The Predictive Value of Basin Modeling in the Caribbean and Gulf of Mexico Area: One Confirmed Giant Cluster and Two Remaining Possibilities

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ABSTRACT

In this talk I review three areas of potential and known hydrocarbons that were identified using basic principles of basin modeling have yielded an estimated recoverable reserve of 9 billion barrels of (Guyana margin) and in two other cases that remain undrilled, frontier basins (Yucatan margin in the Mexican maritime zone and the deepwater Caribbean Sea in the Colombian maritime zone). Our Guyana modeling study was published in two refereed journals in 2011 and preceded the initial discovery in Guyana in 2015 and the subsequent series of 20 large discoveries that has followed. Our Guyana basin model is based on maps generated by interpolation of basin modelling results with 2D dip transects based on 1970s and 1980s vintage seismic reflection data. Our predicted area for maturation of a late Albian-Turonian source rock was the southeastern depocenter of the margin which is the main discovery area (southeastern Stabroek block). Our predicted the northeastern limit of the now established productive area in the northeastern Stabroek and Roraima blocks as a result of the Waini arch produced during the Paleogene through middle Miocene. For the Colombian basin, we have described in two, 2020 publications a mature area of Coniacian-Santonian source rocks based on the integration of a regional seismic reflection grid with a geochemical re-evaulation of equivalent rocks drilled in 1970 during DSDP Leg 15. Basin modeling indicates that this source rock began expelling hydrocarbons in the middle Miocene with updip migration into Miocene and younger sandstone reservoirs of the Magdalena deepsea fan. We support our predicted area of hydrocarbon maturity with seismic amplitude anomalies along the crests of anticlines and in stratigraphic traps along numerous, updip and onlap surfaces. Our modeling for the Yucatan margin and deepwater, southern Gulf of Mexico margin was proposed in a 2020 publication that predicts maturity in Tithonian source rocks confined to the marginal rift of the southern Gulf of Mexico. Our model—that is based on integration of six pseudowells with a seismic grid—

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predicts that this elongate zone entered the oil window during the Paleogene with peak generation during the Oligocene-Miocene. In our area of predicted oil maturity, we document direct hydrocarbon indicators using the seismic grid and a note a spatially associated cluster of persistent, natural oil slicks mapped at the sea surface.