Termitaria sampling in uranium exploration: Refining an old technique

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Cameco Australia & CSIRO

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Termitaria sampling in uranium exploration: Refining an old technique

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[1] Cameco Australia
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Reference:
I. González-Álvarez, R. Anand, A. Stewart, W. Salama, J. Laird and Pinchand, T., 2015. "Termitaria in Arnhem Land, Northern Territory, Australia: geochemical exploration for uranium". *In CSIRO, Mineral Resources Flagship Report, Western Australia, EP148115, 43.*

Historic orientation surveys

Conventional soils

Metal depletion in soil

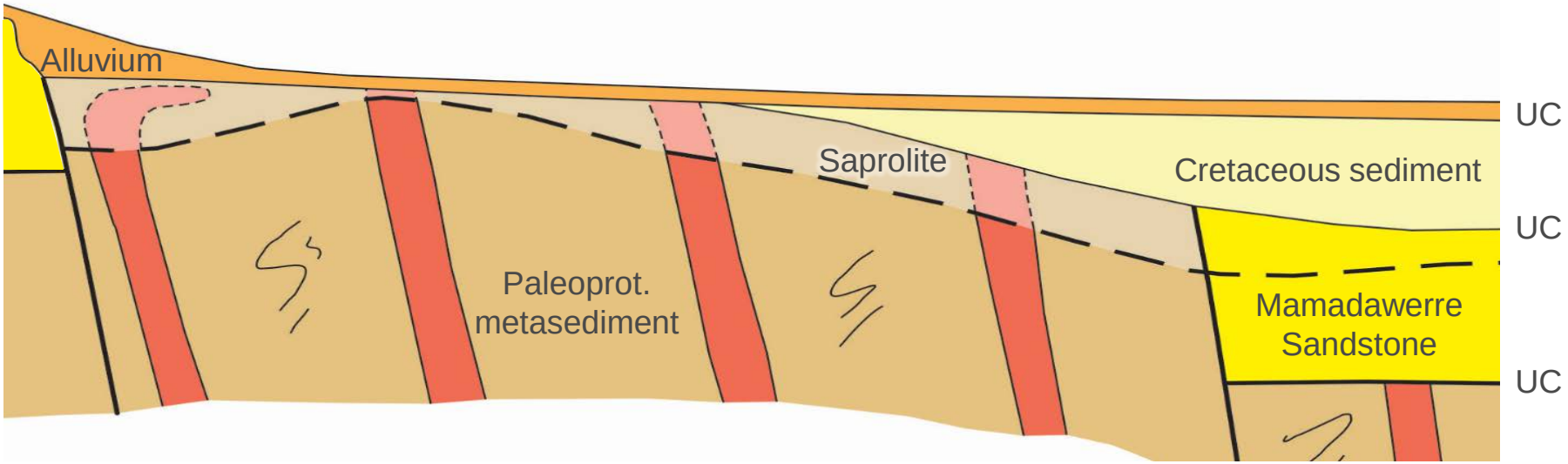
Shallow regolith sampling

Cu, Pb ± U regolith horizons

Vegetation Sampling

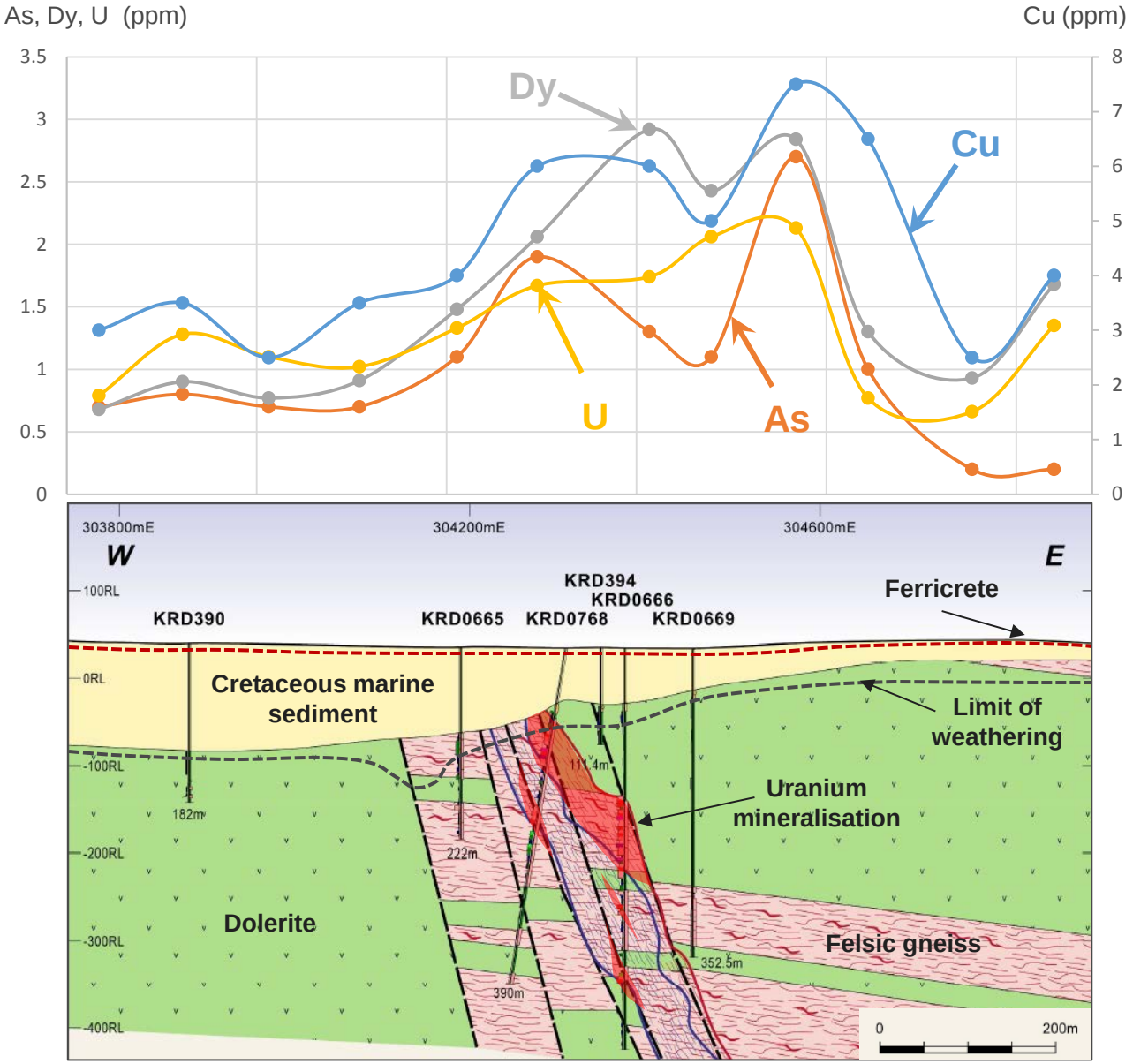
? ? ?

