

Inversion Tectonics in Central Tarim Basin, NW China: Geometric Characteristics and Petroleum Implications

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The evolution and development of Tarim basin were controlled by the background of the plate tectonics in different periods, forming various types of primary basins; multi-phases inversion tectonics were developed in Tarim basin, therefore intra-plate deformation showed complicated structural styles, which have a significant role for the accumulation of hydrocarbon. To better understand the petroleum implications of inversion tectonics, taking central areas of Tarim basin as a study target, based on a combined seismic datum, outcrop, analogue modelling and laboratory data including mechanical properties and petrophysical properties. We studied the mechanism, deformation intensity across basement faults and potential contribution for hydrocarbon re-migration of inverted faults.

During Sinian to middle Ordovician, the central Tarim basin experienced extensional stress field, basin inversion mainly happened in late Ordovician when orogenic process taken place around Tarim basin, which resulted in the compressional stress field within central Tarim basin. The seismic cross-section showed that the final deformation pattern of extensional basins inverted during compression is strongly influenced by the geometry of early normal faults which are zone of weakness with different mechanical properties. During middle Cambrian, the resulting garben or half-garben is progressively filled with synextensional less competent strata, laboratory data suggested that in less competent strata, gypsiferous and salt beds impede normal fault reactivation, resulting in fault-decollement folding in the upper layer.

Physical analogue successfully replicate inversion structures in evolving fault systems thereby restored such structures kinematically through their complex structural history of this deformation in these prospective hydrocarbon traps. The initial development of continental extensional basins provide ideal conditions for the deposition of organic-rich source rocks, such as Yuertusi formation in lower Cambrian. Owing to the compact of gypseous halite in middle Cambrian, both over and under the gypseous halite developed two groups of dolomite which is high quality of reservoir. Structural inversion provides the anticlinal trap for the hydrocarbons, the new faults, propagated during inversion; act as pathway for migration of petroleum.