METAL MIGRATION AT THE KINTYRE U DEPOSIT, WESTERN AUSTRALIA: SOIL, TERMITE, VEGETATION AND GROUNDWATER STUDIES

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Abstract

Understanding how metals move through transported cover and their link to buried deposits is increasingly important for mineral exploration success in areas of transported cover in many regions of the world including Western Australia. At the Kintyre U deposit we used surface soil, vegetation and shallow groundwater sampling to test if near surface methods can detect mineralisation through <1 to 80 m of cover. Three traverses comprised up to 47 soil, spinifex (*Triodia basedowii*), acacia (*Acacia ligulata*), litter and termite mound materials. All samples were analysed, using aqua regia digestion followed by ICP-MS/OES for approximately 50 elements. An additional 18 groundwater samples were collected and analysed for a similar suite of elements and additional anions. Three regolith profiles were also sampled and analysed in a similar manner to the other samples. A specific study of the ore and the unconformity interface between the bedrock and the transported cover was also conducted using SEM EDS mapping and XRF mapping.

Soil chemistry, biogeochemistry and groundwater chemistry all failed at detecting the primary mineralisation except in residual subcropping zones and the thin cover adjacent to these sites. There was little evidence of pathfinder elements associated with the primary ore. In the surface samples, REEs were commonly well correlated to U. In spinifex U was more concentrated in the seeds or the branches whereas in Acacia the phyllodes had the greatest concentration of U.

Soils and plants in residual settings show U anomalism, as do the plants adjacent to these zones that have a thin Quaternary cover (<5 m). Termites and Acacia appear to pick up this signature, with the termites proving better, but they have too limited coverage to clearly link to mineralisation (Figure 1). It is plausible that termites are mobilising a deeper and more enriched regolith U source and are a viable sample medium in the area for broad scale sampling if mineralisation or secondary enrichment is <10 m below the surface. The acacia and the spinifex present are mainly young, relatively small plants probably with a shallower root system compared with mature plants. This potentially limits the enhanced biogeochemical signature that has been observed in mature plants elsewhere (Lintern et al., 2013; Anand et al., 2014) and may explain the limited signature in the vegetation compared to the large and older termite mounds. The vegetation and termite mound samples were patchy in distribution, too, with no clear consistent biogeochemical media to sample.

A model of mechanisms of metal migration at this site was inferred from the results (Figure 2). Primary ore is generally fresh with little dispersion in the overlying Permian and Quaternary cover, commonly greater than 50 m thick. Mechanical and chemical weathering and surface colluvial/alluvial down-slope dispersion are the mechanisms responsible for U migration in the near surface environment mobilised from the Kintyre Hill outcrop.

Plants, litter, soils and groundwater are most likely cycling (near-background levels of) U in the cover at Kintyre. For exploration, other techniques are recommended as the cover is too thick and varied to provide a traceable signature to surface. In shallow cover, plants and termite mounds are potential viable sample media.

