Mobile ^{99}Tc can be Biogeochemically Immobilized in Hyporheic Zone Sediments

Objective

- Determine the mobility of ^{99}Tc in biologically active hyporheic zone (HZ) sediments, and the identity of immobilization mechanisms if they occur.

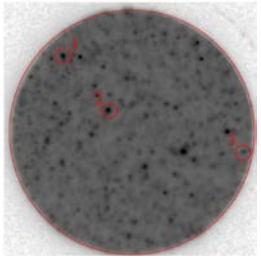
Approach and Results

- Incubation of ^{99}Tc(VII) in Columbia River HZ sediments containing different levels of reactive Fe(II) and sulfide of biogeochemical origin, and robust kinetic analysis.
- Autoradiography, x-ray microprobe, electron microprobe, and x-ray absorption spectroscopy analysis of sediments and Tc-containing particles.
- ^{99}Tc(VII) was immobilized through redox reactions with both Fe(II+) and S(II-) in silt aggregates, with S(II-) being the strongest apparent reductant.

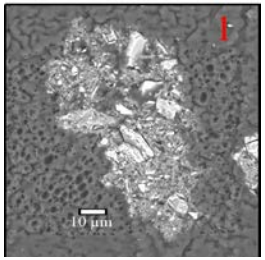
Significance and Impact

- Groundwater ^{99}Tc(VII) may be captured by biogeochemically active HZ sediments before entering surface waters.
- Mobility of ^{99}Tc determined by transport between macropore and intra-aggregate waters, and intra-grain reactive species [i.e., Fe(II+) and S(II-)].

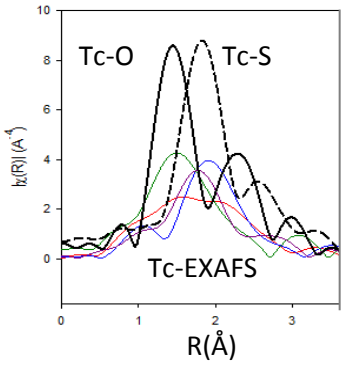
Radiography identifies Tc-containing particles



Reduced Tc resides in aggregates



Speciation a mixture of Tc-oxide and -sulfide



Lee, J., J. Zachara, J. Fredrickson, S. Heald, J. McKinley, A. Plymale, C. Resch, and D. Moore (2014) Fe(II)- and sulfide-facilitated reduction of ^{99}Tc(VII)O_4^- in microbially reduced hyporheic zone sediments. *Geochimica et Cosmochimica Acta*, 136, 247-264, doi.org/10.1016/j.gca.2013.1008.1017.