Geophysical Research Abstracts
Vol. 12, EGU2010-4420-2, 2010
EGU General Assembly 2010

Does the presence of bacteria effect basaltic glass dissolution rates? 1: Dead *Pseudomonas reactants*

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Basaltic glass and crystalline basalt formations in Iceland have been suggested for industrial CO_2 storage due to their porous and permeable properties and high reactivity. Acid CO_2-saturated waters in contact with basaltic glass will lead to rapid dissolution of the glass and release of divalent cations, (Ca^{2+}, Mg^{2+}, Fe^{2+}) that can react to form stable carbonates and thereby trap the CO_2. However, the basalt formations in Iceland not only contains glass and mineral assemblages, but also host microbiological communities that either by their presence or by active involvement in chemical reactions could affect the amount of basaltic glass being dissolved and CO_2 being trapped. Samples of natural bacteria communities from the CO_2 storage grounds in Iceland were collected, separated, and purified using agar plate technique and cultured under laboratory conditions in nutrient broth-rich media. Heterotrophic aerobic Gram-negative strain of *Pseudomonas reactants* was selected for a series of flow-through experiments aimed at evaluation of basaltic glass dissolution rate in the presense of increasing amounts of dead bacteria and their lysis products.

The experiments were carried out using mixed-flow reactors at pH 4, 6, 8 and 10 at 25 ºC. Each of the four reactors contained 1 gram of basaltic glass of the size fraction 45-125 μm. This glass was dissolved in $\sim$ 0.01 M buffer solutions (acetate, MES, bicarbonate and carbonate+bicarbonate mixture) of the desired pH. All experiments ran 2 months, keeping the flowrate and temperature stable and only changing the concentration of dead bacteria in the inlet solutions (from 0 to 430 mg/L). Experiments were performed in sterile conditions, and bacterial growth was prevented by adding NaN_3 to the inlet solutions. Routine culturing of bacteria on the agar plates confirmed the sterility of experiments.

Samples of outlet solutions were analyzed for major cations and trace elements by ICP-MS. Results demonstrate a slight decrease in the Si, Ca, and Mg release rates from basaltic glass with increasing concentration of dead bacteria at pH 4 and 6, but no effect at pH 8 and 10. The Al dissolution rate is lowered by up to one order of magnitude at all four pH values by the presence of dead bacteria. Comparison of SEM photos of the basaltic glass before and after experiments show no visible change of the glass surface. These results suggest that the presence of dead *Pseudomonas reactants* in the basaltic formations of Iceland will likely affect negligible the dissolution of basaltic glass during CO_2 sequestration. The main effect of bacterial presence seems to be 1) the increase of the concentration of DOC that can complex metals and thus facilitate cation release from the solid phase and/or 2) adsorption of released metals at the surface of the biomass thus decreasing the overall element export rate.