FROM THE TANAMI TO TANZANIA: TERMITE ADVENTURES

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ABSTRACT
Tanami Region of northwestern Australia and the highlands of northern Tanzania have long traditions mineral exploration, and many similarities in the impediments to exploration, such as thick regolith sediments. Companies such as Twigg Gold Ltd have long been recording regolith-landform details during sampling programs, and utilising this information in their interpretations of geochemical data to rank exploration targets. This data that has been collected by Twigg Gold may be collated to make quantifiable interpretations of regolith processes in northern Tanzania, therefore making it an attractive place to visit, as a companion to current Tanami regolith-landform and termitaria mapping and geochemical analysis of mound material. Regolith-landform mapping has proved a key tool for the mineral explorer in Australia, utilising geochemical data in a landscape and regolith context. Utilising company data and from observations made in the field, it is planned that regolith-landform maps and termitaria density studies based around company field sites in Tanzania will compliment similar studies in Australia.

Key words: *termitaria, regolith-landform mapping, Tanzania, Tanami Desert, geochemical exploration*

INTRODUCTION

The tropical to semi-arid savannah of the southern hemisphere have proved to be highly prospective ground for mineral exploration. Both the Tanami Region of northwestern Australia and the sub-humid to tropical savannah and highlands of Tanzania have long traditions of gold and mineral exploration in general. Even though there are many similarities in weathering history, development of regolith profiles with substantial superficial cover and style of mineralisation, there has been a lack of discussion between explorers in both continents due to the overwhelming physical distance. It is hoped, therefore, that with an opportunity to conduct research with a gold exploration company in Tanzania, the intellectual as well as physical Indian Ocean can be crossed, bringing researchers and explorers from both continents together to discuss mineral exploration in a regolith context.

OUTLINE OF RESEARCH

During September and October this year, the author has been able to arrange research and fieldwork in Tanzania. Primarily, this fieldtrip provides an opportunity to compare and contrast the African and Australian landscapes, in both a landscape as well as mineral exploration context. Through opening up an avenue of communication between companies in Africa and Australian researchers, it is hoped that cooperation and collaboration will be ongoing, with future research and results from this study being of use to the collaborating companies as well as CRCLEME, as results are generated from the fieldwork.

Similar to previous fieldwork undertaken in the Tanami, research in Tanzania will incorporate the company-generated geochemical data, regolith and landform characteristics and local geology, to understand regolith processes and profile development. Having already compiled a vast database of information collected during soil sampling around northern Tanzania, where exploration ground is held, Twigg Gold Ltd are able to pass on detailed site information for much of their ground. This data will be ‘mined; using excel and ArcGIS, and coupled with fieldwork based from an exploration camp. Detailed site descriptions of the surface materials, vegetation assemblage, landform, geomorphic processes and any minor features are incorporated into regolith-landform units that will be assigned during this fieldwork whilst working alongside company geologists. Comprehensive reports by Britt & Smith (1998), Pain *et* al. (2000), Wilford (2000) and Thomas *et* al. (2002) detail regolith-landform mapping methodologies.

As termite species distribution and mound composition studies have become such an integral part of the research towards quantifying and describing mechanisms of regolith profile development, part of the Tanzanian fieldwork component will incorporate similar termitaria distribution analysis to that described in Petts & Hill (2006). Sources such as Milner & Bernier (1999) and Milner & Myles (1999) have provided much information concerning Africa mound-building termites, and the use of termitaria in mineral exploration, both artisanal and modern.

STUDY AREA

For a comprehensive description of the key Australian sites, please refer to Petts & Hill 2005, and Petts & Hill 2006. This fieldwork is part of a collaborative research project within CRCLEME and minerals industry companies, therefore all three sites are located on mining leases in highly prospective ground; Tanami Gold NL already mining the Coyote Au-deposit as open cut, with plans to go underground in the near future (TGNL, pers.comm.). Coyote is located in Western Australia (Figure 1), whilst the Titania study site is within the Northern Territory. Adjacent is the Tanami Track, the main route through the Tanami, running from Alice Springs to Halls Creek. The Coyote Au-deposit is approximately 750 km northwest of Alice Springs and 300 km southeast of Halls Creek, while the Titania Prospect is approximately 600 km north-northwest of Alice Springs. The mapping area is included in the Billiluna Geological 1:250 000 map-sheet and The Granites Geological 1:250 000 map-sheet.

