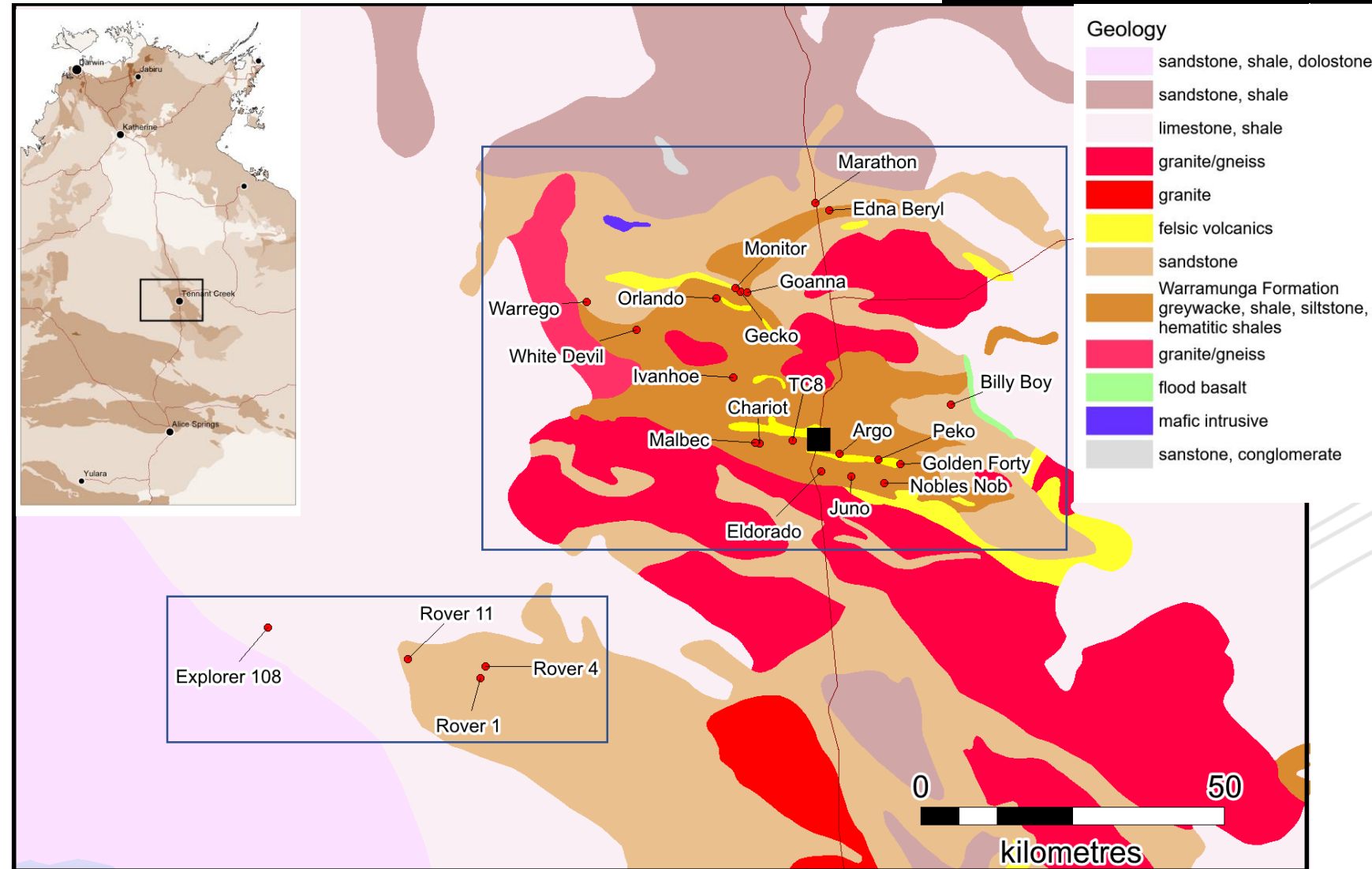


**RESOURCING  
THE TERRITORY**

# Tennant Creek and Rover: Geophysical Exploration and Available Data

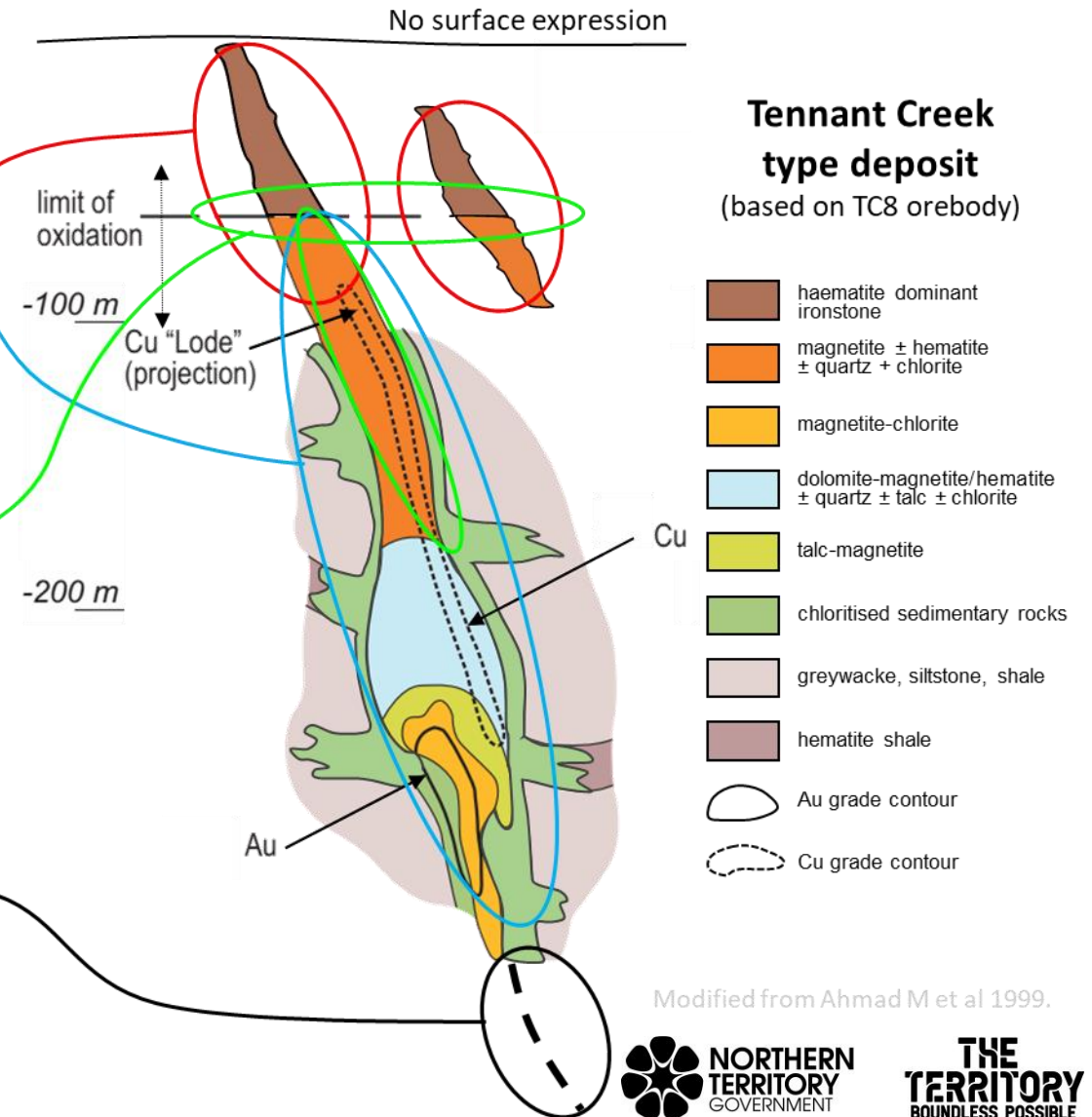
Angus McCoy & Matthew Hutchens

- Gold first discovered in 1874, mining commencing in 1932 with over 130 deposits mined since
- Tennant Creek: Warramunga Formation hosts Ironstone bodies emplaced in shears (lines of lode), some of which are endowed with high grade Au-Cu-Bi deposits
- Rover: similar host rocks with similar mineralisation under cover
- A vast array of government and company acquired geophysical data is available including
  - Magnetics (Airborne & Ground)
  - Gravity (Ground)
  - EM (Airborne & Ground)
  - Resistivity/IP (Ground)
  - Other (MT, Seismic, SAM)



