SEAL EFFICIENCY EVALUATION IN THE ZAR-3 PILOT CCS USING BIOMARKERS, MUDLOGS AND ISOTOPES IN THE RESERVOIR AND CAPROCKS, SE CZECHIA

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Introduction

The Zar-3 oil & gas field located in SE Czechia is a potential candidate for CO_2 storage pilot project (CCS) in Czechia. The field is in the final production phase. Oil and gas are accumulated in fractured Jurassic dolomites of the Vranovice Fm. Primary caprock is built by Upper Jurassic marls of the Mikulov Fm., which is the immature principal source rock of the SE Bohemian Massif. Half of the reservoir body is sealed by Eocene siliciclastics of the Nesvačilka Fm., Žarošice Mb. Thrust plane of the allochthonous Carpathian Flysch Belt together with shales of the Němčice Fm. act as secondary caprock. Underlying Lower Carboniferous Myslejovice Fm. acts as another seal in the system. The current investigation collected abundant data which lead to the mentioned interpretations.

Results

The initial information is drawn from the MudLog data (Fig. 1), primarily the luminescence and gas content in drilling mud. The data show elevated values in the reservoir as well as the underlying seal of Lower Carboniferous Myslejovice Fm. formed by sandy to shaly turbidites. Oil, gas and rock samples were analyzed for biomarkers and isotopes and multivariate statistics was used to evaluate the data.

Conclusions

Three units have been considered up to now as caprocks in the Zar-3 storage complex with Upper Jurassic reservoir: 1) Upper Jurassic Mikulov Fm. – marls, 2) Eocene Nesvačilka Fm. – siliciclastics and 3) Lower Carboniferous Myslejovice Fm. – siliciclastic turbidites. All of them show higher luminescence, gas in mud and bitumen content. Each of the mentioned caprocks has their specific biomarker fingerprint different from the oil in the reservoir provided they are not impregnated by migrating hydrocarbons. All of them, however, show also intervals with considerable oil impregnation. As a result, contrast biomarker families were found. The indigenous molecular fossils are thermally immature while the reservoir oil and oil impregnations in the caprocks are of peak oil window maturity.

Secondary caprock was identified as the thrustplane of the Carpathian Flysch Belt with shales of the Němčice Fm., where the MudLog luminescence extincts and biomarkers show pattern different from the reservoir oil.

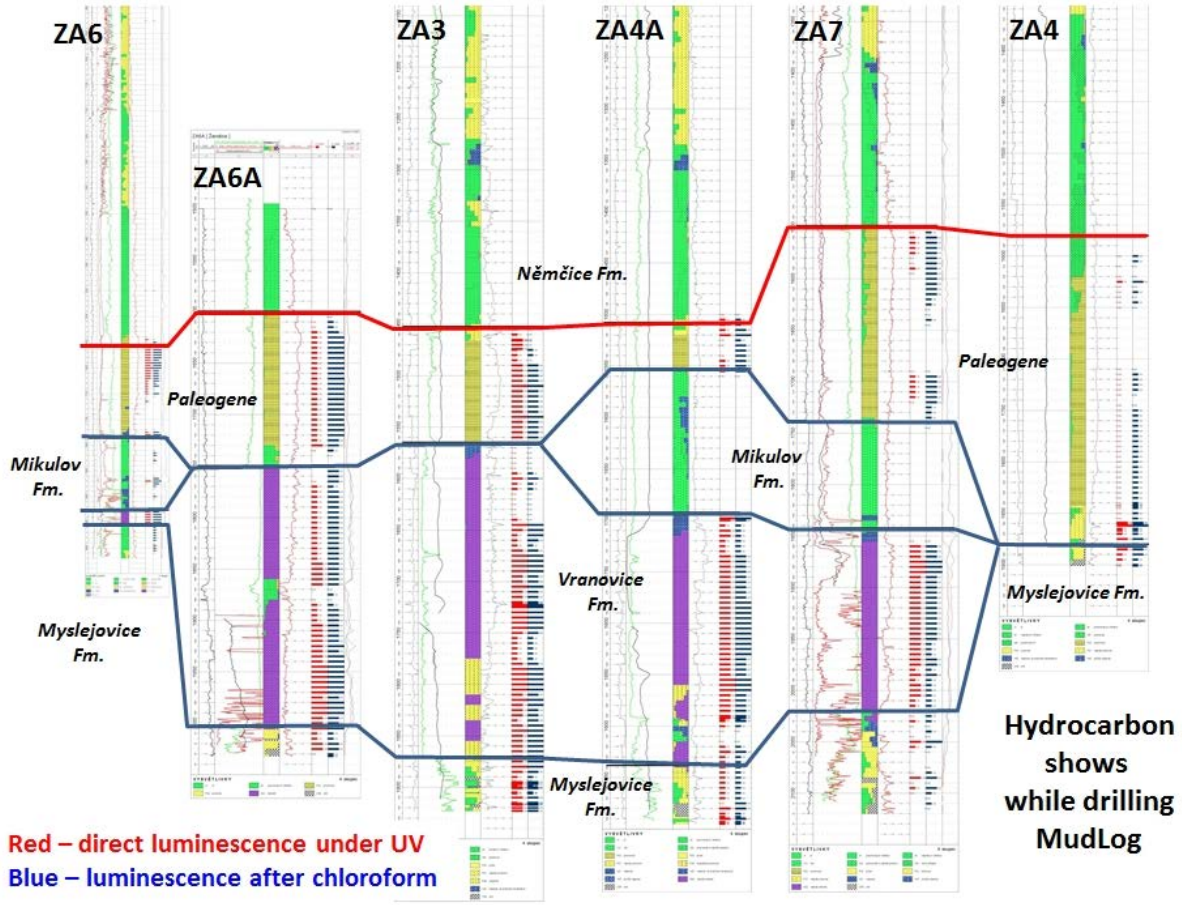

Fig. 1. MudLogs of Zarosice wells showing the measured luminescence intensity on fresh cuttings while drilling. Biomarkers and isotopes are documented in core and cuttings samples.

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