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Microbiological monitoring on two geothermally used aquifers in the North German Basin

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Within the context of assessing the potential of microorganisms to affect the operational reliability of geothermal plants the microbial diversity in two geothermal aquifers of the North German Basin (shallow heat-store and deep geothermal aquifer) was investigated by molecular PCR-SSCP (polymerase chain reaction-single strand conformation polymorphism) analysis of bacterial partial 16S rRNA genes. Comparative genetic profiling of fluids, deriving from aquifers located in 15-25 m and 1.700 m depth, revealed different microbial phylogenetic lineages, despite of partly high temperature (63 °C), high salinity (200 mg l-1) and low DOC (dissolved organic carbon) -content down to 0.2 mg C l-1. Fluids of the heat-store aquifer were characterized by Beta-, Delta-, Epsilon-, Gamma-Proteobacteria, Verrucomicrobia and Clostridia, covering the range of chemolithotrophic to chemoorganotrophic metabolism. Cycling of nutrients, like iron and sulphur compounds, played an essential role in the habitat. The detection of phototrophic Chloroflexi and Chlorobi in filters indicated seeping surface water, interacting with the aquifer. The biocenosis of the saline geothermal aquifer was characterized by organic matter degrading Alpha-, Beta-, Gamma-Proteobacteria, Clostridia and Bacteroidetes. The detected microbial community was probably influenced by organic substances, introduced by drilling and well completion procedures during plant installation or workover procedures to the surrounding of the well. The decrease in the DOC (dissolved organic carbon) -content in fluid within 19 months in the course of plant operation and a TOC (total organic carbon) -content of 15 % in the sediment of the production well indicate organic residuals of drilling fluids in the well. This study demonstrates that a diverse microbial community in geothermal plants may exist even under extreme conditions and such surveys can contribute to characterize the biological and chemical processes in engineered geothermal aquifers (in addition, see Westphal et al. EGU 2011).