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## Dolomites of the Smackover and Buckner Formations in the Mississippi Salt Basin: A Key to Understanding the Dolomitization Process

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### ABSTRACT

Two dolomite types with distinct geochemical compositions are found in the Smackover Formation in the Mississippi Salt Basin near the inferred paleoshoreline. This dolomite is fine crystalline (10-30  $\mu\text{m}$ ) and has positive  $\delta^{18}\text{O}$  and positive  $\delta^{13}\text{C}$  compositions (averaging +4.1‰ Pee Dee Belemnite [PDB] and +5.0‰ PDB, respectively). The second Smackover Formation dolomite occurs on salt diapirs in the basin center. This dolomite is coarse crystalline (50-150  $\mu\text{m}$ ) and has negative  $\delta^{18}\text{O}$  and positive  $\delta^{13}\text{C}$  compositions which is significantly lower than the paleoshoreline dolomite (averaging -2.2‰ PDB and +4.1‰ PDB, respectively).

Dolomite also occurs in the overlying Buckner Formation. The Buckner Formation dolomite occurs in nodular anhydrite layers, and formed by replacement of lime mudstone layers adjacent to anhydrite beds. Buckner dolomite is finely crystalline (30-40  $\mu\text{m}$ ) and its  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values are intermediate between the two Smackover Formation dolomites (-0.3‰ PDB and +4.4‰ PDB, respectively).

Lithofacies association, geographical distribution, and isotopic compositions of dolomites of the Smackover and Buckner formations indicate three different processes of dolomitization. The Buckner Formation dolomite formed as primary precipitate when anhydrite was being deposited and as replacement of lime mudstones from a brine that had reached anhydrite saturation. Therefore, its isotopic composition is indicative of a Late Jurassic anhydrite saturated seawater.

The Smackover Formation dolomite that occurs along the presumed paleoshoreline has  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values which are more positive than those of the Buckner Formation dolomite suggesting that it formed by a more evaporated (possibly halite saturated) seawater very likely in salt ponds. Dolomitization of the Smackover Formation on salt diapirs was accomplished by the seepage of evaporated, Mg-rich Buckner brine into Smackover grainstones through subaerial exposure surfaces on crests of salt diapirs. However, its  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values are lower than those of the Buckner Formation dolomite suggesting that either the brine was diluted by meteoric water due to the exposed nature of the structures or dolomite was recrystallized in meteoric water during burial.