Geophysical Research Abstracts
Vol. 12, EGU2010-15303, 2010
EGU General Assembly 2010

Microbiological Aspects of Geothermal Energy: Influence of Microbial Activity on Scaling and Clogging in a Cold Storage

Stephanie Lerm (1), Mashal Alawi (1), Rona Miethling-Graff (1), Andrea Vieth (1), Andrea Seibt (2), Markus Wolfgramm (3), and Hilke Würdemann (1)

(1) Helmholtz Centre Potsdam, German Research Centre for Geosciences, Potsdam, Germany (lerm@gfz-potsdam.de), (2) BWG GbR, Neubrandenburg, Germany, (3) GTN, Neubrandenburg, Germany

The development of strategies to substantially reduce emission of greenhouse gases to the atmosphere is one of the major challenges of the next decades. Therefore, the utilization of subsurface stored energy arouses increasing interest. Corrosion and scaling are major problems in geothermal operation which create significant maintenance and cleaning costs. In the scope of the research project AquiScreen the operational reliability of geothermal used aquifer systems was investigated under microbial, geochemical, mineralogical, and petrologic aspects (see also Alawi et al.; General Assembly EGU 2010). This presentation focuses on the investigation of a cold storage in Berlin (Reichstag building, depth 30-50 m). In order to evaluate the impact of microbial processes in the low saline aquifer (see also Vetter et al.; General Assembly EGU 2010), the microbial communities of fluid and filter samples were investigated by Fluorescent in situ hybridization (FISH) and DNA fingerprinting techniques based on PCR amplified partial 16S rRNA genes.
Analyses of fluid samples revealed a bacterial community dominated by iron and sulfur oxidizing bacteria closely related to Siderooxidans lithoautotrophicus, Gallionella sp. and Thiotrix unzii. Scanning electron microscope analysis revealed iron hydroxide formation and precipitation in the filter of the top side facility and the well, corresponding to the abundance of iron oxidizing bacteria. Besides oxidizing bacteria sulfate reducing bacteria (SRB) were detected as well, indicating the formation of micro-habitats with divergent redox zones. After several years of operation and routine maintenance procedures the injectivity of the injection wells and the endurance of the top side facility filters were reduced drastically due to clogging. Mechanical cleaning and a disinfection treatment with hydrogen peroxide (H2O2) were successful to re-establish the injectivity of the wells. The results of the microbiological investigations prove that bacteria and their metabolic activities were involved in the decrease of filter endurances. A strong biofilm formation of filamentous sulfur-oxidizing bacteria related to Thiothrix was observed. In the course of the disinfection measure the microbial composition in the process water changed significantly. Thiothrix could not be detected any longer and the biocoenosis in the fluid was dominated now by Flavobacterium, Acidovorax as well as Alcaligenaceae related organisms. In contrast, SRB analyzed by specific dissimilatory sulfite reductase genes were hardly affected by the disinfection measures. However, even if especially SRB are considered as the most important taxonomic group for microbiologically influenced corrosion (MIC), present operational results indicate that scaling and clogging were the predominant processes for the operation of the shallow cold storage in Berlin.