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Subdivisions of Structural Layers and Characteristics of The Fault Systems of Yingshan Fault Depression

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Abstract: **-** The subdivisions of the structural layer and fault system is the basis of the analysis of structural evolution. According to seismic reflection characteristics and stratigraphic contact, the Yingshan Formation is divided into four structural layers: the rifted layers (Huoshiling group - Yingcheng group), fault sag conversion layers (Denglouku group), depressed layers (Quantou group - Nenjiang group) and inversion structure layer (Nenjiang group to now). The faults of which towards mainly the north east and the north-east control the structure largely in this study area. The fault system can be divided into upper and lower system, and each fault system have inheritance and difference.

Keywords: **-** *Yingshan fault depression, unconformity, structural layer, fault system*

I. INTRODUCTION

Yingshan Depression belongs to the deep structural unit of the southeast fault zone in the north of Songliao Basin, and is to the west of Xujiaweizi Fault depression, which is divided by the chaoyanggou anticline belt. Yingshan depression is a asymmetric graben fault depressions controlled by sizhan fault and linjiang fault. The structure now is a concave controlled by three uplifts, which the linjiang northern low uplift in the northwest, duiqingshan salient in the southeast, sizhan paleo uplift in the west, Yingshan depression in the central[2-4](Figure 1).

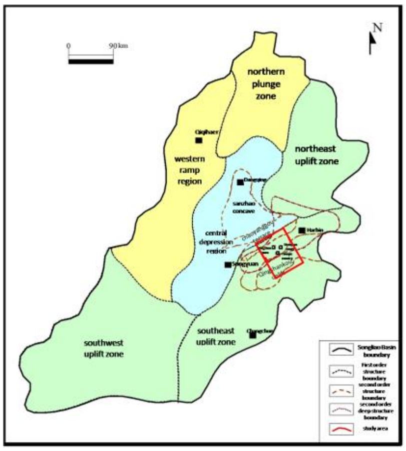

Figure 1 Xingshan structural layers location

II. THE DIVISION OF STRUCTURAL LAYERS

2.1 seismic reflection characteristics

According to the log data and seismic reflection characteristics, T1、T2、T3、T4、T4a、T4-1 and T5 were interpreted, and the characteristics for the seven seismic reflective layer are as follows:

The T5 reflective layer, generally a phase, is a regional unconformity developed in the all region. It have the characteristics of stable waveform, middle strong amplitude, middle continuous in the bedrock raised areas, while the continuous and energy are bed in the deep concave region.

The T4-1 reflective layer is the reflection of the bottom of the volcanic rock in Yingcheng group. The reflection characteristic of the upper volcanic rock is poor continuity, amplitude strength mutation, chaotically distributed and other features, and has a big difference with the lower shale rock of which the reflection characteristic is strong continuous. The reflection characteristic of the fault belt in the west exhibited middle continuous, middle strong amplitude.

The upper of the T4a reflective layer has a good layered property and continuous,which is a clear reflection characteristics of sedimentary rocks, while the volcanic rocks in the lower part showed typical worm-like mess reflection, pie and lenticular reflection occasionally. The reflection characteristic of the fault belt in the west is the same as the T4-1 reflective layer.

The T4 reflective layer, the reflection of the top of the Yingcheng group, is a large unconformity which has a reflection characteristic of mid-high reflection and good continuity. The Overlying is a set of fine sandstone of which the reflection characteristic is mid-high amplitude, medium continuous and parallel reflection, while the underlain is a sand-shale formation of which the reflection characteristic is mid-strong amplitude, medium continuous.

The west of the T3 reflective layer has the characteristics of mid-high amplitude, distinctive reflection axis, waveform stability and good continuity,which reflect the stable sedimentary, while because of the more intense tectonic activity in the east, the continuity and amplitude strength of the formation are poor.

The T2 reflective layer, the top surface of the Quantou group, has a reflection characteristic of uniaxial, high frequency, good continuity, high amplitude and stable waveform, which can be used as the main indicator layer.

The T1 reflective layer, the top surface of the yaojia group, which can be tracked easily because of the reflection characteristic of uniaxial, high amplitude and continuous, is one of the main marker bed in the study area. The overlying strata is another high-amplitude and continuous reflection axis, while the continuity and amplitude of the underlying strata is weak.

