REGOLITH-LANDFORMS AND MAPPING OF THE COYOTE AU DEPOSIT, TANAMI DESERT, NORTHERN TERRITORY

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LOCATION

The Coyote Au-deposit is close to the Western Australia-Northern Territory border (Figure 1), approximately 750 km northwest of Alice Springs and 300 km southeast of Halls Creek. The mapping area is approximately 8.5 km^2 and was chosen to provide context for detailed fieldwork conducted along a 3.1 km transect trending north-south across the Coyote mineralisation. The unsealed Tanami Track, the main route through the Tanami, defines the northern edge of the mapping area. The mapping area is included in the Billiluna Geological 1:250,000 map sheet.

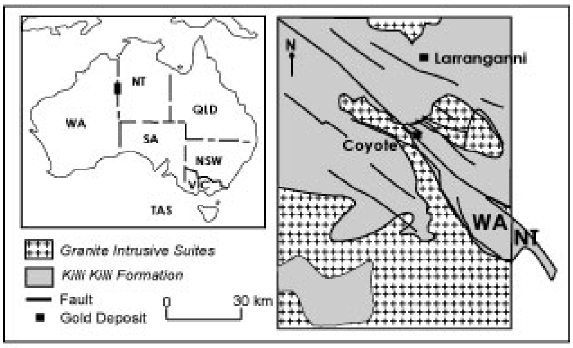

Figure 1: Location and simple geology of Coyote Deposit (adapted from Huston *et al.* 2004).

PHYSICAL FEATURES AND ENVIRONMENT

The Tanami Desert has an arid sub-tropical climate with distinct wet and dry seasons (Bureau of Meteorology 1984). Average rainfall is less than 480 mm, with most of the rain falling between December and March, varying both seasonally and annually. At Rabbit Flat, mean maximum temperatures in December are 39°C, with a mean minimum annual temperature of 17°C (Blake *et al*. 1977).

The predominant vegetation type is desert shrubland, characterised by spinifex (*Triodia pungens* and *Plectrachne schinzii*) (Gibson 1986). Low trees and shrubs of *Acacia spp*., *Grevillea spp*. and *Eucalyptus spp*. are also abundant and widespread. The topography of the mapping area is subdued, consisting of flat to gently undulating sand plains, depositional plains, broad drainage depressions associated with palaeochannels, rocky outcrops, rises and some hills and ridges (Wilford 2000). There is a distinct lack of well-defined surface drainage channels, with palaeo-alluvial valley sediments and channels covered by more recent sheetwash and colluvial material. Shallow overland flow is pronounced in the area, and a general southward flow of both surface waters and groundwater occurs across the area.

GEOLOGICAL SETTING OF THE COYOTE GOLD DEPOSIT

Wygralak & Mernagh (2001) have described the geological setting of mineralisation in the Tanami in great detail, while Hendricks *et al* (2000) have outlined the stratigraphic relationship of the Palaeoproterozoic rocks and their relation to mineralisation. Mineralisation at Coyote is hosted by quartz veins within the turbiditic sediments of the Killi Killi Formation, and is one of many styles of Au-mineralisation along the ‘Tanami Corridor’. The youngest member of the Tanami Group, the Killi Killi Formation (1840-1830 Ma) is comprised of siltstones and sandstones; the basal unit of the group is the Dead Bullock Formation, dominated by siltstone with carbonaceous shale, calc-silicates and banded-iron formation. The oldest Tanami rocks are isolated inliers of Archaean (2550-2500 Ma) gneiss and schist rocks, that underlie the Tanami Group. Dolerite sills intrude the Tanami Group, and predate deformation.

Cainozoic sediments, locally indurated by calcrete and ferricrete, as well as more recent sheetwash and aeolian unconsolidated sand and gravel extend across most of the region.

REGOLITH-LANDFORM MAPPING

The Coyote Prospect lies to the north of a buried, southwest trending palaeochannel. The prospect is on a flat, to gently undulating depositional plain covered by a veneer of colluvial sheetwash sediments and ferruginous lag; there is also some aeolian components of the regolith. The Palaeoproterozoic rocks that host mineralisation have been obscured by later sedimentation.

The deposit lies on a slight topographic rise, with shallow (< 2 m) cover in some parts. Further to the south, alluvium thickens (> 10 m), and a thin veneer of colluvium blankets the alluvial sediments. The work presented here is ongoing, with further work planned both in the field and manipulating ArcGIS software.

