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Geologic Modeling for Production Surveillance and Field Development at Cerro Negro Field, Orinoco Heavy Oil Belt Venezuela

A geocellular model was built for the Cerro Negro Field in Venezuela's Faja (Orinoco Heavy Oil Belt) for the purpose of production surveillance and field development planning. Technical challenges in the Faja range from fair quality seismic reflections, complex stratigraphic relationships, locating horizontal wells into best quality sands, to wells with high water production.

In Operadora Cerro Negro's Concession area, ninety vertical wells, fifteen slant stratigraphic wells, one hundred twenty five horizontal production wells, and three hundred km² of 3-D seismic data have been incorporated into construction of a geologic model. A sequence stratigraphic framework was developed using four thousand feet of core from eight wells, bio-stratigraphic analysis and correlation of the well log data. Integration of seismic data with this framework resulted in mapping of three major flooding surfaces and four unconformities. Twenty foot thick layers parallel to the flooding surfaces were interpreted to define the facies patterns. Petrophysical analysis divided the rocks into fifteen petrofacies, which were reduced into three general facies associations for the model construction. Several ponchera's (perched water) were identified and mapped for the model as well as zones with high moveable water saturation. These data were combined stochastically to construct the geocellular geologic model for the field.

The model is being used for well evaluations, volumetric calculation, and field development drilling planning. It has been scaled up into a reservoir simulation model, which is being used for history matching and field performance prediction.