



A comparison between outcropping Oldman and Paskapoo Formation fluvial sandstones in the Calgary region, with implications for subsurface gas exploration

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Summary

Recent fieldwork on a variety of exposures in the Oldman, Dinosaur Park and Paskapoo Formations in the Calgary region has allowed detailed depositional models to be constructed. The fluvial deposits range from high to low net:gross, and are interpreted as low sinuosity to meandering in character. Interpreted crevasse splay deposits were common. The models are based on sedimentary structures and overall fluvial architecture, and can readily be applied in the subsurface to model potential flow paths and baffles to flow of produced gas.

Introduction

A series of outcrops of interpreted fluvial deposits, located within two hours driving distance from downtown Calgary, were identified and sedimentological logs were measured at each of them. The outcrops are useful both for geological field excursions, and to use as surface analogues. Sedimentological findings, and the resulting interpreted depositional models, can readily be applied in the subsurface. In some cases, particularly in the triangle zone, it was challenging to identify which formation was represented, and these fluvial deposits are flagged. The absence of a marine fauna made dating more difficult.

Oldman Formation

Excellent outcrops of the Oldman Formation, and possibly the overlying Dinosaur Park Formation, were identified in Black Diamond; at the Cottage Club, Ghost Dam; and at Cochrane.

At Black Diamond, the section exposes a thick section of interbedded thinner sandstone and thicker mudstone intervals. The rocks dip fairly steeply, and are exposed along a scarp which parallels the road between Turner Valley and Black Diamond. The sandstone beds are generally up to one metre thick near the base of each sandstone package, and comprise trough cross-bedded sandstone beds. These tend to thin upward, with the upper few centimetres of sandstone being rippled. Stepping back from the outcrop, it is clear that every sandstone is cut through by lateral accretion surfaces. Fossils include plants and unionid bivalves. This outcropping section is interpreted to have been deposited by a series of meandering river channels.

Another outcrop in Sheep River Provincial Park shows a similar depositional setting, and may be from the Milk River Formation.

At the Cottage Club, a series of low net:gross channel deposits outcrop along the Bow River, just below Ghost Dam. These channels have a relatively simple architecture, devoid of lateral accretion surfaces, and are interpreted as low sinuosity channels.

At Cochrane, a magnificent section exposes a series of low net:gross channel deposits. Both laterally extensive fluvial sandbodies and smaller, more incised channels, outcrop, with a potential structural

control. Interpreted crevasse splays can be correlated with the channels. Some unique trace fossils, associated with unionid bivalves, have been observed and interpreted at this outcrop.

Paskapoo Formation

Outcrops of the Paskapoo Formation were logged in Nose Creek Park, in Beddington; at Raven Rocks in Fish Creek Provincial Park; in the banks of Glenmore Reservoir; and along the Bow River. Sedimentary structures were examined in a series of isolated blocks were examined on Airport trail near Deerfoot City. In Nose Creek Park, several outcrops show different aspects of an interpreted meandering fluvial system in the Paskapoo Formation. Well preserved lateral accretion surfaces support this interpretation. The system is a low net:gross deposit with interbedded overbanks mudstone beds. The modern Nose Creek provides an excellent analogue to these outcrops.

The sandbodies at Glenmore Reservoir are more extensive, suggesting wider channels due to greater accommodation space or greater flow. Interpreted crevasse splays are common.

Outcrops along the Bow River are similar to the outcrops at Nose Creek Park and Glenmore Reservoir. Noteworthy was a temporary exposure of Paskapoo Sandstone in the thalweg at Harvey Heights rapids, which provided a highly unusual dataset comprising hundreds of golf balls.

Conclusions

The identified outcrops provide an excellent dataset for use both as field analogues and to construct 3-dimensional models that can be used to model gas flow in the subsurface.