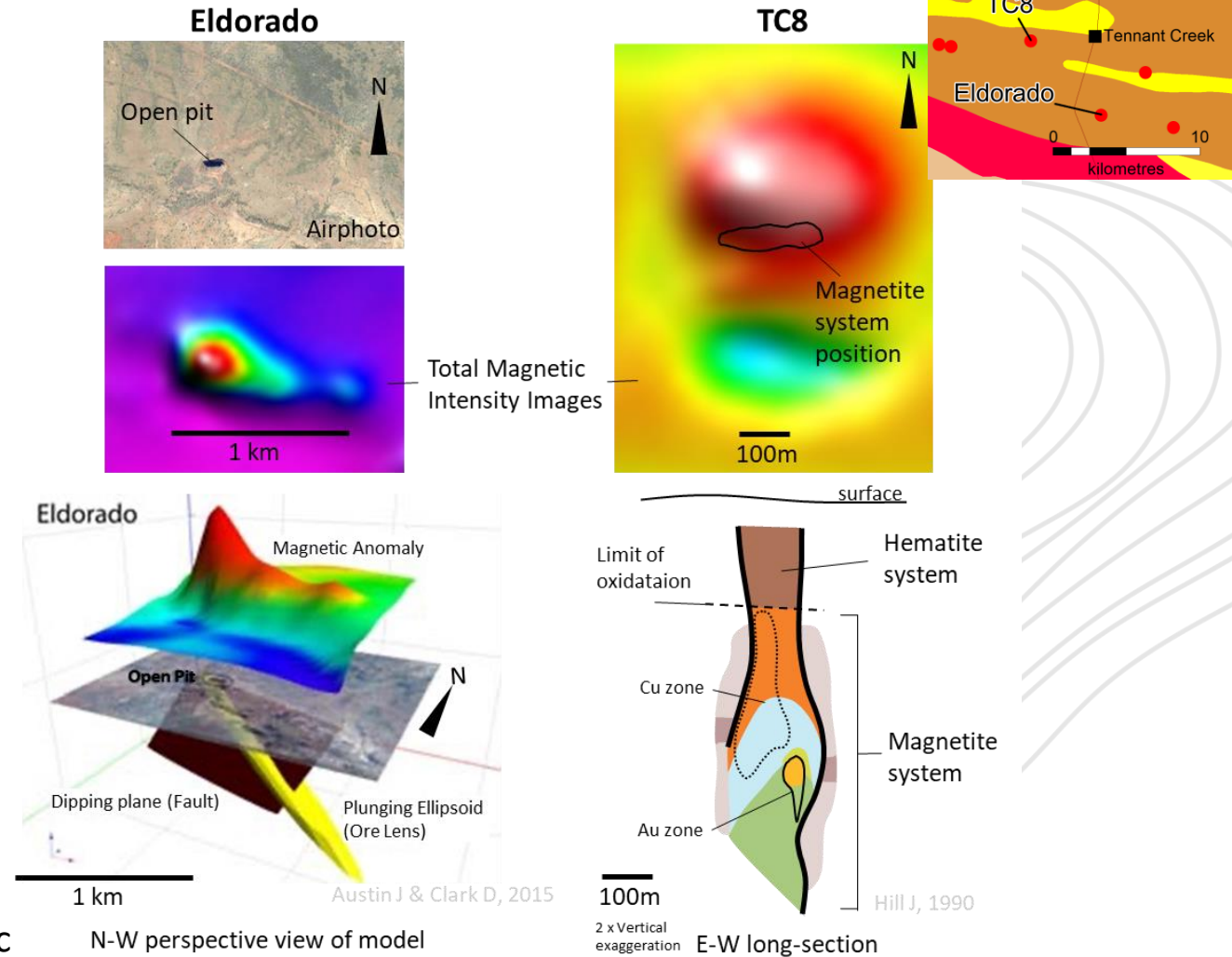
## Ore hosted by ironstone bodies and proximal alteration zones in Fe-rich sediments

- **Ironstone: magnetic method target**
  - Susceptibility contrast of > 2 orders of magnitude
  - Strong magnetic signal from large contiguous pods below oxidation zone
  - Weaker signal from thin stringers at depth and shallow hematite
- **Ironstone: gravity method target**
  - Density contrast in the order of +1 g/cm<sup>3</sup> compared to host shales
  - Strong gravity signal from contiguous hematite pods near surface
  - Weaker signal from thin lenses and at deeper bodies
- **Line of Lode: electromagnetic method target**
  - Electrical contrasts of up to 80x background
  - EM signal from differential alteration/weathering of lithology/shears
- **Unconventional Mineralisation: induced polarisation target**
  - IP response from disseminated sulphides
- **Deep Structures: regional geophysics (seismic/MT)**
  - Fluid pathways



