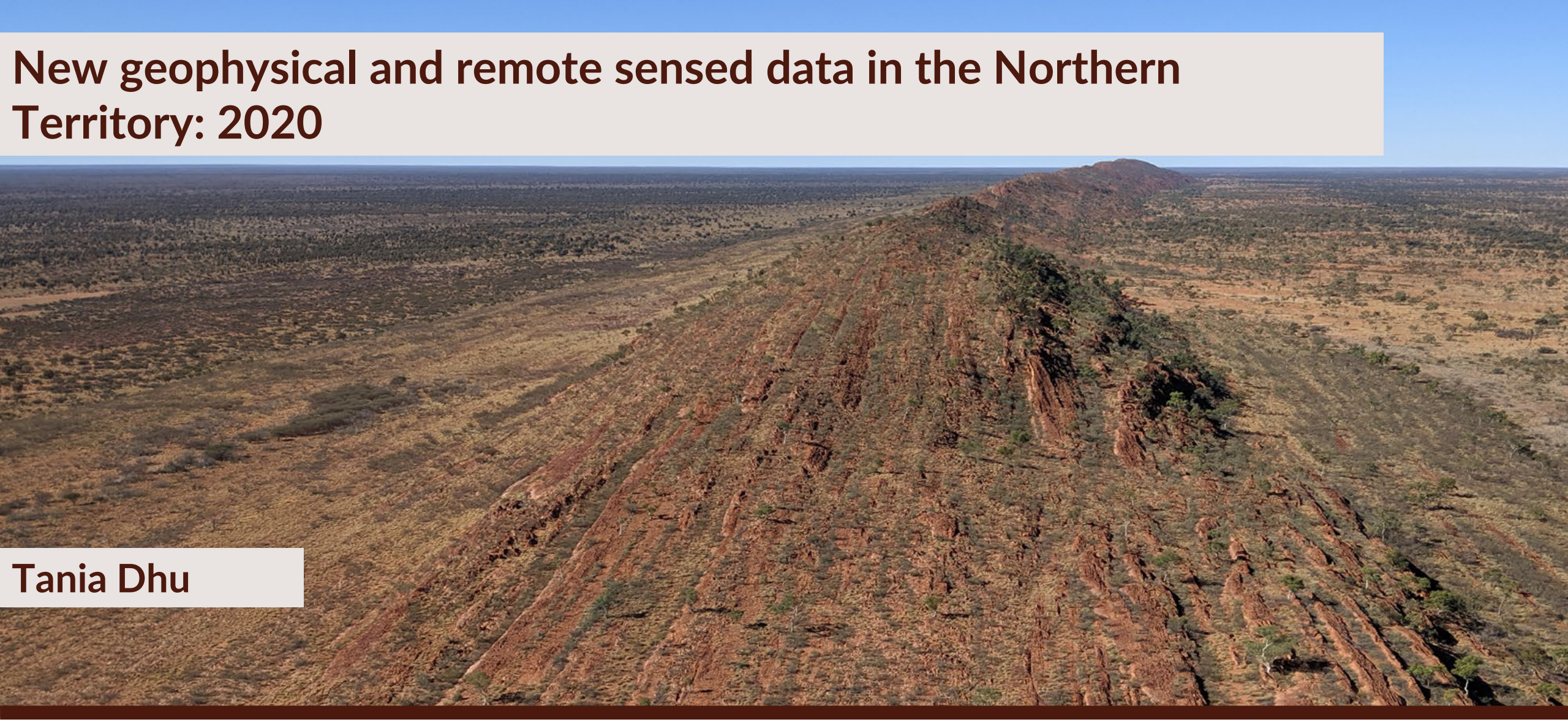
New geophysical and remote sensed data in the Northern Territory: 2020



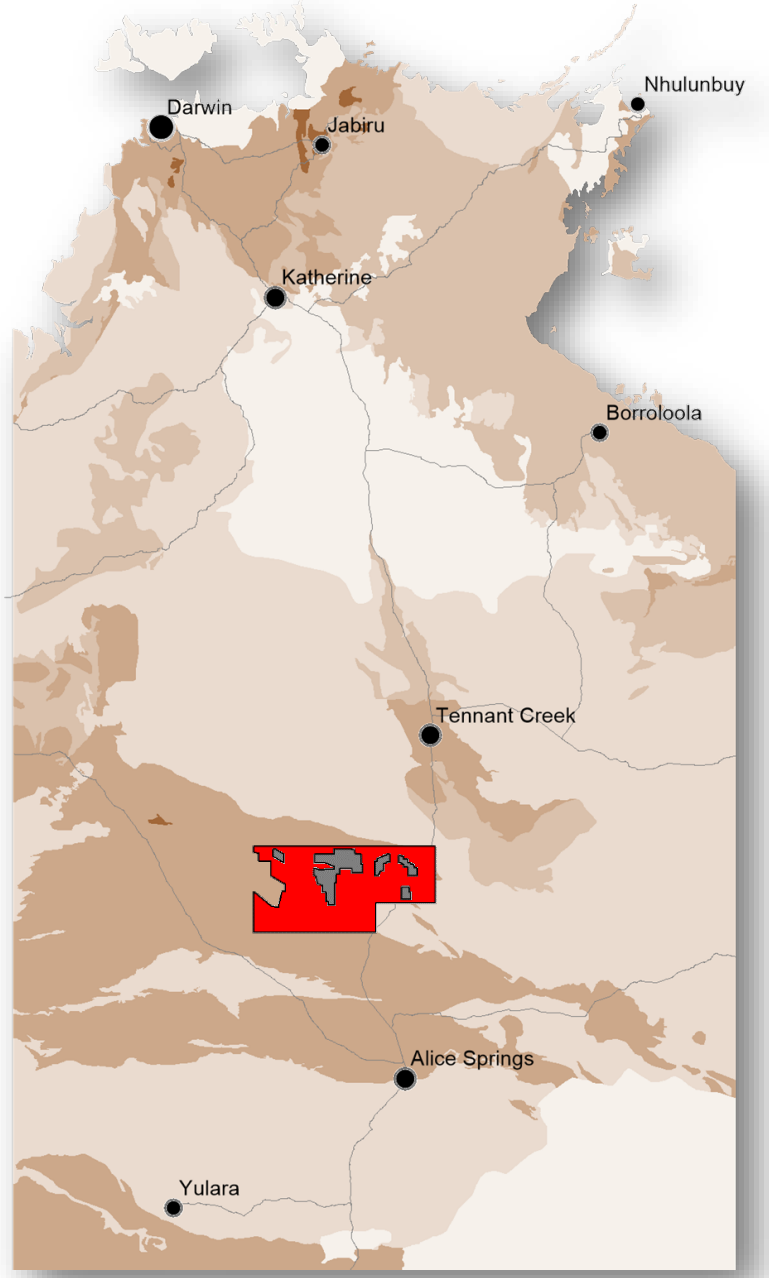
Tania Dhu

NORTHERN TERRITORY GOVERNMENT

NORTHERN TERRITORY GEOLOGICAL SURVEY
AGES2021
ANNUAL GEOSCIENCE EXPLORATION SEMINAR
20–21 April 2021, Alice Springs, Northern Territory

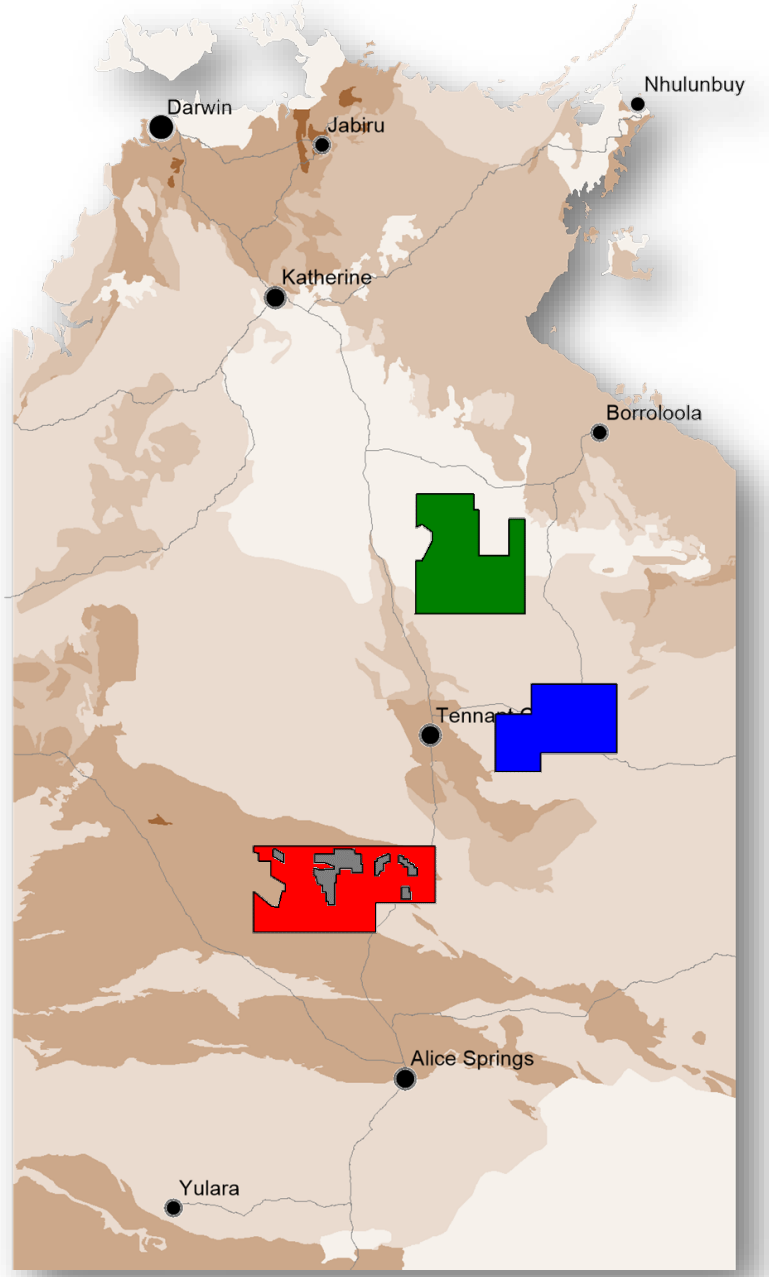
Regional Geophysical Surveys

- NTGS Mount Peake – Crawford airborne magnetic and radiometric survey (red polygon)
  - Located ~250 km north-northeast of Alice Springs covering over 21 000 square km
  - Regional data was acquired at 200 m line-spacing across the entire survey area
  - Infill data was acquired at 100 m line-spacing over areas of interest identified and funded by industry (shown in grey); all data has been released publicly
  - Funded through the NT Government's *Resourcing the Territory (RTT)* initiative
  - Managed by Geoscience Australia (GA) on behalf on NTGS



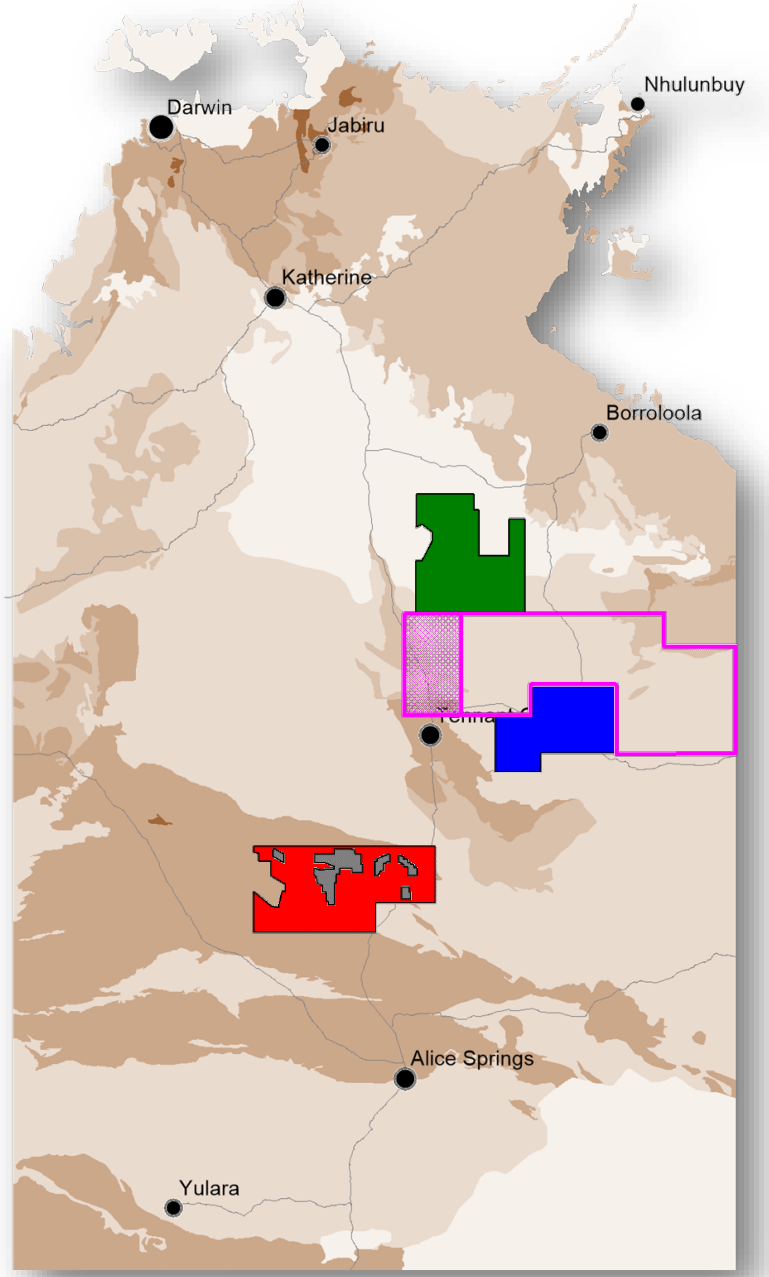
Regional Geophysical Surveys

- NTGS Mount Peake – Crawford airborne magnetic and radiometric survey (red polygon)
- EFTF East Tennant (blue polygon) and Southwest McArthur, Barkly (green polygon) ground gravity surveys
  - Both surveys infilled existing 4 km grid spaced ground gravity stations to 2 km grid spacing
  - East Tennant survey covers almost 14 000 square km
  - Southwest McArthur, Barkly survey covers ~18 000 square km
  - Funded through Federal Government's *Exploring for the Future (EFTF)* initiative
  - NTGS contributed funding to extend the Southwest McArthur, Barkly survey



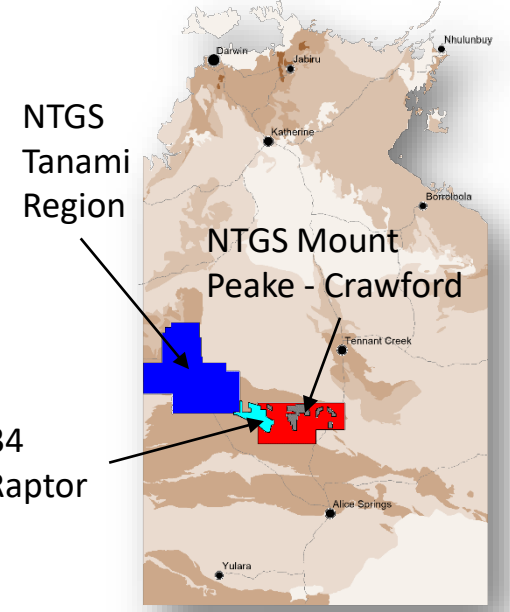
Regional Geophysical Surveys

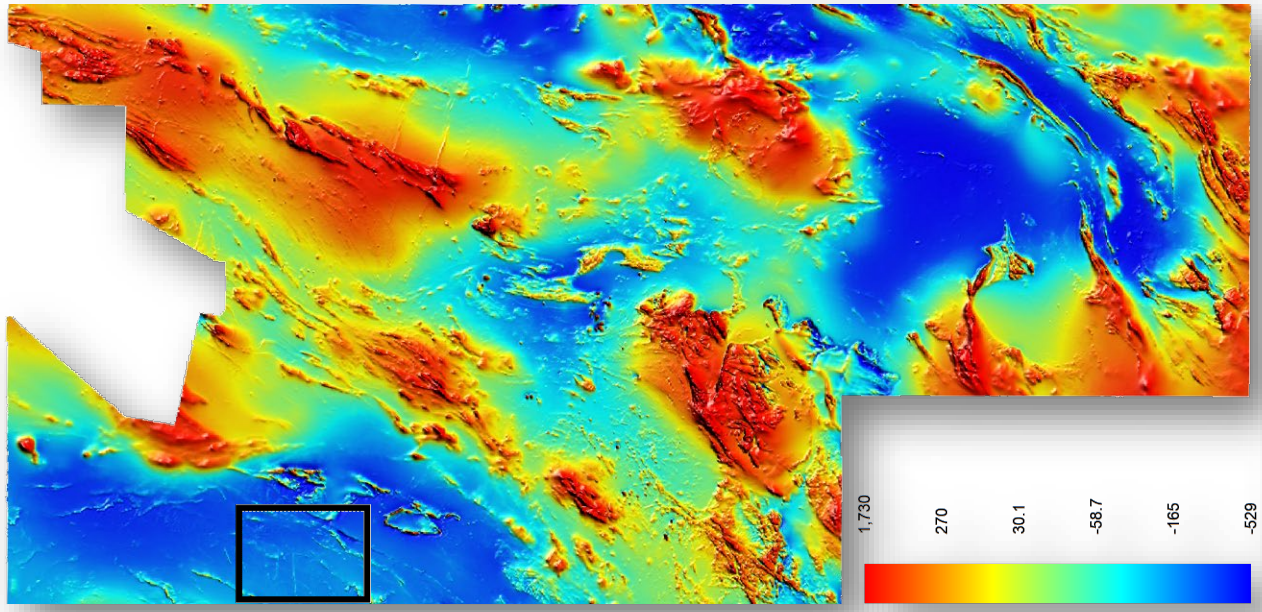
- NTGS Mount Peake – Crawford airborne magnetic and radiometric survey (red polygon)
- EFTF East Tennant (blue polygon) and Southwest McArthur, Barkly (green polygon) ground gravity surveys
- Planned NTGS Brunette Downs ground gravity survey (pink polygon)
  - Survey will infill existing 4 km grid spaced ground gravity stations to 2 km grid spacing
  - Survey will cover over 57 000 square km acquiring ~10 000 new ground gravity stations
  - Connects the East Tennant and Southwest McArthur, Barkly surveys
  - Funded through NTGS *RTT* initiative and managed by GA
  - Industry will be provided with the opportunity to infill of areas of interest



