Evolution and Economic Implications for Upper Cretaceous Sandstones: A New Example from the Inboard Gulf of Mexico

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Abstract

Recent Upper Cretaceous onshore GOM discoveries have re-focused the venture capital cross-hairs on conventional and semi-conventional opportunities. This trend had started prior to the most recent price crash, but conventional oil and gas prospects steadily became more appealing versus unconventional drilling starting in early 2015. Enhanced sub-salt seismic imaging, combined with improved completion techniques in extreme temperature environments, has potentially added trillions of cubic feet of new gas reserves to a very mature basin.

For example, in early 2015, Freeport-McMoran Oil and Gas (FM O&G) discovered >100' of net Cretaceous pay below 28,000 ft in Southern Louisiana. The Highlander discovery tested multiple Upper Cretaceous sands at 75 MMCFGD, with future wells expected to produce greater than 100 MMCFGD. Seismic suggests the reservoir could encompass ~25,000 acres, or potentially 4-6 TCF of resource.

The Highlander success is directly linked to the enigmatic 2009 FM O&G Davey Jones well, drilled just offshore Louisiana. Louisiana is synonymous with serendipity, and although Davey Jones was exploring for deep Tertiary sands, they found gas bearing Upper Cretaceous sands below 29,000 ft that exhibited anomalous 15-20% porosities. This deeper revelation lead to the up-dip Highlander triumph, potentially unlocking a much larger treasure chest than the porosity-challenged Tertiary targets.

Depositionally, these enormous volumes of Cretaceous clastics were sourced from erosion of the Ouachita and Appalachian uplifts and funneled into the Gulf of Mexico by way of the Mississippian Embayment (Woolf, 2012). Conventional core data places the newly drilled Highlander discovery in outer neritic paleobathymetric zonation, thereby extending the Upper Cretaceous shelf/slope boundary 30-35 miles basinward from previous research.

The robust porosities at these great depths resulted from the attenuation of quartz overgrowths when Chlorite was formed after the dissolution of in-situ volcanic rock fragments. The resulting high porosities and extended shelf boundary could potentially add 3000 square miles of new onshore exploration frontier in the very mature Gulf of Mexico Basin. In addition, this discovery could also have enormous implications for worldwide under-explored deeply buried Upper Cretaceous sandstones with similar diagenetic histories.