Sedimentology, Ichnology, and Stratigraphy of the Sparky, Waseca, and McLaren Alloformations, West-Central Saskatchewan, Canada

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The Lower Cretaceous Sparky, Waseca, and McLaren alloformations (Upper Mannville Group) of west-central Saskatchewan comprise an interval up to 60 m thick, consisting of weakly consolidated sandstones, shales, heterolithic bedsets and minor coals, deposited in shallow-marine to coastal plain/delta plain environments. Thirteen facies are recognized. These facies are grouped into six spatially recurring facies associations. Facies Association 1 (FA1) includes sediments deposited below fairweather wave base, but above storm wave base. Facies associations 2 and 3 (FA2 and FA3) coarsen upward and represent the progradation of wave- and storm-dominated shorefaces and mixed wave and river-dominated deltas, respectively. Facies Association 4 (FA4) typically cuts through FA3, and displays a fining-upward trend. Facies Association 4 (FA4) commonly displays fining-upward successions, interpreted as distributary channels and fluvio-estuarine deposits, depending upon their stratigraphic context. Facies Association 5 (FA5) is broadly similar to FA2 but ichnologically distinct. The succession is characterized by low-diversity, impoverished trace-fossil suites with variable bioturbation intensities that is interpreted to record deposition in shallow brackish-water bays. Facies Association 6 (FA6) successions are interpreted as coastal/delta plain deposits.

Upper Mannville strata can be separated into parts of two depositional sequences. The main deposits of the lower sequence comprise a highstand systems tract (HST), corresponding to the Sparky Formation and the Lower Waseca Member, separated by thin deposits of a transgressive systems tract (TST) and a maximum flooding surface (MxFS) associated with Lower Waseca Member. Following accumulation of the Lower Waseca Member, relative base-level fall produced a sequence boundary that marks the base of the upper sequence. Fluvial valley incision during lowstand led to sediment bypass, and deposition of lowstand shoreface and delta complexes towards the northern part of the study area. Early transgressive systems tract accumulation is largely confined to estuarine infill of the incised valleys of the Upper Waseca Member. The Upper Waseca is separated from the McLaren Formation by a maximum flooding surface. The overlying McLaren Formation marks a return to regional shoreline progradation, and corresponds to a highstand systems tract.