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Sub-Thrust Exploration Plays as Upside Potential in South Sumatra Basin, Indonesia.

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Introduction

JRK Field is a part of Gunung Kemala anticlinorium that has been producing oil for more than eight decades. Turns out it is classified as mature field and programmed for waterflooding secondary recovery to optimally withdraw its remaining reserves. 3D seismic acquisition is conducted in 2017 to explore sub-thrust block of southwest JRK. Administratively, study area is located in South Sumatra Province, Indonesia, with an area of 20 km^2 extended from northwest through southeast (Figure 1). JRK first oil well was spudded in 1929 within peak production of 7,518 BOPD (October 1950). Nowadays, JRK Field already has 305 wells with 53 of them are still producing an average of 900 BOPD from 1st, 2nd, 3rd, 4th, 5th, 6th and 7th/Granite Wash (GW) sand layers. According to volumetric estimation, original oil in place reserve of JRK is approximately 261.42 MMSTB (P1) and leaving a remaining reserve as much as 2,840 MMSTB in January 2019. Through borehole and new seismic data, this study will substantially evaluate the presence of sand reservoir distribution, hydrocarbon trap, and fluid content as integrated step out prospect analysis.

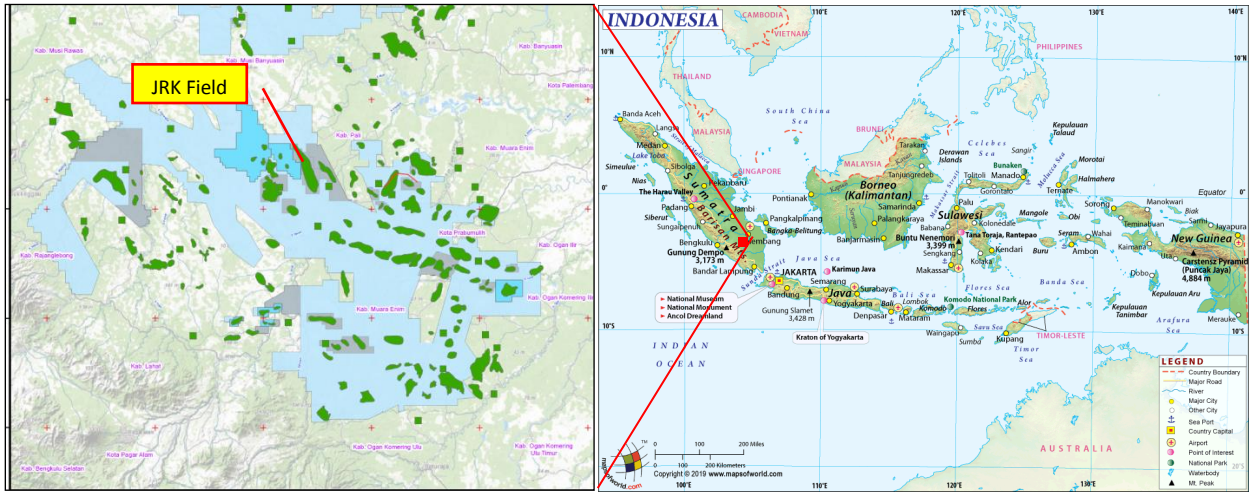
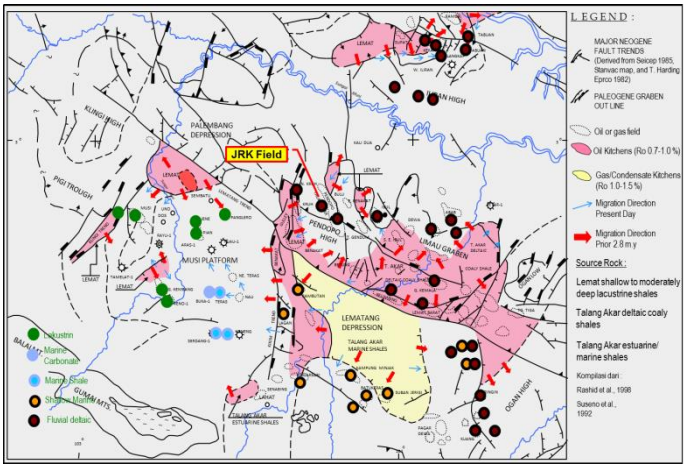


Figure 1 Pertamina EP South Sumatra region working area.

Regional Tectonostratigraphy and Petroleum System

Pull apart sedimentary basin in South Sumatra was began with compressional phase during early Jurassic to Cretaceous period, forming major strike slip fault NNW-SSE such as Lematang, Kepayang and Saka fault (Figure 2) as the first tectonic process (Pulunggono, 1992). Two main anticlinoria, Gunung Kemala and Limau, are vastly elongated from northwest to southeast in Pertamina EP South Sumatra working area. These anticlines are formed by

compression tectonic force during inversion megasequences, creating major northwest-southwest dextral strike-slip faults associated with thrust faults.



