The interaction of U(VI) with *Bacillus sphaericus*

C.G. SHEPLER[1], L.C. HULL[2], T.E. LETAIN[3,5], T.C. HAZEN[4], H. NITSCHE[3,4], AND S.B. CLARK[1]

[1]Washington State University, Department of Chemistry, Center for Multiphase Environmental Research, Pullman, WA (cgillaspie@wsu.edu), (s_clark@wsu.edu)
[2]Idaho National Laboratory, Idaho Falls, ID (hulllc@inel.gov)
[3]Lawrence Berkeley National Laboratory, Berkeley, CA (HNitsche@lbl.gov), (TCHazen@lbl.gov)
[4]University of California at Berkeley, Berkeley, CA
[5]Currently at Livermore National Laboratory, Livermore, CA (letain2@llnl.gov)

The sorption of U(VI) as the uranyl cation (UO_2^{2+}) to bacterial surfaces is well documented, and this sorption is known to influence UO_2^{2+} behavior in natural systems. However, this influence is not easily predicted. Sorption can occur by a variety of processes including (1) general electrostatic interactions between negative cell surfaces and positively charged cations; (2) more specific interactions with functional groups on the cell surfaces (e.g. surface complexation); (3) and nucleation/precipitation of solids at or within the cell membrane. Knowledge of each of these processes is needed to fully describe the biogeochemistry of U(VI).

The geochemistry of U(VI) solid phases under oxic, abiotic conditions has been extensively studied. Previous work in our laboratory has focused on both abiotic and biotic transformation of U(VI) oxyhydroxides to less soluble U(VI) phosphate solids. The abiotic transformation is known to require dissolution and reprecipitation of the solid phase, a process that may be kinetically hindered. *Bacillus sphaericus*, a common Gram positive aerobe that has been isolated from U mill tailings, was used since it possesses phosphate functional groups that we hypothesized could serve as nucleation sites for the precipitiation of U(VI) phosphate solids. Contrary to our hypothesis, the presence of *B. sphaericus* did not appear to facilitate the transformation of U(VI) phosphate solids. Despite the lack of evidence for nucleation/precipitation on the cell surface, the possibility of other sorption processes could not be excluded.

In the current study, thermodynamic models will be used to further investigate the data from previous biotic and abiotic experiments. The ability of these models both to predict the behavior of U(VI) solids and to gain a more complete understanding of the complicated biogeochemistry of U(VI) solid phases will be examined.

Soil free-living nematodes community structure and soil microbial biomass response to soil pollution in the vicinity of Navoiy industrial area, Uzbekistan

N. SHUKUROV[1], S.PEN-MOURATOV[2], Y. STEINBERGER[2] AND R. TALIPOV[1]

[1]Institute Geology and Geophysics, Academy of Sciences of Uzbekistan (nosirsh@yahoo.com).
[2]Faculty of Life Sciences, Bar-Ilan University, Ramat-Gan 52900, Israel (steinby@mail.biu.ac.il)

The effect of ammonium-rich and heavy-metal air pollution produced by the Navoiy industrial enterprises on soil free-living nematodes and microbial population activities was investigated in soil samples collected in a 5-km radius surrounding the industrial enterprises. At each location, soil samples were collected (n=4) from the upper layer (0-10 cm) for determination of soil moisture (SM), total organic carbon (Corg), total soluble nitrogen (TSN), soil electrical conductivity (EC) and cations (Ca^{2+}, K^+, Na^+). Heavy metals (As, Cu, Pb, Zn), soil basal respiration (BR), microbial biomass (Cmic) and nematode population were determined. Soil pH was found to be weakly alkaline, with levels ranging between 7.9 to 8.1. Mean soil moisture content varied from 0.75 to 0.93%, without any significant differences between the sampling stations. The Cu, Pb and As were accumulated in the upper soil layer. A significant difference was found between soil heavy metal content for Cu ($p<0.0005$) and As ($p<0.02$). BR and microbial coefficient (Cmic/Corg) were found to be significantly negatively correlated with Cu and As soil content. A significantly positive correlation was found between the Cd concentration and the metabolic quotient (qCO_2) ($p<0.003$). The highest level of TSN was found near the industrial enterprises, with 23.8 and 24.0 mg kg^{-1} at NavoiAzot and NavoiGRES, respectively. No significant correlation was observed between the soil microbial population and TSN. Furthermore, the qCO_2, which is a known ecophysiological index for the soil microbial population, was found to be correlated with the total number of nematodes in general and with the bacterivore-feeding group in particular. The nitrogen pollution significantly influenced the total number of nematodes and the distribution of nematode communities. TSN was correlated with the total density of nematodes ($p<0.05$) and plant-parasites trophic group ($p<0.02$). Results of present study elucidate the direct and indirect effects of industrial pollution on soil microbial biomass and nematode community around the Navoiy industrial complex.