SMACKOVER EXPLORATION ALONG THE FLANKS OF INTERMEDIATE SALT RIDGES, CENTRAL MISSISSIPPI SALT BASIN

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ABSTRACT

Recent Smackover fields discovered in the Central Mississippi Salt Basin can be characterized by their positions along the flanks of a series of northwest to southeast trending salt ridges. The majority of the Smackover production discovered in Mississippi during the 1960's and 1970's was in structural/stratigraphic traps associated with low relief salt anticlines. These discoveries were located along the basin margin and typified by such fields as Prairie Branch, Nancy, West Nancy, East Nancy and Pachuta Creek. Recent discoveries along the flanks of intermediate-size salt ridges indicate that significant additional Smackover reserves remain untapped. New and rejuvenated fields, such as West Chaparral, Clear Creek, Tallabogue Creek, Shubuta and Winchester were located or extended by a combination of methods including salt deformation modeling, high quality, multi-fold seismic acquisition and interpretation and subsurface analysis of existing well control.

Intermediate salt anticlines, as described by Hughes (1968), range in relief from 3500 to 7000 feet. Although each salt ridge exhibits a unique growth history, salt deformation styles and resultant fault patterns are similar from ridge to ridge. Many intermediate ridges have a dominant normal fault that is parallel or subparallel to the salt crest, and divides the ridge into ''upthrown'' and ''downthrown'' flanks. On the ''upthrown'' side the Smackover Formation has been uplifted by rapid salt movement during Haynesville deposition and, to a lesser extent, during Cotton Valley deposition. The Smackover Formation on the ''upthrown'' flank is truncated updip by the dominant ridge fault or by a subparallel buried fault. On the ''downthrown'' flank, Haynesville depositional loading has forced salt to flow laterally and vertically into the ''upthrown'' flank. As a result, the ''downthrown'' flank is structurally low due to withdrawal of underlying salt. The dominant normal fault, which transects the ridge, controls the shape of the salt feature. Yorsten (1989) describes these faults as downbuilding glide plane faults. On the ''downthrown'' flank of some salt ridges, a ''salt wall'' can develop along the plane of the dominant normal fault. Norphlet, Smackover and younger formations are successively truncated against the salt. The thickness of Jurassic strata juxtaposed to salt is dependent on the volume of salt transferred from the ''downthrown'' to the ''upthrown'' flank. On some intermediate sized salt ridges, compensation faults have developed on the ''downthrown'' flank, complicating the simple ''upthrown''/''downthrown'' model.

''Upthrown'' Smackover fields in Mississippi range in size from 100,000 to 10,000,000 barrels of oil and from one to ten wells. Many of the fields exhibit steep Smackover dips (10 to 50 degrees), thick pay columns and limited areal extent. Lateral and vertical seals are of critical importance in evaluating ''upthrown'' traps. Existing field evidence suggest that the best ''upthrown'' fields exhibit lateral and vertical reservoir seals formed by Lower Haynesville (Buckner) anhydrites.

Relatively few ''downthrown'' Smackover fields have been exploited to date. West Chaparral Field, discovered in 1989, has made one million barrels of oil through December, 1991 from seven wells, and may ultimately produce five million barrels of oil. A generalized ''downthrown'' trap model shows the Smackover to be terminated updip by Louann Salt with the vertical seal provided by a thick Lower Haynesville section. Bed dips in the Smackover should be lower than those found in the ''upthrown'' trap due to the absence of late salt movement. Thick pay columns and larger closures may be expected in future ''downthrown'' fields as a result of excellent lateral and vertical reservoir seals and the lack of late structural movement.