

The Evolution of the Pre-Salt Play in the Kwanza Benguela Basins, Angola

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ABSTRACT

The pre-salt microbialite play of the South Atlantic is one the most prolific of the 21st Century. After the play-opening discoveries in Brazil, industry focus was drawn to the conjugate margin of Angola in the hope that success would be replicated. The Angola deep water licence round of 2011 occurred when the Brent spot price averaged \$111, there was fierce competition for access to what were considered the most prospective areas of the margin. In 2017 the landscape is very different. What do we wish we had known prior to access of the Angolan pre-salt? With the benefit of hindsight were there clues available at the time? Are there lessons that can be learned and applied to other untested margins? The original play concept was carbonate reservoirs deposited in shallow water over basement highs in the lacustrine rift basin, the key risk pre-drill were considered to be reservoir quality. Drilling commenced in 2011, to-date 22 exploration and appraisal wells have been drilled and eight discoveries announced. In 2015 an industry data trade programme, supported by Sonangol, enabled access to a broader set of well data. These data have enabled the industry to build a picture of the subsurface of the basin beyond their incumbent positions. Angola is a rifted margin characterised by a necking zone adjacent to the shoreline and seaward zone of hyper-extended crust, the Kwanza Benguela basins encompass both zones. The necking zone broadly corresponds to the shallow water depths of the platform area and hyper-extended zone in the deep water area. Seismic data indicates that the pre-rift section is “chopped-up” within the necking zone. As drill-out continued the play was evolved, driven by the geometry of the hyper-extended zone. Carbonate reservoir facies vary across the basin and the volume of silica is on average greater within the hyper-extended zone when compared to the necking zone. The discontinuous nature of the pre-rift section contributed to heterogeneity of source rock facies. Post-rift heating is believed to have cracked some oil accumulations to gas and flushed some with CO₂. The pre-salt section is observed to thin towards the oceanic - continental crust boundary, to a point where salt directly overlies basement and the source and reservoir section are absent. The original observations, linked to well data from drill-out, stimulate a thoughtful analysis of points to consider in exploration and development of other rifted margins.