**861 Seismic fracture characterization of Middle Marrat Formation using prestack azimuthal inversion: a case study in Kuwait**

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The Middle Marrat Formation is one of several major producing reservoirs in SE Kuwait. In the study area, the Middle Marrat formation has moderate porosity and is highly fractured. The existence of open fractures enhances the reservoir zone permeability. It has become an important production factor for the zone. Therefore, mapping and detecting these fractures are very important for proposing the new well locations, especially for additional horizontal and deviated wells. Historically, poststack seismic attribute analysis was carried out to predict fracture distribution with limited success. In recent years, prestack azimuthal analysis has been used as an effective tool for fracture prediction. The 3D seismic data was acquired with long offsets (8000 m), full azimuth and high fold (3600 fold). True amplitude preserving prestack depth migration workflow was utilized in the processing. The migrated data was then re-sorted into the CDP domain to analyze amplitude variation with offset/angle along with azimuth by using common offset common azimuth (COCA) displays. A total of 45 azimuthal sectors of 5 angles with 9 azimuths were available for the study. In 2016, Mesdag introduced a novel method of using isotropic inversion and anisotropic modelling to predict the anisotropic behavior of fractured reservoirs. This inversion methodology was adopted in our study. All 45 azimuthal sector stacks were aligned in angle/offset and azimuth directions. Also the amplitude balancing was performed to further reduce the acquisition footprints and the processing artefacts. One important QC step is to display the data in the COCA domain, to see whether amplitude variation with azimuth can be observed in the data. Several COCA views were generated at important well locations. Strong amplitude variation with azimuth (sinusoidal patterns on COCA views) was observed at mid to large offsets. These sinusoidal patterns are related to the seismic anisotropy and can further be attributed to open fractures. This interpretation is reasonable since the azimuth of the strongest amplitude is approximately parallel to the fracture strike direction observed on the image data. Finally, the prestack azimuthal inversion was carried out for the study. We observed that the fracture orientation predicted from the prestack azimuthal inversion is reliable. The predicted open fracture orientations were compared to the image data at 6 well locations, and good match was found between the predicted orientation and actual orientation in the image log data. Out of the 6 wells, results of 4 wells were excellent (less than 10 degree azimuth difference between predicted and actual), and results of 2 wells were reasonable (less than 20 degree azimuth difference between predicted and actual). The inversion results are incorporated with other geological studies to improve our development well placements and to enhance our oil production.