

Balanced cross-sections: tools for finding bypassed oil and gas in the Crowsnest Pass and Hinton areas

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Summary

Two examples from the Crowsnest Pass and Hinton areas will be given to demonstrate that balanced cross sections using well and seismic data in combination with fieldwork can reveal hidden structures with may contain strata with bypassed oil and gas.

Introduction

Notwithstanding large completed production, the Foothills of Alberta still contain significant undiscovered oil and gas resources. Detailed geological and geophysical observations will be necessary to unlock these bypassed resources.

Theory and/or Method

The areas were mapped, LiDAR images analyzed and cross sections constructed based on seismic lines. The LithoTect software integrates information from outcrop and subsurface, allowing the balancing of these cross sections. These cross sections provide exploration targets.

Examples

On Turtle Mountain (SW Alberta) fault-propagation folding was observed and pre-, syn- and post-tectonic fractures were documented. In addition, LiDAR images were analyzed and cross sections constructed. It was determined that stress release played a role in reactivation of syn-fold and syn-thrust structures. The folding/thrusting phase took place during Paleocene/Eocene. Post-folding structures were formed from Miocene to the present. The fracture fabrics define the stability of the mountain and define areas where advanced warning systems need to be employed to secure the safety of the people in the Crowsnest Pass area. Seismic lines (Isaac *et al.*, 2008) allow structures in the Turtle Mountain and Livingstone thrust sheets to be tied to the Triangle Zone. Use of the LithoTect software allowed the construction of a balanced cross section (Figure 1).

In the Crowsnest Pass area the Upper Wabamun and equivalent Palliser are highly prospective. Correlation between the subsurface and outcrop demonstrates that the Upper Stettler shabkha dolomites of the Wabamun and equivalent lower Costigan dolomites of the Palliser display good reservoir potential (Hartel *et al.*, 2012). Unfortunately, the Exshaw silt between the high radioactive shales of Lower Exshaw and the Lower Banff (the Alberta Bakken in a strict sense) do not mimic the reservoir performance of the Williston Basin Bakken siltstone of 1000 bbls/day.

The prospective Costigan dolomites of the Crowsnest Pass area still remain largely unexplored except in some wells from the 1970s and in a more recent well near Green Creek. Several targets could be defined from Figure 1.

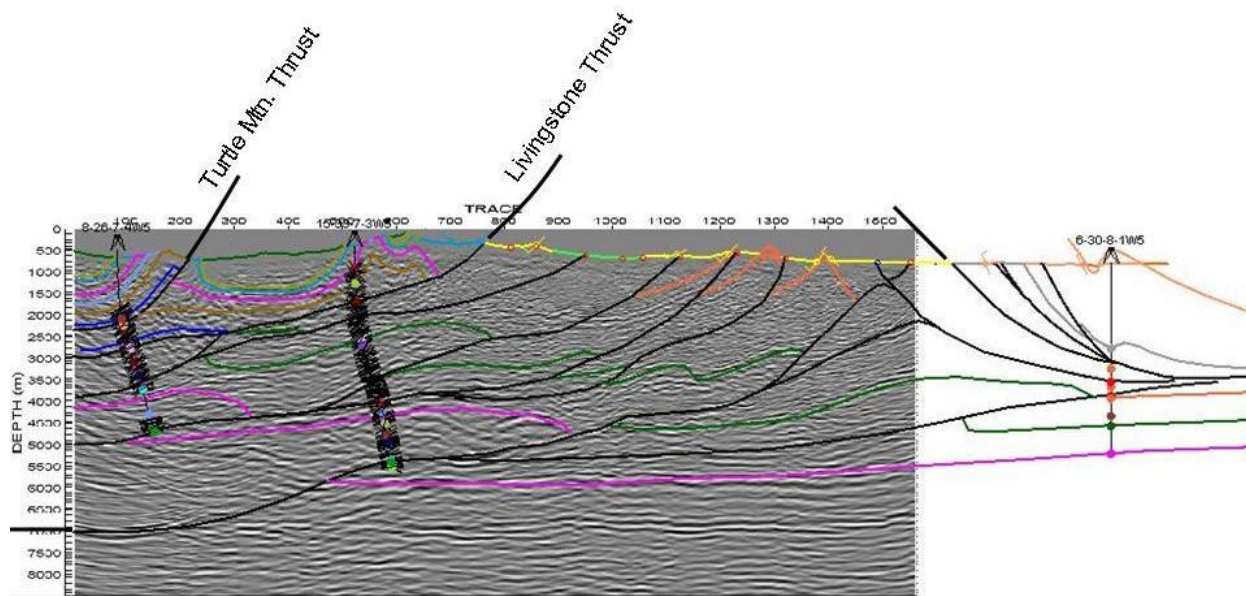


Figure 1. Crowsnest Pass cross section.

