Strike-Slip Faults vs Lateral Ramps in the Zagros Thrust Belt (NE Iraq): Impacts on HC Potentials

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ABSTRACT

Strike-slip faults and lateral thrust ramps are typical structural features characterizing most of the curved Tertiary Thrust Belts surrounding the Mesozoic Tethys. Their presence and abundance depend on several regional and local characteristics and they can strongly affect the architecture of the thrust belt and the hydrocarbon exploration potentials of these regions. Typical geometries associated with the presence of strike-slip faults and lateral ramps are cross-strike structures or transverse zones. They are discontinuities trending remarkably oblique to the thrust belt structures causing along-strike variations and lateral changes. Among the possible causes controlling the location of cross-strike structures and transverse zones are (1) pre-existing sub-décollement basement faults, (2) cover strata deformed above basement faults, and (3) along-strike variations in mechanical stratigraphy and lateral thickness/facies changes. Commonly, these cross-strike structures are constituted by regionally important faults or arrays of faults therefore mostly represented by lateral/oblique thrust ramps, oblique faults, strike-slip or transfer faults. This study reappraises several examples from the carbonate-dominated Alpine-type fold-and-thrust belts of the Zagros in the Kurdistan region of NE Iraq. A large dataset, including high resolution satellite images, 2D seismic lines and outcrop data, was used to assess how these structures control the timing and pathways of hydrocarbon migration. They can either represent preferential conduits for up-dip migration, they can be part of the trapping mechanism acting as structural barriers for lateral migration or they may also contribute to reservoir compartmentalisation. Furthermore, these structures can affect the development and distribution of fracture patterns within thrust-related anticlines and, as a consequence, can help to optimize reservoir management strategies. The results of this study suggest that cross-strike structures have a dramatic impact on hydrocarbon migration and accumulation because in the analysed area they mostly act as structural barriers to lateral fluid migration being crucial in compartmentalizing carbonate reservoirs and contributing in localizing hydrocarbon accumulation. Generally, the fracture intensity is variable and it increases significantly towards fault zones. Depending on the mechanical stratigraphy, local structures and varying stress fields, the characterization of the fracture network along cross-strike faults is of fundamental importance to understanding fluid migration within carbonate reservoirs and quantifying exploration risks.