STRATIGRAPHIC-STRUCTURAL INTERPRETATION AND RESERVOIR CHARACTERIZATION OF LAVACA BAY FIELD, CALHOUN COUNTY, TEXAS.

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ABSTRACT

Lavaca Bay field, located in Calhoun County, Texas, covers approximately 7 mi^2 and contains 35 wells that produce from the downdip Greta Carancahua Barrier/Strandplain System of the lower to upper Frio Formation. Since 1964,19 gas reservoirs have been discovered that have total annual and cumulative productions of 5 and 65 Bcf, respectively; each reservoir is produced by 1 to 3 wells. This paper discusses the detailed stratigraphic-structural interpretation of the Frio section in Lavaca Bay field, specifically emphasizing the three-dimensional architecture of the reservoirs, as well as the flow character within each reservoir.

Using the lithofacies interpretation and correlation of 125 well logs of Lavaca Bay and surrounding fields, the Frio Formation (6500 ft thick on average) was divided into nine principal depositional sequences, which were subdivided into component sandstone/shale units. In general, the vertical well log profiles of the depositional sequences show a progradational-aggradational character; the component sandstone/shale units are predominantly transgressive in the lower Frio (sequences I through III) and regressive in the middle-upper Frio (sequences IV through V and VI through IX). The boundary between sequences III and IV provides a well-defined well log signature and is inferred to represent a major sea-level fluctuation. Thickness variation within each unit in sequences I through IV reflects the influence of major growth faulting; however, units of sequences V through IX are only offset by postdepositional displacements of such faulting.

Each sandstone/shale unit was characterized by well log and production parameters, including depth to top; total thickness; net-sand thickness (h); relative deflections of spontaneous potential (SP), gamma-ray (GR), and resistivity (R) curves; and initial flow potential. The parameters that were normalized for each well, and some numerical relationships between them, were mapped and compared. Correlative and distinctive trends of thickness, net-sand, and production isolines provided guides for defining individual reservoirs and their structural and fluid boundaries; isoline trends of net-sand, SP and GR, and R maps defined internal facies and stratigraphic boundaries of the reservoirs. Extrapolation of these distinctive map trends, supported by the three-dimensional geometry of the sandstone/shale units and their reservoirs, defined prospective intervals and areas for additional hydrocarbon production on each unit.

For each unit and its contained reservoirs, the maps of SP and GR relative deflections were considered to represent qualitative values of lithofacies permeability, and therefore (SP)(h) to represent their qualitative values of flow capacity and (SP)(h)(R) to represent their qualitative values of hydrocarbon flow potential; these maps will guide the infilling well program in individual reservoirs.

This procedure for characterizing the flow quality of reservoirs from well log parameters is a powerful and practical technique that is validated when core permeability correlates with SP or GR deflection, or both, or (SP)(h) correlates with (K)(h) obtained from transient pressure analysis or with initial production potential. In such cases the qualitative value of well log parameters can be transformed into quantitative values.

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