Paper B15

Application of Innovative & Unconventional Techniques Enhanced Subsurface Interpretation of the J Sands, Berantai Field

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The Berantai field is fast track development project under a Risked Service Contract (RSC) agreement. The oil and gas are planned to be produced from multiple reservoirs, ranging from the F to the J sandstones. The development potential for the shallower reservoirs (F to I sands) is well defined due to good subsurface data coverage and tested productivity.

Although these J sands are known prolific hydrocarbon producers in nearby fields, but due to limited or inconclusive data by conventional analysis, the subsurface definition and development potential of these reservoirs are less certain. This paper will focus on how detailed analysis and the use of an alternative interpretation methodology of the all available data have enhanced the subsurface definition.

In the original Berantai FDP, the reservoir characterizations of the J sands were based on log data from three pre-2007 appraisal and exploration wells (C, D and E, Figure 1). The acquisition of cores and additional subsurface data from another J sand well drilled in mid 2011 (well F), provided valuable information on reservoir properties to enhance geological and petrophysical interpretations, and reservoir engineering analysis. Improved sedimentological understanding was made possible by integrating the data from this well with earlier wells.

The J reservoirs comprise of sand and shale intercalation. The sandstones are very fine to silty grained, heavily bioturbated, abundance marine micro faunas, well compacted and display coarsening upward trends. Based on a combination of lithology, sedimentary features, stacking pattern, ichnofacies assemblages and facies association analysis, the J sand in Berantai area have been interpreted as being deposited within a low energy setting, as reworked shoals/bars in lower shoreface/distal shelf areas. The shoals and bars are frequently being reworked, resulting in a sheet like sandbodies which can be correlated field wide and across to nearby fields.

Based on regional trends, a WNW-ESE trending shoreline is located towards the northern part of the Berantai field, whereby the sediments in well F area is deposited in the most distal part of the shelf and display poorer reservoir properties (Figure 2). The J sandstones penetrated by wells C and D, located in areas north of well F represent a more proximal shelf environment. These wells display better reservoir properties with calculated mobility value up to 22 mD/Cp. In addition, the ability to recover gas samples from LFA and bottom hole sampling runs in well D confirmed the presence of moveable gas.

Petrophysical interpretation of the J sands is not straightforward. Although mud logs and LWD logs indicated the presence of gas, the inability to flow during DST renders fluid identification inconclusive. Several innovative non-conventional petrophysical interpretation techniques using Rock Physics analysis principles were applied to help firm-up the fluid types (Figure 3). A detailed assessment of the acoustic properties was used to assist in discriminating gas-filled sand from wet sand and shale. Assessment using other well data, such Near versus Far neutron counts, and Compressional versus Shear curves was used to compliment and validate the interpretation results. The results from the alternative interpretation approaches supported the presence of gas.

The data from well F indicates a lower formation pressure of about 3200 psia compared to an expected 4500 psia, recorded in previous wells drilled in 2007. As the higher pressure was recorded from the adjacent fault block, it is possible that the lower pressure in the Fault Block A could have been drawdown by nearby large and matured producing fields. Based on an improved subsurface understanding of the Berantai J reservoirs, several optimizations were made to the development plan in the area of well placement, well design, and drilling and completion techniques.

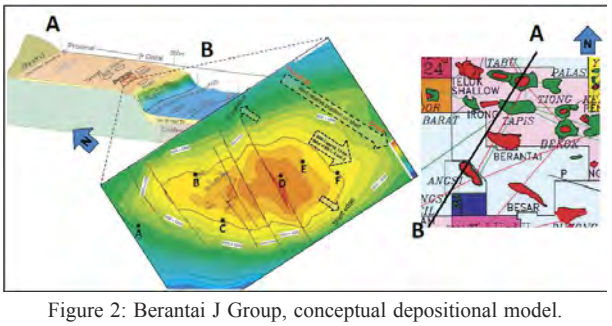

Figure 2: Berantai J Group, conceptual depositional model.

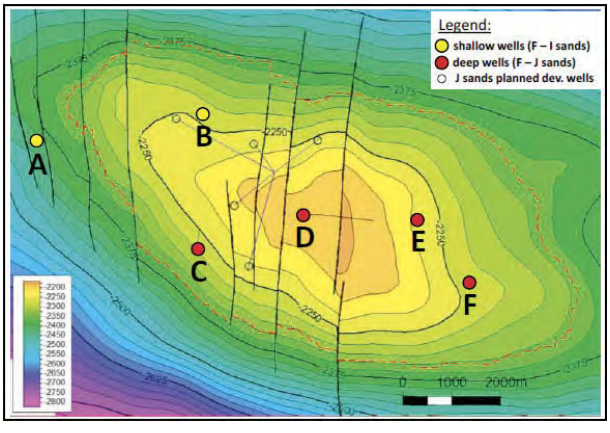

Figure 1: Berantai structure map, Top J Group reservoirs.

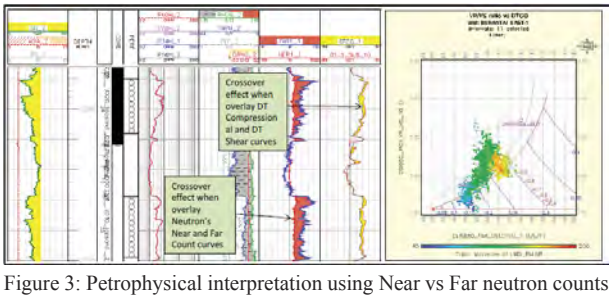

Figure 3: Petrophysical interpretation using Near vs Far neutron counts and rock physics analysis.

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 38, No. 2, April-June 2012
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