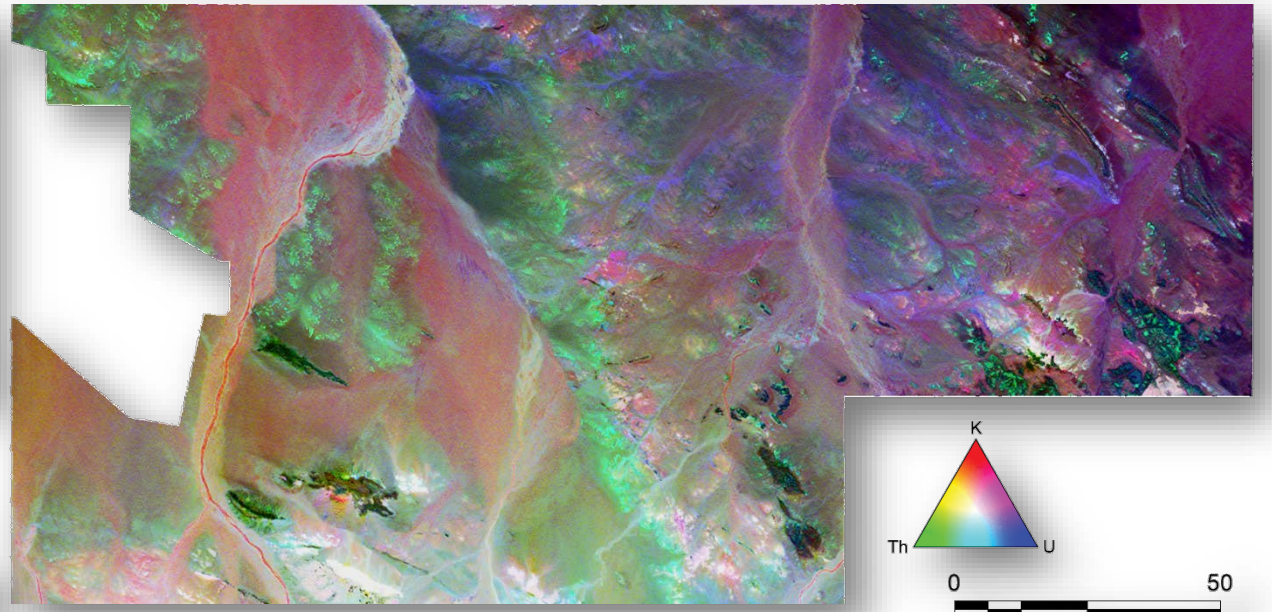
NTGS Mount Peake – Crawford Survey

- Survey was flown at 60 m ground clearance acquiring ~120 000 line km magnetic, radiometric and elevation data at 200 m spacing and ~18 000 line km of infill data at 100 m line spacing
- Survey extends the coverage of modern 200 m line-spaced (or better) data from the WA border through to central Northern Territory





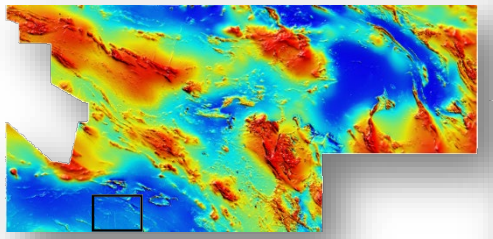
Total magnetic intensity (TMI) reduced to pole (RTP)

