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Depositional Response to Dynamic Slope Topography, Eastern Gulf of Mexico, USA

Abstract

Acquisition of high-quality 3D data volumes in the eastern Gulf of Mexico, coupled with proprietary 3D coherency visualization, has allowed for enhanced clarity in imaging deep map-view realizations of Miocene and Pliocene depositional systems in slope and base of slope environments at one to four seconds below mudline. Regional studies and detailed analyses of deepwater seismic facies geometries in this area indicate a dynamic response of depositional systems to seafloor gradient change in time and space.

Evolution of salt-cored fold structures caused critical slope changes through Mio-Pliocene time that affected both regional and local drainage patterns in pre-, syn-, and post-growth strata. Depositional topography related to variable rates of sediment accumulation also played a key role in influencing slope sediment pathways, drainage capture, and compensatory relief. Growth of the fold belt effectively created elevated "plateau" areas deflecting sediment pathways that bypassed their flanks. Differential growth rates within the fold belt resulted in an overall west to east gradient, with younger, more elevated structures developed in the west. This topography was later encroached on, and ultimately enveloped by, Plio-Pleistocene slope progradation. Pliocene drainage capture within the fold belt is evidenced by east-west trending erosional valleys and channel meander belts sourced from evolving dip-fed canyon systems to the west and directed eastwards, for up to 40 miles along strike prior to exiting onto the abyssal plain.

Up slope of the fold belts, Mio-Pliocene depositional rates periodically overwhelmed salt topography, creating a bypass or smoothed slope profile with relatively linear erosional valley systems, locally deflected by salt structures. Geometric aspects of a wide variety of channel and sheet architectural elements interpreted as mud-prone or heterolithic constructional and sand-prone, ponded seismic facies are discussed within the structural-stratigraphic framework with implications for reservoir and seal distribution in the area.

Biographical Sketch

CIARAN O'BYRNE completed a PhD in 1990 on deepwater clastics in a transtensional basin setting at University College, Dublin, Ireland. He then completed a Post-Doctoral study with the Reservoir Modeling Group at Shell Research, The Netherlands, on sequence stratigraphic analysis of nearshore marine and fluvial sediments in the Book Cliffs Utah and its application to reservoir modeling in the North Sea Brent province and in Nigeria. He subsequently joined the Stratigraphic Prediction Group at Shell's Bellaire Research Center in Houston, USA, involved in domestic and international exploration/production projects and training courses. Ciaran resigned from Shell in 1993 and joined Amoco Production Co.'s Worldwide Exploration Business Group, providing technical support to prospect quality risk and exploration teams. Working primarily in Tertiary basin clastics he was involved in various exploration plays in the S. China Sea, S. America, West Africa, USA, and Mexico. Currently Ciaran is a member of BP's Gulf of Mexico Deepwater Exploration team and is actively involved in various internal and external sedimentology and stratigraphy networks. In addition, Ciaran continues to provide training classes in clastic sedimentology and stratigraphy at BP. Ciaran is a member of the AAPG, SEPM, IAS, and Houston Geophysical and Geological Societies. □

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