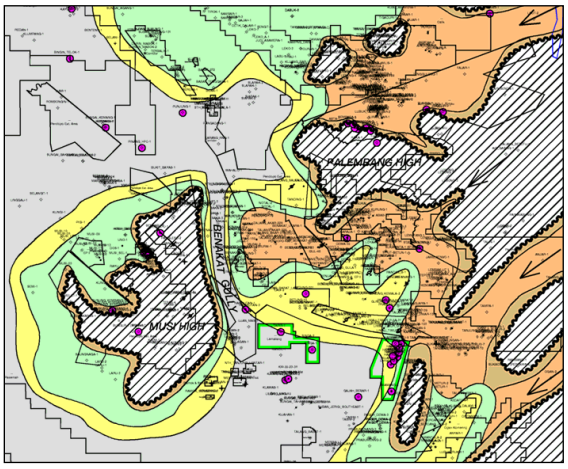


Figure 2 Structure trends, kitchen and hydrocarbon migration pathways. **Figure 3** Fluvial-deltaic depositional environment of upper Talang Akar in study area as shown in paleogeography map (Ginger, 2005).

Seismic image in southwest JRK Field sub-thrust block confirms a three-way dip structural trap geometry as different compartment from JRK existing field. Talang Akar sand in sub-thrust JRK block is laterally distributed as syn-rift deposits of fluvial deltaic-transitional depositional environment from northeast to southwest as shown in figure 3 and 4.

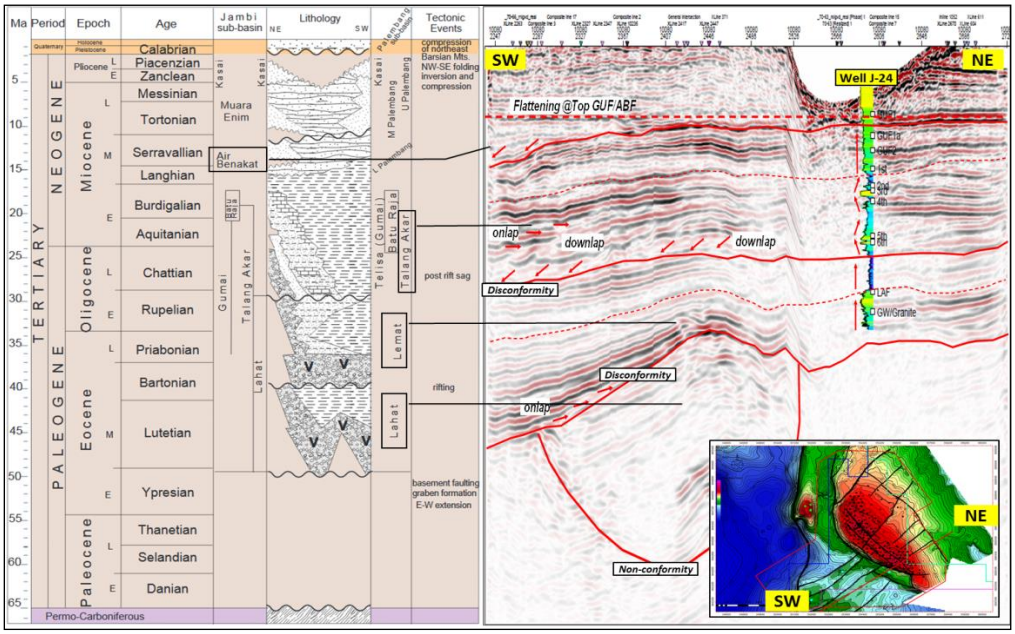


Figure 4 Generalized stratigraphic column for the South Sumatra basin related to hydrocarbon play in southwest JRK Field (Based on Courteney and others, 1990; de Coster, 1974; Sudarmono and others, 1997; Hutchinson, 1996; Sosrowidjojo and others, 1994).

Integrated Subsurface Study and Evaluation

In the study area, Talang Akar Formation become a main sand reservoir target. JRK Field step out prospect evaluation is analyzed by using 3D Seismic within a coverage area of 755 km^2 and total number of existing 245 well logs analysis from JRK, Kruh and Benakat Barat fields (Figure 5). Acoustic impedance is generated in study area that helps to find sand distribution. Low acoustic impedance theoretically is correlated to high porosity reservoir. The sweetness attribute is calculated by dividing amplitude envelope by the square root on instantaneous frequency. The increase of sweetness value generally explains the presence of fluid. High value of sweetness shown by a bright color in map. According to seismic attributes, sand reservoirs are represented by high value of sweetness anomaly and low value of acoustic impedance anomaly (Figure 6).