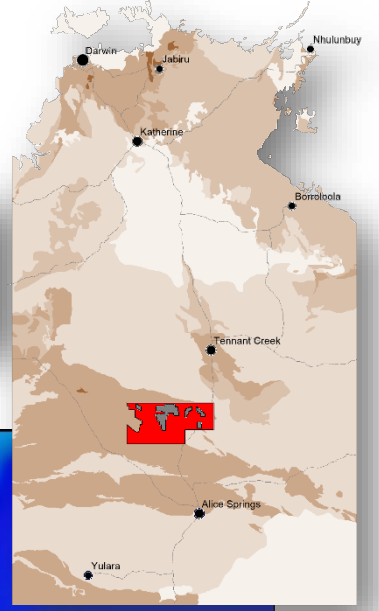


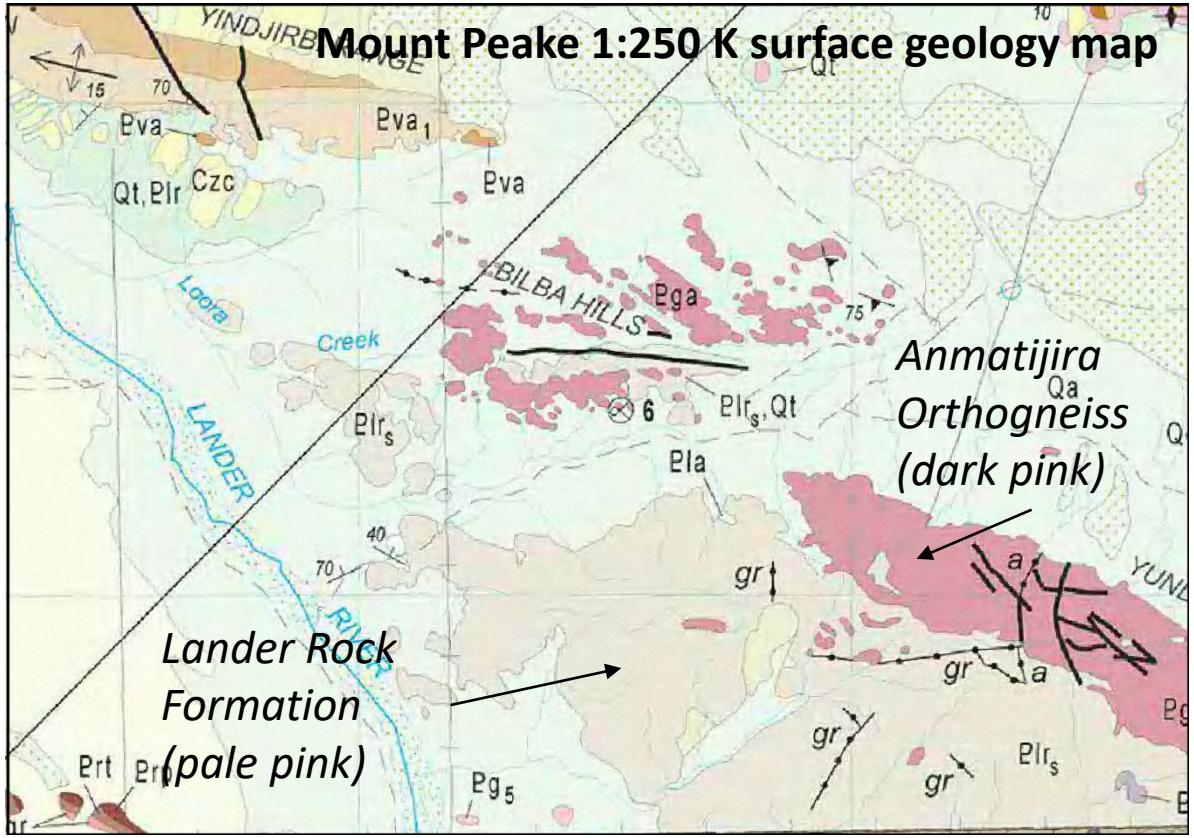
Ternary radiometrics

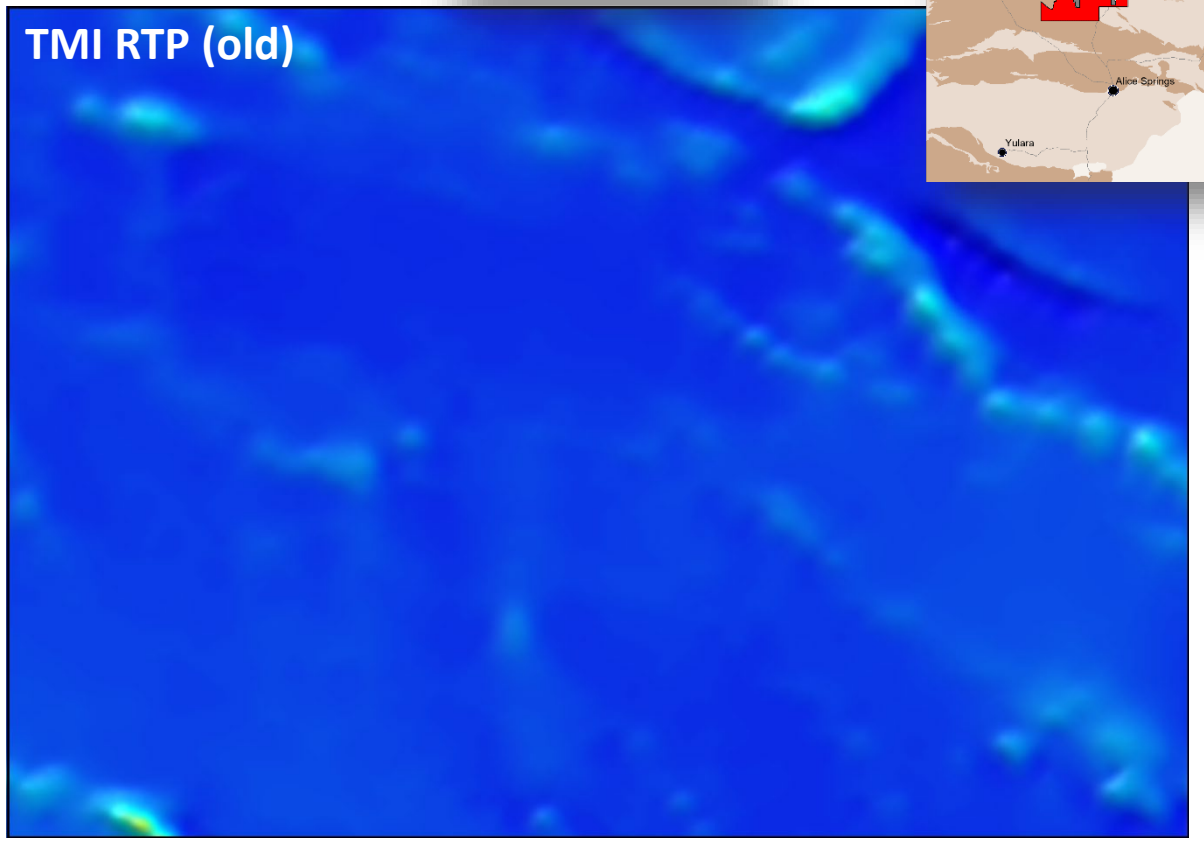
NTGS Mount Peake – Crawford Survey

- Region of subdued magnetic signal



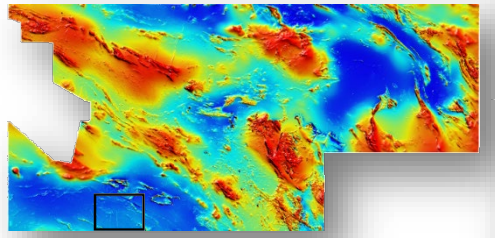


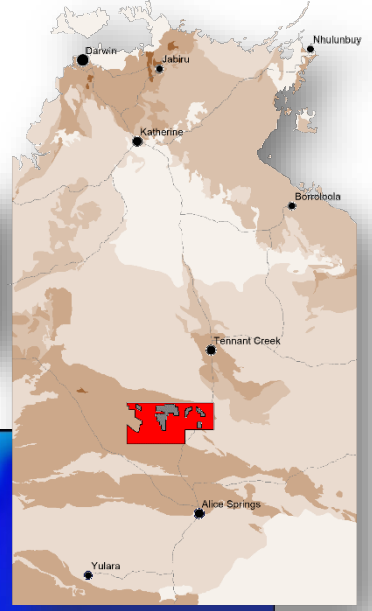


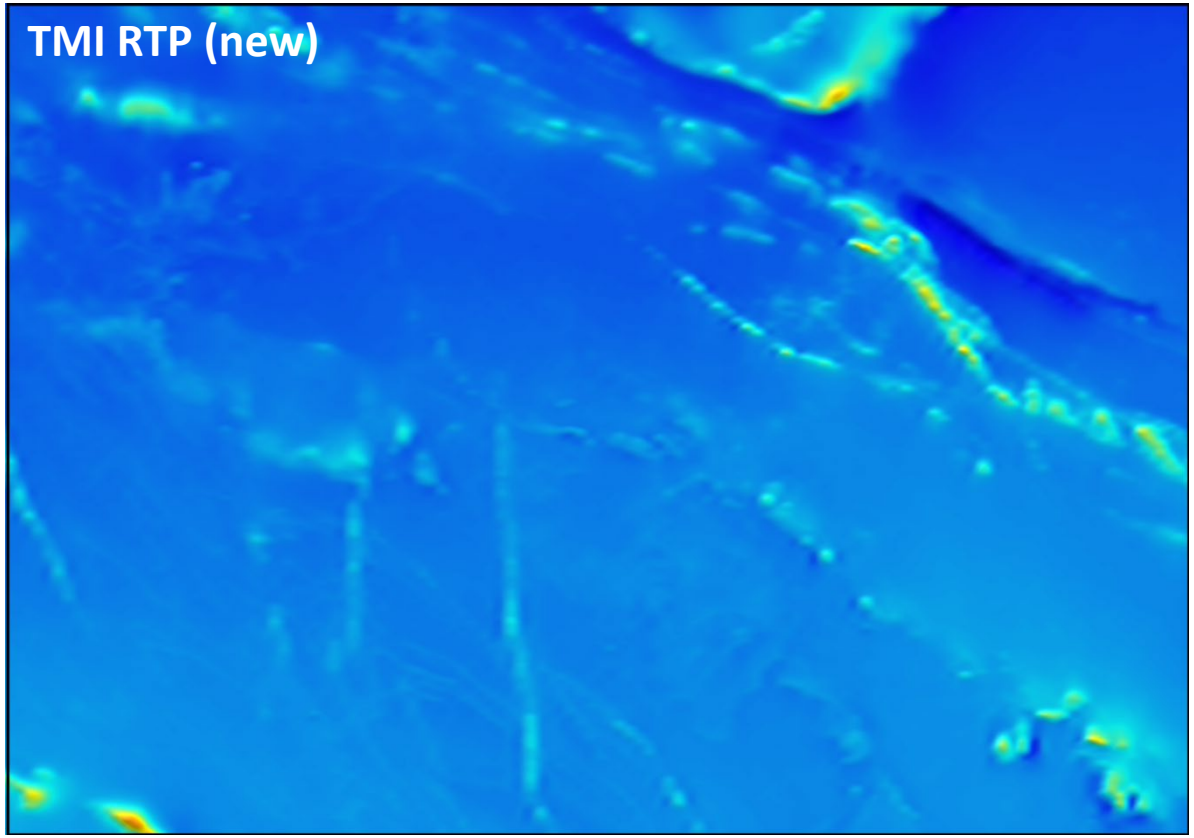


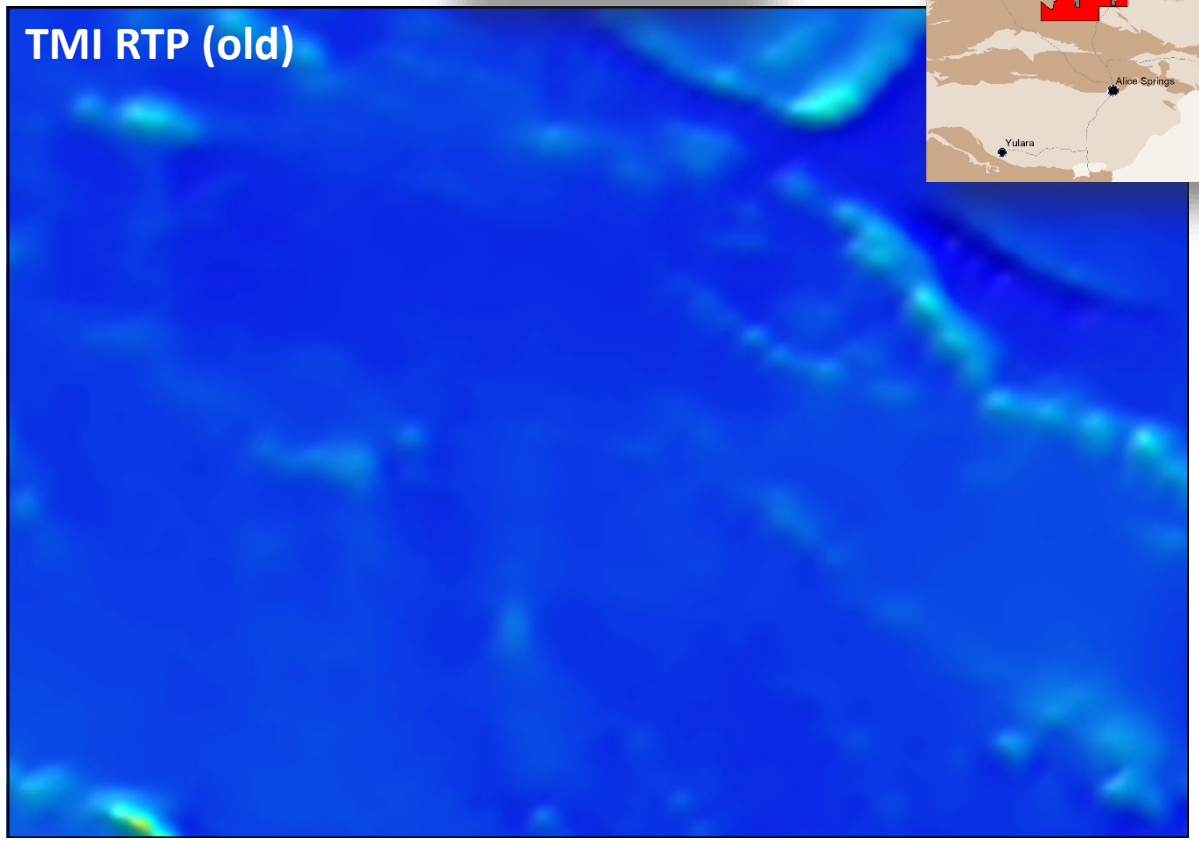
NTGS Mount Peake – Crawford Survey

- Subtle structures visible in the new data



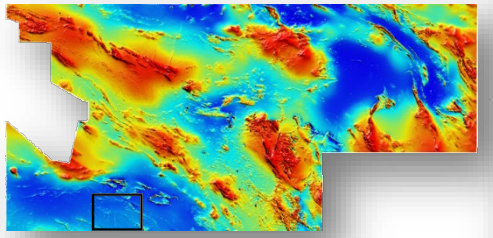


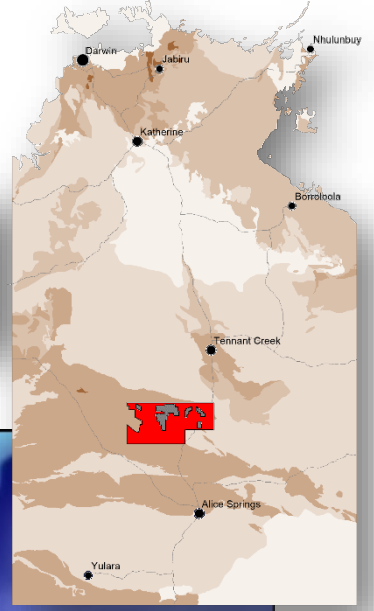




~24 km

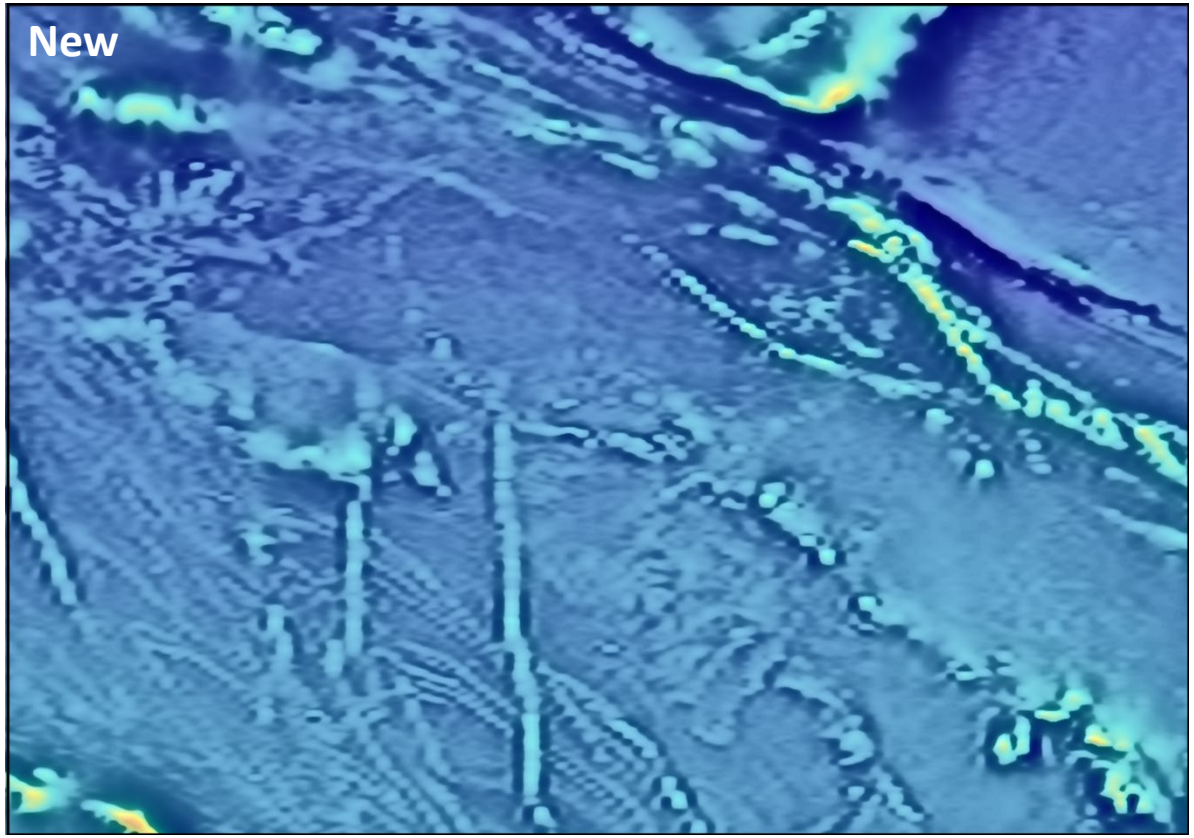
NTGS Mount Peake – Crawford Survey

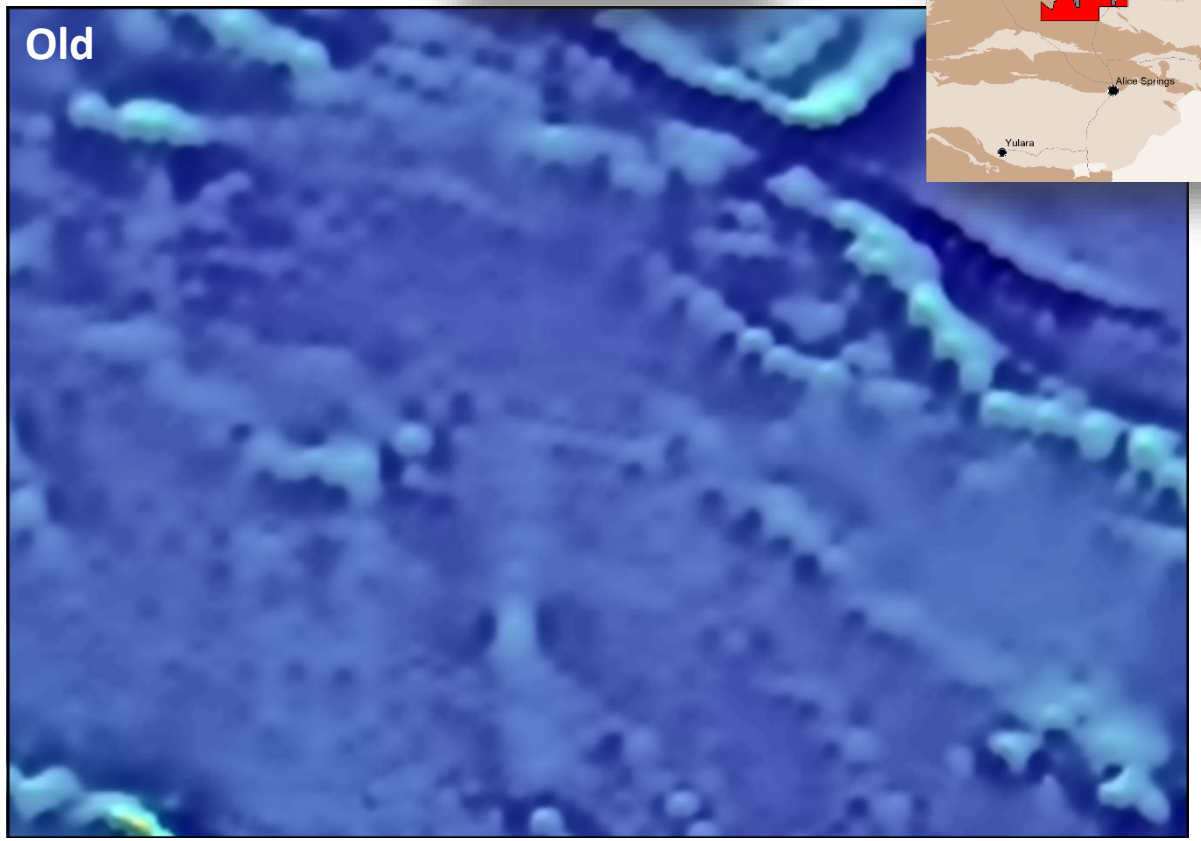




- Subtle structures visible in the new data

TMI RTP overlaying first vertical derivative of TMI RTP

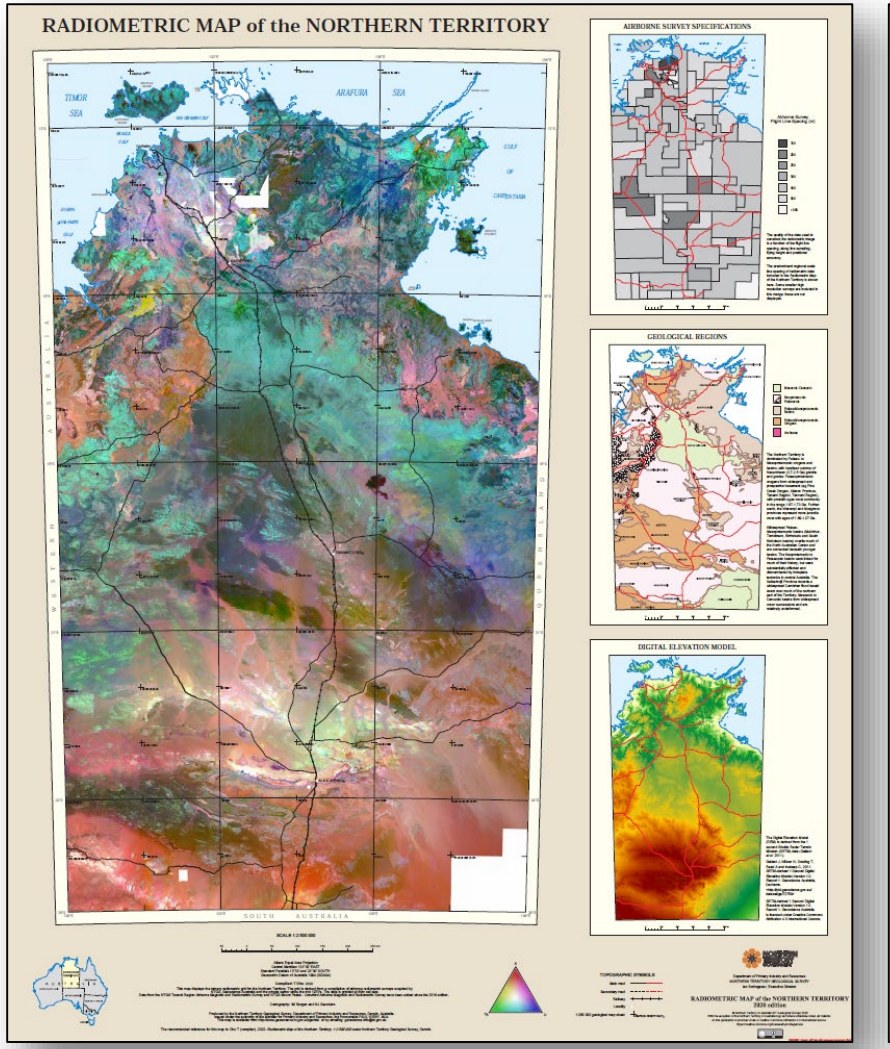


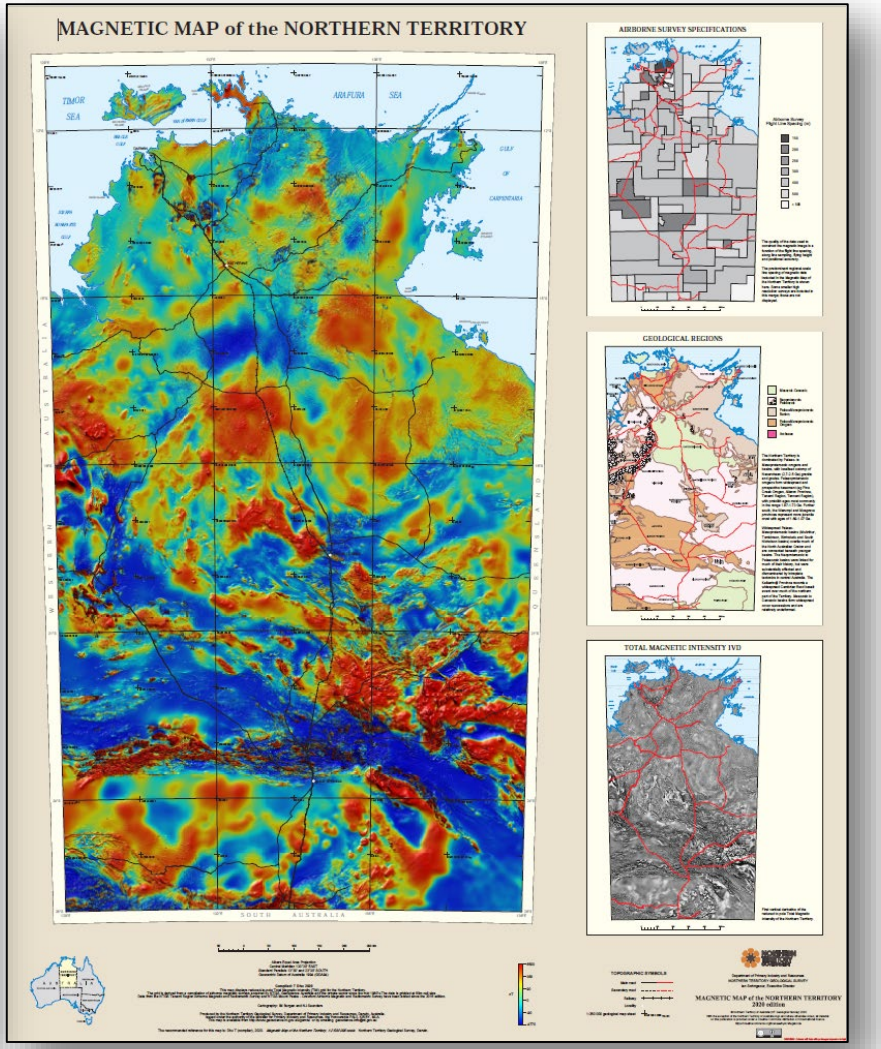


~24 km

NT Wide Magnetic and Radiometric Grids

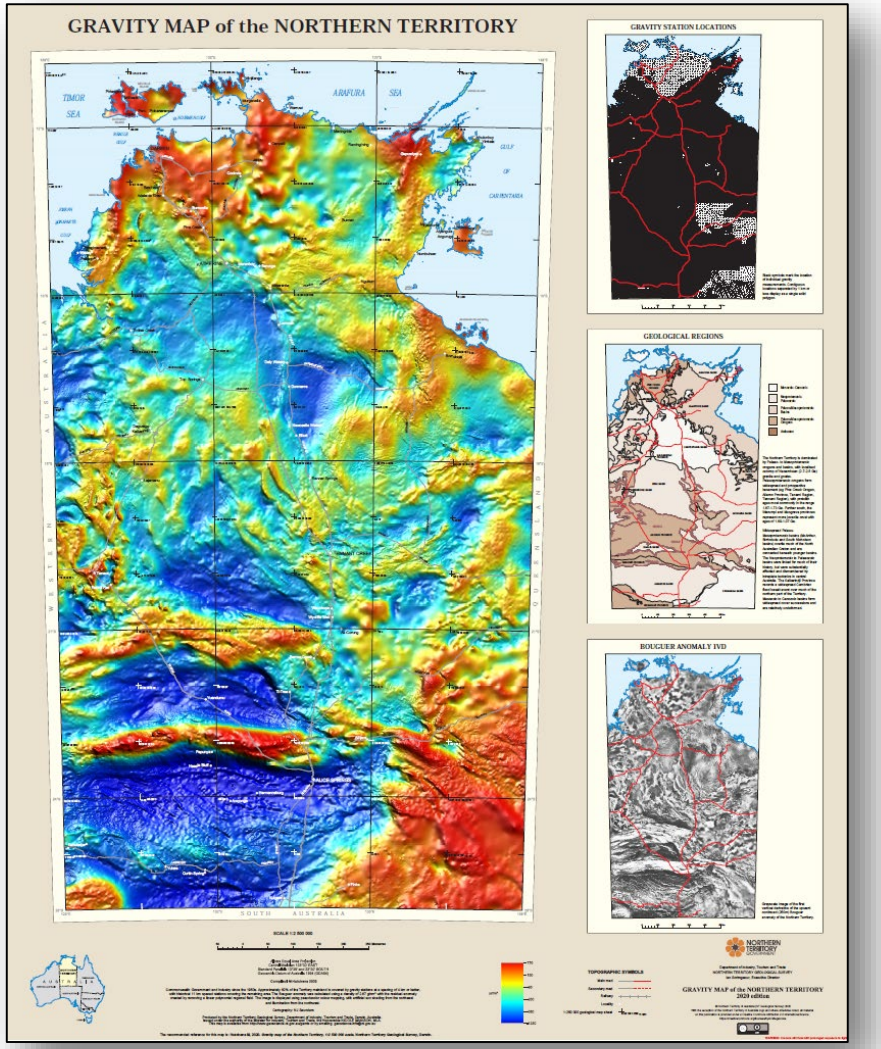
- Updated to include NTGS Tanami Region and Mount Peake – Crawford surveys
- Maps, grids and most of the input grids are downloadable on GEMIS





NT Wide Ground Gravity Grid

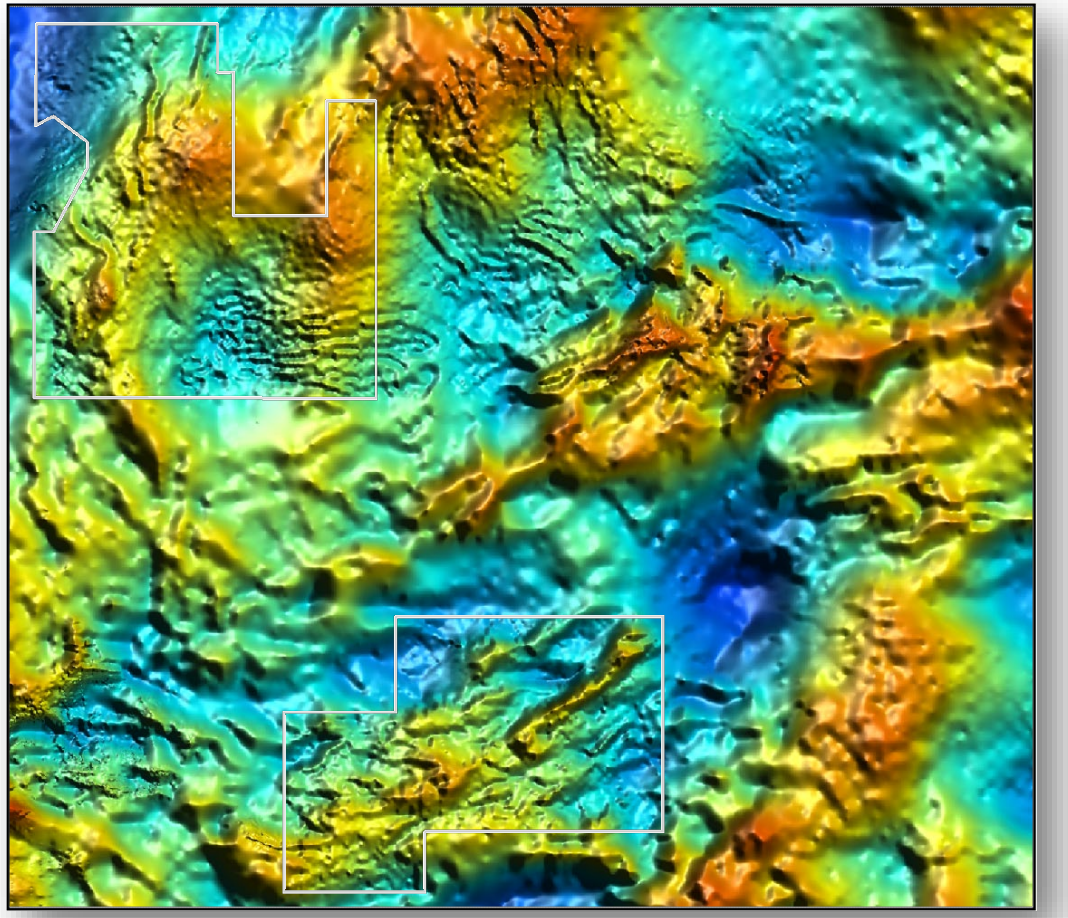
- Updated to include the EFTF East Tennant and Southwest McArthur, Barkly ground gravity surveys
- Grid interpolated from a compilation of 218 155 ground gravity stations from 171 surveys using ‘splines under tension’ algorithm to grid to 250 m cell size
- Map, grids and input data are downloadable through GEMIS



