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Biogeochemical Processes of Mercury in Natural and Contaminated Environments

S. C. Brooks, *Organizer*

ABSTRACTS

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Mercury in marine macroaggregates

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Macroaggregates (macrogels), produced episodically in the northern Adriatic by agglomeration of dissolved organic macromolecules - mostly heteropolysaccharides, of prevalently phytoplankton (diatom) origin, offer a rare opportunity to study the interactions between colloidal organic matter and Hg. The chemical speciation of macroaggregate Hg in the Gulf of Trieste (northern Adriatic Sea) was studied discriminating between water insoluble (sediment) and water soluble (supernatant) fractions. Water soluble fraction was ultrafiltered through membranes with a nominal pore size of 30, 10 and 5 kDa cutoff, and fractions characterized by carbohydrate, Corg. and Ntot. contents, FTIR and enzymatic (α-amylase, β-glucosidase) cleavage. The results revealed that glycoproteins and aminopolysaccharides can be important constituents of higher molecular weight (MW) fraction, >30 kDa, while lower MW fractions should be mostly composed of polysaccharides. Analyses of Hg, determined by CV AFS, revealed the highest concentrations in permeates >30 kDa suggesting its prevalent bonding to proteic and amino sugar components.

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Microbial community structure and function related to geochemistry in mercury contaminated stream sediments

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Streambed microbial communities were examined in Oak Ridge, TN, along a mercury gradient using a functional gene array and by phylogenetic characterization. The contaminated sites (*e.g.*, mercury at 33.3 µg/g) exhibited higher gene frequencies in several categories (sulfate reduction, denitrification, carbon utilization, and rubisco) and specific genes associated with a contaminant response (*e.g.*, metal resistance and contaminant degradation) compared to the control site (*e.g.*, mercury at 0.065 µg/g). The 16S clone libraries from the most highly contaminated site had a higher proportion of cyanobacteria and lower diversity than the control. A synoptic snapshot of six sites (mercury range 0.071 µg/g to 39.1 µg/g) showed a poor correlation between mercury in stream sediments and in the water (r = 0.71). This observation was consistent with the complex relationship between stream sediment and stream water concentration that is likely influenced by geochemical factors and mercury speciation. The relationships among community structure, methyl mercury, total mercury, and other geochemical factors will be examined though further analysis of the data taken over a full year (application of non-linear techniques such as artificial neural networks).