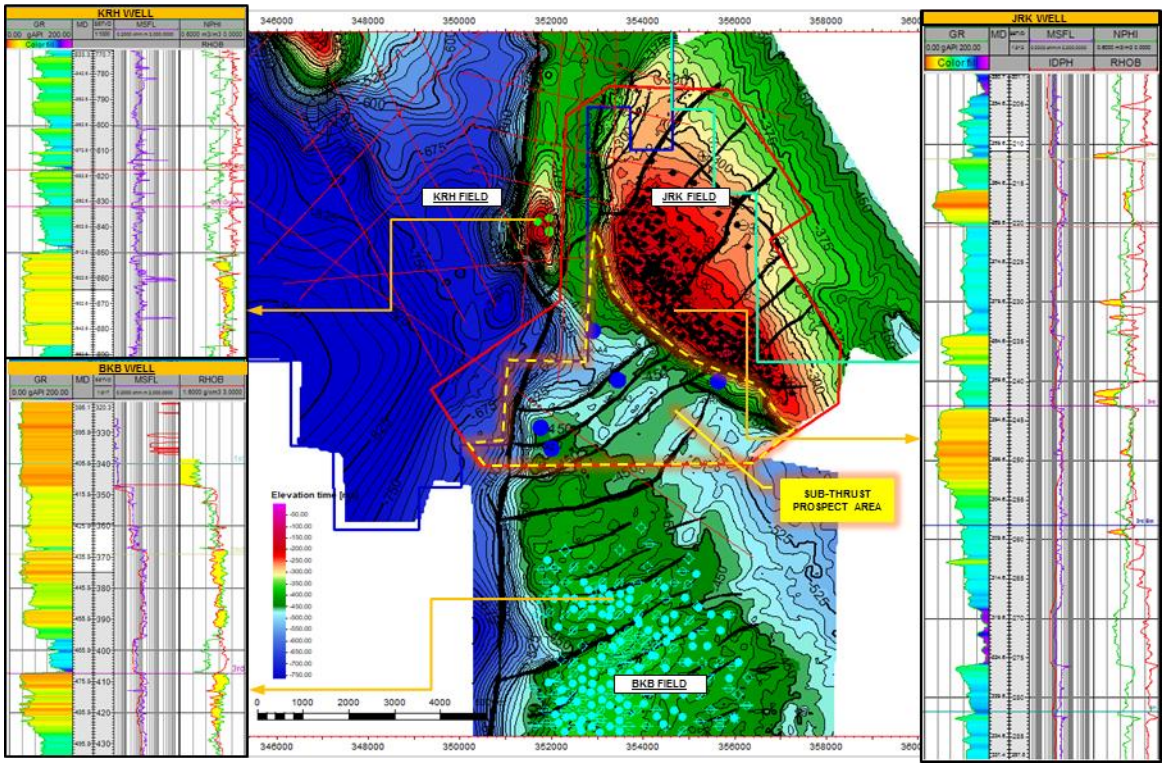


Figure 5 Sub-thrust prospect area in southwest JRK by evaluating existing well logs from each JRK, Kruh, and Benakat Barat oil field.

AVO is generated from seismic gather, s-wave, p-wave and density logs from well J-24 as main seismic attributes parameter input. Based on AVO analysis, sand reservoirs in sub-thrust block have a class 3 Amplitude Versus Offset (AVO) anomaly. It represents relatively fair-good porosity reservoirs and also hydrocarbon fluid content in southwest JRK closure. Analog to productive Kruh and Benakat Barat oil fields as similar petroleum plays in sub-thrust area, southwest JRK Field certainly has high potential prospect of hydrocarbon. This study leads to propose five step out drilling wells in southwest JRK Field (Figure 7).

