

Geology of the Rocky Mountains West of Calgary, Alberta, in the Kananaskis West Half Map Area (82J)*

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Summary

The Rocky Mountain Thrust and Fold Belt forms the eastern margin of the Canadian Cordillera and is one of the world's classic thin-skinned thrust and fold belts. Great exposures of the thrust and fold belt occur west of Calgary in an area that includes the Kananaskis west half map area ([Figure 1](#)). The Kananaskis west half map area extends from the western edge of the Rocky Mountain Foothills in the northeast to the Southern Rocky Mountain Trench in the southwest ([Figure 1](#)). Major changes in stratigraphy and structural style occur across the area. The Lower Paleozoic section thickens dramatically from both the northeast and the southwest into the White River Trough extensional basin (Cecile and Norford, 1993) by a combination of depositional thickening and increased preservation beneath the sub-Devonian unconformity ([Figure 2](#)). A major facies change in Middle Cambrian to Middle Ordovician strata from "platformal carbonates" to a thick, shaly, basinal succession at the Kickinghorse Rim (Aitken, 1971) marks the eastern boundary of the White River Trough in the north-central part of the Kananaskis west half area. Upper Ordovician and Lower Devonian ultramafic diatreme breccia pipes and dykes in the White River Trough succession indicate episodic crustal extension continued into the Devonian. Significant hydrothermal alteration occurred along the Kickinghorse Rim and produced the Brussilof magnesite mine and several Zn showings. Upper Devonian Fairholme Group also changes facies westward into basinal strata in the eastern part of the study area. Both facies changes affected the subsequent structural style.

The structural style in the Front Ranges, in the northeast part of the study area, is dominated by major thrust faults carrying variably folded Paleozoic and Mesozoic carbonate and clastic strata. Imbricate thrust slices and duplexes are commonly developed along the leading edge of each major thrust fault. Map relationships show significant displacement transfer, and kinematic linkage occurred between the individual thrust faults. A prominent zone of transverse faults, with a syn-sedimentary, basement-controlled origin (McMechan, 2010), crosscut Paleozoic strata in each thrust sheet in the east-central part of the area. Kilometre-scale folds dominate the structural style of Upper Paleozoic strata where the Upper Devonian Fairholme Group has changed facies into basinal shale. A change in level of exposure to Neoproterozoic, Cambrian and Ordovician strata marks a south-plunging culmination in the Bourgeau thrust sheet and the transition into the Main Ranges. East and north of the Kickinghorse Rim competent, Lower Paleozoic strata outline the classic large-scale open-folded eastern Main Ranges structural style and form castellated mountain peaks, including Mount Assiniboine. Immediately basinward of the Rim, tight and overturned northeast-facing folds occur, whereas a regional southwest-facing, overturned fold occurs at the transition into the Western Ranges along the western edge of the

study area. Steep longitudinal and transverse faults cutting folded Cambrian to Middle Devonian strata characterize the Western Ranges. Thick breccia zones occur along several faults, the Redwall breccia being the most well known of these.

Until now, bedrock geological map coverage of the Rocky Mountains west of Calgary in the Kananaskis west half area was incomplete. New GIS-enabled bedrock geological maps for 6 of the 8 1:50,000 sheets comprising the area are published (McMechan, 2011, 2012, 2013; McMechan and Leech, 2011a,b,c;) and available for free download at the Natural Resources Canada website. These maps will provide a detailed geologic framework for geologists and outdoor enthusiasts alike.

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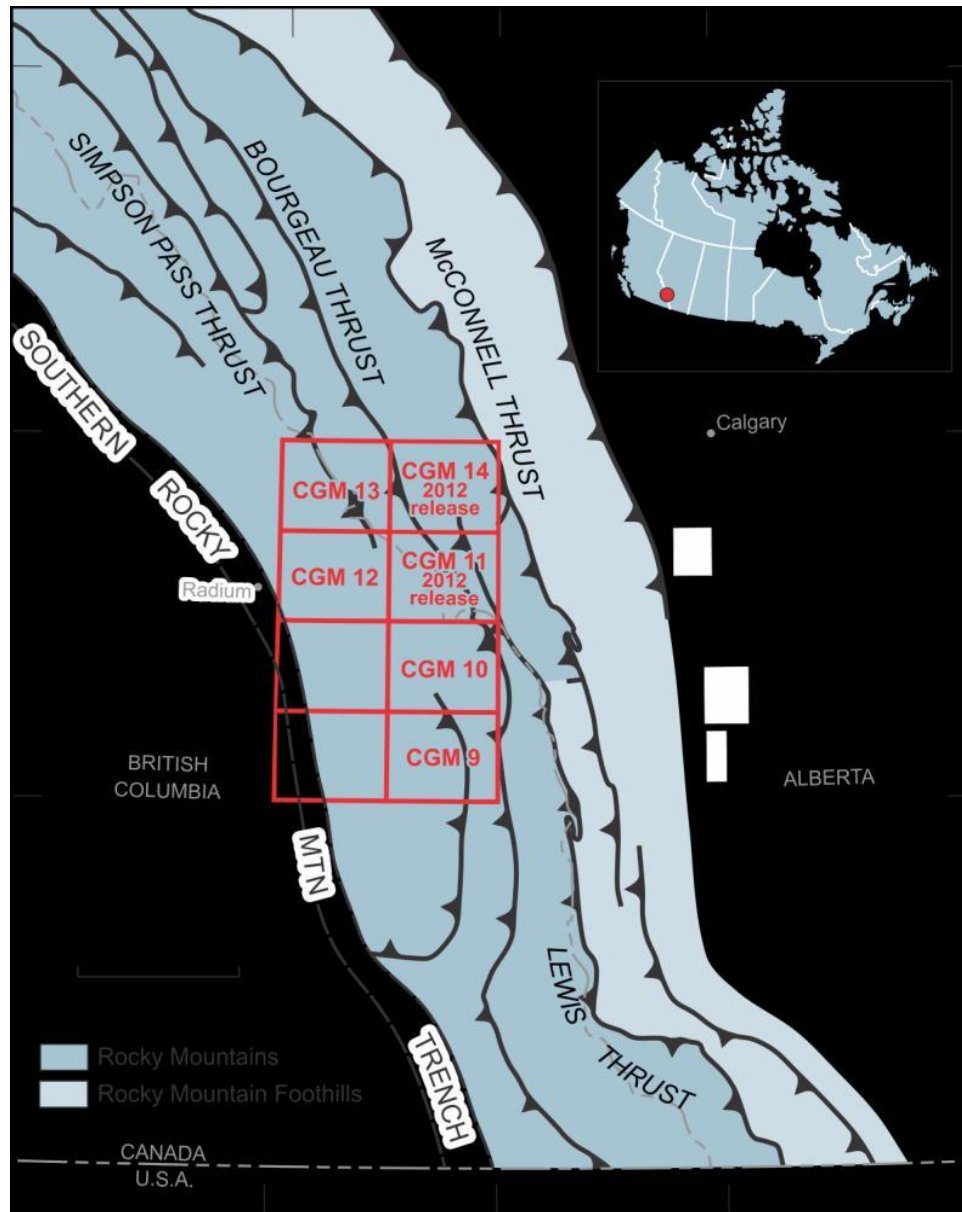


