Differential Oil and Gas Accumulation Mechanism and Exploration Breakthrough in the Strike-Slip Extensional Fault Zone of Easten Huanghekou Depression

Huang Zhen[1], Gao Yanfei[1], Zhao Dijiang[2], Haifeng Yang[3]
[1]Bohai Oilfield Research Institute; [2]CNOOC; [3]CNOOC Ltd. - Tianjin

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Abstract

The east depression of Huanghekou, located in the south of bohai sea, is a small marginal depression. The depression is sandwiching between the eastern branch and the west branch of the tanlu strike-slip fault zones. Affected by the superposition of stress between extensional fault and strike-slip fault, the depression is characterized by unique tectonic deformation, frequent uplift and subsidence, structural fragmentation, and complex petroliferous system. The core problems that restrict the exploration in this area are as follows: firstly, the settlement center migration under strike-slip and extensional composite stress causes the distribution of the main source furnace to be unclear. Secondly, Due to the complex faults in this area, it is difficult to predict the dominant migration path of oil and gas. The structural deformation mechanism of strike-slip and extensional composite zone is analyzed by means of three-dimensional seismic sand box physical simulation test, and the tectonic evolution model of the studied zone is clarified. The stress transition between pressure release and pressure increase under strike-slip - extension conjugate mechanism results in the differential uplift of easten huanghekou depression. Under this mechanism, the study area presents a seesaw structural pattern. Strike-slip and extensional conjugate pressure release control the spatiotemporal order superposition of the main hydrocarbon sources. The oil-gas differential enrichment model under the longhorn-concave transformation was established. In the western Bonzhong A tectonic ridge, it was

characterized by early longhorn-late depression and ridge-fault-ring accumulation model. The B area of Penglai in the east is the early uplift and late depression, and it is the vertical through migration mode of the source. The oil and gas migrated directly along the fault from the deep source rock to the shallow trap and formed the reservoir. The fault-cap coupling controls the transmission efficiency, which controls the hydrocarbon accumulation layer longitudinally and the differential enrichment of shallow traps horizontally. For the shear source (transit silo) fault, when the fault-cap ratio is less than 1.2, it is difficult for oil and gas to break through the sealing of mudstone cap in the lower section of the second east, which is mainly concentrated in the paleogene. When the fault-cap ratio is greater than 1.2, oil and gas can be transported to shallow reservoirs. When the fault-cap ratio is greater than 1.5, the oil and gas charging along the fault to the shallow layer is strong, and the oil and gas charging capacity of the shallow layer is different in different parts of the same fault. This geological understanding has guided the exploration and deployment of Huanghekou Dongwa, and the commercial success rate of drilling has reached more than 90%, Proved reserves of 50 million tons were found.