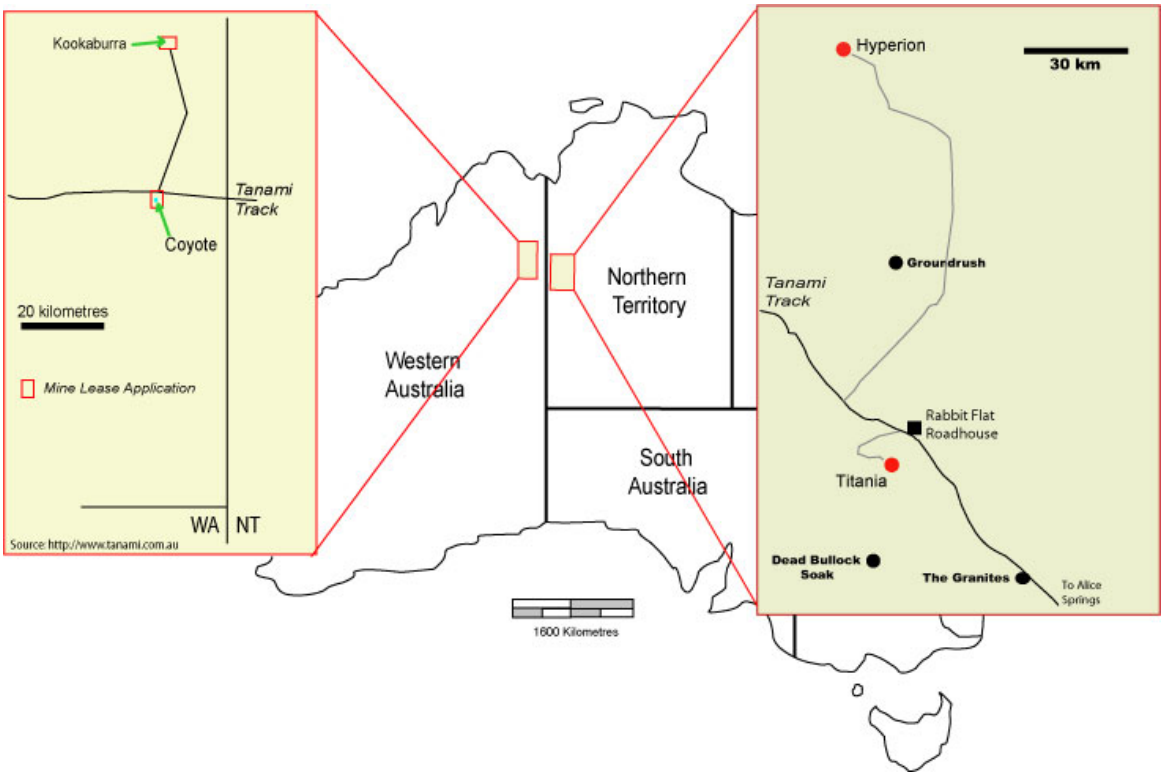

Figure 1. Location of main Tanami field sites

The Twigg Gold Ltd exploration sites within Tanzania are mainly in the country's north (Figure 2). The Miyabi exploration area is situated to the south west of the main town of Mwanza, on the banks of Lake Victoria. The exploration area is within the boundaries of the Provisional Geological Map of the Lake Victoria Goldfields Tanzania 1:500 000 (Barth, 1990). Miyabi is a gold system discovered wholly by Twigg Gold's exploration team, but is now the site of newly-arrived artisanal workers.