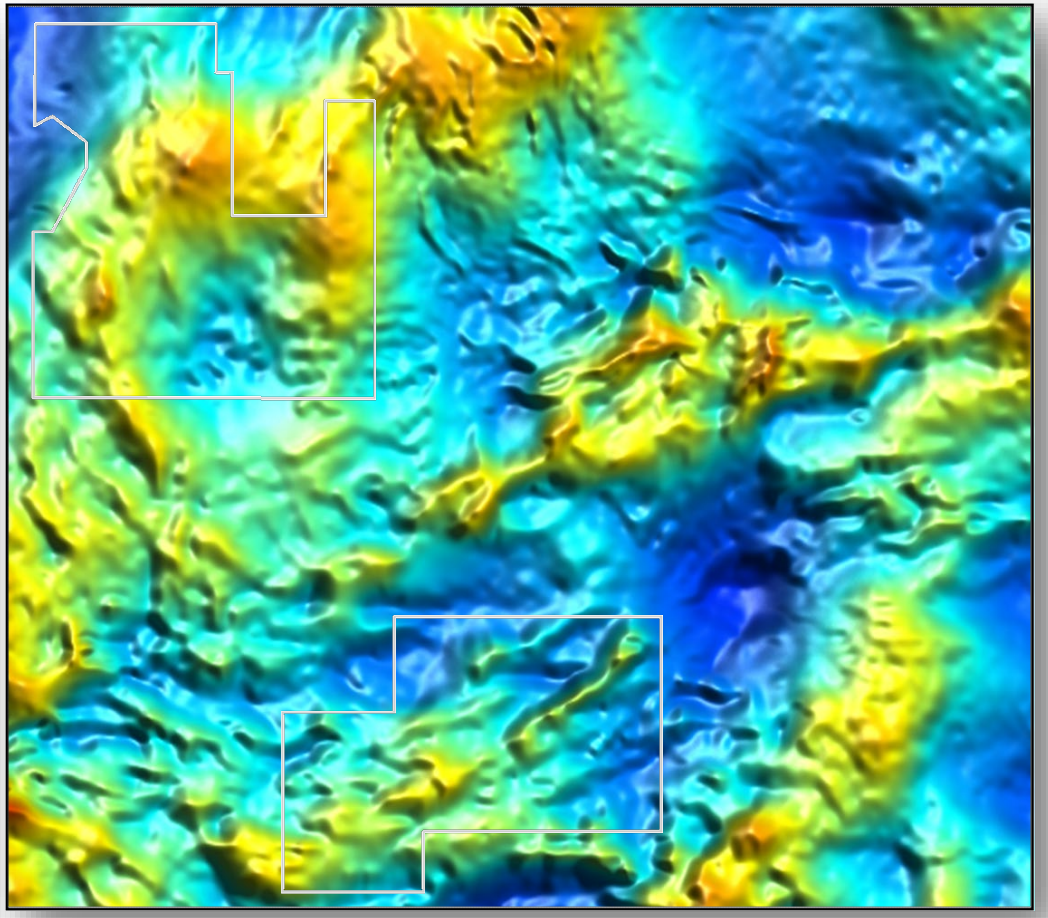
NT Wide Ground Gravity Grid

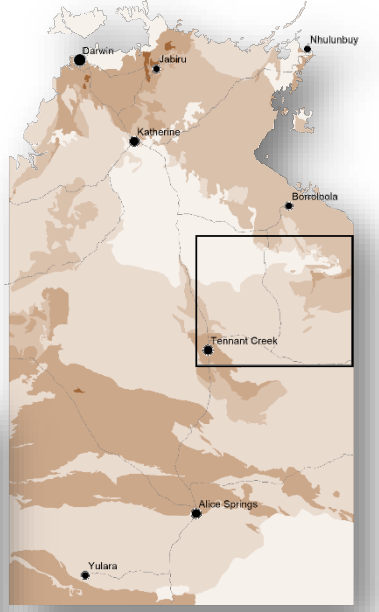
- Increased detail due to both new data and gridding specifications

Residual Bouguer Anomaly (new)



Residual Bouguer Anomaly (old)

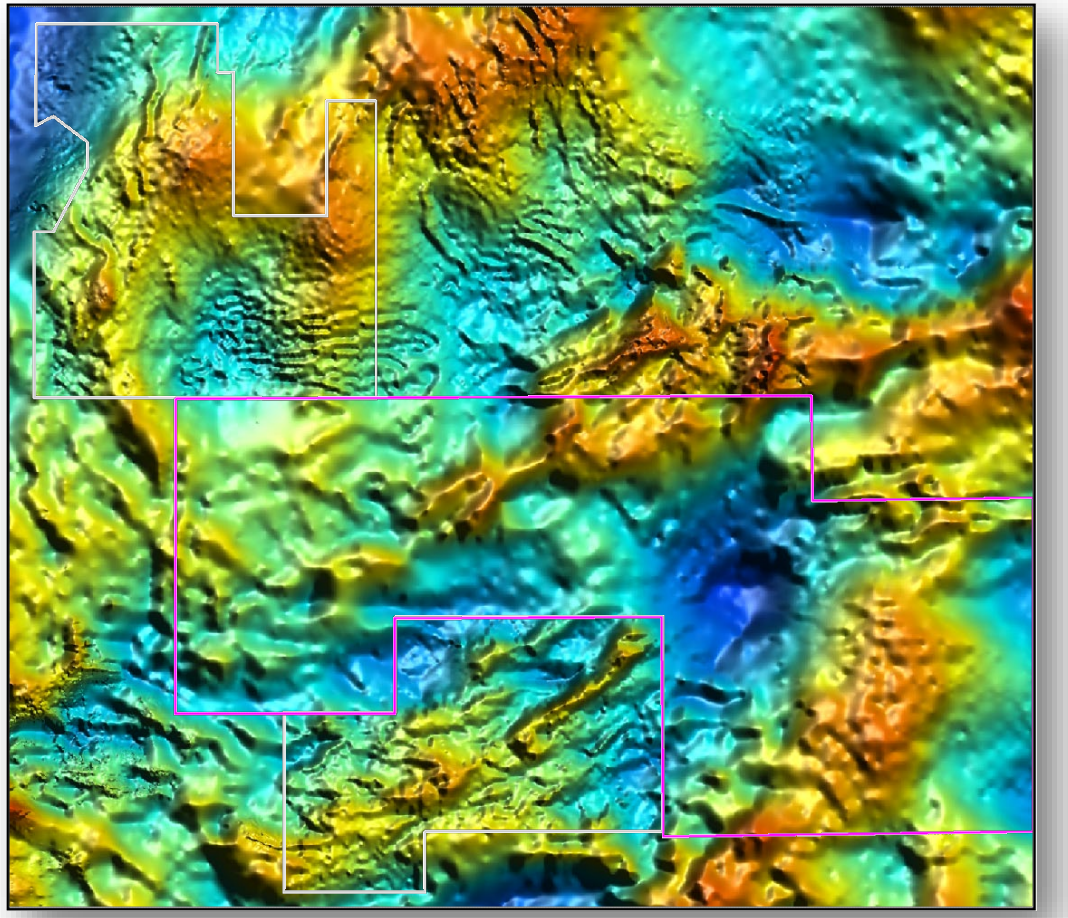




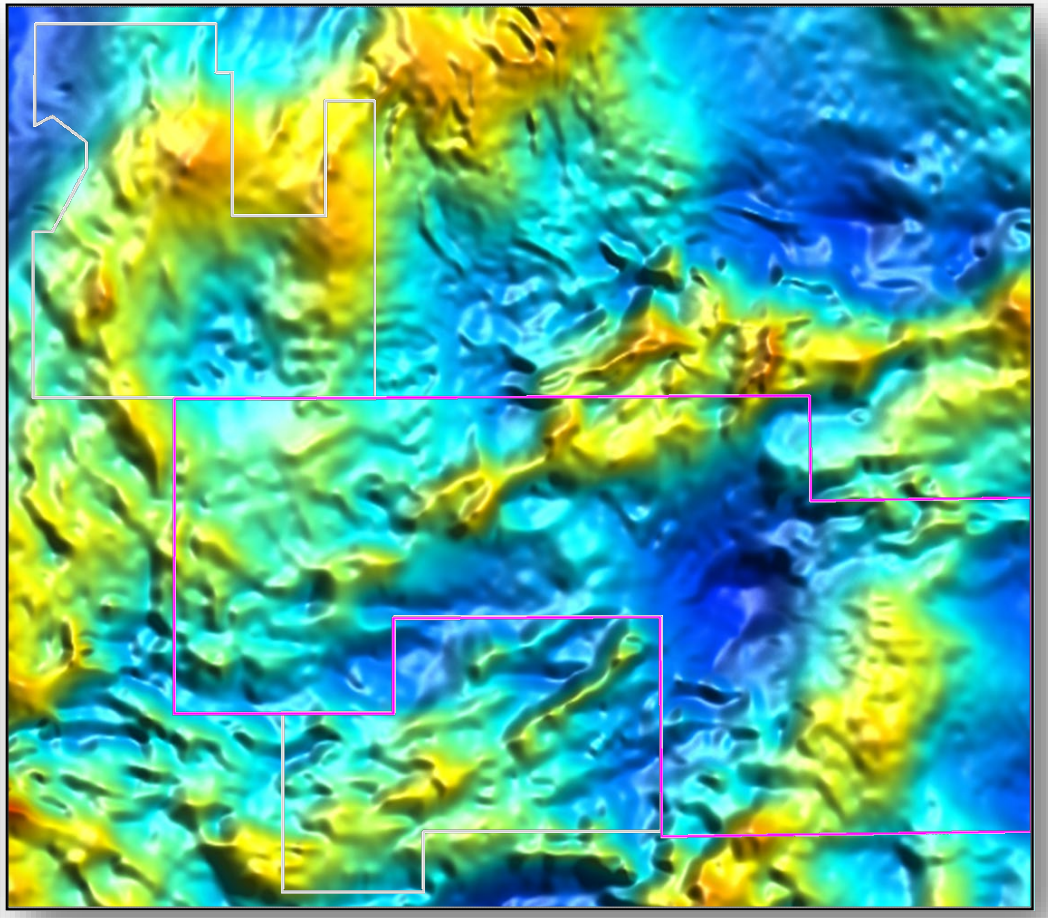
NTGS Brunette Downs Ground Gravity Survey

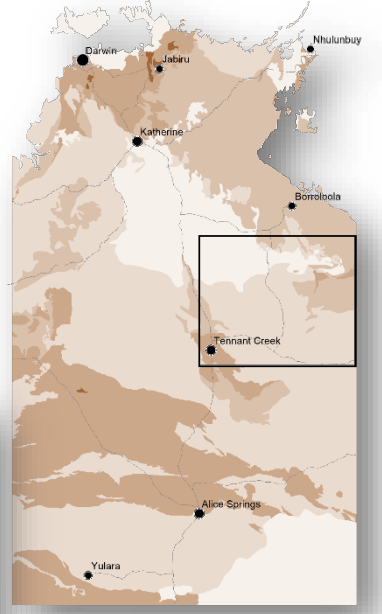
- Planned ground gravity survey will complete 2 km resolution in this area

Residual Bouguer Anomaly (new)



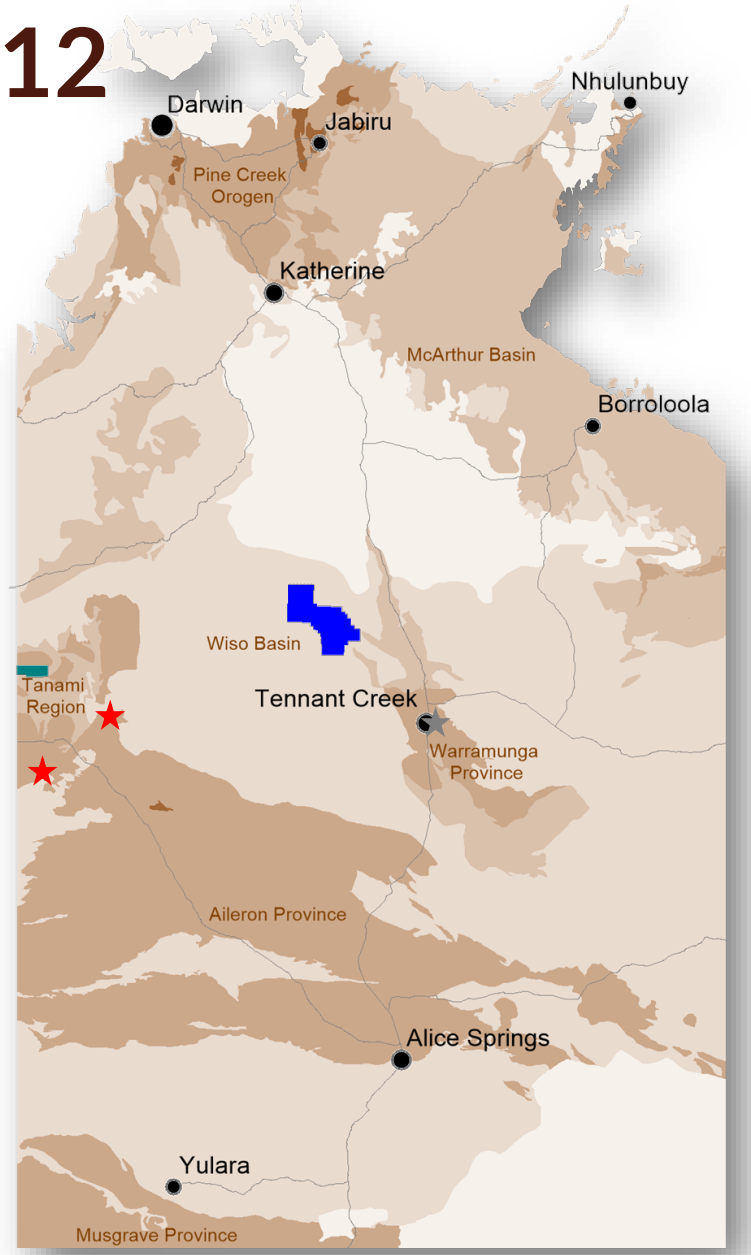
Residual Bouguer Anomaly (old)





Geophysics and Drilling Collaborations R12

- CR2019-0418 Sub-Audio Magnetics (SAM)
  - ~300 line km covering ~3 km^2 over 2 areas (grey)
- CR2019-0742 Ground Gravity
  - ~2200 observation sites covering ~30 km^2 over 2 areas (red)
- CR2019-0743 Airborne Electromagnetics (AEM)
  - ~1400 line km covering ~4450 km^2 (blue)
- CR2020-0005 Airborne Gravity Gradiometry (AGG)
  - ~1400 line km over ~530 km^2 (green)

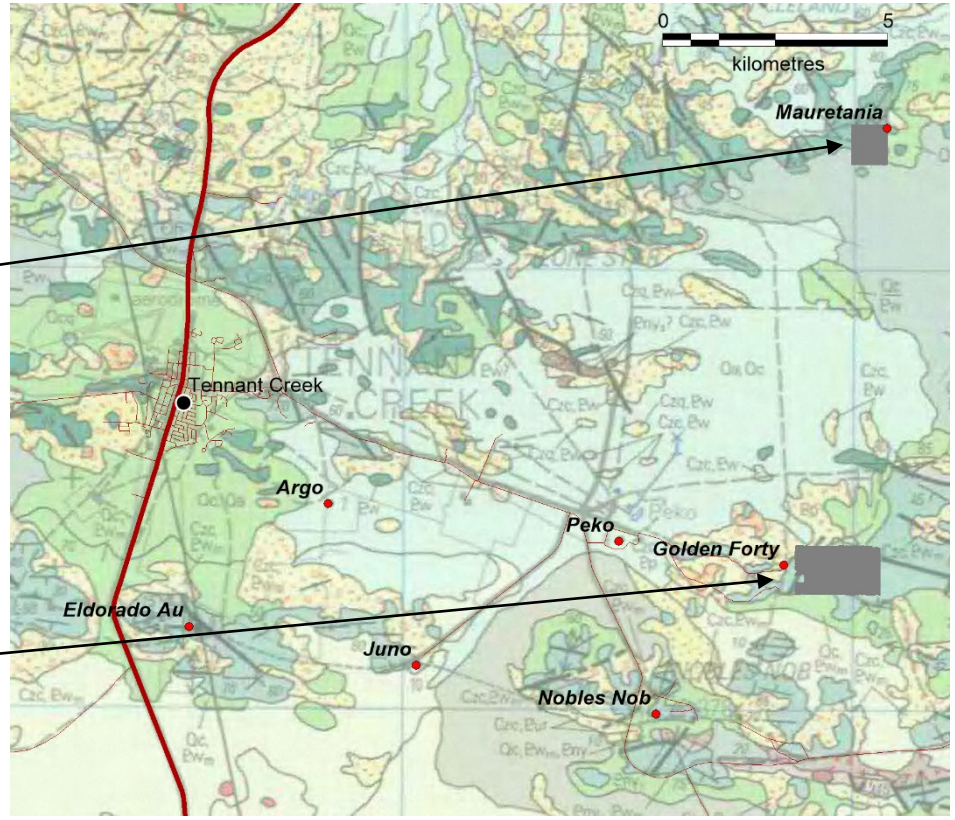


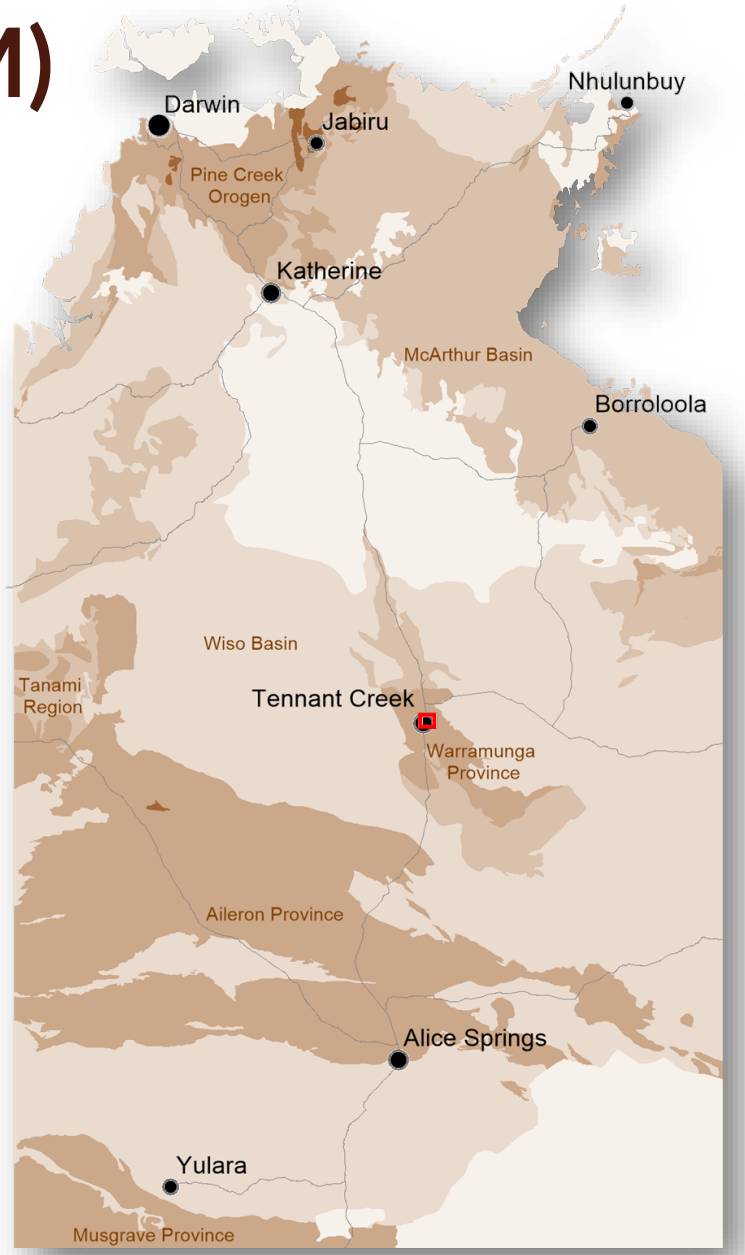
CR2019-0418 Sub-Audio Magnetic (SAM)

- Emmerson Resources Limited conducted two SAM surveys with 10 m line-spacing in the Tennant Creek Mineral Field over the Mauretania and Three Thirty prospects

Mauretania survey was designed to assist in accurately mapping the ironstone structural architecture and define its extent

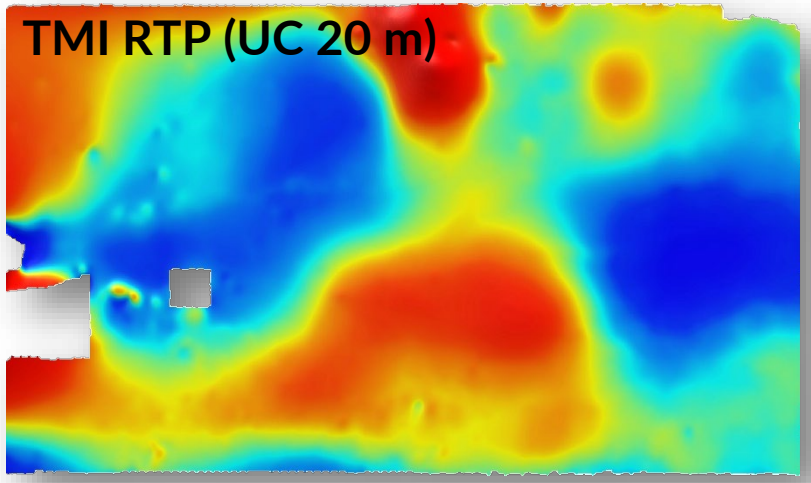
Three Thirty survey was designed to map blind sub-surface hematite altered sediments

