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Classification of fault condensed belt and faults development characteristics in Xingbei Region, Daqing placanticline

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Abstract*:* - Based on the northern Songliao Basin regional seismic interpretation, this paper analyses the faults geometry characteristics such as faults strike, faults density and scale, And further studied the faults profile shape and trans-formational properties, then inferred the stress field change during the faults evolution, and the repeated movement of faults. At last, as the basic of the faults geometry characteristics, this paper divided study area into some fault condensed belt and different direction of fault zones, stuty the relationgship between them, then find that the study area has experienced many times of stress change.

***Keywords: -** Faults; Geometry characteristics; Fault condensed belt; Fault zone*

I. INTRODUCTION

Xingbei Region located in the central depression of Songlioa basin, at the north of the Xingshugang anticline, Daqing placanticline. The Saertu anticline is at its north area, the Qijia-Gulong sag is at its west area [1-2] . The Songliao basin go through three evolution periods, they are rifted period, depression period and inversion period, the formation develop in this area are Lower Crataceous Huoshiling formation, Shahezi formation, Yingcheng formation (they belong to the rifted structural layer), and Denglouku formation, quantou formation, Upper Crataceous Qingshankou formation, Yaojia formation, Nenjiang formation(they belong to the depression structural layer), and also the Sifangtai formation, Mingshui formation(they belong to the inversion structural layer). The faults we study this time were developed during the depression period in the Putaohua reservoir. After that they experienced the inversion period, and then finally fall into a pattern [3] . The faults in the study area are quite developed, there are three types of faults, the antithetic faults, the synthetic faults and the reverse ridge faults, and their main strike are NW-NNW trending (Fig.1). This paper analyses the faults geometry characteristics and divided the fault condensed belt. So it can help people prepare for the next step of exploratory development [4] .

II. FAULTS DEVELOPMENT CHARACTERISTICS

2.1 faults geometry characteristics

Faults developed in the same basin usually experienced multi-superimposed deformation evolution, and because of this deformation, different layer systerm has different faults geometry characteristics [5] (Fig.2), this kind of difference also inferred the different faults deformation properties during the deformation periods.

2.1.1 faults strike

The faults strike from bottom to top are similar, mainly NW-NNW trending. The dip is mainly about NE trending, and also a small part of faults are dipping NW trending (see the Fig.4 for the reflector). In the depression period and the inversion period, the faults are inherited, but also have some defferences. In the depression structural layer, faults strike are mainly NW trending, a little part of NNE trending; In the inversion structural layer, faults strike are mainly NW and NNW trending. This is because during the depression period, Songliao basin's stress field direction is change from SEE –NWW trending extension to the nearly EW trending extension. The strong activity period is the Late Quantou formation –Early Qingshangkou formation sedimentary period, and devoloped many nearly SN trending extensional normal fault; During the inversion period, the sinistral transpression stress field make the early nearly SN trending fault become deformation and also developed new faults or faults reactivation, so that is why the faults active in the inversion period are mainly NW-NNW trending. Above all, illustrates that the faults strike are different during the different periods, and the region stress field properties are also different [6] .

