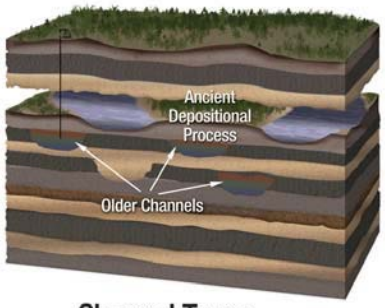
VIALOGY®
REDEFINING SEISMIC℠

QuantumRD® Carbonate/Sandstone Case Study

"Improving Your Net Pay"

OBJECTIVE: To detect, validate and characterize reservoir size and depth for a 6,000 feet deep stratigraphic Wolfcamp carbonate and the deeper (8,000 feet) Cisco sandstone formation prospect located in the Permian Basin. To map formation porosity and recommend drilling locations for maximum net pay.



Channel Traps

PROSPECT DESCRIPTION: The Permian Basin in Central Texas has among the most complex geological formations from a petroleum exploration perspective. Porosity "anomalies" such as the Wolfcamp reservoirs are typically barrier reef carbonate formations, while the Cisco sandstone reservoirs occur in updip, pinchout formations. The primary objective was to evaluate the net pay from the Wolfcamp detritus. The secondary objective was to evaluate the net pay from the Cisco/Canyon sandstone. For the Wolfcamp formation, the preferred locations were those containing five or more multiple, large-sized carbonate bodies, known as High Impedance Geobodies (HIGs). Detection of porosity and fluid presence the HIGs was also an important factor. Finally, the choice of locations with low shale interference in the Wolfcamp horizon and thereby considered "frac-friendly" was deemed important. It is important to note that vertical borehole trajectories locations derived to maximize pay from Cisco/Canyon sandstone (secondary objective) are not necessarily the same as locations intended to maximize pay from the Wolfcamp. Deviated boreholes were not considered for this phase of project.

QuantumRD® ANALYSIS: QuantumRD® was used to analyze 3-D seismic data (PSTM volume, Enhanced PSTM volumes (FXY, Dice), PSTM Image Gathers, Impedance inversion and Migration velocity volume) and well logs in an end-to-end analysis methodology to estimate sub-surface characteristics. QuantumRD® fuses geoseismic and geological datasets to characterize lithology, reservoir boundaries, fluid capacity sizing, and to develop porosity profiles for potential prospects. QuantumRD® enables prediction and quantification of porosity - a key reservoir net-pay indicator – by exploiting subtle changes in seismic noise across the underlying lithology. In essence, this software platform is a signal to noise enhancement engine, able to detect and mediate weak signals critical to the process, not detectable by conventional analytic processes. Over the past 20 years, the geoseismic industry has invested significant time and money developing migration and stacking algorithms that reduce or cancel seismic noise. While these techniques can be useful for large hydrocarbon traps, they often miss and mischaracterize hydrocarbon-rich micro channels in sand and other sedimentary rock formations. QuantumRD® can detect unswept recoverable hydrocarbons from smaller formations or producing fields, thereby enhancing recovery and return on assets. QuantumRD® provides a marked improvement over traditional processing used for locating and characterizing hydrocarbon traps.

QuantumRD® derives its name from quantum physics approaches to non-linear, stochastic resonance-based algorithms for signal processing. Stochastic resonance algorithms excel in being able to extract spatial, temporal, or spatio-temporal signals that are "buried" within background clutter or noise, injecting specially-prepared "noise" into the data, effectively improving the signal-to-noise ratio (SNR). This yields better interpretation of rock faces and porosities. The injected noise seeks to amplify "signatures" and features within data that are indicative of physical attributes, such as porosity. This noise- injection approach differs from the conventional signal processing techniques which are focused on

removing existing noise by filtering data in order to remove the background noise for better SNR. In this instance Impedance Inversion volumes were used for the analysis. However, the spatial resolution of conventional Impedance Inversion volumes is too coarse in order to accurately determine perforation zones & potential for net-pay from the carbonate target. Also, conventional Impedance Inversion volumes cannot spatially resolve high impedance geobodies (HIGS) & hydrocarbon reservoirs within formation tops. It was not possible to resolve multiple reservoirs since the horizons based on seismic cross impedance continuity do not conform to geological horizons as seen in well-control & logs.

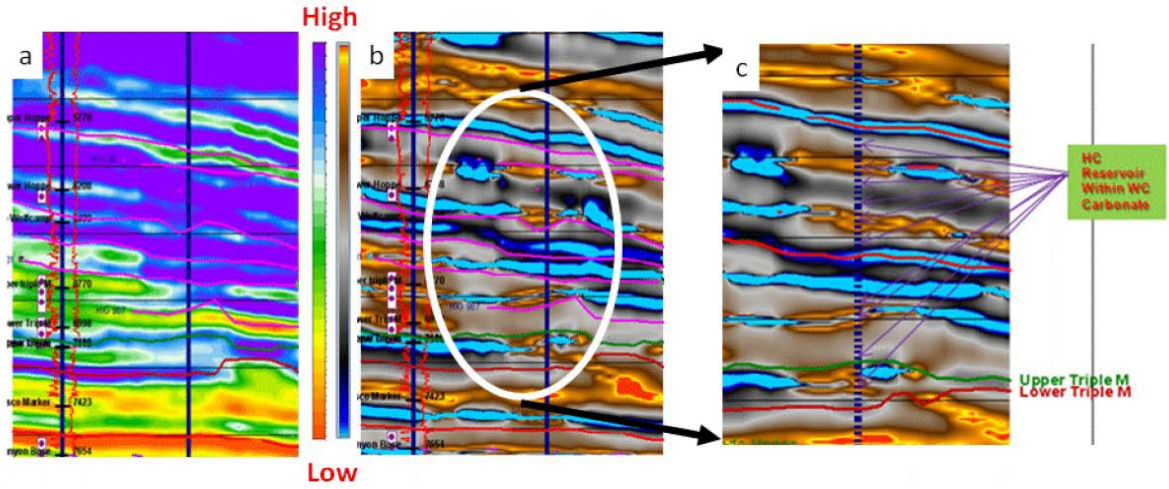


Figure 1. Impedance versus depth distribution for the Wolfcamp Carbonate formation. (b) QuantumRD® analysis generated porosity vs depth distribution for the same formation indicating the hydrocarbon reservoir locations (c) within the Carbonate formation..

RESULTS: Based on the results of the QuantumRD® analysis, ViaLogy generated new seismic attributes correlated with the well log geophysical properties for carbonate debris. These attributes quantified the risks involved with use of seismic for predicting physical properties in undrilled areas. ViaLogy deployed its novel "noise injection" computational method to determine large porosity anomalies with hydrocarbon presence to position wells. Acoustic energy is filtered (absorbed or reflected) as seismic waves pass through rocks & fluids. The frequency-dependent absorption is different for hydrocarbon-bearing anomalies versus the matrix rock with low and high frequencies being attenuated differently. QuantumRD® analysis attempts to amplify energy attenuation within the formation to characterize the presence of hydrocarbon-bearing HIGs structures. ViaLogy delivered analysis that chose the position of the well to penetrate two pay zones; the Wolfcamp carbonate formation at 5,800 feet and the Cisco Canyon sandstone formation at 7,780 feet. ViaLogy accurately positioned the well, predicted multiple high impedance geobody (HIG) pay zones, and their porosities – all subsequently verified by actual well logs. Drilled to a total depth of 8,175 feet, log analysis showed net pay from multiple zones, including stratigraphic Wolfcamp carbonates and the deeper Cisco sandstone.

Contact one of our technical specialists for more information:

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