

ABSTRACT

Assessing Impact of NMR Data on the Development of Shaly Sand Reservoirs Offshore Southwest Trinidad

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Development of sandstone reservoirs offshore Southwest Trinidad depend heavily on log well data to assess hydrocarbon and water production potential. This is of critical importance as the lifespan of wells are significantly shortened by water production (especially considering that hydrocarbons range from medium to high viscosities across the field). Additionally, there is a high degree of mismatch between conventional log analysis and test/production results where water saturations of 40-60% produce water-free oil or have small water cut values (<5%) based on production reports. These high water saturation values can also cause the elimination of potential pay zones if typical water saturation cutoff values of 40% have been applied.

This study aimed to assess the contribution of NMR data in improving the reliability of petrophysical outputs in these shaly sand reservoirs. It was done by carrying out a comparative study using NMR data and conventional (triple combo) data in which shaly sand analysis techniques were applied. An effective baseline for comparison was established by using the same shale and clay parameters, R_w and saturation exponents for all techniques.

The study found that the largest factor affecting petrophysical outputs from triple combo data was the highly variable and subjective approximations of volumes of clay and shale. Shale volumes varied from 5-40% in some intervals and clay volumes from 5-30%. In the same interval, it was found that the effective porosities varied by as much as 15% due to the volume of shale method used. The NMR volumes however were completely independent of shale/clay attributes and gave reasonable values of clay bound water, irreducible water and total porosities when compared to core. The total porosities ranged from 24-36% over the field and effective porosities from 22-33%.

Computed total water saturations ranged from 25% - 60% on average. However, in most intervals the median total water saturation was greater than 40%. Effective water saturations ranged from 20-55%. Irreducible water saturations were found to be high ranging from 30% to 50%. As such, moveable water saturations were less than 6% in wells AD1, AD2 and AD3 and 5% in wells AD8 and AD18. Finally, it was found that by using NMR data, although total water saturations were high, over 95% of the hydrocarbon intervals were interpreted to be at irreducible water condition.

Keywords: Kala Singh; Nuclear Magnetic Resonance; NMR; Shaly sand; Log analysis; Trinidad; Water Production Potential; Water Saturation.