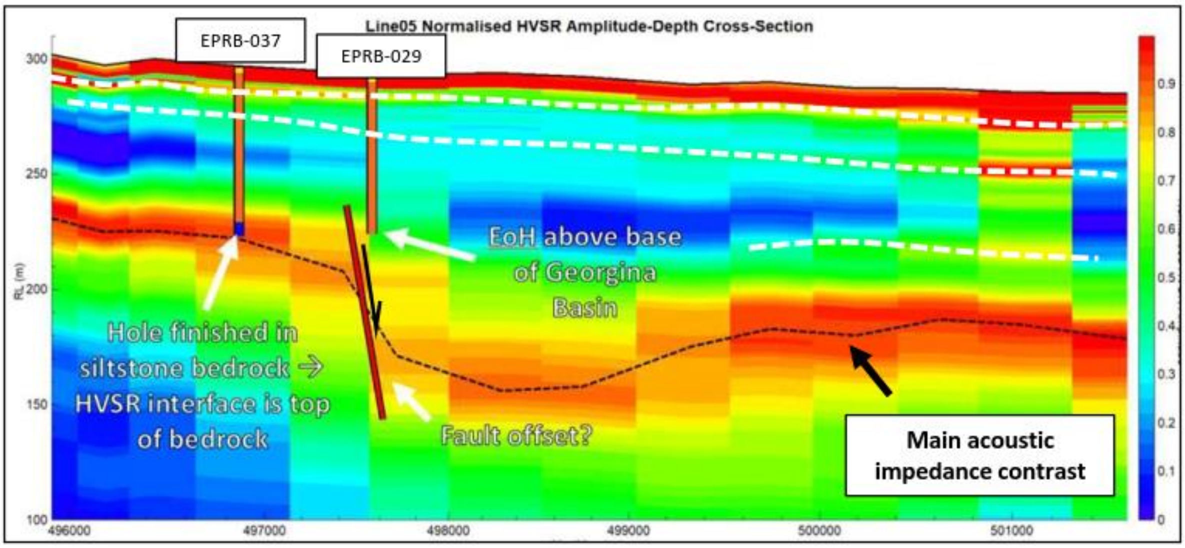


Figure 33 Passive Seismic - Line 5 - Normalised HVSR Amplitude-Depth Cross Section with historic holes

The normalised HVSR cross section for line 05 has resolved shallow acoustic bedrock at a depth of around 70m on the southwestern end of the line (left), which agrees with the drilled depth to Warramunga Formation in EPRB-037. HVSR stations acquired in close proximity to drillhole EPRB-029 resolved a vertical offset of the acoustic bedrock of approximately 75m and this is interpreted as a fault. According to the HVSR survey data, drillhole EPRB-029 might have needed to be extended to 150m downhole to intersected Warramunga Formation bedrock. Subtle HVSR responses above the main acoustic impedance contrast layer (dashed white profiles) could be associated with layering within the overlying weathered regolith cover.

HVSR survey line 03 was the longest traverse carried out in this survey program (29.5 km) and the normalised HVSR cross-section for this line is shown to the bottom right of the page. The HVSR survey data along this line has resolved a saw-tooth pattern acoustic bedrock interface, and this pattern is likely related to a series of faults (figure below).

There are some concerns over data quality issues at some stations (see report Appendix B) this could be noise due to wind during surveying.

