Along Depositional Strike Variability in Paralic Systems and Implications for the Construction of Shelf to Slope Margins

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Abstract

Early stratigraphic models emphasized stratal patterns along depositional-dip direction, and used these patterns to interpret corresponding autogenic or allogenic responses in the sedimentary records. The three-dimension, along depositional strike variability (channel avulsion, delta lobe switching) is now well known as short time-scale “autogenic” behavior of sedimentary systems. Here we present, (1) 3-D (along dip and along strike) variability of delta systems expressed as a single regressive-transgressive, deltaic cross-shelf transit and (2) the 3-D variability of a longer time-scale set of regressive-transgressive cycles, showing how these build the accretion complexity of an entire shelf-slope prism. Examples of modern delta systems and their shelf to shelf-edge morphologies, together with ancient shelf-slope systems from Paleocene-Eocene Wilcox Formation at Gulf of Mexico, Maastrichtian Fox Hills deltas in Washakie Basin in Wyoming and Jurassic Lajas Formation in Neuquen Basin, Argentina provide key lessons on 3-D variability of paralic deposits during short and long time scales. All river deltas change their process mix (river, wave, tide) even during the accumulation of a single regressive-transgressive sequence, and during this time period, in 3-D, regression and transgression transits can co-exist. During one regressive-transgressive sequence, the depocenter-migration pathway from inner shelf to the shelf-edge is different, with progradation and retrogradational depocenters along distinct pathways. For successive regressive cycles the depocenters “align” along different paths ending at different shelf-edge locations. The highly variable depocenter location for successive cycles allow the formation of a wide

shelf-edge protrusion formed by prograding of tens of shelf-edge deltas at different locations. Finally, the variability along strike at the river mouth, combined with the delta depocenter migration results in irregular shelf edge progradation that will control the location of the sediment-fairway to deepwater slope and basin floor.