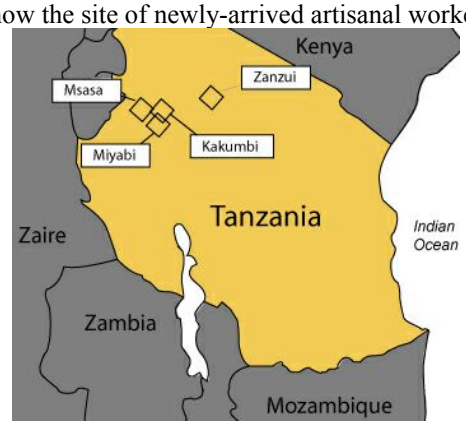

Figure 2. Locality of main Twigg Gold exploration projects, in northern Tanzania (Adapted from Twigg Gold website)

The northern Tanzanian climate is subhumid to tropical, and areas experience a bimodal rainfall pattern; the 'short' rains October to December, and the 'long' rains from March to May. (Msanya *et al*, ?). The onset of rains, and their general distribution, is irregular and unreliable. Vegetation varies from "miombo" woodland (Lamberton, 1962) to open savannah grassland, though much of the natural vegetation has been cleared for subsistence agriculture.

COMBINING KNOWLEDGE: RESEARCH PLANS

Data that has been collected by Twigg Gold may be collated to make quantifiable interpretations of regolith processes in northern Tanzania. Factors that will be considered include:

1. Weathering – alteration of minerals, development of deep weathering profiles;
2. Erosion – exposure of underlying regolith, dispersion across landscape which may effectively invert soil geochemistry;
3. Groundwater movement – groundwater can leach regolith profiles or assist in secondary mineralisation development, if groundwater is enriched in metals;
4. Bioturbation – using knowledge from previous studies in Africa and Australia, the surface expression of termites (termitaria) with the underlying regolith profile, as well as results from surface soil surveys.

The dispersion of eroded mound material as well as colluvium and alluvium across the landscape has possible repercussion for any interpretations of soil geochemistry results, meriting an in-depth regolith-landform and termite distribution study. Brooks (1979) discusses the earliest use of termitaria in geological mapping and geochemical exploration. Termites have the capacity to carry fine soil particles including the underlying weathered basement from depth and through thin colluvium to the surface and alter soil characteristics, as discussed in Holt & Coventry (1980) and de Bruyn & Conacher (1990). These soil particles may carry the geochemical signatures of the underlying regolith (Robertson, 2003). To this day, much work has been undertaken in Africa, however the relationship between termites and the regolith in a mineral exploration context has been largely ignored in Australia. This fieldwork in Tanzania should provide in-depth information about this early use of termitaria in sampling programs.

Other objectives for research include an open discussion concerning some of the impediments to successful exploration in Australia and current research activities within CRCLEME (biogeochemistry, regolith-landform mapping for mineral exploration, geozoological excursions in research). An understanding of the local geology and incorporation of local knowledge of the geology, surface geochemistry and any possible biogeochemistry/biozoochemistry (termitaria sampling) will be used to develop a working model for landscape evolution, surface dispersion and cycling of regolith material through bioturbation.

Field sites will be chosen from company sites of interest, either based on similar regolith terrains to field areas in northern Australia, or as typical examples of African regolith terrains, for further research and fieldwork. These projects of interest are located where previous regolith studies have taken place, through soil sampling by Twigg Gold geologists. Drill hole data can be used to interpret depth-to-bedrock estimates at Twigg sites, and related to vegetation assemblages, termitaria abundance and density. This will allow associations to be made between vegetation and other surface features, and the depth of transported cover, often overlooked in initial exploration reconnaissance.

CONCLUSIONS

Regolith-landform mapping has proved a key tool for the mineral explorer in Australia, utilising geochemical data in a landscape and regolith context. As awareness grows of the value of regolith-landform data collection during sampling programs, an increasing number of exploration companies both abroad and within Australia will look to past exploration experiences and research for guidance. Taking research ideas from regions such as the Tanami, to unfamiliar terrain such as Tanzania allows testing of ideas and prompts discussion between earth scientists that previously, is virtually unknown. Knowing that termites are very important bioturbators in both northern Australia as well as many parts of Africa, and may be a central mechanism for regolith profile formation and landscape, gives greater dimension to the regolith studies undertaken within this project and scope for quantification of the influence of termites on landscape evolution in the Tanami.

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