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Effective diffusion and microbiologic activity as constraints describing pyrite oxidation in abandoned lignite mines

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Abstract:

This paper reports detailed O_2 measurements of pyrite bearing sediments in a column study and their interpretation based on a hydrogeochemical modelling approach. The research focuses on the quantitative effects of effective diffusion and microbiologic activity on pyrite weathering and acidification. A column experiment was set up and O_2 saturation and moisture contents were monitored over 100 days. The anoxic material used for the column experiment was taken from a sediment core of a mining waste dump in the southern periphery of the Lohsa storage system in the Lusatia region of Germany. The measured O_2 breaktrough curves were modelled using the simulator SAPY, a one-dimensional reactive transport code which considers the kinetics of chemical reactions and the delivery of O_2 into the sediment. The simulation yielded a strong dependence of pyrite oxidation on the moisture content which was quantified by empirical equation. It was shown that the oxidation rate was catalysed by microbial activity exceeding the rate of diffusive O_2 delivery. In order to develop a management tool for predictive issues the results have already been applied to natural environments in another study using the adapted model.