Observations on Tectonic Evolution and Prospectivity of Madagascar Offshore Basins Based on Interpretation of New Seismic Data

Roel Dirkx[1], Ben Sayers[1], Erika Tibocha[1], Felicia Winter[1], Paul Chandler[1], Bonaventure Rasoanaivo[2], Lalanirina Ranoroarisoa[2], Xu Wenshuai[3], and Xing Hongkai[3]

[1]TGS
[2]OMNIS
[3]BGP Multi Client

Abstract

TGS has completed a geophysical and geological evaluation of the hydrocarbon prospectivity of the entire western offshore margin of Madagascar from the Cap St. Marie Basin in the south to the Ambilobe Basin in the north. The study was based on 49,000 km of multiclient 2D seismic acquired in partnership with OMNIS, with 20,000 km of this acquired in partnership with BGP. The seismic and potential field data were acquired between 2001 and 2013 and were integrated in the study along with existing well data.

A revised tectono-stratigraphic framework will be presented for the offshore Madagascar basins. This study has identified new exploration targets and plays, e.g. the Jurassic tilted fault block play in the frontier Ambilobe Basin. The TGS Clari-FiTM broadband solution enabled sharper definition of previously poorly understood and imaged plays in the Morondava Basin and outboard of the Davie Fracture Zone (DFZ).

Three major events have influenced the formation of the offshore basins of Madagascar in its present form: Early Jurassic rifting of Madagascar-India from Africa, Middle Jurassic to Aptian movement south along the DFZ transform and Aptian to Late Cretaceous rifting that resulted in the break-up of India and Seychelles from Madagascar. Results from this study indicate that the Late Cretaceous tectonic events had a much greater influence on the western offshore Madagascar basins than previously known.

The seismic data show the DFZ was re-activated during India-Madagascar separation and resulted in large inverted structures in the Morondava Basin. This permits creation of trap structures and migration of hydrocarbons from older source rocks. The potential for drape traps over volcanic structures (and pinchout traps against them) will also be discussed. The new, denser seismic coverage better defines the geometry and extent of large fan complexes (e.g. Morondava and Majunga) associated with the tilting of Madagascar to the west during the India-Seychelles separation.