
Hydrocarbon Potential of the Lower Smackover Formation in the North-Central Gulf of Mexico (Arkansas, Louisiana, and Mississippi)

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ABSTRACT

The Smackover Formation has historically been viewed as having two members. The Lower Member consists of a lime mudstone that is rich in organic carbon generating oil and gas upon maturation. The Upper Member is made up of ooid grainstone with high porosity and permeability forming prolific reservoirs. Approximately, two-thirds of the over 1,200 feet maximum thickness of Smackover Formation is comprised of the Lower Member. In one of the first descriptions of the Smackover Formation, Weeks (1938) referred to the lower member as “gray to brown, dense, cryptocrystalline limestone,” and perhaps the term “brown-dense member” was born. This description implied a nonporous, non-permeable unit devoid of any hydrocarbon potential. With rare exceptions, attention has been concentrated exclusively on the Upper Oolitic Member for over 70 years. Although systematic studies are still lacking, conventional core observations, sequence stratigraphic studies, and geochemical analyses indicate that the Lower Member of the Smackover Formation shows abrupt variations some of which are listed below. In places, as much as 50 feet of pure sandstones are sandwiched between laminated limestones. These sandstones were delivered into the basin during one of 3 major sea-level lowstands and could form reservoirs. In other areas, as much as 100 feet of dolomite with excellent porosity and permeability occurs in the middle of tight lime mudstone lithologies. The origin of dolomite remains unclear. The uppermost part of the Lower Member is chalky showing micro-porosity. Major variations in carbon and oxygen isotope compositions are observed in the Lower Member perhaps indicative of major fluctuations in seawater salinity in the basin. Other lithofacies variations and characteristics are possible and need detailed investigations.