“In depth” integration to build a reliable static and dynamic reservoir model for the Santa Barbara field, Venezuela

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ABSTRACT
Santa Barbara is a giant oil field exhibiting complex stratigraphy, structure and oil column. An “in-depth” integration has been vital in the elaboration of a reliable static and dynamic reservoir model. This full-blown integration has incorporated a 3-D visualization and a 3-D statistical analysis of many parameters from various disciplines: geophysics, geology, petrophysics and reservoir engineering.

Four parameters have been of great help in our 3-D depth trend analysis. These parameters are porosity, API, isotope and capillary pressure. Each of these parameters has proven useful in understanding better the structure of the field, the reservoir quality distribution and the oil column.

A large part of the tectonic activity has been posterior to the oil emplacement. The techniques used have been successful because the oil emplacement has “frozen” the diagenesis and the compressive stress has brought various tectonic nappes to shallower depths preserving the rocks from further quality deterioration. Thrust sheets have been identified through the existence, for various parameters, of very distinct depth trends parallel to each other. The integration in a 3-D volume has corroborated the validity of the proposed findings.

In the analysis, time was added as a fourth dimension for the fluid gravity (API), the Gas Oil Ratio and the pressure calculated at a reference depth. These various parameters have allowed the visualization of the vertical displacement of the oil column through time and have helped define some of the existing reservoir compartments and their associated fault planes and have allowed a better understanding of the stratigraphy.