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# Structural Evaluation and Interpretation of TM-Field in Niger Delta Using Velocity Models.

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## Introduction

The quest for optimization in the E&P industry has been the driving force for the trends of innovations experienced in the industry. Amongst others, velocity modeling modules have led to the accurate and precise velocity determination for interpretation of subsurface inhomogeneity and true depth positioning from the generated time section of the subsurfaces of TM-Field located between longitudes $6^0$77'80.11 - $6^0$80'77.71 (Easting) and latitudes $4^0$61'74.50 – $4^0$62'93.33 (Northing) within the western region of the Niger Delta Area.

The main focal point of this project was on true depth positioning using three different velocity approaches for accurate and precise structural interpretations.

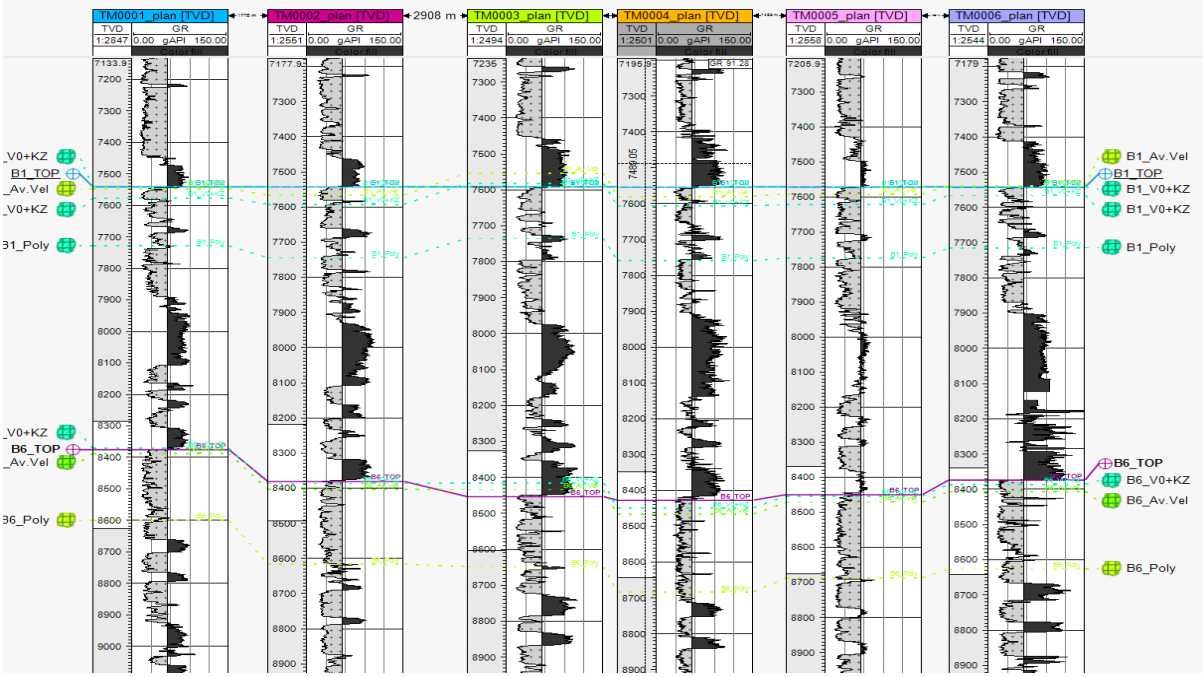
## Theory and/or Method

3D seismic interpretation and three velocity models- **LinVel velocity model, Average cube velocity model, and polynomial velocity model** were used to delineate the subsurface structures and true depth positioning of the TM-Field respectively, using the Schlumberger Petrel software 2013 version. The processes included but were not limited to data loading, frequency analysis, well correlation and top picks, spectrum analysis, fault mapping and horizon picking, time surface generation, attribute analysis, velocity models and depth surface positioning, and error correction. **Two horizons of interest B1 and B6 resulting from the synthetic and seismic tie were identified and mapped**, which had good attribute signatures (i.e. amplitude and RMS) for Fluid content in conformity with the correlation. A convolution of the different velocity models with the generated time surfaces gave depth positioning. But after correction from the error analysis, it was observed that the average cube velocity model was better in accurate depth positioning, as its error margin deviation from the well top data is minimal and acceptable when compared to others.

