Bosea sp. WAO oxidizes metal sulfides at neutral pH

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Trace heavy metals such as lead and cadmium are typically toxic to humans at even low levels in the environment. The geochemical cycling of trace metals is closely associated with the sulfur cycle due to the reactions between the metals and reduced sulfur compounds in anoxic sediments and pore water [1]. When present in anoxic sediments the metals are bound as monosulfides. However, due to microbial activity or events where oxygen is introduced, the metal sulfides can be oxidized to release a soluble metal ion and sulfate [1]. If microorganisms have a role in oxidizing these metal-sulfides at circumneutral pH then the metals could be more readily bio-available, resulting in a higher risk of human exposure.

Bosea sp. WAO was previously isolated in our laboratory from an arsenic containing shale in the Newark Basin of New Jersey, based on its ability to autotrophicly oxidize arsenite to arsenate [2]. Strain WAO is shown here to autotrophically grow on several reduced sulfur sources. The growth yield per electron transferred based on protein analysis was determined for sodium sulfide, sulfur, and sodium thiosulfate. Its ability to oxidize these reduced sulfur sources at circumeutral pH suggests that microorganisms can have an important role in the oxidation reactions of the sulfur cycle.

This isolate was used to examine the role of microorganisms in the mobilization of heavy metals from galena (PbS) and greenockite (CdS) at neutral pH. The microbially mediated oxidation of PbS and CdS was compared to the oxidation rate of background and sterile controls. Active cultures containing either PbS or CdS were shown to completely oxidize the 1mM of metal-sulfide to sulfate measured by ion chromotography (IC) within 25 days of incubation. No release of sulfate was measured in the background and sterile controls during the incubation period. This suggests that microorganisms can play a role in oxidizing metal sulfides and releasing hazardouse metals into solution at circumneutral pH.

[1] Canavan *et al.* (2007) *Science of the Total Environment* **381**, 263–279. [2] Rhine *et al.* (2008) *Environmental Sci. Technol.* **42**, 1423–1439.

Collaboration of EarthChem and EARTHTIME to develop a geochronology and thermochronology database

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One of the most difficult aspects of developing data reporting and databases for geochronological and thermochronological studies is to capture all of the metadata needed to completely document both the analytical work as well as the interpretations of the analyst. Such information is available in the data reduction programs used by researchers, but has proven difficult to harvest into either publications or databases. For this reason, the EarthChem and EARTHTIME efforts are collaborating to foster the next generation of data management and discovery for age information by integrating data reporting with data reduction.

EarthChem workers have met with groups working on the Ar-Ar, U-Pb, and (U-Th)/He systems to establish data reporting requirements as well as XML schemas to be used for transferring data from reduction programs to database. At present, we have prototype systems working for the U-Pb_Redux, ArArCalc, MassSpec, and Helios programs. In each program, the user can select to upload data and metadata to the Geochron system hosted at EarthChem (http://geochronportal. org). There are two additional requirements for upload. The first is having a unique identifier (IGSN) obtained either manually or via web services contained within the reduction program from the SESAR system (http://geosamples. org). The second is that the user selects whether the sample is to be available for discovery (public) or remain hidden (private). Search for data at the Geochron portal can be done using age, method, mineral, or location parameters. Data can be downloaded in the full XML format for ingestion back into the reduction program or as abbreviated tables.