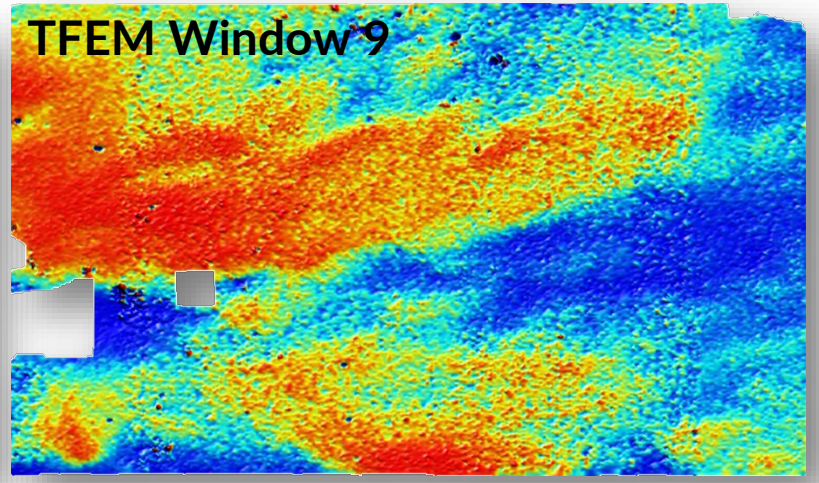


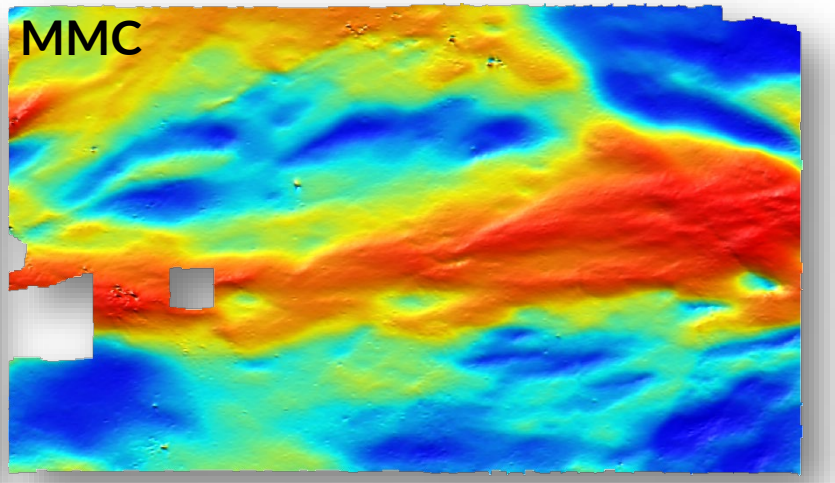


CR2019-0418 Sub-Audio Magnetic (SAM)

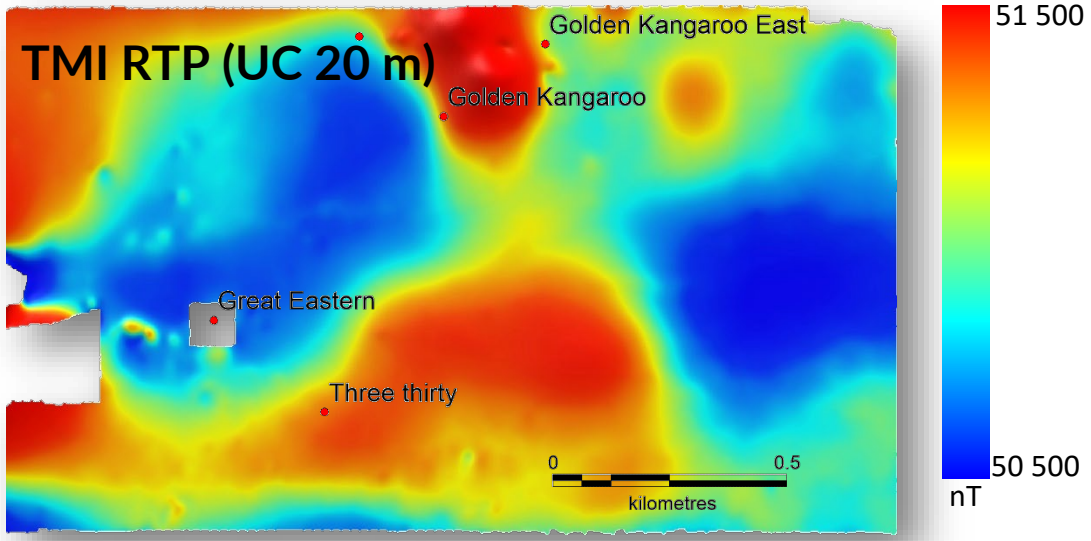
- A time-varying electric current is applied to the ground and changes in the resultant magnetic field measured
- Electrical and magnetic characteristics of the ground can be derived through spectral analysis of these data resulting in:
  - Total Magnetic Intensity (TMI)
  - Total Field Electromagnetics (TFEM) for different time windows
  - Magnetometric Conductivity (MMC) which reflects sub-surface current channelling; high values shown in red are associated with relatively conductive features and low values with shown in blue with resistive features

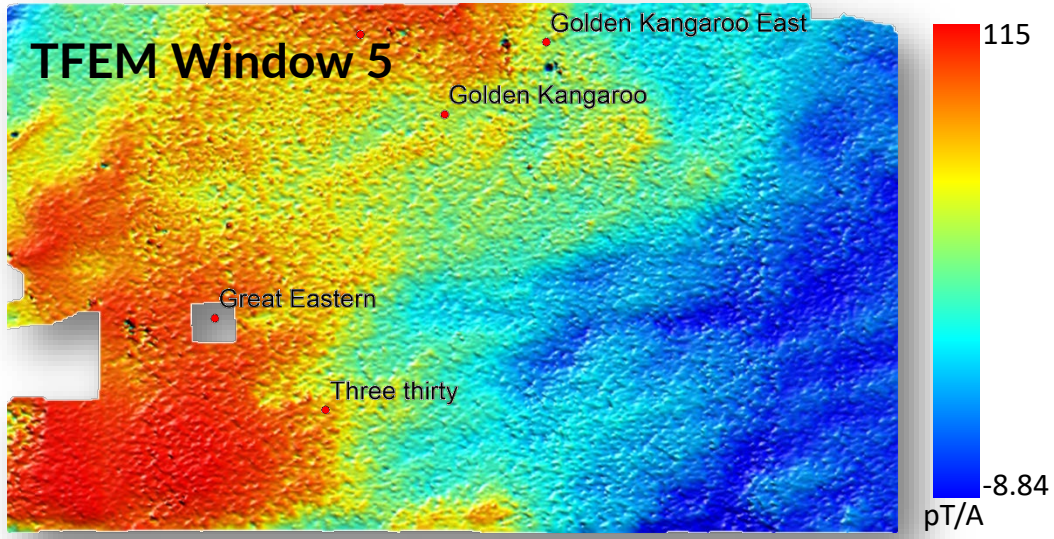




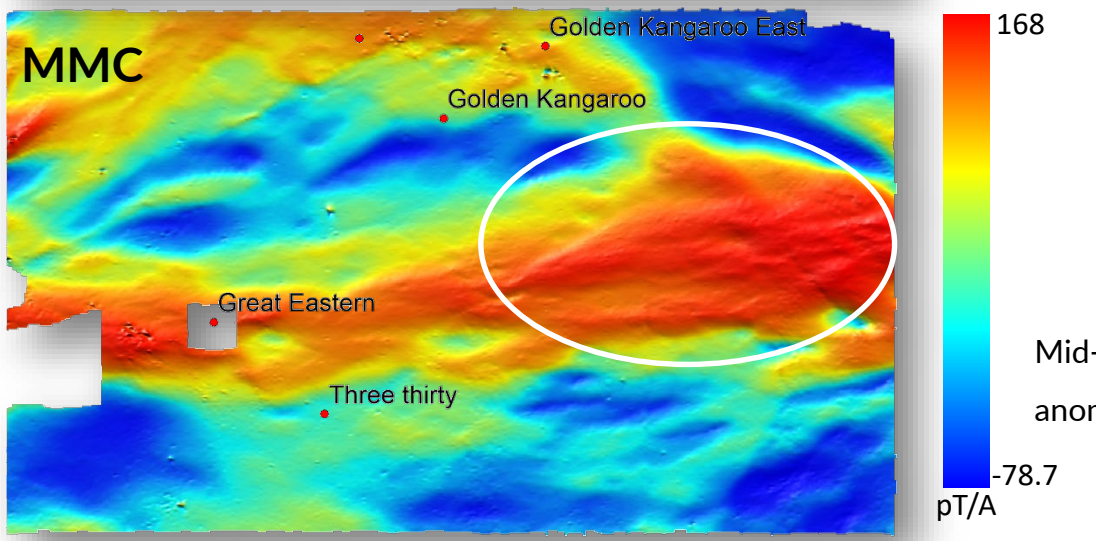


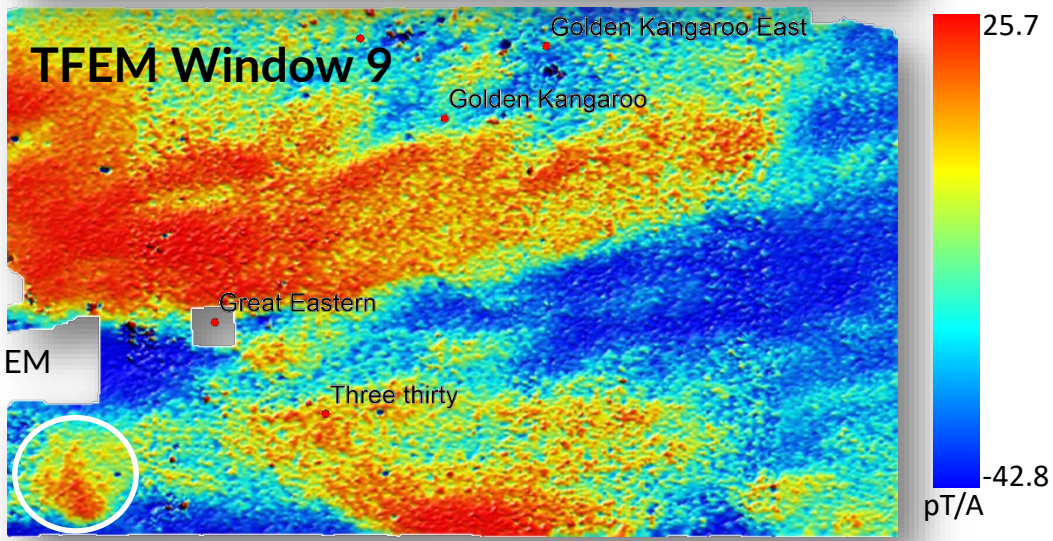
CR2019-0418 Three Thirty





Structural complexity along trend from Great Eastern and Three Thirty prospects

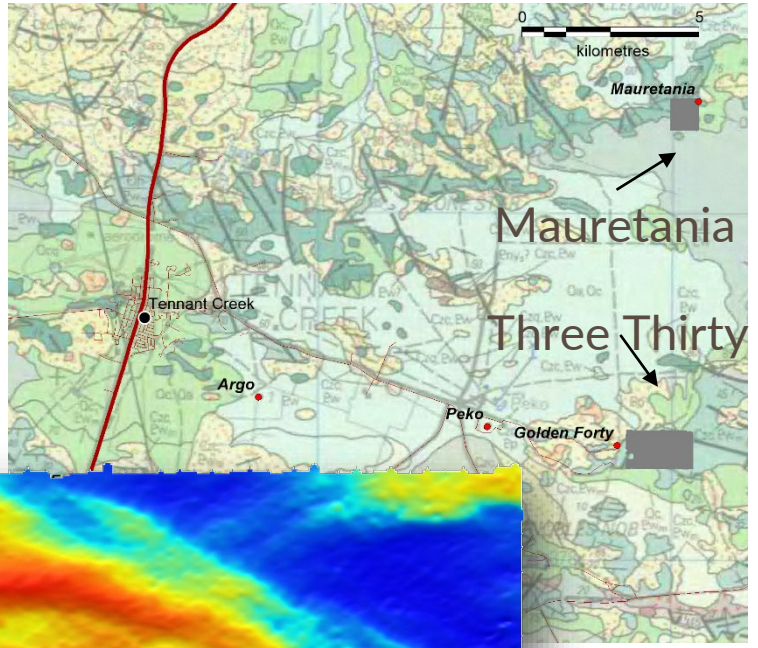


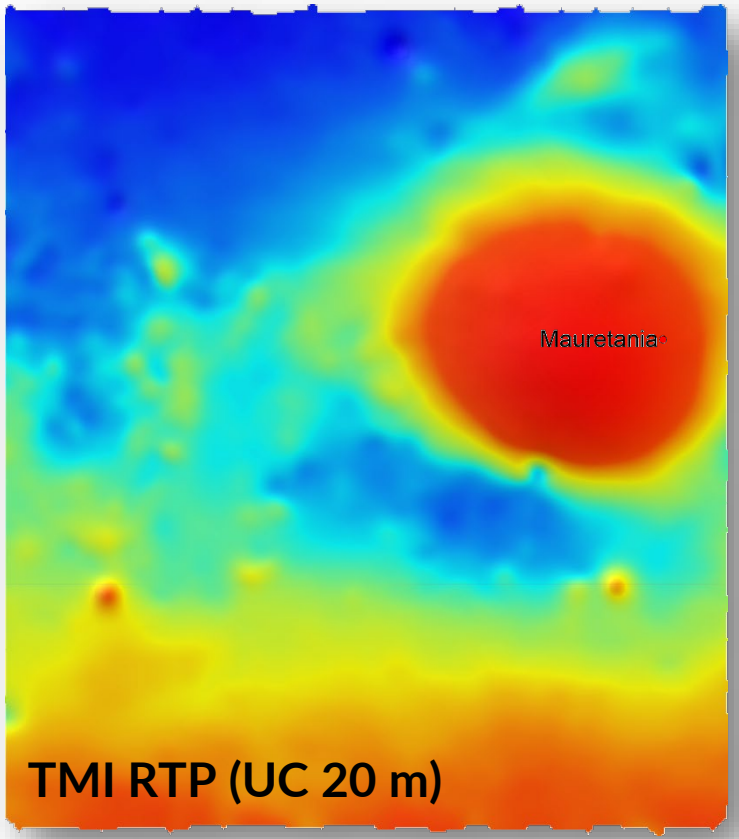


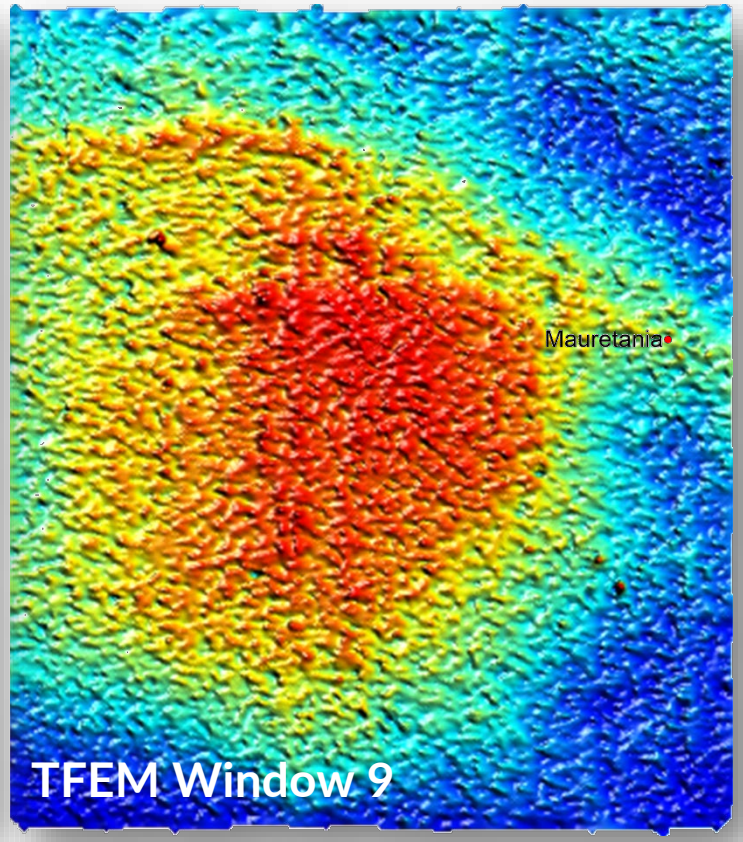
Mid-time EM anomaly

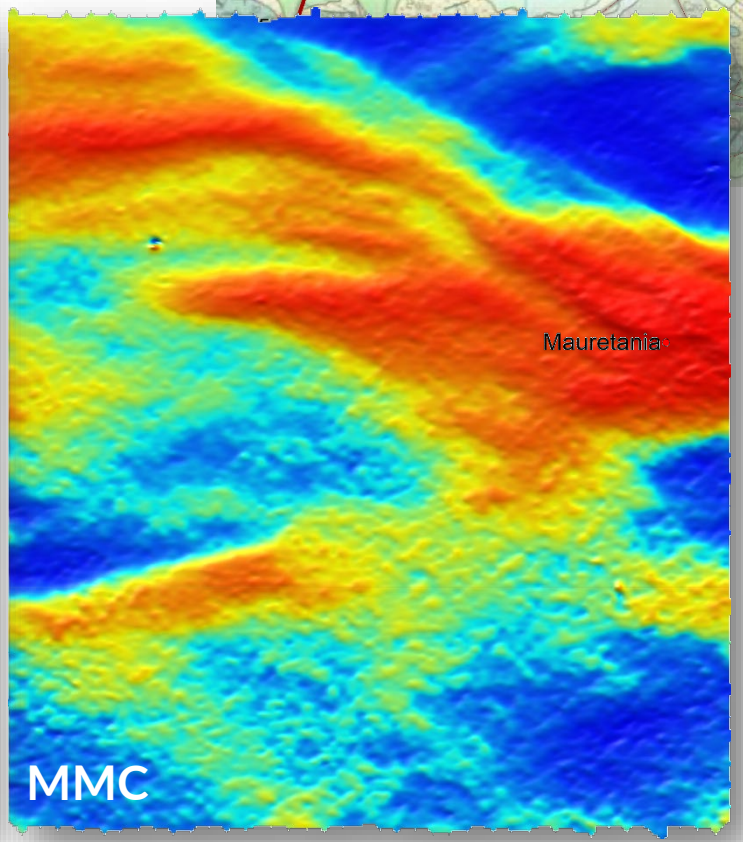
CR2019-0418 Mauretania

- Survey identified known mineralisation but no other mineralised structure delineated



