Prediction of Porosity and Fluid Saturation from Full Stack Seismic Data Using Seismic Inversion and Neural Network Analysis.

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ABSTRACT

Prediction of Rock physical parameters such as porosity and hydrocarbon saturation is essential for exploration and development of hydrocarbon reservoirs. These parameters affect the signature of the seismic data significantly. Studying this signature is essential for seismic reservoir characterization which, in turn, opens up new opportunities in places where the qualitative interpretation is the most commonly applied techniques. This paper describes the successful utilization of probabilistic neural network analysis in predicting the effective porosity and hydrocarbon saturation over the reservoir zone. The Upper Abu Roash G sandstone reservoir is of Cenomanian age in Wadi El-Rayan Field, Western Desert, Egypt. It is composed of three subunits; Estuary channel, Estuary funnel bar, and Estuary mouth bar. Seven wells were used and full stack 3D seismic data was inverted to P-impedance. The effective porosity and water saturation logs have been converted from depth to time and sampled at the same sample rate as the seismic data. Then, the neural network analysis method was applied using full stack seismic data as an internal attribute while P-impedance and RMS Velocity cubes as external attributes in order to generate 3D porosity and Water saturation volumes over the reservoir zone. The Correlation coefficients, for the blind well, between the predicted and measured porosities and water saturation following that the probabilistic neural network show correlation of 0.95 and 0.97 respectively. A high effective porosity and hydrocarbon saturation values are located to the west of the main producing field and were interpreted to be a possible reservoir. The results suggest that the combination of post-stack seismic inversion and PNN can be applied effectively to estimate reservoir properties.