

The Application of Ichnology, Sedimentology and Sequence Stratigraphy to Identify Reservoir Distribution in the Middle Triassic Sunset Prairie Formation, Northeastern British Columbia

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Summary

The Sunset Prairie Formation is a newly named Middle Triassic formation in the Western Canada Sedimentary Basin (Furlong et al., 2018a). Sitting above the Montney Formation (one of Canada's most important unconventional reservoir intervals), the Sunset Prairie Formation has the potential to contribute valuable hydrocarbon resources to wells drilled into Triassic horizons. This study incorporates sedimentological and ichnological characteristics of the Sunset Prairie Formation to construct a sequence stratigraphic framework to evaluate and predict reservoir-distribution and exploration potential of the Sunset Prairie Formation.

A facies analysis was conducted to characterize sedimentological, ichnological and paleontological features in 28 core across the basin. Thin sections were additionally utilized to document microscopic features, including grain size distribution, mineralogy, cement types and diagenetic features. Collectively, seven facies were identified that are ascribed to offshore, offshore transition and lower shoreface depositional facies associations (Furlong et al., 2018b). Three shoaling-upward parasequence sets can be identified through upward increases in grain size (up to very fine-grained sandstone), bioturbation intensity and trace fossil size. Additionally, a *Glossifungites*-demarcated discontinuity surface and/or conglomeratic lag deposit is observed at the base of each parasequence sets. The retrogradational stacking pattern of parasequence sets suggests an increase in relative sea level during deposition.

Sequence stratigraphically, the Sunset Prairie Formation is interpreted to represent lowstand systems tract during deposition of the lowermost parasequence set, which is capped by a maximum regressive surface; the overlying two parasequences represent the transgressive systems tract (Figure 1). The formation is bound by unconformities. The lower unconformity truncates the underlying Montney Formation. The upper unconformity, at the base of the Doig phosphate zone, truncates the Sunset Prairie Formation and, to the east, incises into the Montney Formation.

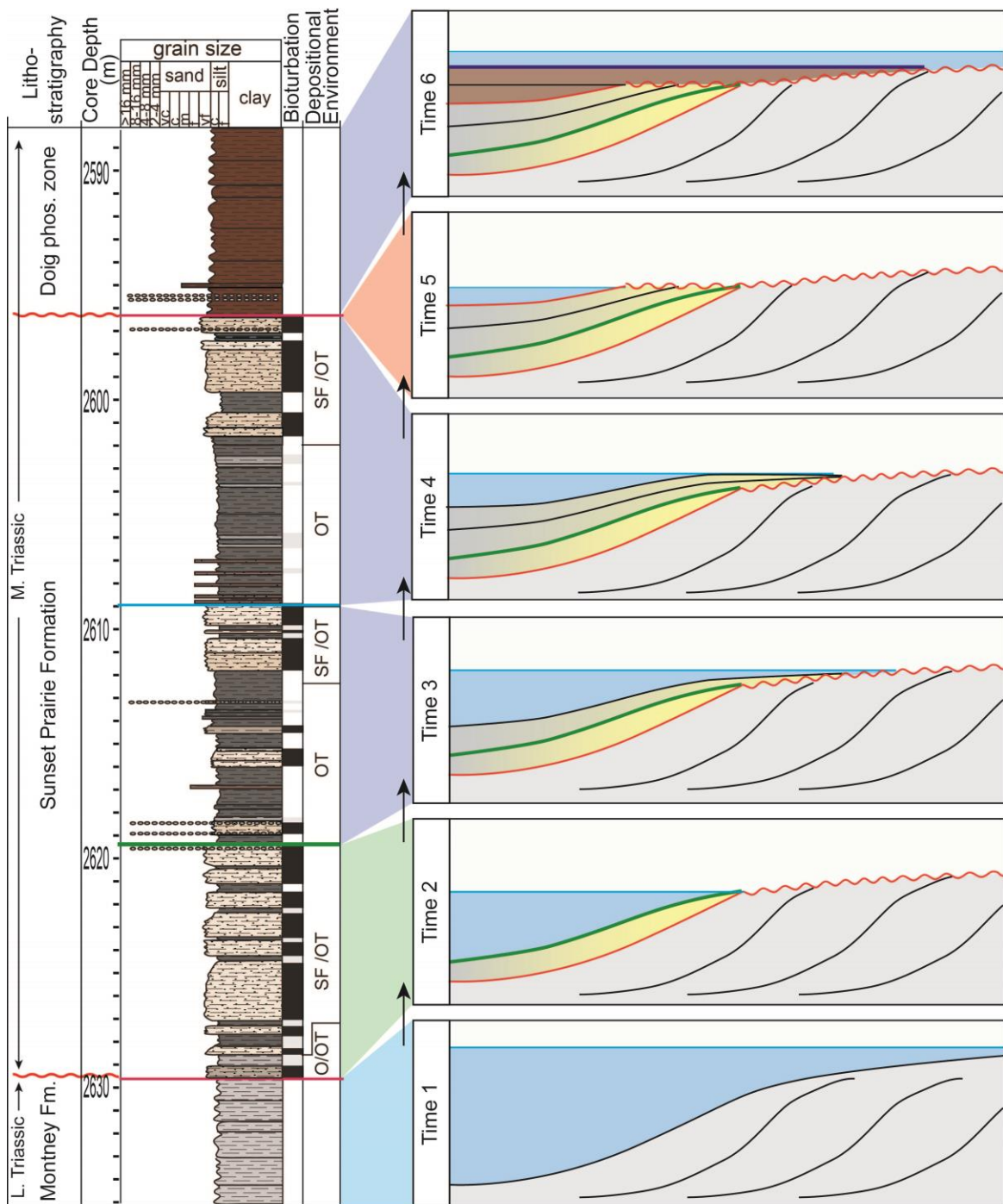
Due to the retrogradational nature of the parasequence sets, the lowermost parasequence set is where the thickest packages (up to 7 meters) of pervasively bioturbated, very-fine grained sandstone are observed. Fine-grained sand content, thickness of coarse-grained beds and bioturbation intensity decrease with each proceeding parasequence set. The result of this retrograde stacking pattern and high net to gross sand in the lowermost parasequence set produces a "pseudo conventional" reservoir within

