Application of Chronostragraphic and Lithostratigraphic Concepts to Deepwater Reservoir Characterization

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Deepwater siliciclastic sands were deposited by accumulations of external clastic materials carried by turbidite flows from shoreface or slope areas to the basins. However, whether the concepts of classic sequence stratigraphy model developed from relative coastal onlap and offlap can be applied to deepwater environment is still an issue of open debate, mainly due to the fact that the magnitude of sea-level fluctuation in a typical 3rd order cycle is much less than the total water depth of most deepwater basins. This paper presents a case study from a Gulf of Mexico deepwater reservoir currently under development to investigate the impact of relative sea-level and sediment input in the development of submarine lobe system. A chronostratigraphic framework was constructed by integrating biostratigraphic data with regional seismic mapping using amplitude volumes. The framework was verified by quantitative analysis of petrographic, geochemical, and pressure data, and correlated to the GOM sequence chart. The top boundary of each sequence is capped by a shale interval that serves as the vertical barrier for flows, and limits the interval deposition of multi-sand zones, each with unique pressure trend, and representing subsequence deposition at higher frequencies. Subsequence deposition of reservoir scales was accomplished by two major processes, downlapping and backstepping, as revealed by investigation on seismic acoustic impedance (AI) volumes. The resultant depositional model allows us to successfully predict the occurrence of sand depositional events during the development drilling. We conclude that classic sequence stratigraphic concepts can be applied in deepwater turbidite environment in order to construct a chronostratigraphic framework, while by applying advanced seismic technology, profound lithostratigraphic correlation within each 3rd order sequence can be performed to characterize the pattern of flow unit distribution, greatly enhancing the effects of reservoir modeling on field development.

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