

## Study on sedimentary microfacies of the key sedimentary units of the Fuyu oil layer in Toutai

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**Abstract:** Fuyu oil layer in Toutai oil field has entered the development stage, in order to improve the recovery efficiency, needs to understand the underground fine geological conditions, and the study of fine sedimentary microfacies provides a solid foundation for the geological study. Through core and thin sheet material observation, combined with logging and experiment data analysis research, show that this area belongs to the delta plain, delta front and meandering river sub phase, and identified a further twenty-three kinds of microfacies. Analysis of the important sedimentary unit F I 3a, F I 5a, F I 8a, F II 5a sedimentary microfacies and plane sedimentary characteristics and logging facies model, which is conducive to a correct understanding of the favorable facies belt and distribution characteristics, tapping the potential of the remaining oil laid the foundation. F I 5a and F I 8a sedimentary units are delta plain subfacies phase. F I 3a and F II 5a sedimentary units are delta front subfacies.

**Keywords:** Toutai oil field, the important sedimentary unit, Feature of microfacies.

### INTRODUCTION

Toutai area is located in Zhaoyuan County of Heilongjiang Province in the North Bank of the Songhua River, the regional structural location in the west end of the terrace and nose like structure of Chaoyang District of the central depression of Songliao basin, which the west and the north is the central depression in Sanzhao sag. The South is contact with Fuyu uplift phase of the central depression zone. From the point of view of sedimentary evolution history, Songliao Basin experienced Quantou group - Qingshankou group, Yaojia formation - Nenjiang group about two lake water expansions - shrinking processes, two periods of the largest lake expansion are in the one section of Qingshankou and one and two section of Nenjiang formation. The three and four of the Quantou group deposition in Songliao basin subsidence stage, after the spring head group second segment at the end of the deposition of the basin was uplifted as a whole were subjected to erosion to the Qingshankou group a bottom suddenly between transgressive developed overall with characteristics of subsidence and a significant continental sedimentary filling construction [1-2]. In the Toutai area, the main oil producing area is Fuyu oil layer. The Fuyu oil layer is a set of sand and mudstone which is mainly red, and the high calcium content [3].

### Sedimentary microfacies identification

Through the M61-89 take heart well core data analysis, of rock color, lithology, structure, structure and logging facies elements research and reference

background of the sedimentary system in the study area, which identify the study area are the Delta and meandering river system, mainly in the delta sedimentary system and a total of 3 phase 23 phase 2 microfacies were identified.

### Sedimentary microfacies characteristics of key sedimentary units

#### Delta plain subfacies

Delta plain is the onshore portion of the Delta, which is between the flood water level and the dry water level. Its mudstone with purple red and grey green, which can visible parallel to bedding, wedge shaped cross bedding. The sub-phase is further divided into 5 types of sedimentary microfacies, such as water diversion channel, abandoned channel, overflow sand body, overflow sand and diversion bay.

Water distributary channel microfacies are the main microfacies of the delta plain sub-phase, which the lithology is mainly fine sandstone and siltstone. It is thickness of single sandstone 1-5m and the bottom scour is obvious, and it has the parallel bedding and the cross bedding.

Overflow shore sand body microfacies distribute in water distributary channel microfacies on both sides, the development degree of sand is worse than that of a river, which is mainly fine sandstone and siltstone and with cross bedding.

Overbank sand microfacies mainly have siltstone and argillaceous siltstone, which is positive rhythm and develop the cross bedding.

Mudstone and silty mudstone are the main types of rock in the microfacies of the main flow, and a small amount of shale powder sandstone can be found. The horizontal bedding and wedge cross bedding can be seen.



Fig-1: The figure of characteristic of delta plain subfacies in M61-89.

### Delta front subfacies

Delta front deposition is the front part of the delta sedimentary system, which is distributed in the sea side of the delta plain. It is the most active area of the river and sea, and is the fastest speed in the delta depositional system. Due to the separation of sea water waves, the more pure and heavy minerals are deposited. In this paper, the subfacies were further divided into 6 types of sedimentary microfacies about underwater distributary River, sheet sand body, sheet sand, take the edge, seats and outer edges of the shunt.

