[PS]Structural Interpretation, Trapping Styles and Hydrocarbon Potential of Block-X, Northern Depobelt, Onshore Niger Delta*

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Abstract

Detailed structural interpretation had been carried out on the three fields within Block-X with the aim of better understanding the structural evolution, trapping styles, and the influence of the fault system on the facies distribution within the Block. Well correlation was carried out on six wells for log analysis and to determine variation in lithology, which in turn was tied with seismic for horizon and structural interpretation to generate structure maps that formed inputs (fault polygon and depth structure maps) for static modelling. This allows for building a 3D spatial framework, facies, and property distribution models and ultimately determine probabilistic hydrocarbon-in-place volume.

Structures interpreted include listric growth faults, roll-overs, synthetic and antithetic faults. The synthetic faults are dominant across the Block and they formed the main boundary of the three Fields within the Block. The faults showed a dominant NW-SE trend, and the variance attribute also validated the interpreted fault trend. Impact of a mobile clay substratum was more noticeable around ‘FLO’ and ‘A’ Fields around the Upper Eocene to Lower Oligocene strata of the Agbada Formation. Four-way closures dominate ‘OGEY’ Field, the traps on ‘FLO’ Field are fault assisted while ‘A’ Field at best have some good leads which given some more control on the seismic acreage could possibly have good prospects.

A 3D structural model was built for the hydrocarbon zone in which grid cells were assigned values for facies (discrete) and property model (continuous) to estimate the hydrocarbon in place. An oil-down-to was picked at -1763 m SSTVD on the depth structure map of Shale marker (SM) 3. The facies model showed minor shale content localized at the western part of the Block with good reservoir sand and some silty sand making up the remaining Block. The fault system of the Block was not observed to have any significant effect on the facies and property distribution. A probabilistic volume of hydrocarbon-in-place determination yielded a volume of 69.8 x 10^3 MMbbls. The fluid contact model revealed communication across the fields and that the reservoir is not compartmentalized.

This integrated approach in determining the hydrocarbon potential of Block – X, Northern Depobelt of the Niger Delta reduces the effect of under estimation and over estimation of hydrocarbon-in-place volume, thus assisting in well planning and input into running petroleum economics.

Reference Cited

Dessauvagie, T.F.G., 1975, Explanatory Note to the Geological Map of Nigeria, scale 1: 1,000,000: Journal of Mining and Geology (Nig. Min. Geol. And Met. Soc.), v. 9(1/2), 28 p.

Structural Interpretation, trapping styles and hydrocarbon potential of Block-X, Northern Depobelt, Niger Delta

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Introduction

The key to understanding the structural styles and hydrocarbon potential of any Field in a highly petroliferous basin such as the Niger Delta requires an integrated approach involving wireline log, 3-D seismic data & biostratigraphic data. This allows for high resolution study that allows correlating specific reservoir sands and accurate reservoir model generation, especially at reservoir scale.

Objectives

- Establish rock packages deposited at a particular time period for proper understanding of relative sequence of deposition and the time domain.
- Determine the local geology from the subsurface images, by mapping faults and other structural features to examine elements of the hydrocarbon systems.
- Retrieve valuable information from electrical logs, including rock type, porosity and presence of oil, gas or water for possible volume quantification/calculate reserves.
- Establish a quick pixel model for possible facies and rock property distribution on the hydrocarbon bearing sand for possible development purposes.

Location, Data Set and Methodology

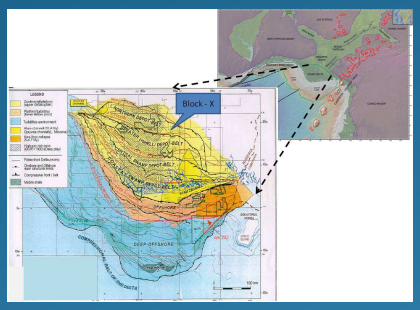

Fig. 1: Field location relative to Niger Delta Depobelts (after Dessauvagie, 1975)

