Holistic Evaluation of Reservoir Oil Viscosity in Breidablikk Field – Including Mud Gas Logging Approach

Paper Ref : **SPWLA-2023-0039**

Authors : **Alexandra Cely, Ingvar Skaar, and Tao Yang, Equinor ASA**

Speaker : **Alexandra Cely**

Abstract:

Breidablikk is a greenfield on the Norwegian Continental Shelf and just started the preproduction drilling of 23 wells in two structures. We have only two reservoir fluid samples from exploration wells in each structure with relatively high viscosity of 4 cp and 8 cp, respectively. Currently, we assume each structure has constant oil viscosity homogenously. Any change in the viscosity in each direction can lead to a 20 to 30% difference in oil recovery. Therefore, it is important to update the viscosity distribution in the reservoirs along with the drilling activities

Different methods can be used to acquire reservoir oil viscosity, including downhole logging and sampling, mud gas logging, extracts from cuttings, and surface oil sampling. Our previous studies demonstrate that mud gas provides real-time and continuous reservoir oil properties. However, due to the low concentration of hydrocarbon components in mud gas (like ethane and propane), it is challenging to apply the machine-learning models we developed for standard black oil and gas condensate. Therefore, we developed a different approach to predict the oil viscosity based on the light mud gas component ratios.

A thorough study has been performed based on the reservoir fluid database from the Bredabikk Field and the neighboring Grane Field. The results show the methane/propane ratio is the best parameter correlated to reservoir oil viscosity. Before adopting the new method from mud gas, we extensively compared results with other methods, including the measurement of pressure-volume-temperature (PVT) samples and oil extracts from cuttings. The comparison shows the approach based on mud gas provides an oil quality classification that allows distinguishing between high- or low-viscosity reservoir oil along a given well. The threshold for the two categories is identified from the reservoir fluid database. The mud gas method agrees well with the PVT measurements, which are regarded as the ground truth answer. The cutting extracts study supports the conclusion on oil viscosity provided by the mud gas analysis. Therefore, we decide to deploy mud gas data as the main method for future wells

The new approach using mud gas logging provides a real-time and cost-efficient method to identify the continuous reservoir oil viscosity following the well path. Along with drilling more wells, we achieve a detailed and accurate reservoir oil viscosity distribution in different reservoirs. The viscosity mapping of the reservoirs lays the ground for further optimizing the drilling target and well placement and improving the oil recovery.

Bio:

Alexandra Cely is a principal reservoir engineer at Equinor ASA in Norway, where she is the leading researcher on reservoir fluid property prediction using cuttings and mud gas data. She applies her background in thermodynamics, chemistry, and data science to develop real-time solutions for early fluid type identification. She started in Equinor in 2012, as flow assurance engineer, and joined the PVT and fluid analysis group in 2019. Alexandra holds a MSc in Env. offshore engineering with a chemistry major, from the University of Stavanger, and BSc in Chemical engineering. Besides oil and gas, Alexandra is part of the low carbon solutions organization, where her focus is on hydrogen thermodynamics for storage and transportation.