Warramunga Province mineral deposit series: Explorer 142 3D compilation and deposit atlas

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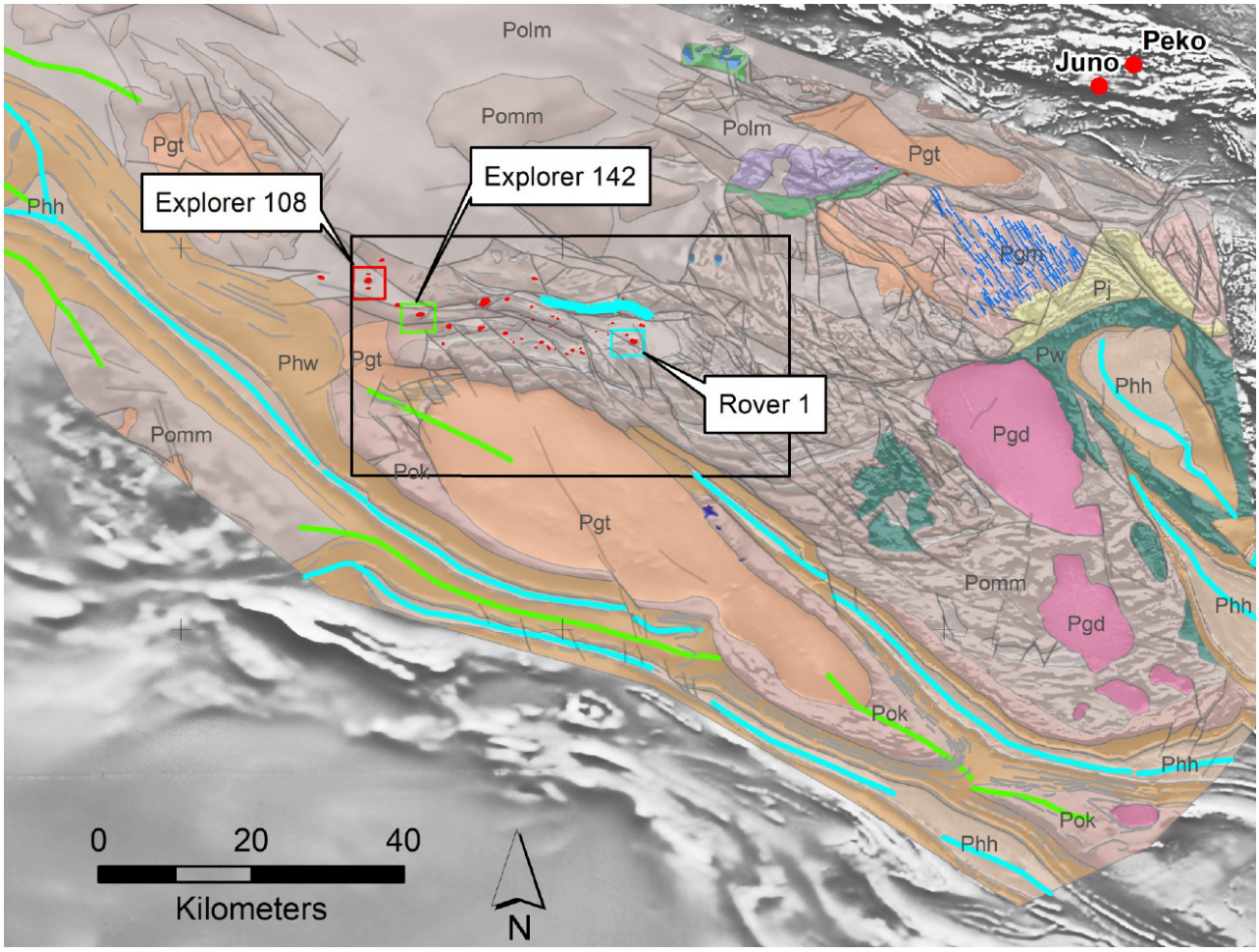

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CONTENTS

DIGITAL FILE CONTENT

Folder ‘Geoscience Analyst - 3D compilation’:
    Geoscience Analyst Explorer 142 3D compilation

The 3D compilations can be viewed using Geoscience Analyst software, which is a free viewer and can be downloaded from the following location: https://mirageoscience.com/mining-industry-software/geoscience-analyst/

In addition, the raw imported data has been provided for import to other software platforms.

INTRODUCTION

DIP026 is one of 4 publications (DIP023–026) in the Warramunga Province mineral deposit series focussing on the Rover field. The publications and digital data comprise regional and individual deposit 3D compilations and accompanying atlases. A 1:25 000 scale interpreted geology GIS package is also provided. The series covers the regional setting (DIP023), Rover 1 deposit (DIP024), Explorer 108 and Curiosity deposits (DIP025), and the Explorer 142 deposit (DIP026).

