Northern Territory Regolith-Landscape Framework

by
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Aims

The Northern Territory (NT) Regolith Project was designed to establish a regolith-landforms map supported by the characterisation of a wide variety of local regolith materials suitable for addressing the diverse needs of mineral exploration and land management, and if possible, fit the major landscape domains and their associated weathering history and evolution into the emerging broader geochronological framework of the Australian regolith.

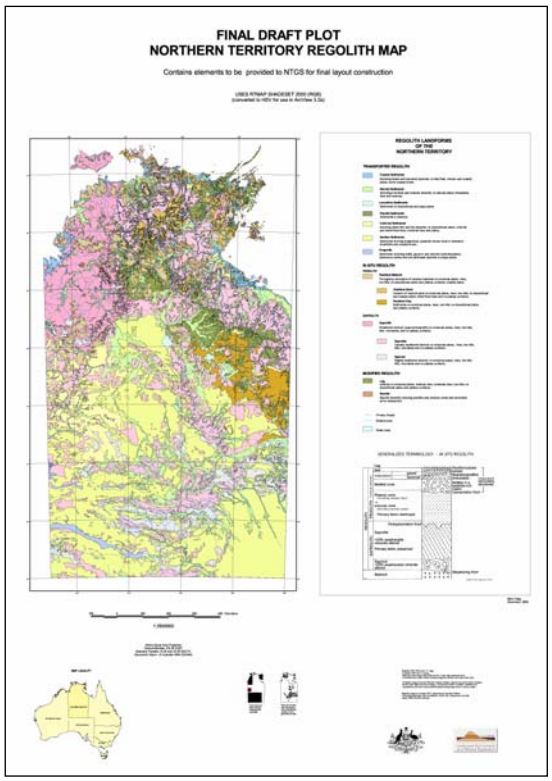

Figure 1. Elements of the NT Regolith Map 1:2 500 000 scale.

Deliverables (outputs)

- Regolith-landform map (1:2.5 Million scale), as a companion to other Territory-wide maps (such as Geology, TMI, DTM and Radiometrics).
- Regolith Materials Atlas describing how the wide variety of regolith materials vary in appearance, where they can be expected to occur and what their broader identifying characteristics might be.

Project scoping

The beginning phase of this project involved a major scoping meeting in Alice Springs in mid 2003 with staff from the Northern Territory Geological Survey and CRCLEME. This meeting was responsible for establishing the overall strategic plan, the general work plan and deliverables for the life of the project. Staffing mix, individual roles and responsibilities within the life of the project were clearly defined at that meeting. The formal project work finished in December 2005.

Major Project Activities and Products

1. Generating a Regolith-Landforms Map of the Northern Territory at 1:2 500 000 scale (Fig 1).
2. Conducting a Trans NT Regolith Traverse to set the scene for more detailed investigation of the nature and distribution of regolith and associated landforms throughout the NT (Fig 2).
3. Studying major regolith terrains to better characterise the regolith and landform variations throughout the NT (Fig 3).
4. Conducting a regolith materials and mapping workshop, in Darwin, following on from the NT "Gabfest" (January 18th to 21st 2004). The audience consisted of NT Geological Survey staff and invited industry representatives. The workshop focus was on regolith

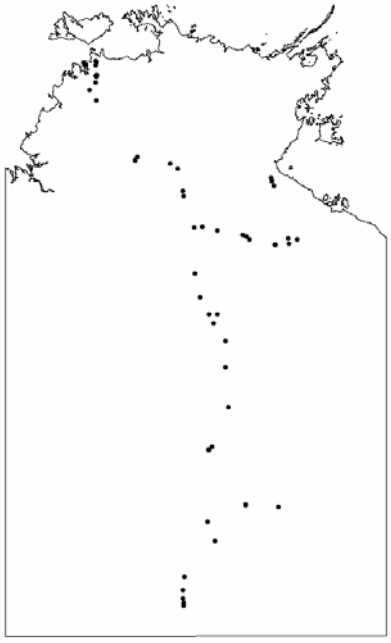

Figure 2. Trans-NT Regolith Traverse observation sites.

materials and mapping techniques and was presented by Mike Craig, Ravi Anand and David Gray.

5. Distilling a wide range of regolith information from within the project activities sufficient to construct an Atlas of NT regolith materials (Figs 4 & 5).
6. Using palaeomagnetism in a pilot study, begin to establish a geochronology of oxidation events using surface and mine exposures of the NT regolith and fitting this information into the emerging wider Australian regolith geochronology (Figs 6 & 7).
7. Providing, at project closure to NT Geological Survey, a copy of the detailed GIS of regolith-landforms and material attributes constructed.
8. Providing a summary Project report.

