NORTHERN TERRITORY GEOLOGICAL SURVEY

# Compilation of industry geophysical data over the Tennant Creek and Rover mineral fields

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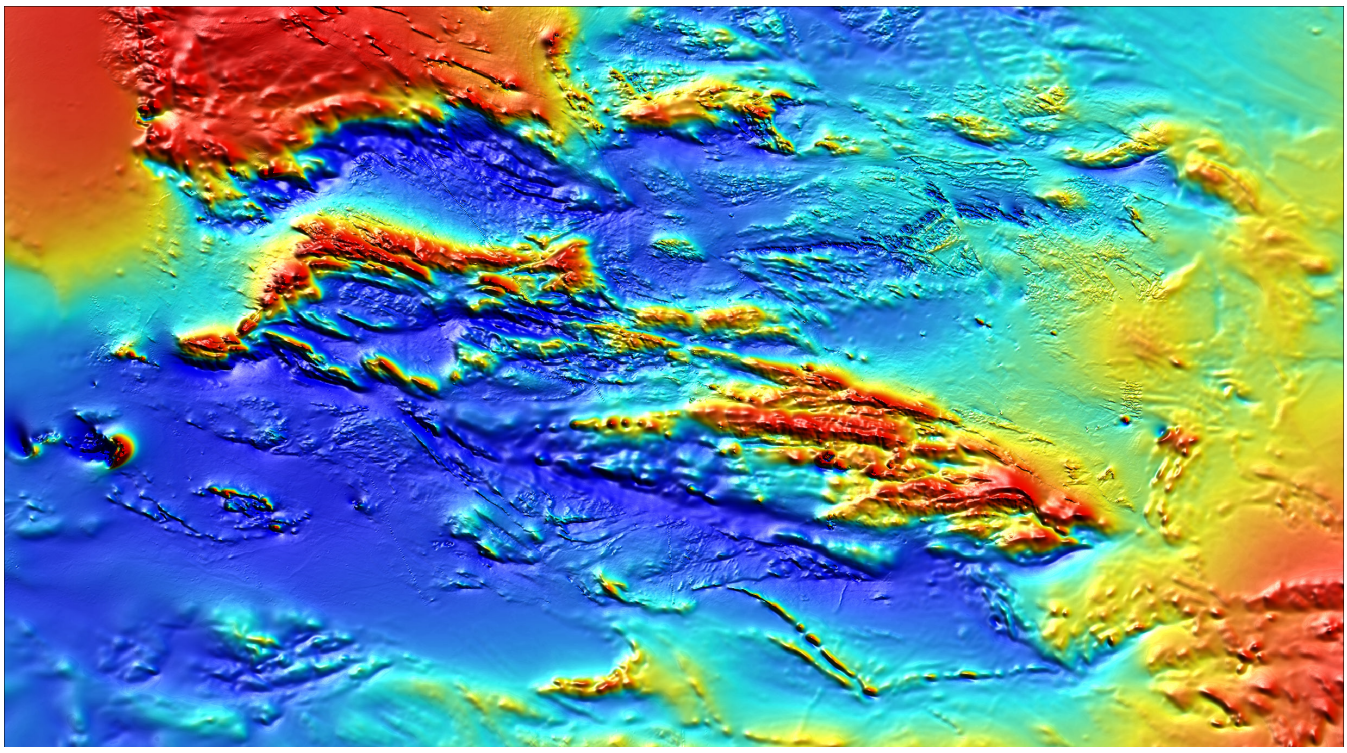

**Digital Information Package DIP 032**

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NORTHERN TERRITORY GOVERNMENT

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## SUMMARY

The Northern Territory Geological Survey (NTGS) has performed an audit of geophysical data available in digital format over the Warramunga Province and surroundings, encompassing the Tennant Creek mineral field and the Rover field. To assist industry locate and utilise the NTGS archive of geophysical data in the region, this digital information package (DIP) contains catalogues of currently available geophysical survey data from open file company reports in GIS format, as well as magnetic and gravity grids in ERmapper format, and reprocessed gravity data in ASCII (csv) format. The supplied GIS files show geophysical survey extents and include tabulated survey information for the airborne magnetic (+/- radiometric), ground gravity, airborne electromagnetic, ground magnetic, ground electromagnetic, resistivity/induced polarisation, downhole, and other geophysical surveys. The users of this DIP can use the listed Company Report numbers in the GIS tables to obtain a digital copy of the geophysical data through the NTGS Geoscience Exploration and Mining Information System (GEMIS[1]). The project area and summary of geophysical survey boundaries are shown in **Figure 1**. Industry-submitted ground gravity data has been combined with government data into a single coherent dataset and re-processed to the Australian Absolute Gravity Datum 2007 (AAGD07). The resultant ground gravity dataset has been assessed, with low quality points identified and flagged. The remaining high quality points were then gridded into a single high resolution grid, 20 m cell size, supplied in ERmapper format. The best available quality airborne magnetic surveys have been gridded and merged into a single high resolution grid, 10 m cell size, supplied in ERmapper format. The gravity and magnetic grids have been filtered to produce enhanced products, which have been supplied as ERmapper format grids. All products in this data package are in the GDA94 MGA zone 53 projection (EPSG: 28353).


