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Does Aging Matter to Core Analysis in Carbonates? A Case Study from Offshore Green Field

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ABSTRACT

Conventional core analysis during the appraisal phase of a green field is usually completed many years before the field reaches its development stage. Core studies are performed on fresh and old cores as there is a general belief that core samples can be stored for unlimited time and that, at any moment, a new study can be performed with high degree of success and confidence. But core analysis on fresh cores is often not coherent with older core analysis. This paper comprises the core evaluation which was performed on old core samples from nine appraisal wells drilled between 1974 and 2003, including mercury injection capillary pressure (MICP), conventional core analysis (CCA) and Rock-typing. Over 3100 plugs and 380 were analyzed. After integrating results from all appraisal wells, the defined rock-types were not showing porosity-permeability relationships and water saturation as a function of height above water oil contact were inconsistent. The full dataset of plugs and MICP results was then reviewed to assess the quality of the measurements.

Old measurements of plug porosity were compared with new measurement for the same plugs and showed a significant change of porosity over time in half of the available samples. In the other half, trim porosity derived from MICP was compared to plug porosity from CCA, and ten percent of trims had a significant mismatch with plug porosity, linked to plug heterogeneity. The main finding of this study is that poor storage conditions and age of cores have a great effect on the quality of measurements but these effects can be accounted for to eliminate unrepresentative samples. Also, multiple cleanings of plugs and different technologies used by contractors affect the confidence in quality of measurements. The standard rock-typing workflow was then performed on the clean dataset and allowed to clearly discriminate between rock-types, both in dolomite and limestone.
This study shows how to identify unrepresentative samples when new and old core measurements are available. Quality check of core measurements allows the use of old data with more confidence as inputs for rock-typing and to eliminate bad data. This has proved essential to properly define the new rock-types which were used to update the dynamic model and the early field development plan.