GEOPHYSICS PAPER 13

INTEGRATED APPROACH TO IDENTIFY STRATIGRAPHIC PROSPECT FROM SPARSE 2D SEISMIC ATTRIBUTES (AVO), WELL CORRELATION AND GEOLOGICAL MODEL – A SUCCESS CASE FROM GENALE B-2X IN BLOCKS 3&4, OGADEN BASIN, ETHIOPIA

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Genale B-2X is a vertical wildcat exploration well drilled in Blocks 3 & 4 (Genale), Ogaden Basin onshore Ethiopia, 590m above sea level. The well is located approximately 800 km to the southwest of capital Addis Ababa, 15 km northwest of Genale-1 and 40 km southeast of El Kuran-1. It was drilled to evaluate the hydrocarbon potential in the Gumburo and Calub reservoirs.

Geometrically, Ogaden Basin is divided into two sub-basins namely Western sub-basin which was relatively sagged during post Triassic period and Eastern sub-basin which was tectonically active throughout Permian to Tertiary period (as shown in the Figure 1). Prior to drilling, prospect Genale B was identified by bright seismic anomalies, extraction of seismic impedance and AVO seismic attributes from sparse 2D seismic data shot by PETRONAS Carigali Overseas Sdn Bhd (PCOSB) in 2006. The prospect is situated at the western flank of Ogaden Basin that experienced minimal structuration due to its close proximity to Negele Basement which shielded the blocks from intensely being further rifted.

The well was successfully penetrated the Gumburo and Calub reservoirs respectively. Based on the petrophysical evaluation, three gas bearing reservoirs are identified in the Gumburo formation namely Upper Gumburo, Lower Gumburo and Middle Gumburo (Figure 2). High gas reading during drilling was observed in these reservoirs.

Based on the log motif of Genale B-2X and surrounding wells, the log consists of fining upward sequence of Transgressive System Tract (TST) at the base of Gumburo reservoir followed by coarsening upward sequence of Highstand System Tract (HST) and later capped by the TST sequence (Figure 3). The inferred depositional model in Gumburo reservoir consists of progradation of the shoreline with depositional proximal washover fan. Water level rise caused shoreline to retreat with depositional of distal washover fan or lagoon. Results from sample analysis indicate a moderate to low energy deposition environment which may reflect a lagoonal facies between shore and the sandbar. The paleo-depositional environment for Gumburo reservoir is interpreted as sand bar within upper coastal plain (Figure 4).

The workflow involves well to seismic correlation, seismic sequence stratigraphy analysis and extraction of seismic attributes findings combined with the geological model leading to the delineation of prospect. Attributes such AVO and impedance have been extracted within the reservoir level (Figure 5). Positive AVO response represents the minimum and most likely scenario while seismic impedance signifies lithology which is considered as maximum scenario.

As conclusion, exploring a stratigraphic play in frontier area with sparse 2D data is feasible. Integration of seismic attributes with strong geological understanding is very crucial in identifying potential stratigraphic play.

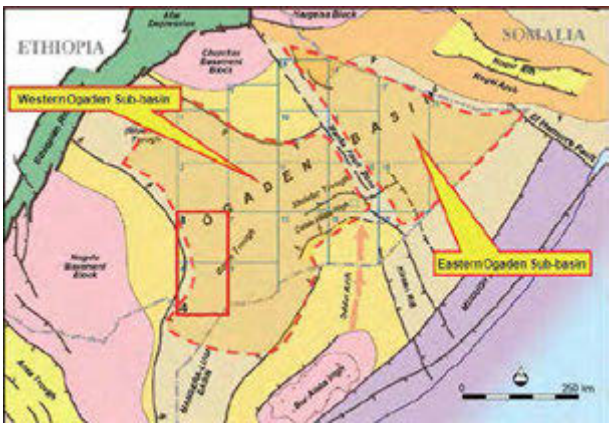

Figure 1: Basin Geometry of Ogaden Basin.

