

Dolomitization and Dedolomitization of the Middle Devonian Winnipegosis Carbonates in South-central Saskatchewan

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Abstract

The Middle Devonian Winnipegosis carbonates in south-central Saskatchewan is partially to completely dolomitized. Two major types of replacive dolomite are distinguished based on petrographic characteristics. Micro- to finely crystalline dolomite (Type 1) mimetically replaces the precursor limestone, accounts for about four fifths of dolomite phases volumetrically and mainly occurs in the Winnipegosis mounds and the Lower Winnipegosis Member directly beneath the mounds. Medium crystalline dolomite (Type 2) is fabric-destructive and commonly occurs in the Lower Winnipegosis and Brightholme members, decreasing in abundance upward. Stratigraphic, petrographic and geochemical data suggest that Type 1 dolomite has penecontemporaneously formed from Middle Devonian hypersaline seawater. Type 2 dolomite has higher $^{87}\text{Sr}/^{86}\text{Sr}$ ratios (0.70823 to 0.70928) and is interpreted to have formed from upward-migrating basinal fluids in the burial environment during late Devonian and Carboniferous time. Medium crystalline limestone composed of calcite mosaics is only present in the top part of the Winnipegosis Formation in the west-central margin of the Elk Point Basin where the overlying Prairie evaporites have been removed, and calcite mosaics are suggested to have resulted from dedolomitization. The Winnipegosis dedolomite crystals are anhedral and contain abundant dolomite relicts. The spatial distribution and geochemical signatures of the Winnipegosis dedolomite suggest that dedolomitization is probably related to an influx of fresh groundwater and dissolution of anhydrite during the latest Mississippian to early Cretaceous when the basin was subjected to uplift and erosion.