Microbial controls on contaminant metal transport in porous media

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Toxic heavy metals in aquifers, which may arise from either natural geologic processes or anthropogenic activities, pose risks to human health as well as to other life forms. Previous laboratory experiments have demonstrated that bacteria commonly found in geologic settings are likely to adsorb metal contaminants, a fact suggesting that their presence can attenuate metal migration. However, as bacteria are also likely to migrate through the groundwater system a better understanding of the combined effect of these two processes is required. The aim of our laboratory study is to explore a) the affinity bacteria exhibit towards metals b) the effect that bacterial shape and surface chemistry have on the bacterial filtration and c) use the above data to develop predictive models of the impact of microbes on metal mobility in porous media.

We make use of *Micrococcus Luteus* (spherical shape) and *Pantoea Agglomerans* (rod shape) species, grown in the same medium to mimic the nutrient uniformity of the subsurface environment and a range of metals. Potentiometric titrations and spectroscopic measurements are conducted in order to identify the type and concentration of sites present on the bacterial wall. The stability constants for the adsorption of metals onto these sites are determined through batch absorption experiments Titration and Zn adsorption experiments confirm that by using the same growth medium, the two microbes acquire the same surface chemistry in terms of site pKa, site concentrations and Zn stability constants. We envisage that the use of a set of thermodynamic metal stability constants will improve the accuracy of the reactive transport model used to simulate our data.