ACKNOWLEDGEMENTS

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Explorer 142

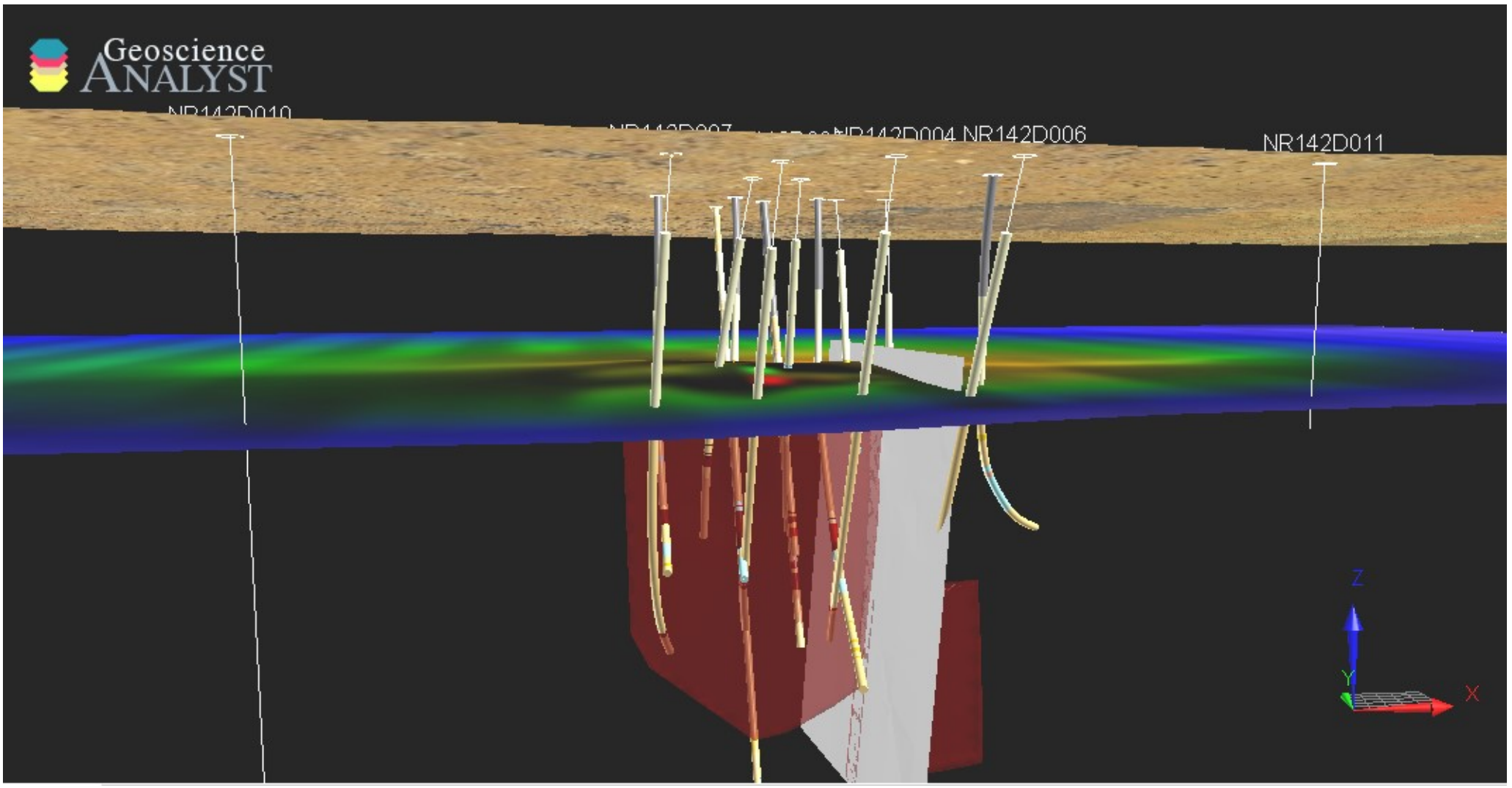

Figure 29: Explorer 142 Geoscience Analyst Project, showing the Google Earth image draped on the DEM, RTP 1VD magnetic data draped on the top of Proterozoic as modelled using down hole data, and simple mineralised ironstone model with offsetting fault.

PREAMBLE

Explorer 142 is an ironstone hosted copper-gold deposit located approximately 90km west-southwest of Tennant Creek in the Northern Territory, Australia.

