Integrated Remote Sensing, Structural and Petroleum Systems Modeling of the Iraqi-Kurdish Fold Belt

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An integrated two-dimensional remote sensing, structural and petroleum systems modeling study was carried out for the Iraqi-Kurdish Fold Belt to analyze potential trap structures as well as the driving mechanisms of petroleum generation, migration and accumulation in the structural complex thrust belt area.

Processing of Landsat-7 ETM data has been used to create false color images, highlighting lithological differences, from which geological maps can be generated. Analysis of lineaments in these images is used to generate fault and fracture maps, producing a suite of geological surface maps. In addition, analysis of drainage patterns and erosional features is used to understand the relative age of the structures. Key regions were selected for ground-truthing. Lastly, these maps were combined with published and proprietary subsurface data to create a structural cross-section of the Qara Chauq to Bina Bawi transect of the Kurdish Folded Belt. The cross-section indicates that a minimum of 20% shortening has occurred across this region.

Twelve paleo-sections, including pre- and post erosion geometries, were used for the model building process. The model features both, basement faults and surface folds as well as thrust geometries that accommodate the structural framework and its development. The strata were modeled as an alternating limestone and shale sequence. The Sargelu and the Kurra Chine Fm were considered as source rock intervals. The reservoir rocks include the Shiranish, Aqra-Bekhme and the Sargelu Fm. The Gercus Fm acts as a regional seal horizon.

Special focus was laid on the N-S trending basement faults and their evolution through time since these faults appear to divide the petroleum system into areas of differing maturity. The influence of fault permeability evolution upon petroleum migration has been evaluated to unfold the charge history of the region. Temperature and vitrinite reflectance data derived from key wells and literature have been used for thermal calibration.

The model results and a detailed petroleum systems analysis show the differential maturation and generation behavior of the source rock compartments and reveal the major influence of timing and fault migration for the oil & gas charge over time.