Jurassic Beach: A Depositional Facies Model for Smackover Stratigraphic Traps in the Ark-La-Tex

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State Line field, Union County, Arkansas, produces oil from a five-well stratigraphic trap at 8,900 ft. Conventional cores were cut in all wells. Core studies show that the trapping porosity pinch-out is a facies change from lower foreshore to ooid beach. Sedimentation occurred along a high-energy coastline. Thus, the depositional setting at State Line field differs from the commonly accepted "oolite bar" model used for many other fields in the trend.

Four facies were delineated: (1) siliciclastic lagoon (Buckner Formation), (2) ooid beach, (3) oncoid-ooid lower foreshore, and (4) patch reef. Intergranular porosity is facies selective, found mainly in the poorly sorted lower foreshore facies. Cross-stratification and the absence of lime mud indicate high-energy conditions. Porosity and permeability in the lower foreshore facies average 10.9 percent and 496 md, respectively. The ooid beach facies is characterized by well-sorted, crossbedded, and massive ooid grainstones that tend to be extensively calcite cemented. Porosity and permeability values are generally below 2 percent and 1 md, respectively, although they can be higher adjacent to porous lower foreshore strata. The top of the Smackover is a transition from high-energy, sandy ooid beach (grainstone) to low-permeability, lagoonal siliciclastics, which seal the reservoir. Depositional features suggesting tidal channels at the east and west ends of the field support a beach and/or barrier island interpretation. Coral-algal boundstones of the patch reef facies are thin, local, and not of reservoir quality.

The value of predicting reservoir trends from cores is shown by a successful 400-ft sidetrack away from a borehole with no reservoir facies or oil shows. A slabbed "piece of the rock" can pay off in Smackover development.

Statistical Characteristics of Gassy Sedimentary Rocks in the Northwestern Gulf of Mexico

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Examination of seismic data from more than 1,000 U.S. Minerals Management Service geohazard reports and core logs of 1,670 foundation boreholes (drilled to an average subbottom depth of 125 m) has revealed that gassy sediment sections are most abundant near the Mississippi River delta, in buried stream channels eroded during the early and late Wisconsinan, and in Miocene and Pliocene–Pleistocene depocenters on the shelf and upper slope. Of all the boreholes we examined, 1,158 (68 percent) contained indications of gassy sediments.

The "average" Mississippi-River-delta-related gassy sediment section occurs at a water depth of 53 m; the top of the section lies at a subbottom depth of 10 m; its thickness is 12 m; and the sediment water content is 45 percent, with liquid and plastic limits of 73 percent and 24 percent, respectively. In nondeltaic areas of the continental shelf (areas west of 90°W), the average gassy sediment section lies at a water depth of 37 m, its depth below the seafloor is 37 m, its thickness is 8 m, the water content is 40 percent, and the liquid and plastic limits are 68 percent and 27 percent. In the upper continental slope in the northwestern Gulf of Mexico, the average gassy sediment section is at a water depth of 265 m and 25 m below the seafloor, its thickness is 60 m, the water content is 40 percent, and the liquid and plastic limits are 62 percent and 32 percent.

The median areal extent of gassy sediment sections within the entire shelf and upper slope of the northwestern Gulf area ranges from 238 to 546 m. Although large patches of gassy sediments exist, some exceeding 10 km in size, most are less than 500 m.