The deposit was discovered between 1979 and 1982 by GeoPeko, using ground magnetic and gravity surveying with follow-up diamond drilling (Leggo *et al*, 2019).

The Explorer 142 deposit is at an advanced stage of exploration and is owned by Castile Resources Ltd.

LOCATION

Geological Domain

Explorer 142 is located within the Rover field (Fig 4).

Co-ordinates

Lat: 19° 58’ 1” S Long: 133° 23’ 14” E

MGA Zone 53: 331,260 E, 7,791,390 N

NATURE OF MINES

Mined Commodities

Mining has not occurred at Explorer 142. The main commodities are copper and gold, and these are the only elements the published Mineral Resource includes (Table 4).

Mining Method & Depth of Mining

No scoping or other assessment studies for mining have been published for the Explorer 142 deposit. No metallurgical testwork was located in the literature.

PRODUCTION AND RESOURCES

Mineralised Bodies

The Explorer 142 deposit comprises copper and gold mineralisation hosted primarily within and on the boundaries of a metasomatic iron formation developed in a sub-vertical shear zone within a highly altered and deformed sedimentary sequence (Leggo *et al*, 2019).

It has been interpreted that a north-south fault has cut off and down-thrown mineralisation in the east, faulting it down 90m vertically (Figure 30). A resource model was developed extending from below the unconformity surface (200m below the current topographic surface) to 650m below the current topographic surface.

Dimensions and Orientation

The known overall dimensions of the mineralised material are approximately 300m east-west along the strike of the shear, 13m thick (in an east-west direction), and up to around 250m vertically.

Mineralisation probably extends up to the Wiso Basin–Proterozoic contact where a positive relief anomaly of approximately 20m on the top of Proterozoic surface (modelled from drilling) is associated with the presence of ironstone modelled directly below the Wiso Basin.

Production

There has been no production from the deposit.

Mineral Resources & Ore Reserves

The most recent Mineral Resource estimate, was completed in 2012 (Leggo *et al*, 2019). The Explorer 142 deposit is estimated above a lower cutoff of 2.5% Cu to contain an Inferred Mineral Resource of: 0.17 Mt at 0.21 g/t Au and 5.2% Cu for 1.2 koz gold and 9.2 kt copper (Table 4).

Table 4: Tabulated Mineral Resource figures for Explorer 142, from Leggo *et al* (2019).

