Fluid Distribution Assessment in a Tight Sand Reservoir

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Abstract

Fluid phase prediction in tight reservoirs can be challenging. Typical gravity segregation and maturity stratification distribution of fluids might not hold. This work presents the fluid phase behavior across a tight sand reservoir in order to assess the degree of reservoir connectivity and fluid distribution across the field.

An array of fluid data were used, including bulk PVT and molecular, such as GC-fingerprinting of C7 compounds and C8-C20 hydrocarbon range, as well as biomarker data. Results were then integrated within the structural framework of the field.

The molecular geochemistry and the bulk-fluid results suggest that the fluids belong to one system, despite the large variations in their physicochemical properties. The tight nature of the reservoir appears to have a remarkable control on fluid distribution. In particular, the saturation pressure reduction with depth and laterally indicates that the mixing rate of fluids successively entering the reservoir was very low, imposing fluid grading, both vertically and laterally. It is interesting to note that the earliest charge appears to have suffered a greater degree of water washing, being at the forefront of the migration channel. The earliest charges of lowest maturities were displaced diagonally updip by later charges of higher maturities, where the later and lighter charges remained deeper and closer to the entry point due to the tight lithology. With this model, the highest gas to oil ratios (GOR) and deepest gas-down-to (GDT) are expected to occur downdip, closer to the filling point(s).

The lateral-vertical stacking of fluids observed will serve as a model to explain the higher GOR downdip in tight reservoirs, unlike better quality reservoirs where lighter and more mature fluids accumulate updip.