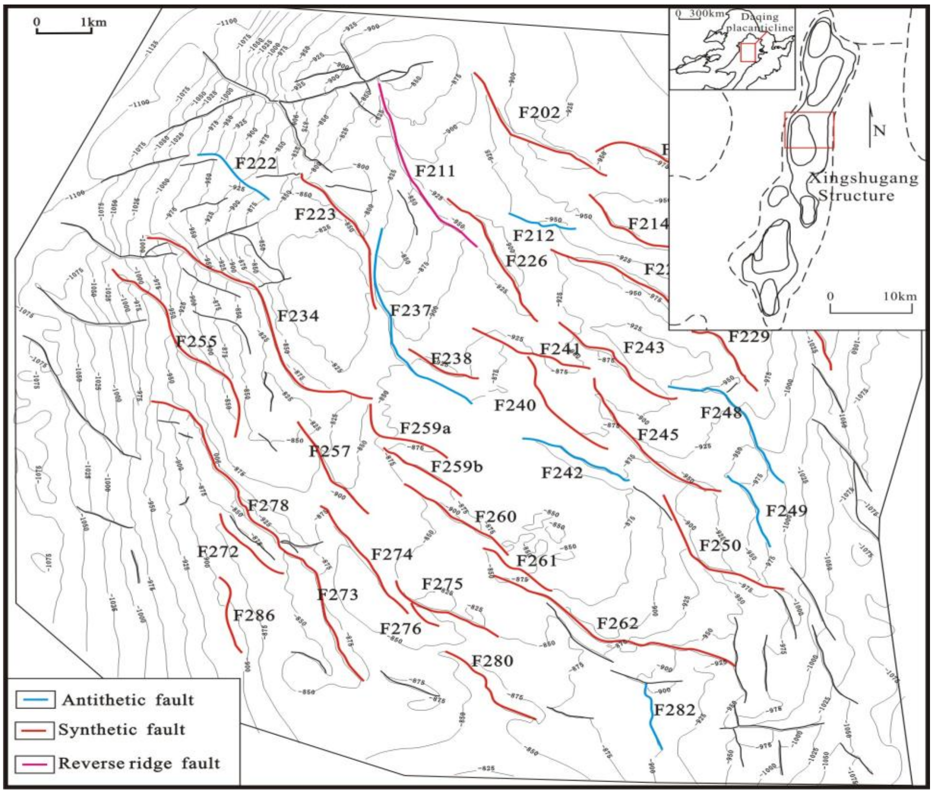

Fig.1 faults distribution characteristics in the Xingbei Region

2.1.2 faults density

Faults density reflects the faults strength, expecially during the postrift period of the basin evolution, the faults scale is smaller than the faults developed during the syn-rift period. From the statistical results, the faults density become larger from bottom to top. The depression period(the reflector T_2) faults have the largest faults density, usually around 1.0 /km^2; the inversion structural layer(T_{06}) faults density is less than it, usually around 0.11 /km^2, shows that the faults are multistage activities (Fig.2).

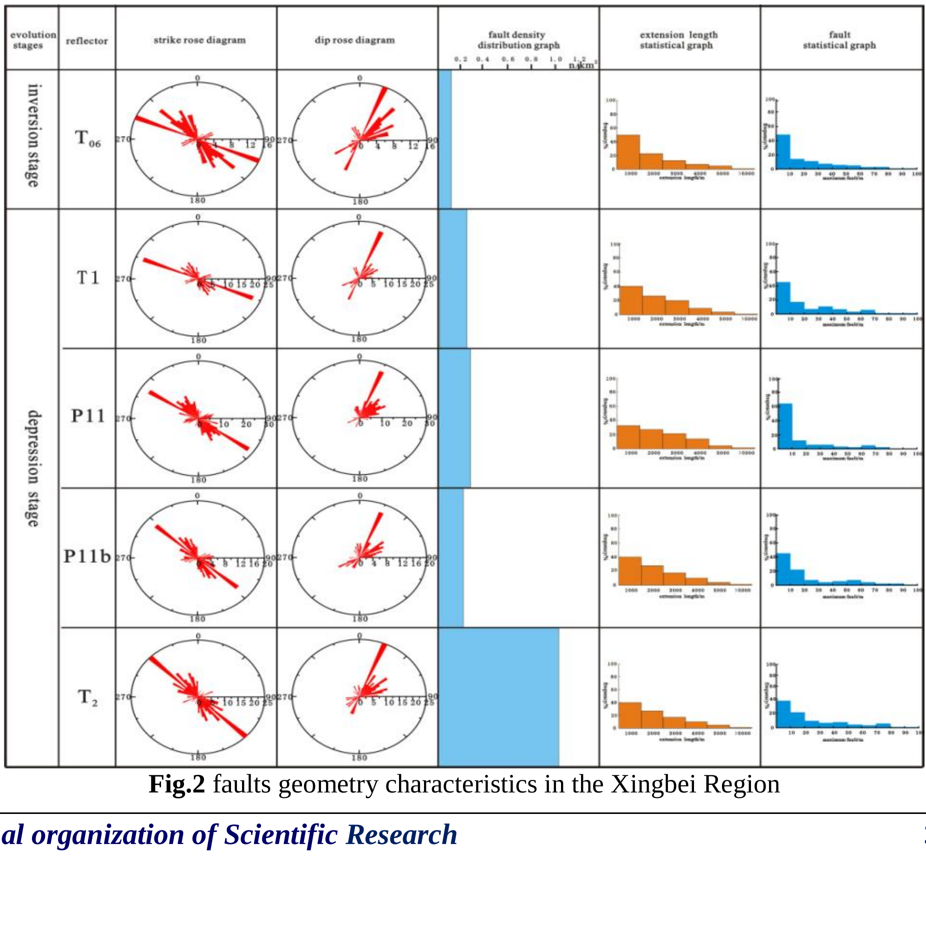

Fig.2 faults geometry characteristics in the Xingbei Region

2.1.3 faults scale

Fault extention length and fault throw reflect its scale, and the fault deformation strength. Overall, there are various sizes of faults scale, faults throw and extention length, that means the properties of fsults multistage activities. The faults throw in the depression structural layer are usually under 20m, extention length are shorter than 4km; the faults throw in the inversion structural layer are usually 0~10m, extention length are 1~3km (Fig.2). This indicates that from bottom to top, the faults scale become smaller, the stress strength become weaker and the tectonic deformation strength become weaker.

