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## Structural Characteristics in Western Liaodong Bay Depression

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# Structural Characteristics in Western Liaodong Bay Depression

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**Abstract.** Liaodong Bay Depression is affected by both extensional and strike-slip processes. Its structural deformation is complex. Various structural styles are developed. Liaoxi Area located in the western part of the Liaodong Bay Depression. This paper classifies and sorts out the structural styles and summarizes the development characteristics of the structural styles in Liaoxi Area.

## 1. Introduction

The Liaoxi Area located in the western part of the Liaodong Bay Depression. The whole body is NNE-oriented and develops into a narrow and long strip structure. In Liaoxi Area, there are mainly four sub-structural units: Liaoxi sag, Liaoxi uplift, Liaoxi South uplift and Liaoxi South sag [1, 2, 3, 4, 5, 6]. There are four main faults, most of which are tensional or strike-slip-tensional faults (Fig. 1). A penetrating strike-slip fault zone is developed in Liaoxi sag. Due to the joint action of early extension and late strike-slip, the tectonic deformation in Western Liaoning is very complicated.

## 2. Development characteristics of fault system

There are four main faults in Liaoxi Area, including Liaoxi South 1 Fault, Liaoxi 1 Fault, Liaoxi 2 Fault and Liaoxi 3 Fault. Only Liaoxi South 1 Fault is NE-trending.

These faults are mainly shovel-type extensional faults with gentle angles. It can be combined with shallow secondary faults to form y-shaped structures or multi-y-shaped structures.

The Liaoxi Strike-slip Fault Zone can be divided into three sections: the north, the middle and the south. The north part located in Liaoxi sag, NNE-trending. The main faults are vertically developed with flower-like structures on the section. The middle part is NE-trending, where the fault is relatively continuous, and flower-like structures are developed. The south part controls the formation of Liaoxi South Sag, Liaoxi South Uplift and the south part of Liaoxi Uplift. On the section, the main fault is vertically developed, while the secondary faults are basically not developed.

## 3. Development characteristics of structural styles

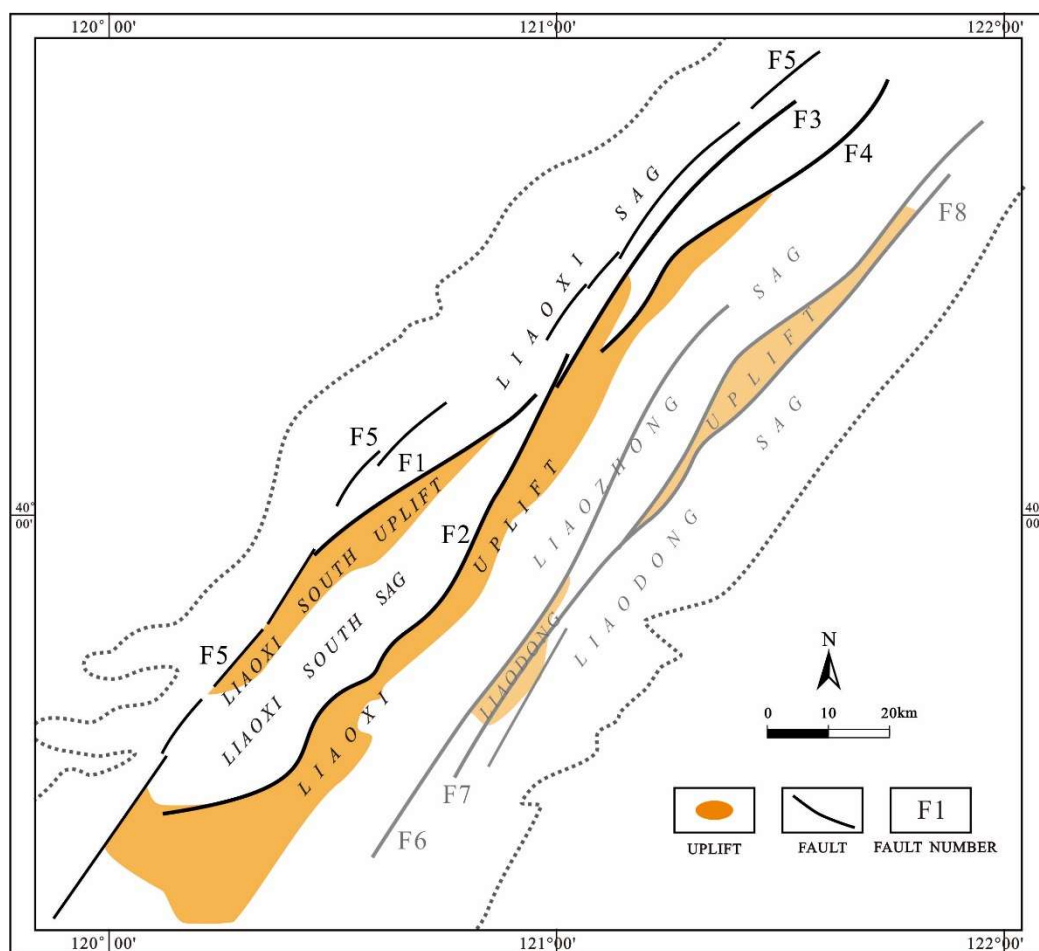
Extension and strike-slip in Liaodong Bay Depression are superimposed and compounded. Structural deformation patterns in basins are often constrained by more than one tectonic factor or stress field in more than one direction, and are characterized by complex deformation.



According to the mechanical mechanism of structural genesis, the structural styles in Liaoxi Area are divided into extensional structural styles, strike-slip structural styles, extensional strike-slip structural styles and inversion structural styles.