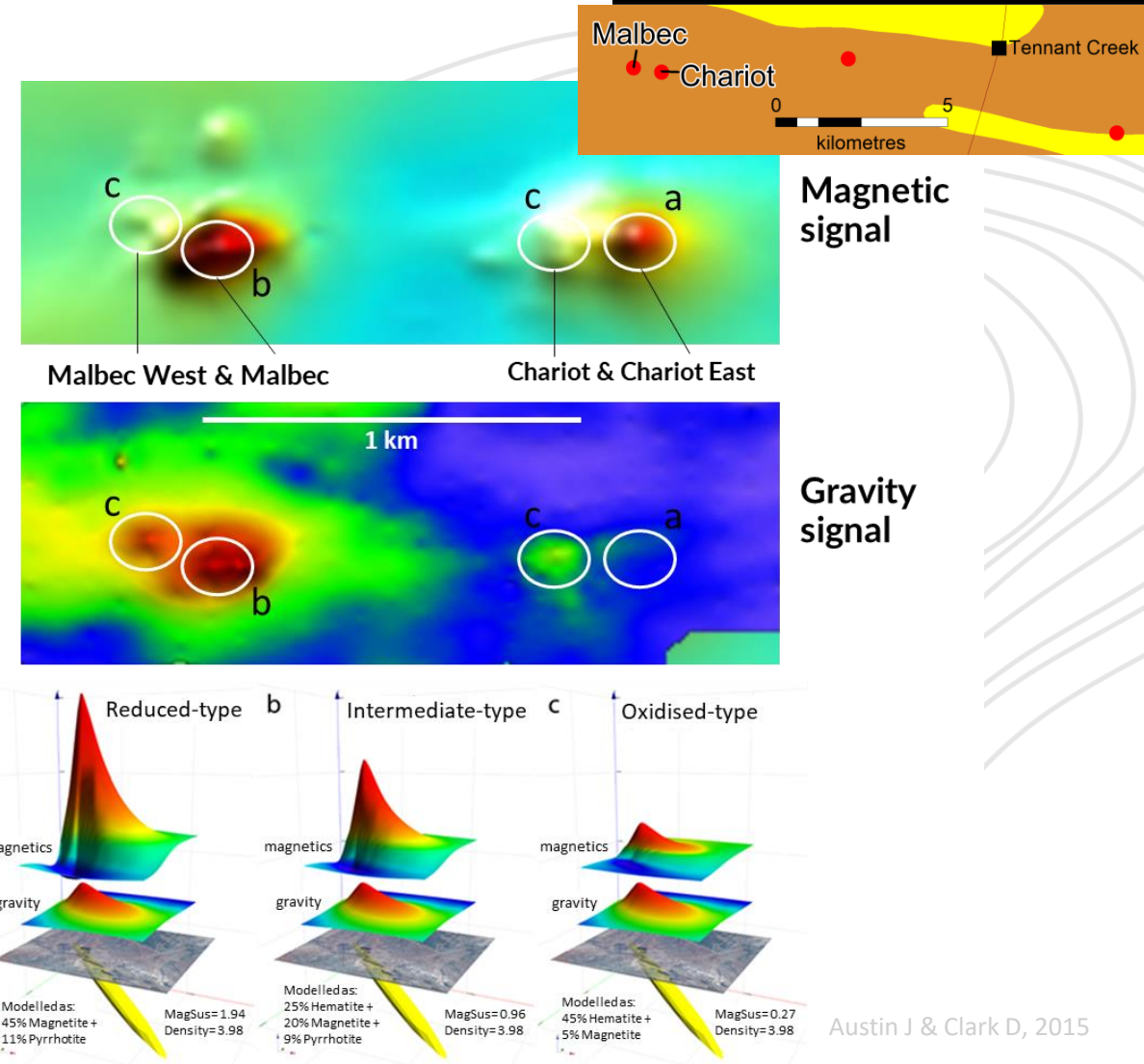
# Magnetics

- Technique a major contributor to deposit discoveries
- 700 ironstones identified, 100+ mineralised
  - Significant discoveries at Orlando, Ivanhoe, Juno, Warrego, Golden Forty, Gecko, Argo and TC8.
- **Eldorado** magnetic anomaly is characteristic of a plunging pipe-like magnetite ironstone: An asymmetrically elongated dipole
- **TC8** magnetic anomaly is typical of many near-vertical Tennant Creek deposits: A laterally symmetric discrete dipole
- Increased survey resolution, instrument sensitivity and advanced processing has enabled:
  - The detection of weak anomalies
  - Identification of hematite dominated ironstones
  - The mapping of subtle structural features
  - The differentiation of geological units based on magnetic characteristics
- Drilling has revealed a large number of false positives: a magnetic anomaly does not necessarily indicate a mineralised ironstone.



