THE FLANK SHALLOW PIERCEMENT PLAYS OF MISSISSIPPI

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ABSTRACT

There is an active play on the flanks of piercement salt domes in the upper Gulf Coast region from East Texas through the Mississippi Interior Salt Basin. The combination of fundamental subsurface geology, modern seismic and deeper drilling has resulted in several field discoveries in Mississippi. Reviewing the seismic, subsurface, and production information reveals the flanks of the domes are structurally and stratigraphically complicated, but commercial quantities of hydrocarbons are present. A brief review of the existing flank productive fields illustrates both the complexities and similarities of the flank dome-related fields.

The first such field in Mississippi was Shell's Camp Shelby Field on the flank of the Cypress Creek Salt Dome in Perry County, discovered in 1972. Shell drilled through a 2775 foot salt overhang and established production in the Tertiary Clayton and the Lower Cretaceous Paluxy formations. The Cypress Creek dome salt stock extends into the Miocene section. The resulting structural uplift of the surrounding beds extends out as far as 2000 feet and has created 200 to 500 feet of structural rise. The oil and gas accumulations are due to structural uplift of porous strata and their termination against the salt, and to reservoir sands which "roll" over the flanks of the domes. At Camp Shelby Field five wells were drilled; three produced and one of the dry holes was used as a salt water disposal well. The wells were drilled to an average depth of 15,400 feet. In addition to the productive zones, the Hosston Formation tested 169 BOPD but was deemed noncommercial. As of January 1991, the Camp Shelby Field has produced 588,412 BO and 305,082 MCFG.

The next flank dome field was discovered in 1985 by Enserch. The discovery, West Raymond Field, was on the southwestern flank of the Oakley Salt Dome in Hinds County, Mississippi. The discovery well was a Cotton Valley test which was plugged back and completed in the Lower Cretaceous Rodessa. Further development of the field has resulted in 13 producing wells and three dry holes. Production has been established in the Lower Cretaceous Mooringsport, Pine Island, and Rodessa formations. Oakley Dome Field was established in a southeastern fault block of the same salt piercement. Two wells have been drilled in this field, with production from the Rodessa and Paluxy formations. North Oakley Dome Field is located on the northern flank of the dome in a horst fault block. The two wells in this field produce from the Rodessa and Pine Island formations. As of January 1991, the three fields at Oakley Salt Dome have produced 1,689,633 BO and 1,054,193 MCFG. Oakley has a complex system of radial faults created by the salt piercing through the stratigraphic section, as is typical of many shallow piercement domes. There are nine known fault blocks at Oakley Dome. Production has been found in three of the four fault blocks which have been tested. The radial faulting can provide the mechanism for the development of traps on the flanks of the piercement domes. Fault displacement can place impermeable beds opposite potential reservoirs, thus creating lateral seals. For example, in West Raymond Field the displacement along fault planes has placed the Ferry Lake Anhydrite and Mooringsport shale against the Rodessa sands. The faulting may provide a conduit for migration of hydrocarbons from deeper seated source rocks. The vertical migration of hydrocarbons can result in multiple reservoirs being charged in the process. Conversely, the complex faulting can make development much more difficult. Too many faults may result in small reservoirs, which can impact the economics. Also, the faulting may juxtapose porous rocks against porous rocks, thus eliminating the necessary lateral seals. Because of the nature of the radial faults, every resulting fault block is an individual entity which must be evaluated separately. Oakley Dome provides a good illustration of variation among fault blocks around the same dome. The western block has yielded commercial production, other blocks have had minor production, and another has been nonproductive. Thus, the flank of a dome must not be condemned because one fault block fails to be productive. A dome cannot be evaluated by one or two wells.

In 1985, Sun Oil drilled the discovery well for the Leaf River Field on the southern flank of Dont Dome in Covington County, Mississippi. The well was a dual completion from the Lower Cretaceous Rodessa and Sligo formations and tested 468 BOPD and 3710 MCFGPD. Based on what was observed at the Oakley Dome, Dont Dome should have similar characteristics. There should be radial faulting present with resulting separate fault blocks, uplifted beds which contain reservoirs draping the structure or terminating against the salt, and lateral seals which result from fortuitous fault displacements. Sun has since drilled two more producing wells in the Leaf River Field. As of January 1991, the field has produced 295,748 BO and 4,314,901 MCFG. Oryx (formerly Sun) then moved over to the Centerville Salt Dome in Jones County, Mississippi, and drilled a discovery well in 1989. The No. 1 Frankie Smith flowed 1231 BOPD and 4425 MCFGPD. Production is from a series of sands in the Lower Cretaceous Hosston Formation on the flank of the dome. The Free State Field is in the southern fault block of a typically radial fault system. As of January 1991, the No. 1 Frankie Smith has produced 221,267 BO and 962,298 MCFG.