U – Cu ± Ga ± Mo
Seasonal variation



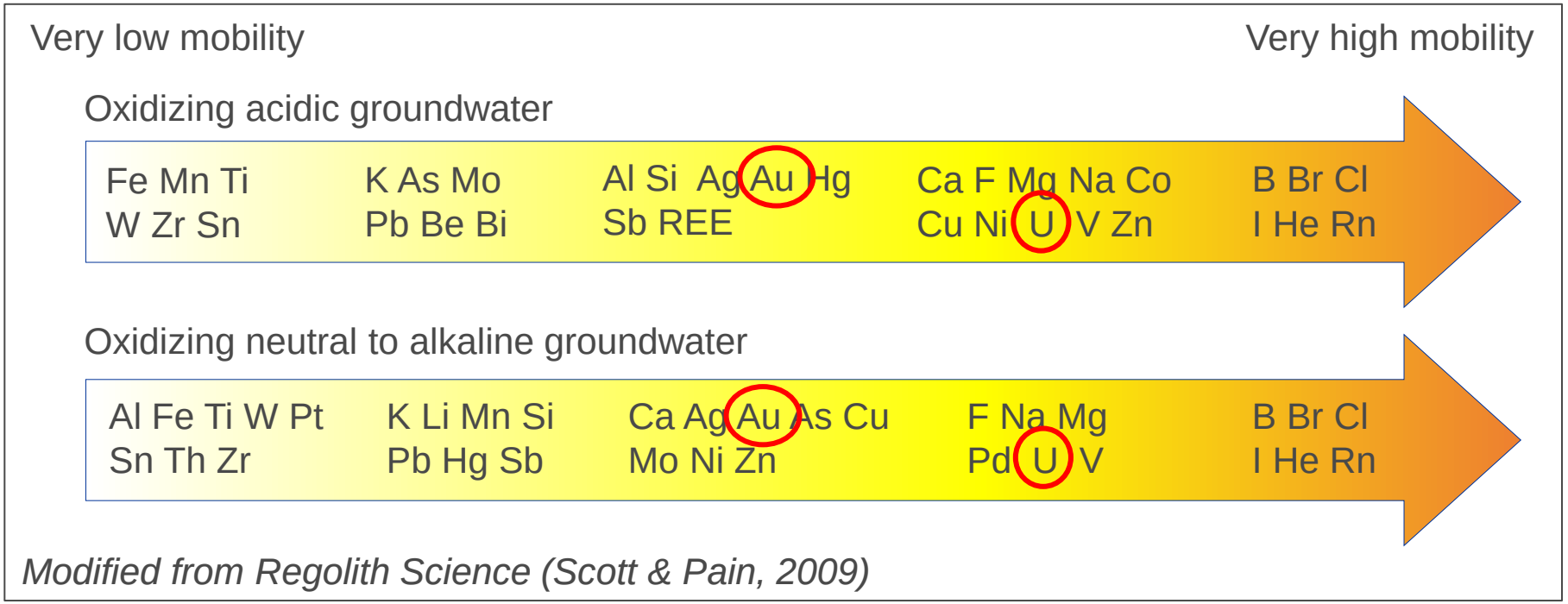
Aurari Termitaria Orientation Study

- Fault hosted uranium mineralisation below 60 m cretaceous cover
- No surficial radiometric expression
- U, As, Cu and HREE enrichment in termitaria samples over fault system
- 500 m wide low level dispersion anomaly
- Peak of anomaly displaced to east – shallower cover?



2014 Termitaria Research Study

- Sub-tropical climate promotes leaching of soil and regolith
- Uranium is significantly more mobile than gold and most base metals



Modified from Regolith Science (Scott & Pain, 2009)

AIM: Optimise the termitaria sampling technique for uranium exploration in a sub-tropical weathering environment

Termites of the Top End

Nasutitermes

Schedorhinotermes actuosus (?)

