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Prediction of Rock Properties Using Well Logs, Seismic Attributes, and Neural Networks

Abstract

This case study shows the benefit of using multiple seismic trace attributes and the pattern recognition capabilities of neural networks to predict reservoir architecture and porosity distribution in the Pegasus Field, West Texas, and net pay and reservoir property distribution in the Zafiro Field, offshore Equatorial Guinea. The study used the power of neural networks to integrate geologic, borehole, and seismic data. Illustrated are the improvements between the new neural network approach and the more traditional methods of estimating rock properties from seismic data, such as seismic trace inversion, amplitude mapping, and AVO studies. Our procedure is straight forward but does require careful quality control to ensure reliable predictions from the seismic data. Network training, test, and validation data sets provide calibration of seismic attributes with well log data, optimize the network parameters, and estimate the performance of the system to predict hidden representative data. Comprehensive statistical methods and interpretational/subjective measures ensure that only attributes providing true relationships and a physical basis are used in the prediction of rock properties from seismic attributes. The result is a 3-D volume of seismically derived rock properties for the reservoir interval of interest. In effect, we are transforming the seismic trace attributes into seismic-scale petrophysical logs. The advantage of this transformation is the additional interwell information this method provides. The additional reservoir detail allows for optimum placement of horizontal wells and improved field development.

Biographical Sketch

Jim Schuelke is a senior geophysical advisor with Mobil's Technical Center in Dallas, Texas. He is the team leader for a multi-disciplinary team researching and developing new geophysical analysis and interpretation technologies. His

latest work is the development of a method to use more of the seismic attribute information and to integrate it with geologic, borehole, and engineering data. This technique has been very successful in quantifying seismic information and deriving more accurate rock and fluid properties from seismic data. Jim started his career in geophysics with Geophysical Service, Inc., twenty-five years ago. He came to Mobil via the Superior Oil merger and joined their research and services group in Dallas. Jim has a very diverse work record having put in his time in seismic data processing and acquisition, geophysical interpretation, special projects work, research, consulting, training, and project management. In addition, he has worked both domestic and international, exploration and production. □



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