Class	Tonnes (Mt)	Au (%)	Cu (%)
Inferred	0.176	0.21	5.21
Total	0.176	0.21	5.21

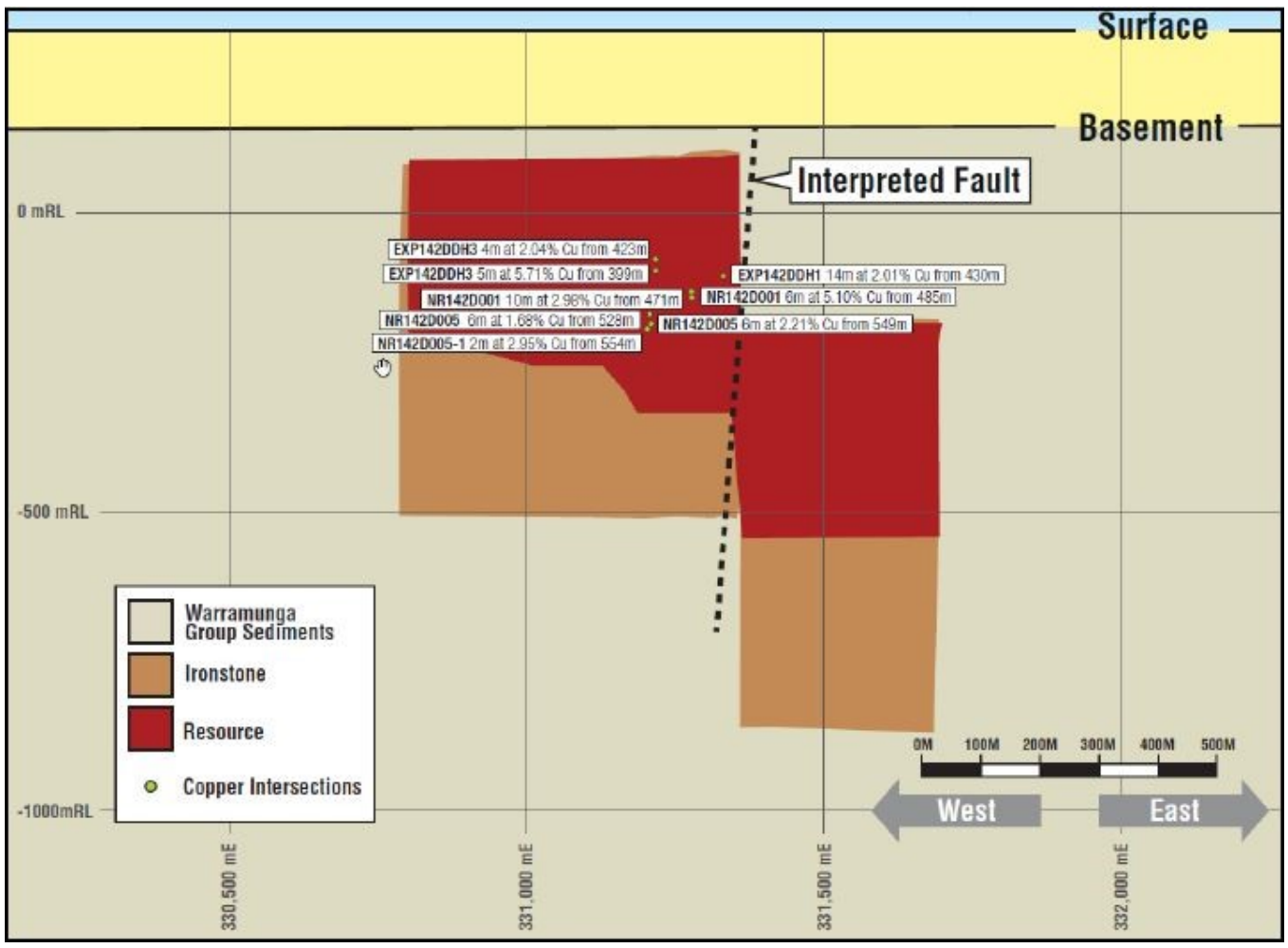

Figure 30: Explorer 142 long section, from Leggo *et al* (2019).

The copper mineralisation has a well-defined high-grade core which was domained separately from the low grade to prevent smearing during the resource estimation (Leggo *et al*, 2019).

No Ore Reserves have been published, and there are no Measured or Indicated Mineral Resources.

GEOLOGICAL SETTING

Explorer 142 lies within the central part of the Proterozoic Rover field (Figure 3), which is under shallow cover of the Wiso Basin. The Rover field is located to the west of the Davenport Province, and to the south-west of the Tennant Creek mineral field, with which it is considered to have a common tectonic history (Donnellan, 2013).

Recent work by this project interprets the Rover field to be dominated by units of the Ooradidgee Group, and Explorer 142 is interpreted to be hosted by predominantly sedimentary Ooradidgee Group lithologies with a high magnetic character (Pohm, Figure 7).

COVER SEQUENCE

Explorer 142 is entirely covered by recent sediments and flat-lying Cambrian siltstones, mudstones, dolomitic siltstones, dolomites, and sandstones of the Wiso Basin. Depth to the top of the Proterozoic host sequences is approximately 190 - 210m from surface.

HOST ROCKS

The deposit is hosted within a sequence of hematitic metasediments including greywackes, sandstones, siltstones, jaspilite, chert and ironstone, which is likely metasomatic (Leggo *et al*, 2019).

These are part of the highly magnetic sequence of sediments interpreted here (Figure 7).

IGNEOUS ROCKS

Two narrow intervals of porphyry, and one very narrow interval of tuff have been logged in the drilling, and igneous lithologies are not discussed in the published literature.

Unlike Explorer 108 and Rover 1, Rover 142 does not appear to have a substantial volumetric contribution from igneous rocks.

METAMORPHISM

Evidence for metamorphism is not described at Explorer 142, although argillite is logged within drilling, leading to the interpretation that at least one episode of metamorphism and deformation has occurred. Interpreted ductile deformation associated with the mineralisation is also described in Leggo *et al* (2019) and discussed in more detail below.

Though detail of metamorphism was not found in the literature, the Explorer 142 area may have been subject to the same greenschist facies metamorphism and deformation events as reported at Rover 1, allowing for analogies with the Tennant Creek mineral field to be extended to this area.

STRUCTURAL CHARACTERISTICS

Structural Setting

The significant (~200m) cover of the Wiso basin, and the low magnetic character of the lithologies that host the Explorer 108 deposit (interpreted as Ooradidgee Polm), present challenges for interpretation of the regional structural setting (Figure 5).

Structure and Mineralisation

Locally, mineralisation occurs within a 20m wide, sub-vertical east-west striking hematitic shear that continues over a distance greater than 400m (Leggo *et al*, 2019).