Fieldwork & Data Collection
Regolith-landform mapping was undertaken as part of a larger collaborative research project within CRC LEME, which included vegetation mapping and sampling for biogeochemical analysis, groundwater sampling, regolith chronology, logging and petrophysical analysis of core and cuttings from select drillholes, and downhole and group geophysical surveys.

Aerial photographs were used as basemaps for the field and mapping work, derived from company GIS databases as well as ortho-images from the WA Geological Survey. Detailed site descriptions were made at 64 sites along a 3 km north-south transect, as well as a number of individual sites of interest including a further study site at Larranganni Prospect, to the north. This transect is sub-perpendicular to mineralisation and stratigraphic trends, coincident in part with the ground EM survey carried out by other members of the project team. Locations were recorded using a hand-held GPS. The site was photographed and the site description was recorded, which included attributes such as surface lag and regolith materials, landform expression, termitaria characteristics and vegetation type (Figure 2).

Figure 2: Field photographs of the Coyote transect area. **2.a**) Spinfex-dominated grassland with *Tumulitermes spp*. termitaria in the foreground. Note also the sandy lag with some ferruginous material; **2.b**) Drainage depression south of the deposit, with common *Hakea spp.*, *Eucalyptus brevifolia*, spinifex. Minor quartzose and ferruginous gravel lag material; **2.c**) On the left, a photo looking north across the surface expression of the Coyote mineralisation. The right-hand side photo depicts open *Eucalyptus brevifolia* (snappy gum) woodland with a spinifex-dominated understorey, 1 km west of the mineralisation.

The location and relative height of termitaria was recorded, with a total number of 550 separate mounds observed along a 20 m wide corridor along the transect (Figure 3). Information on dispersion vectors was also recorded using litter dams; this information will be combined with the digital elevation model of the region, to give a better insight of the regolith-landform associations in the area.

REGOLITH-LANDFORM UNITS

Colluvial Sheetwash Depositional Plain Units

Colluvium covers a major portion of the mapping area, with colluvial sheetwash sediments (CH) the dominant regolith type. These colluvium-dominated areas have been further divided into separate units based on landform expression, composition of regolith material and vegetation. There are five colluvial sheetwash depositional plain (CHpd) units with fine to medium, red-brown quartzose sands with some (10-30%) sub-rounded ferruginous and sub-angular quartz lag.

Close to the deposit, transported cover is estimated to be thin and includes more quartz lithic fragments within the surface materials of this unit ($CHpd_1$). Hummocks or 'island-like' features ($CHpd_4$), consisting of similar quartzose sands and ferruginous lag, are widespread across much of the map and represent the coarse-grained components of materials transported by sheetwash or overland flow, along with some aeolian additions. The $CHpd_2$ and $CHpd_3$ units are distinguishable due to the noticeable litter dams and evidence for water dispersion across these lower-lying, sloping units.

Spinifex (*Triodiae spp.*) is widespread and abundant throughout the map-area mostly within a hummocky grassland community. Snappy gum (*Eucalyptus brevifolia*) is widespread throughout the northwest Tanami; its variable local abundance is reflected by its prevalence in the northern and central parts of the mapping area. Close to the deposit and further south, towards the colluvial sheetwash drainage depressions (i.e., $CHed_1$), desert bloodwoods (*Eucalyptus terminalis*) become the abundant tree species.

Vegetation distribution patterns are not only influenced by regolith-landform settings, but also by fires, which are a frequent occurrence in the Tanami, particularly adjacent to the Tanami Track. Termitaria are present throughout the mapping area, but are less common within the CHpd units. Figure 3 shows the relative height of termite mounds, with additional information on the preliminary RLUs displayed. This demonstrates the strong regolith-landform association with termitaria characteristics, as well as the possible association with the depth of transported regolith cover, where termitaria tend to be taller and more abundant where the transported cover is thicker.