Amitermes laurensis

Tumulitermes pastinator

Coptotermes acinaciformis

Microcerotermes serratus

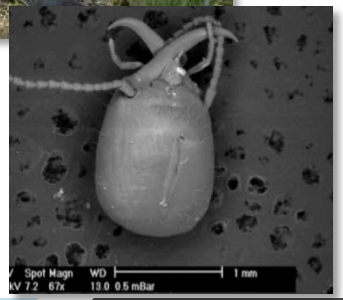
Speciation Study

Seasonally flooded lowlands

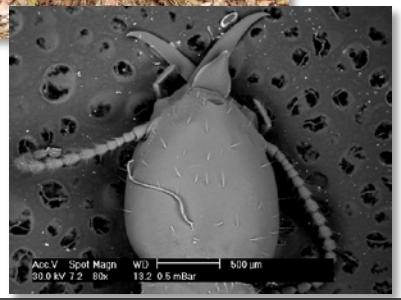
Open eucalypt forest

Grassland with sparse eucalypt

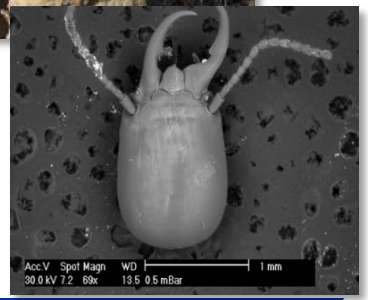
Amitermes meridionalis



Coptotermes acinaciformis

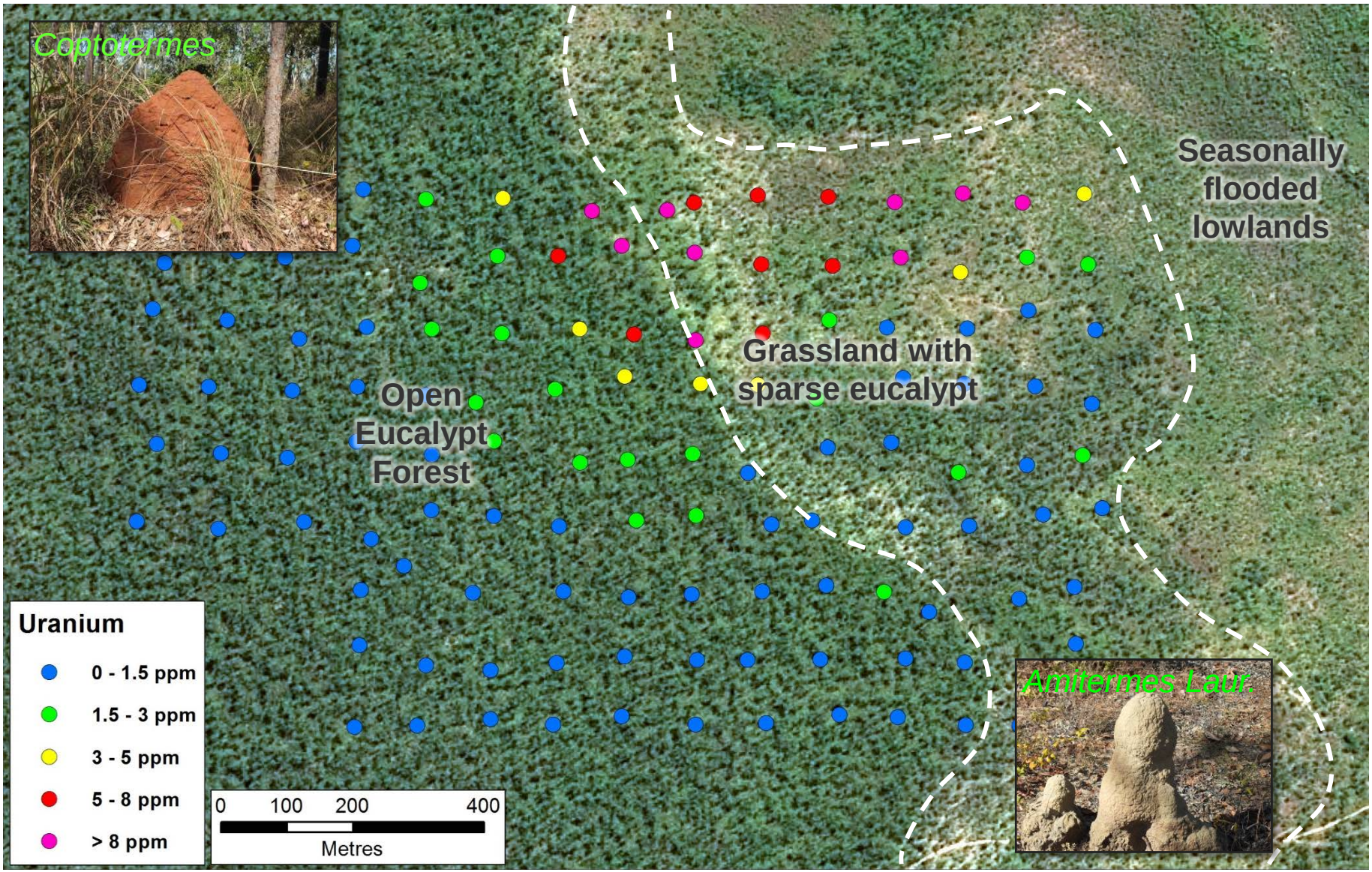


Amitermes laurensis

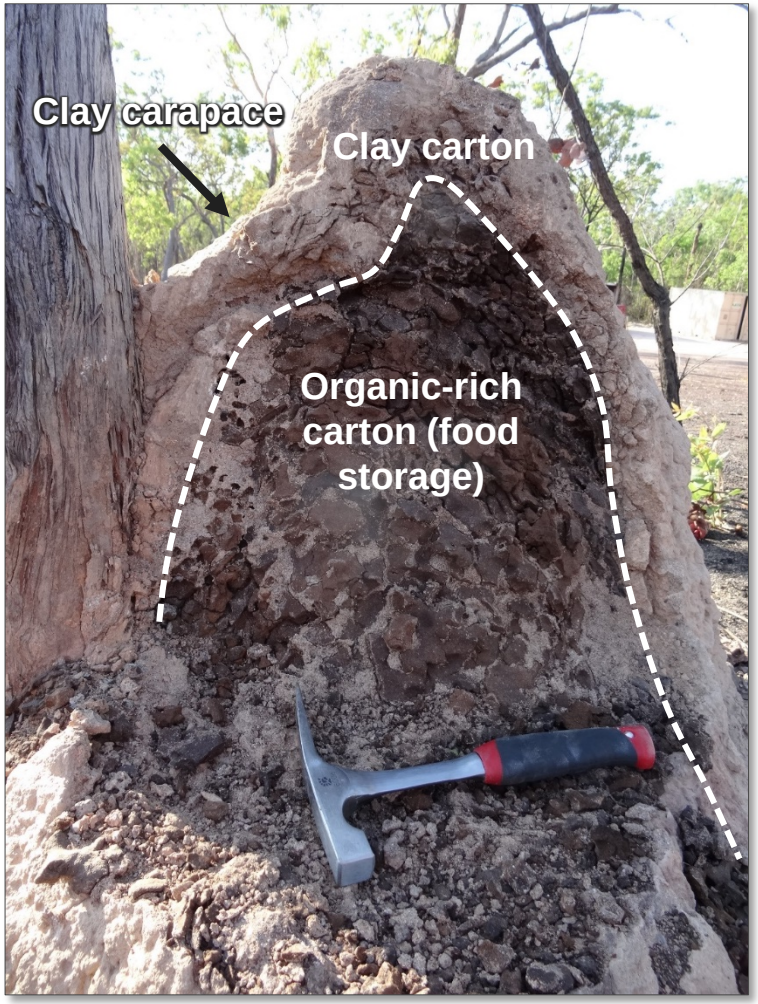


Speciation Study

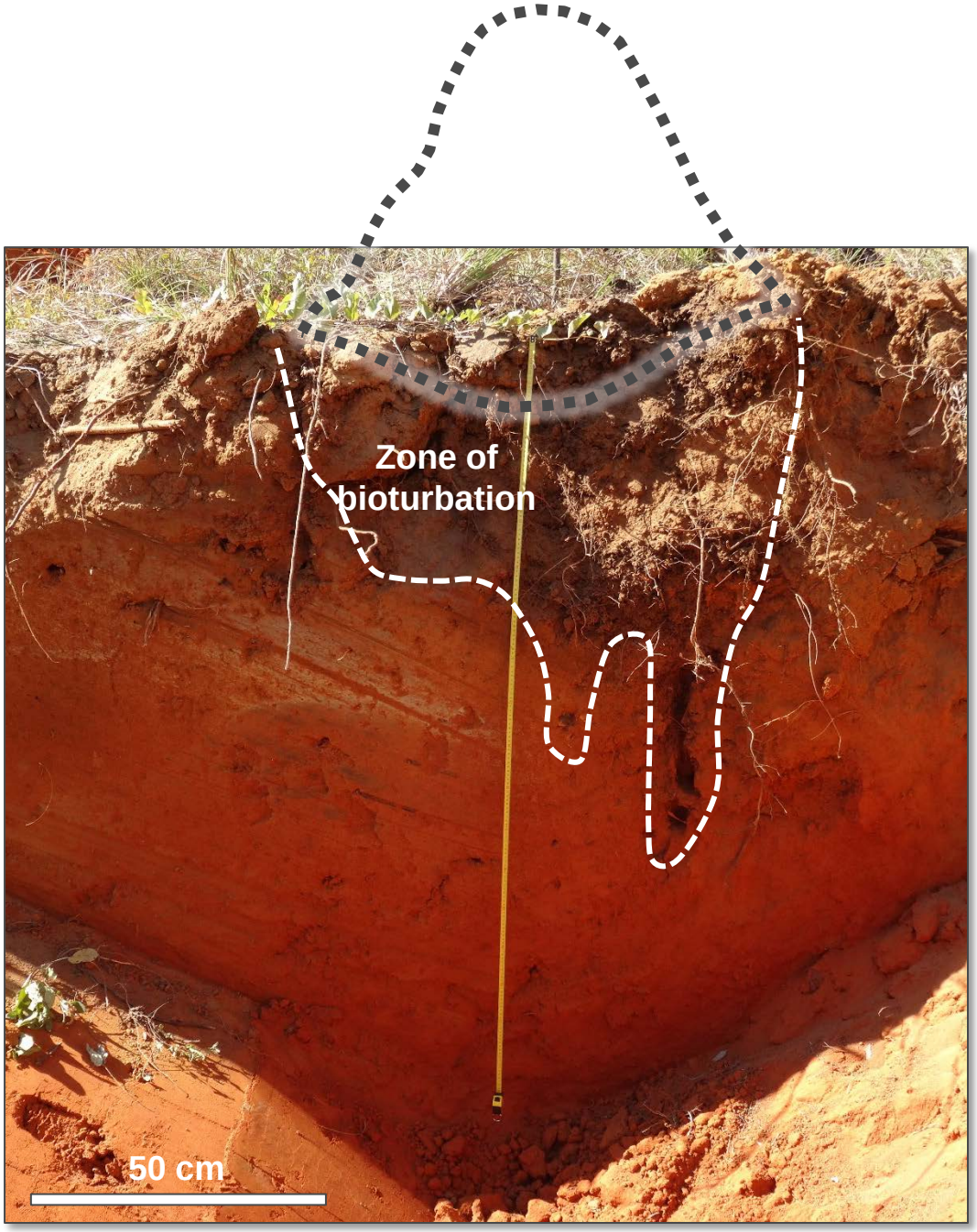
Spot Imagery with termitaria sample points



