

Ichnological variability of a Cretaceous shelf-edge delta: the Missisauga Formation, Offshore Nova Scotia, Canada

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Summary

Shelf-edge-delta clastic wedges are reported to be deposited under a set of environmental factors that represent high to extreme physicochemical stressors on the benthos. Such elevated stress factors engender highly impoverished ichnological suites for individual sedimentary subenvironments. Shelf-edge delta deposits also demonstrate its characteristic sedimentological features in each of these subenvironments. Integration of sedimentologic and ichnologic evidence yields a robust and fine-tuned depositional model for the deltaic clastic wedges forming at and near the shelf margin.

During the Late Jurassic to the Early Cretaceous, a shelf-edge-delta prograded, where the present-day offshore Nova Scotian basin exists today. In the Sable subbasin, part of this deltaic megasequence is represented as the subsurface Lower Cretaceous upper Missisauga Formation (UMF) succession. Conventional cores from the UMF collected in the Glenelg and Alma fields have been studied here from an ichnological viewpoint and integrated to the sedimentological and stratigraphic framework.

On northeastern side of the Glenelg field, the ichnological expression of UMF shows two parasequences with conspicuous influence of bottom-current reworking by both tidal currents and underflows (“hyperpycnal” *sensu lato*) in its lower part of the upward-coarsening deltaic deposits. This lower interval demonstrates dominance of the archetypal *Phycosiphon* Ichnofacies. The overlying wave- and storm-influenced deltaic upper succession is dominated by the archetypal *Rosselia* Ichnofacies with subordinate occurrences of the *Phycosiphon* Ichnofacies. The archetypal deltaic ichnological nature of this part of the Glenelg field testifies that the delta developed on inner or, at the most, on medial shelf. On the southwestern part of the Glenelg field, the ichnological expression is uniquely of a deeper-marine variety of *Phycosiphon* Ichnofacies (or

a mixed *Zoophycos-Nereites-Phycosiphon* ichnofacies) of the clastic wedge forming near the paleo-shelf-slope break.

Contrastingly, the Alma field region demonstrates a peculiar and ubiquitous overprinting of a *Zoophycos(-Phycosiphon-Nereites)* suite on the pre-existing suites with high to complete bioturbation intensity and varying relationships in terms of tiering and taphonomic pathways. The pre-existing suites intermittently preserve relicts of what can be inferred to be archetypal *Skolithos*, *Rosselia*, and *Phycosiphon* ichnofacies at different depth intervals. Trace-fossil characteristics of the Alma region indicate development of the wave-influenced deltaic and shallow-marine clastic wedges at the distal-most region at the shelf-slope break, where likely the autogenic abandonment led to the development of the archetypal *Zoophycos* suite that overprints on all three previous suites.

Shell-fragment-rich erosional discontinuity surfaces preserve the *Glossifungites* Ichnofacies possibly marking the intermittent flooding surfaces in both regions.

Keywords: Delta; ichnofacies; shelf-edge delta; deltaic ichnology; Missisauga Formation; Nova Scotian offshore.

References

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