THEME 2: THE DYNAMIC INTERFACE

Session 2.7: Biomineralisation

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Biomineralization describes the variety of processes by which inorganic minerals are synthesized, assembled and organized into functional units within biological systems. Over 60 types of biominerals are found in nature. These include the aragonitic concretions of reef corals, bacteriogenic iron minerals and minerals found in humans and other animals as parts of teeth, bone and various pathological calcifications. Together, biominerals form an important link between life and the geosphere and play a fundamental role in the geochemical cycling of elements on the Earth's surface. This session will highlight the diversity of biominerals and the environments in which they occur, focusing on the processes by which they are formed and are maintained. The study of biomineralization is necessarily interdisciplinary and combines aspects of chemistry, biology and materials science with important spin-offs for paleoclimatology, paleontology, astrobiology, medicine and dentistry. Contributions to this session are expected to reflect this. Potential topics include: dynamic interface of biominerals and organic macromolecules; the size- and structural-dependent properties of biominerals; the chemistry and isotopic composition of biominerals; and the mechanisms by which organisms interact with mineral surfaces and aqueous metal complexes.

2.7.11

Interaction between radionuclides and microorganisms

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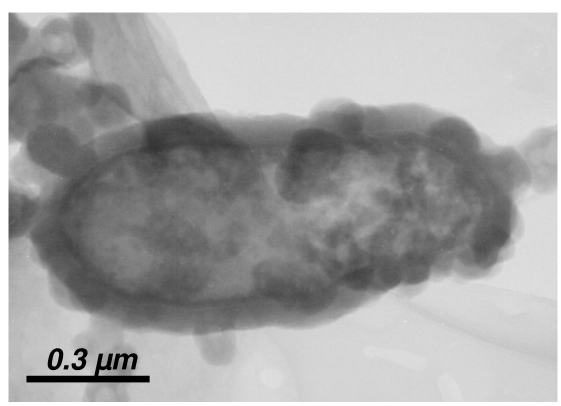
Introduction

Microorganisms can affect the solubility of radionuclides in subsurface environments via processes including biosorption, bioaccumulation and bioprecipitation. These processes can enhance the retention of radionuclides onto soil particles.

Results

We investigated the interaction of ^{238}U and ^{99}Tc and soil microorganisms under a variety of environmental conditions. Under denitrification conditions a fraction of U(VI) was biosorbed while Tc(VI) did not sorb at all. At the end of denitrification and in excess of organic matter both U(VI) and Tc(VII) were reduced by metal reducers into U(IV) and Tc(IV), respectively, as a result of Eh drop. U(IV) precipitated as hydrated UO_2 and Tc(IV) as hydrated TcO_2. In addition, Tc(IV) sorbed onto bacteria cells under appropriate Eh-pH conditions. Under sulfate-reducing conditions the drop in Eh was even lower than under metal-reducers and U(VI) and Tc(VII) were reduced and precipitated together with iron sulfides (see figure).

This contribution underlines the fact that microorganisms can enhance the retention of redox-sensitive radionuclides via the precipitation of highly insoluble mineral phases.



A indigenous sulfate-reducing bacteria with iron sulfide and Tc(IV).