Sampling

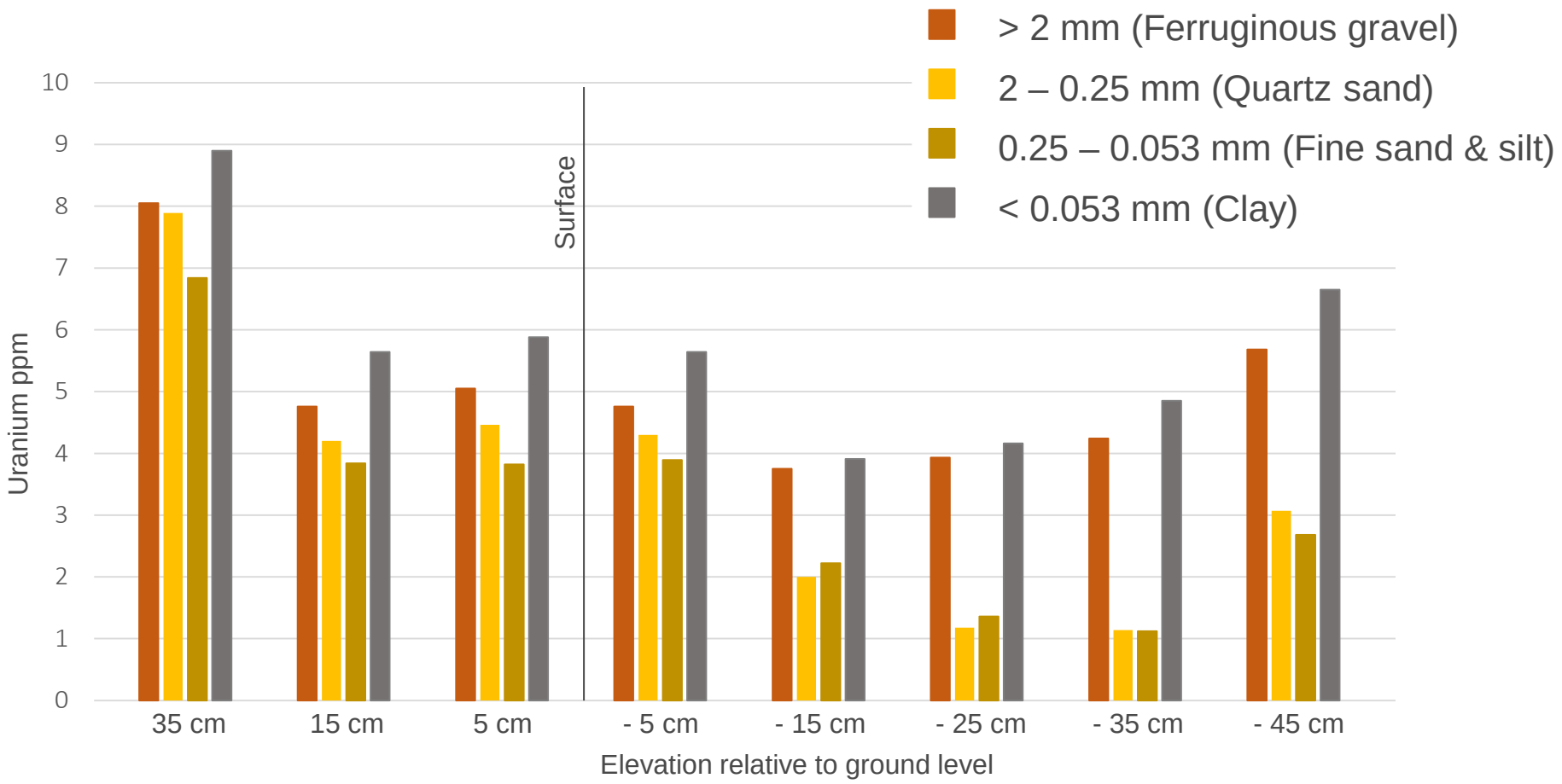


Internal structure of the above ground part of a Coptotermes nest

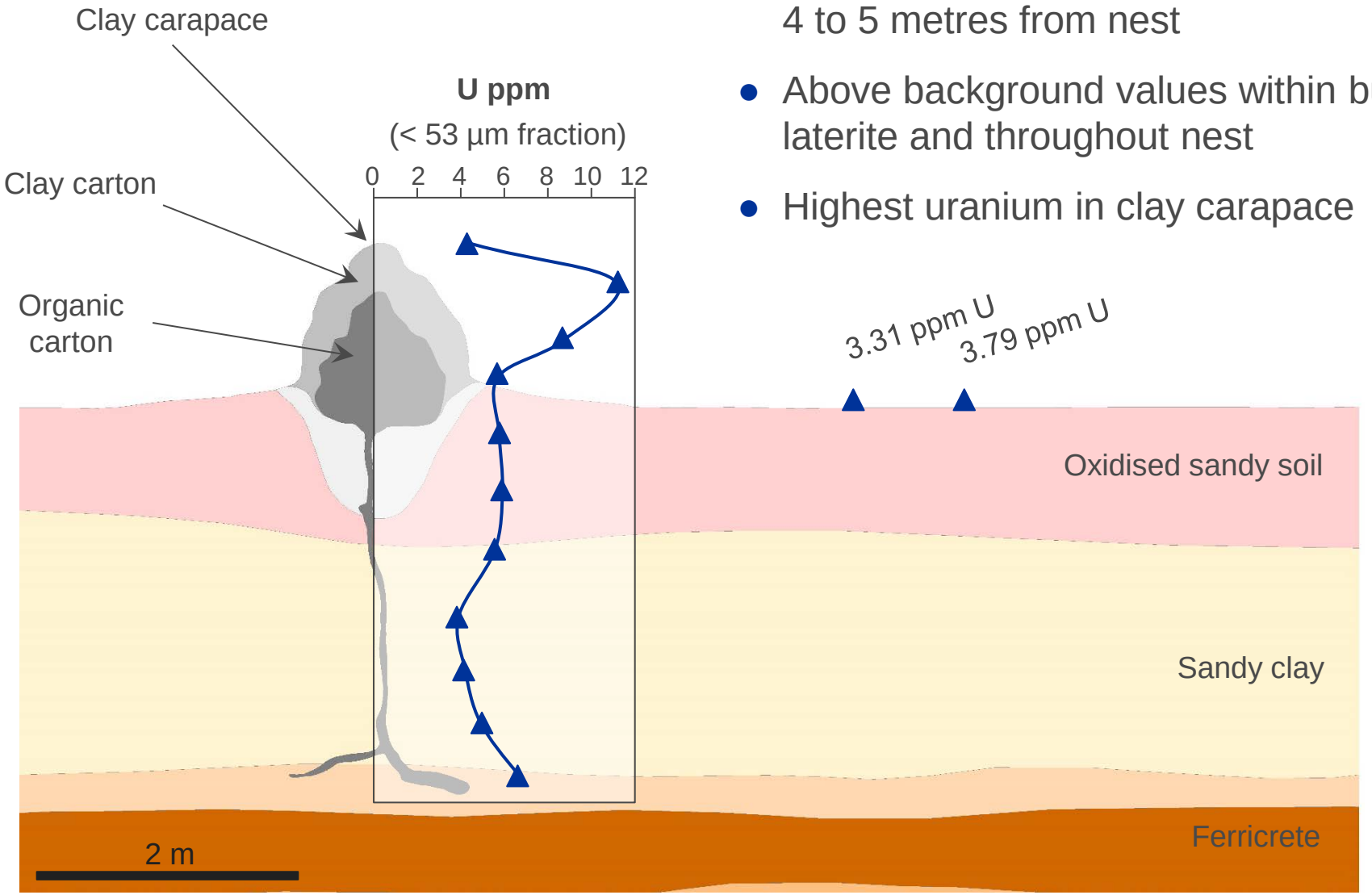


Size Fraction Analysis

- Highest uranium results consistently reported from the clay fraction
- Elevated uranium from coarse (> 2 mm) fragments
- Variable results from sand and silt sized fractions