a dominantly tight sandstone/siltstone interval. Elucidating the sequence stratigraphic architecture allows for better prediction of potential reservoir intervals to optimize hydrocarbon recovery within the Sunset Prairie Formation.

References

- Furlong, C.M., Gingras, M.K., Moslow, T. and Zonneveld, J-P. 2018a. The Sunset Prairie Formation: Designation of a new Middle Triassic formation between the Lower Triassic Montney Formation and Middle Triassic Doig Formation in the Western Canada Sedimentary Basin. *Bulletin of Canadian Petroleum Geology*, v. 66, p. 193-214.
- Furlong, C.M., Gogolick, A., Gingras, M.K., Hernandez, P., Moslow, T., Prenoslo, D, Playter, T. and Zonneveld, J-P. 2018b. Sedimentology and Ichnology of the Middle Triassic (Anisian) Sunset Prairie Formation of the Western Canada Sedimentary Basin. *Bulletin of Canadian Petroleum Geology*, v. 66, p. 215-236.

Figure 1 (on next page). Litholog and sequence stratigraphic interpretation for the Shell Groundbirch 16-29-079-20W6 drill core. Sequence stratigraphic schematic represents idealized depositional history of the Sunset Prairie within the Fort St. John Graben system.



Legend

- Sunset Prairie Fm Facies**
- Facies 1 ■ Facies 5
 - Facies 2 ■ Facies 6
 - Facies 3 ■ Facies 7
 - Facies 4 ○○○○ Facies 7
- Bioturbation Index (BI)**
- 6 (100% bioturbated)
 - 3 (50% bioturbated)
 - 0 (no bioturbation)

- Formations in Schematic**
- Montney Fm
 - Sunset Prairie Fm
 - Doig Phosphate Zone
- Depositional Environments**
- SF_L Lower Shoreface
 - OT_U Upper Offshore Transition
 - OT_L Lower Offshore Transition
 - O Offshore

- Sequence Stratigraphic Framework**
- ~ Sequence Boundary
 - Correlative Conformity
 - Transgressive Surface of Erosion
 - Maximum Flooding Surface
 - Flooding Surface
 - Transgressive Systems Tract
 - Sequence Boundary
 - Lowstand Systems Tract
 - Highstand Systems Tract