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2027 Atlas Update on the Rocky Mountains and Foothills Chapter for Alberta and BC

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Summary

The chapter contains a set of consistent structural cross sections to illustrate the variation of structural style in the deformed belt from the United States border (49°N) to 60°N near Liard River, a distance of approximately 1400 km. This chapter and interpreted cross sections represent a significant update to “Chapter 2: Cordilleran Tectonics and the Evolution of the Western Canada Sedimentary Basin” of the Geological Atlas of the Western Canada Sedimentary Basin (Mossop & Shetsen, 1994) and include digitized versions of previously published cross sections, significantly modified versions of previously published cross sections and original cross sections created in digital software products. Construction of these sections is based upon published maps, digitized well information and, where available, seismic data. This paper will describe the final submitted version of this chapter in the Atlas.

The Cross-sections

Figure 1 shows the cross sections included in the Chapter on a digital elevation model (DEM) base map. All cross sections have been prepared to be downloaded in high-resolution digital format and include spatial data coordinates. In total, 15 cross sections were completed as of the end of 2025 (indicated in red on the map in Figure 1). An additional 9 cross sections will be produced in Q1 2026 (indicated in blue on the map in Figure 1). An example of a completed and final drafted version of a cross section is shown in Figure 2, which would occupy an entire page in the Atlas Chapter. Note that the cross section example is divided, as given the length, much detail would be lost if the whole section was scaled to fit in a single page. Note that the cross section example also contains a small gap between wells numbered 42 and 46 to facilitate accommodating the cross section at a scale chosen for the Atlas publication. Many of the constructed cross sections will also display such gaps but none of the gaps will involve any significant structural features. Copies of the larger-scale version of all cross sections that are undivided and gap-free will be available digitally in an Appendix to the Chapter. In addition to the cross section all of the section figures will also include;

1. a legend customized to the stratigraphic units shown in the section,
2. a list of the UWI’s of the numbered wells shown in the cross-section,
3. an index map showing the location of the section,
4. a short description of the key features of the cross section by the main interpreter.

All cross sections have been created using a consistent colour scheme, based on stratigraphic age, to allow for easy comparison of structural styles within and between the cross sections. Note that several cross sections extend eastwards, into the foreland basin to illustrate the linkage between deformation in the deformed belt to the west, to deformation in the foreland basin to the

east. Additionally, some of the sections extend westwards, across the Rocky Mountain Trench (RMT), into the more deformed and metamorphosed Proterozoic and Phanerozoic rocks in the eastern part of British Columbia. These extended, large-scale cross sections provide a more holistic view of the deformation across the entire North American Margin, in comparison to those published in the previous version of the WCSB Atlas (Mossop & Shetsen, 1994).