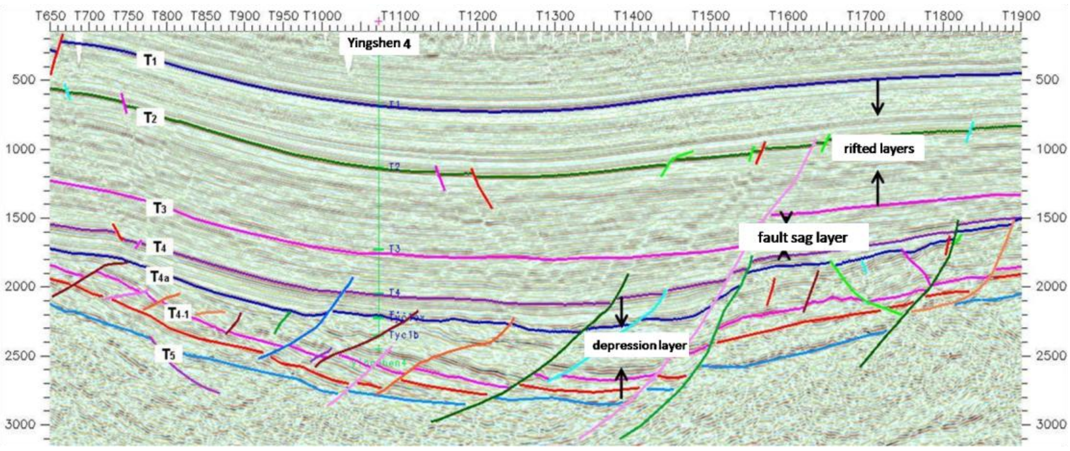

Figure 2: typical section plane in Yingshan area(Line1416)

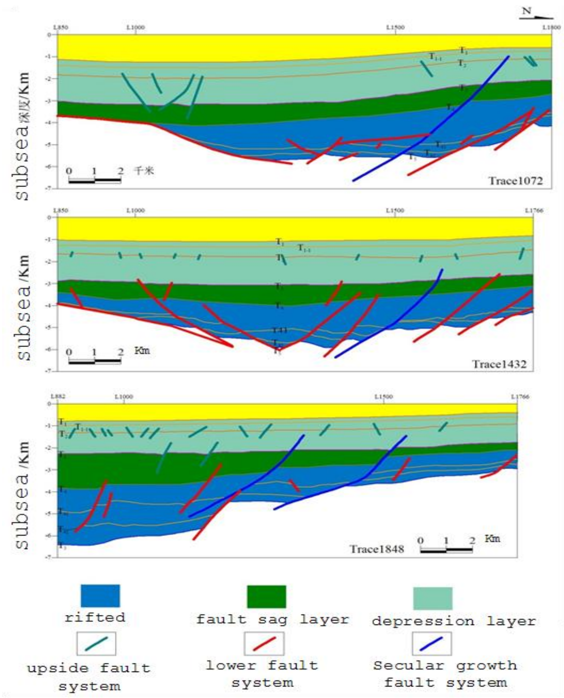

Figure 3: division of structural layer

2.2 division of structural layer

Based on the characteristics of seismic wave group and the distribution, folds and faults of each formation, combined with the geological information of the adjacent region, the regional angle unconformity and disconformity between the formations are used to divided the structural layer, and then making a balanced section to research the tectonic evolution (Figure 2). Based on the 5 wells and seismic data, the structural layers can be divided into four: the rifted layers, fault sag conversion layers, depressed layers and inversion structure layer, and were described from old to new as follows (Figure 3)

2.2.1 the rifted layers: Huoshiling group- Yingcheng group(T5-T4a)

Huoshiling group - Yingcheng group deposition period is a strong extension period of Yingshan Fault Depression. In the central of this area, a strip subsags extending at NNE is developed, while the ridges are developed on both sides of the central. the western tectonic rifted layers overlap in the sizhan fault, which is separated with the ridges by the main fault which controlled the concave. It developed obviously in the subsags area and converted to the uplifts at the two ends, which lead to the trend of the structure layers is the same with the subsags.

2.2.2 fault sag structural layer: Denglouku group (T4a-T3)

The tensile principal stress began to abate at the end of Yingcheng group, compressional structure was evidence. Because of the raising earth crust, high part of sedimentary structural previously suffered strong denudation, forming an obvious regional angle unconformity surface in section, it's the boundary of Yingcheng group and Denglouku group. Then faults couldn't control the distribution range and stratigraphic distribution of the basin any more, the geometric style of stratigraphic distribution in depression basin had formed, and the formation overlapped on the original fault. Sedimentary deposit only lay down to the center of previous sag, and the activity intensity of the master control faults diminished. Its boundary is the master control F27-F28-F93 faults with the "x" type combination in the south of deep Yingshan concave, the late Yingshan southern syncline have begun to pay scale.

