

## **Resolving the Structural Complexities in the Deepwater Niger-Delta Fold and Thrust Belt: A Case Study from the Western Lobe, Nigerian Offshore Depobelt**

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The deep-water Western Niger-Delta region in a little more than a decade has been a bee-hive of exploration, development and production activities and represents a major oil and gas province. The region holds several giant oil accumulations and large gas fields with a lot of unexplored opportunities trapped in a variety of structural styles spanning through the continental shelf to the continental slope within the Nigerian Offshore depobelt. The diverse and complex structural styles entrenched within the region presented challenges to Geoscientist and Explorationist alike and required the application of specialized interpretation techniques in defining the prevailing structural styles.

Detailed structural interpretation, section reconstruction, seismic stratigraphy and facies analyses, afforded by high quality seismic data, integrated with field analogues from within the deepwater Niger-Delta and other published examples around the world were key to defining the prevailing structural styles within the region. Mapping the internal reflectivity and architecture of the identified structures including the toe thrust anticlines, listric and transcurrent faults, shale diapirs and mud volcano gave good insight into the prevalent structural element in the subsurface.

Initial structural models showed that the delta has been influenced by tertiary gravitational tectonics and has identified several fracture zones. We expand upon these theories and identified the presence of an additional fracture zone up-dip within the extreme deepwater Western Niger-Delta, named the Benin fracture zone for the purpose of this study. The large amount of lateral movement along this fracture zone transposes two distinct structural regimes to the east and west of the wrench fault, resulting in diverse structural styles in the deepwater Nigerian Offshore.

We considered evidence from deepwater discoveries, Offshore Nigeria and resolved that in terms of trap and retention capacity, structures south of the wrench fault are highly favourable, while acreages located to the north of the major transcurrent fault does not conform to the conventional Nigerian deepwater play. We also attempt to review the overall structural styles within the region to ensure that successes made in the past can be repeated and also make significant advances to ensure future exploration success.