Structural Analysis of the Zagros Fold Belt in Northern Iraq

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The Zagros Fold Belt in northern Iraq is 500 km long and 200 km wide, forming a crescent-like belt facing southwest. At least three super giant and several giant oil fields occur within this belt.

In plan view, the fold consists of many long, narrow anticlinal features separated by broad synclines. Seismic and drilling data show that the major anticlines developed in response to movements on positively inverted flower systems.

Late Miocene-Pliocene contraction on former Late Cretaceous grabens and half grabens resulted in development of these positively inverted fault-related folds. However, the surface synclines are underlain by uninverted or slightly inverted faults. The resulting folded sedimentary sequence ranges in thickness from 6 km in the far northwest to 12 km in the southeast. This folded sequence includes Late Cretaceous syn rift, pre-Late Cretaceous pre rift, post Cretaceous post rift, and finally a Pliocene syn inversion sequence.

The pre and post rift sequences maintain thickness across the faults, but fault-controlled thickness variations characterize the Late Cretaceous syn-rift sequence. The later syn inversion sequence tends to pinch out towards the anticlinal crests.

In northwest Iraq where the sedimentary cover is relatively thin, seismic data show that the Middle-Late Triassic sequences also vary in thickness across these fault systems. This likely occurs in the southern parts of the belt, but this is not clear on present seismic data.

We conclude that major extensional movements took place during the Middle-Late Triassic resulting in the present fault systems. Late Cretaceous rejuvenation then complicated the existing graben systems. Finally, the Late Miocene-Pliocene contraction resulted in positive inversion along these faults and produced the present folded belts.

Seismic data show that the Early-Middle Miocene salt bearing rocks exhibit thickness variation under contractional stresses. Similar variation occurs in the Jurassic salt and the bituminous bearing rocks. The presence of these mobile sequences added complexity to the three-dimensional configurations of the major inverted folds.

Drilling and exploration activities to date in northern Iraq only targeted conventional structural traps on anticlinal crests. Structural analysis suggests unconventional down-flank duplexes and fault controlled structural traps that could add additional major hydrocarbon targets for the future exploration activities in the area.