Seismic facies analysis of Pliocene-Pleistocene turbidite systems, Ship Shoal South Addition, Northwestern Gulf of Mexico

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The sedimentary rocks in the study area consist mainly of turbidite systems deposited in the intra-slope salt withdrawal basin. To define the geometries and spatial distributions of sand prone turbidite elements, which are the main reservoirs in intra-slope basins in Gulf of Mexico, is one of the most important challenges in hydrocarbon exploration in this area. 3-D seismic volume and six well data including basic well logs and biostratigraphic information were used to build a chronostratigraphic framework in the southern part of Ship Shoal South Addition. Within a sequence stratigraphic framework, seismic facies analysis was carried out using the 3-D seismic data and flattened horizon slices. The interpreted seismic facies were calibrated with well logs to predict their lithofacies and classified as genetic facies associations or turbidite elements.

Four different turbidite elements were identified: channel fills with associated levee and overbank deposits, turbidite lobes, mud turbidite fills and sheets, and hemipelagic drapes. Sub-parallel reflectors with low amplitude and moderate continuity correspond to Mud turbidite fills and sheets, and parallel seismic patterns of high amplitude and continuity indicate hemipelagic drapes. Turbidite lobes usually lap out onto the sequence boundary and are characterized by the mound like seismic patterns with high amplitude and high continuity. In horizon slices, they are generally recognized by overall elliptical shape of high amplitude areas. The seismic reflectors of sub-parallel with variable amplitude and low continuity correspond to channel fills with associated levee and overbank deposits. Flattened horizon slice techniques are proved to be exceptionally useful in defining the lateral variations of channel fill sediments in this intra-slope salt withdrawal basin. Depositional channels are interpreted as sand prone and represented as the elongated sinuous forms of high amplitude areas, while erosional channels are interpreted as mud prone and represented by the low amplitude channel like features on the horizon slices.

Channel fills and turbidite lobes are interpreted as the sand prone facies recognized in this study. The detailed seismic facies analysis using high resolution 3-D seismic data with horizon slices within a sequence stratigraphic framework can improve the prediction of reservoir distribution in slope turbidite systems and reduce the risk of hydrocarbon exploration.