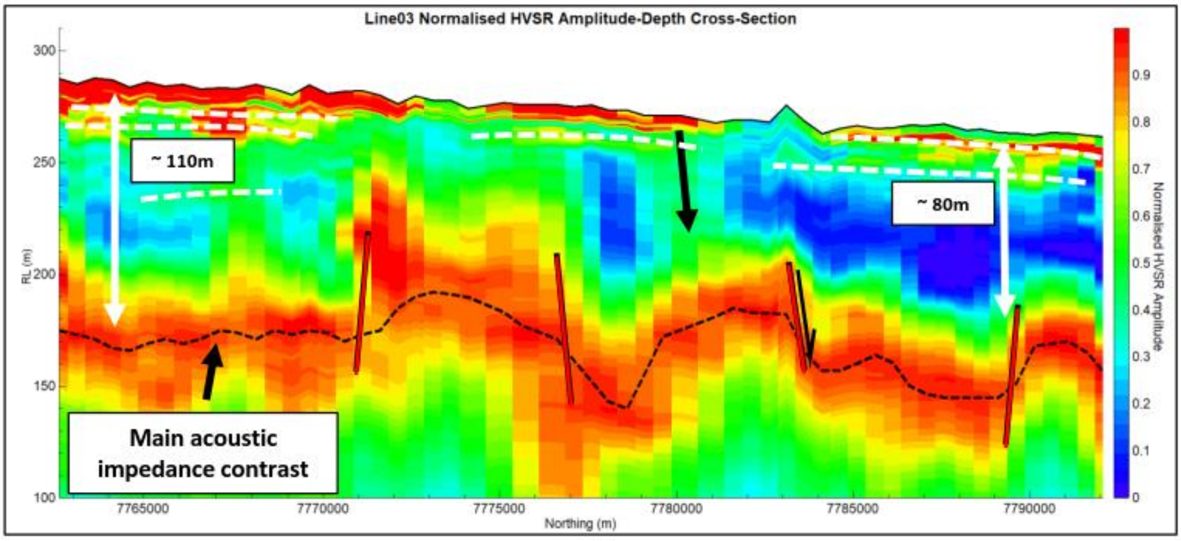


Figure 34 Passive Seismic - Line 3 - Normalised HVSR Amplitude-Depth Cross Section with depth estimation. Interpreted faults shown as red lines.

The figure below shows the depth to 'basement' for the individual passive seismic stations.

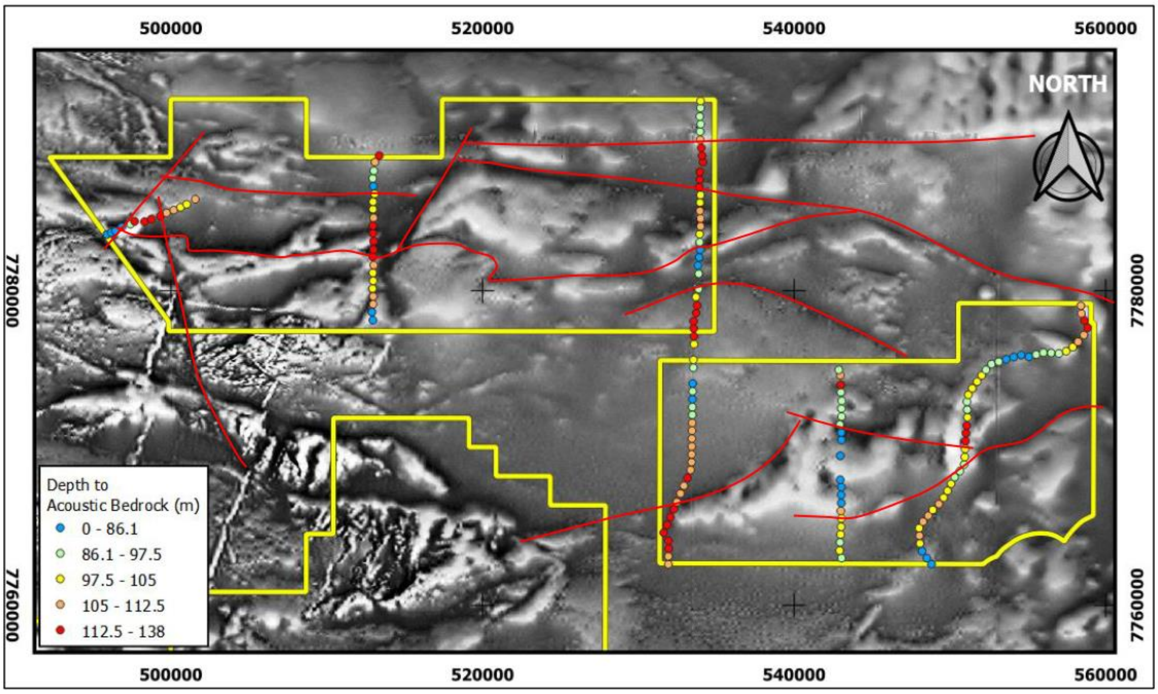


Figure 35 Total Magnetic Intensity 1st VD image with interpreted major structures and depth to acoustic bedrock estimates for each passive seismic station.