Regolith Uranium Distribution

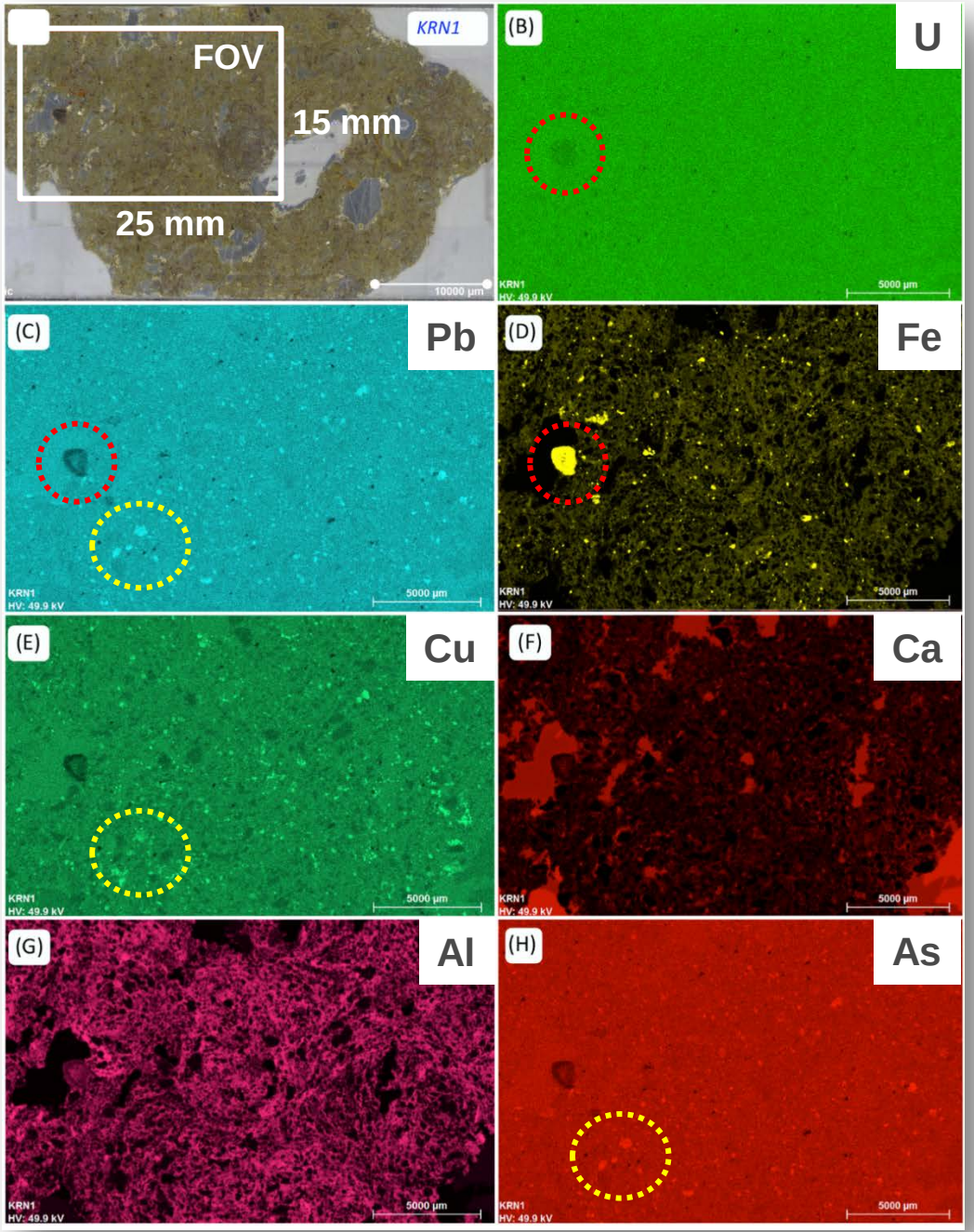


- Background uranium concentrations 4 to 5 metres from nest
- Above background values within buried laterite and throughout nest
- Highest uranium in clay carapace

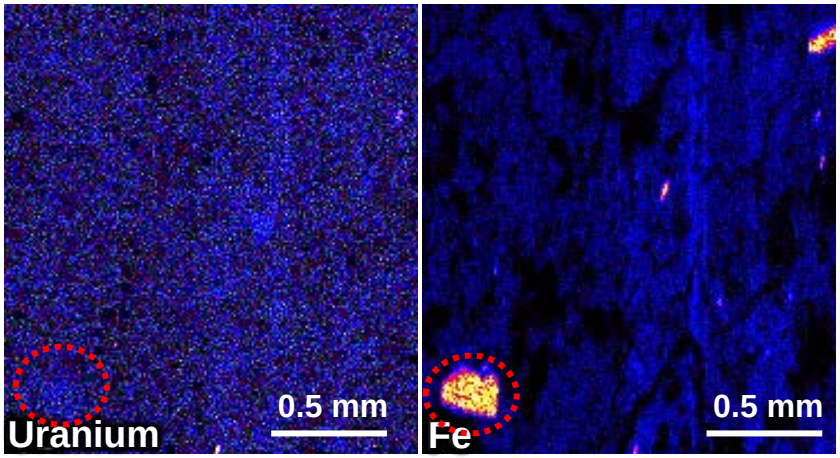
Uranium Deportment

- Uranium is finely distributed at low levels
- Pb, Cu and As finely disseminated and as < 0.5 mm grains
- Poor correlation between uranium and iron

