

EA25

The Value of Core: Petrographic and Petrophysical Integration. A Case Study from the onshore Southern Mozambique Basin

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Summary

The value of conventional core for the calibration of wireline logs and reservoir characterisation cannot be underestimated. A case study which shows how petrographic data and data from Routine and Special Core Analysis (RCAL and SCAL) can be integrated with the wireline log data to better understand the nature of the pore types and systems and the controls on reservoir quality is presented. The methodology used to capture the proportion of the multiple pore types and the impact on other petrophysical properties (such as water saturation estimation) is also explored.

Upper Cretaceous Lower Grudja reservoirs in the onshore Southern Mozambique basin are the target reservoirs for SASOL's current development drilling operations. These reservoirs are shallow marine sediments, mainly comprising clay-rich very fine to fine grained sandstones and siltstones with common nodular, early diagenetic calcite cementation. High clay content and fine grained textures makes the petrophysical interpretation of water saturation from wireline logs challenging.

Data acquisition programmes associated with the drilling campaign are specifically targeted towards reservoir characterisation studies required to not only narrow the key uncertainties in terms of hydrocarbon distribution but also to aid in real-time drilling decisions.

In addition to Logging While Drilling (LWD) logs and conventional wireline logs (Gamma Ray, Density/Neutron, Sonic, Resistivity etc.), the taking of conventional whole core forms a key part of SASOL's acquisition plan. Other wireline logs such as the CMR (which aids in the real-time estimation of permeability as well as fluid fractions) are also used for picking points for pressure sampling. The Formation Micro Imager (FMI) tool highlights reservoir variation, for example calcite cemented nodules which have also been verified by core. The Modular Dynamic Tester (MDT) dual packer combined with single probes for vertical interference testing also helped improve reservoir characterisation.

The value of conventional core for the calibration of wireline logs and reservoir characterisation however cannot be underestimated. A case study which shows how petrographic data and data from Routine and Special Core Analysis (RCAL and SCAL) can be integrated with the wireline log data to better understand the nature of the pore types and systems and the controls on reservoir quality is presented. The methodology used to capture the proportion of the multiple pore types (see Figure 1) and the impact on other petrophysical properties (such as water saturation estimation) is also explored.

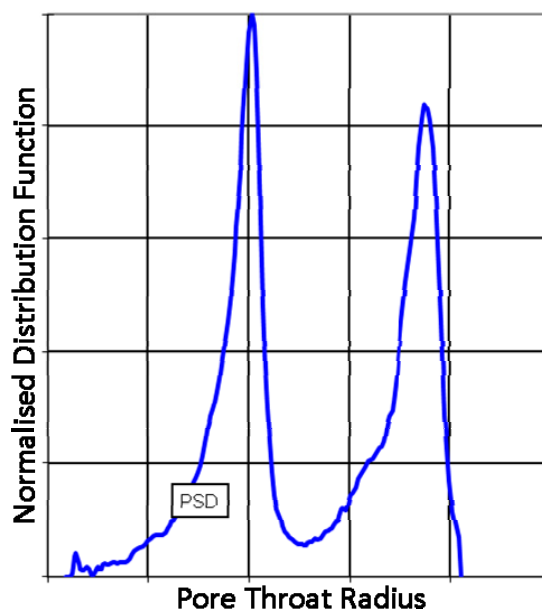


Figure 1 Mercury Injection and Capillary Pressure (MICP) data from core. Note the bimodality of the pore throat distribution.