All the normalised sections produced by Respot are shown below:

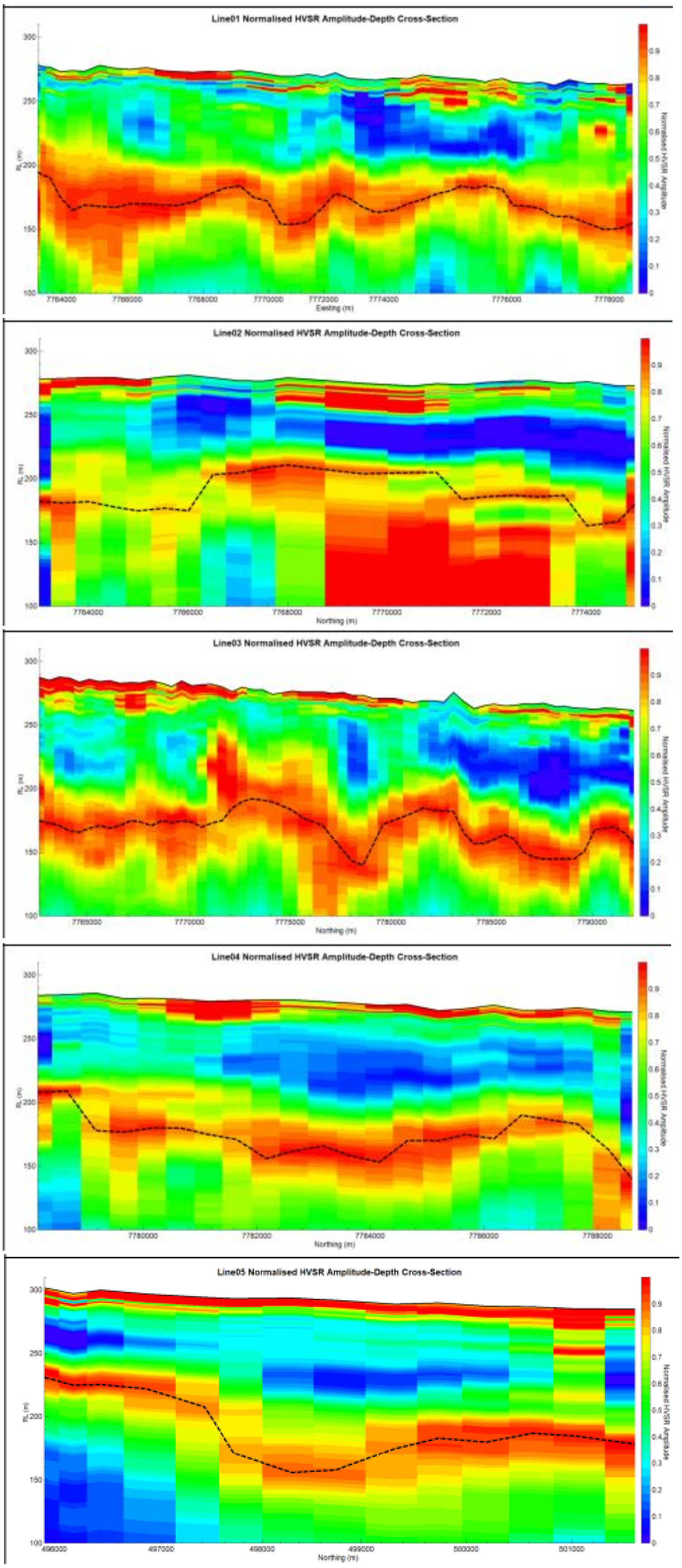


Figure 36 Normalised HVSR Amplitude-Depth Cross Section with depth estimation for lines 1 to 5.

Comparison with other geophysical depth estimations

Figure 35 above shows faults interpreted by using both the passive seismic and the magnetic data where drops in basement are shown by the passive seismic lines matching linear features in the magnetics.

Respot compared the depth to acoustic bedrock to the depth to magnetic bedrock after carrying out Euler deconvolution processing. The figure below compares the HVSR defined depth to acoustic bedrock as coloured dots over the coloured image which is depth to magnetic bedrock. Both show deeper bedrock as hot colours.

There are some areas where both datasets agree well (e.g. western and eastern most lines), but in other places relative acoustic and magnetic bedrock depth is counter-intuitive. Further work is required to understand these differences.

