



Controlling drill mud contamination – Laboratory experiments

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Within the frame of CO₂SINK one injection well and two observation wells were drilled to a depth of 750 m to 800 m by mud rotary drilling in 2007. The fluorescent dye tracer fluorescein was used to label drilling mud in order to acquire core samples suitable for geochemical and microbiological studies [1]. Since drilling mud is the main source of contamination of rock core and brine samples with microorganisms, as well as organic and inorganic components, the contamination degree has to be assessed.

In the past different tracers have been used to monitor the contamination with technical fluids, like perfluorcarbon tracers, fluorescent dye tracers, fluorescent microspheres and drilling mud components.

This study is focusing on establishing laboratory simulation experiments to repeated the mud penetration observed in Ketzin and to examine the penetration behaviour of different tracers. The results of these studies will be presented.

In order to simulate the drilling conditions from Ketzin, Stuttgart Formation rock samples from an outcrop were infiltrated with synthetic brine similar to the Ketzin reservoir brine. Experiments were performed incubating the samples of Stuttgart Formation into the water-based calcium carbonate/bentonite/carboxymethyl cellulose drilling mud containing Fluorescein, using vacuum and different amounts of pressure but the fluorescein was detected only at maximum 4 mm below surface.

To better replicate the real conditions a collaboration with the Institute of Drilling Technology and Fluid Mining, Technische Universität Bergakademie Freiberg was realized, and some experiments using pressure equipment were performed.

The experiments were performed using Bentheimer Sandstone that shows similar pore radius and permeability as Stuttgart Formation. After experiments the sample were sectioned in layers of about 3 mm thickness. Layers were examined microscopically using a stereo fluorescence microscope. In addition, the tracer was extracted from layers. Tracer fluorescence intensities in extracts were analysed using a fibre-optic fluorimeter. In consistence with the results obtained during Ketzin drilling operations [1] microscopic observations and extraction measurements showed a fluorescein concentration decrease from the surface towards the inner section of the core. In all the experiments the tracer is visible in the outer 15-20 mm regions of the core.

References

[1] Wandrey, M., Morozova, D., Zettlitzer, M., Wuerdemann, H., and the CO₂SINK Group, 2010. Assessing drilling mud and technical fluid contamination in rock core and brine samples intended for microbiological monitoring at the CO₂ storage site in Ketzin using fluorescent dye tracers International Journal of Greenhouse Gas Control, 4, 6 (2010), pp. 972 - 980