Methodology for Static Characterization of Natural Fractures: Implementation in Pemex Projects and its Application in Oil and Gas Field Development

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ABSTRACT

Development of computer programs for determination of fracture orientation and properties, using 3D seismic, has been intensified in recent years. Study of fractures in well logs and cores complement these studies. However, a good calibration is still needed. This paper describes the methodology called Structural-Diagenetic Petrographic Study (SDPS), as a tool that complements, at micro-scale, the fracture characterization in a reservoir. The methodology focuses in the determination of families or 'sets' of conductive fractures and the quantification of fracture attributes such as orientation, opening, degree of cement, porosity, geometry, connectivity between fractures, and connectivity of matrix-fracture. This is performed by means of diagenetic and structural analyses. These attributes provide hard data to calibrate other fracture studies at different scales.

The methodology is supported by the measurement and study of more than 16,500 fractures in outcrops of Sierra Madre Oriental and Sierra de Chiapas, Mexico. With the established use of this methodology in Pemex, it has been recognized as a tool that has improved fracture models in several oil fields, e.g., Ku-Maloob-Zaap, Puerto Ceiba, Costero, and Cactus. Reservoir engineering data, such as production tests, tracers, PLTs, accumulated production, and interference testing, calibrate the final fracture model to support the reservoir simulation for development and exploitation.

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