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Pay Sands prediction in Baram Delta through rock properties and 3D simultaneous inversion study

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The ***Bario West*** prospect is located some 7 km northeast of the oil producing Baram field and 2.5 km west of the ***Bario-1*** oil and gas discovery. This prospect is a fault intersection trap created by the intersection of the ***Bario/ Faridah*** growth fault and the ***Bario*** splay fault. The prospect objective interval is of Late Miocene age, fluviomarine inner-neritic (inner shelf) environment. The main risk associated with the prospect is lateral seal failure of the ***Bario/ Faridah*** main growth fault (small throw at the tip end of the fault and the possibility of sand to sand juxtaposition). Results from fault seal analysis at this growth fault indicate that the active sealing mechanism is not working as most of the sands are juxtaposed. The only sealing mechanism along the ***Bario/Faridah*** growth fault plane is clay smearing. The chances of having hydrocarbon charge, good reservoir quality and favorable hydrocarbon timing are high, as the prospect location is only some 2.5 km west of the ***Bario-1*** oil and gas discovery. Seismic inversion study was then conducted to increase the confidence level of the sealing capability of the ***Bario/Faridah*** growth fault at **Bario West** prospect.

Bario-1 well logs displays and cross-plot analyses have been assessed to decide a feasible type of seismic inversion. A clear discrimination of hydrocarbon bearing reservoirs was observed from the cross-plots of acoustic impedance versus shear impedance and acoustic impedance versus V_p/V_s. This analytical conclusion necessitates a "Simultaneous Inversion" study over the study area to be able to identify hydrocarbon-bearing reservoirs.

The Well log data, geological interpretation, angle seismic sub-stacks and seismic DMO velocities were algorithmically integrated through simultaneous inversion to generate acoustic impedance and V_p/V_s, rock property volumes as well as Lambda-Rho and Mu- Rho derivatives.

The lateral distribution and connectivity of the O4 hydrocarbon reservoir was captured and discriminated from non-reservoir rocks using the 3D visualization and body checking technique. Two sets of analysis were carried out; the first was using the V_p/V_s versus acoustic impedance volumes cross-plotting while the second made used of the Lambda-Rho versus Mu-Rho volumes cross-plotting. A number of different scenarios were analyzed based on a variation of time gates and cut-off values.

The simultaneous inversion results show that both ***Bario*** field and ***Bario West*** prospect have connected hydrocarbon-bearing geobodies. The absence of connected geobodies on the up-thrown side of the main growth fault indicates the growth fault is sealing. The integrity of the "Simultaneous Inversion" results was successfully validated by a blind test of the ***Faridah-1*** dry hole (located to the east of ***Bario's*** structure) which was not disclosed or used in the course of the study. As a conclusion, simultaneous inversion study enables PCSB to reduce the uncertainties of fault seal at ***Bario West*** prospect.