

Salt Structures in the Laizhouwan Depression, Offshore Bohai Bay Basin, Eastern China: Implications for Structural Models and Hydrocarbon Exploration

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The salt structures in the Laizhouwan depression, offshore Bohai Bay basin are adjacent to the Tan-Lu fault, and were originally interpreted as flower structures induced by the dextral strike-slipping movement of the Tan-Lu fault. However, the high-quality 3D seismic data indicate that the structures are typical salt diapirs and pillows. The wells have also encountered 300 m thick halite in the Sha-4 Member of the Paleogene Shahejie Formation.

As a whole, the salt structures in the Laizhouwan depression formed an S-N trending salt wall, which changes shape regularly along its trend from salt diapir to salt pillow. The change in thickness of the suprasalt layers record five growth phases of the salt wall from the Eocene to the Quaternary: (1) early diapirism, (2) active diapirism, (3) passive diapirism, (4) relative structural quiescence, and (5) arching. The evolution of the salt structures was mostly governed by the multi-phase compression induced by the dextral strike-slip of the Tan-Lu fault, which formed a restraining bend in the Laizhouwan depression. There was an original passive stock in the south, which was later tectonically squeezed by E-W compression and became a diapir. As the shortening propagated to the north from the original stock, the salt pillow was created in the north. Relative structural quiescence then followed until the next phase of compression, which arched the thick roof of the salt wall.

Now, oil and gas shows have been discovered in the strata above the salt diapirs, including the Paleogene Dongying Formation, Neogene Guantao Formation and Minghuazhen Formation, which shows the salt structures have close relationship to hydrocarbon accumulations. In the seismic profiles, some subsalt fault-anticlinal traps and stratigraphic traps in the diapiric limbs are relatively obvious. Generally, these traps should have greater hydrocarbon potential than the suprasalt traps, and are the favorable objectives in the future oil and gas exploration.