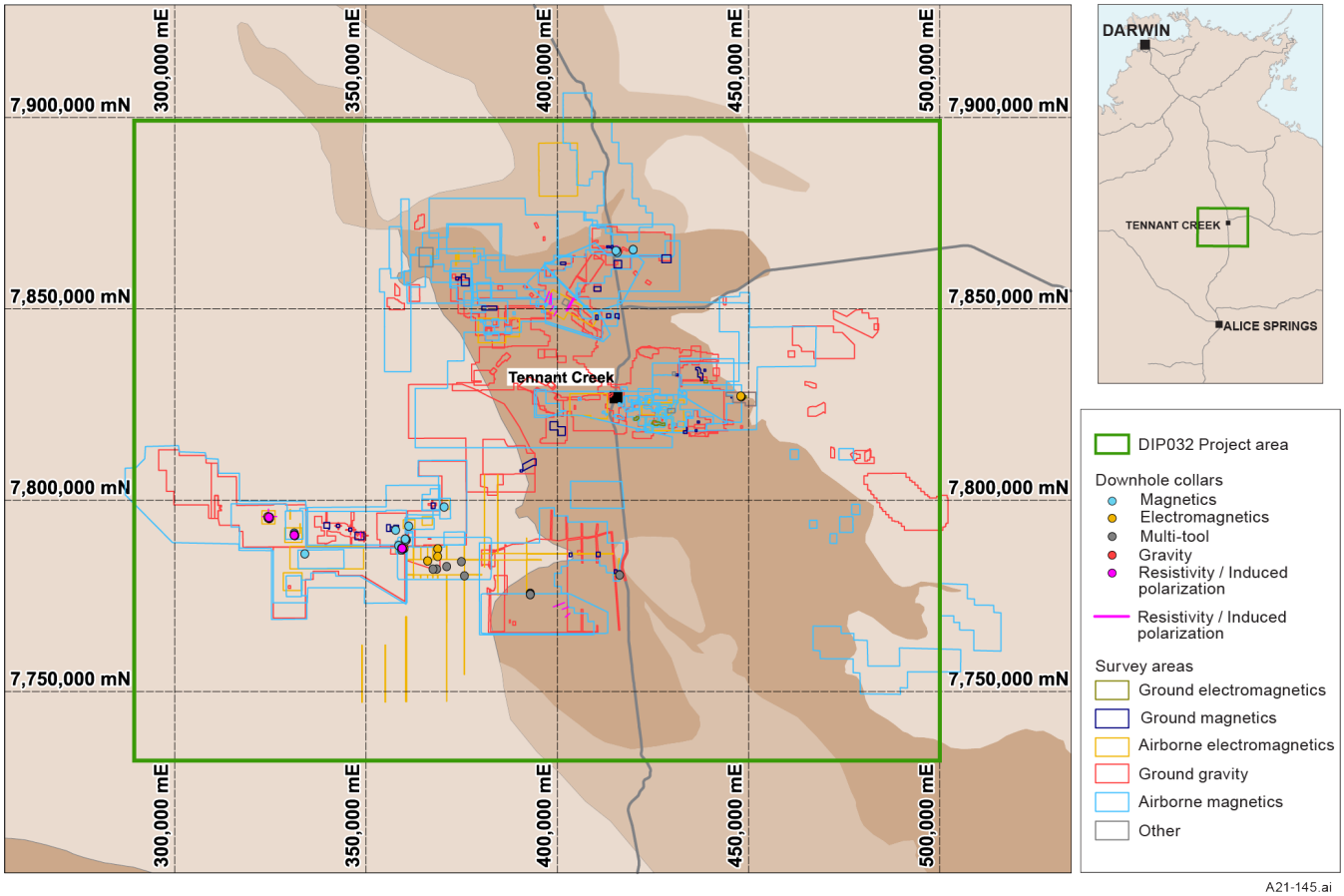


**Figure 1**. Plan showing the location of the project area and summary of geophysical survey boundaries. Co-ordinates are GDA94 MGA zone 53. Mapsheets covered whole or in part - 250K: TENNANT CREEK[2], BONNEY WELL*, GREEN SWAMP WELL*, LANDER RIVER*; 100K: Tennant Creek, Short Range, Kelly, Flynn, Gosse River, Barkly, Chaluba, Billiat, Bonney, Ooradidgee, Hanson, Lee. * denotes partial coverage.

