

Unlocking the Potential of Deep Carbonate Unconventional Gas Play: An Integrated Seismic Reservoir and Fracture Characterization Onshore Abu Dhabi

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Abstract

The first step towards a sustainable future requires exploiting resources responsibly while meeting demands. Natural gas is becoming an important resource on a global scale for meeting energy demands while minimizing carbon emissions. Over the preceding years, unconventional plays have proven to be essential in supporting growth and meeting demands. This emerging industry in the Middle East brings not only new opportunities but also challenges. To meet worldwide demands, tapping into unconventional resources becomes crucial, especially gas plays. In Abu Dhabi, the unconventional gas play is predominantly limestone and situated relatively deep yet within the required thermal maturity window. To unlock this unique gas play, Abu Dhabi underwent a mega seismic acquisition campaign providing a high-resolution multi-azimuth, multi-angle stack seismic data covering thousands of kilometers that is utilized to image and characterize the deep unconventional reservoirs where well control is sparse. Characterizing this tight reservoir leverages data from the core and logs to establish a regionally consistent rock physics model and then upscaled to the seismic scale. Once this data is upscaled, it is not only integrated with seismic attribute analysis but also used alongside simultaneous seismic inversion which extracts elastic attributes to properly characterize the reservoir. This process of seismic reservoir characterization provides information on porosity cutoffs, kerogen content, and litho-facies away from well control. Given the depth of the play, it is naturally over pressured and fractured. To account for fractures, drilling and mud losses data were integrated with multi-azimuth seismic data inversion which provides information on fracture orientation and intensity to understand the regional fracture system. This integrated approach allows for classifying rock facies, mapping respective reservoir qualities in terms of properties, determining sweet spots, and ranking prospects regionally in the challenging deep carbonate unconventional gas play. The outcome of this integration identified good prospect areas and optimized future drilling plans.