

Basinal and sedimentological controls on organic matter preservation and distribution in distal mudrocks of the Upper Cretaceous Colorado Group

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Summary

Allostratigraphic frameworks permit the comparison of time-correlative units within the Colorado Group across the foredeep, forebulge and backbulge sections of the Western Canada Foreland Basin (WCFB) – a task that had not yet been performed prior to the current study. This work focuses on the mudstone-dominated Fish Scales to Second White Specks formations and incorporates sedimentological and geochemical data into a basinwide allostratigraphic scheme to better understand subsidence history in the distal portions of the WCFB and, in turn, how basinal controls influenced sedimentation and organic matter preservation.

Theory / Method / Workflow

The Fish Scales to Second White Specks formations were deposited during a major epicontinental marine transgression over North America and span the foredeep, forebulge, and backbulge segments of the WCFB. This basinwide interval records depositional response to time-variant and paleogeographically diverse tectonic, eustatic and climatic controls that influence a broad spectrum of depositional and burial histories of carbonaceous mudstone strata (Schröder-Adams, et al., 2001; Tyagi et al., 2007; Varban and Plint, 2008; Hu and Plint, 2009). This varied record, along with abundant public domain data available from oil and gas exploration in Alberta and Saskatchewan, provides an exceptional opportunity to investigate the allogenic controls influencing organic matter preservation and distribution beyond the foredeep. Furthermore, extensive drilling in the WCFB has produced a valuable collection of well log and core data that allows correlation of key surfaces with confidence.

Isopach and lithology distribution maps developed for each allomember within the framework demonstrate basinal controls on sedimentation patterns and lateral compositional variability, reflecting depositional conditions that influenced sedimentation across the basin at that time. Geochemical data obtained from programmed pyrolysis (Rock-Eval II and Rock-Eval 6) and direct combustion (LECO SC-444) was integrated into the framework to evaluate patterns in organic matter preservation and stratigraphic distribution that is unique to its position within the basin.

Results, Observations, Conclusions

The basinwide allostratigraphic framework demonstrates a degree of stratigraphic condensation with allomembers thinning basinward and becoming completely or locally truncated, or the units gradually thicken as they extend eastward past the forebulge region. Stratigraphic mapping completed at basin scale demonstrates differential subsidence occurring from the interplay

between basement structures and shifting depocentres. Generally, organic matter preservation across the basin is greatest within thinly bedded silty argillaceous mudstone and very thinly bedded, calcareous-argillaceous mudstone deposits. Facies evaluation and lithology mapping at allomember scale show lateral and vertical variation of organic matter preservation and distribution is controlled by factors contributing to the transport and deposition of fine-grained allogenic sediments.

References

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