Advanced Geophysical and Geological Solutions of Imaging and Interpreting Complex Carbonate Low Seismic Reflectivity Reservoirs in Abu Dhabi, UAE

Khalid Obaid[1], Mohamed Mahgoub[1], Olivier Kirstetter[1], Oleg Khakimov[2], Peter Szafian[3], Paul van der Vegt[4]

[1]ADNOC
[2]CGG
[3]GeoTeric
[4]PanTerra Geoconsultants & ENRES Technical Alliance

Abstract

Geophysicists use strong seismic reflectivities in seismic interpretation to identify faults or horizons and characterize them in order to derive petro-elastic properties that will be useful for their various subsurface endeavors, such as modeling and drilling plans. Reflectivity typically depends heavily on the contrast between the acoustic impedance of the various layers, which may have a wide range of rock velocities and densities because of alterations in lithologies, porosities, and fluid saturation. Another aspect that may have an impact on producing a distinct seismic response is the layer thickness in relation to seismic frequency bandwidth.

The Cretaceous, Jurassic, and Permian Carbonate Formations in Abu Dhabi host majority of low seismic reflectivity reservoirs (LSRRs). They are regarded as the nation's primary gas reserves because of the quantity of gas they produce. The extremely high lateral and vertical heterogeneities brought on by the modest velocity changes are what define them. Geophysicists are having difficulty deciphering and extracting the geological characteristics due to the low contrast in seismic reflection imaging. According to borehole seismic studies, LSRRs are properly resolved in seismograms with frequencies of 60 Hz or higher but are not detectable in seismograms with frequencies lower than 60 Hz.

This publication will provide examples of practical geophysical and geological methods used to address the issues with LSRRs, including high-quality seismic acquisition, well-driven seismic processing and imaging, interactive seismic multi-attributes and expressions, and borehole Integrated Prediction Error Filter Analysis (INPEFA). Enhanced structural and stratigraphic definition were revealed by the integration of all solutions, which enabled precise reservoir characterization and modeling.