Based on the detailed anatomy of different types of structural styles in Liaoxi Area, it is found that there are obvious differences in the developmental location and stratigraphic position of different types of structural styles.

Extensional structural styles are widely developed in the whole region. In terms of main faults, most of them are extensional faults in the early stage and listric normal faults or y-shaped structures are developed in the section. The styles of rolling anticline and sliding fault steps are mostly developed in the upper plate of large extensional faults, and the multistage y structure is more developed in Liaoxi Area. The upward-dip fault block structure style mainly appears in the secondary faults, mostly develops in slope or in sag.



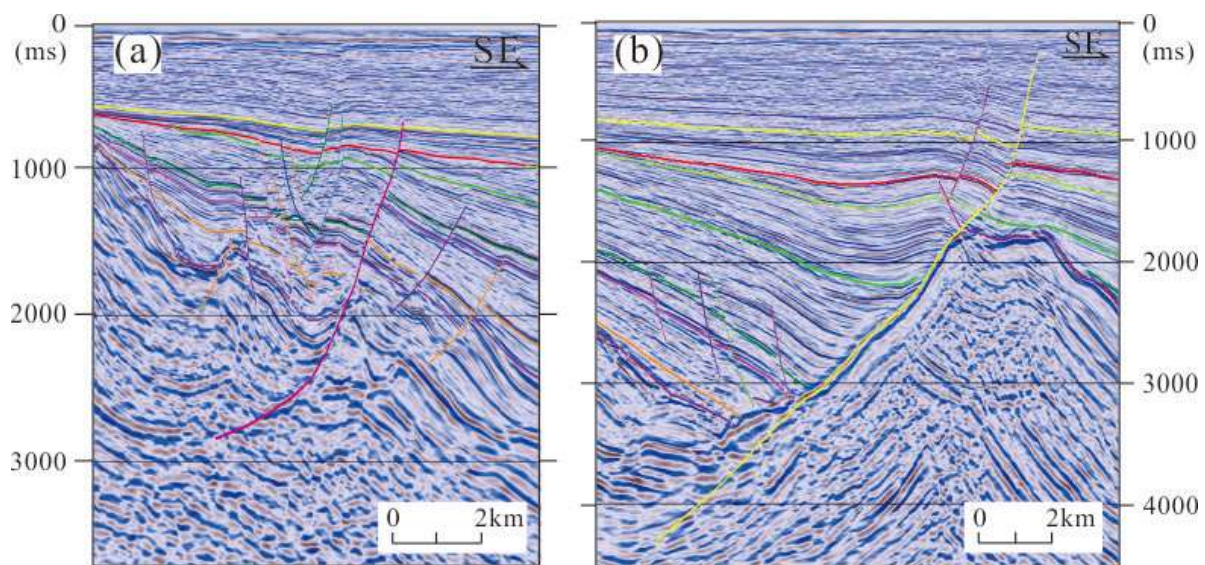
**Figure 1.** Distributions of tectonic units of Liaoxi Area.

(F1-Liaoxi South 1 Fault; F2-Liaoxi 1 Fault; F3-Liaoxi 2 Fault; F4-Liaoxi 3 Fault; F5-Liaoxi Strike-slip Fault Zone; F6-Liaozhong 1 Fault; F7-Liaozhong 2 Fault; F8-Liaodong 1 Fault)

The dolphin effect caused by strike-slip is obvious in the strata thickness along the strike on both sides of Liaoxi 2 Fault. According to strike-slip strength, the strike-slip structural styles can be divided into weak strike-slip structural styles, medium strike-slip structural styles and strong strike-slip structural styles. Weak strike-slip structural styles are common in Dongying Formation, mainly developed in Liaoxi strike-slip fault zone. (Fig. 2-a) The medium strike-slip structural style can be seen in Liaoxi 1 Fault (Fig. 2-b). Strong strike-slip structural styles are developed in the southern part of

Liaoxi strike-slip fault zone. In the process of strike-slip activity, strike-slip derived structures are extremely developed due to the different occurrence and combination patterns of fault planes. The extensional horsetail fan structure (such as the southern end of Liaoxi 1 Fault, etc.) is developed at the end of the Paleogene main fault. The extensional lateral-extension double structure is developed between Liaoxi 2 Fault and Liaoxi 3 Faults. In addition, strike-slip tensile bending and compressive bending developed in different parts of Liaoxi 1 Fault. Some of the major faults in Liaoxi Area stopped their activities in Neogene.

Affected by the superposition effect of extension and strike-slip action, the southern part of South Liaoxi 1 Fault was an extensional fault in the early stage, and after the transformation by strike-slip action, the section showed flower-like structure. The strike-slip activity still exists in Neogene, but its intensity is somewhat weakened.



**Figure 2.** Section of strike-slip structural style of Liaoxi Strike-slip Fault Zone  
(a- weak strike-slip structural style; b- medium strike-slip structural style)

#### 4. Conclusion

The structural styles in Liaoxi Area are divided into extensional structural styles, strike-slip structural styles, extensional-strike-slip structural styles and inversion structural styles. Extensional structural styles are widely developed in the whole region. The dolphin effect is obvious along Liaoxi 2 Fault. The strength of strike-slip influences the development of structural styles. And strike-slip derived structures are extremely developed.

The spatial and temporal differences of structural styles in Liaoxi Area reflect the superposition of tectonic stresses of different evolution stages and different properties in different regions. It further reflects the difference of regional and local tectonic stress field and causes the difference of structural characteristics of different tectonic units and basins.

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