In the Hinton area, down-plunge cross sections and vitrinite reflectance aided in the location of petroleum and coal resources in the Moberly Creek area of the Foothills north of Hinton. The Collie Creek Thrust brings lower Cretaceous coal to the surface. The rank indicates that the source rocks are in the gas window. Balancing this section (Figure 2; balancing performed by Thomas Kubli) indicates a major blind and untested anticline in the Triangle zone, below the Wildhay back thrust.

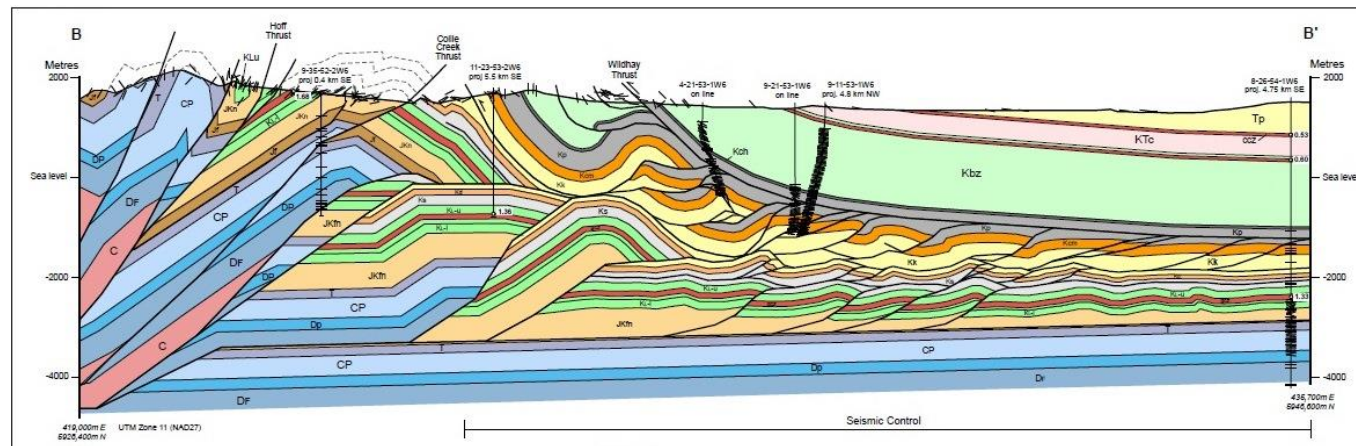


Figure 2. Balanced Moberly Creek cross section (from Langenberg *et al.*, 2002).

A detailed cross section was obtained through the Salomon Anticline in the Collie Creek Thrust sheet near the Moberly Creek cross section. The low volatile bituminous coal shows tectonic

thickening in fold hinges. Balancing this cross section reveals that the Collie Creek Thrust is deeper than originally assumed (Figure 3).

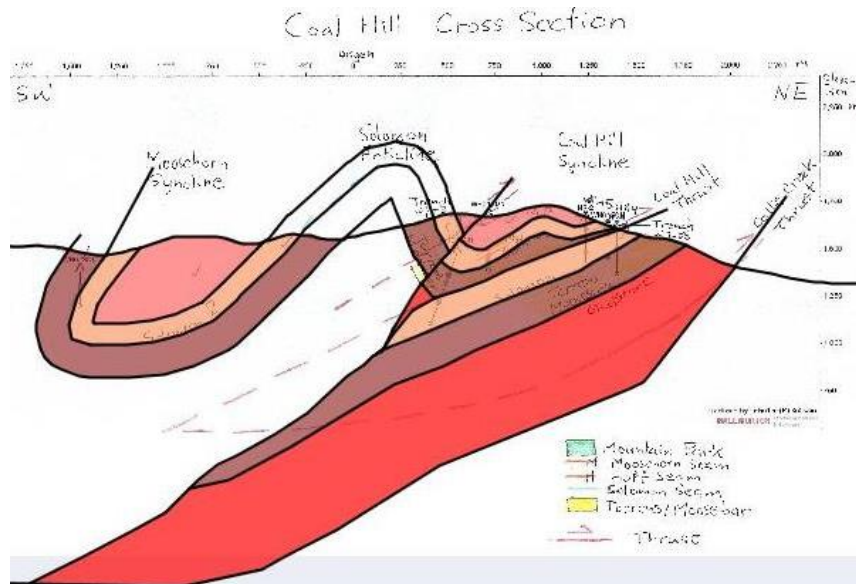


Figure 3. Balanced Collie Creek Thrust sheet cross section.

Conclusions

Balanced cross sections provide exploration targets for bypassed oil and gas in the Crowsnest Pass and Hinton areas. Initial exploration in the 'Alberta Bakken' plays targeted the un-prospective Exshaw stratigraphic horizon. It might be un-productive to label plays such as the Exshaw play as shale gas or shale oil plays because production is from a variety of lithologies and not just pure shale. It is suggested to drop the shale gas term and designate such resources as bypassed oil and gas.

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References

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