The near vertical shear is interpreted to have formed along the southern limb of an anticline during a north-south shortening event.

MINERALISATION

Metals of significance at Explorer 142 include copper and gold, with bismuth also present in minor amounts (Leggo *et al*, 2019).

Mineralisation occurs within a vertical, high strain shear zone that is thought to be the pathway for mineralising fluids (Leggo *et al*, 2019). Within this shear zone, metasomatic ironstones have developed, and high grade mineralisation generally occurs at the contact between the ironstone and sediments.

Resource domaining indicated that geological controls on mineralisation within Explorer 142 appear to be consistent for copper, gold, and bismuth.

ALTERATION HALO

General Characteristics

Alteration is poorly described, but hematite is present as an alteration product that appears to have lead to the development of metasomatic ironstones.

The similarity between this aspect of the mineralisation as well as the location within the same field as Rover 1, suggests that similar alteration systems were active.

PETROPHYSICAL PROPERTIES

Limited downhole magnetic susceptibility readings were available for Explorer 142, with data for only one hole located. Magnetic susceptibility values range from 218 x 10^{-3} SI to 0 SI, with values in the haematitic ironstone typically only mildly magnetic, ranging from approximately 18 x 10^{-3} SI to 3 x 10^{-3} SI. The highest values were in an apparently unaltered sandstone.

Density data provided values between 2.34 and 5.12 t/m$^{3.}$ In resource modelling, density of the sedimentary cover was assigned as 2.33 t/m^3, the sediments as 2.77 t/m^3, and the ironstone as 3.88 t/m^3 (Leggo *et al*, 2019).

GEOPHYSICAL EXPRESSION

Aeromagnetic

The general area of Explorer 142 shows a diffuse positive aeromagnetic anomaly visible in both the regional and detailed datasets (Figures 13 and 31). The anomaly appears to be primarily lithology-related, and may additionally have undergone some upgrading within the area of Explorer 142, however it does not show an exact correlation with the Explorer 142 ironstone (Figure 31), consistent with both geological observation and downhole magnetic susceptibility readings that indicate that it is only mildly magnetic.

Gravity

Due to the relatively small volumes of high density material associated with the deposit, it does not show a significant regional gravity anomaly.

Detailed gravity data, however, does show a local gravity high which forms a distinctive east-west gravity ridge (Figure 32).

Airborne EM

HeliTEM was flown in 2011. A plot of raw gridded HeliTEM data from channel 20 is provided in Figure 33.

