Geophysical Research Abstracts, Vol. 8, 07651, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07651

Aeration conditions modify the immobilisation of Se (selenite) and Tc (pertechnetate) on various soils

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Isotopes of both selenium and technetium are important components of radioactive waste destined for long-term storage and so it is important to understand their behaviour in the environment. In addition, selenium is an essential micro-nutrient, deficient in some soils but potentially toxic at only slightly larger concentrations found naturally or as a result of human activity. Both elements are redox sensitive, having oxidation states from +7 to 0 for Tc and from +6 to –2 for Se. They are often considered to behave very similarly in the environment, with the oxyanions dominating in well-aerated soils.

We have studied the sorption of both elements in contrasting soils and compared the consequences of prolonged incubation under well-aerated, water-saturated, or strictly anaerobic conditions. We used sequential or parallel chemical extractions to assess the chemical nature of the immobilised fractions.

Pertechnetate remained easily water-extractable throughout prolonged incubation of the soils under aerated conditions. However flooded, hence reducing conditions decreased the water-extractability of Tc. There was no difference between the fraction extracted by water or by simple salt solution (exchangeable fraction). However, as Tc became progressively immobilised, 1M NaOH (to solubilise humic substances) or H_2O_2 (to solubilise soil organic matter and reoxidise reduced forms of Tc) increased more Tc, indicating the strong association of Tc with organic matter and differing extents of chemical reduction.

Selenite sorbed to differing extents on the various soils studied however the fraction extracted by water was systematically very low. There was a large difference between

the water-extractable and the exchangeable fractions. Incubation of the soils under well aerated conditions led to different changes in Se extractability. Freshly added Se was more easily extracted than native Se. Addition of fresh organic matter or strictly anaerobic conditions enhanced immobilisation.

The reversibility of immobilisation processes varied from 0 % for Se to up to 50 % for Tc depending on the incubation conditions.