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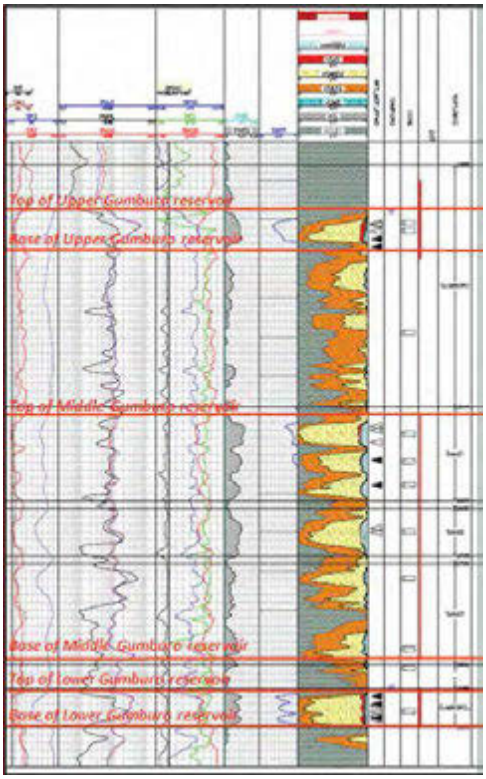

Figure 2: Petrophysical Log Evaluation Genale B-2X.

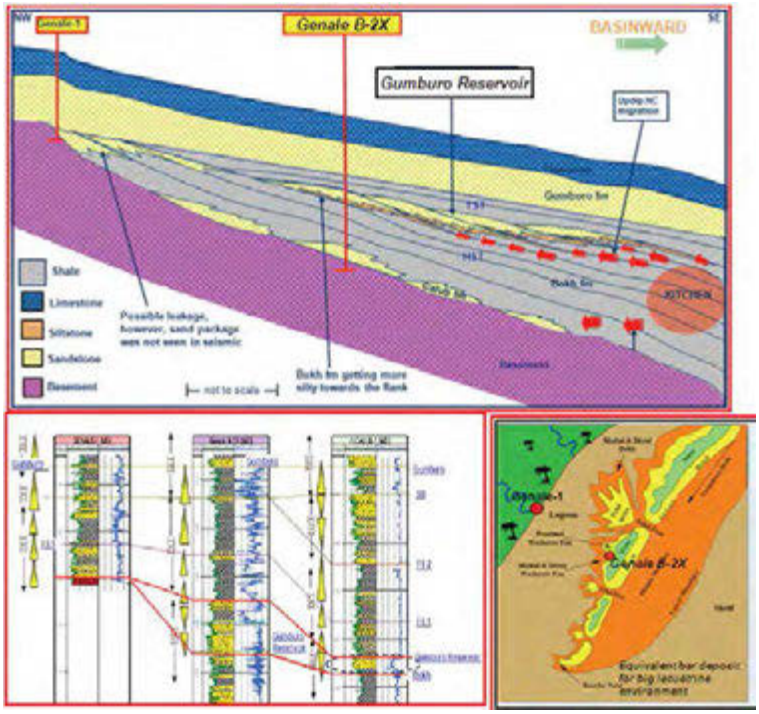

Figure 3: Geological Model and Log Correlation Across Genale area.

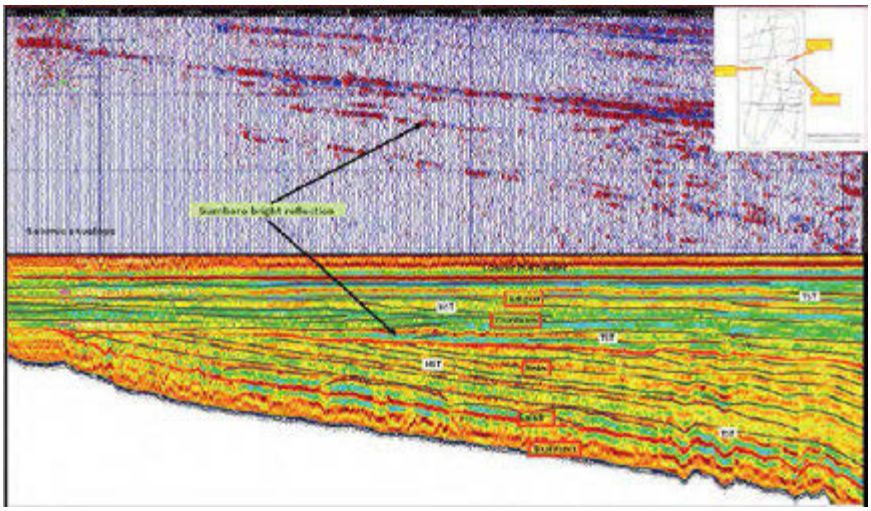

Figure 4: AVO response and Seismic Impedance Analyses.