THE USE OF SEISMIC ATTRIBUTES AND SPECTRAL DECOMPOSITION TO SUPPORT THE DRILLING PLAN OF THE URACOA-BOMBAL FIELDS

Cuesta, Julián[*1], *Pérez, Richard*[1]; *Hernández, Freddy*[1]; *Carrasquel, Williams*[1]; *Cabrera, Raúl*[2]; *Moreno, Carlos*[2]; *Castagna, John*[3]
1: PDVSA Petrodelta; 2: Fusion Petroleum Technologies; 3: University of Houston

Summary

Interpretation of 3D seismic attributes including AVO, spectral decomposition, spectral inversion and multi-attribute inversion data, proved to be the key driver to set the drilling program for heavy oil, Miocene reservoirs in the *Uracoa* and *Bombal* Fields.

230 km^3 of 3D seismic and close to 200 wells were used for calibration. Petrophysical evaluation and fluid substitution analyses were conducted to ensure robust calibration of seismic attributes. The integrated interpretation led to identify anomalies associated to structural and stratigraphic traps filled with hydrocarbons that were confirmed by drilling.

AVO and velocity analysis on gathers allowed deriving moderate-to-good S/N ratio seismic information. Despite low acoustic contrast among net-sand, net-pay and encasing shales, the combination of different attributes led to identifying areas to set new drilling locations.

Spectral decomposition and pseudo density from multi-attributes inversion, proved to be a lithological / hydrocarbon predicting tool when properly calibrated with well logs. Pseudo impedance and reflectivity computed using spectral inversion techniques were used for sand/shale delineation that provided a large improvement of the structural and stratigraphic frameworks.

Fine-tuned velocity analysis and geostatistical techniques, tied to geological tops and seismic horizons, were used as driving elements to run a time-to-depth conversion of the seismic volumes. The seismic information represented in depth, honored the key geological tops of the reservoir, and has been used -successfully- to forecast the entry point and total depth of wells in the latest drilling campaign. Bounding features -unseen in previous studies- were identified on depth converted seismic cubes, generating a more robust model of the reservoirs.

Introduction

The Oficina Formation within the Uracoa and Bombal fields is located in the *Monagas Sur* area, Eastern Venezuela (Figure 1). The study was run by *Petrodelta*, a *PDVSA*-Harvest Vinccler joint venture in Venezuela. Two main objectives were defined for this study: 1) the characterization of mature oil and gas sandstone fields and, 2) to provide geophysical support to the drilling of new locations.

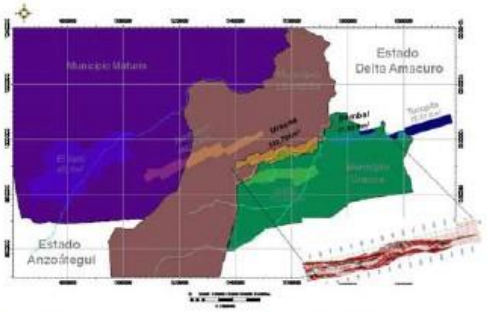

Figure 1: Location of the uracoa-Bombal fields. The seismic survey coverage extends along these two fields with a total area of 230 Km^2.

The Uracoa field has extensively been drilled however; there are still zones with potential for further development within the area. 3D seismic coverage was provided originally, with the idea of refining the structural and stratigraphic frameworks. Just recently, the idea of using the seismic information for reservoir characterization was implemented. The methodology consisted of a calibrated analysis of well information with different seismic attributes derived through multiple techniques such as spectral decomposition, spectral inversion, AVO, and multi attribute and neural network inversion.

Methology

Detail petrophysical analysis was done at key wells for calibration. This analysis included edition of existing logs, generation of pseudo logs (where missing) using multilineal inversion techniques, invasion/dispersion corrections to represent sonic and density measurements within a frequency range equivalent to surface seismic