

Biostratigraphy of the Montney Formation: From the Alberta and British Columbia subsurface, to the Outcrop

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Summary

For the last few years we have been focused on the development of our Montney (Early Triassic) Tupper and Tupper West tight gas fields in NE BC. Initial work focused on a regional evaluation of the Montney Formation, to place this play into context, a reinterpretation of the depositional model for the Montney (Figure 1), as well as construction of a sequence stratigraphic model (Wilson, 2009, 2011), to provide a rigorous framework to develop these assets.

As development progressed from our Tupper Field to our Groundbirch assets, we identified that the 'type wells' for the Montney-Doig Formational boundary were not representative for the western part of the Peace River Embayment (PRE) where we identified additional stratigraphic units, and shallower water facies, that were not present in the 'type logs'. In the east the boundary is a clear, erosional unconformity, however, in the west the boundary is much more transitional-conformable and suggests more continuous deposition between the Montney and Doig Phosphate Formations (Figure 2).

To test this idea, we collected 40 core samples for conodont biostratigraphy from a transect (Figure 3) from the AB/BC border to the western part of the PRE, which allowed us to integrate the limited amount of published data (Davies et al., 1997) from west central Alberta with the more extensive dataset from Williston Lake and the outcrops along the thrust front (e.g. Zonneveld et al., 2010, Orchard and Zonneveld, 2009). The aim of this study was to determine the relationship between the Montney and Doig Phosphate Formations, and test whether the Montney Formation is restricted to the Early Triassic or whether we see a more complete record of deposition in the western deeper parts of the PRE.

Results

Our results are summarized in Figure 2. The key points are:

- The Lower Montney (Figure 2) was deposited (BC stratigraphy; Wilson 2009, 2010) in the Early Triassic, during the Induan (Griesbachian - Smithian) stage. Samples from the top of the Lower Montney (a pronounced GR marker present across the basin; Figure 1) are of Early Triassic, late Smithian age. Additional samples are required to determine if this top is a regional chronological marker.
- Conodont recovery from the Middle Montney (Figure 2) was limited by the facies, and by the limited number of cores in this zone. Underlying and overlying conodont samples constrain the age of the Middle Montney to being Early Triassic, and of late Smithian to Spathian age. Additional samples need to be collected from laterally equivalent zones to place firmer constraints on this unit.

- Rapid progradation of the Upper Montney clinofolds (A-C; Figure 3) occurred during the Early Triassic, Spathian age. Deposition of the overlying clinofolds, the Upper Montney D-E, initiated during the Middle Triassic, late Spathian to early Anisian and probably continued to the middle Anisian, and preserved shallower water facies (Lower Shoreface?).
- Overlying these clinofolds, the Doig Phosphate transgressed across the subareally exposed Montney surface during the Middle Anisian.
- Progradation of the overlying Doig Formation began in the Middle Triassic, late Anisian to Ladinian.

Conclusions

Depositional geometries, stratigraphic relationships, and biostratigraphy indicate that the deposition of the Montney Formation was not restricted to the Early Triassic as was previously thought and continued into the Middle Triassic, early-middle Anisian age. The boundary at the top of the Montney Formation in many places is a clear marker; in other areas it is more transitional and therefore 'type logs' require re-evaluation in these areas.

When we compare these data with the sections from Williston Lake and the outcrops along the front ranges we see equivalent Early to Middle Triassic formations. However in these sections we see rapid thickness variations between sections, missing / non-deposition of some periods, which suggests significant syn-depositional movement, in a distal quiescent environment? So we now have a better grasp on some aspects of the Montney but there are still plenty of problems to still to solve.

Acknowledgements

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References

- Davies, G., 1997, The Triassic of the Western Canadian Sedimentary Basin: tectonic and stratigraphic framework, paleogeography, paleoclimate and biota, CSPG Bull., 45, No. 4, 434-460.
- Orchard, M J and Zonneveld, J -P., 2009, The Lower Triassic Sulphur Mountain Formation in the Wapiti Lake area: lithostratigraphy, conodont biostratigraphy, and a new biozonation for the lower Olenekian (Smithian), Canadian Journal of Earth Sciences, 46, no. 10, 2009, pages 757-790, doi:10.1139/E09-051 (ESS Cont.# 20080714)
- Wilson, N., 2009, Integrated Regional Model for the Deposition and Evolution of Montney Formation, NE British Columbia, CSUG Conference Presentation, Nov 2009, Calgary, AB.
- Wilson, N. and Zonneveld, JP., 2011, Transition of the Montney to Doig Formations; subsurface to outcrop correlations, NE BC, BC Unconventional Gas Forum Presentation, April 2011.
- Zonneveld, J -P; Orchard, M J; Beatty, T W; McRoberts, C; Williford, K H, Stratigraphic architecture of Upper Triassic strata in the Williston Lake area, northeastern British Columbia: implication for the Carnian-Norian GSSP in, New developments on Triassic integrated stratigraphy, Program and Abstracts; Di Stephano, P (ed.); Balini, M (ed.). 2010, pages 49 (ESS Cont.# 20100469).

