USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003NJ42B

Title: Microbial respiration of arsenic and selenium

Project Type: Research

Focus Categories: Toxic Substances, Water Quality

Keywords: arsenic selenium oxidation-reduction redox anerobic soils sediments microbial transformation

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Abstract: The primary goal of this study is to elucidate the role of microorganisms involved in redox transformations of arsenic and selenium in anaerobic soils and sediments. In the absence of oxygen, microorganisms use a wide range of electron acceptors from nitrate through iron, sulphate and carbonate for their respiration.Recent evidence indicates that there are microorganisms that exist in nature which are capable of utilizing arsenate or selenate for respiration by the process of dissimilatory arsenate or selenate reduction. There have been some studies on arsenate reduction coupled to respiration. An organism from the genus Desulfitobacterium has been shown to reduce both As (V) and Se (VI). Desulfitobacterium strains are also known to reductively dechlorinate chlorinated ethenes (Niggemyer et al. 2001). These types of strains may be used to remediate contaminated environments. They would precipitate As (V) and Se (VI) as arsenic sulphides and elemental selenium while reductively dehaloginating chlorinated hydrocarbons. This study focuses on the microbial transformations that occur in the anaerobic zone because these are central in determining the mobility of arsenic and selenium in the environment.

The main objectives and some questions that will be addressed are:

Ø How diverse are the microorganisms that have the capability to carry out dissimilatory arsenate or selenate reduction and how widely are they present in the environment in particular New Jersey where arsenic rich soils are found.
Ø Is the reduction of arsenate and selenate coupled to respiration in these organisms?
Ø How do other electron acceptors such as nitrate compete for carbon source in the same environment?
Ø What is the metabolic diversity of arsenate and selenate reducing bacteria in terms of carbon requirements?

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