2.2.3 depression structural layer: Quantou group - yaojia (T3 - T1)

Yingshan Shuangcheng area experienced a brief revolution in the end of Denglouku group, then it went into the depression evolution stage. Faults had no control action, while fault depression faded. As a result of the effect of erosion and sedimentation, the structure of "low middle and high around" reformed into one with less elevation difference and bigger sedimentary scope. Depression structural layer formed the obvious syncline anticline belt, and the characteristics mainly succeeded from the fault structural layer. The basin experienced a major tectonic activities in Quantou formation sedimentary period, a series of "v" type of small fault formed, then sedimentary was stable for a long time.

2.2.4 inversion structural layer: Nenjiang group (T1-T03)

The new Pacific plate in the western Pacific region dived down to the Eurasian plate subduction plate in the end of Nenjiang group, and the effect of shear and extrusion in northeast Asia area formed tectonic inversion[5]. The days, we can identify the reversal of the basin at the end of Nenjiang group, Mingshui group and Tertiary, and it formed a series of en echelon faults in northwestern area. But the overall structure was low in the middle and high surrounding, structural relief intensity was not strong, especially in the northern sag, uplift amplitude was obviously smaller than current uplift. This structural feature illustrated that reverse extruding tectonic movement in the end of Nenjiang group, promoted linjiang northern low uplift today, and part of the traps were destroyed, the size was reduced or even disappeared.

III. FAULT SYSTEM CHARACTERISTICS

3.1 fault properties and size

Basin was effected by the east-west tension in the period of fault depression, and the faults were north-east trending, north-south trending and east-west trending, and the major controlling faults were main "shovel type" normal faults, they were all steep up and slow down. The whole fault system is composite of long-term succeeded faults and the lower fault system. Large-scale fracture were main the faults which succeeded and developed for a long time, researching the fault elements TAB. Faults broke through the formation between

Qingshankou group and Yingcheng group, reached to T1 or T2 upward and converged to shahezi group downward. From the basement-fault structural layer to fault sag-depression structural layer, the largest fault displacement and length were decreased, this is the result of decreasing intensity of stress. At the time it was the process that fault structural layer transformed into depression structural layer.

3.2 combination of fracture mode

Combination of fracture mode is a composite of the characteristics of the basin, stress field and the plastic property of strata[6]. If we start to analyze the fracture combination mode, it's benefit to study the evolution of the basin formation and the faults. Yingshan Shuangcheng area fault system of main boundary faults is comprised of shovel type, "y and reverse y" type, "v" type, graben and horst combination pattern, it's a typical combination of fault basin. Profile fault system is major "y ",reverse" y" type, and "v" type, while it's

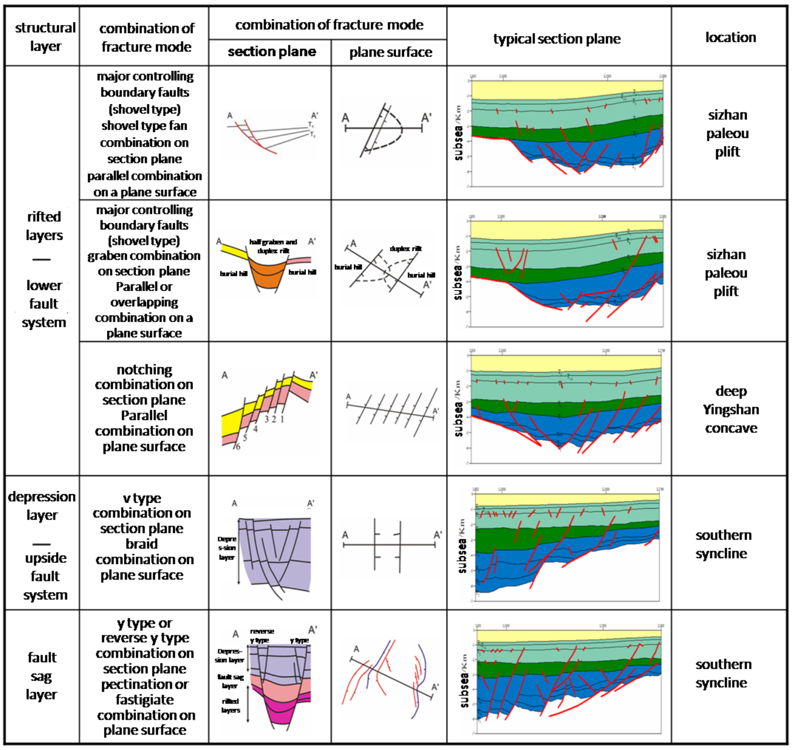

Figure 4: combination of fracture mode in Yingshan area

parallel on plane surface. While analyze the combination of fracture mode, faults were mainly formed in stretch background (figure 4).

