

Bentonite - geotechnical barrier and source for microbial life

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The safe storage of high-level radioactive waste is a challenging task for our society. For a deep geological deposition of the waste, a multi-barrier concept is favoured, which combines a technical barrier (canister), a geotechnical barrier (e.g. Bentonite) and the geological barrier (host rock). Due to their properties, namely a high swelling capacity and a low hydraulic conductivity, Bentonites fulfil in this system a sealing and buffering function. Depending on the mineral composition, Bentonites contain many suitable electron-donors and -acceptors, enabling potential microbial life. For the potential repository of nuclear waste, the microbial mediated transformation of Bentonite could influence its properties as a barrier material. To elucidate the microbial potential within selected Bentonites, microcosms were set up containing 20g of Bentonite and 40ml anaerobic synthetic Opalinus-clay-pore water solution under an N₂/CO₂-gas-atmosphere. Substrates like acetate, lactate and H₂ were supplemented to stimulate microbial activity. Microcosms were incubated in the dark, without shaking at 30°C and 60°C. Within a year, samples were taken at six different time-points and were analysed regarding geochemical parameters like pH, O₂-concentration, redox potential, iron-concentration and sulphate-concentration as well as biological parameters like the consumption and formation of metabolites. Our results show that indigenous microbes from Bentonite are active and could therefore facilitate diverse transformations within the respective Bentonite.