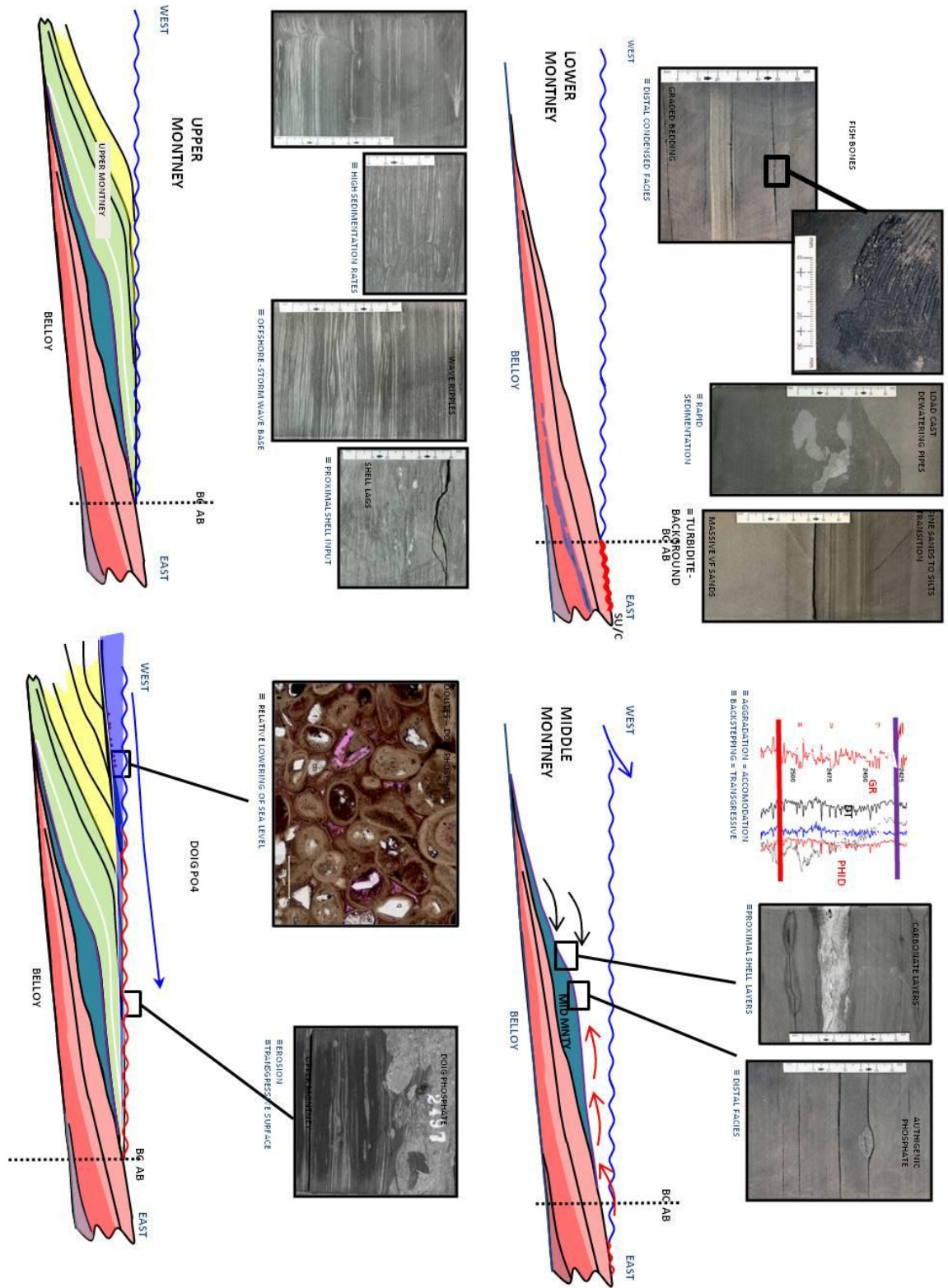


Figure 1. Depositional Model for the Montney Formation.

