AAPG Search and Discovery Article #90049©2000 AAPG/EAGE International Research Conference, El Paso, Texas, October 1-5, 2000 (2005)

Characterization of the Smackover Reservoir: Chatom Field, Washington County, Alabama

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Chatom Field is located in west central Washington County, Alabama. The field is situated over a salt anticline, which is the trap for hydrocarbons. The Upper Jurassic Smackover Formation is the producing unit in the field. In the Chatom Field area, the Smackover can be divided into lower, middle, and upper intervals. The lower unit consists of algally laminated mudstone and peloidal and oncoidal wackestone/packstone. The middle unit, the “brown dense" is comprised of peloidal wackestone interlaminated with mudstone. Peloidal wackestone/packstones, peloidal, oncoidal, and oolitic grainstones and packstones, and anhydritic mudstones and wackestones comprise the upper unit.

Reservoir grade rock at Chatom Field occurs in shoal grainstones and packstones in the upper interval. The Buckner Anhydrite, which includes both sabkha and subaqueous anhydrites, acts as the upper seal for the reservoir. Organic mudstones in the “brown dense” and the lower Smackover mudstones are the source rock for the hydrocarbons in the field. Three distinct grainstone/packstone shoal intervals comprise the multiple reservoirs of the Upper Smackover.

Porosity and permeability values vary both within and between the shoal reservoir intervals. Shoal 1 has an average permeability of 9.15 millidarcies and an average porosity of 18.39 %. Shoal 2 has an average permeability of 11.6 millidarcies, with an average porosity of 21.35 %. Shoal 3 has an average permeability of 15.73 millidarcies, and an average porosity of 23.13 %. The variation in porosity and permeability is a reflection of the role diagenesis played in reservoir development within Chatom Field. Individual reservoir intervals are heterogeneous and consist of several pore types. Moldic porosity is the most common pore type with lesser amounts of interparticulate and vuggy porosity, and minor amounts of intercrystalline porosity. Understanding variations in permeability within the reservoir intervals and tracking variations in porosity are essential to maximizing the recovery of hydrocarbons.

3-D modeling has aided in the characterization of the reservoir in Chatom Field. Through the use of a 3-D modeling program, depositional and structural models have been constructed for each of the reservoirs. These models suggest development of the shoals was controlled by pre–Smackover salt movement with the thickest and highest-quality reservoirs located in the eastern portion of the field. Continued salt movement produced the present structural configuration of the field with the structural crest located west of the area of maximum shoal development.