Fracture Characterization Challenges in Developing Tight Carbonate Reservoirs of Kuwait

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One of the key drivers in optimal development of Tight Carbonate Gas reservoirs characterized by very low porosity and permeability is the degree of understanding of the role of natural fractures / fracture characterization. The distribution and type of fractures is a function of palaeo and present day stress, regional tectonics and major structural elements, history of diagenesis and specific mechanical layering. Direct detection of fractures is below the resolution of conventional seismic data. However, even in the absence of availability of analog outcrop data for calibration, integrating diverse data sets such as image logs, cores, P and S wave data, Stonley wave data, present day stress, seismic attributes and 3D seismic azimuthal anisotropy studies in a limited area has resulted in an improved understanding of fractures and high grading potential areas of higher fracture intensity/ fracture corridors.

During the last few years, extensive exploration activity focused on the Jurassic reservoirs of North Kuwait areas, has culminated in the discovery of six major Oil and Gas fields. Kuwait Oil Company (KOC) is presently engaged in an aggressive campaign to quickly develop these fields and bring them on early production.

These Carbonate reservoirs, consisting of the present many challenges for field development.Particularly the reservoir is challenging from a development standpoint due to very low porosity/permeability characteristics (matrix porosity of less than 2% and permeability of .1mD), which are purely fracture driven.

A good correlation of orthogonal relationship between the strike direction of the open fractures and the orientation of the faults, lineaments is established based on this analysis. A correlation between the density of faults and lineaments picked on seismic and the fracture density is also established in the area. This study is helping in guiding the design of trajectories of deviated wells and planning of horizontal wells in the area. Constraining DFN models through seismic attributes was found to offer more logical fracture propagation in the inter-well space. Recent drilling results have corroborated the interpretation based on these integrated studies by encountering higher fracture intensity as predicted at the well locations.