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Development characteristics of the fault system and its control on basin structure, Bodong Sag, East China

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Abstract: The Bodong Sag, located in the Bohai Sea, offshore China, is one of the most petroliferous basins in China. Based on three dimensional seismic reflection data and time slice data, we analyze the fault system of the Bodong area in detail, establish the fault structure pattern of different types and summarize the distribution of the fault system. It is concluded that the development characteristics of the Cenozoic fault system are in accordance with the dextral stress field of the Tanlu Fault, which displayed a brush structure with NNE strike-slip faults as its principal faults, NE-trending extensional faults as secondary faults and EW-trending faults as minor faults. Faults can be divided into (1) strike-slip type, (2) extensional type, (3) strike-slip extensional type and (4) extensional strike-slip type. The spatial structures of different faults have obvious differences because of the fault properties and activity intensity. The fault system at different stages shows tremendous differences because of the transition of the Tanlu Fault from sinistral strike-slip to dextral strike-slip, the transition between extension and strike-slip, and the transition from mantle upwelling to thermal subsidence. According to the controlling effect of faults on basin structure, the Cenozoic basin experienced four evolutionary stages, (a) transition stage from sinistral strike-slip to dextral strike-slip, (b) strike-slip extensional faulted stage, (c) extensional strike-slip faulted stage and (d) strike-slip depression stage. The identification of temporal and spatial differences of faults could be used as a significant guideline for oil and gas exploration in the Bodong area.

Key words: Fault system, basin structure, Bodong area

1 Introduction

The Bodong area is situated in the eastern Bohai area, East China and is surrounded by the Jiaoliao Uplift in the east, Bozhong Sag in the west, and the Liaodong Bay Sag in the north (Fig. 1) (Xiu et al, 2013; Qi and Yang, 2010; Jiang et al, 2011). It is one of the most petroliferous basins of Bohai area, and is about 6,000 km^2 in area. The study area contains four secondary structure units: the Bodong Sag, Miaoxi Sag, Bodong Low Uplift, and the Miaoxi Uplift. The Bodong area is considered as an important target area of the Bohai Bay Basin with great exploration potential and several mid-large scale oil and gas fields have already been found (Gong et al, 2007; Zhu et al, 2009; Zuo et al, 2011).

Faulting is the main deformation mode of the sag and the main controlling effect of the basin structure (Li et al, 2012). Under the joint action of the Tanlu Fault's strike slip, subduction of the Pacific Plate and mantle upwelling, the fault system displays a superimposed effect of the extensional fault system (Paleogene) and the strike-slip fault system (late Paleogene and Neogene) (Tong et al, 2008; Li et al, 2011; Yu et al, 2009; Chen et al, 2012; Wan et al, 2009; Zhao and Zheng, 2005), which results in the diversity of the fault trends, properties and spatial structure.

Based on abundant three dimensional seismic data, we analyzed the 3D characteristics of the fault system by combining analysis of profiles and time slices, which broke through the former researchers' limitation of 2D analysis of the fault, and established the 3D structure pattern of faults. Furthermore, we analyzed the control of fault systems on the basin structure, aiming at guiding oil and gas exploration.

2 Basin-controlling fault system of the Bodong Sag

2.1 Feature of the main faults

The NNE, NW, NE, NEE and WNW trending faults are well developed in the Bodong area. This paper systematically describes the main basin-controlling faults by analysis of the characteristics of seismic sections and time slices (Fig. 2, Fig. 3).

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