Resourcing the Territory initiative: Precompetitive geoscience across the Territory

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With limited opportunity for field data collection in 2020, a focus of the four year Northern Territory Government funded *Resourcing the Territory* initiative (2018–2022) this year has been delivering data information and products under the identified themes. The release of major products such as the updated Northern Territory SEEBASE® and GIS (Debacker *et al* 2021) is an example of significant new interpretation products that can provide explorers with key information to accelerate resources' discovery.

Upgrading the Territory's coverage of geophysical data

A key focus of the *Resourcing the Territory* initiative is to undertake targeted, regional-scale magnetic-radiometric or gravity data acquisition programs in prospective areas in order to upgrade data quality and density to modern standards (Close 2020). During the initiative, the Tanami Region has been the focus of acquisition of improved resolution and accurately located magnetic and radiometric data with the acquisition of the NTGS Tanami Region Airborne Magnetic and Radiometric Survey (Dhu 2019) and the Mount Peake–Crawford Airborne Magnetic and Radiometric Survey (Dhu 2020, 2021), covering over 65 000 km^2.

Regional-scale ground gravity data acquisition has been the focus in the greater McArthur Basin with the intention of providing insight to major structural controls on basin formation. Through *Resourcing the Territory* initiative funding, the Northern Territory Geological Survey (NTGS) collaborated with and co-funded Geoscience Australia's *Exploring for the Future* South West McArthur, Barkly Gravity Survey, covering a section of the boundary of the Beetaloo Sub-basin and into the greater McArthur Basin with 2 km-spaced gravity stations (Dhu 2020).

Unlocking the resource potential of the Barkly and Gulf regions

NTGS has undertaking a range of collaborative geoscience programs designed to investigate the minerals and energy potential beneath the soils of the Barkly Tableland and into the Gulf region. This builds on major geoscience programs in the greater McArthur Basin that were conducted under the NT Government funded *Creating Opportunities for Resources Exploration* (CORE) 2014–2018 initiative.

A key component of this has been to collaborate with Geoscience Australia and co-fund pre-competitive data acquisition programs in the Barkly region under the federally funded *Exploring for the Future* program and through the MinEx CRC's National Drilling Initiative. Previously there was insufficient geological information to attract explorers into the area as the prospective rocks are more than 100 m below the surface. The large volume of new geoscience data generated in the Barkly Tableland region led to a substantial increase in industry activity in this greenfields area. Since late 2018, more than 17 000 km^2 of new mineral exploration licence applications targeting copper and gold have been submitted by industry in the Barkly Tableland east of Tennant Creek. This area has not previously been explored for these minerals. The area also attracted six applications from four companies for co-funding in the 2020 round of the Geophysics and Drilling Collaborations (GDC) program.

Through *Resourcing the Territory* funding, NTGS contributed to the acquisition of the Barkly 2D Deep Crustal Reflection Seismic Survey, which provides a complete seismic profile from the newly discovered Carrara Sub-basin to the eastern margins of the highly prospective Beetaloo Sub-basin (Southby *et al* 2021). Interpretation of the seismic data has led to the identification of three distinct geological domains with significant implications mineral and petroleum prospectivity (Southby *et al* 2021).

Stratigraphic drilling under the MinEx CRC's National Drilling Initiative included a 10-hole, 4000 m drilling campaign in the East Tennant region, which was completed in December 2020. The program was designed to test stratigraphic and structural interpretations, and assess the mineral potential of basement rocks to the east of the Tennant Creek mineral field (Clark *et al* 2021). Data from these drillholes has been available through Geoscience Australia's portal (Clark *et al* 2021) and MinEx CRC's portal. NTGS undertook acquisition of hyperspectral data and high resolution core imagery via the HyLogger™ instrument. The processed HyLogger data for each of the 10 drillholes is available through GEMIS[3].

To stimulate exploration in the Tennant region, NTGS commissioned a series of mineral deposit atlases and 3D visualisation products from the WH Bryan Mining & Geology Research Centre at the University of Queensland (Valenta *et al* 2020, 2021). These products compile existing open file data and models of key mineral deposits in the Tennant mineral field and the Rover field detailing characteristics of the mineral system and regional setting. The data is delivered in a format that provides explorers with understanding of the potential of the region and a guide for future targeting. The Warramunga Province mineral deposit series release comprises Digital Information Packages (DIP) for the Warrego, White Devil, Explorer 142, Explorer 108, Curiosity, and Rover 1 deposits.

