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Online gas monitoring and sampling during drilling of the INFLUINS borehole EF-FB 1/12 into the Thuringian Syncline, Germany

Marco Görlitz (1), Michael Abratis (1), and Thomas Wiersberg (2)

(1) Institut für Geowissenschaften, Friedrich-Schiller-Universität, Jena, Germany (MarcoGoerlitz@gmx.net), (2) Helmholtz-Zentrum Potsdam, Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany

Online monitoring and sampling of drill mud gas (OLGA) was conducted during standard rotary drilling and core drilling of the INFLUINS borehole EF-FB 1/12 to gain information on the composition of gases and their distribution at depth within the Thuringian Syncline (Germany). The method can help to identify areas of enhanced permeability and/or porosity, open fractures, and other strata associated with gases at depth.
The gas-loaded drill mud was continuously degassed in a modified gas-water separator, which was installed in the mud ditch in close distance to the drill mud outlet. The extracted gas phase was pumped in a nearby field laboratory for continuous on-line analysis. First information on the gas composition (H_2, He, N_2, O_2, CO_2, CH_4, Ar, Kr) was available only few minutes after gas extraction. More than 40 gas samples were taken from the gas line during drilling and pumping tests for further laboratory studies.
Enhanced concentration of methane, helium, hydrogen and carbon dioxide were detected in drill mud when the drill hole encountered gas-rich strata. Down to a depth of 620 m, the drill mud contained maximum concentration of 55 ppmv He, 1400 ppmv of CH_4, 400 ppmv of hydrogen and 1.1 vol-% of CO_2.
The drilling mud gas composition is linked with the drilled strata. Buntsandstein and Muschelkalk show different formation gas composition and are therefore hydraulically separated. Except for helium, the overall abundance of formation gases in drilling mud is relatively low. We therefore consider the INFLUINS borehole to be dry. The correlation between hydrogen and helium and the relatively high helium abundance rules out any artificial origin of hydrogen and suggest a radiolytic origin of hydrogen. Values $CH_4/(C_2H_6/C_3H_8)$ <50 imply that hydrocarbons are thermogenic. Stable isotope and noble gas isotope studies are planned to better understand origin and migration processes of fluids at depth.