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Reservoir Facies in the Upper Jurassic Smackover Formation and Identification of the Factors that Control Their Distribution in the Vocation Field Structure, Manila Sub-Basin, Eastern Gulf Coastal Plain

Accumulation of reservoir-grade rocks of the Upper Jurassic Smackover Formation in association with paleotopographic highs has been widely identified in the Gulf Coastal Plain. Vocation field is one of more than 40 Smackover oil fields discovered in this type of play. It is located over a crystalline basement paleohigh with an irregular relief due to extensional faulting and differential erosion. Shallow marine sediments of the Smackover Formation unconformably overlie continental deposits of the Norphlet Formation and progressively onlap basement rocks in an updip direction.

Analysis of cores from 8 wells in the field indicates that thrombolitic doloboundstone and ooidal/oncoidal dolograins are the best potential reservoirs. Additionally, intense dolomitization improved the reservoir properties of muddier facies that originally had low porosity and permeability.

These observations were integrated with well log and 3-D seismic data in order to build a three-dimensional geologic model of the reservoir. Statistical population of the NPHI/DPHI porosity values in the model gives an aid in the delineation of the reservoir-grade rock distribution.

Intervals of microbial buildups with thickness up to 200 feet were accumulated on the eastern and northern flanks of the paleohigh during a transgressive phase in a "catch up" response of a carbonate system. Shoal facies began to accumulate during a regressive phase as a result of isolated sand bar progradation. Backstepping of these shoals is the result of high order sea level fluctuations.

Eustasy, tectonic subsidence, paleotopography and local environmental conditions are critical factors in the spatial distribution of these reservoir-grade facies.