Termitaria Geochemistry for Uranium Exploration in Arnhem Land, Northern Territory, Australia

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Cameco Australia initiated a trial in the application of *termitaria* (termite mound) sampling as a reconnaissance geochemical exploration tool in the eastern Alligator regions, Northern Territory, Australia. The objective is discovery of a large-tonnage U unconformity-type deposit similar to the world-class Ranger and Jabiluka deposits. This study aims to refine the sampling protocols and analytical techniques for application in the climatic and weathering regimes of northern Australia.

Termitaria derived from regolith material are an excellent sample medium for geochemical exploration in eastern Arnhem Land, since they are enriched in U relative to the underlying regolith. The near-surface regolith profile in the study area is comprised of a ferricrete unit 1 to 3 m below the surface, overlain by a sandy clay soil containing pisoliths and red sandy soil.

Termite species variation seems to have no effect on the U concentrations in the termite mounds sampled in a previous orientation survey. However, differences between mound types based on the oxidation (red vs. gray) state of the material used to build the termite mound may be significant in controlling the U and other trace element contents of the *termitaria*. In the 250-53-µm fraction samples, organic matter accounts for up to ~90% of the total U in the termite mound. Organic matter has the capacity to fix a wide range of elements; however, total organic matter content and U do not directly correlate.

The finest-grain fraction of the *termitaria* material (<53 µm), which predominantly comprises kaolinite and organic material, has consistently elevated U concentrations relative to the other size fractions (e.g., mean ~55 ± 5 U ppm). The coarsest-grain fraction, >2,000 µm, also returned relatively elevated U concentrations (e.g., mean ~60 ± 40 U ppm), which may be attributed to the lateritic fragments incorporated in the mound material. Intermediate size fractions, 250-53 µm and <2,000 to >250 µm, are dominated by quartz sand which has no affinity for sorption of U. SEM, XRD, XRF, and PIXE analyses confirm that U finely disseminated throughout the sample material with no specific U-bearing minerals identified.

Ferricrete has U concentrations similar to or higher than samples from the *termitaria* and underlying regolith units; it may play an important role concentrating U. Uranium absorption or adsorption in the *termitaria* is principally focused in the organic matter and clay-size fraction. This accumulation could be consistent with the effects of several processes: (1) repeated (seasonal) introduction of U into the mounds via capillarity during periods of elevated water table levels; (2) direct physical transport of U-enriched ferricrete and organic material into the mounds by termites, (3) through termite food sources, and (4) physical introduction of saturated soil with enriched U by termites. Due to the impermeability of the outer carapace of the termite mounds, U concentrations may increase within the mound over time, whereas the surrounding and underlying regolith loses U to erosion or chemical leaching. Additional work will determine how uranium is being introduced into the termite mounds. The source of the U in these *termitaria* remains uncertain.