[1] https://geoscience.nt.gov.au/gemis/ntgsjspui/community-list.

[2] Names of 1:100 000 and 1:250 000 mapsheets are shown in small and large capital letters respectively, eg Bonney, TENNANT CREEK.

**CONTENTS**

## DATA PACKAGE CONTENTS

The data package includes GIS files (MapInfo and ArcGIS format), ASCII data and grid files.

### GIS files

All GIS files consist of a shape (polygon/line/point) showing survey location and a table containing survey information including company report number (ReportID), geophysical survey name (SurveyName), geophysical method (Method), survey type (SurveyType), company (Company), acquisition contractor (Contractor), acquisition year (Year), and contractor job reference number (JobNumber). GIS files for a specific geophysical method and survey type contain other survey information such as line spacing for airborne magnetic surveys. The geophysical methods have been separated into eight categories: airborne magnetics (+/- radiometrics), ground gravity, airborne electromagnetics, ground magnetics, ground electromagnetics, resistivity/induced polarisation, downhole geophysics and other miscellaneous geophysical methods. GIS files are supplied in MapInfo 'tab' and ESRI 'shp' format in GDA94 MGA zone 53 (EPSG: 28353) projection. The geophysical survey GIS layers are supplied in a zip file named DIP032_GIS_GeophysicsSurveys. Description of the contents of the zip file are given in **Table 1**.

**Table 1**. Description of the contents of DIP032_GIS_GeophysicsSurveys zip file. All GIS files are in MapInfo and ArcGIS format and GDA94 MGA zone 53 projection.

| File prefix | Description |
|---|---|
| DIP032_AMAG | GIS catalogue of Airborne Magnetic (+/- Radiometric) survey data |
| DIP032_GGRAV | GIS catalogue of Ground Gravity survey data |
| DIP032_AEM | GIS catalogue of Airborne Electromagnetic survey data |
| DIP032_GMAG | GIS catalogue of Ground Magnetic survey data |
| DIP032_GEM | GIS catalogue of Ground Electromagnetic survey data |
| DIP032_RESIP | GIS catalogue of Resistivity & Induced Polarisation survey data |
| DIP032_DOWNHOLE | GIS catalogue of Downhole Geophysical survey data |
| DIP032_MISC | GIS catalogue of Miscellaneous Geophysical survey data |

### Ground gravity dataset

The available digital ground gravity data from company reports has been combined with government (NTGS and Geoscience Australia) gravity data into a single re-processed dataset conforming to AAGD07. The AAGD07 is the current Australian gravity datum and includes a set of reduction formulas used to process gravity data (Tracey *et al* 2007). The reprocessing required data re-formatting to AAGD07 observed gravity and ellipsoidal elevation values. A spherical cap Bouguer anomaly (SCBA) value has been calculated for each station in the dataset. Each station has been flagged (Grid_Flag) to show whether the station is included in the supplied gravity grid. Descriptions of the supplied ground gravity data file and its fields are given in **Table 2** and **Table 3**.

**Table 2**. Description of the ground gravity data file supplied with this data package.

| File name | Description |
|---|---|
| DIP032_GRAVITY_DATA | DIP032_GGRAV_AAGD07.csv: comma separated ASCII (csv) file containing gravity data |

**Table 3**. Description of the fields contained in the ground gravity data file supplied with this data package.

| File name | Description |
|---|---|
| Company_Report | NTGS company report reference |
| Survey_Name | Ground gravity survey name |
| NTGS_ID | Unique NTGS data source ID |
| Survey_Number | Unique ground gravity survey number |
| Station_Number | Unique ground gravity station number |
| Year | Year of data acquisition |
| Longitude_gda94_dd | Longitude (GDA94) in decimal degrees |
| Latitude_gda94_dd | Latitude (GDA94) in decimal degrees |
| Easting_gda94mga53_m | Easting (GDA94 MGA zone 53) in meters |
| Northing_gda94mga53_m | Northing (GDA94 MGA zone 53) in meters |
| Elevation_ellipsoid_m | Elevation of station (ellipsoid datum) in meters |
| obsG_AAGD07_gu | Observed gravity (AAGD07 datum) in gravity units ($\mu ms^{-2}$) |
| SCBA_gu | Spherical cap Bouguer anomaly value in gravity units ($\mu ms^{-2}$) |
| Grid_Flag | Flag indicating if station used in gridding (0=no,1=used) |

