The Grand Rapids Formation: An Unexploited Bitumen Reservoir

Douglas Cant*
Doug Cant Geological Consulting, Redwood Meadows, AB
dcant@personainternet.com

Summary

The Upper Mannville Grand Rapids Formation (Fig.1) of the Wabiskaw area of northeastern Alberta contains thick, laterally continuous, composite sand bodies that are partly bitumen-saturated (Fig. 2). The Proven-In-Place-Reserves have been estimated to be 8.7 billion cubic metres of 10 – 13 API gravity bitumen. The deposits are at depths of 100m in the northeast to about 300m in the southwest, so development will use in-situ processes. Authigenic kolinite and chlorite in pores of the reservoir rocks, tightly cemented concretionary zones, and boittom water (usually) are factors in in-situ development.

The Grand Rapids sands were discharged from deep incised channels that cut the Colony to Waseca Formations of the Lloydminster area (Fig.1). The NNW trends and discharge locations of these channels were influenced by solution of underlying Devonian salts, resulting in some of the largest concentrations of sandstone in the Alberta Basin. Because the sands are discharged from these valley that shifted laterally because of salt tectonics, they are three-dimentional and shifted laterally.

The reservoir bodies are lowstand complexes of shoreface and incised channel sands (Fig. 1). These different facies are indistinguishable on logs and development of bitumen reservoirs will require extensive coring. The two main Grand Rapids sand complexes are elongated in northeast-southwest orientations. Each has dissociated gas in places. Previously the Grand Rapids sand complexes were believed to be sheets, but improved log correlations show these to be a series of lens-shaped northerly prograding wedges. Only composite units can be separated on logs; these are bounded by more extensive transgressive surfaces that are marked by regional shales (Fig. 3). Internal correlation in the Grand Rapids is challenging and must take into account 1) clinoforming shoreface sands, (Fig. 3), 2) the appearance distally of new thick lowstand sands (Fig.3), and 3) numerous incised valleys cutting through the lowstand complex (Fig. 1).

The two cores that are displayed (Figs. 4, 5) reflect the stratigraphic and sediemntologic complexity of the Grand Rapids, including the presence of several unconformities within the Grand Rapids, and at the top of the Mannville.

