Stratigraphic Architecture of the Upper Cretaceous Williams Fork Formation, Piceance Basin, Western Colorado Through Outcrop Studies and High-Resolution Lidar Imaging

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The Upper Cretaceous Williams Fork Formation in the Piceance basin of western Colorado is a major source of unconventional gas. Although fractures control fluid flow in many of these gas reservoirs within the basin, the stratigraphic architecture of these fluvial deposits significantly affects drainage patterns and fluid storage. These factors are directly associated with the distribution and connectivity of sandbodies, especially in low to moderate net:gross (<40%) fluvial systems similar to the Williams Fork Formation. This outcrop-based study addresses the connectivity, geometry, stacking, and internal heterogeneities of fluvial channels at the reservoir scale using conventional field methods, high-resolution lidar imaging, and 3-D outcrop modeling.

The stratigraphic analysis of the Lower Williams Fork Formation is conducted on well-exposed outcrops within Coal Canyon, near Grand Junction, Colorado. Various fluvial elements from outcrop are examined and described in detail, including channels, splays, and meander-bend point bars. Detailed measured sections and outcrop correlation panels capture the variation of channel geometry, stacking, and internal sedimentology that is associated within the fluvial deposits. Lidar (LIght Detection And Ranging) data collected at well-exposed channel and point-bar sandstone outcrops provide detailed 3-D images of the outcrop. The centimeter-scale resolution that Lidar images provide are used to define fluvial elements and bounding surfaces, and to extract dimensional data from sandstone bodies. Using a combination of photomosaics and Lidar images, statistical methods are used to evaluate sandstone architecture and connectivity. The quantitative information on sandstone connectivity and geometry are useful to constrain 3-D geologic models of analogous subsurface petroleum reservoirs.

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