## Ground gravity grids

The ground gravity data was gridded to generate a high resolution image over the project area. The SCBA field values from stations considered high quality were gridded at a cell size of 20 m. The Generic Mapping Tools (GMT) software was used, which grids data using splines under tension (Smith and Wessel 1990). A tension factor of 0 was chosen for the SCBA grid. Initially the entire dataset was input with the resulting grid assessed and ill-fitting surveys and stations identified and removed from subsequent gridding iterations. The supplied SCBA grid was generated using stations in the supplied dataset that have a Grid_Flag value of 1. A residual SCBA grid has been generated to make local gravity features such as trends and anomalies more easily identifiable. This was created by subtracting a smoothed SCBA grid from the original. The smoothed SCBA grid was generated using Intrepid Geophysics software by upward continuing the original to a height of 1 km with a 2D fast Fourier transform (FFT) filter. Descriptions of the supplied gravity grid files are given in **Table 4**.

**Table 4**. Description of the ground gravity grid files supplied with this data package. All grid files are in GDA94 MGA zone 53 projection and ERmapper format.

| File name | Description |
|---|---|
| DIP032_SCBA_Grid | AAGD07 SCBA grid (Grid_Flag = 1) |
| DIP032_resSCBA_Grid | Residual grid created by subtracting SCBA grid upward continued to 1km from the original SCBA grid |
| DIP032_SCBA_uc1km_Grid | SCBA grid upward continued to a height of 1 km |

### Airborne magnetic grids

The data from high quality airborne magnetic surveys listed in Airborne Magnetic (+/- Radiometric) GIS catalogue has been gridded and merged into a single high resolution grid using Intrepid Geophysics software. The field 'MergeUse' in the GIS table indicates whether a survey was included in the grid merge procedure. The total magnetic intensity (TMI) field was used for gridding, with units in nanotesla (nT). The minimum curvature gridding algorithm was used (Briggs 1974). A description of the grid merging procedure applied by Intrepid Geophysics software can be found on their website[3]. The surveys were ranked firstly on lowest line spacing and secondly on most recent acquisition year. The NT 2020 total magnetic intensity (TMI) grid stitch[4] was used as a base grid for the merge. The final cell size of the merged magnetic grid is 10 m. Filtering of the merged magnetic grid has been performed in Intrepid Geophysics using 2D fast Fourier transform (FFT) routines. The filtered grids enhance the usability of the magnetic data. These filtered products include reduce to pole TMI (RTP), 1st vertical derivative of RTP (RTP1VD), tilt angle of RTP (RTPTILT), analytic signal of TMI (AS), and vertical integral of AS (VIAS). The RTP grid aims to plot the anomalies over the source bodies. The RTP1VD is a high pass filtered image that enhances features caused by shallow sources. The RTPTILT is also a high pass filtered image that normalises anomalism. The 0 contour of the RTPTILT image can be used to approximate source body boundaries. The AS is a high pass filtered image that is less dependent on the direction of magnetisation and can be compared to the RTP1VD, with significant differences in those grids commonly associated with remanence. The VIAS grid is a low pass filter of the AS grid and can be used for modelling; however, long wavelengths are over-accentuated. Descriptions of the supplied magnetic grid files are given in **Table 5**.

**Table 5**. Descriptions of the magnetic grid files supplied with this data package. All grid files are in GDA94 MGA zone 53 projection and ERmapper format.

| File name | Description |
|---|---|
| DIP032_TMI_Grid | Merged total magnetic intensity grid in nT |
| DIP032_RTP_Grid | Reduced to pole TMI grid in nT |
| DIP032_RTP1VD_Grid | 1st vertical derivative filtered RTP grid in nT/m |
| DIP032_RTPTILT_Grid | tilt angle filtered RTP grid in nT/m |
| DIP032_AS_Grid | Analytic signal filtered TMI grid in nT/m |
| DIP032_VIAS_Grid | Vertical integral filtered AS grid in nT |

## REFERENCES


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[3] https://docs.intrepid-geophysics.com/intrepid/topics/guided-tour-grid-merge.htm

[4] https://geoscience.nt.gov.au/gemis/ntgsjspui/handle/1/82536