Project Achievements:

Formal Project work has now ended . The team has achieved the following significant milestones:

1. The NT Regolith Project has produced a Regolith-landform map (1:2.5 Million scale) of the entire Northern Territory (generated from a more comprehensive working Geographic Information System (GIS) detailing the Northern Territory Regolith. The hard-copy map becomes a much needed companion to other Territory-wide maps at 1:2.5 Million scale. Much more detail can be extracted from the project's working GIS;

Figure 3. NT Regolith characterisation sites. At each site, the regolith is characterised, a photographic record of the immediate landscape context is taken and for some 600 sites, a whole sample geochemistry has been determined.

2. The Regolith Atlas is now complete and is a key milestone in providing critical information in support of the NT Regolith-Landforms map and the detailed NT Regolith GIS. Without this Atlas, it would be more difficult to convey to explorers, land use managers, and others interested in knowing more about the nature and distribution of NT regolith, exactly how the wide variety of regolith materials vary in appearance, where they can be expected to occur and what their broader identifying characteristics including their geochemistry might be. The Atlas will become an indispensable field reference for those needing to know about Northern Territory regolith; and

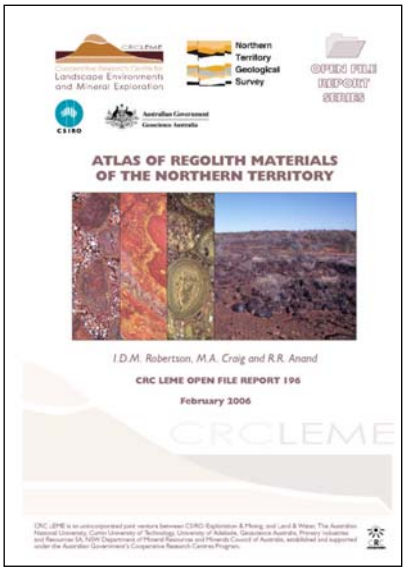

Figure 4. Atlas of Regolith Materials of the Northern Territory

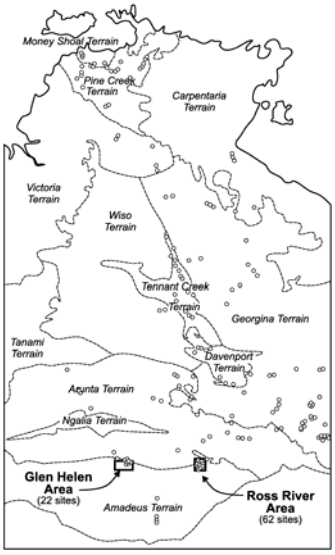

Figure 5. Geochemical Regions as defined for the NT Regolith Materials Atlas.

3. The pilot palaeomagnetics sample program was successfully conducted to help address the issue of the lack of age control in NT regolith materials and landforms. Overall palaeomagnetic ages ranged from 2Ma in a weathering profile along the Darwin foreshore to 295Ma in a road cutting at

Tennant Creek. A small cluster of ages occur around 5-10Ma, from samples taken from the hinterland of the Darwin coastal plain. A single age of 47Ma comes from near Glenn Helen Gorge west of Alice Springs. Project results generally fall within three major age clusters determined from a very much larger range of samples being amassed by Brad Pillans (pers. comm). In view of the results of our pilot program, a much clearer understanding of the timing NT regolith, weathering and landscape development can be derived from a more focussed palaeomagnetic age determination program across the Territory and would be a welcomed addition to the understanding of NT regolith.

