

Microbiologically induced dissolution of smectite

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Experimental dissolution of smectite in the system with and without bacteria was carried out to confirm the effects of microbial activity on dissolution rate of smectite. The dissolution experiment was performed using polyethylene bottles containing 1.0g of smectite and 100ml of 0.1M NaCl solution under constant temperature at 25°C. Three reaction systems were prepared as follows. Reaction system (1): abiotic system containing no bacteria, reaction system (2): biotic system containing 10^5 to 10^9 cells/ml of *B. subtilis* with no nutrient, and reaction system (3): biotic system containing 10^5 to 10^9 cells/ml of *B. subtilis* with 0.1g of glucose. The dissolution rates of smectite were calculated using Si concentrations released to the solutions for duration of 5 to 15 days. Results of this study indicated that the bacteria extensively increased dissolution rate of smectite depending on their amounts and nutrient conditions. In the reaction system (2), the dissolution rates of smectite were successively increased 2 to 18 times with increasing bacterial amounts from 10^5 to 10^9 cells/ml relative to the abiotic system. HPLC analysis verified the bacteria produced various organic acids during reaction processes. The total organic acid contents showed good correlation with the dissolution rates, indicating that the dissolution of smectite was accelerated by organic acids produced by the bacteria. In the reaction system (3), the solution pH was decreased to about pH=4 independent of bacterial amounts due to production of organic acids by microbial metabolism of glucose. The dissolution rates of smectite were also increased approximately 8 to 10 times independent on the bacterial amounts. It was found that there was no relationship between total organic acid contents and the dissolution rates. This possibly indicates that the dissolution of smectite was mainly affected by pH rather than organic acids.