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Stratigraphy and Characterization of the Lower Cretaceous Cummings Formation, Lloydminster, Alberta

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Abstract

Sandstone bodies within the Lower Cretaceous Cummings Formation in the Lloydminster area represent important reservoirs of heavy oil. Here, we present initial results of a geological analysis of the Cummings Formation near the Lloydminster field utilizing core and wireline log data in an effort to characterize facies, determine stratigraphy, and develop a preliminary assessment of sandbody architecture. The Cummings Formation is characterized by a series of coursing-upward packages deposited in a low-energy setting and contains a mixture of sandstone, shale, and thin coals. The 20-30 m thick Cummings Formation in the study area overlies massive fluvial sandstone beds of the Dina Formation and is in turn overlain by marine shale associated with the Lloydminster flooding event. The Cummings Formation is approximately 107 Ma which is around the end of the Aptian time. Depositional environments are variable and include marginal marine to nonmarine coastal plain settings. Combining detailed core analysis with wire-line log data we are able to improve log data-lithofacies correlations and provide insight into the 3-D distribution of sandstone units.

Whereas the Cummings Formation consists of sediments deposited during an overall marine transgression, the facies stacking patterns indicate the marine incursion was punctuated by smaller-scale regressions. An idealized vertical succession through the Cummings Formation includes: 1) a basal, pedogenically-altered sandstone or mudstone overlain by shale; 2) bioturbated black mudstone containing small traces fossils, *Teichichnus, Chondrites, Planolites, Zoophycus;* 3) interbedded mudstone and sandstone; 4) relatively thick beds of bitumen-saturated sandstone; and 5) thoroughly bioturbated mudstone with diverse and robust traces. This succession is interpreted as recording transgression and backstepping facies, during which time brackish estuarine muds were deposited over coastal plain deposits. Antithetic to the general shoreline transgression, periodic influxes of sand-sized material likely produced localized and temporary shoreline progradations. The thoroughly bioturbated mudstone in the uppermost part of the succession indicates fully marine conditions occupied the region as the transgression continued. The transgressions appeared to have extended far south within the study area. Bitumen saturation tends to be most pervasive in sandstones located in the upper half of the formation. These sandstone units tend to be fairly homogeneous with some thin shale beds between the sand packages. These data suggest a complex distribution of sandstone reservoirs in the Cummings Formation, and are a function of the complicated depositional history of the area.