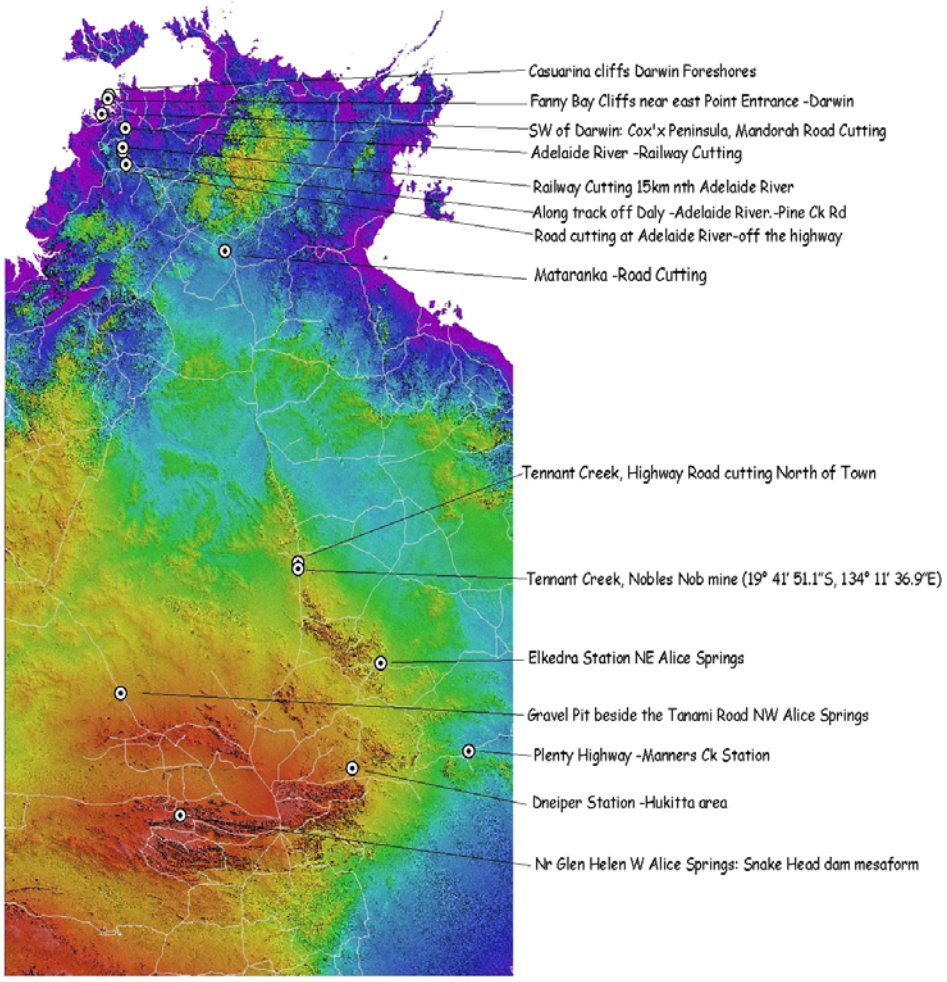

Figure 6. Location of NT regolith sample sites for palaeomagnetic age determination.

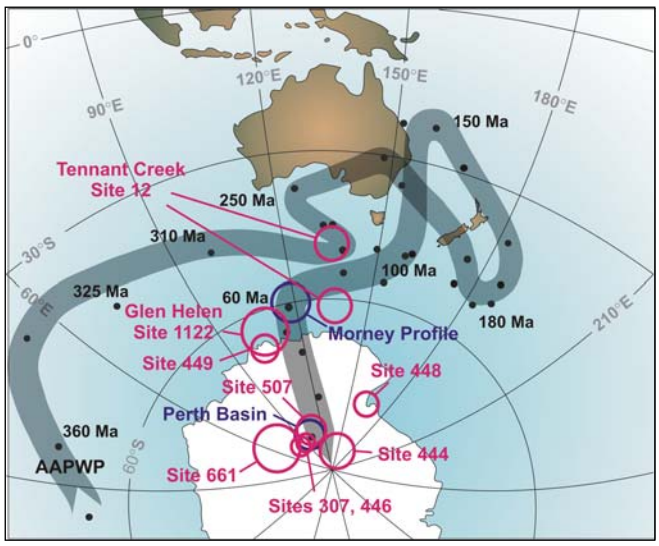

Figure 7. Reconnaissance paleomagnetic poles from Northern Territory sites (from Pillans and Craig 2005), Morney Profile (Idnurm & Senior 1978) and Perth Basin (Schmidt & Embleton 1976), plotted on the Australian Apparent Polar Wander Path (after Schmidt & Clark 2000).

Impacts
The project products provide the Northern Territory with the first comprehensive, structured regional account of its:

- regolith-landforms in terms of variability and distribution from 300k to 2.5 Million scale;
- regolith material characteristics from the mesoscale through to the microscale;
- its broader regolith geochemistry; and
- the beginnings of a systematic oxidation event geochronology.

The detailed Regolith-Landforms GIS and the pictorial Atlas of regolith materials represent a new valuable source of information that will help foster mineral exploration and land management decisions within the Territory through providing a better understanding of its regolith. This work contributes significantly to building a better integrated and more substantial underpinning for geoscientific work in the Territory.

Acknowledgements
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