

The D Sandstone: A Record of a Sea-Level Cycle

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ABSTRACT

The D Sandstone of the Colorado portion of the Denver-Julesburg basin is an excellent producer of hydrocarbons from numerous isolated reservoirs (>50). Porosity and permeability pinch outs counter to regional dip are the primary structural controls on these reservoirs. It is only within the context of the entire basinal fluvial to shoreline depositional system and sea-level cycle that the distribution of reservoirs becomes understandable. Using a database of more than 20,000 well logs, 900 mudlogs, and 160 cores, internal correlations of the reservoir sandstones of the D Sandstone interval were documented. Valleys eroded during the falling stage of sea level and a variety of sediment fill accumulated during the subsequent sea-level rise. This variety of fill was defined from the distal shore setting to the more proximal fluvial setting. In the interfluves, abrupt-based, forced-regressive shoreline sandstones document the base of the D Sandstone, while transgressive lags cap the tops of the interval. Organic-rich source shales of the lower Graneros accumulated laterally basinward and atop the D Sandstone.

Paleogeographically, the D Sandstone prograded westward into the southeastern portion of the Western Interior Seaway from source areas of low-lying hills on the continental interior. The sediments were predominantly recycled Paleozoic sands and muds. Because of offshore winds and minimal tides, the D Sandstone sediments were deposited along a low-energy part of the seaway. Storm-related deposits dominated the more distal parts of the valley fills, while fluvial deposits accumulated more commonly in the proximal valleys. Right-angle bends in the D Sandstone valleys suggest contemporaneous basement-block movements controlled the local direction and fill of these valleys. Numerous authors have alluded to these block movements and documented them on a regional scale. More recently, High-resolution aeromagnetics have defined the margins of these blocks in more detail. Understanding the heterogeneity of the D Sandstone deposits provides valuable insights into reservoir compartmentalization that must be addressed during the design of efficient enhanced recovery methods. Knowledge of the tectonic controls on the distribution and orientation of the D Sandstone valleys offers exploration opportunities for discovering by-passed pay and new fields in an already mature play.