

The type section of the Canol Formation (Devonian black shale) at Powell Creek: Critical assessment and correlation in the northern Cordillera, NWT, Canada

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Summary

Type stratigraphic sections (stratotypes) are key in defining and tracing stratal units for various industrial and fundamental research applications. Once defined, a stratotype cannot be abandoned, but its usefulness can be drastically limited by major regional facies changes, justifying the need for supplementary reference sections (NACSN, 2005). This situation fully applies to the Canol Formation, a black-shale unit of broad geographic extent in the Northwest Territories and northern Yukon. The Canol Formation has a major economic potential as a high-quality shale hydrocarbon prospect. This formation also provides invaluable information about global oceanic processes and carbon-cycle perturbation events of the Devonian time (e.g., Fraser and Hutchison, 2017; Kabanov and Jiang, 2020; Biddle et al., 2021; Kabanov, 2022). The stratotype of the Canol Formation at Powell Creek is neither thick enough, nor an adequately representative for this formation across its geographic expanse, and definitions of base, top, and internal stratigraphy in this section were not consistent in a sequence of regional geology papers. These shortcomings in stratotype definition motivated our work (Kabanov and Gouwy, 2021).

Results, Observations, Conclusions

The Canol Formation is only 24.5 m thick at its historic type section at Powell Creek, northern Mackenzie Mountains, whereas in the off-bank sections of the Mackenzie Plain subsurface, where it is considered a high-quality shale hydrocarbon prospect, it thickens to 60–120 m. Kabanov and Gouwy (2021) review available lithological and conodont biostratigraphic information from the type section, discuss choices of contacts and subdivisions, and explore the limits of regional correlation using gamma spectrometry proxies. The base of the Canol Formation is positioned at the top of the lower resistant unit of the “allochthonous limestone beds” *sensu* MacKenzie (1970), the thick off-reef debris package present in this outcrop but absent in other well-known Canol sections. The base of the formation can be of a latest Givetian age as suggested by the *Skeletognathus norrisi* zone conodont fauna from the “allochthonous limestone”. The top of the Canol Formation is placed at the base of a distinct, 2.1 m thick horizon with concretionary carbonate beds within the thick shale transition between the Canol and the Imperial formations. Limestone nodules from this horizon produced a conodont fauna that can occur in the *Palmatolepis jamieae* to Upper *P. rhenana* zones (Frasnian zones 11–12) thereby suggesting a middle to earliest Late Frasnian age for the Canol top. The cross-section tying several outcrop and well sections across the regional facies zonation reveals that the Dodo Canyon Member, a unit erected in thick off-bank Canol sections, is traceable at Powell Creek. In this correlation, the Vermillion Creek Member, which is the lower portion of the Canol Formation in thick off-bank sections, finds its counterpart in the allochthonous limestone beds *sensu* MacKenzie (1970). This cross-section is the first correlation of the Canol stratotype at member level available in published sources. Thinness of the Canol Formation at Powell Creek, as well as its location in the carbonate bank toe-of-slope setting, are factors impairing its reference value and

calling for more representative sections to act as reference sections and constitute a composite-stratotype for the Canol Formation.

Acknowledgements

The Powell Creek field mission and data processing were conducted in 2016 through the Mackenzie Project of Geomapping for Energy and Minerals (GEM) Program. We are grateful to Karen Fallas (GSC) who was the field party leader in 2016 and to Robert MacNaughton (GSC) who performed the internal GSC review of the early manuscript version. This paper (Kabanov and Gouwy, 2021), in its final form, greatly benefited from the constructive criticism of three anonymous reviewers. The rigorous scrutiny of the revised version by the Editor in Chief Hairuo Qing led to the utmost paper refinement. We feel very privileged to receive the prestigious 2022 CSPG Medal of Merit for our modest efforts in the Devonian stratigraphy of the Canadian North.

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