Coastal-plain Channel Architecture of the Cretaceous Blackhawk Formation, Wasatch Plateau, Utah: Implications for tight-gas reservoir development

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As a low net-to-gross system, tight-gas reservoirs are highly compartmentalized with added subsurface complexities. Documenting their explicit reservoir heterogeneity and identifying sweet spot areas are strategic to successful tight-gas reservoir prospect evaluation and performance. Using photomosaics, measured sections, and GPR data, this study addresses various scales of lithological heterogeneity in the coastal-plain deposits of the Cretaceous Blackhawk Formation, demonstrating constraining parameters for sweet spot development and compartmentalization at field-scale. Moreover, as an outcrop analog, the study offers insights on improved tight-gas exploration and exploitation practice, particularly for the producing tight-gas reservoirs in the adjacent Uinta and Piceance Basins of Utah and Colorado.

Detailed architectural element analysis on outcrop dataset from a ~100-m-thick section along a cliff-face (~500-m of dip-section and ~150-m of strike-section, thus generating a pseudo-3D model) in Cottonwood Creek of eastern Wasatch Plateau documents well-developed large-to-small-scale heterogeneity within and among fluvial elements. Alternating fluvial channel sandbodies encased within coastal-plain mudstones generate large-scale heterogeneity. Intermediate-scale heterogeneity is associated with development of various architectural elements like bar-accretion and crevasse splays. Small-scale heterogeneity is related to facies variability within individual architectural elements. Individual channel sandbodies are 2-15 m thick and intensive investigation reveals more sedimentologic and stratigraphic detail. GPR data shows internal bar geometry within channel-fill sandbodies. At a larger field-scale, the study demonstrates spatial variability of high net-to-gross, amalgamated channel sandbodies to low net-to-gross, isolated channel sandbody that, as a conditioning dataset incorporating effects of scale, heterogeneity, and stratal arrangement, shed critical lights on subsurface tight-gas reservoir development and production.