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Please fill in your abstract title.	Application of Seismic AVAZ Ratio Method for Reservoir Fracture Characterization

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Abstract

One of the most popular approaches to estimate reservoir fracture parameters such as fracture orientation and fracture density is the analysis of the amplitude variation with angle and azimuth (AVAZ). Recently, a methodology of removing the effect of anisotropic overburden and recovering the true fracture parameters was recently introduced. Here, we address the impact of the shallow subsurface layers (i.e., so called overburden layer) at the target interface when using the AVAZ technique. In addition, we compare conventional AVAZ to the ratio method and validate results with fracture characterization diagrams from FMI logs images.

The Fluid flow and the production in petroleum reservoirs can be greatly affected by the presence of natural fractures, especially in tight formations. Information about the orientation and the density of fractures is required to optimize the production. Recently, AVAZ analysis became widely applied for the detection of fractures in formations with vertically aligned cracks.

Amplitudes of seismic reflection from a target reservoir can be significantly distorted by wave propagation in the overburden layer, leading to unreliable amplitude analysis. For example, the presence of anisotropy in shallow formations may cause amplitude distortions all the way up to the target zone, thus, mistaking the AVAZ analysis. To cope with this issue, we deploy the ratio method. The main idea consists of first transforming the AVAZ gathers from time-angle domain to delay time-slowness domain. Then, the ratio of top and bottom reservoir picks is used for the AVAZ analysis in order to remove the transmission effect from the overburden.

In this study, we apply the ratio method on 3D land seismic dataset from a reservoir in the Arabian Peninsula where the fracture characterization will suffer from the overburden effect. The amplitude ratio of the two horizons confining the desired reservoir is picked from AVAZ gathers in the tau-p domain. Because, the ratio approach is only valid in ray-parameter domain where the horizontal slowness or ray-parameter is preserved in each layer. The whole 3D land dataset is tested and analyzed with both conventional and ratio AVAZ techniques. The fracture density and orientation are estimated and mapped along the target reservoir. Then, validated by the fracture characterization results from Formation Micro Imaging (FMI) interpretation. Unlike the conventional AVAZ approach, the ratio method shows a better correlation with FMI logs detecting a major trending fractures in NE-SW direction in addition to minor trends in the same directions as identified by FMI images.