

Sedimentology and conodont biostratigraphy of Frasnian-Famennian units of southwest Northwest Territories

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Summary

The subsurface of southwest Northwest Territories holds a record of the tectonostratigraphic evolution of the Mackenzie Platform during the Devonian. These strata, scantily exposed across the Great Slave Plain, form with overlying Carboniferous rocks awe-inspiring outcrops along the Cordilleran fold and thrust belt. The general stratigraphy of Upper Devonian units in NWT has been revealed by multiple studies (see Morrow, 2012). Bulletins and memoirs published by the Geological Survey of Canada have put forth detailed syntheses of the Devonian geology of specific areas (Meijer-Drees 1993; Ferri et al., 2021). These efforts, mainly focused on outcrop belts, have provided a generally complete picture of the stratigraphy of the region and its potential to host mineral and hydrocarbon resources (e.g. gas showings/discoveries in the Jean Marie Member and the Kakisa Formation).

Despite this vast amount of work, detailed sedimentological and stratigraphic analyses of Upper Devonian units in the subsurface of southwest NWT are lacking. This, in part, is likely due to the lack of well-exposed outcrops and rare available cored material. In this presentation, we will showcase the preliminary results of an in-depth sedimentological study of the Upper Devonian subsurface of the Great Slave Plain based on core description and microfacies analysis. Intervals analyzed include discrete segments of the upper Fort Simpson, Redknife (including Jean Marie Mbr), Kakisa, Trout River, Tetcho, Kotcho, and lowermost Exshaw formations intersected by exploration well Island River No. 1 (Fig. 1). Together, these units represent sedimentation on the Mackenzie Platform during two transgressive-regressive cycles (T-R cycles C and D [Morrow 2012]). Updated relative ages based on their conodont content will also be provided.

Additive Information

The aim of the analyses mentioned above is to enhance our understanding of the tectonostratigraphic evolution of the northwestern margin of Laurentia during the Devonian. In general, the Paleozoic evolution of western Laurentia is divided into a period of tectonic quiescence during the Precambrian-Middle Devonian and a period of tectonic activity during the Late Devonian-Early Carboniferous (Miall 2019). Tectonic quiescence allowed for sedimentation of thick, extensive carbonate platforms on a passive margin along the western continental margin (e.g., Mackenzie Platform). In the Devonian, this tectonic lull was accompanied by continent-wide transgression of the Kaskaskia megasequence (Sloss 1963). Generalized transgression pushed the coastline to the east and inundated extensive areas of the craton, allowing for carbonate sedimentation to reach its peak across western Laurentia (i.e., Alberta and Northwest Territories).

By Middle-Late Devonian, rifting of the western Laurentian margin and the southwesterly advancement of the Ellesmerian orogen in northern Laurentia had a profound impact on sedimentation (Embry and Beauchamp 2019). A thick siliciclastic wedge developed in front of the Ellesmerian orogen to the north, and an influx of clastic sediments into northern Yukon and Northwest Territories blanketed earlier carbonate deposits (Gordey and Anderson, 1993). Rifting in western Laurentia and associated large-scale transform structures caused regional variations in rift magmatism, heat flow, and basin development. These conditions created localized tectonic settings for MVT and Sedex deposit formation in platform carbonates of the Mackenzie platform and coeval slope and basinal shales of the Selwyn Basin (Goodfellow 2007).

The proposed analyses in this study will provide us with a comprehensive understanding of the depositional systems and relative ages of Upper Devonian units in the study area. In turn, this will enhance our understanding of the tectonostratigraphic framework of the region and will facilitate regional lithostratigraphic and biostratigraphic correlation with coeval successions.

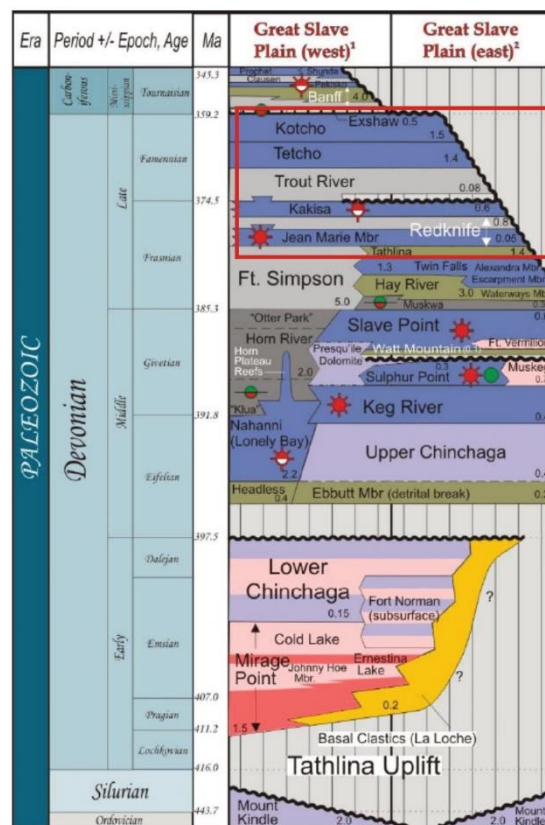


Figure 1. Table of formations for the subsurface of Great Slave Plain (southwest Northwest Territories). Red rectangle shows formations studied in this project. Modified from Morrow (2012).

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