INVESTIGATION OF THE INFLUENCE OF CHEMICALLY ASSISTED REMEDIATION TECHNIQUES ON THE MICROBIOCOENOSIS IN A FORMER URANIUM MINE

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Embedded in the determination of geochemical long-term processes at the former uranium ore mine "Königstein" microbiological processes were investigated as an effect of chemically assisted flooding. Multiphase column experiments simulate different flood scenarios to understand geochemical, biochemical and especially microbiological processes taking place at the phase boundaries between flooding water, solid rock and bioactive iron-sludge, all taken from the mine area. The investigated scenarios were first the currently running remediation process "washing" and second the chemically assisted treatment with sodium Hydroxide solution for the elimination of acid. A third type of experiments describes the sustainable fixing of heavy metals in solid sulfide phases by stimulating sulfate reducing bacteria with several organic carbon sources directly or in combination with pretreatment by alkalinity. The determination of the DNA of the biocoenosis shows, that every flooding scenario causes a different influence on the composition of the microbial community in the iron-sludge and related areas compared to the original sludge.

The different microbial systems react in variant manners. The origin biocoenosis of the supernatant before starting the experiments includes an acid mine drainage typical composition of sulfate reducing, iron-oxidizing and related bacteria. The treatment "washing" by exchanging the free water phase leads to higher populations of sulfate reducing bacteria. The use of sodium hydroxide solution shows two different effects. While the supernatant includes a wide spread of different microbial populations the silica gel layer shows a remarkable enrichment of sulfate and sulfite reducing bacteria. Iron-oxidizing bacteria were repressed to less than 3%. The silica gel layer seems to have comparable properties as a biofilm. Also the treatment with variant substrates causes different bacterial communities depending on the carbon source.

The knowledge about the effects of stimulating certain microbial communities in this geochemical system is important for the success of sustainable retention of heavy metals in the mine related groundwater system. The results should give a decision support for the most effective treatment to implementate a natural post-operative system of mine maintenance.