Understanding Autogenic Channel Clustering and A/S Ratios in Fluvial Sandstones of the Ericson Sandstone: Implications for Predictability and Reservoir Architecture

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Abstract

Fluvial strata of the Cretaceous Ericson Sandstone is exposed for over 50 km along the Rock Springs Uplift in southwestern Wyoming, and records the largest shoreline progradation associated with the Cretaceous Interior Seaway. Along the southeast flank of the Rock Springs Uplift, detailed description and photogrammetric modeling of the basal Trail Member has identified three distinct units that are mappable for tens of kilometers along depositional strike. We attribute these systematic stratigraphic changes to variability in the Accommodation/Sedimentation ratio within this strata. The upper and lower Trail Member units are characterized by highly amalgamated, high NTG (up to 85%) fluvial channel complexes that have a high degree of lateral connectivity, representing a low A/S ratio system. The middle of the three units represents a higher A/S system, with a lower average NTG. We attribute these regionally mappable changes in the A/S ratio, and the resulting fluvial architecture, to allogenic forcings, either through 1) a decrease in accommodation due to tectonic uplift of the incipient Rock Springs Uplift, or 2) an increase in sedimentation rates through climatic or tectonic changes in the sediment source terrane. The middle Trail unit, though relatively lower NTG, is dominated by multistory, vertically stacked channel complexes that appear to be excellent exploration targets when intercepted by vertical well logs. Spatially,

however, these channel complexes are much more laterally isolated than those of the upper and lower units. Channel cluster analysis of over 800 identified channel bodies shows that the distribution of channel elements is non-random; channels show a consistent clustering at multiples of ~110 meters. This leads to a very different reservoir architecture when compared to the upper and lower Trail, with thick vertical channel complexes having limited lateral connectivity. Through a detailed analysis of the Trail Member of the Ericson Sandstone, we see that distribution of channel elements is systematic and predictable. On longer time scales, allogenic drivers lead to important changes in NTG and channel stacking/connectivity on a regional scale. On finer time scales, we see that autogenic processes cause self-organization of this fluvial system and clustering of channel elements into isolated ‘silos’ of multi-story, vertically thick channel complexes. A better understanding of Accommodation/Sedimentation variability and autogenic channel clustering leads to a more predictive model of reservoir distribution within the Trail Member fluvial system, with important implications for analogous systems elsewhere.

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