

Stratigraphic Complexity in the Cretaceous Mannville Group of Southern Alberta and Saskatchewan: Exploration Analogs for the Kootenai Group in Montana

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ABSTRACT

The Cretaceous Mannville Group in Canada contains billions of barrels of oil, yet its stratigraphy is poorly understood. The results of a regional Mannville Group study in southern Saskatchewan and Alberta (Twp. 1-20, Rge. 13-30W3 and Twp 1-10, Rge. 1-13W4) provide an analog for correlative stratigraphic units of the Kootenai Group in Montana. These include reservoirs of the Glauconite, Cutbank and Sunburst sandstones. The geological history is one of multiple erosional events, creating a complexly-evolving landscape where accommodation space was generally low. A series of maps, cross sections and analogs illustrate the following sequence of events.

The lowermost Cretaceous sediment (Hauterivian-to-Barremian) is the predominantly braided fluvial sandstones of the Sunburst/S2, deposited as a continuous, unconfined sheet directly overlying the basal Cretaceous unconformity. The top of the Sunburst/S2 is a deeply-weathered paleosol which represents several million years of non-deposition and corresponds to a lull in tectonic activity in the Rocky Mountains.

Renewed Cordilleran tectonic activity resulted in deep incision in the eastern foreland basin, characterized by multiple episodes of incision and slow sediment supply. The result is deeply incised valleys cut into Cretaceous and older sediments. The Sunburst/S2 was preserved as erosional remnants forming valley interfluves. The valleys are up to 75 m deep, 30 km wide and hundreds of km long.

Where the incised valleys cut into Mississippian carbonates, the lowermost sediments are called the Detrital; the deposits of a landscape consisting of carbonate scarps, debris-flow deposits, talus cones and karst features.

As relative sea level started to rise and create limited accommodation space, sediments of the Basal Quartz/McCloud were deposited on the valley floors. These quartzose reservoir sandstones were deposited as valley-confined sandy-braided rivers in Alberta, and sluggish meandering rivers in southern Saskatchewan. Brackish to lacustrine, fine-grained sediments of the Bantry/Ostracod Member were deposited within and overlapped onto margins of the valleys. Debris flow and colluvium deposits within the Bantry/Ostracod zone indicate considerable local relief, associated with nearby interfluves. The Glauconite Member represents a complex of different facies types resulting from multiple changes in relative sea level. Shorelines and deeply incised estuarine channel deposits have been identified, opening up new exploration opportunities in Saskatchewan.

In the predominantly lithic Upper Mannville, accommodation space and sediment supply increased, changing the fluvial style to predominantly meandering with associated fine-grained floodplain deposits.