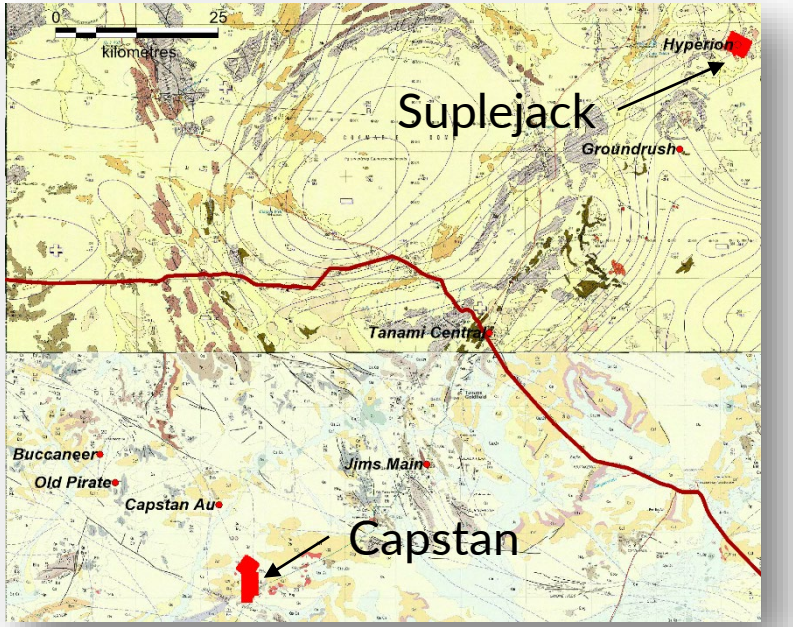


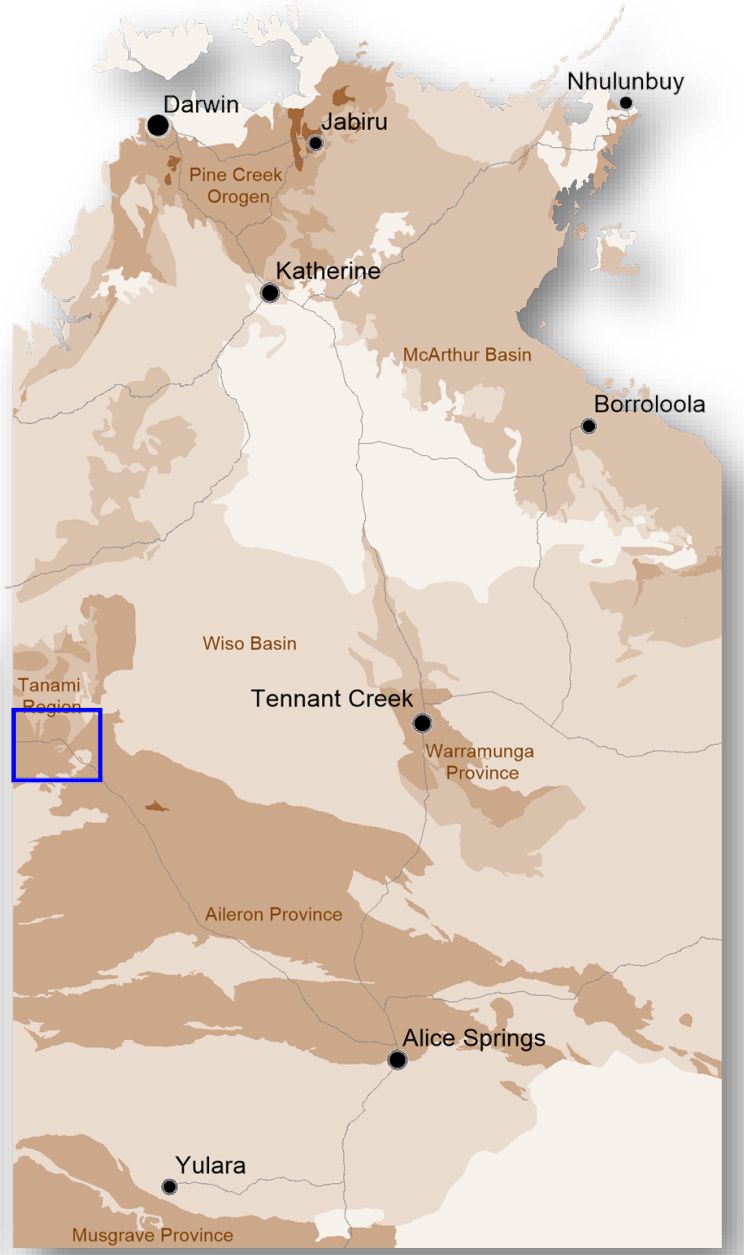




CR2019-0742 Ground Gravity

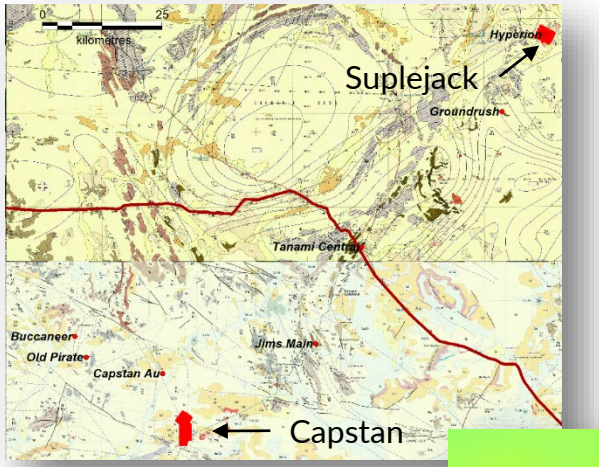
- Prodigy Gold completed two ground gravity surveys over the Capstan and Suplejack prospects in the Tanami Region 400 km northwest of Alice Springs
- Both surveys aimed to resolve the Tanami Group lithologies beneath cover

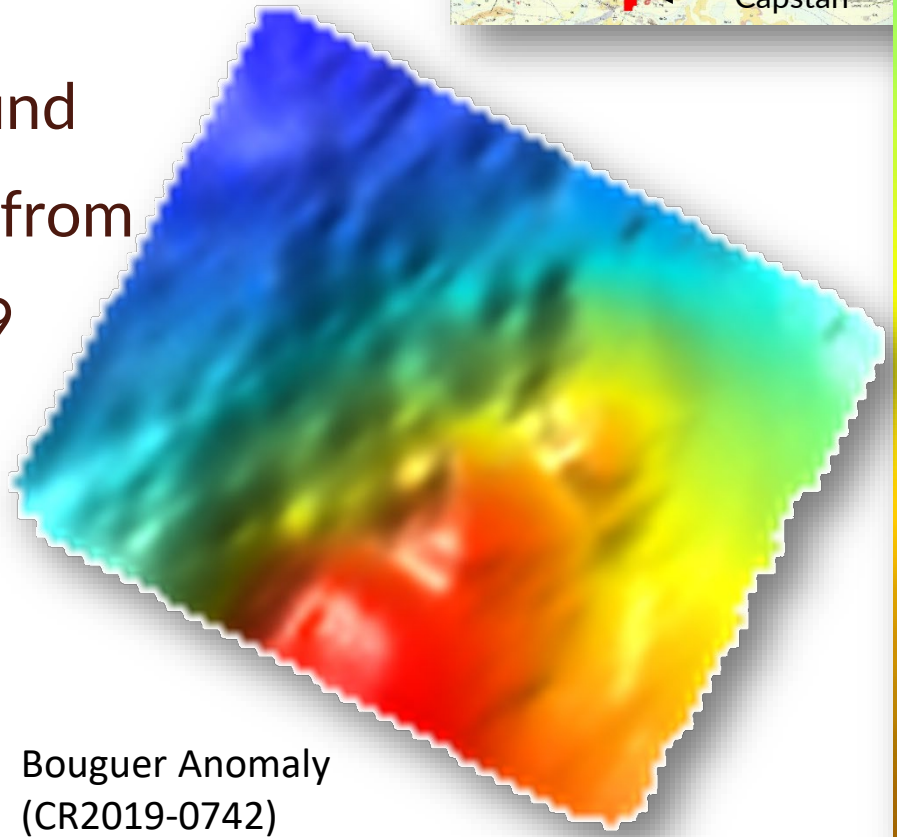




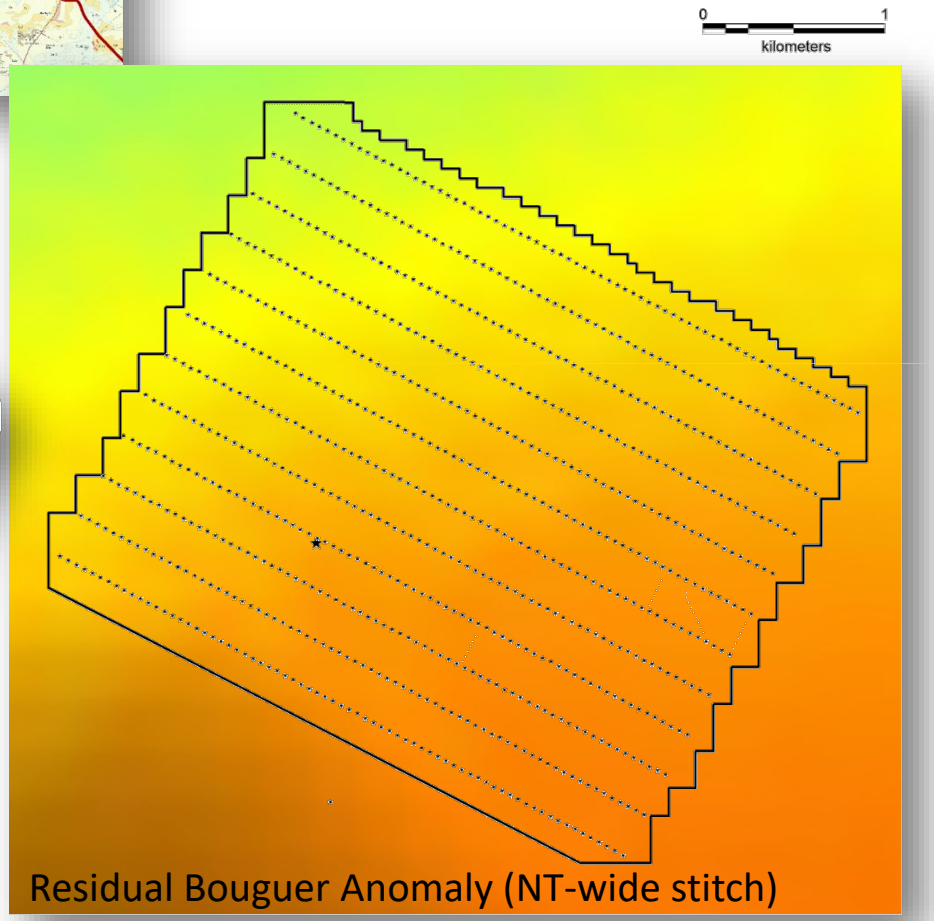
CR2019-0742 Suplejack

- Survey area approximately 11.25 square km
- One pre-existing ground gravity measurement from the 4 km spaced 1999 Tanami survey
- Survey acquired 852 measurements at 250m x 50m spacing





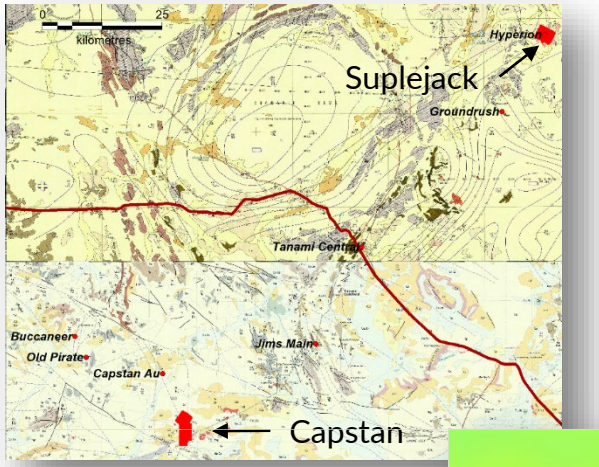
Bouguer Anomaly (CR2019-0742)

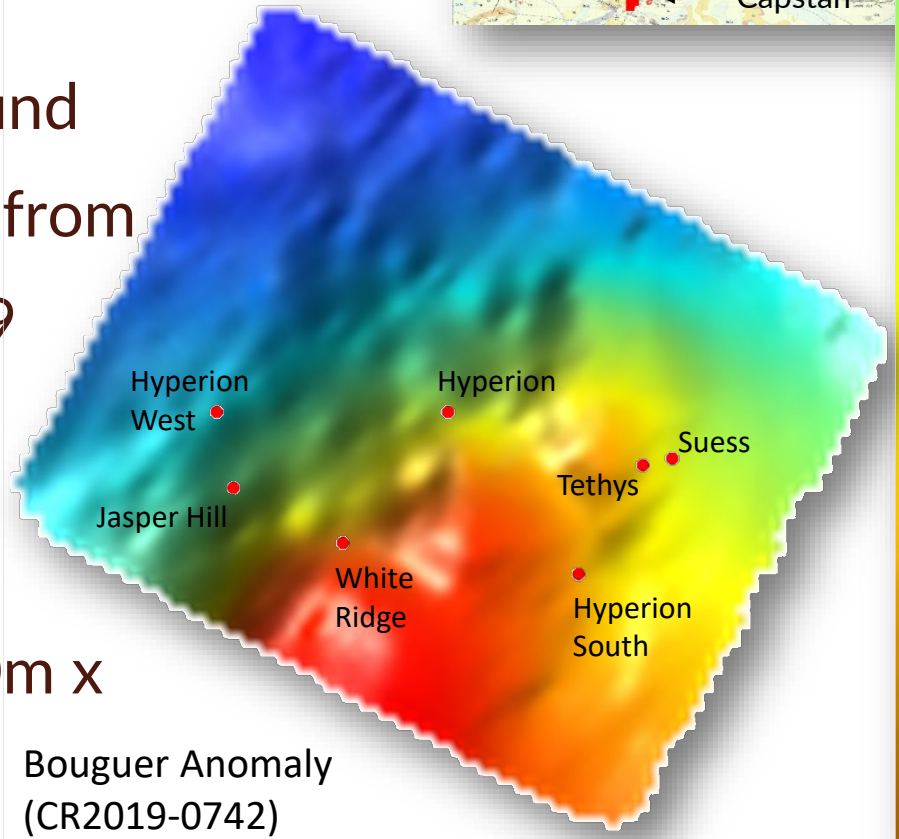


Residual Bouguer Anomaly (NT-wide stitch)

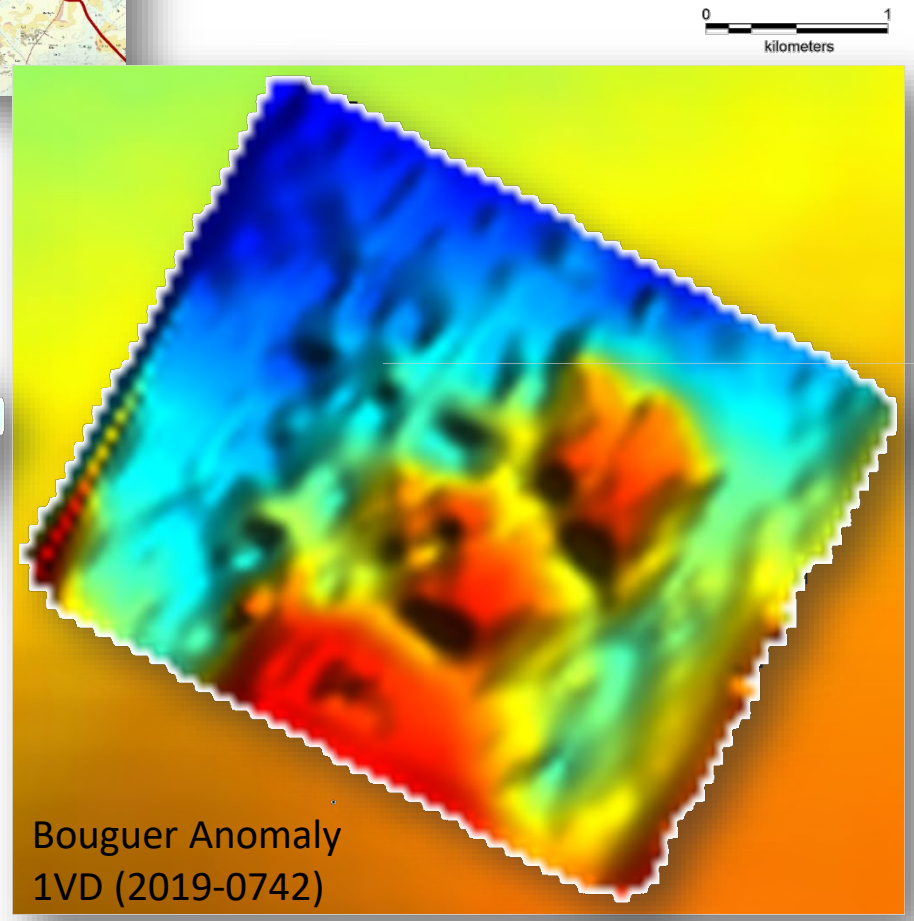
CR2019-0742 Suplejack

- Survey area approximately 11.25 square km
- One pre-existing ground gravity measurement from the 4 km spaced 1999 Tanami survey
- Survey acquired 852 measurements at 250m x 50m spacing over





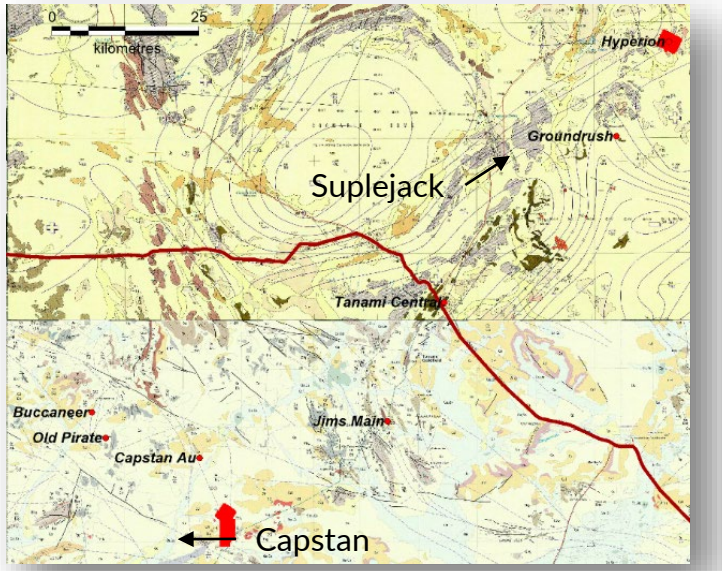
Bouguer Anomaly (CR2019-0742)

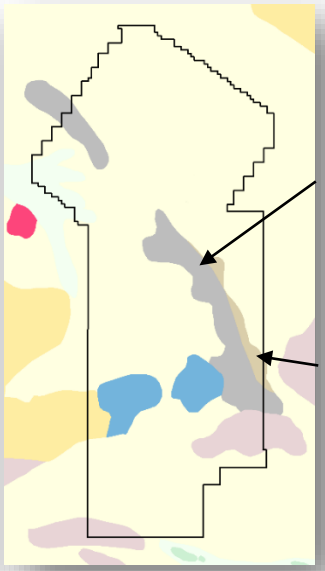


Bouguer Anomaly 1VD (2019-0742)

