An Application Spectral Decomposition to Unlock The Potential A Thin Reservoir With Shale Pinch Out Opportunity In Mature Water Flood Of Bravo Field, Central Sumatra Basin

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ABSTRACT

Bravo is one of major oil field located in northern Central Sumatra Basin. Most of the production has originated from the Duri Formation (primarily the Duri D16 Sand) which is currently under water flood optimization. It was deposited as an incised valley fills sandstone followed by stacked progradational delta-front packages, separated by thin calcareous transgressive lag sandstones. These delta-front packages are subsequently overlain by localized tidally-influenced incised valley fill sandstones with very good reservoir quality with 29% average porosity and 4040 mD average permeability. The T15 Sand with gross thickness ~10-20ft is especially well developed locally in the northern area, separated from the D16 Sand by a thin shale, which pinches out from northwest to southeast.

Production data has revealed very stable pressure since first oil nearly 50 years ago. Cumulative oil production is larger than initial estimates of OOIP. Several theories have attempted to explain this disparity. We have incorporated seismic stratigraphic interpretation to better understand the geological complexities between these two sands. One hypothesis states that the T15 Sand is united with the D16 Sand due to shale pinch out, allowing water injection from the D16 Sand into the T15 Sand. This is supported by the pressure decline history, in addition to the matching pressure plots between the T15 and D16 Sands. Stratigraphically, the T15 Sand has been shown from core and subsequent lithofacies interpretation to be genetically distinct from the Duri Formation, and is here interpreted as the first episode of “T” deposition, the first phase of a transgressive system tract. Duri D16 Sand, in contrast, was deposited under distinctly different environmental conditions where D16 Sand is an aggradational lowstand system dominated by coarse -grained sandstone with excellent reservoir characteristics. The T15 Sand is a transgressive shale-prone, calcareous, glauconitic generally fine-grained sandstone with generally moderate to poor reservoir characteristics.

Understanding the distribution of the thin T15 Sands and its depositional setting by optimizing all available data has been the key to understanding why the T15 Sand is in pressure communication with the D16 Sand. Using the approach of optimizing seismic data through spectral decomposition while integrating core and stratigraphic analysis, we were able to remap sand distribution with pressure data validation. While the thin reservoir is mainly below seismic tuning thickness, making it challenging to accurately extract the right seismic event to have good amplitude-frequency predictor and knowing the conception of reflective properties of thin bed is a must to disclose hidden interest reservoirs boundary. The study result assists and has impact to further strategic reservoir development either by infill well development, and or work over activities.