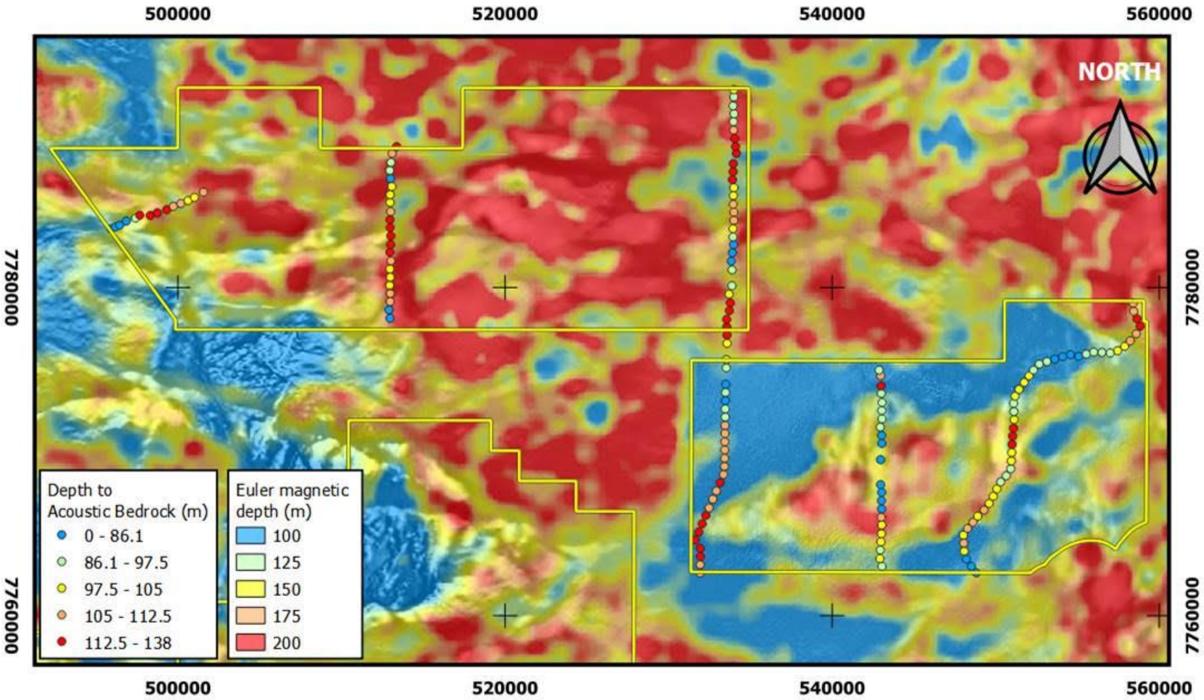


Figure 37 Euler magnetic depth estimation image with depth to acoustic bedrock estimates for each passive seismic station.

Comparison with the Government AusEM 2017-2018 Tempest Airborne EM sections show good correlation as well. The figures below show EM lines 117 and 118 compared to Line 4 and 3 respectively (see Figure 14 in section 4 for EM section locations). There is a high conductivity layer between 50 and 200m depth in both EM sections which could, in this case, be interpreted as Cambrian cover units. Although the resolution of the EM section images is for broader scale usage the two methods seem to be producing similar results. Reprocessing the EM sections on a more local scale would produce better results/comparisons.

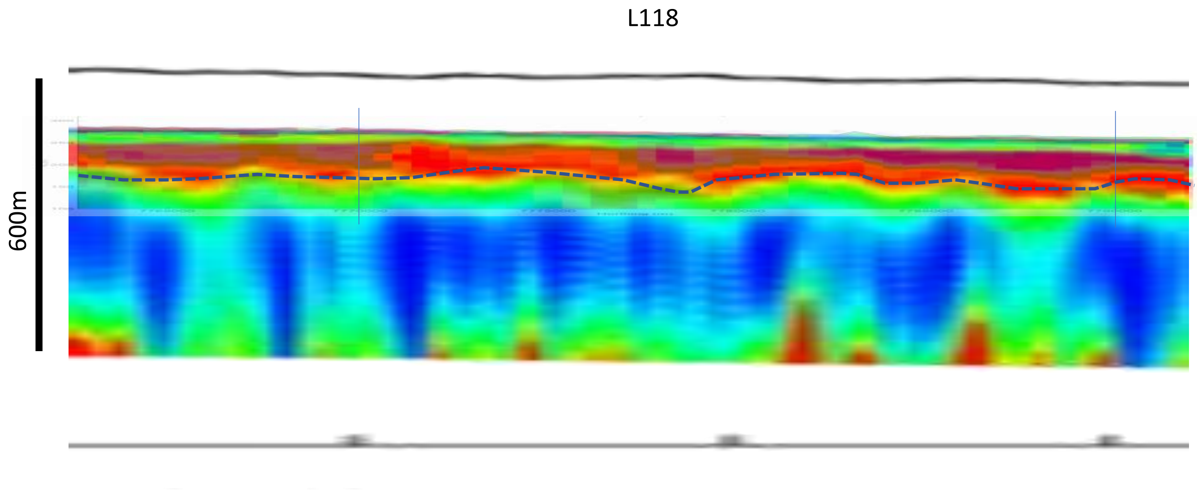


Figure 38 Passive Seismic Line 3 over AusEM (2018) conductivity section L118, dashed line is the acoustic impedance contrast interface – Interpreted cover/basement contact