Underwater distributary channel microfacies are distributary channel underwater extension, and water distributary channel, bifurcation increased, the river becomes shallow, single sand body thin, fine granularity, poor physical property, high shale content, thickness of single sandstone 1-5m, around mudstone color for gray green.

The main microfacies of sheet sand are developed on both sides of the river channel, and the sand body size is fine and the thickness is thinner than that of the river channel.

Sheet sand microfacies in lithologic siltstone and argillaceous siltstone, with flat cross bedding, positive rhythm.

Margin microfacies sand particle size are finer than sand sheet, it mainly has mudstone and silty mudstone. The layers are thin.

Table edge microfacies lithology is mainly mudstone and silty mudstone. The layers are thin.

The main flow of the microfacies in the separation Bay is mainly mudstone, and the color of the mudstone is mostly grey green.

### Establishment of the microfacies model of the key sedimentary units of the important of Fuyu oil layer

Because the core of the research area is limited and the well logging curve can reflect the characteristics of sedimentary microfacies, so the logging data has become the main data to study sedimentary microfacies.

### Optimization of well logging facies curve

According to the logging curve can well reflect the "three sexes", which are physical property, lithology and oil content, lithologic interface and top and bottom contact relationship, shale content, cycle and each well universality and high precision requirements. Sonic, natural gamma, microneural and the depth of three sides to well logging curve can be very good response characteristics of sedimentary microfacies, so logging facies model select these several curves to identify the all microfacies about deposition of the region [4-5].

### Fuyu reservoir logging microfacies model

Based on the determination of sedimentary facies, the characteristics of sedimentary microfacies and well logging facies are summarized. Three kinds of sedimentary microfacies logging patterns of two phases and twenty-three subfacies have been established:

### Delta plain subfacies

- The first kind of channel: First, the curve shape is box and the amplitude is high. Second, the bottom is mutation and the top is gradient. Third, the layer is thick and the sandstone thickness more than five meters.
- The second kind of channel: First, the curve shape is bell or box and the amplitude is high.

Second, the bottom is mutation and the top is gradient or mutation. Third, the layer is thick and the sandstone thickness more than three to five meters.

- The third of channel: First, the curve shape is bell and there is high amplitude. Second, the bottom is mutation and the top is gradient. Third, the layer is thick and the sandstone thickness more than two to three meters.
- Abandoned channel: First, the curve shape is bell and there is medium amplitude. Second, the scale is small. Third, the mudstone thickness is greater than the thickness of sandstone and the sandstone thickness is less

than 3 meters.

- Shore sand body: First, the curve shape is bell and there is medium amplitude. Second, the scale is large. Third, the sandstone thickness more than 1.5 meters.
- Overflow sand: First, the shape of the curve is single or finger shaped. Second, the amplitude is low. Third, the thickness of the sandstone is less than 1.5 meters.
- Split bay: First, the curve shape is straight or micro - dentate. Second, the amplitude is low. Third, the thickness of sandstone is zero meters.