Figure 1. Location of the Kananaskis west half map area and new GIS-enabled bedrock geology maps relative to the major thrust faults in the southern Canadian Rocky Mountains Fold and Thrust belt.

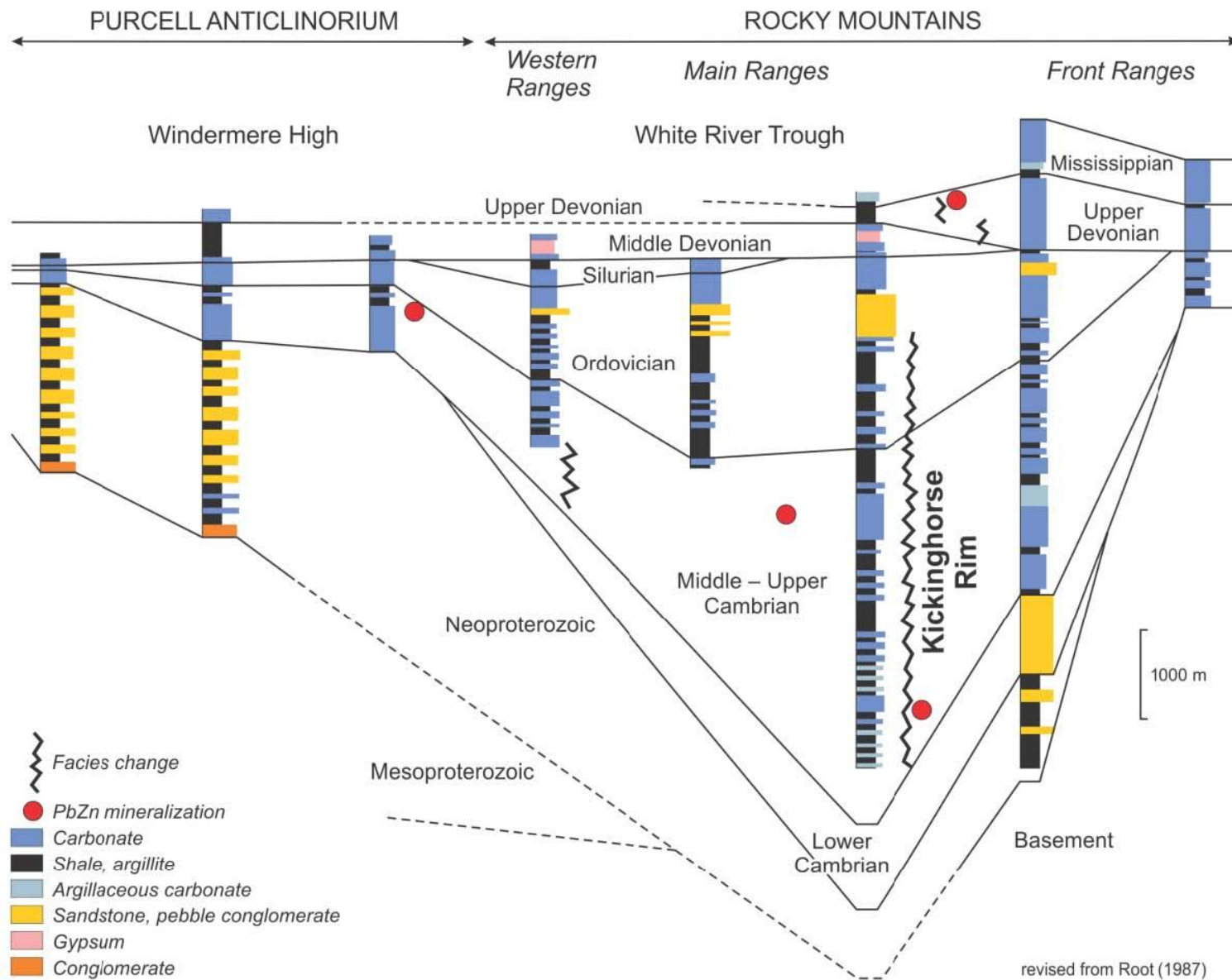


Figure 2. Stratigraphic cross section of pre-Pennsylvanian and Proterozoic strata from the leading edge of the McConnell Thrust sheet to southwest of Radium.