# Micron-scale U distribution in organic soil

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Organic rich soils represent a complex system with variable redox conditions and a heterogeneous mix of organic and mineralogical components. The fate of U and other metals in organic soils has been extensively studied and a complex story is beginning to emerge. Previous work has shown that U retention in organic soil is controlled by redox processes, complexation with organic matter, and mineral interaction [1,2]. The use of high resolution spatially resolved analytical tecnhiques allows the identification of minor geochemcial processes which may be masked by bulk techniques but play an important role in controlling U fate and mobility.

In this work we focus on the distribution of U in organic rich soil sampled from the Needle's Eye, Scotland, UK. Here weathering of a natural pitchblende vein has transported U into an organic soil where it has become concentrated. We have used synchrotron microfocus-XRF mapping and μ-XAS to investigate the micron-scale variability in the U distribution, redox state and association with other elements.

Coarse scale (30 μm resolution) mapping revealed that U was abundant throughout the core and enriched both in the bulk organic material and as discreet particles. The dominant U oxidation state varied significantly with depth and we were able to clearly identify a transition from U(VI) to U(IV). Coarse scale mapping also revealed the presence of Fe particulates throughout the core. We used fine scale (3 μm resolution) maps to probe elemental correlations and U geochemistry beyond bulk enrichment. This revealed two key insights. Firstly U was greatly enriched throughout the core in discreet features in association with plant essential nutrients (Ca and Zn). Secondly, ferromanganese concretions were commonly observed and in a minority of cases U was associated with these features.

By using high resolution techniques we have been able to extend our understanding of U cycling in organic soils and reveal associations not easily determined by bulk analysis.

[1] Wang, *et al.* (2014) *Env. Sci. Technol.* **48**, 10062-10069.
[2] Kaplan, *et al*. (2016) *Env. Sci. Technol.* **50**, 4169-4177.