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Biogeochemical and microbial analyses around gas wells and in the reservoir in a long-term used gas field

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As part of a joint research project microbial communities in the area of the second largest natural gas field in Europe in the Altmark, Germany are analyzed. The Altmark gas field operated by GDF SUEZ E&P Germany GmbH is located at the southern edge of the Northeast German Basin. The reservoir horizons belong to the Permian Rotliegend formation (Saxon) and have an average depth of about 3300 m. CO_2 will be injected to enhance the recovery of gas in this with conventional extraction methods nearly depleted gas field (Enhanced Gas Recovery – EGR, BMBF project CLEAN).

Microbiological analyses are used to supplement a continuous gas monitoring program at the soil surface above the EGR-site. Microbial production and consumption of CH_4 and CO_2 are determined together with the carbon isotopic compositions to separate these indigenous biological activities from possibly upward migrating reservoir gases including CO_2. The $\delta^{13}C$ of CO_2 collected in situ was similar to those in incubations, confirming a biological origin. Archaeal cell numbers were approximately one magnitude lower than bacterial cell numbers. In all samples the total number of detectable microorganisms was high in contrast to a generally low activity for CO_2 and CH_4 production and oxidation.

For monitoring of the deep reservoir microbiological and isotopic analyses are used to investigate the microbial community before and after injection of CO_2. The $\delta^{13}C$ of CO_2 and CH_4 collected in situ in production waters indicate a thermogenic origin. High cell numbers for bacteria and archaea were detected in production waters from different wells. In contrast microbial activities for CO_2 and CH_4 production and oxidation were relatively low. So far microbial activities in reservoir fluids collected with in situ samplers at 3512m depth could not be determined in this hypersaline (salinity of 400 per mille) and hot (around 130˚C) environment.