[PS]Geophysical Characterization of an Oligo-Miocene Prospective Interval in Copa Macoya Field, Guárico Sub-basin, Venezuela*

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Abstract

The study objective was to determine the boundaries of the gas reservoir within a combine structural /stratigraphic trap located in the eastern side of the field. The prospective interval comprises 89 feet of vertically stacked channel belt sandstones deposited as a response of avulsion and lateral migration of individual channels until its complete abandon. At the same time, seismic attributes evaluation has also been applied at different stratigraphic intervals in the rest of the 3D volume in order to find additional potential gas bearing reservoirs in the field. To accomplish the aim of the study, a combination of different techniques was applied (AVO, Spectral Decomposition, Seismic Inversion and Coherence) to obtain the best estimation of the remaining gas potential bearing within the 3D block. Three main results were obtained from this methodology: 1) degree of reliability and applicability of each attribute, 2) classification of each anomaly in based on combination of different attributes, and 3) selection of those with high probabilities of gas. Several variables were analyzed: attribute vs. logs calibrations to discriminate between water and gas sands, areas of intersection of all attributes, evidence of gas in the area, and the geological model. The results show that the new gas reservoir within the prospective interval is associated with one anomaly. This anomaly was confirmed by the evidence of gas in one well. Also, the presence of a flat spot was identified that has been mapped in time and depth maps. The flat spot confirmed the gas-water contact which was reported also in two wells that drilled the reservoir. Stratigraphic and structural features where interpreted using the coherence and spectral decomposition. One of the most important stratigraphic features was an abandoned channel whose geometry is interrupted by the presence of a synsedimentary fault. The fault could have been syntectonic with the deposition of the prospective interval. Finally, the response observed by different attributes was validated by the sedimentological model and also, confirmed the presences of the gas. Regarding AVO analysis, the anomaly P is classified as a Class 3 AVO anomaly associated with a negative gradient and intercept. The fluid factor also confirmed the presence of gas in the prospective interval. The methodology applied in this study allowed an accurate delineation of the potential gas reservoir associated with anomaly P in the study area.

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1.- INTRODUCTION

Copa Macoya Gas field is located on the North East of the Guárico sub-Basin. The objective of the study was: A) to determine the boundaries of a gas reservoir zone, located on the eastern side of the field which is associated to a combined structural and stratigraphic trap and B) To identify within these boundaries, potential prospective areas with high reservoir rock conditions and gas accumulation. In order to accomplish the aim of the study, a combination of different techniques was applied (AVO, Spectral Decomposition, Seismic Inversion and Coherence) to obtain the best estimate of the remaining gas areas within the 3D block.

2.- DATA AVAILABLE

- 160 sq Km of 3D Seismic volume (Merge data)
- 9 seismic attribute cubes (Seismic Inversion, AVO, Spectral decomposition & Coherence)
- 4 keys wells for petrophysics analysis and rock physics model

3.- GEOLOGICAL FRAMEWORK

The prospective interval comprises 89 feet of vertically stacked channel belt sandstones deposited as a response of avulsion and lateral migration of individual channels until they were completely abandoned. Stratigraphic section shows the sedimentary units inside interval 1. Well 2 shows gas at interval 1 (considered as a potential gas reservoir) and well 3 shows water at the same interval.
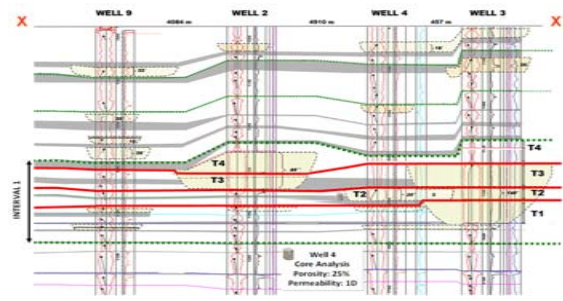