XRF Mapping



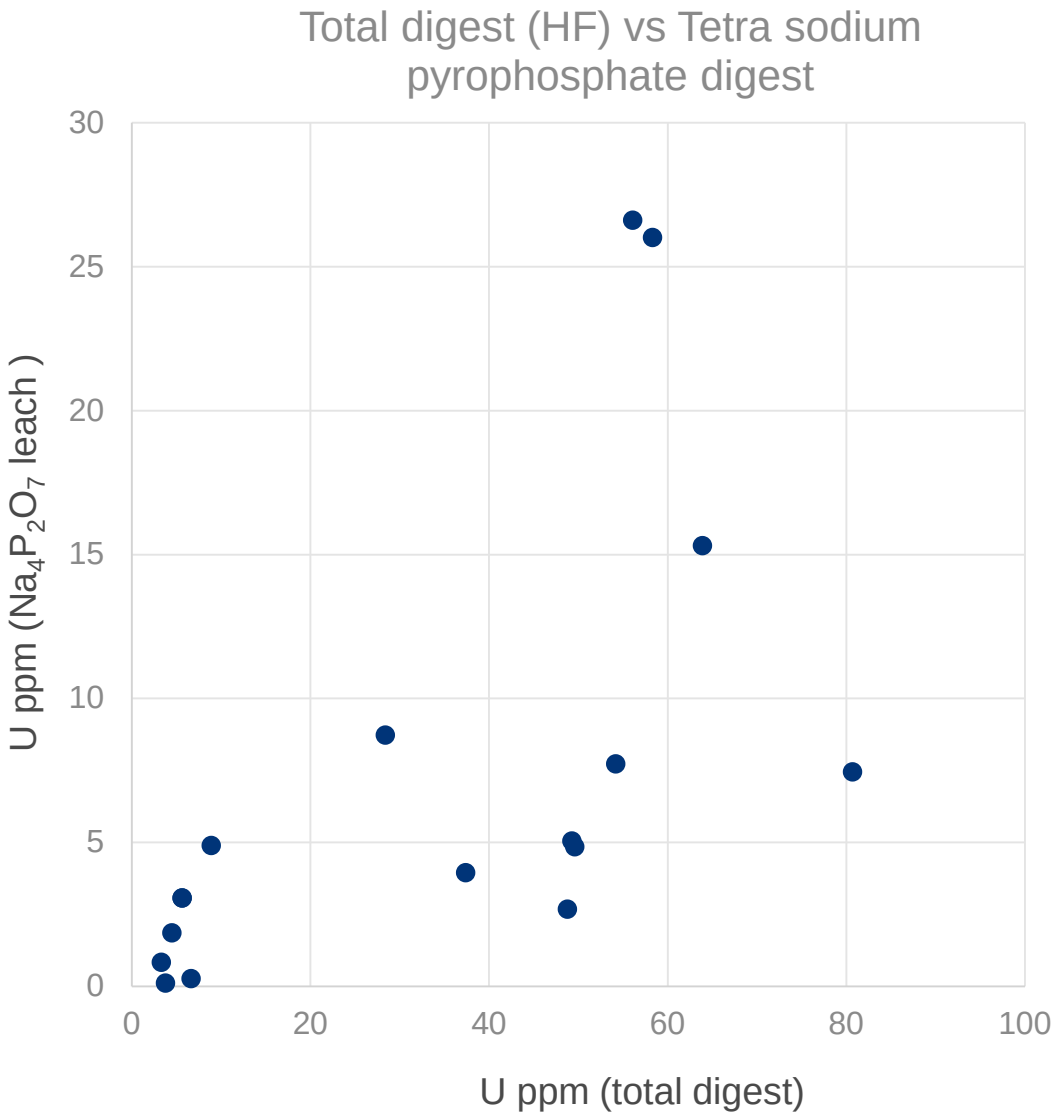
PIXE Mapping



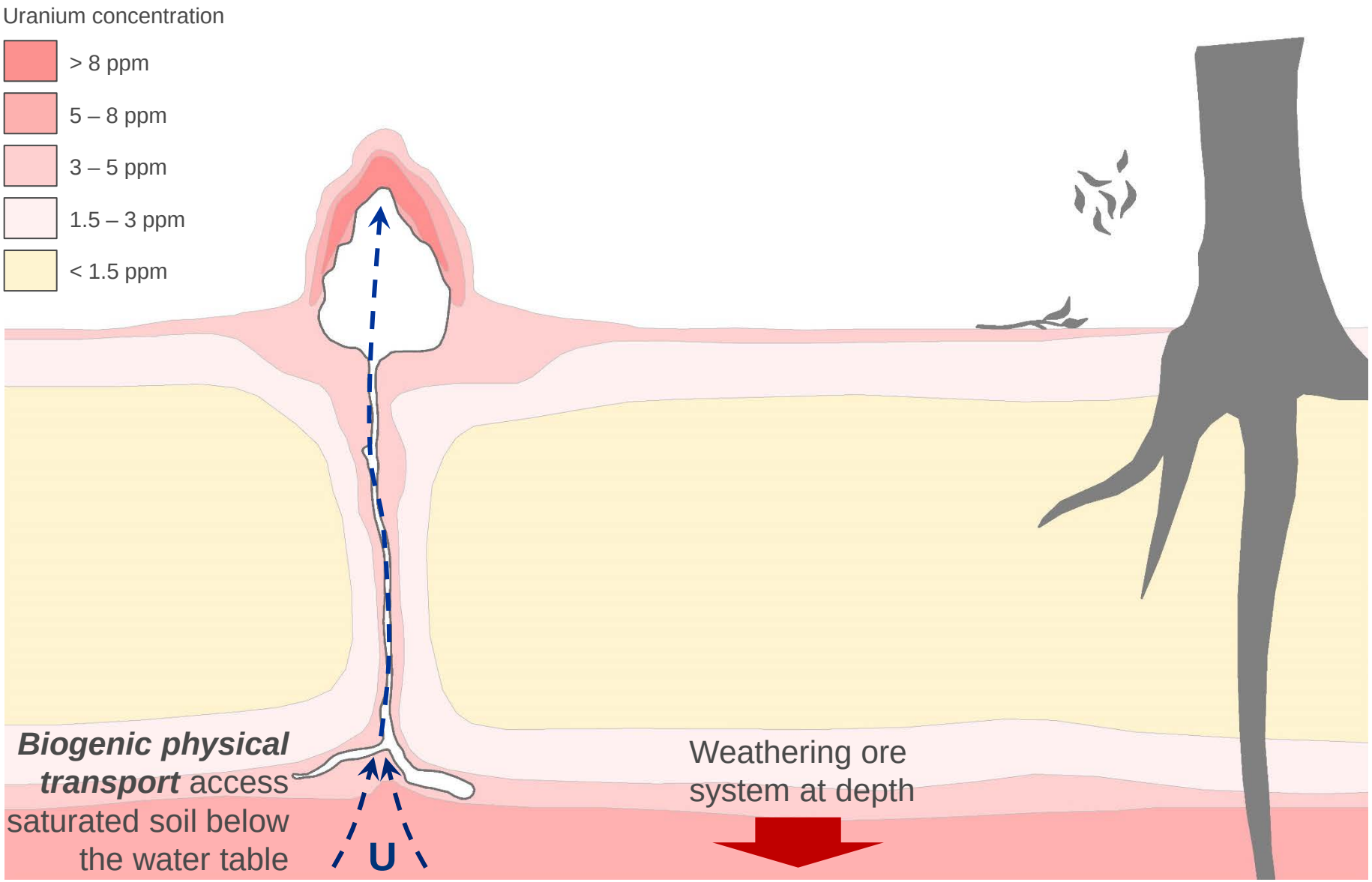
Uranium Deportment

- < 53 µm samples prepared with a $Na_4P_2O_7$ leach
- Targets highly soluble organics (humic and fulvic acid)