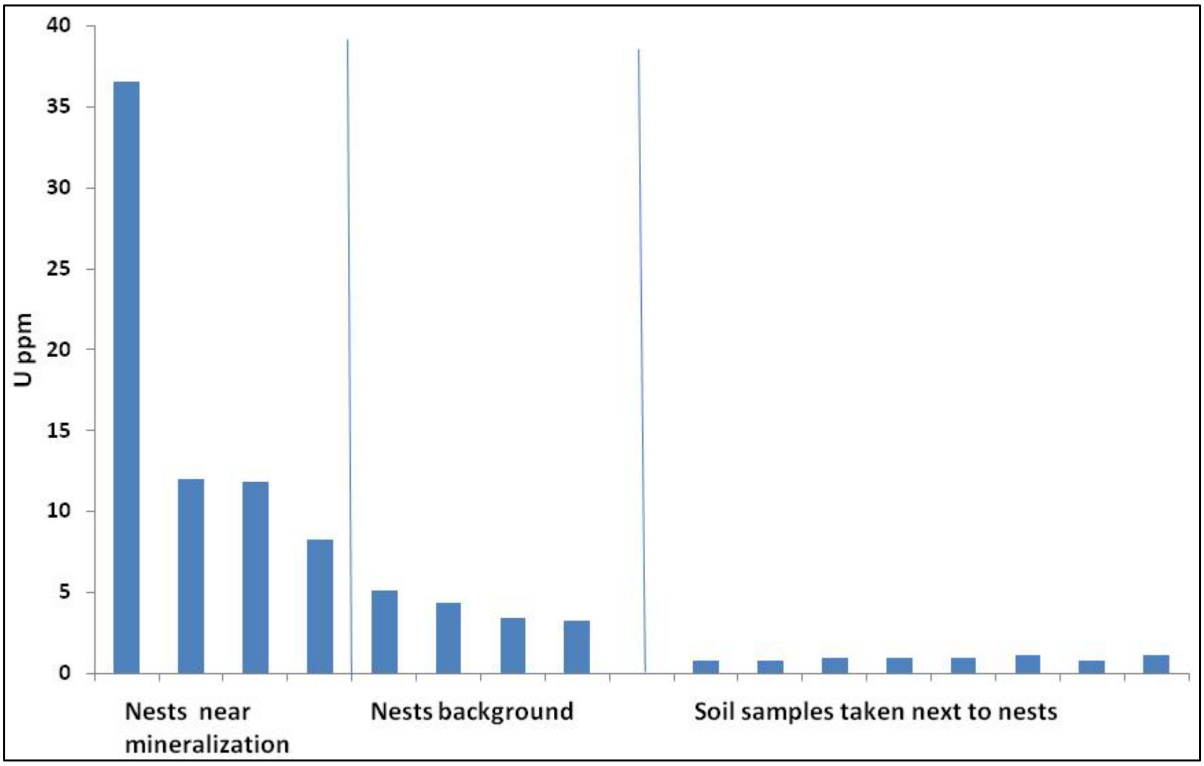

Figure 1. Comparison of U concentrations in termite mounds near mineralisation, in background areas and the adjacent soil samples.

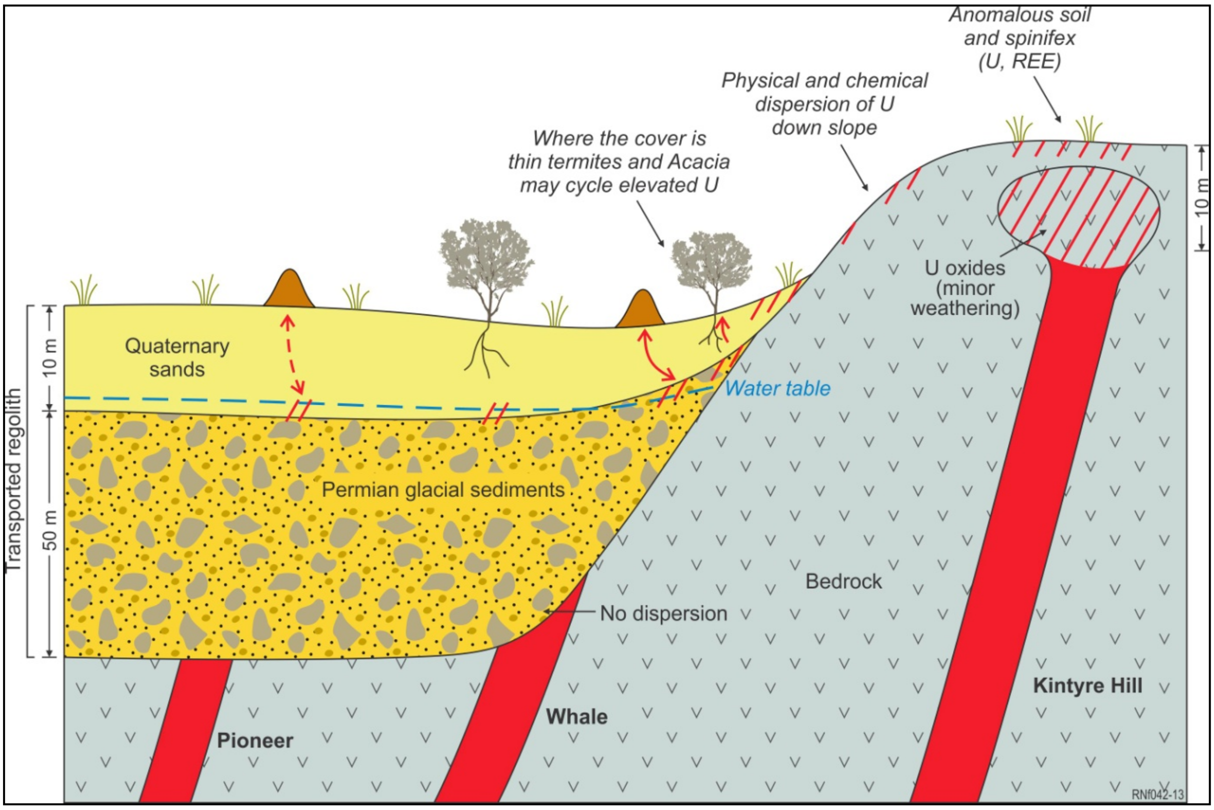

Figure 2. Model of the mechanisms of metal migration operating at Kintyre. As cover thickens the metals taken up into the vegetation is reduced. Surface anomalies are partially mobilised down slope.

References

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