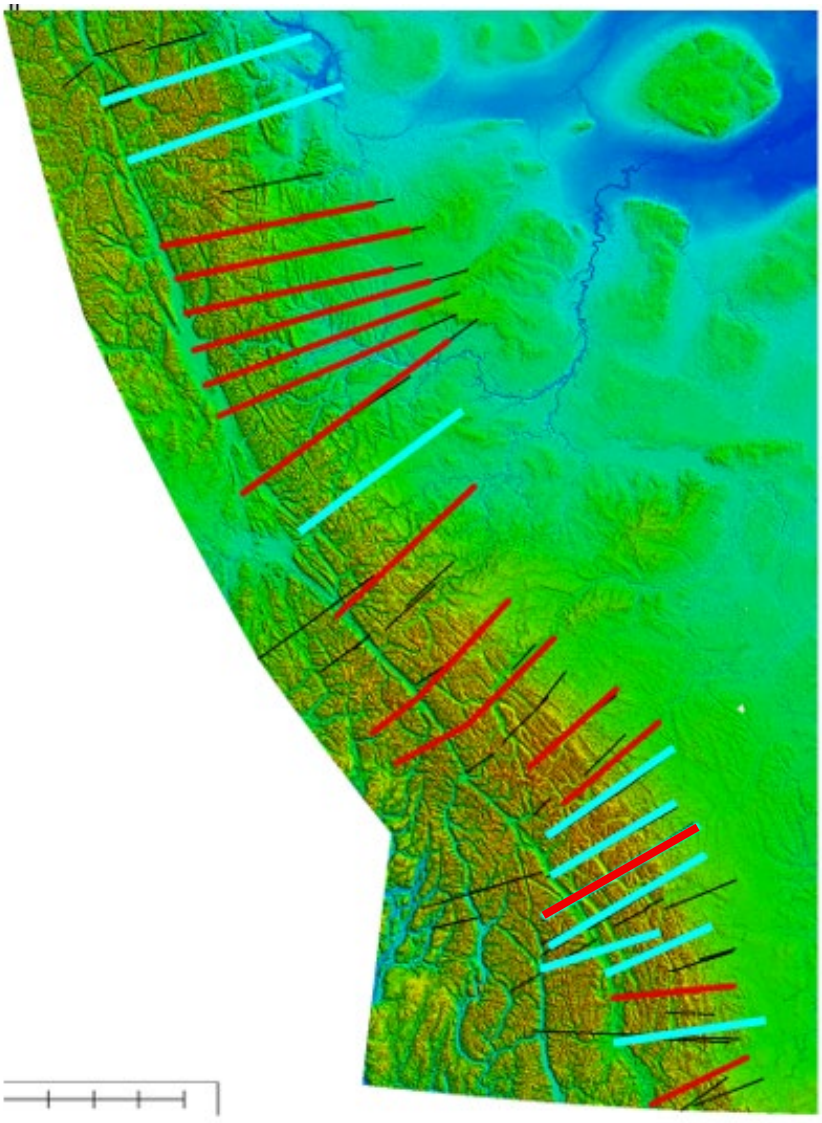


Figure 1. A topographic map showing the locations of the chapter cross sections for Alberta and British Columbia. Black Lines are existing published cross sections that have been used in the construction of the chapter cross sections. Red Lines are cross sections completed as of end 2025. Blue lines are cross sections to be completed in Q1 2026.

