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Microbiological monitoring of carbon dioxide storage in a subsurface saline aquifer in Ketzin/Germany within the scope of CO2SINK

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Within the scope of the EU project CO_2SINK (www.co2sink.org) a research facility in Ketzin (Germany, west of Berlin) is operated to store CO_2 in a saline subsurface aquifer (Würdemann et al., EGU General Assembly 2009). In order to examine the influence of CO_2 storage on the environment a comprehensive monitoring program is applied at this site including molecular and microbiological investigations.

With the injection of CO_2 into the geological formation chemical and physical reservoir characteristics are changed. This may influence the composition and activities of the deep biosphere at the storage horizon. Mineral precipitation, dissolution and corrosion of reservoir casing may be consequences, influencing permeability and long-term stability of the reservoir.

The objective of the microbial monitoring program is the characterisation of the microbial community (biocenosis) in fluid samples, as well as in samples from reservoir and cap rock before and during CO_2storage using molecular biological methods.

16S rRNA taxonomic studies, Fluorescence in situ hybridisation (FISH), and RealTime PCR are used to examine the composition of the biocenosis. First results of fluid sampling revealed that the microbial community of the saline aquifer is dominated by haloalkaliphilic fermentative bacteria and extremophilic organisms, coinciding with reduced conditions, high salinity and pressure.

RealTime RT-PCR of selected genes and the creation and analysis of cDNA libraries will allow the prediction of microbial metabolic activities. In addition, the analysis of organic and inorganic components of the samples will add to the knowledge of possible metabolic shifts during CO_2 storage. In order to simulate the storage conditions *in situ*, long term laboratory experiments in high pressure incubators have been set up using original rock cores from Ketzin.

Since DNA and RNA analysis techniques are very sensitive, contamination entries from the adjacent environment have to be excluded and/or controlled. As a consequence of the drilling process, drill mud and other drilling fluids are the main reason for contamination. The addition of fluorescence tracer to the drilling fluids and the calculation of total carbon entries with the drilling fluids into the wells allowed the determination of the contamination degree of fluid and rock core samples. It became obvious that drill mud and other organic polymer additives do not only cause contamination but also promote bacterial growth in an extensive manner. Thus, the decreased injectivity of the injection well could be traced back to the promoted growth of sulphate reducing bacteria (SRB) in the filter zone. The bacteria seem to use the organic polymer of the drill mud as carbon source and their metabolic activity led to the precipitation of FeS, blocking the filter pores. After an extensive cleaning of the borehole via repeated pumping and lifting with N_2(Zettlitzer et al., EGU General Assembly 2009), a decrease in drilling fluids and SRB, and an increase in injectivity could be observed.