## Gravity

- Technique led to many deposit discoveries
  - High resolution surveys are able to directly detect concealed shallow hematite dominant ironstone targets
    - Significant discoveries at Malbec West, Chariot, Marathon, Billy Boy and Edna Beryl
- The subtle gravity signal of the **Malbec West** and **Chariot** deposits in relation to their non-magnetic responses, is reflective of an oxidised (hematite dominant) type deposit as shown by the type c model response (bottom figure)
- The Malbec and Chariot East deposits have gravity and magnetic responses that are consistent with intermediate- and reduced-type deposits as shown by the type b and a model responses respectively (bottom figure)
- Regional gravity data also provides province/camp scale geological unit differentiation and insights into basement structures

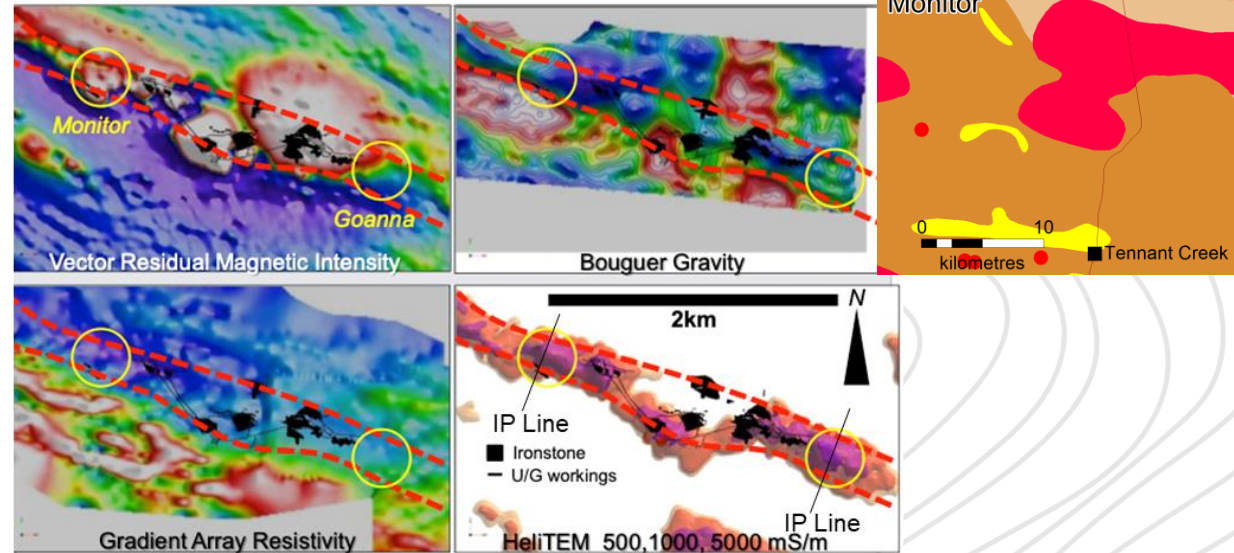


Austin J & Clark D, 2015

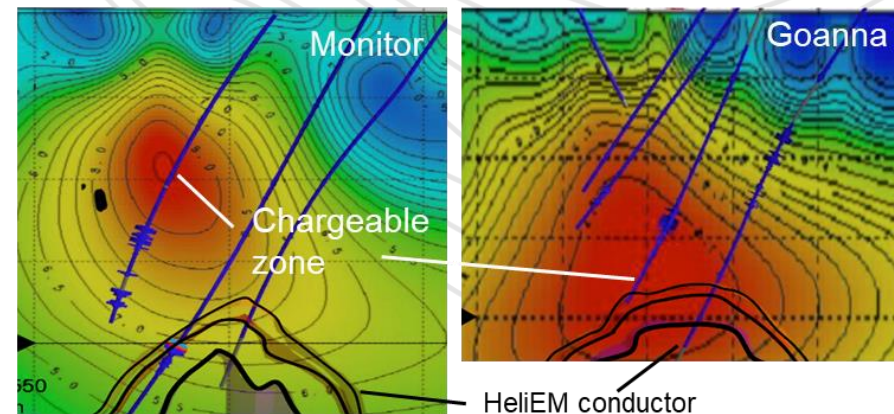
# Electrical Methods

- Technique contributed to recent deposit discoveries
- Modern airborne EM systems are able to image subtle changes in electrical resistivity due to alteration, weathering and shear zones
- High power ground IP can resolve the depth of the same conductive features and detect chargeable sulphide mineralisation zones
- Significant discoveries at Goanna and Monitor
  - Airborne EM along the Gecko Corridor revealed anomalous conductivity responses along a conductive shear zone (line of lode). The features do not have strong gravity or magnetic responses.
  - IP detected anomalous chargeability zones above the conductive features
  - Drill testing of the geophysical anomalies resulted in discovery of ironstone and shear hosted gold and copper mineralisation at 200+ meters depth (Monitor and Goanna deposits)

