The Importance of Competing Allogenic Drivers and Implications for Fluvial Architecture on a Regional Scale, Trail Member of the Cretaceous Ericson Sandstone

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Abstract

The Late Cretaceous Trail Member of the Ericson Sandstone represents a regionally extensive fluvial system located within the Greater Green River Basin in Wyoming, Utah, and Colorado. Sediments were primarily sourced from the mature Sevier fold and thrust belt to the west, but the early onsets of the Uinta Mountain uplift likely provided a secondary sediment provenance. These sediments were transported towards the Western Interior Seaway while being influenced by early subsidence and uplift of Laramide-aged sub-basins and arches. The abundant outcrop, wellbore, and core data available allows for a regional analysis of how the fluvial architecture changes towards the Western Interior Seaway. Observations made along the Utah-Wyoming border suggest a sand-rich, highly mobile fluvial system in this more landward portion of the field area, and channel stacking architectures show evidence for both autogenic channel clustering at a fine scale and allogenic forcing (tectonics) at a larger scale. Multi-story channel complexes are vertically and laterally amalgamated, with abundant trough cross bedding, common soft sediment deformation and rare laminated silty shales in between individual channel elements. These sedimentary structures suggest a high energy fluvial system that avulsed frequently. Both sediment supply and tectonic activity played a major role in the distribution and connectivity of reservoir sands in this more proximal area. Basinward outcrops in northern Colorado (65 km basinward) show significantly different facies relationships, architectures and stacking

patterns. Lenticular, fluvial-dominated sands are still common, but channel bodies show an overall greater width-to-depth ratio, are often separated by fine-grained laminations, and are more commonly characterized by low energy sedimentary structures. On a larger scale, photogrammetric analysis shows a rapid lateral change from a sand-rich, channel-dominated interval to a mud-rich, channel-poor section over just 0.3 km at this locality. These observations indicate a lower energy, more distributary fluvial system that is constrained within a possible incised valley. This highlights the potential importance of eustatic allogenic driving forces in this more distal part of the Trail depositional system, in contrast to the tectonic signal more landward. Additionally, subsurface data from twelve wells located north of the northern Colorado locality show a rapid (15 km) increase in thickness (97 m to 182 m) and decrease in net-to-gross (89.3% to 65.3%). Early subsidence of the Washakie sub-basin is proposed as the cause of this rapid increase in accommodation. Significant changes in the character, connectivity, and thickness of the Trail Member have important implications for exploration and production from this reservoir in the nearby Trail and Canyon Creek fields, as well as other analogous fluvial systems.