3.3 tectonic type

Shovel type fault: This type of fault control the development of the basin, they grew on its either side with a form of steep up and slow down, it is also the most important identification sign of tectonic type. Fault activities associated with sediment deposition process, broken while deposits, gravity makes the upside strata thickness is greater than the footwall strata thickness, sizhan fault and XF15 fault are typical of the shovel type fault, accompanying secondary fracture of convergence to the inside basin.

Rolling anticline: It is a kind of tectonic characteristics, associating with the shovel type faults. It formed on the upside profile in the shovel type fault. Gravity makes the upside strata down, because of a huge pulling power effect the strata, rolling anticline is high swell with small area formed on the profile. The formation overlapped on the sizhan fault has the same characteristic, it can be used to reserve the oil and gas migrated through fracture from the deep hydrocarbon source rocks.

Fault terrace: It's a series of homotaxial parallel fault complex, which controlled It's a series of homotaxial faults combination with parallel arrangement, which are the trunk backbone control concave transition to the basin center. With the dip direction is consistent or not, it can be divided into synthetic fault terrace and reverse fault terrace. Synthetic fault terrace in all the study area, but reverse fault terrace only in the eastern study area.

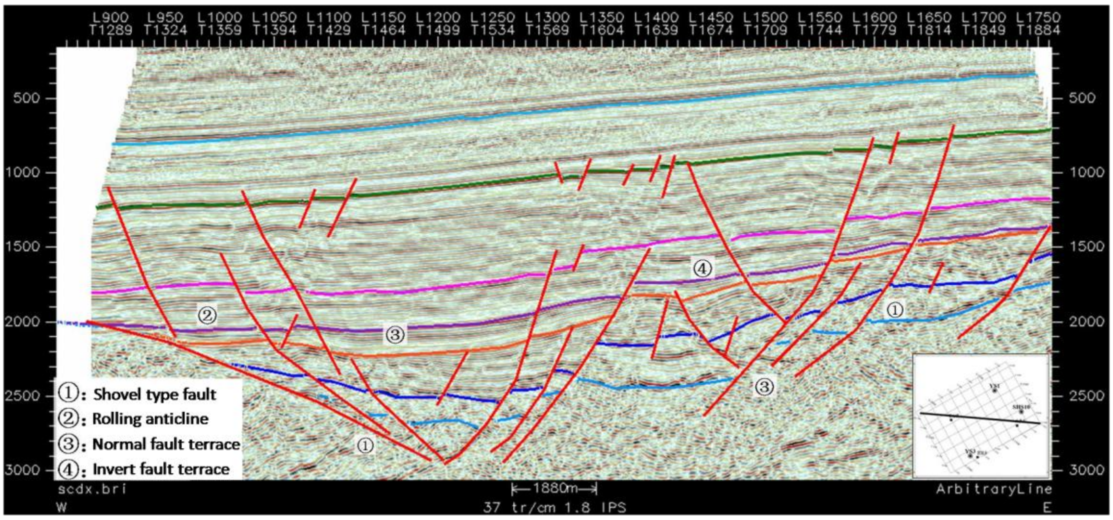

Figure 5: tectonic type in Yingshan area

IV. CONCLUSION

In this paper, we have discussed the characteristics of seismic events and formations, which is the results of structure interpretation. Yingshan Shuangcheng area can be divided into four structural layers, it's fault structural layer (Huoshiling group - city group), fault into depression structural layer (Denglouku group), depression structural layer (Quantou group to Nenjiang group) and the inversion structural layer(Nenjiang group).

The fault system in the study area is mainly normal faults, their strike extended towards south-north, towards north northeast, the major boundary faults are shovel type, "y and reverse y" type, "v" type, graben and horst combination pattern, it's a typical combination of fault basin. Tectonic type is an extending tectonic style, like shovel type of fault, rolling anticline and fault terrace.

REFERENCES

[1] Lowell J D. Structural Styles in Petroleum Exploration [M]. *OGCI.* 1985,13-75.

[2] Taylor B, Hayes D E. The tectonic evolution of the South China Sea[M]//Hayes D E. The Tectonics and Geological Evolution of Southeast Asia Seas and Islands Washington D C: *American Geophysical Union*,1980:89-104.Liu

[3] He Liansheng. Formation and evolution of South China Sea and their relation to oil and gas resources[J].*Marine Geology&Quaternary Geology*,1988,8(2):15-28.

[4] Ben Avrahren Z, Uyeda S. The evolution of the China basin and the Mesozoic paleography of Bomeo[J]. *Earch and Planetary Science Letters*,1973,18:365-376.

[5] W. C. Ross. Modeling base-level dynamics as a control on basin-fill geometries and facies

[6] Tapponnier P, Pelter G, Armijo R. Propagating extrusion tectonics in Asia: New insights form simple experiments with plasticine[J].*Geology*,1982,10:611-616.