Variations of Sediment Flux and Implications for Sequence Stratigraphy and Sediment Routing Systems: Wasia Formation, Eastern Saudi Arabia

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ABSTRACT

Changes in both the volume of delivered sediment and grain-size regulate dispersal and deposition of sediment in basins and depositional sinks. In other words, the interplay between sediment flux and subsidence controls the distribution of reservoirs and seals. The Lower Cretaceous Wasia Formation provides an example where sediment flux, grain-size, and spatial distribution of deposition (i.e., volumetrics) control such basin wide grain-size trends. A source-to-sink study made on the Wasia comprises both carbonate and siliciclastic-dominated members. The focus here is on the siliciclastic component of the stratigraphy. The Wasia was deposited in a shallow marine setting that includes siciliclastic deltas and shallow marine carbonates and includes five members that span 12 Ma. From oldest to youngest these include the Khafji, Safaniya, Mauddud, Wara, and Ahmadi Members. This approach tracks lithofacies and grain-size distributions using cuttings data from more than 1000 boreholes, and predicts locations of sediment point sources and pathways, and calculates volumetrics. Results are related to the evolution of the basin. Variations in sand flux and siliciclastic detritus input, influence reservoir and seal architecture through time. Wasia volumetrics related to sequence stratigraphic trends. Sand percentage changes from approximately 30% in the Khafji, Safaniya and Wara to less than 10% in Ahmadi and Mauddud; the latter two members are thought to represent regional seals. Basin-wide progradational and retrogradational trends are strongly correlated to sediment flux estimates. Sediment flux (Qs) data correlate with the sequence stratigraphic trend with an overall transgression from Khafji (Qs~40*103km3/Myrs) to Mauddud (Qs~4*103km3/Myrs), retrogradation in the Wara (Qs~20*103km3/Myrs), and transgression in the Ahmadi (Qs ~8*103km3/Myrs) Member.