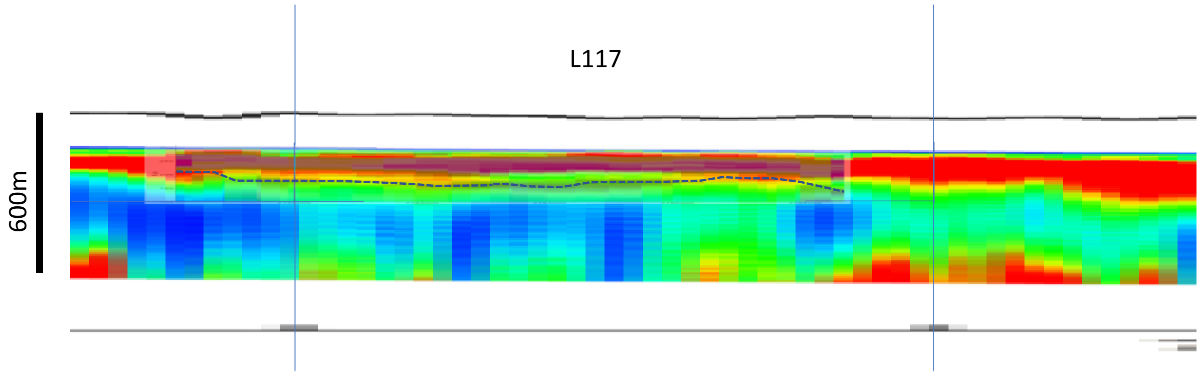


Figure 39 Passive Seismic Line 4 over AusEM (2018) conductivity section L117, dashed line is the acoustic impedance contrast interface – Interpreted cover/basement contact

8. Conclusion

The airborne magnetic and passive seismic surveys have assisted with:

- Regional geological understanding of the area – more understanding of the depth and nature of the Cambrian cover and basement contact.
- Understanding methodologies for estimating Cambrian cover depth.
- King River Resources exploration/target prioritising on EL31633/31634 and our surrounding tenements.

The passive seismic has so far confirmed expectations that the Cambrian cover in over EL31633 and EL31634 is in the range of 70-150m depth over the lensoidal magnetic complex. The detailed magnetics have confirmed and defined targets for prioritisation and further exploration.

It is likely that the number of survey stations along the survey lines could be reduced if only a general cover depth was needed to be estimated, more would be required if trying to identify faults with vertical offsets.

It should be noted however that information from only one RC hole has been used for 'calibrating' the processing of the passive seismic data. This hole is on the western side of EL31334 and that there are no other physical confirmations of depths so far.

Interpreted depth of cover estimates from the government AusEM 2017-2018 tempest EM conductivity sections are overall similar to the depth estimates given by the passive seismic work which gives more confidence. Also, the magnetic depth estimations also give similar depth ranges overall but seem to be overestimating and varying more. Passive seismic surveys are a cheap and easy alternative to other more expensive and intensive methods of estimating basin depth.

9. References

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10. Appendices

Appendix A – Airborne Magnetic Survey Data and Reports

AppendixA_Magnetic\Data_From_Contractor\

- *ResPot_Filters_and_FileNaming_Convention_TennCreek_2020-12.pdf*
- *1195_Barkly.rar*
- *1195_Barkly_Report.pdf*

AppendixA_Magnetic\Images\Magnetics\

- *Multiple images*

AppendixA_Magnetic\Images\Radiometrics\

- *Multiple images*

Appendix B – Passive Seismic Data and Reports

AppendixB_PassiveSeismic\

- *ResPot_TreasureCreek_TC_HVSR_Feb2021.pdf*

AppendixB_PassiveSeismic\Data

- *Data for passive seismic survey – raw/processed.*

AppendixB_PassiveSeismic\GIS\

- GIS and Image files for passive seismic