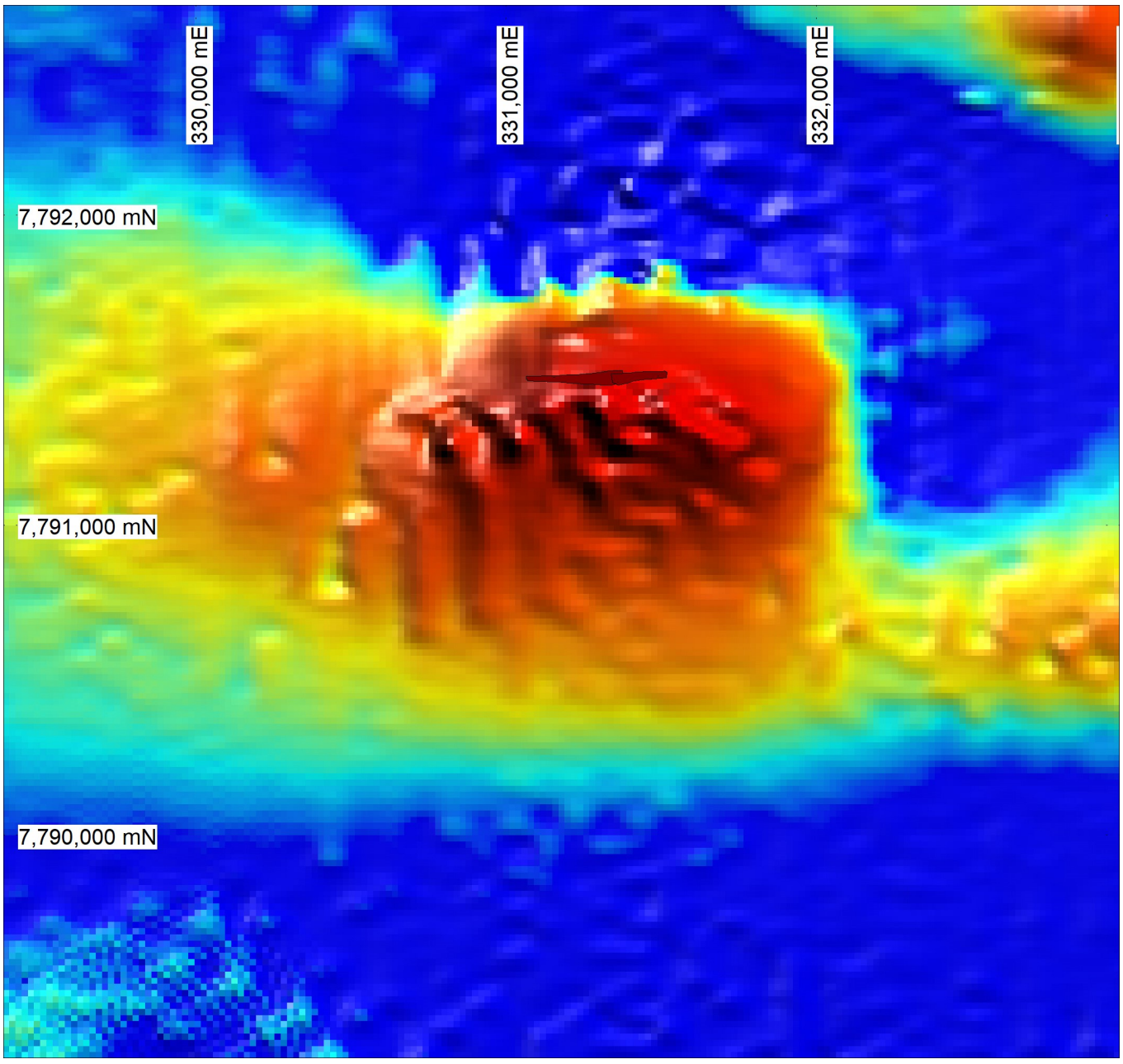

Figure 31: RTP 1VD aeromagnetic image, with ironstone projected to the top of the Proterozoic shown in maroon.

TIMING OF MINERALIZATION

Relative Timing

There is little information regarding paragenesis in the published literature for Explorer 142, and no relative timing of mineralisation has been proposed. Comments in Leggo *et al* (2019) support the mineralisation being syn-tectonic.

Absolute Age

SHRIMP U–Pb zircon dating of an immature massflow volcaniclastic intersected in drill core at Explorer 142 yielded a weighted mean $^{207}Pb/^{206}Pb$ age of 1798 ± 5 Ma (Smith, 2001). This age is interpreted as a maximum crystallisation age for the volcaniclastic unit (Smith, 2001)

The sample was collected from drill hole DDH4 (other names reported for the same hole include RV053 and EXP142DDH4) from 452m to 469m downhole. This interval is approximately 25m further downhole and to the south of the main ironstone intersected in drilling (415–424m downhole).

This date provides a maximum mineralisation age, and is younger than the age from Compston (1994) for gold mineralisation in the Tennant Creek mineral field of 1825 ± 5 Ma, or the reinterpreted age from these data of 1847-1851 Ma by Fraser *et al* (2008).