- Indicates a portion of the uranium occurs within organic material in the clay fraction

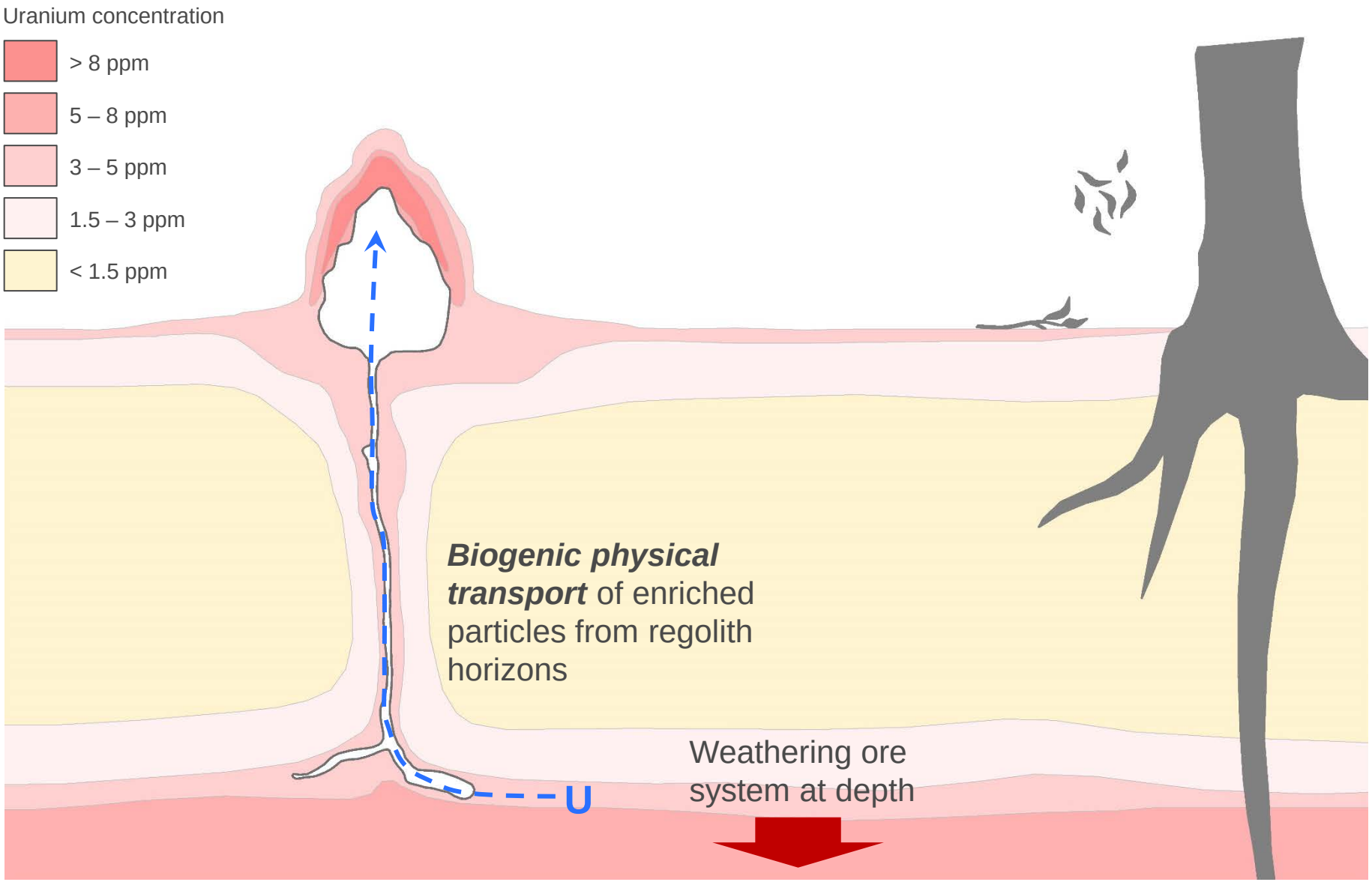
Clay carton composed of alluvium bound together by organic material