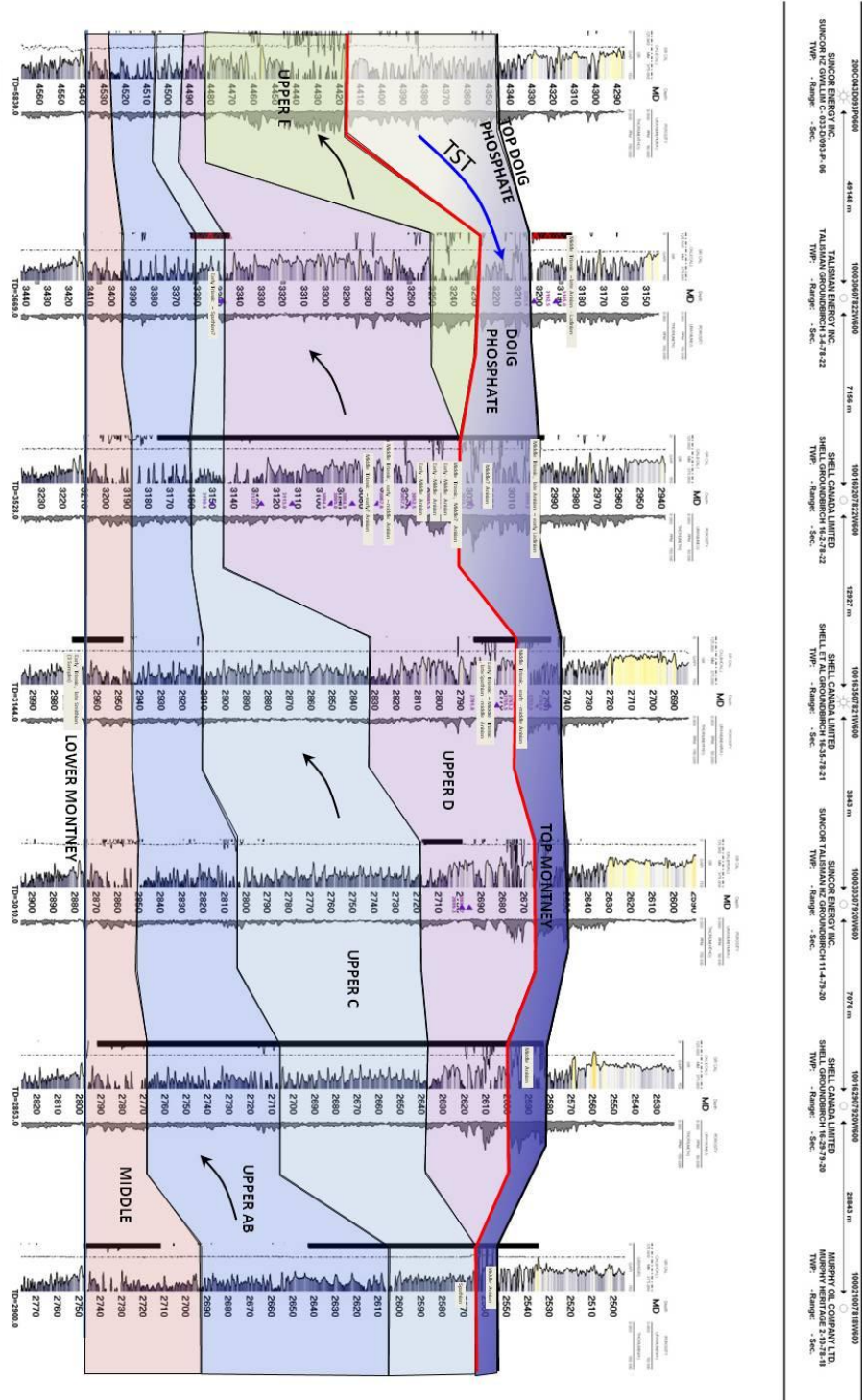
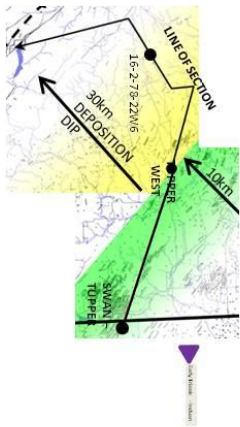


Figure 2. Cross section from Groundbirch to the mountain front showing where the biostrat samples were taken.