Seismic Imaging of a Cretaceous Fluvial System

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Ancient fluvial depositional systems often can be important hydrocarbon reservoirs. Such fluvial systems present considerable variations in channel styles, lateral and vertical facies heterogeneity, and complex geometries, factors that contribute to make evaluation, production and petroleum recovery complicated. The study of ancient analogs may provide realistic insights into the long-term preservation styles of fluvial deposits and their reservoir potential, which is of major importance to provide enough information leading to maximize hydrocarbon resources. The Potomac Formation, which was deposited in an aggrading coastal plain during the Early Cretaceous, is a potential production-scale ancient analog for fluvial reservoirs in a passive margin, alluvial plain setting. Precise delineation of the distribution and geometry of these Cretaceous sands has proven to be difficult based on well correlations alone. To address this, we collected a 20-km high-resolution seismic reflection dataset in 2008 using a land streamer system, an alternative to conventional seismic acquisition equipment for collecting large amounts of seismic reflection data in urbanized and semi urbanized areas. This was followed in 2009 by drilling of a 152-m-deep continuous-cored test hole with a full suite of geophysical logs adjacent to a seismic line. The minimum and maximum depths imaged were ~18 m and ~ 268m, with a resolution of ~4 m, which is sufficient to resolve 10 to 20 m thick sands typical in the Potomac Formation. Reflection depths correspond well to depths of lithologic changes in the test hole. The core, geophysical logs, and seismic data are being integrated to make a facies classification and maps and to test and refine the existing Potomac facies model. The data also will enable us to test the current sequence stratigraphic model in which lowstands are characterized by sand-prone facies whereas transgressive and highstand intervals are characterized by more mud-prone facies. The results will provide a better understanding of how the sequence stratigraphy and geometry of these deposits affect the nature and distribution of fluid flow pathways and barriers.