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Abiotic H_2 generation supporting microbial CO_2 transformation in geological storage units

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Microbial transformation of sequestrated CO_2 in its geological storage units depends on the existence of autotrophic microbes and the availability of essential H_2. Anaerobic incubation tests at milled rock material from potential CO_2 sequestration units (sandstone oil and gas fields, Gaz de France, Germany) revealed the generation of up to 500 nmol H_2 per gram rock sample. Dissolved H_2 concentrations (20-450 μmol/L) clearly exceed environmental levels of e.g. sulphate reducing or methanogenic aquifers (1-30 nmol/L; [1]). The proposed mechanism of H_2 generation is abiotic water reduction at iron containing silicate minerals (comp. [2]). XRD analysed chlorite and layer silicate contents of the investigated rock samples equal 1 and up to 35 mass%, respectively. Sequential extractions were used to identify chamosite within the rock samples, the iron containing end member of the chlorite mineral group. Comparable to the milled sandstone samples, milled and hand crushed chamosite samples (Mikon Mineralienkontor, Germany) showed H_2 generation in anaerobic batch tests. The comparison of non-sterile and sterile anaerobic batch tests indicates microbial consumption of generated H_2 by autochthonous autotrophic microbes.

[1] F.H. Chapelle, D.A. Vroblesky, J.C. Woodward, D.R. Lovley: Practical considerations for measuring hydrogen concentrations in groundwater, Environ. Sci. Technol. 1997, 31, 2873-2877

[2] T.O. Stevens, J.P. McKinley: Abiotic controls on H_2 production from basalt – water reactions and implications for aquifer biogeochemistry, Environ. Sci. Technol. 2000, 34, 826-831