Monitor & Goanna deposit geophysics including Gradient IP & HeliTEM



Cross sections showing IP Chargeability



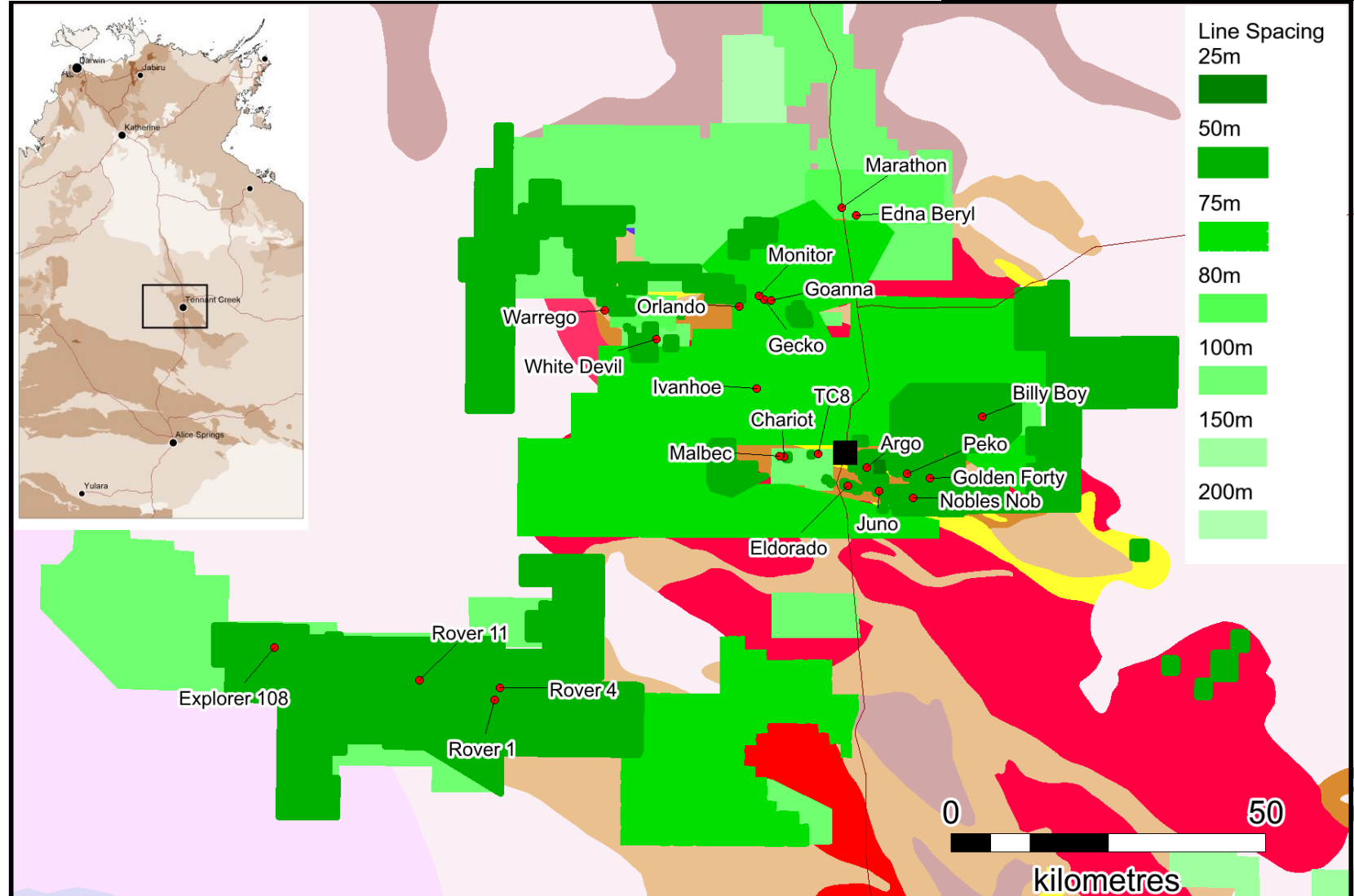
# Airborne Magnetics

## Government surveys

- Near complete coverage at 200m line spacing
- Over 180,000 line km acquired
- High quality data

## Industry surveys

- Over 50 very-high resolution surveys covering 8200 km<sup>2</sup>
- 100m or better line spacing
- Over 200,000 line km acquired