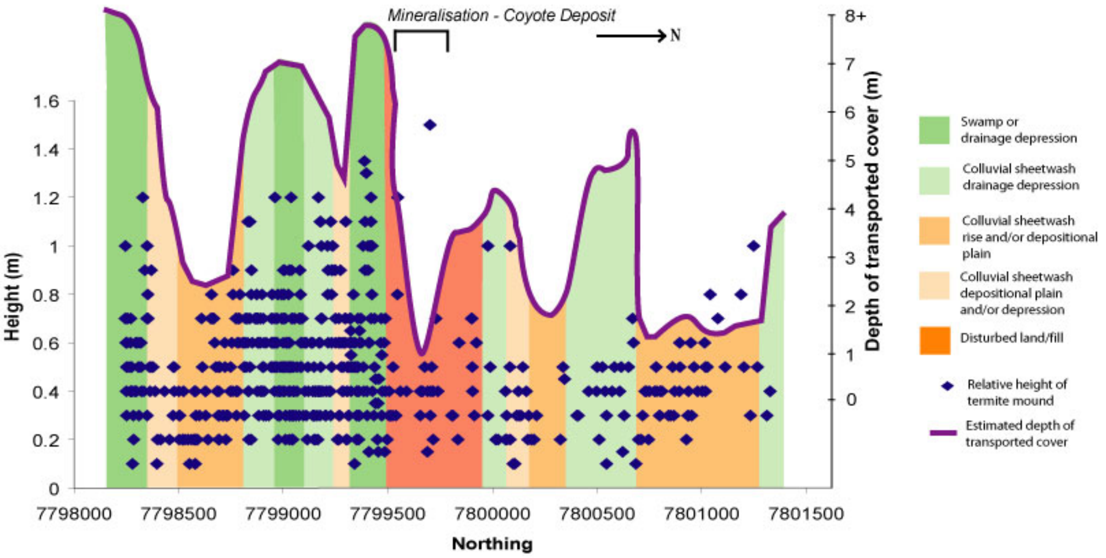

Figure 3: Termitaria-RLU relationship diagram. The termitaria abundance and height is very closely associated with the regolith-landform setting, and to some extent the depth of transported cover.

Colluvial Sheetwash Drainage Depressions Units

There is a general southwest trend for water movement across the mapping area, supported by dispersion vector measurements taken in the field. The surficial appearance of this palaeochannel system is defined by the numerous drainage depressions in the southern region of the map, and the associated vegetation and geozoological anomalies. The landforms and vegetation community characteristics have been used to further subdivide these units, where the regolith materials are otherwise very similar. Comprised of fine red-brown quartzose sands and minor (5-10%) ferruginous lag, the relative roundness of these regolith materials indicates a greater distance of transportation. There is little to no quartz material in these units, except when close to a termite mound or subcrop of Palaeoproterozoic rocks hosting quartz veins.

Corkwood (*Hakea lorea*), and dogwood (*Acacia coriacea*), as well as snappy gums, form a woodland of low trees within these units to the south of the deposit. *Melaleuca spp*., and *Acacia spp*. are also more abundant within the drainage depressions, as were desert bloodwoods to some extent. The transition between these units is typically marked by the abrupt change in vegetation assemblage, rather than the composition of the regolith material. In these areas of sheetwash dispersion and drainage flow, the termitaria assist in defining regolith-landform units particularly due to changes in termitaria abundance.

Site Disturbance/Fill Units

Colluvium has been locally disturbed in the vicinity of mineralisation, by drilling and some vehicle tracks (Figure 2c). In many areas vegetation has been cleared to allow access for heavy machinery and trucks, as well as construction of 'turkey's nests'. The amount of water dispersed across the area during drilling programs may have allowed vegetation to flourish in the arid climate.

Termitaria and Bioturbation

The dominant termite species in the Coyote area is has been identified as *Tumulitermes spp.* (Aspenberg-Traun & Perry 1998) based on field observations of the termitaria and comparison with known occurrences of termites in the arid inland of WA. These termites prefer the drainage depressions and to a lesser extent, the depositional plains and erosional rises in the area (Figure 3). The termitaria in this area may be up to 1 metre high, densely populated within the regolith-landform units in the south of the mapping area.

Termites have the capacity to carry fine soil particles including the underlying weathered basement from depth and through thin colluvium to the surface. These soil particles may carry the geochemical signatures of the underlying regolith (Robertson 2003).

FURTHER RESEARCH

Research in this area will combine fieldwork (regolith-landform mapping, geobotanical analysis, geozoological studies) with termitaria geochemical sampling results. GIS will also be used to bring together the multi-variate approaches to mineral exploration (as part of wider research group in the Tanami), to better understand the relationship between the regolith, landscape, groundwater, biota and the mineralised rocks.

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