CR2019-0742 Capstan

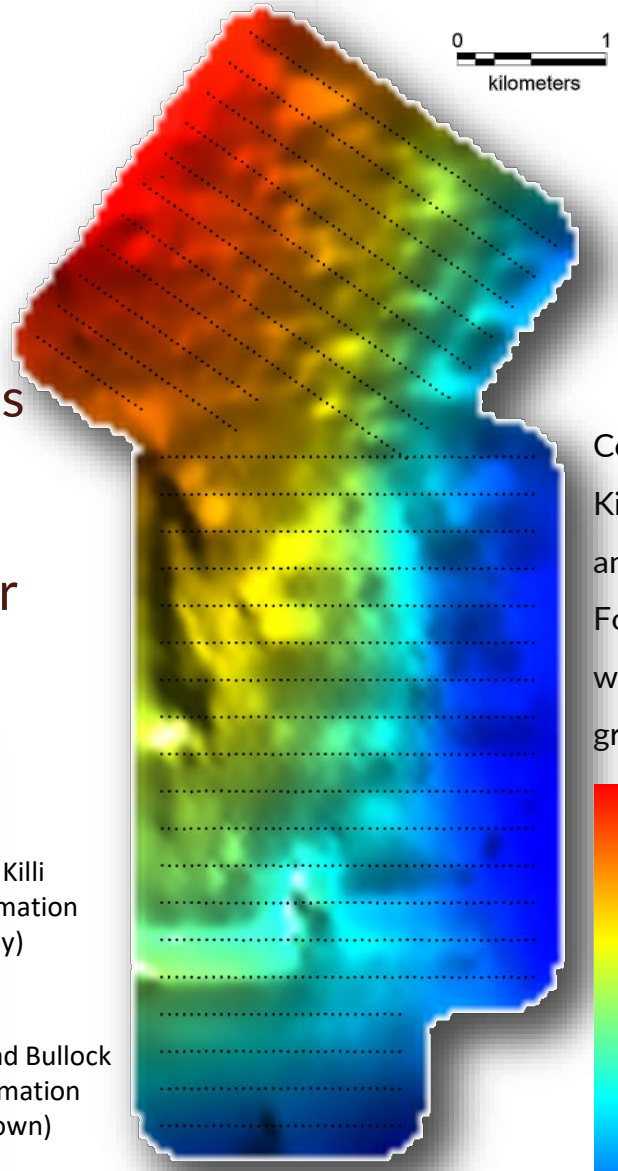
- 1383 measurements at 250m x 50m spacing
- Tanami Group lithologies and cover sequences resolved in Bouguer Anomaly grid
- Structural complexity apparent in the Bouguer Anomaly first vertical derivative grid





Killi Killi Formation (grey)

Dead Bullock Formation (brown)



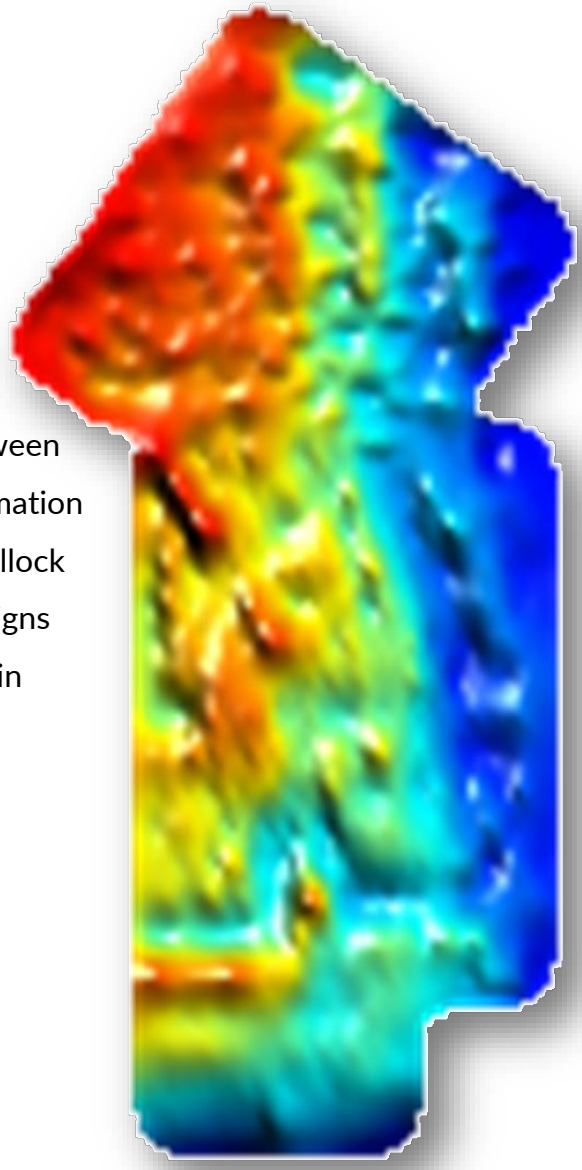
Bouguer Anomaly

Contact between Killi Killi Formation and Dead Bullock Formation aligns with change in gravity

-14

-28

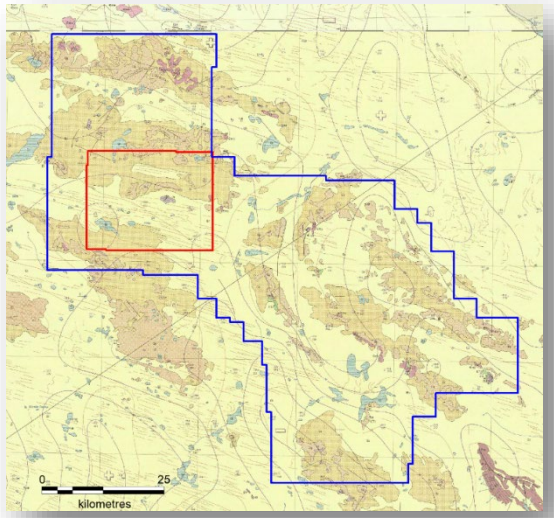
mGal

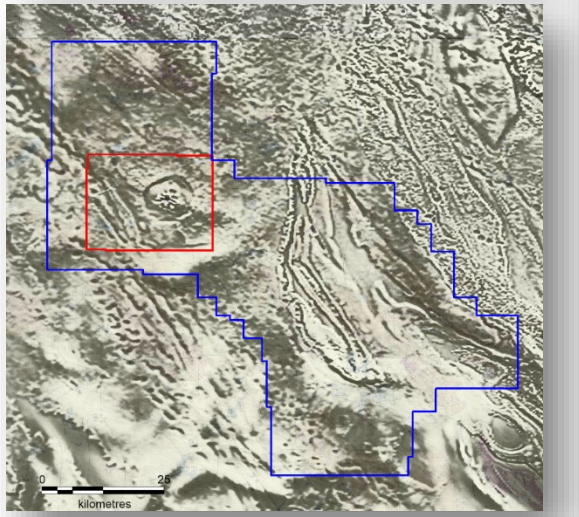


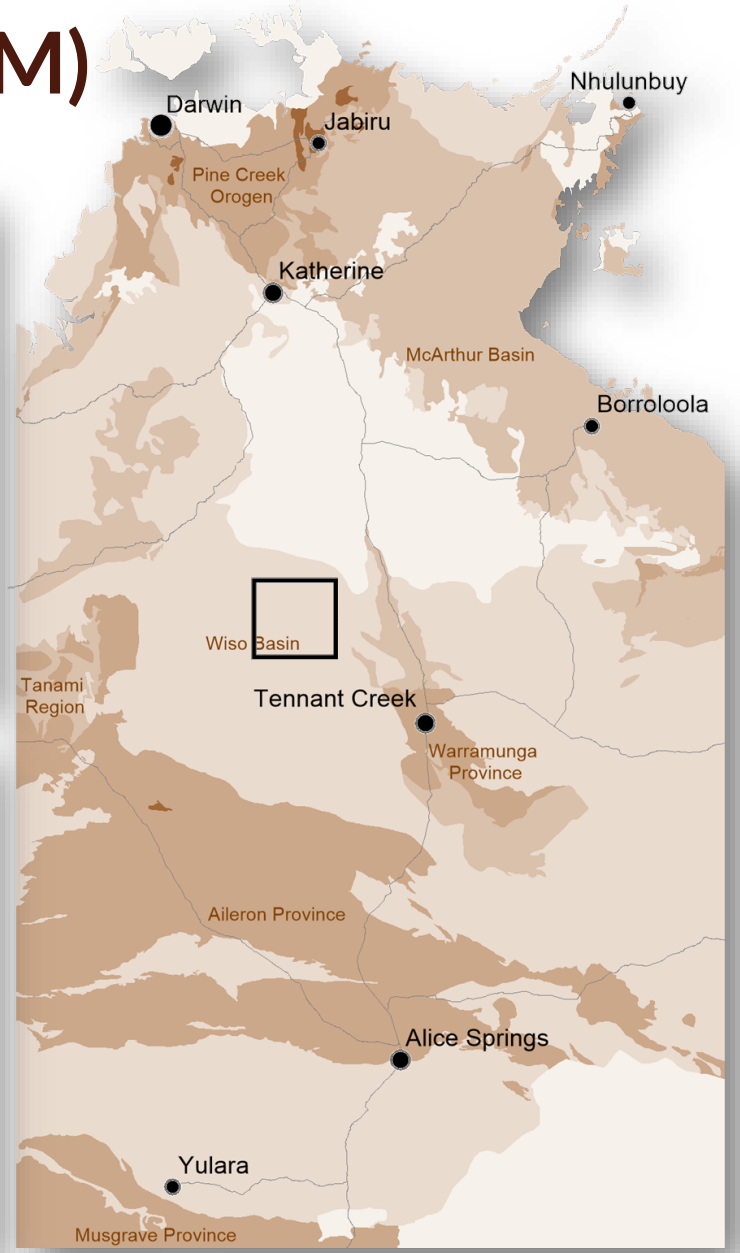
Bouguer Anomaly
1st Vertical Derivative

CR2019-0743 Airborne Electromagnetics (AEM)

- Asian Minerals Pty Ltd acquired regional-scale AEM data (4800 m line-spacing) using the TEMPEST system over the East Tanami project area located northwest of Tennant Creek to provide baseline geophysical data in an under-explored area
- A further higher-resolution (1200 m line-spacing) infill survey was acquired over a possible diatreme structure identified in the NTGS Buchanan airborne magnetic and radiometric survey

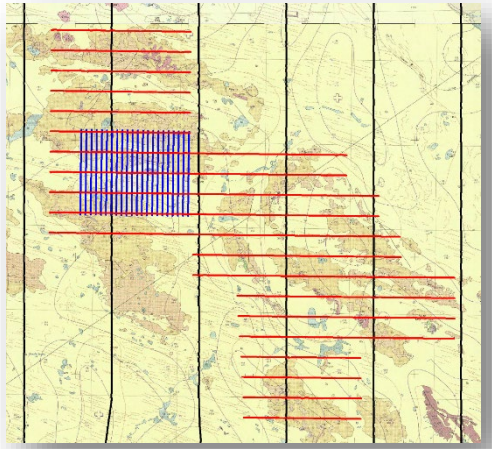


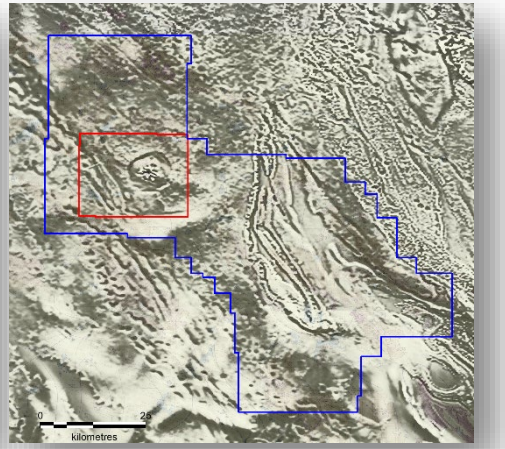




CR2019-0743 AEM

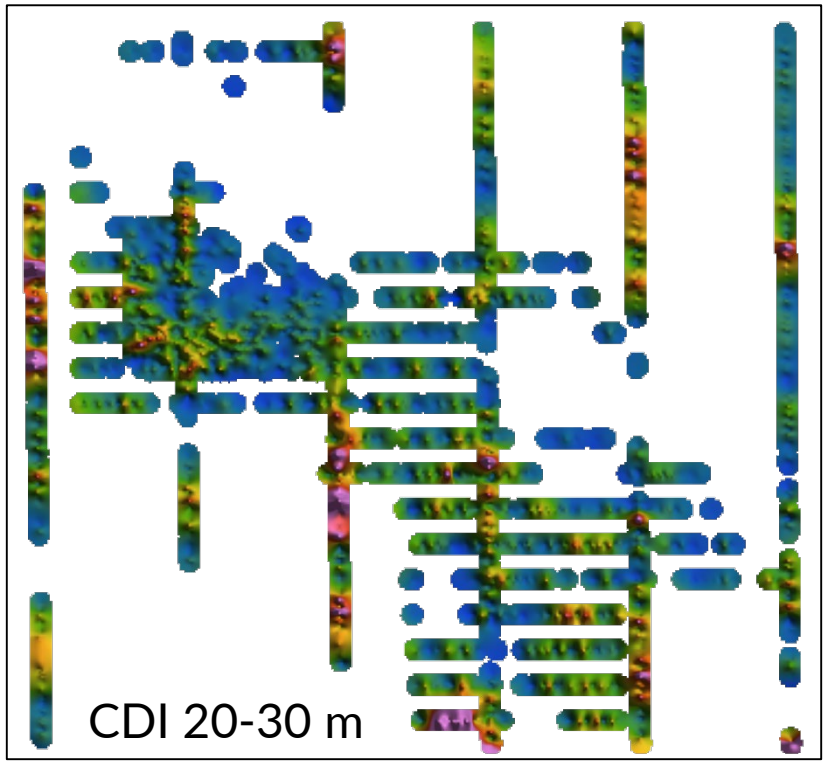
- The high resolution survey defines the possible diatreme structure
- Regional data allows focussing of site clearance work and enhanced target generation