2.2 faults profile shape and trans-formational properties

The faults at the study area are steep, the dip are usually around 50～70° (Fig.3). While, on the sesmic section, the faults are steep and straightness, its trans-formational properties is different. From the sesmic section(Fig.3), we can see that in the vertical profile, mainly develop the fault type T_2, the fault type T_{11}-T_1, the fault type T_{06}, the fault type T_2-T_1 or T_2-T_{11} and the fault type T_2-T_{06} (Fig.4). Among them, the number of fault type T_{06} are least. The different of the faults trans-formational represent the different faults active stages, and the different deformation properties.

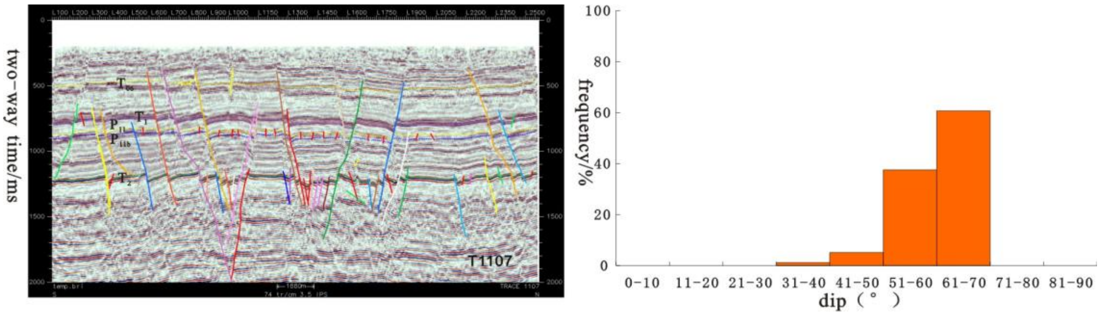

Fig.3 faults profile shape and dip distribution of Xingbei Region

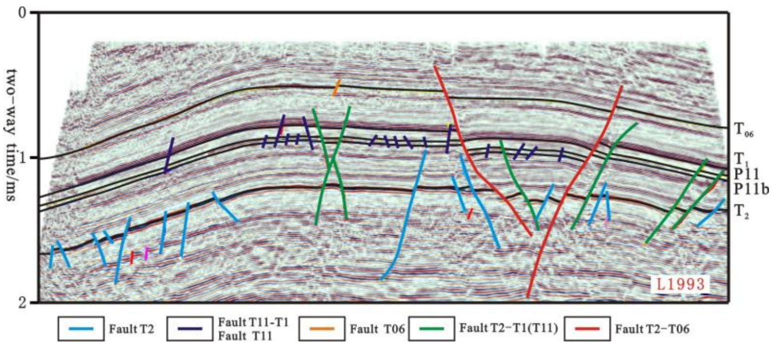

Fig.4 faults trans-formational characteristics of Xingbei Region

III. DIVIDED FAULT CONDENSED BELT AND THE CHARACTERISTICS OF FAULT ZONE

According to the sesmic section, the faults developed in the study area ofren show the "V" shape, and banded distribution on the plane, we call it fault condensed belt. These densed faults are opposite inclination in the sesmic section, constitute a graben zone. The study area developed 5 strips of fault condensed belt (Fig.5), these strike are NW trending, and they are all fault type T2-T06. The faults in the belt are almost echelon distribution, and also banded distribution.

In order to determine the fault zone distribution and its evolution characteristics, we identified the fault zone in the study area (Fig.5). This area developed 4 groups of fault zone, 13 strips of NW trending, 15 strips of NWW trending, 6 strips of NE trending, 9 strips of nearly SN trending. The NW trending fault zone are right-step en-echelon, indicates the sinistral deformation. The NWW trending fault zone are left-step en-echelon, indicates the dextral deformation, thus this two zones are conjugate. The NE trending fault zone mainly developed in the north of the study area, this is because the north area is located at the main part of the compressional inverse. The nearly SN trending fault zone are located at the top of the anticline, distributed discretely, can not constitude the en-echelon distribution, so it's not the shear deformation, only developed by the extensional stress. Comprehensive above, the stress field direction which make the NW trending fault zone and the NWW trending fault zone developed was actually the compresion component of the NWW-SEE trending. Considering the NE trending sub-anticline on the placanticline is left-step distribution, we speculation that before the compresion component, the stress field direction is nearly SN trending, so the study area is deformed by the sinistral transpression stress.