**Keywords**: Velocity Models, 3D interpretations, TM-Field, LinVel Velocity Model,

Polynomial Velocity Model, Average Cube Velocity Model, Horizon B1 & B6.

## Results and/or Observations

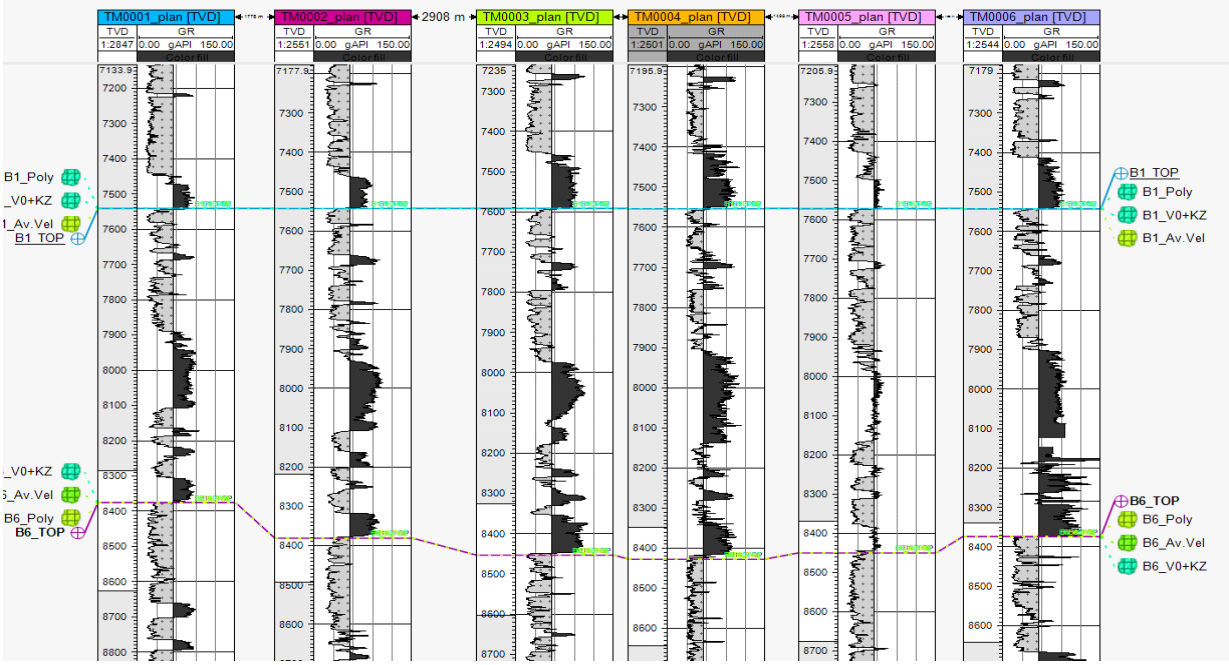



**Error analysis of depth conversion with different velocity models.**

| B1_V0+KZ | | | | | |
|---|---|---|---|---|---|
| Well | Md | X-value | Y-value | Z-value | Residual |
| TM0006_plan | 8227.41 | 482061.9 | 68509.4 | -7542.66 | 24.32 |
| TM0005_plan | 7571.63 | 480365 | 69515 | -7571.63 | 50.85 |
| TM0004_plan | 7553.52 | 481860 | 69595 | -7553.52 | 53.05 |
| TM0003_plan | 7596.24 | 482790.3 | 68651.1 | -7591.54 | -9.1 |
| TM0002_plan | 7542.66 | 479500 | 69800 | -7542.66 | 49.64 |
| TM0001_plan | 7540.85 | 481200 | 69280 | -7540.85 | 35.81 |
| | | | | Average | 34.095 |
| B1_Av.Vel | | | | | |
| TM0006_plan | 8227.41 | 482061.9 | 68509.4 | -7542.66 | -3.55 |
| TM0005_plan | 7571.63 | 480365 | 69515 | -7571.63 | 20.79 |
| TM0004_plan | 7553.52 | 481860 | 69595 | -7553.52 | 26.34 |
| TM0003_plan | 7596.24 | 482790.3 | 68651.1 | -7591.54 | -38.12 |
| TM0002_plan | 7542.66 | 479500 | 69800 | -7542.66 | 23.6 |
| TM0001_plan | 7540.85 | 481200 | 69280 | -7540.85 | 6.32 |
| | | | | Average | 5.896666667 |
| B1_Poly | | | | | |
| TM0006_plan | 8227.41 | 482061.9 | 68509.4 | -7542.66 | 176.31 |
| TM0005_plan | 7571.63 | 480365 | 69515 | -7571.63 | 203.54 |
| TM0004_plan | 7553.52 | 481860 | 69595 | -7553.52 | 205.54 |
| TM0003_plan | 7596.24 | 482790.3 | 68651.1 | -7591.54 | 143.09 |
| TM0002_plan | 7542.66 | 479500 | 69800 | -7542.66 | 201.96 |
| TM0001_plan | 7540.85 | 481200 | 69280 | -7540.85 | 187.93 |
| | | | | Average | 186.395 |

| B6_V0+KZ | | | | | |
|---|---|---|---|---|---|
| Well | Md | X-value | Y-value | Z-value | Residual |
| TM0006_plan | 9293.34 | 481858.8 | 68523 | -8373.64 | 12.37 |
| TM0005_plan | 8449.68 | 480365 | 69515 | -8449.68 | 4.34 |