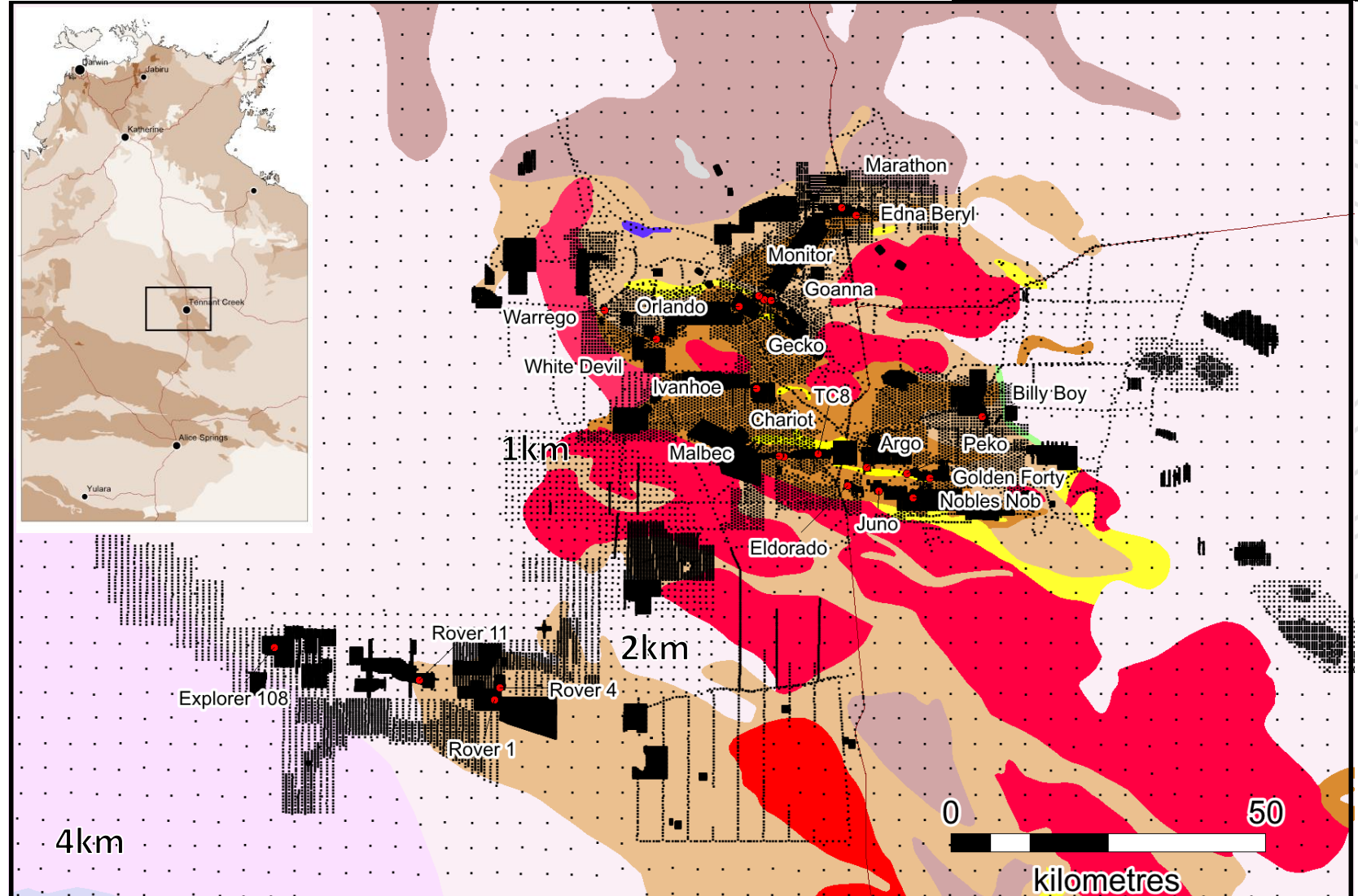
# Ground Gravity

## Government acquired

- Approximately 1300 stations
- Regional coverage across entire mineral field
  - Mostly 4km spacing and some 2km spacing

## Industry acquired

- Over 130,000 stations
- Semi regional coverage
  - 100m to 500m spaced stations
- Detailed coverage
  - 20m to 100m spaced stations