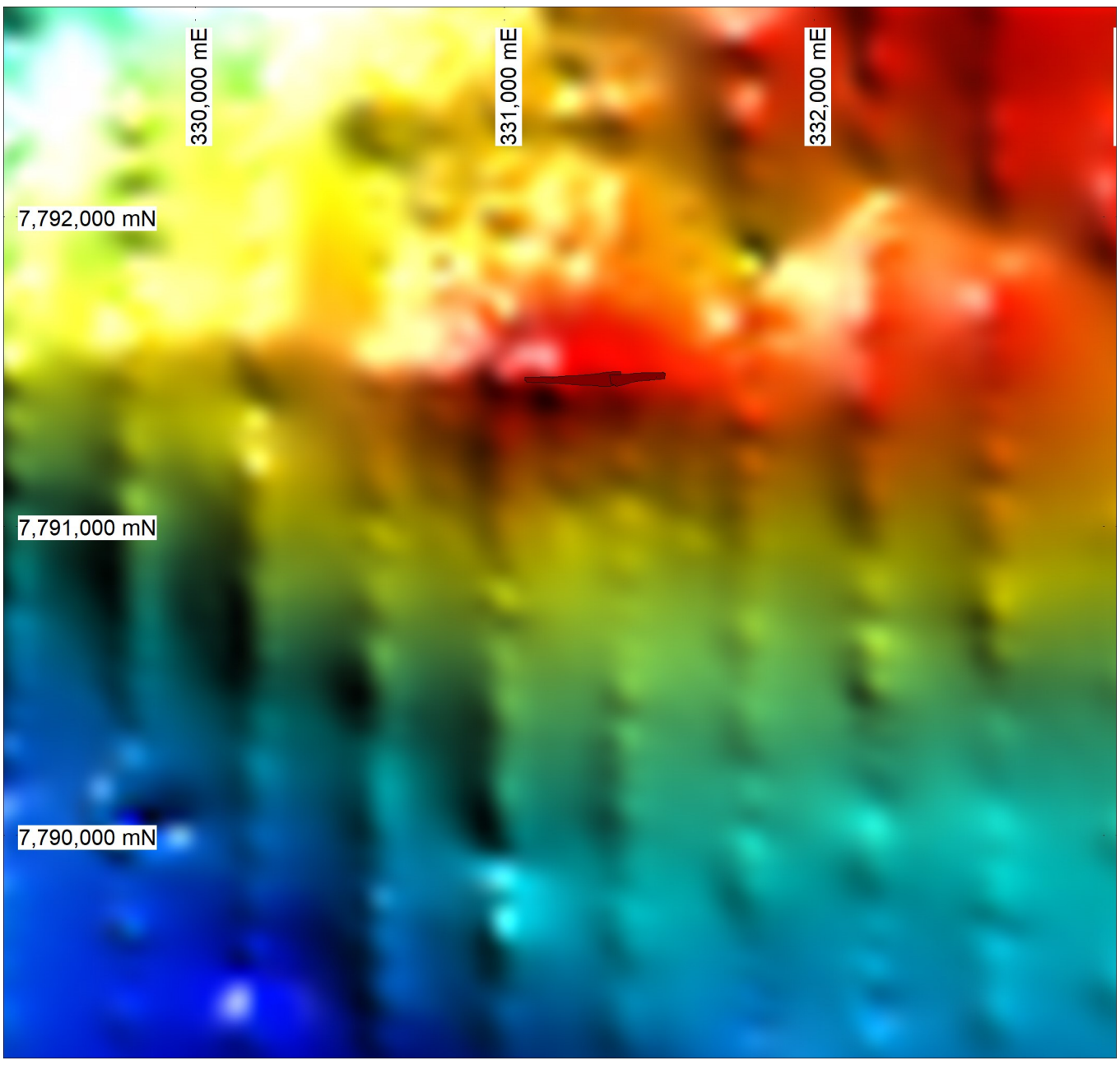

Figure 32: Residual bouguer gravity upward continued to 2,000m, with ironstone projected to the top of the Proterozoic shown in maroon.

GENETIC MODEL

Savage (2020) notes that the Explorer 142 deposit conforms closely to typical Tennant Creek-style IOCG mineralisation.

Huston *et al* (2020) identifies four types of mineralisation present in the Tennant Creek mineral field;

(1) pyritic, mineralogically and chemically well-zoned, gold-rich deposits with minor copper and lead but locallyhigh bismuth and selenium (Juno-type);

(2) Pyrrhotite rich, poorly-zoned or unzoned, copper-rich deposits with moderate gold and minor bismuth (Peko -type);

(3) Pyrite hematite-rich, copper-rich deposits with low gold (Gecko-type); and

(4) Pyrite- and hematite-rich, copper deposits with variable gold in shear zones that are not associated with massive ironstones (Eldorado-type).

Of these types, Explorer 142 would most consistently fit with the Gecko-type.

POST-FORMATION MODIFICATION

Due to the lack of paragenetic information available, it is unclear if the Explorer 142 mineralisation has been subject to deformation post-mineralisation.

Weathering of the deposit is not described by workers in the area, however given the prominent nature of the altered lithologies at the top of the Proterozoic contact, some minor effects may be expected.

