A 3D GEOLOGIC MODELING STUDY OF THE SOUTHEAST FLANK OF HUMBLE FIELD

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ABSTRACT

Stratigraphic Geocellular Modeling™ (SGM) software was used to create a three dimensional model of a portion of Humble field. The field was discovered in 1905, and Texaco began drilling in 1913. Texaco has produced about 70 million barrels of oil from this field.

Humble field is a shallow piercement salt dome with caprock at 954 ft and salt at 1200 ft. Humble is located within the Yegua trend in the north-central portion of the Houston Salt Dome basin. The structure experienced growth during Jackson, Frio, and Miocene time resulting in unconformities and associated structural and stratigraphic traps. Faulting on the dome is both radial and tangential.

Very little electronic information was available for wells in Humble field. A clerk was hired to type data from the original well reports into a Lotus spreadsheet. The spreadsheet was then converted into SGM well format. In addition, perforations were retrieved and converted into SGM format.

The stratigraphic framework was constructed using the depth to domal material, five sand tops, and one unconformity. The well model was constructed using 28 directional surveys and core information from 199 wells that could be located geographically.

Core information captured in the well files included permeability, porosity, API gravity, hydrocarbon shows, lithology, and perforations, where available. The older core reports only contained lithology and hydrocarbon shows.

The purpose of the study was to determine if there were areas in Humble field where hydrocarbon production had been predicted but never exploited. In areas where there is so much data, computer software is ideal for organizing the data and making calculations, but three dimensional software is necessary for exposing patterns that emerge from processing massive datasets.

Five working models of Humble field were constructed using three levels of geographical detail. In addition, three sets of parameters were used for generating the 3D cells so that the effect of imposing a directional bias and varying the search radius could be observed.

Model operations were performed to identify areas where permeabilities were greater than 48 mD, porosities greater than 15%, shows were present, and the lithology was sand. Any area that tested positively for all 4 cases was labeled "predicted production". Another model operation then compared areas where the cores predicted production to areas where the wells had been perforated, to determine "perforated predicted production". Subtracting "perforated predicted production" from "predicted production" pointed out areas that comprise prime targets for workovers and new wells.

As a result of this study, about five million barrels of oil equivalent were identified that have been discovered by cores but never produced in the study area. In addition, the methodology involved in this study can be used as a recipe for evaluating remaining potential in other old producing fields.