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The above described fields provide examples of flank dome production. They show that all the necessary elements for potential hydrocarbon discoveries are present on the flanks of Mississippi's piercement domes. In areas of good rock quality, the steeply dipping beds, thick potential reservoirs, and multiple pays can offer large per well reserve potential under relatively small acreage. With the utilization of subsurface well information and today's modern seismic, the complex structure and stratigraphy associated with the shallow piercement salt domes can be interpreted. What can be learned from the fields already discovered will surely aid in future efforts to explore and develop other dome-related fields.

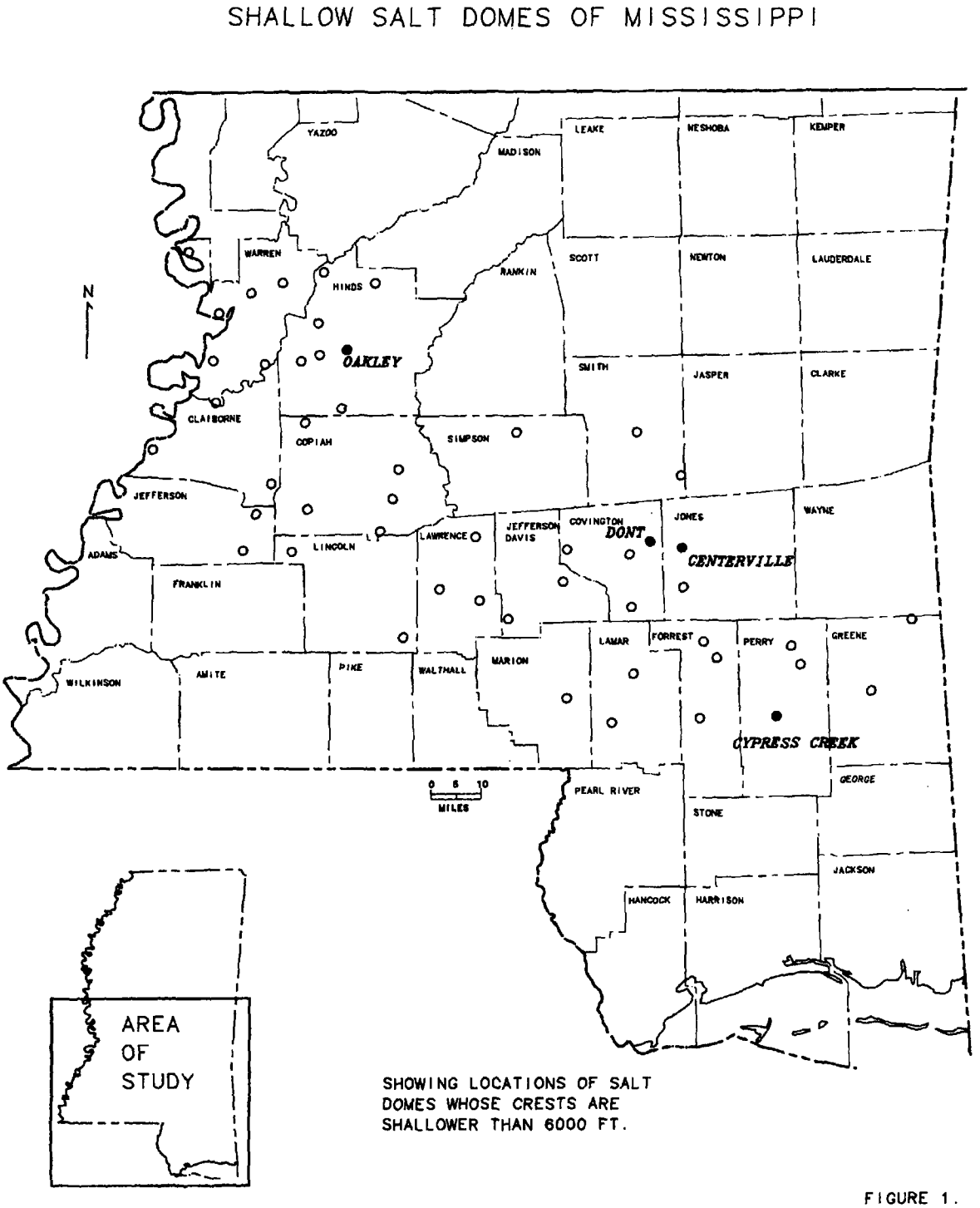

FIGURE 1.