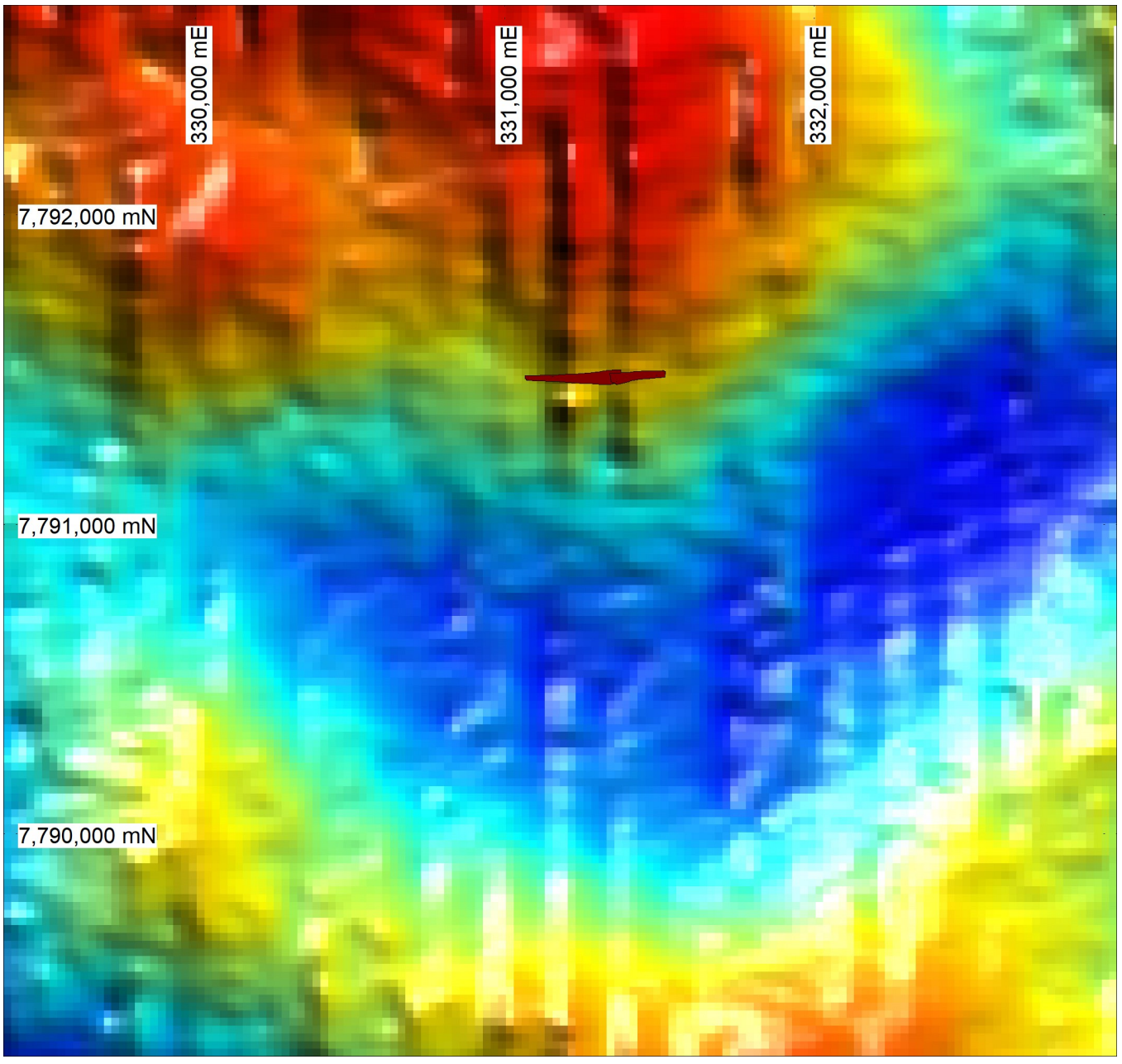

Figure 33: Explorer 142 raw gridded HeliTEM, channel 20 (Z-component), with ironstone projected to the top of the Proterozoic shown in maroon.

REFERENCES

Donnellan, N. (2013). Chapter 9: Warramunga Province. In M. Ahmad, & T. J. Munson, Geology and mineral resources of the Northern Territory. Northern Territory Geological Survey, Special Publication 5.

Fraser, G.L., Hussey, K. & Compston, D.M, (2008). Timing of Palaeoproterozoic Au-Cu-Bi and W-mineralization in the Tennant Creek region, northern Australia: Improved constraints via intercalibration of $^{40}Ar/^{39}Ar$ and U-Pb ages. *Precambrian Research, 164*, 50-65.

Huston, D. L., Cross, A. J., Skirrow, R. S., Champion, D. C., & Whelan, J. A. (2020). The Tennant Creek mineral field and Rover field: many similarities but some important differences. *Annual Geoscience Exploration Seminar (AGES) Proceedings, Alice Springs, Northern Territory, 24-25 March 2020. (pp. 70-83). Darwin: Northern Territory Geological Survey.*

Leggo, N., Ulrich, S., & Whishaw, A. (2019). *Independent Technical Assessment Report - Castile Resources Ltd - Rover and Warumpi Projects.* CSA Global Report R339.2019, in Castile Resources Ltd Prospectus, issued December 2019.

Savage, M. (2020). The Rover Project. Annual Geoscience Exploration Seminar (AGES) Proceedings, Alice Springs, Northern Territory, 24-25 March 2020 (pp. 82-87). Darwin: Northern Territory Geological Survey.

Smith, J. (2001). Summary of Results Joint NTGS-AGSO Age Determination Program 1999-2001. Northern Territory Geological Survey, Record 2001-007.