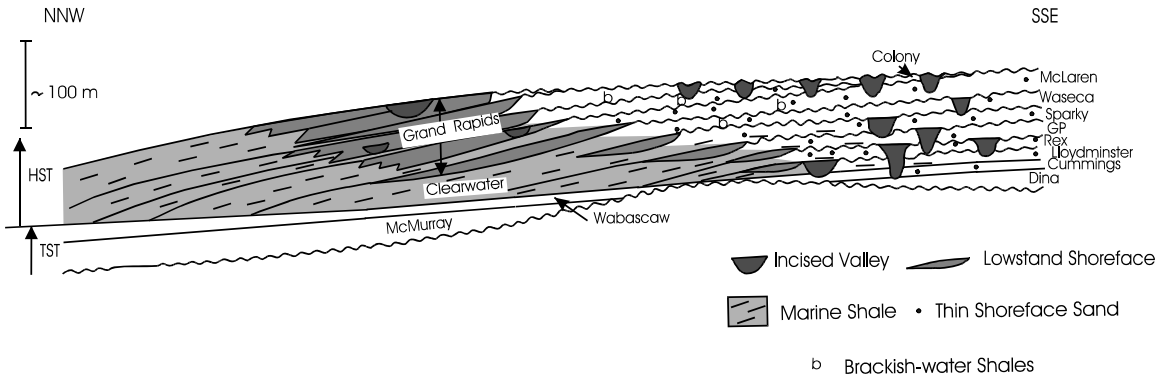

Figure 1: Upper Mannville Stratigraphy – Lloydminster to Wabiskaw

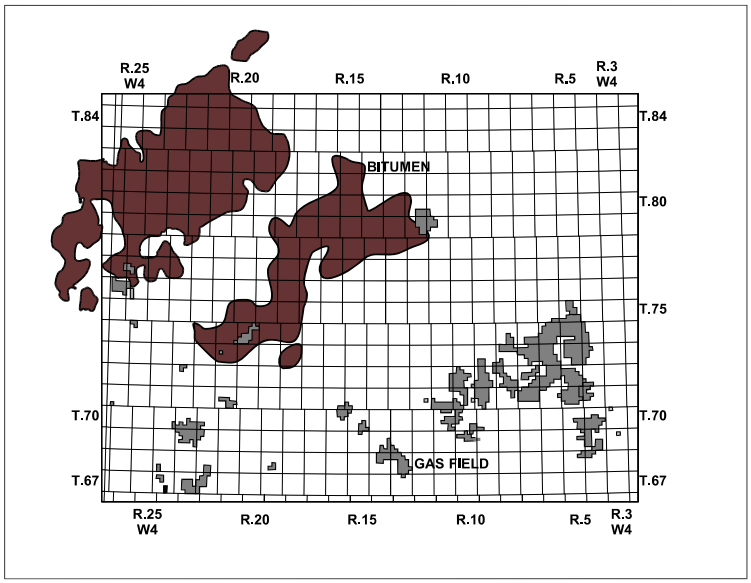

Figure 2: Hydrocarbon occurrences – Grand Rapids Formation

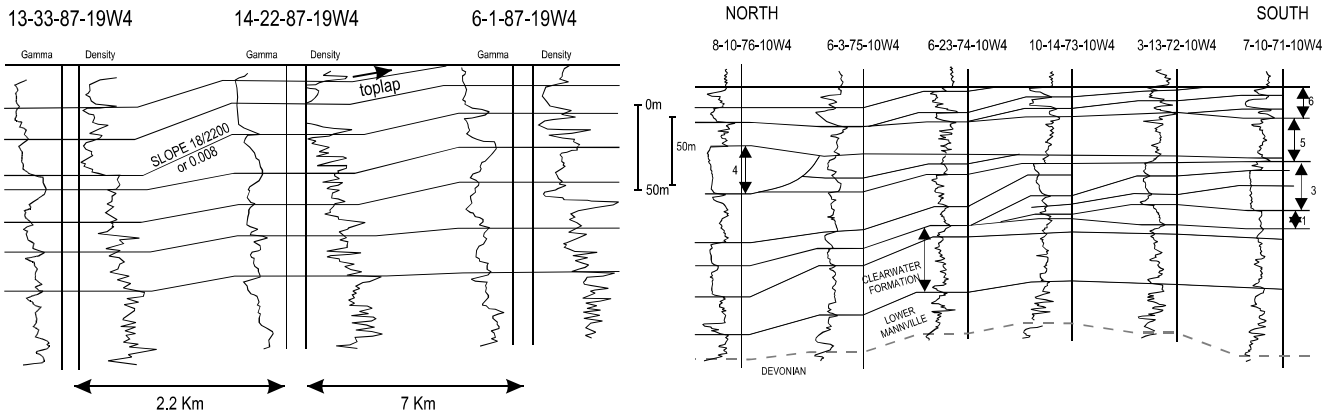