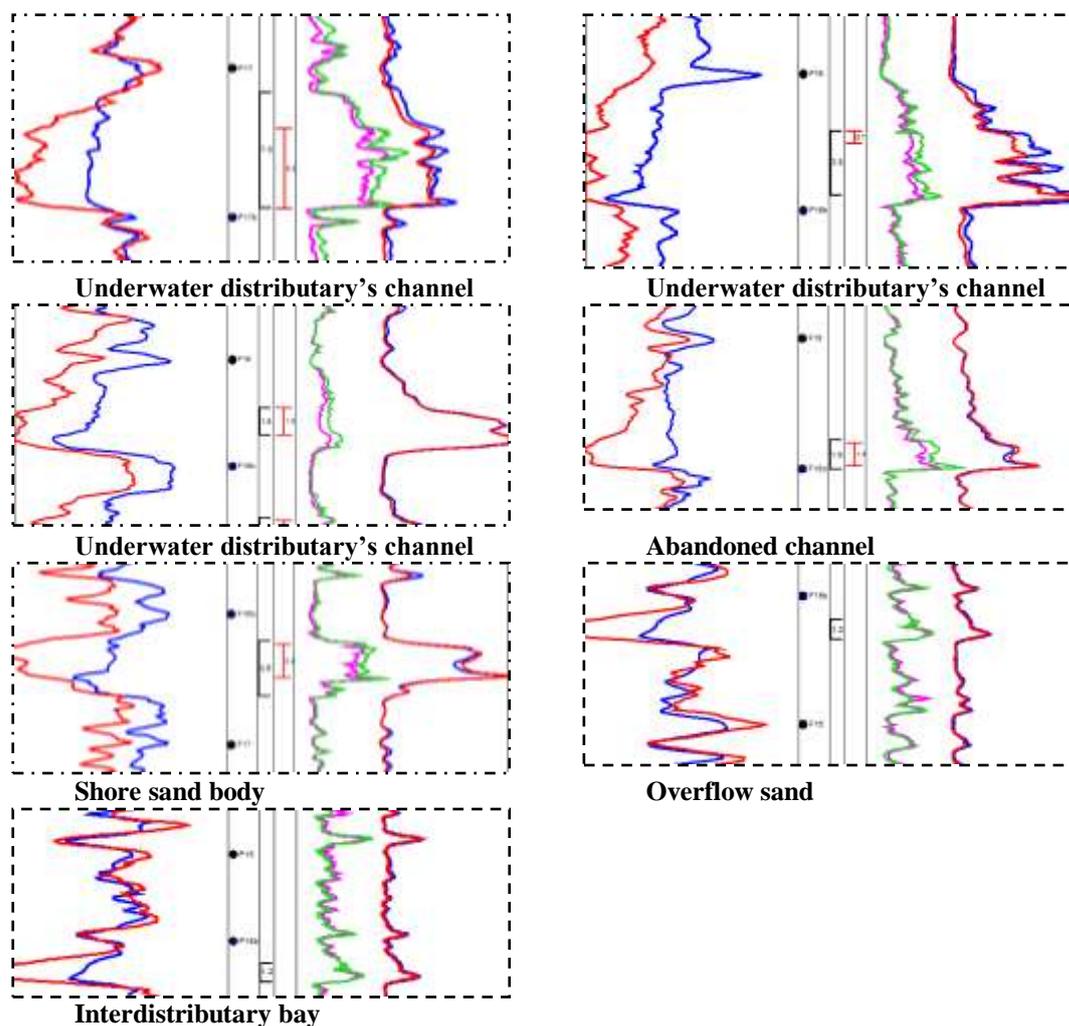


Fig-2: The pattern of microfacies of logging in Fuyu reservoir

## 2) Delta front subfacies

- The first kind of channel: First, the curve shape is box and the amplitude is high. Second, the bottom is mutation and the top is gradient. Third, the layer is thick and the sandstone thickness more than four meters.
- The second kind of channel: First, the curve shape is bell or box and the

amplitude is high. Second, the bottom is mutation and the top is gradient or mutation. Third, the layer is thick and the sandstone thickness more than 2.5 to 4 meters.

- The third of channel: First, the curve shape is bell and there is high amplitude. Second, the bottom is mutation and the top is gradient. Third, the layer is thick

and the sandstone thickness less than 2.5 meters.

- Seat body: First, the curve shape is the finger shape. Second, the amplitude is medium. Third, the sandstone thickness is more than 1.5 meters.
- Sheet sand: First, the curve shape is the finger shape. Second, the amplitude is lower. Third, the sandstone thickness is less than 1.5 meters.
- Take the edge: First, the shape of the

curve is small finger. Second, the amplitude is low. Third, the thickness of sandstone is zero meters.

- The outer seats: First, the curve shape is the shape of the tooth. Second, the amplitude is low. Third, the thickness of sandstone is zero meters.
- Split bay: First, the shape of the curve is linear or micro - dentate. Second, the thickness of sandstone is zero meters.

