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Linking Normal Fault Propagation Processes with Oil Bearing Reverse-Drag Folds: A Case Study from Leona Field, Eastern Venezuela Basin

In the mature Leona field, recent 3-D seismic interpretation allowed us to identify well-developed reverse-drag folds in the hanging wall of the main E-W normal fault. Successfully drilled by a campaign of fifteen wells started in 1996, these fault-associated folds have produced around 3 MMbbls of medium-light oil until today. To understand the features of these fault-associated folds (geometry, kinematics, etc), we performed a comparative study of the faults and folds.

The main reverse-drag fold is elongated and parallel to the strike of the associated fault, and displays three regularly distributed highs. This normal fault system, that divides the Leona field, is composed of interconnected fault segments. The main fault plane shows throw variations along strike, with maximum displacements coinciding with the fold highs. The location of the minimum displacement values corresponds to the main undulations of the fault plane, which we interpret as evolved breached relay zones. We interpret this fault and fold geometry as the result of the linkage of three fault segments and their associated simple folds.

Well documented for normal fault segments, the linkage of fault-associated folds seems to follow the same rules, suggesting the close relationship between fault shape and deformation of the hanging wall. The knowledge and understanding of this relationship can be used to depict fold geometry and optimize drilling locations.