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1.4-O2. Modelling Anisotropic Effects for Reservoir Fracture Characterization of a Naturally Fractured Tight Carbonate Reservoir, Onshore Texas, USA

Anisotropic modelling was carried out using 3D-PP full-azimuth full-offset reflection data acquired over a naturally fractured tight carbonate field, onshore Texas, USA. The processed data were inverted to generate anisotropic parameters used for modelling and fracture characterization of the carbonate reservoir currently experiencing production decline despite reservoir studies that suggested an un-depleted reserve. Generated model confirmed azimuthal anisotropy as crack induced shear-wave splitting and variation in P-wave velocity with offset and azimuth, where P-wave is fastest (Vp-fast) in direction parallel to the crack and slowest (Vp-slow) along orthogonal direction. Amplitude Variation with Angle of incidence (AVA) presented a case I AVO, while AVAZ confirmed multi-crack sets induced anisotropy characteristic of orthorhombic symmetry, evident as multiple bright and dim-amplitude azimuth directions as well as complete reversal of bright-amplitude to dim-amplitude azimuth direction as the angle of incidence increases from near (150) to mid (300) offsets. Fitted P-wave velocity ellipse gave crack intensity, open-crack orientation (N26E) and minimum in-situ stress axis (N116E) within the reservoir. The derived information aided the design of horizontal well paths that intercepted open fractures, carry out effective and cheap hydraulic fracture stimulation and guide placement of injection wells for production optimization and sweep efficiency.

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