

Detecting environmental mobility of emerging contaminant tellurium (Te) using Te isotopes as novel indicators

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Project Description:

Tellurium (Te) is exceptionally toxic and an emerging contaminant; mining activities and industrial use in photovoltaic cells, electronics industry, and metallurgy over the last few decades has released this metal into the environment where it can potentially contaminate soils, water supplies and food sources. Little is known about the chemical behavior of Te in the environment. Te is only mobile and toxic in its 'oxidized' form; when turned into its 'chemically reduced' form it becomes mineralized and is no longer mobile. Understanding the processes by which tellurium is oxidized or reduced may be approached through monitoring changes in concentration in its oxidized or reduced form, but this is a costly and often equivocal approach. In contrast, the isotope ratios of tellurium are very sensitive to oxidation and reduction of this metal. Particularly, the isotope ratios of dissolved tellurium may prove to be effective tracers of reducing conditions in groundwater systems where this toxic element may be immobilized and concentrated. This work will establish tellurium isotope ratios as novel sensors of its environmental mobility. We will use interrelated field and laboratory investigations to fulfill the objectives - 1) determine isotopic fractionation of tellurium for various naturally occurring reductants and 2) determine how isotopic fractionation is related to the reaction mechanism.

Research methodology

At RHUL, the student will conduct batch experiments under anaerobic conditions using aqueous Te(VI) and Te(IV) and synthetic minerals (i.e., Iron-sulfide) and metal reducing bacteria. Te isotope ratios of remaining Te will be measured to determine the magnitude of isotopic fractionation in each experiment. Similar batch experiments will determine Te isotopic fractionation during adsorption of Te oxyanions on minerals. In addition, we will collect samples from a Te contaminated site near Clydach in the Swansea Valley, UK. The student will characterize Te species in soil and in pore-water, determine their bio-accessibilities by developing specific extraction techniques, and measure the isotopic composition in the extracted pools of Te.

Training

The student will receive training in isotope measurements using multicollector inductively coupled plasma mass spectrometry (MC-ICP-MS), clean lab techniques for sample purification, bacterial culturing skills, experiments under controlled environments. The student will be trained in surface characterization techniques using atomic force microscopy (AFM) at UCL.

Person specification

Strong background in geochemistry/isotope geochemistry is desired but not essential.

References:

- Perkins, W.T. *Science of the Total Environment*, 2011, 412-413, 162-169
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This project has been shortlisted for funding by the ARIES NERC Doctoral Training Partnership. Undertaking a PhD with ARIES will involve attendance at training events.

ARIES is committed to equality & diversity, and inclusion of students of any and all backgrounds. All ARIES Universities have Athena Swan Bronze status as a minimum.

Applicants from quantitative disciplines who may have limited environmental science experience may be considered for an additional 3-month stipend to take appropriate advanced-level courses.

Usually only UK and EU nationals who have been resident in the UK for 3 years are eligible for a stipend. Shortlisted applicants will be interviewed on 26th/27th February 2019.

For further information please see www.aries-dtp.ac.uk or contact us at aries.dtp@uea.ac.uk

Details on how to apply can be found here www.rhul.ac.uk/studyhere/postgraduate/applying

Please contact the Postgraduate Programmes Co-ordinator, if you have additional questions about the department or application procedures (email: pgadmin@es.rhul.ac.uk; tel: 01784-443581).

Applicants are requested to send an additional copy of their CV directly to the lead supervisor of the project in which they are interested. Please also contact the supervisor if you have any questions about the project itself