Effects of the interaction between vermiculite and the bacterium *Pseudomonas fluorescens* strain CHA0 and its genetic derivatives

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It has been known for a long time that bacteria can alter various properties of clay minerals considerably.

In an ongoing study we have analyzed the influence of *Pseudomonas fluorescens* strain CHA0 (wildtype) and its genetic derivatives strains CHA631, CHA77, CHA89, CHA400 and CHA661 (derivatives modified in the production of various metabolites) on the chemical (e. g. minor and trace element content), mineralogical (e. g. X-ray diffraction pattern, water content, grain size distribution, cation exchange capacity, layer charge, specific surface) and mechanical (e. g. rheology) properties of the clay mineral vermiculite affected by microbial activity. All strains change the BET surface as well as the grain size considerably.

All of the mentioned strains with the exception of strain CHA661 take up Fe from vermiculite. The wildtype CHA0 moreover incorporates V, whereas strains CHA631 and CHA400 incorporate Mn. Zn is used by strains CHA77, CHA89, CHA400 as well as by CHA661 and Co by strain CHA89.

Electrochemical analysis at the microbe/mineral interface

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Dissimilatory metal reducing bacteria (DMRB) grow by transferring electrons directly to solid, insoluble metal oxides, thereby contributing to the biogeochemical cycling of metals. By examining how DMRB transfer electrons from the cell to solid minerals, we can better understand, predict, and control this phenomenon as it relates to the biogeochemical cycling of metals, including the bioremediation of metal contaminated environments.

We have developed novel analytical methods that address electron transfer (ET) from whole cells and their reactivity with specific solid terminal electron acceptors, including metal oxides, through the use of cyclic voltammetry (CV). *Shewanella oneidensis* MR-1, a model DMRB, is capable of coupling H_2 oxidation to the reduction of solid terminal electron acceptors. To date we have shown that living cells of *S. oneidensis* MR-1 demonstrate ET to several types of working electrodes (including Fe(III) oxide/carbon paste electrodes), under anaerobic conditions in the presence of H_2. Differences in ET were recorded using bacterial mutants with altered metal reduction capabilities as well as with different electrode surface composition.

In order to verify CV studies, current response was monitored over time at a poised potential of 550mV vs. Ag/AgCl, as determined from CV analyses. Bacterial cells were immobilized onto a Pt working electrode with a dialysis membrane (10kDa MW cut-off) and were exposed to either N_2 or H_2 saturated deionized water containing 170mM NaCl. A sustained current response over time was greater for cells exposed to H_2 as compared to N_2.