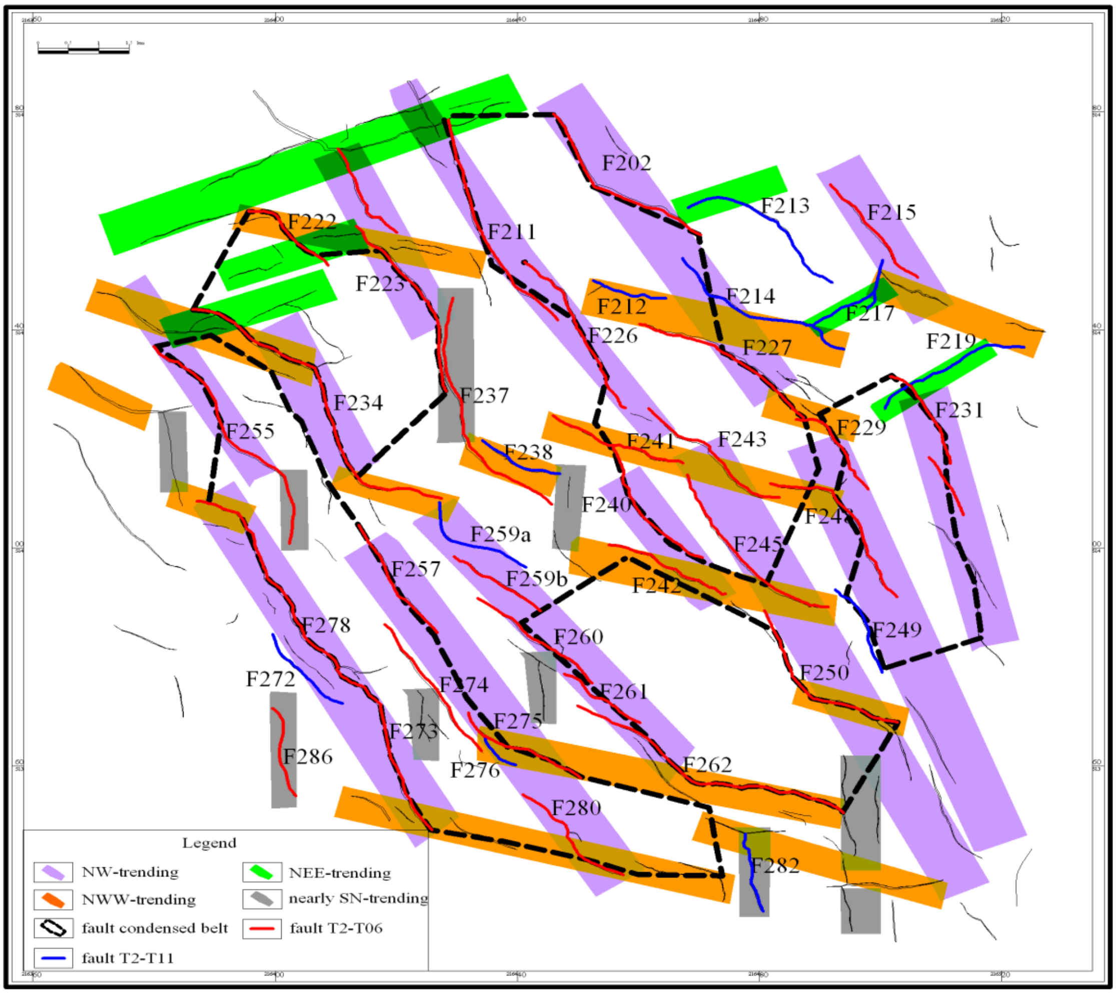

Fig.5 the fault condensed belt and the fault zone of Xingbei Region

IV. CONCLUSION

Based on the analyses of the faults in the Putaohua reservoir of the Xingbei Region, Daqing placanticline, we can get these conclusions:

1. In the Xingbei Region, Daqing placanticline, faults strike are mainly NW-NNW trending, but the faults strike are different during the different periods, this shows that the region stress field properties are also different..
2. The faults density in the study area are different. The depression structural layer (T_2) faults have the largest faults density, the inversion structural layer(T_{06}) faults density is less than it, illustrates that the faults are multistage activities.
3. The faults scale in the study area are decrease from bottom to top, reflects the stress strength become weaker and tectonic deformation strength become weaker. Meanwhile the different of the faults trans-formational represents the different faults active stages, and different deformation properties.
4. The study area developed 5 strips of fault condensed belts and 4 groups of fault zones, the distribution of these fault zones are induced by the sinistral transpression stress mechanism.

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