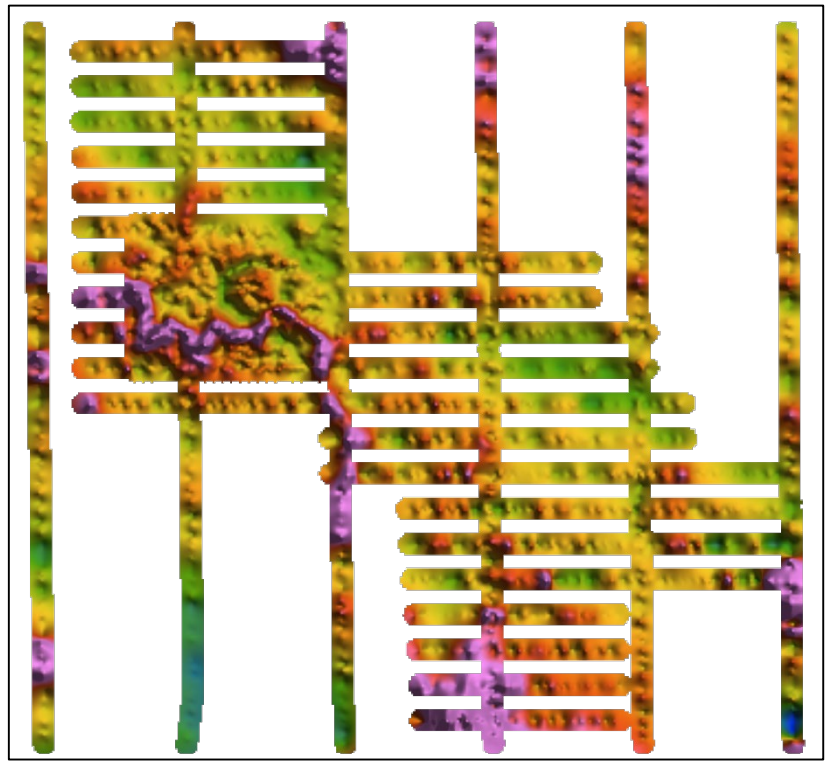


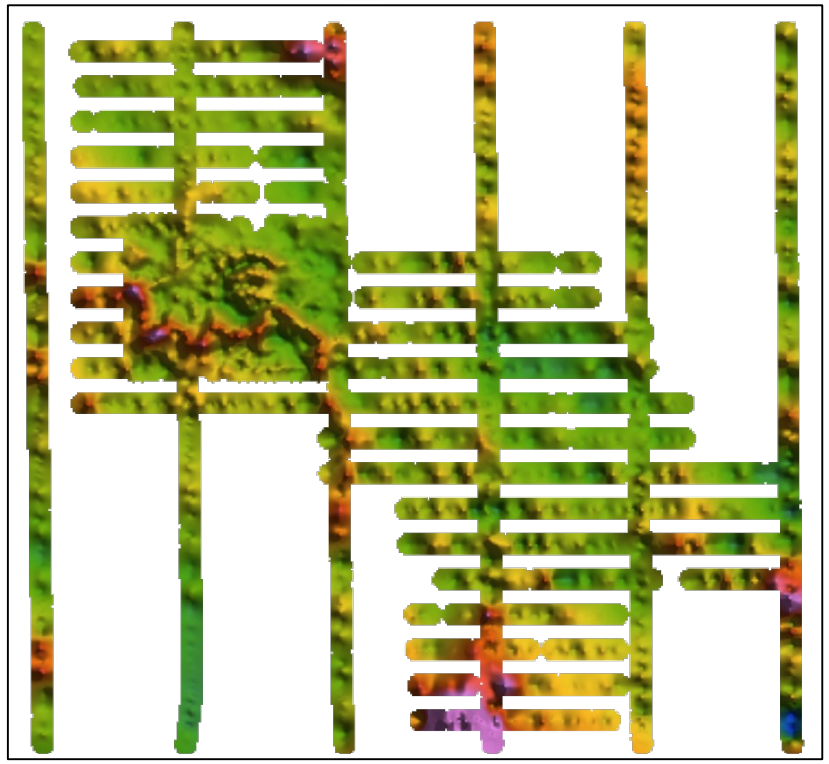


CDI 70-100 m

CDI 180-220 m

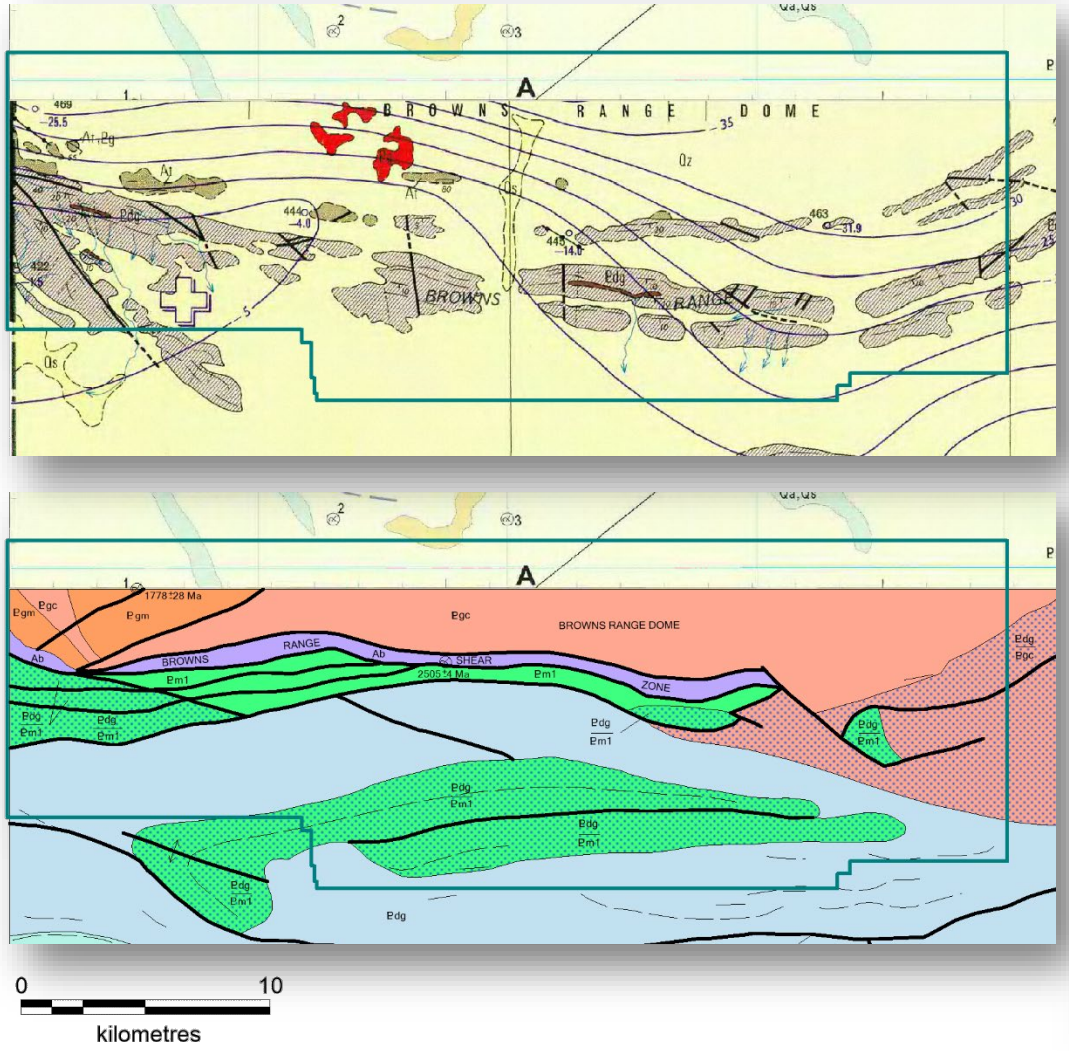


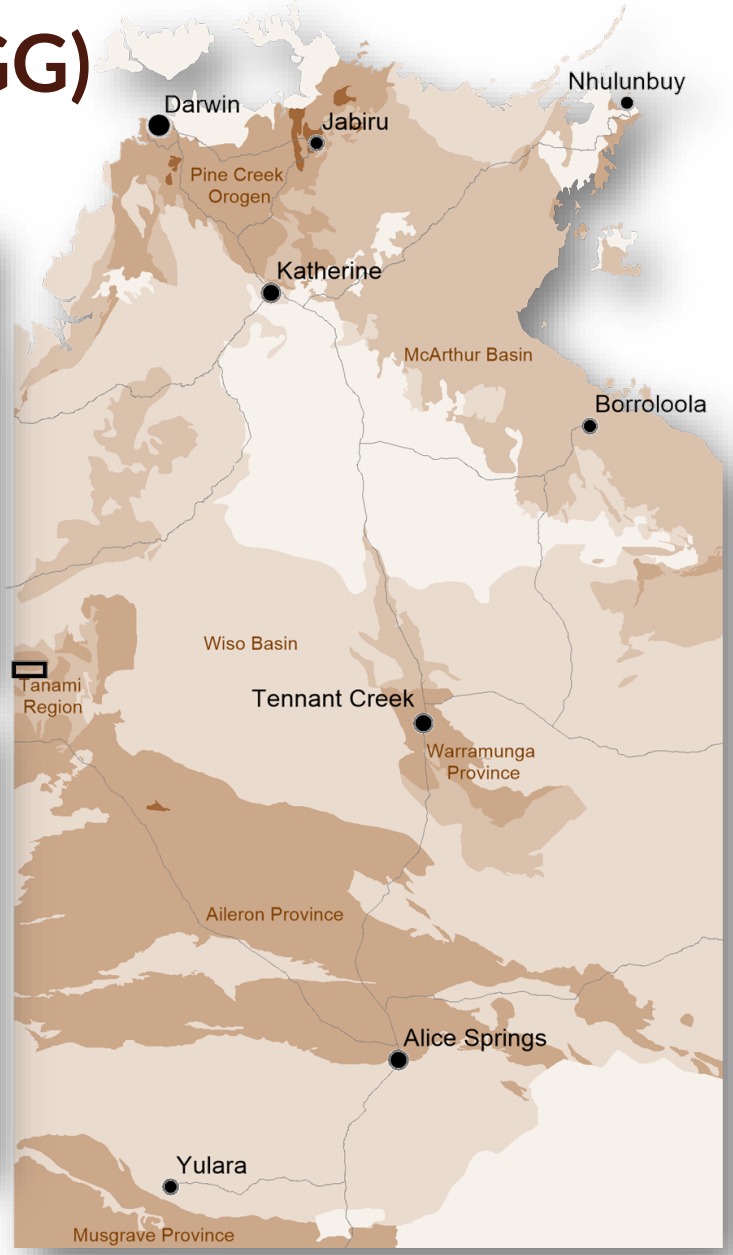




CR2020-0005 Airborne Gravity Gradiometry (AGG)

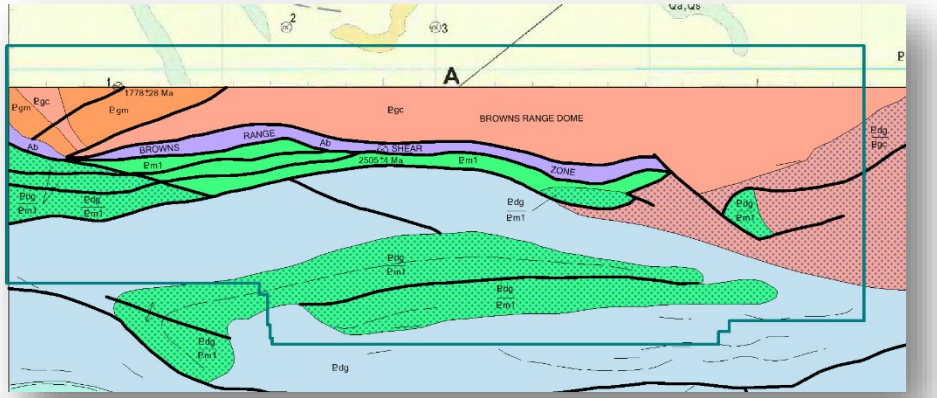
- Northern Star Resource Ltd completed an AGG survey over Browns Dome in the Tanami Region to assist with mapping the southern margin of the dome
- The survey was flown at 400 m line-spacing



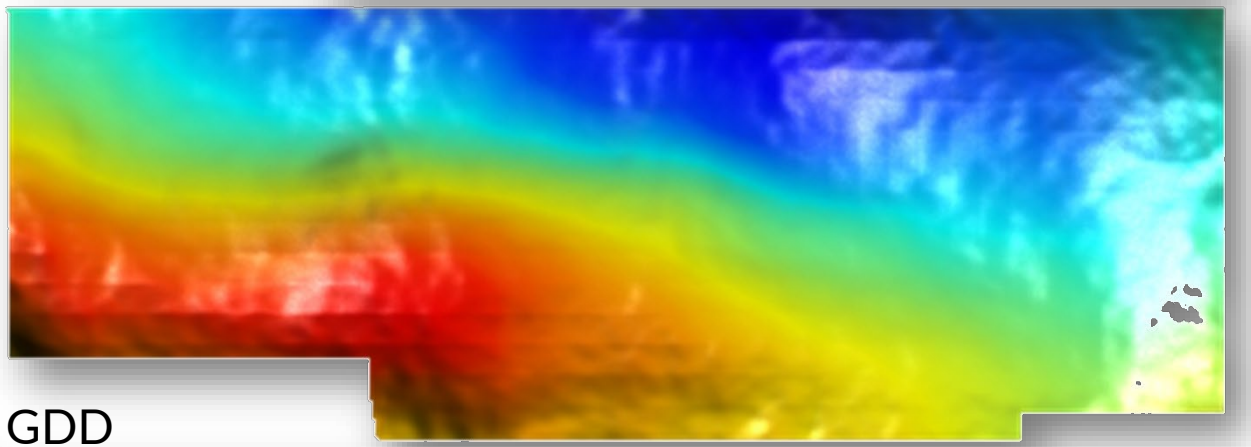


CR2020-0005 AGG

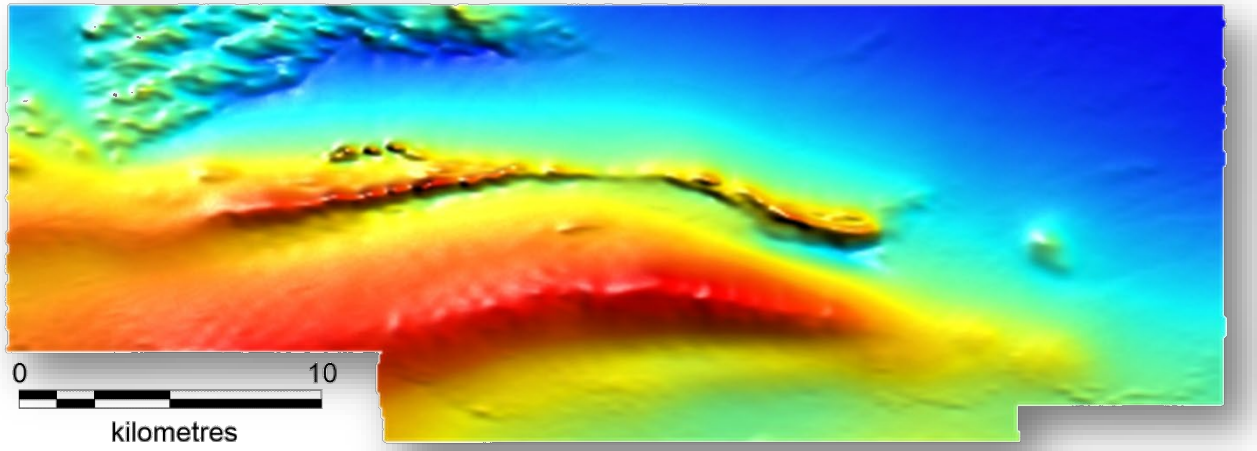
- The contact between the Browns Dome intrusive complex and surrounding Tanami Group rocks appears steeply north-dipping
- There appears greater complexity within the granite dome then previously recognised



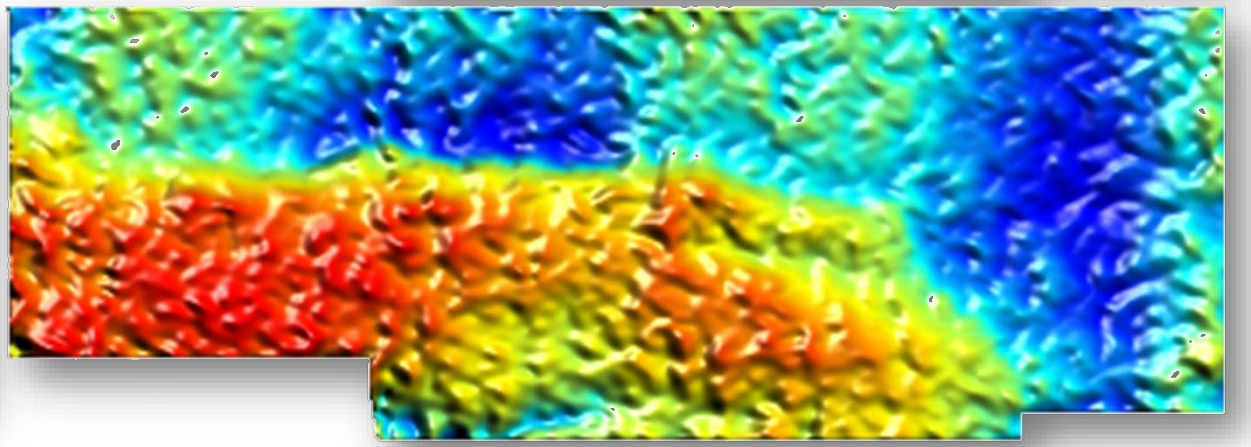
GD (conformed to ground)



TMI

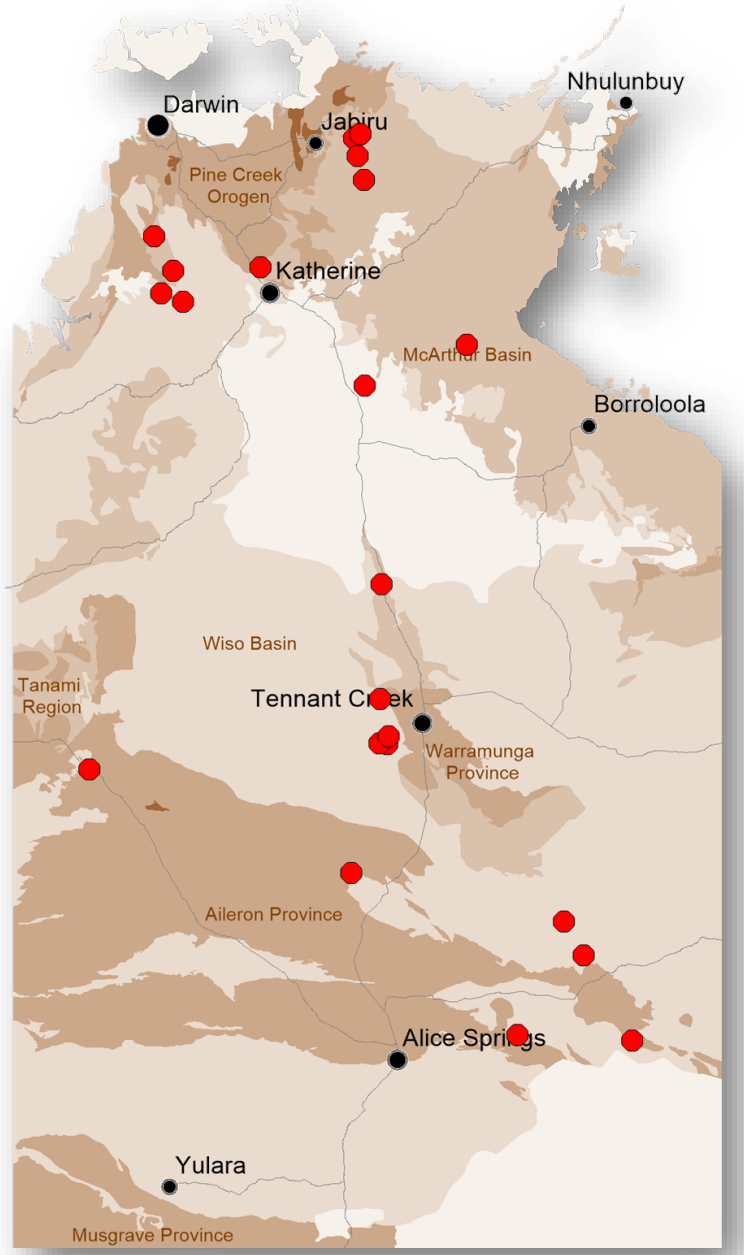


GDD



HyLogger Data Packages

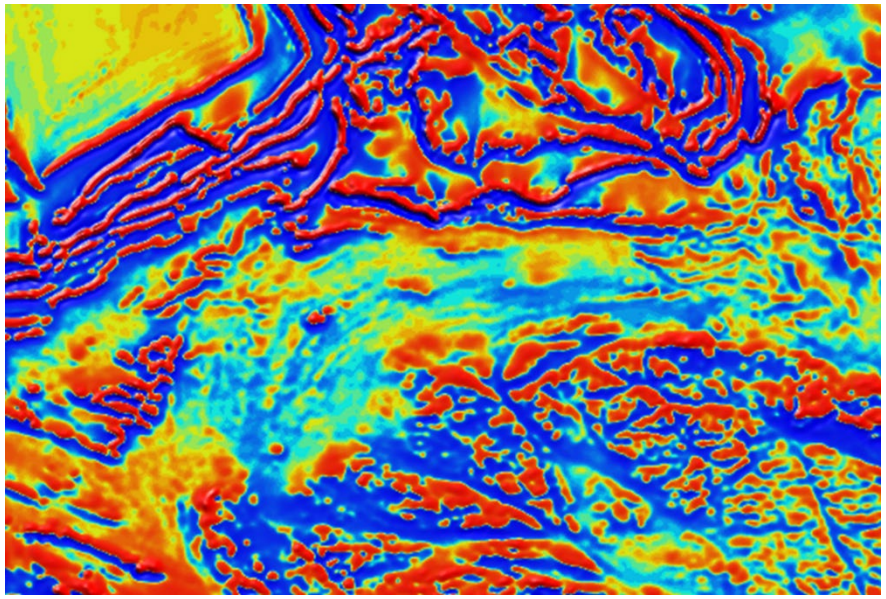
- Over 20 HyLogger Data Packages (HDP) have been released over the last 12 months
- HDPs provide a summary of interpretation of reflectance spectra measured on drill core using the HyLogger instrument
- HDPs have been published on drill core from the Aileron Province, Georgina Basin, Irindina Province, McArthur Basin, Pine Creek Orogen, Tanami Region, Tomkinson Province and Warramunga Province



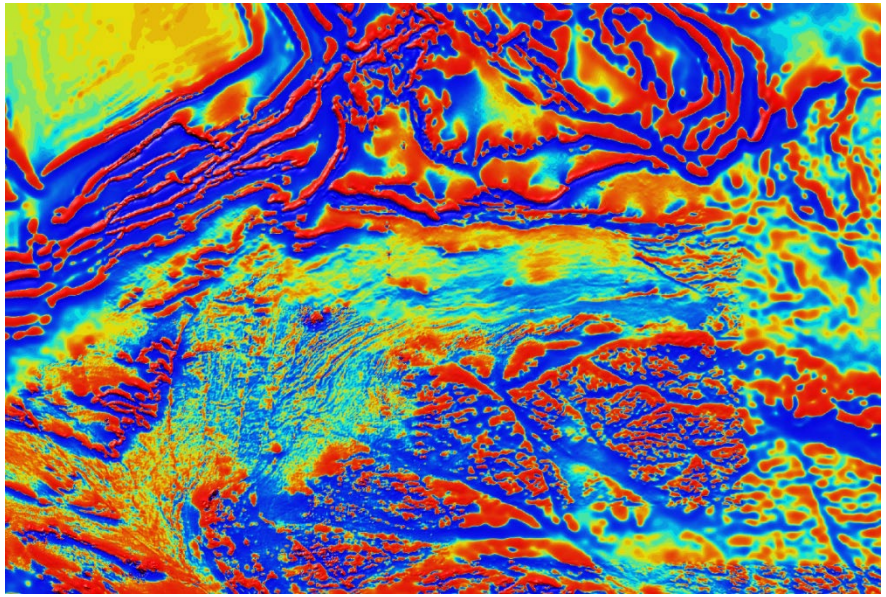
Modelling and Interpretation

- DIP020 CSIRO-NTGS McArthur Basin Project: Geophysical data, interpretation and models
- DIP021 CSIRO-NTGS Tanami Project: Aeromagnetic interpretation of the Tanami Region – GIS
- DIP022 CSIRO-NTGS Tanami Project: Aeromagnetic interpretation of the Tanami Region – Geophysical Data
- DIP030 Northern Territory SEEBASE® and GIS
- DIP031 Northern Territory SEEBASE® and GIS – Gravity and Magnetics
- DIP032 Compilation of industry geophysical data over the Tennant Creek and Rover mineral fields

NT-wide TMI 1VD



DIP032 TMI 1VD



Thank You

- Industry and NTGS geophysical survey data can be located on STRIKE https://strike.nt.gov.au
- Digital Information Packages, HyLogger Data Packages, NT-wide geophysical grids, industry and NTGS geophysical survey data are available through GEMIS https://geoscience.nt.gov.au/gemis
- NTGS geophysical survey images are available from the Geophysical Image Web Surver (GIWS) http://geoscience.nt.gov.au/giws
- Hyperspectral datasets are available to view and download through AUSGIN Geoscience Portal http://portal.geoscience.gov