



Investigation of CO₂ induced biogeochemical reactions and active microorganisms of two German gas fields

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The BMBF-Geotechnologien project "RECOBIO 2" continues the investigation of the long-term biogeochemical transformation of stored CO₂.

In addition to the Upper Carboniferous gas reservoir Schneeren (Westphalian C) the almost depleted Altmark gas field (Permian – Upper Rotliegend) is also investigated. Both sandstone reservoirs belong to the North German Basin and are operated by the GDF SUEZ E&P Germany (GDF SUEZ). The reservoirs differ in depth, initial and current fluid pressure as well as reservoir temperature, which is a biogeochemical important parameter. While the uplifted horst structure of Schneeren (approx. depth 2700 m) has a temperature level of 80 – 90 °C, the Altmark gas field (approx. depth 3300 m) shows temperatures around 120 °C.

The Altmark site is known to be favourable for underground CO₂-storage by enhanced gas recovery (EGR). This EGR process is operated by GDF SUEZ at the small and hydraulic isolated reservoir block "Altensalzwedel". This pilot test is accompanied by the scientific large-scale project CLEAN.

In addition the RECOBIO2 project characterises the biogeochemical situation of the both large reservoir blocks of the Altmark gas field - „Salzwedel/Peckensen“ and „Heidberg/Mellin“.

The produced formation waters of these reservoir blocks were sampled on different wellheads. The redox potentials are partly very low (Eh up to -300 mV) with slightly acidic pH-values (5,5 to 6). The high saline and (nearly) sulphate free formation waters of Na/Ca-Cl type have very high loads of Zn, Pb, Hg and As. In combination to the analysed DOC levels the talk discusses the importance of metal organic complexes. Also results of fluid geochemical calculations will be presented. Furthermore the diversity of bacteria and archaea of the formation waters as well as the potentials of CH₄-, CO₂-formation and sulphate reduction will be shown. Therefore the cultivation experiments were carried out with different substrates (H₂/CO₂, acetate, methanol).

It can be summarised, that mainly the differences between wells treated with chemical foams (to enhance the gas lift) and such without this treatment have to be taken into account.

The autoclave experiments for the Schneeren site show the importance of biogeochemical reactions for the long-term pressure behaviour of the storage unit. During autotrophic (CO₂ consuming) metabolic activities a CO₂ turnover into the liquid and solid phase takes place (DOC increase, carbonate phase formation). Without the knowledge of these biogeochemical induced processes the accompanied decreasing pressure can be interpreted wrongly as a leaky storage unit. That's why a well-founded biogeochemical process understanding is important.