Offshore Deepwater Tanzania Exploration: Sequence Stratigraphy Enhances Reservoir De-Risking

Katie-Joe McDonough[2] and Brian W. Horn[1]

[1]ION E&P Advisors, Houston, TX, United States.
[2]ION E&O Advisors and KJM Consulting, Houston, TX, United States.

ABSTRACT

Global exploration opportunities abound in offshore deep water offshore provinces, despite depressed oil prices in the current industry slowdown. The economic impetus to meet the challenge of de-risking offshore blocks with sparse data offers an opportunity to utilize the power of predictive stratigraphy. Our reservoir de-risking methodology predicts the existence of sand-rich fairways by stratigraphic interval. This method of high-grading the exploration blocks in the vast region offshore Tanzania and Mozambique allows lease ranking based upon likelihood of reservoir presence. We anticipate that this application in a significant global gas province will enhance recovery of the estimated 100 TCF residing in offshore deep water fan reservoirs. Fan/channel systems in offshore Rovuma Basin discovery wells exhibit remarkable reservoir properties and high connectivity. However, sparse seismic coverage in the outlying exploration blocks continues to make mapping their spatial/temporal distribution elusive in the absence of 3D data. Our approach to this problem is to maximize the vertical information extracted from each of the high-resolution, yet widely-spaced 2D surveys. We generate a HorizonCube (closely-vertically-spaced horizon interpretation) on each 2D survey. This dense seismic horizon tracking reveals high-resolution stratigraphic geometric configurations, in a manner akin to stratal surfaces viewed in an outcrop. We combine several geometric dip attributes and apply to seismic facies recognition. We identify and map discrete stratal surface configurations and stratigraphic architecture, which can be extracted as 2D representations of geobodies. We then extract 'geobodies' based upon these meta-attributes and relate facies occurrence to stratigraphic architecture over a large exploration block in southern offshore Tanzanian waters. A horizon density attribute derived from the HorizonCube gives a proxy for sedimentation rates. Overlying the horizon density attribute on stratigraphic geometries highlights sand-rich reservoir architectural elements. These include fan lobes, levees and cut-and-fill geometries. We co-render the horizon density attribute with extracted geobodies to derive the fairways with the highest probability of containing sand-rich reservoir. By providing fairway delineation and reservoir property prediction from even coarsely-spaced regional 2D data, application of this work can focus and de-risk exploration efforts.