Figure 3: Detailed well-log correlations, bitumen reservoirs

TEXEX WABASCA 10-27-82-24w4 760-860 FT

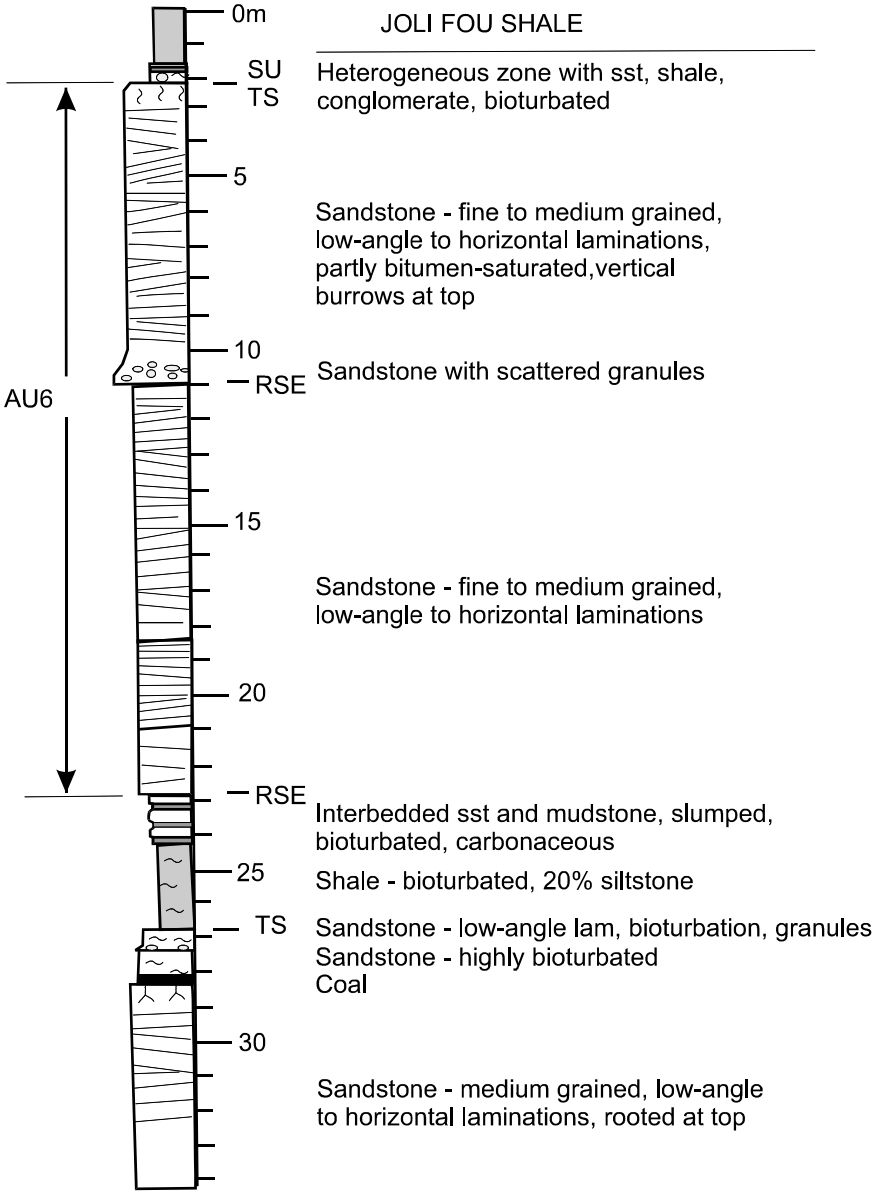

Figure 4: Core log showing amalgamated shoreface sands

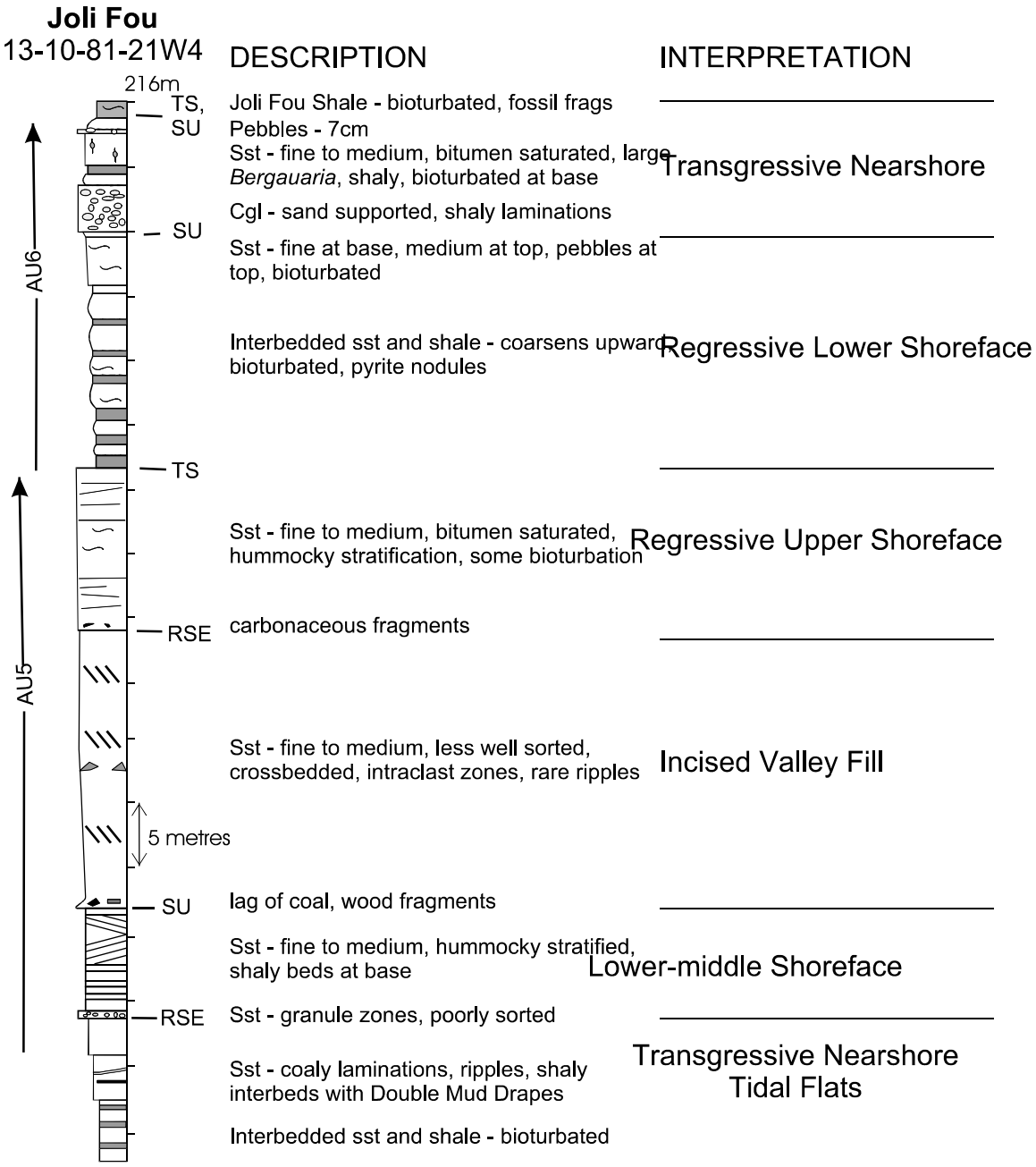

Figure 5: Core log showing amalgamated valley-fill sands and shorefaces