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Characterization of the Jurassic Petroleum System of Iraq, and Prediction of Petroleum Migration Pathways

Multiphase-flow modeling of the Jurassic Petroleum System in Iraq provides an integrated analysis of the stratigraphic, thermal maturation, and hydrocarbon migration histories of the Zagros basin and Zagros fold belt. The model incorporates the essential geologic elements and processes required for the accumulation of petroleum in the region. Upper Mesozoic and Cenozoic reservoirs host the majority of oil generated from Jurassic source rocks. The oil-generation potential of Jurassic source-rocks was modeled using kinetics for Type II-S kerogen. Fluid-flow and thermal parameters used in the model were calibrated with reservoir pressure and temperature data. Calculated present-day geothermal gradients vary locally averaging 22 C/km in the basin and 25 C/km in the foldbelt. These modeled gradients match measured gradients assuming a present-day heat flux of 43 and 48 mW/m^2, respectively. Calculated vitrinite reflectance profiles are in agreement with measured Ro values, indicating that heat flow has been relatively uniform since the Cretaceous. Peak oil generation and expulsion occurred during Oligocene time in the basin and during the late Miocene in the fold belt. Hydrocarbon flow-path simulations show that structural traps in close proximity to modeled migration pathways that diverged from (local) intra-platform basins were filled earliest. Other structures were charged later as flow pathways focused toward these features. The location of undrilled structures in relation to predicted migration pathways should be considered when evaluating these structures for their hydrocarbon potential. It follows that structures close to modeled migration paths have lower exploration risk than those structures more distant from fluid-flow pathways.