New Insights from 3D Data over an Extinct Spreading Ridge and Its Implications to Deepwater Offshore Exploration

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ABSTRACT

Exploration activity in the Gulf of Mexico has evolved over several decades. Initial focus extended many of the onshore plays into the shallow water (<20 m), gradually moving deeper (<100 m) and finally to what is today considered deepwater (>300 m). Through this progression we have observed drill depths increasing to pursue older aged sediments from Pleistocene through Jurassic and water depths increasing beyond 1000 m. A considerable amount of work has been done to assess the drainage patterns and run out lengths of large deltaic systems to account for their present, and past, locations of deposition (Galloway et al., 2011; Covault et al., 2012). Small scale channels and larger scale lobe and lobe complexes extend into the Lund protraction area where deposition has been influenced by Mesozoic tectonics and Cenozoic subsidence.

To supplement this, considerable work has been done to understand the timing and formation of the Gulf of Mexico (Mann, 2007; Pindell and Kennan, 2009) and more recent work to understand the interactions between continental and oceanic crust (Eddy et al., 2014) and their relationships to the petroleum systems. In many instances each new piece of information dispels or changes conventional thinking (e.g., hydrocarbons do not exist on oceanic crust, sands could not be transported that distance) and opens up new fairways to exploration.

A new global hi-resolution gravity dataset was published by Sandwell et al. in 2014. This data provided an unprecedented level of detail highlighting the extinct spreading ridge in the Gulf of Mexico. The gravity data is used in conjunction with new high resolution narrow azimuth 3D seismic data acquired in the Lund protraction area of the U.S. Gulf of Mexico. Initial observations from the correlation of these data reveal new information quantifying the direction and magnitude of the Mesozoic rifting in the Gulf of Mexico as well as providing insight on the nature of crustal accretion, exhumation and subsequent sediment accumulation. The seismic data identifies exciting new potential exploration fairways related to both the Mesozoic structural regime and later Cenozoic mass transport complexes. These fairways extend to the abyssal plain of the Mexican offshore region and provide new insight into the source to sink scenarios influencing the petroleum systems in the entire Gulf of Mexico.

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