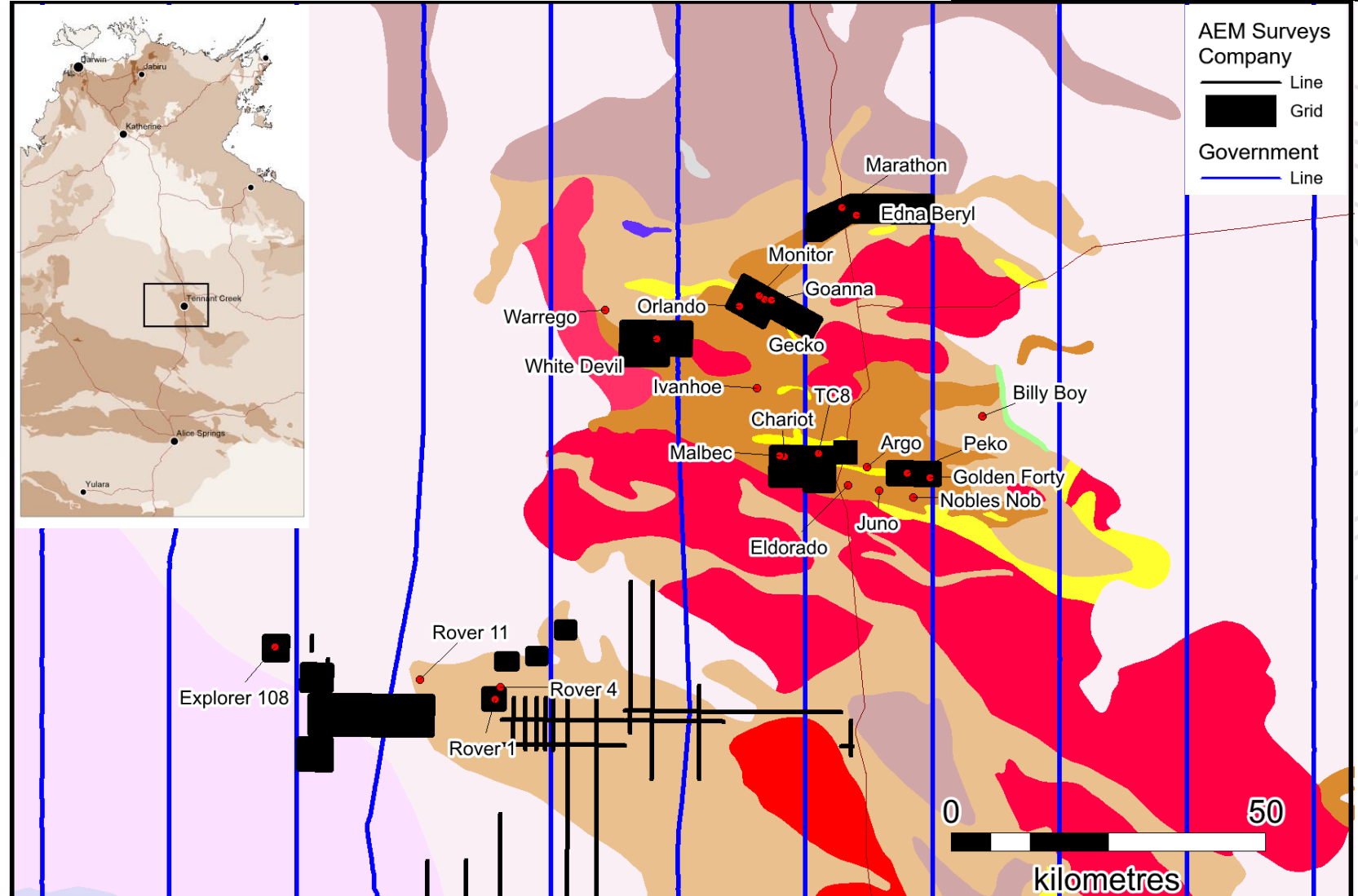
# Airborne EM

## Industry airborne surveys

- High resolution at 100m to 200m line spacing
- Systems used include, HoisTEM (Normandy Exploration proprietary), HeliTEM, and Xcite
- Less than 5% of Tennant Creek and Rover fields covered by modern Airborne EM

## Government airborne surveys

- AusAEM 20km spaced TEMPEST lines



- Industry and NTGS geophysical survey data are available through GEMIS

<https://geoscience.nt.gov.au/gemis/ntgsjspui/community-list>

- Industry and NTGS geophysical survey data can be located on STRIKE

<https://strike.nt.gov.au>

- NTGS geophysical survey images are available from the Geophysical Image Web Server (GIWS)

<http://geoscience.nt.gov.au/giws>

Thank You

## Questions?

Matthew Hutchens

matthew.hutchens@nt.gov.au