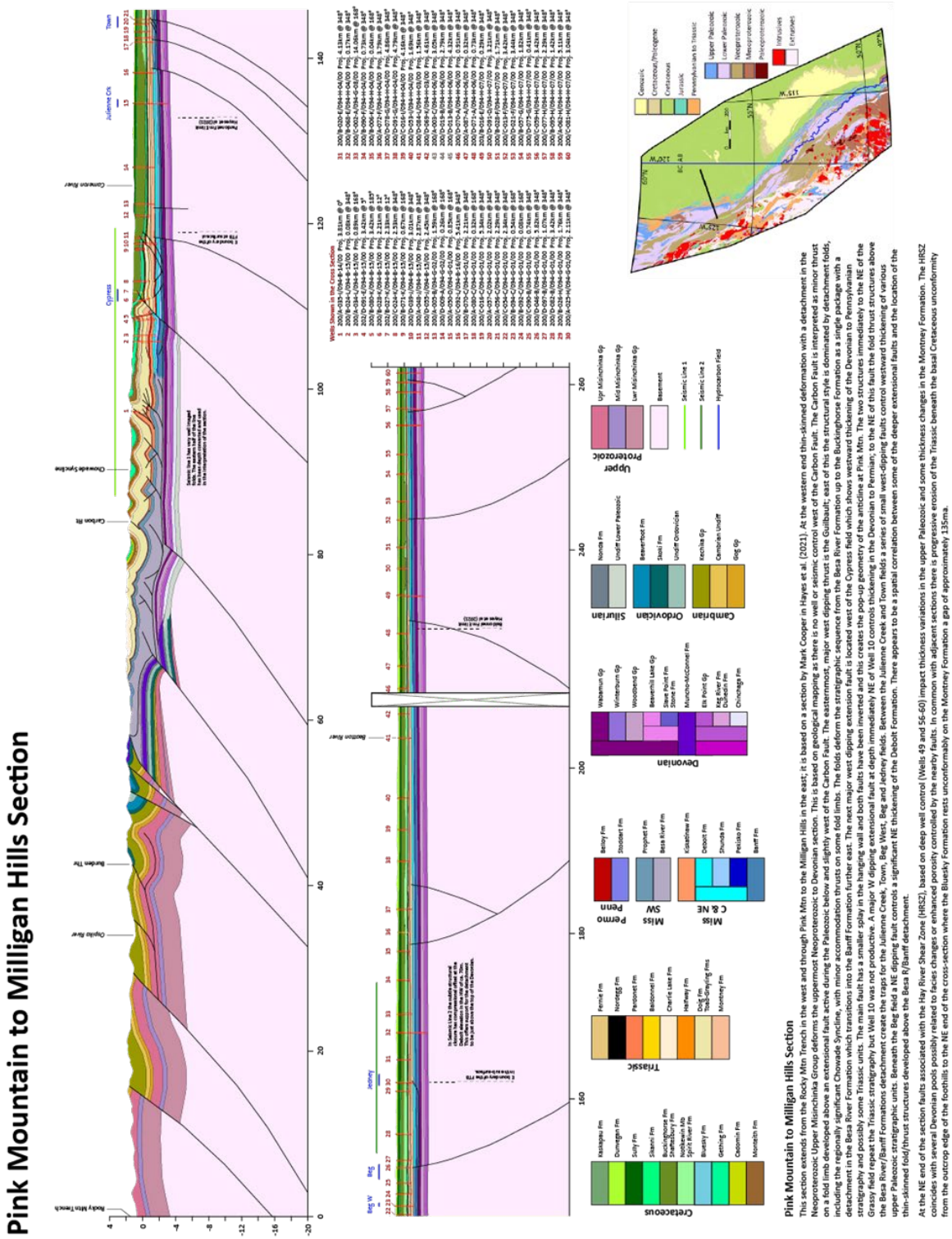


Figure 2. An example of the final drafted cross section product “Pink Mountain to Milligan Hills, British Columbia.” This will occupy an entire page in the Atlas Chapter.

Insights and Learnings from the Cross-Sections

The cross-sections illustrate the structural style variations which resulted from the deformation history of the fold and thrust belt through the Mesozoic and Cenozoic considering the relationship between deformation and stratigraphy of the basin. The cross-sections can also be used to create palinspastic restorations of selected stratigraphic units. The suite of sections provides the following insights into the fold and thrust belt:

1. Significant and abrupt structural changes occur at basement terrane boundaries and at changes in the rifted continental margin developed in the Proterozoic and Early Paleozoic.

2. Structural style is influenced by the mechanical stratigraphy of the deformed strata and how the stratigraphy changes along strike in the fold belt. Interaction between tectonic processes and erosion also contribute to variations of structural styles.

3. Basement involvement in the structures and the eastward extent of the fold and thrust belt into the foreland varies along the length of the deformed belt. Changes in basement properties and tectonic histories result in along strike changes from thick- to thin-skinned to mixed styles including inverted extensional faults.

4. The fold and thrust belt contains significant changes in displacement along strike creating structural salients and re-entrants manifested as lateral ramps; these changes influence hydrocarbon pool distribution, for example the lateral ramp at the Panther River culmination and the southern end of Limestone Mountain and the Peace Reach Lateral Ramp in BC.

5. There is a regional change shortening in the fold and thrust belt from south to north along strike. In the south the shortening is larger and large displacement thrusts are dominant, e.g. the Lewis Thrust. This continues northwards into the central Alberta Foothills but as the displacement decreases on the Lewis Thrust it is transferred onto other large displacement thrusts e.g. the McConnell Thrust. In the northern Alberta foothills, north of McLeod River, thrust displacements are much reduced and folding becomes more dominant and as the foothills cross the border into BC folding becomes increasingly dominant as thrust displacements continue to decrease.

The intention of the new Atlas is that it will be an “evergreen” digital document the cross-sections can be changed and that alternate interpretations and additional infill sections can be added. To facilitate this the database of well data which includes basic well information, deviation surveys and tops will be available for use. In addition, a GIS project that was created to allow easy browsing of what data resources exist for new sections to be created will be available for use.

Acknowledgements

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References

Mossop, G.D. and Shetsen, I., comp. (1994): Geological atlas of the Western Canada Sedimentary Basin; Canadian Society of Petroleum Geologists and Alberta Research Council, URL https://ags.aer.ca/reports/atlas-western-canada-sedimentary-basin .