The undercover Rover field to the southwest of the Tennant mineral field indicates the extension of the classic Tennant-style IOCG copper-gold deposits buried beneath the Neoproterozoic to Palaeozoic Wiso Basin. The presence of the Explorer 108 Pb-Zn deposit in the Rover field suggests there is potential in the area to host significant lead–zinc mineralisation that would diversify commodity base for the Tennant region. Under *Resourcing the Territory*, and

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

in collaboration with Geoscience Australia, NTGS is undertaking range of projects to improve understanding of the geological framework and resource potential of the Rover field, with broader implications for prospectivity of the Warramunga Province (Huston *et al* 2020, Farias *et al* 2021)

The release of DIP020 on the CSIRO–NTGS McArthur Basin Project delivers geophysical data, interpretations and model results from a collaborative project between CSIRO and NTGS focused on the southern McArthur Basin (Blaikie and Kunzmann 2019). The McArthur Basin is considered highly prospective for sediment-hosted base metals and contains the McArthur River and Teena lead–zinc–silver deposits. A structural and geological interpretation of the southern McArthur Basin, including forward modelling of potential field data, was undertaken as part of this study to improve understanding of the regional structural architecture, sub-basin development, and tectonic evolution of this area. DIP020 provides GIS-formatted lithological and fault event interpretations, processed geophysical data and imagery, and georeferenced figures for all models.

Stimulating greenfields exploration in central Australia

NTGS continues to work in the Aileron Province and Amadeus Basin in central Australia using modern techniques and an integrated approach to provide a consistent geological framework for these areas. Regional-scale mapping of the western Amadeus Basin will produce seamless stratigraphic and structural outcrop geology at 1:250 000-scale, together with a complimentary pre-Mesozoic interpreted geology at 1:500 000-scale (Verdel *et al* 2021, Weisheit 2021a,b). The characterisation of the Neoproterozoic stratigraphy, best exposed in the northeast Amadeus Basin (Normington and Donnellan 2020), provides a blueprint of diagnostic features of key formations that can be applied in areas of isolated exposures.

Geological outcrop mapping at 1:100 000-scale of the northeastern Aileron and Irindina provinces (Close 2020) is providing the regional geological context for targeted mineral system studies. Systematic analysis of copper and tungsten mineralisation in the northeastern Aileron Province around the Jervois mineral field, Bonya Hills and Molyhil areas has identified two main styles of epigenetic mineralisation (McGloin and Weisheit 2021).

In the Tanami region, NTGS is collaborating with CSIRO to value add to the regional-scale, high resolution aeromagnetic and radiometric surveys acquired in the Tanami and Aileron regions under *Resourcing the Territory*. This has led to seamless interpreted geology of the Tanami Region and across the contact with Aileron Province, revising the previous interpretation of the distribution of key stratigraphic units and providing a new structural framework for the area (Blaikie and McFarlane 2021).

Precompetitive geoscience through co-funded industry grants program

The GDC program has been a highly successful grants program designed to encourage key geoscientific data acquisition in greenfields areas of the Northern Territory. The program has been continuously funded since 2008 under a series of Northern Territory initiatives and has contributed to over 51 000 m of diamond drill core, 23 000 co-funded gravity stations, 125 000 line km of airborne magnetics and radiometrics, and 20 000 line km of airborne electromagnetics.

The NTGS administers the GDC program and awards $1 million annually in exploration grants to be shared between the successful applicants. The program aims to address gaps in the critical understanding of the geology of the NT, share greenfields exploration risk with industry, support brownfields exploration to advance project development, and encourage projects that may open up new areas for exploration. The program ensures the data is made available to the wider exploration community. Applicants are encouraged to apply for co-funding for drilling and geophysical acquisition programs where the outcomes are expected to improve geological knowledge and mineralisation targeting within a region, particularly at depth.

For Round 14 of the GDC, the funding criteria has been expanded to include drilling in brownfields areas (close to known mineral deposits) as recommended in the Territory Economic Reconstruction Commission report[4]. The program provides co-funding assistance for 50% of the exploration program cost: up to $125 000 for selected greenfields diamond drilling programs, and up to $100 000 for selected brownfields diamond drilling, greenfields reverse circulation drilling, and geophysical acquisition projects. All reports, drill core and data from the projects are made public six months after the completion of project field work. Additional funding is available through the Territory Supplier Incentive, which offers an additional $10 000 of co-funding per project to engage NT enterprises to complete works in the Territory. The GDC Round 14 funding is for projects to be undertaken during 2021; applications will close on 4 May 2021.

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