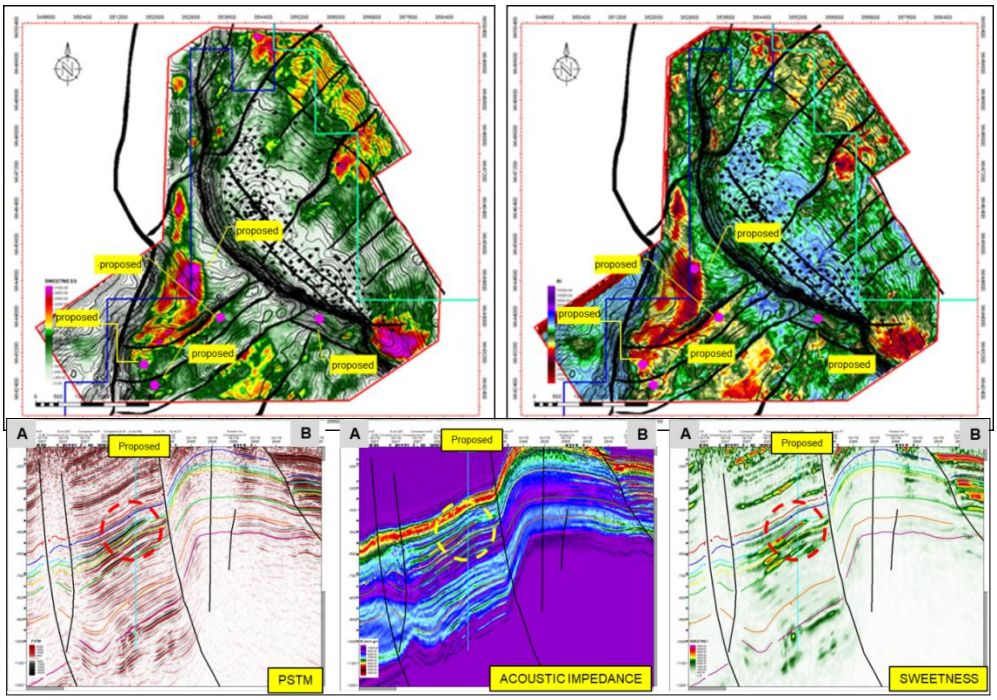


Figure 6 Sweetness and acoustic impedance anomaly of 2nd layer JRK field.

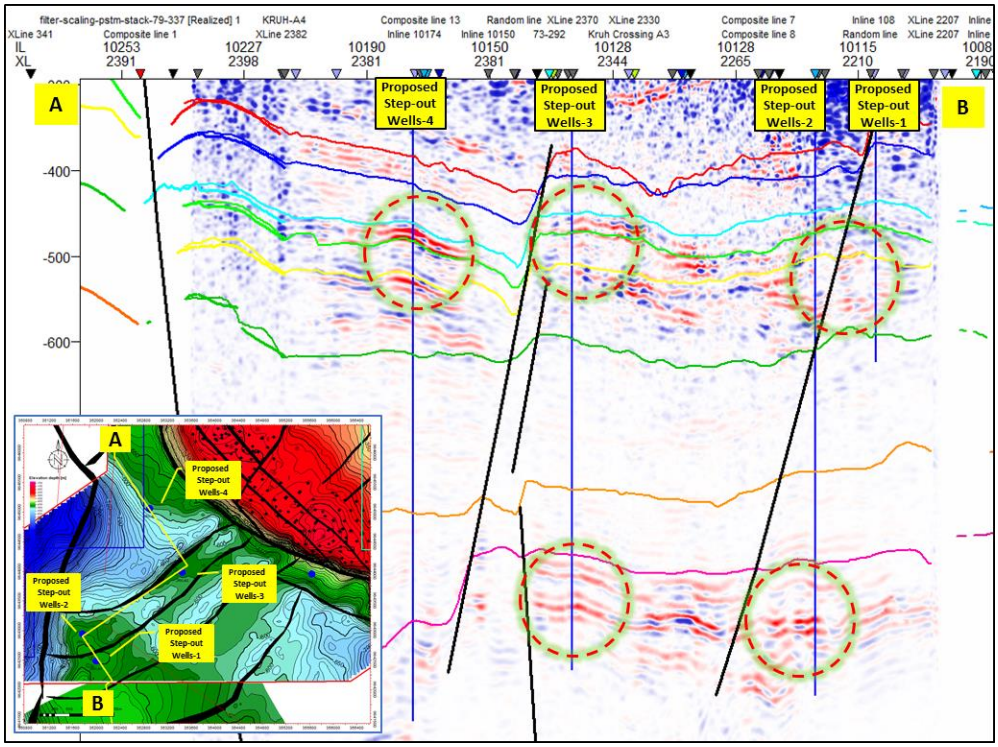


Figure 7 Amplitude Versus Offset (AVO) anomalies in step out area of southwest JRK Field.

Conclusion

Structural traps in sub-thrust block could be found either as four-way dip or three-way dip closures. Sand reservoir should be presence as siliciclastic material sedimentation process is deposited during syn-rift phase right before inversion megasequence. Through integrated subsurface study and surrounding oil field analogue in sub-thrust block, step out drilling is needed to prove the hydrocarbon potential. This play concept will be applied to discover more oil resources as upside potential to leverage mature existing asset along the sub-thrust anticlinoria of Pertamina EP South Sumatra working area.

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