

Multiple Petroleum Systems of the Ceará Basin, Brazilian Equatorial Margin

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ABSTRACT

The Ceará Basin is one of a continuous series of basins along the equatorial margin of Brazil formed during the break-up of Gondwana. Exploration of the shelfal part of the basin commenced in the 1970s since when around 100 exploration wells have been drilled, resulting in several moderate discoveries. Only 5 wells have been drilled in the deeper water (>1000 m) part of the basin, including the Pecem oil discovery well 1-CES-158 in 2012. The Pecem discovery and others along both the South American and conjugate African equatorial margins in recent years suggest that this will be an exciting area for exploration in the coming years. Indeed much of the deep water Ceará Basin was licensed in the 11th bid round in 2013 and drilling on these licences is anticipated to commence in 2018/9. The first sediments to be deposited in the basin were Aptian continental lacustrine and fluvio-deltaic sediments during the rift phase, which reach a thickness of over 1600 m in well 1-CES-158. Fluvio-deltaic to shallow marine sediments, including sandstones, shales and carbonates, represent a transitional phase as the depositional environments changed from continental to marine. Post-rift thermal subsidence commenced in the Albian and the remaining sediments in the basin were deposited in an open marine setting. Total organic carbon contents and Rock-Eval pyrolysis results indicate the presence of multiple Cretaceous source rock intervals in the syn-rift, transitional and drift megasequences. Geochemical characterisation of oils from the shelfal part of the basin suggest that the syn-rift and transitional source rocks are effective in that area, while the Pecem discovery confirms the extension of post-rift source rock facies into the deep water province. Reprocessing of existing seismic and acquisition of a new multi-client broadband PSDM survey have significantly improved definition in both the syn-rift and post-rift sections, enabling the mapping of the likely extents of multiple source rock and reservoir facies in the deep water area. The new seismic dataset has also been used to identify and derisk prospects in all parts of the stratigraphy, including potential play openers. The presentation will demonstrate how the geochemical and other well data have been integrated with the seismic interpretation in 3D petroleum systems models to identify areas for future exploration.