Facies Analysis and Stratigraphic Relationship of Avulsion Splay Successions in the Paleogene Wilcox Formation, Deep Water Gulf of Mexico

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ABSTRACT

The Wilcox Formation (Paleocene-Eocene) in the deepwater Gulf of Mexico comprises a thick sand-rich succession (2000-6000 feet thick) of deep water sedimentary rocks interpreted to have been deposited in channelized systems and unconfined lobe/sheet systems in slope and basin floor environments. Over the last decade, the Wilcox Formation has emerged as a major hydrocarbon reservoir, and it is the focus of significant exploration and development activity within the petroleum industry.

Argillaceous hybrid event beds are interpreted to be deposited by gravity driven flows that are transitional between laminar and turbulent flow. They are a common occurrence in sediments interpreted to have been deposited in medial to distal unconfined lobe environments in the Wilcox Formation and other deep water systems. The argillaceous character of hybrid event beds is interpreted to reflect longitudinal flow evolution of the depositional turbidity current event, in which the silt/clay to sand ratio is interpreted to increase with increasing runout length. This causes a transition from turbulent to laminar flow, changing the rheological nature of the deposit. The resulting deposits contain significantly greater amounts of argillaceous silt and clay than would be found in a sand bed deposited as a turbidite. The Wilcox Formation also contains intervals with abundant hybrid event beds that are interstratified with rocks interpreted as to have been deposited in channel and overbank environments. Interpretation of these hybrid event–dominated intervals as distal lobe/sheet sediments is challenging, as it requires repeated large magnitude shifts of depositional environment from proximal to distal. Equally challenging would be interpreting these intervals as channel margin deposits. Channel and overbank environments are dominated by deposits that reflect higher energy turbidity current processes and through-going flow to more distal environments.

We interpret these argillaceous intervals to represent the initial deposits of channel avulsion. The mix of hybrid event beds, debrites, and turbidite sands and shales is interpreted to be deposited by the initial flows of a channel that has broken through its confining levee, and is forming a frontal avulsion splay in what was previously an unconfined environment. A distinctive aspect of the avulsion splay intervals is that they usually underlie confined channel or levee sediments, and are interpreted to have a genetic relationship to these overlying channelized strata. Similar deposits of argillaceous sand-stones in the Neoproteropzoic Isaac Formation of the Windermere Supergroup (east-central British Columbia, Canada) have also been interpreted as hybrid event beds in avulsion-related crevasse splay deposits.