| TM0004_plan | 8427.5 | 481860 | 69595 | -8427.5 | 21.93 |
| TM0003_plan | 8501.04 | 482735.1 | 68710.2 | -8453.3 | -37.56 |
| TM0002_plan | 8380.88 | 479500 | 69800 | -8380.88 | 6.09 |
| TM0001_plan | 8375.45 | 481200 | 69280 | -8375.45 | -4.45 |
| | | | | Average | 0.453333333 |
| B6_Av.Vel | | | | | |
| TM0006_plan | 9293.34 | 481858.8 | 68523 | -8373.64 | 31.7 |
| TM0005_plan | 8449.68 | 480365 | 69515 | -8449.68 | 21.62 |
| TM0004_plan | 8427.5 | 481860 | 69595 | -8427.5 | 39.08 |
| TM0003_plan | 8501.04 | 482735.1 | 68710.2 | -8453.3 | -18.95 |
| TM0002_plan | 8380.88 | 479500 | 69800 | -8380.88 | 22.92 |
| TM0001_plan | 8375.45 | 481200 | 69280 | -8375.45 | 11.7 |
| | | | | Average | 18.01166667 |
| B6_Poly | | | | | |
| TM0006_plan | 9293.34 | 481858.8 | 68523 | -8373.64 | 244.19 |
| TM0005_plan | 8449.68 | 480365 | 69515 | -8449.68 | 237.41 |
| TM0004_plan | 8427.5 | 481860 | 69595 | -8427.5 | 255.93 |
| TM0003_plan | 8501.04 | 482735.1 | 68710.2 | -8453.3 | 194.94 |
| TM0002_plan | 8380.88 | 479500 | 69800 | -8380.88 | 235.23 |
| TM0001_plan | 8375.45 | 481200 | 69280 | -8375.45 | 224.47 |
| | | | | Average | 232.0283333 |

**Residual analyses for the three different Velocity models of B1 and B6 depth map**




**Corrected B1 & B6 depths matching with the well tops**

## Conclusions

The 3D and the average cube velocity model used, proved effective in the evaluation, imaging and positioning of the true depth of the TM-Field, which has led to a better positioning and understanding of the TM-Field structural geometry, reservoir architecture for optimal recovery of hydrocarbon accumulation, which has been proven and to evaluate the future potential, which is as yet unproven.

## Acknowledgements

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## Reference

Please direct your questions and obtain additional references from Department of Geology, University of Port Harcourt, Nigeria.