

A Depositional Model for the Mississippian Frobisher Carbonate-Evaporite Cycles within the Steelman Field in Southeastern Saskatchewan

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The Mississippian strata is the most important hydrocarbon producer in the northern Williston Basin, and has proven to account for 75% of known oil reserves in Saskatchewan. The Steelman Field is located on the northeastern flank of the Williston Basin, where hydrocarbons are produced from the Frobisher and Midale beds. The reservoirs within these units are characterized by highly variable porosities and permeabilities that are related to their complex depositional and diagenetic history.

A depositional model for the Frobisher strata in the Steelman Field is comprised of cyclic shallowing-upward progradational successions of carbonates and evaporites. Based on the analysis of core and well log data it has been determined that a typical succession may include, in ascending order: oolitic-peloidal banks; fossiliferous-peloidal back-bank deposits; argillaceous calcitic algal marsh deposits; argillaceous dolomitic and/or lateritic tidal flat deposits, and/or; variable nodular to chicken wire sabkha type anhydrite. Other localized lithofacies found within the study area include: argillaceous fossiliferous mudstone to packstone, typically found in depositional lows, that are considered to deposited during a relative sea-level rise, and/or; pisolite that is typically found overlying some oolitic-peloidal grainstones-packstones, and is interpreted to be the result of vadose diagenesis during a relative sea-level fall.

The cyclic successions of lithofacies may be used to suggest that the Mississippian Frobisher carbonate-evaporite sequences, within the Steelman Field in southeastern Saskatchewan, were deposited within shallow subtidal to intertidal to supratidal environments as a complex succession of progradational parasequences during several transgressive and regressive cycles, and form part of the upper shallowing-upward sequence of the Madison Group.