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Repeated exposure of shorelines in the non-marine to marine transition of the Lower Mannville Group in southern and west-central Alberta

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ABSTRACT

Distinguishing between non-marine and marginal marine shorelines can be challenging where freshwater input to waterbodies influences trace-fossil composition and genetic packages are thin, but it is important for understanding the early fill of the Cretaceous foreland basin in Alberta as well as the distribution of organic source types and the size and distribution of reservoir bodies. This study investigates the non-marine to marine transition in the upper Lower Mannville Group in two study areas, where thin (~1-3 m) coarsening-upwards packages are especially apparent adjacent to structural uplifts, namely, the Pembina High in west-central Alberta and the Sweetgrass Arch in southern Alberta. Evidence for repeated flooding and exposure of small-scale wave-influenced shorelines and other progradational settings (e.g., delta lobes) from trace fossils, rhizoliths, sedimentary structures, and facies packaging is present in both study areas. Although they are often misidentified or go unrecognized, terrestrial backfilled burrows are key to recognizing exposure at the tops of the packages and the basinward position of the shoreline in both marginal marine and lacustrine settings. X-ray fluorescence and RockEval data from cores help to interpret conditions in the water bodies, which range from isolated or restricted small bays and/or lakes to marine. Statistical analysis using “depth” series to help recognize cyclicity in the stratigraphy and determine thicknesses of repeated facies packages also helps to distinguish stratigraphic units across the irregular underlying topography of the Lower Mannville Group. This integrated approach is needed to interpret and map complex facies distributions in depositional settings with variable degrees of non-marine vs. marine influence.

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