4.- METHODOLOGY
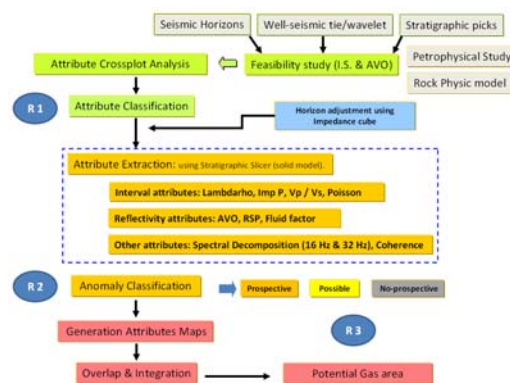
5.1- COHERENCE & SPECTRAL DECOMPOSITION (16 HZ & 32 HZ)

Stratigraphic and structural features where interpreted using the coherence and spectral decomposition technique. One of the most important stratigraphic features was the presence of an abandoned channel whose geometry on the Northwest part is controlled by the presence of a fault oriented SW-NE.
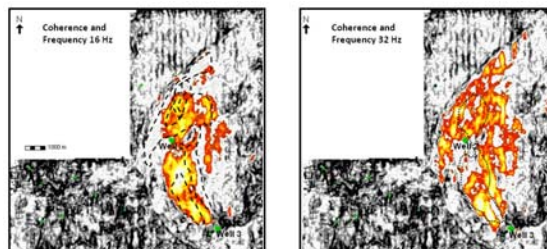

5.2- REFLECTIVITY ATTRIBUTE: AVO ANALYSIS

The anomaly related with the prospective interval in well 2 is classified as Class 3 with the negative intercept and gradient, according to Rutherford 1984. Also, Scaled Poisson´s ratio change and fluid factor verified the presence of gas.
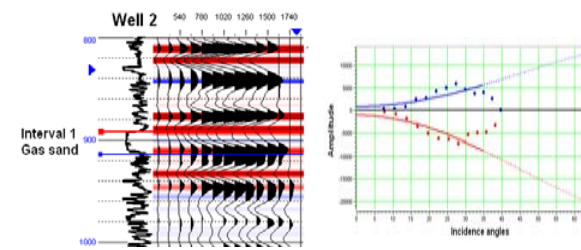

5.3- INTERVALIC ATTRIBUTES:

From the pre-stack seismic inversion, Impedance, Lambdarho, Vp/Vs, and Poisson attribute cubes were generated. Specially Poisson's ratio is inherent properties of rocks, and is one of the most important parameters indicating viscoelastic nature of rocks.
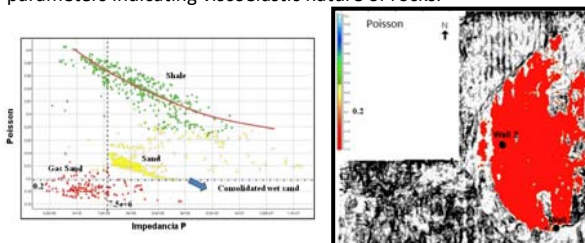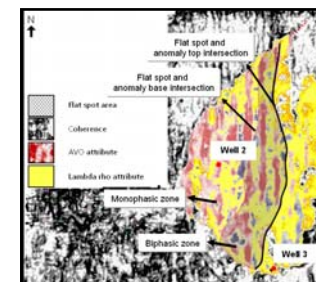

6.- CONCLUSIONS

The anomaly observed by different attributes was validated by the sedimentological model and was confirmed by the evidence of gas in well 2. The presence of a flat spot was identified and mapped in terms of time and depth, and confirmed the gas-water contact reported found in wells 2 & 3 for interval 1.
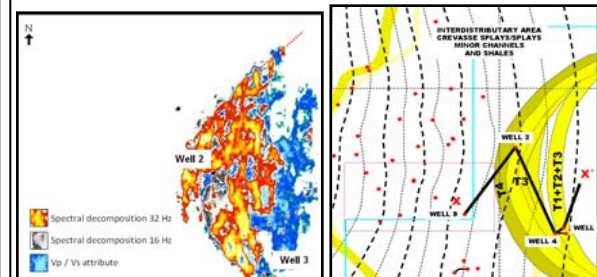
The methodology applied in this study allowed an accurate delineation of the potential gas reservoir associated with one anomaly in the study area.

A combination of coherence, Lambda-rhob (low values is in yellow color), Intercept vs Gradient maps (red color) show the anomaly in the Eastern area.