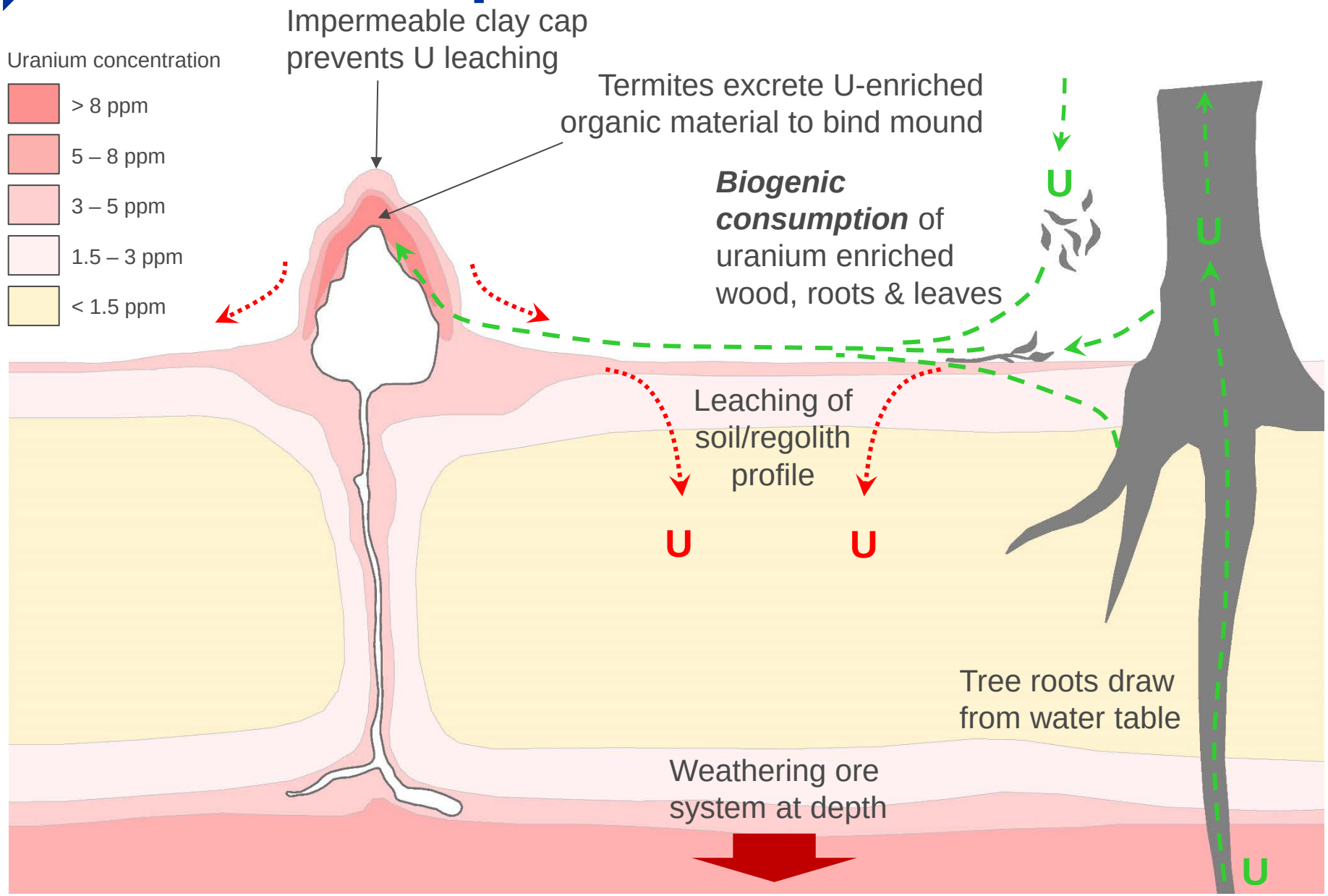
Uranium dispersion mechanisms



Uranium dispersion mechanisms



Uranium dispersion mechanisms



Conclusion

AIM: Optimise the termitaria sampling technique for uranium exploration in a sub-tropical weathering environment

- No evidence to suggest that any particular mound building termite species provides better sampling media
- Apical cemented clay-rich portion of mounds is the optimal sample media
- Tenor of uranium anomalism can be improved by only analysing the < 53 µm size fraction
- Partial leach technique (i.e. Aqua regia) should be sufficient to liberate uranium from sample

Termitaria sampling technique

References

CSIRO entomologist, Dr Aaron Stewart, collecting soldier termites, 2014.

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- *Eupene, G.S. and Williams, B.T., 1980. Ranger One U deposits, Pine Creek Block, N.T. In C.R.M. Butt and R. E. Smith (editors), Conceptual Models in Exploration Geochemistry, 4: Australia. Journal of Geochemical Exploration 12: 230-233.*
- *Giblin, A.M. and Snelling, A.A., 1983. Applications of hydrogeochemistry to uranium exploration in the Pine Creek Geosyncline, Northern Territory, Australia. Journal of Geochemical Exploration 19: 33-55.*
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- *González-Álvarez, I., Stewart, A., Anand, R., Sinclair, P., Salama, W., Laird, J., Ibrahimi, T., Pinchand, T., 2015. Termitaria Geochemistry for Uranium Exploration in Arnhem Land, Northern Territory, Australia. Society of Economic Geology Annual Meeting, September 2015 Hobart, Tasmania, Australia, P218.*
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