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An Integrated Study for Natural Fracture Detection by Using Advanced Azimuthal Shear Anisotropy Analysis and Geomechanics

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ABSTRACT

This study summarizes natural fracture characterizations using the geomechanical facies and azimuthal shear anisotropy, comparing and validating the results through the borehole image interpretation. Prediction of natural fractures by azimuthal shear anisotropic analysis is achieved by dispersion analysis, analyzing the magnitude of cross shear energy, slowness and time-based anisotropy. The fracture characterization in this study used an advance workflow to identify the possible presence of the natural fractures by integrating the results from azimuthal shear anisotropic analysis, drilling data analysis, rock mechanical properties, “in situ stress” regime, and borehole image interpretation. The study area is characterized by a Strike-Slip-Faulting regime for which the maximum principal horizontal stress (SHmax) is the largest principal stress (i.e., SHmax > Sv > Shmin). In-situ stress directions were inferred from drilling induced tensile fractures observed on the borehole images. Geomechanical facies were computed as a pattern model using the elastic rock properties and stress magnitude profiles, making mathematical combinations between the variables classifying the formation into mechanical layering “facies.” Azimuthal shear anisotropy analysis results were of high confidence because of good acquisition quality and wellbore conditions. The anisotropy intensity recorded high values (>10%) in fractures zones, reducing to less than < 4% in zones without fractures. The type of anisotropy identified in the wellbore changes from “stress induced” to “intrinsic” induced by natural fractures.