

3D Seismic Characterization and Petroleum Significance of Shallow Faults on the Shijiutuo Uplift, Bohai Bay Basin, China

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Abstract

Oil and gas exploration experience of the Bohai area has indicated shallow faults dominate the distribution of oil and gas of the Shijiutuo Uplift. In this study, based on 3D seismic data, high resolution fault throw plot was employed to analyze throw distribution characteristic that are displayed on the fault plane of two faults (F1 and F2) on the Shijiutuo Uplift to illustrate accurately activity features of shallow faults. According to criteria of identifying blind fault and regional tectonic stress, we discussed growth pattern and genetic mechanism of F1 and F2 faults in order to understand petroleum significance of shallow faults on the Shijiutuo Uplift.

Three main throw plot profiles were identified with flat-topped, conic, and bimodal shape which represent steady, intense, and multiperiodic activity, respectively. The throw contours for Fault 1 is elliptical in shape, concentric, and centered on the two zones of maximum throw located at the middle of the two segments. The greatest throw gradients occur in the upper part of the fault plane. In contrast, throw contours for Fault 2 illustrate a major zone of throw maxima occur in the lower part of the fault plane.

Research results confirms that F1 and F2 faults were blind normal fault which formed under the condition of regional submeridionally extension. It initiated as a series of intrastratal fault nucleation, which propagated in a semi-elliptical geometry downward and sideward. The rate of fault nucleation growth along with the point of fault nucleation determined the throw plot profiles.

Investigating the correlation of blind fault and oil distribution, we considered that it is more favorable to oil accumulation with slow upward and steep downward throw plot profile of the F2 fault, which need further research in hydrocarbon migration and conduction in the Shijiutuo Uplift, Bohai Bay Basin. This research reveals that the analysis of 3D seismic characterization of shallow faults provide us with a new method to figure out significance of shallow faults for oil accumulation.