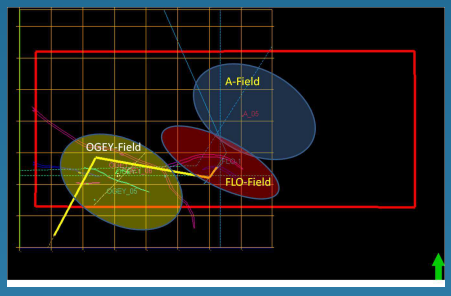

Fig. 2: Block-X acreage, 3D Seismic extent and wells

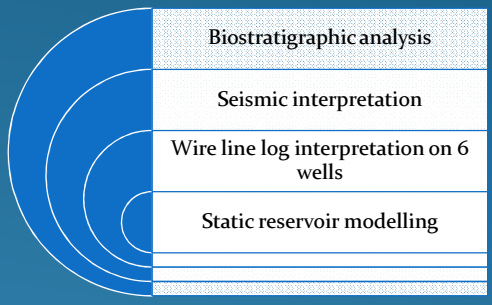

Fig. 3: Important methodologies adopted in the study

Results

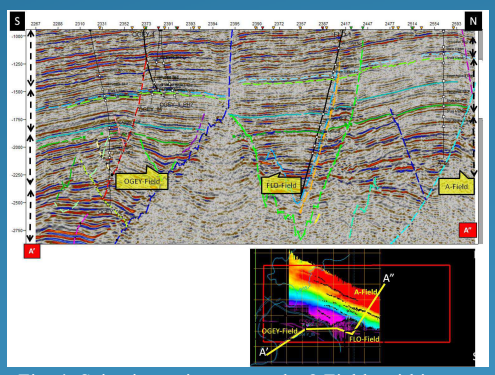

Fig. 4: Seismic section across the 3 Fields within Block-X

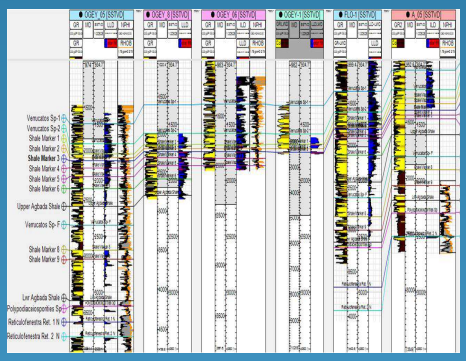

Fig. 5: Correlation across the 6 Wells in Block-X

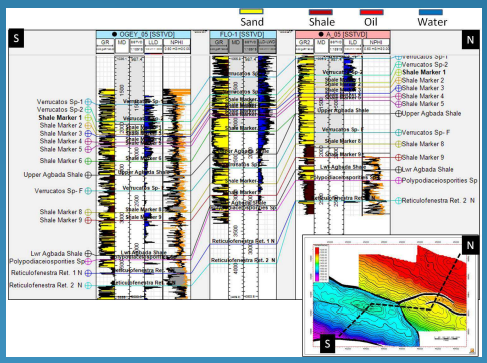

Fig. 6: Correlation using deeper wells on each field and map section in which wells were correlated

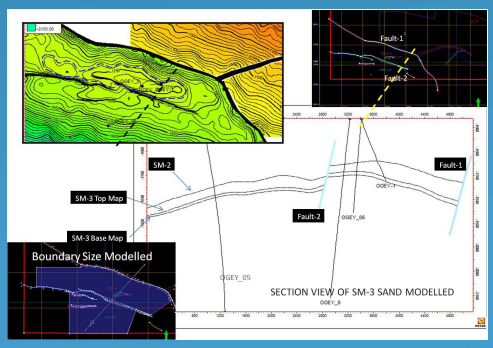

Fig. 7: Section view showing Input for Structural model, Top/Base Depth Structure map and Fault Polygon

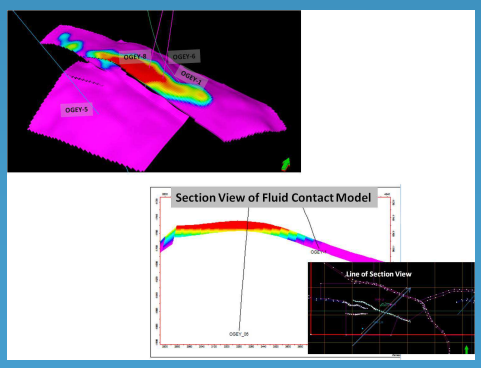

Fig. 8: Fluid contact model

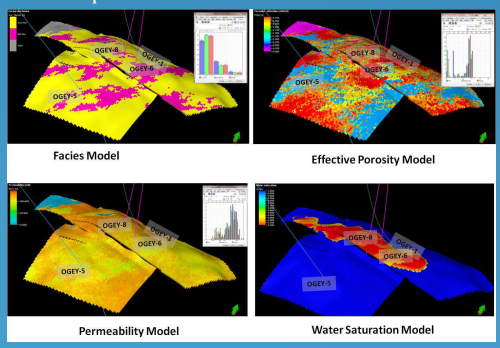

Fig. 9: Property models

Conclusion

The integration of principles of petroleum geology to seismic, well and biostratigraphic data has proven useful in deciphering reservoir architecture and in the generation of reservoir property models of Block-X, Northern Delta Depobelt. This can therefore serve as a useful input for the estimation of hydrocarbon –in – place volume, thus assisting in well planning and input into running Petroleum economics.

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