Application of Geostatistical Inversion in Understanding Reservoir Architecture of Najmah and Sargelu Formations, North Kuwait

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ABSTRACT

Najmah and Sargelu formations in Kuwait are excellent source rocks, which is predominantly organic rich mudstone with high Kerogen content. Najmah/Sargelu reservoirs have low porosities and are entirely depend on open fracture network for their commercial productivity in Kuwait. The reservoir consists of a distal marine that transition into a carbonate slope deposition. The study area covers an area of around 250 sq. km, with a high-density 900 fold single sensor broadband 3D seismic data acquired in 2013. The main objective of this study is to understand the relationship between the critical rock properties with the elastic moduli by improving the resolution through geostatistical inversion, and in turn identifying the prospective zones suited for hydraulic fracking. Total Organic Content (TOC) plays a vital role in the case of Najmah and Sargelu reservoirs. The zone of high TOC are the best zones for hydraulic fracking. The source rock interval in North Kuwait is approximately 80 ft. thick and has TOC in the range of 6.35 to 15.62 wt.%. A strong correlation exists between the TOC content and acoustic impedance. This correlation is used to identify the zones of high TOC content. The identification of fractured zones and its spatial distribution is also very important in characterizing these reservoirs. It has been found that the zones, which are more homogenous, are best suited for inducing fractures compared to the heterogeneous zones. Identifying these homogenous zones with in the highly heterogeneous limestone units is a considerable task. Geostatistical inversion can help identify these local areas of homogeneity contained within zones of greater heterogeneity in order to create complex fracture networks optimal for production. Briefly, one can describe stochastic seismic inversion methods as the generation of several realizations of elastic properties, acoustic and/or elastic impedances, with the final purpose of uncertainty assessment of those properties. The approach presented here can constrain the inherent spatial uncertainty, associated with geostatistical seismic inversion processes with features inferred from the seismic signal and other the seismic attributes. The approach was highly beneficial in understanding the lateral and vertical litho facies variations and fracture corridors, in addition to the identification of probable brittle areas for hydraulic fracking.