Uranium biogeochemistry – Novel insights from a microbe's prospective

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Diverse groups of microorganisms affect the oxidation state and complexation of metals and, therefore, influence or control the mobility of toxic radionuclides in subsurface environments. Relevant to uranium (U) speciation are bacteria that reduce predominantly water-soluble and mobile U (VI) to U (IV), which has reduced solubility and typically forms uraninite (UO_2). Most knowledge has accrued from research with Gram-negative model organisms including *Shewanella* spp., *Geobacter* spp., and more recently *Anaeromyxobacter* spp., which use U (VI) as growth-supporting electron acceptor. Recent findings demonstrated that U (VI) reduction is a shared capability among members of the genus *Desulfitobacterium*, which are widespread in soil and subsurface environments. Interestingly, extended X-ray absorption fine structure (EXAFS) analysis demonstrated that the U (IV) produced by *Desulfitobacterium* spp. was not UO_2 but rather a phase or mineral composed of mononuclear U (IV) atoms. Since the properties of the reduced product influence U fate, knowledge of the diversity of U reduction mechanisms and end products is desirable for controlling and predicting U mobility. For example, UO_2 is susceptible to reoxidation by oxidants. Hence, controlling oxic/anoxic interface processes to ensure the long-term stability of the precipitated material is critical for lasting immobilization. *Anaeromyxobacter* spp. grow with oxygen as electron acceptor at partial pressures equal to or below 0.18 atm. Thus, *Anaeromyxobacter* are uniquely adapted to life at the oxic-anoxic interface where they consume oxygen and take advantage of oxidized metal species including U (VI) as electron acceptors. Monitoring the *Anaeromyxobacter* community at the Oak Ridge IRFC site using 16S rRNA gene-targeted qPCR approaches revealed unexpected strain diversity and responses to environmental conditions (i.e. ethanol biostimulation, oxygen intrusion). The quantitative assessment provided novel information on the distribution of *Anaeromyxobacter* in the contaminated subsurface, and suggested that members of an *Anaeromyxobacter* clade with no cultured representatives dominated the U reduction treatment zone, emphasizing the need for continued isolation efforts.

Record of oceanic metamorphism by Spl in the serpentinites from the Frido Unit ophiolites (Southern Apennine- Italy)

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The ophiolitic sequences of the Liguride Units in the Southern Apennines are remnants of the Ligurian oceanic lithosphere pertaining to the Jurassic western Tethys. They consist of sequences characterized by an HP/LT metamorphic overprint, in the Frido Unit, and sequences lacking orogenic metamorphism, in the North-Calabria Unit. The ophiolitic rocks occurring in the Frido Unit include serpentinite derived from a lherzolitic to harzburgitic mantle. The primary mantle minerals are represented by olivine, orthopyroxene, clinopyroxene and spinel. Mineral assemblage records oceanic metamorphism in the amphibolite facies, greenschist-amphibolite transition and greenschist facies conditions. More specifically, spinel shows a holly-leaf habit and is often armoured by a corona of Cr-chlorite. The core of the analysed spinel has a Cr-Al spinel composition corresponding to chromite, whereas the rim has a Fe-Cr spinel composition corresponding to ferritchromite. The Cr-Al spinel/ ferritchromite ratio may be various in different spinel porphyroclasts. The metamorphic assemblages in the Frido Unit serpentinites allowed to infer the physical conditions operating during serpentinization. The geochemical features of serpentinites show differences in compositions with respect to the Primitive Upper Mantle (PUM). These are likely related to serpentinization processes, since elements normalised to PUM show different trends, comparable to Residual MORB Mantle and to Primitive Upper Mantle respectively.