

Dolomitization models for the Frobisher and Midale Beds in the Steelman Field, southeastern Saskatchewan

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Abstract

The Mississippian strata in the Williston Basin have a complex depositional and diagenetic history that has been extensively documented over the years. These strata are also of substantial economic interest to the oil industry, and certain zones have produced large quantities of hydrocarbons. However, many aspects of the Mississippian strata still remain a mystery. Dolomitized horizons occurring in both Frobisher and Midale successions are known hydrocarbon producing reservoirs, although there is very limited information in the literature as to the mechanism of dolomite formation within either succession. Core and well log analyses in the Steelman Field, southeastern Saskatchewan, can be used to suggest that cyclical lithofacies successions in Frobisher and Midale carbonate-evaporite parasequences were deposited in a peritidal environment. Complex successions of onlapping progradational parasequences are deposited as multiple transgressive and regressive cycles, forming part of the overall shallowing-upward sequence of the upper Madison Group. Geochemical analysis results from $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ stable isotopes and $^{87}\text{Sr}/^{86}\text{Sr}$ ratios, as well as petrographic analyses and core studies of Frobisher succession carbonates are used to infer that dolomitization occurred fairly early in the diagenetic history, soon after the precipitation of evaporites within a sabkha type environment. All carbonates present within the Frobisher succession within the study area have been precipitated from Mississippian sea water. Petrographic analyses and core study interpretations of Midale strata indicate early dolomitization related to hypersaline marine conditions on the landward side of oolitic shoal complexes.