

Seismic reservoir characterization of the Bone Spring and Wolfcamp formations in the Delaware Basin with efforts at quantitative interpretation - Part 1

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Spread over west Texas and southeastern New Mexico, the Permian Basin is the biggest producing basin in the US today. The Delaware Basin forms the western sub-basin of the Permian and presents a multi-stacked play prospect, with the prospective zones for production located in the Bone Spring and Wolfcamp formations. The latter combo is often referred to as WolfBone play.

A multicient seismic survey was acquired in the Delaware Basin for TGS in November 2017, and its processing completed over the next six months. Thereafter, the processed data was picked up with the *objective of seismic reservoir characterization to be carried out using all the available data, which would differentiate the reservoirs of interest and prove useful towards cost-effective drilling*. Keeping in mind the geology of the formations of interest, workflows were devised to carry out the exercise in a planned way. Rock physics analysis formed a significant step in these workflows.

One significant benefit of poststack seismic data is to generate geometrical attributes such as coherence and curvature, which could help locate faults and fractures in the formations of interest. Not only can big faults (if any) be avoided while drilling, fractures could be considered while designing horizontal wells in low-permeability target zones. This was followed by prestack azimuthal AVO analysis to detect fractured zones and describe fracture strike orientations as well.

Next, we turned to seismic facies classification using unsupervised machine learning methods to study the variation of facies at different levels in the zones of our interest. These methods included the k-means clustering, principal component analysis, independent component analysis, self-organized mapping and generative topographic mapping applications. We will present a comparison of these applications and their correlation with a similar machine learning classification to the available well log data.

This presentation will form part 1 of the talk.