

Corrosion of depleted uranium in soils in Bosnia and Herzegovina

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Penetrators made of depleted uranium (U) metal are used as anti-tank ammunition and are typically left behind in the soil in former war zones. Metallic U undergoes corrosion to tetravalent and then hexavalent U depending on the prevalent soil geochemical conditions [1] and may represent a potential source of U contamination.

We recovered penetrators from two sites in Bosnia and Herzegovina seven years after they were fired. We characterized the mineralogy of the corrosion products using powder X-ray diffraction (XRD), X-ray absorption spectroscopy (XAS), and transmission electron microscopy coupled to selected area electron diffraction (TEM-SAED), as well as their elemental composition using acid digestion and inductively coupled plasma optical emission spectrometry (ICP-OES).

In both cases, the dominant mineral observed in the corrosion product was metaschoepite, a hexavalent U oxyhydroxide. However, soil geochemistry of the two sites impacted the composition of minor U mineral phases. In one case, the corrosion product included studtite (a hexavalent U peroxide), while in the other, it included becquerelite (a hexavalent U oxyhydroxide that includes calcium). The latter corrosion product was also characterized as a function of distance away from the metallic core of the penetrator. Closest to metallic uranium, the corrosion product is mainly composed of U and oxygen, and based on XAS linear combination fitting, consists mainly of metascheopite (~2/3) and becquerelite (~1/3). As the corrosion product increasingly closer to the soil is considered, a greater proportion of becquerelite is observed (~2/5, then ~1/2), demonstrating the effect of the soil geochemical conditions on the mineralogy of the product.

The study provides insight into the depleted uranium corrosion products that form under *in situ* conditions. This is significant because the specific mineral phase produced has implications for uranium mobility in the soil.

1. Handley-Sidhu S. et al. (2010) Sci. Total Environ., 408(23), 5690-700.