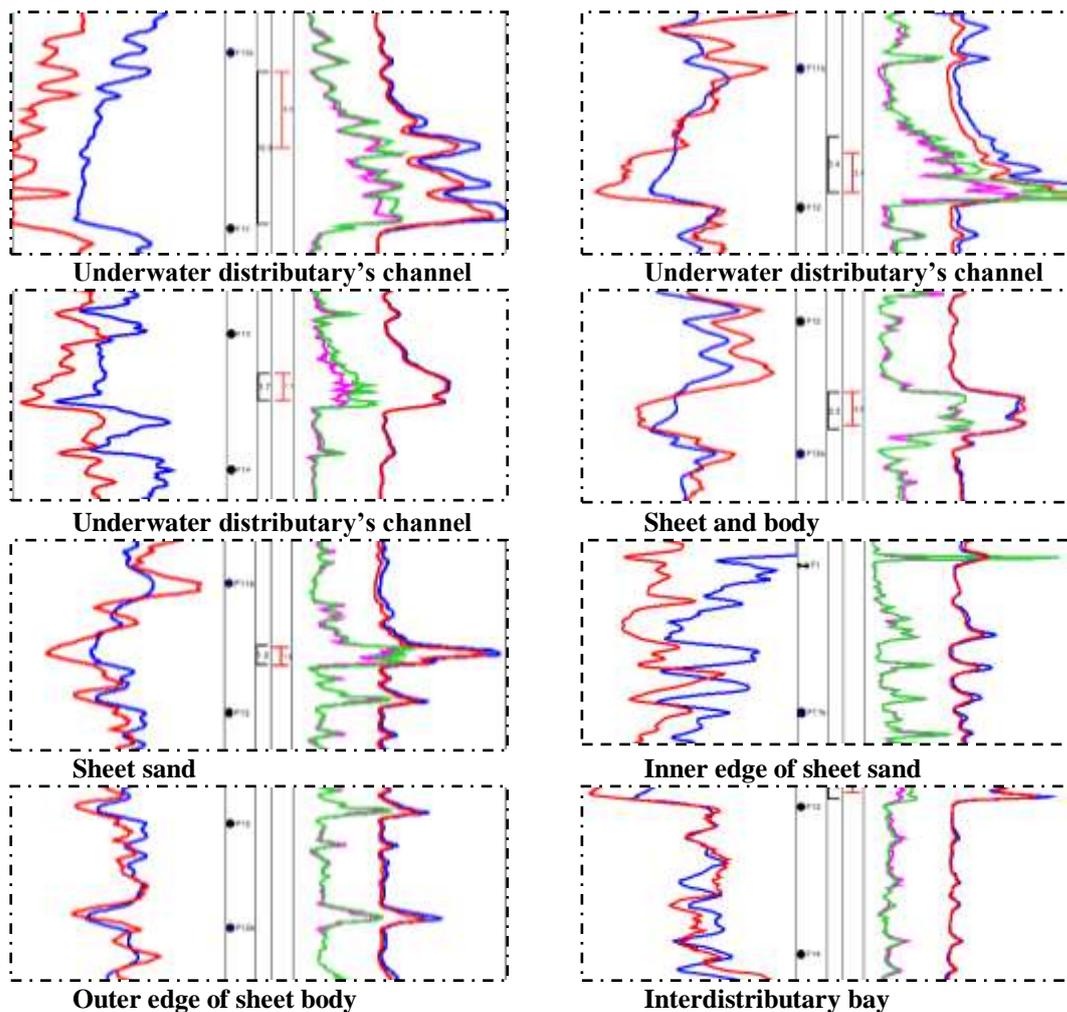


Fig3.The pattern of microfacies of logging in Fuyu reservoir

### Plane distribution characteristics of sedimentary microfacies in key sedimentary units of Fuyu oil layer

Small layer plane sedimentary microfacies are the most important research contents. It is directly related to the small layer sand body genesis, plane distribution, physical properties, oiliness, especially the complex oil control factor, lithologic trap, reservoir, extremely complex oil and gas distribution in the understanding of the most important material basis.

Based on the analysis of the distribution of sedimentary microfacies and the corresponding

thickness of sandstone, the sedimentary microfacies of Fuyu oil layer have the following characteristics as the F I 3a: 1) The sandstone reservoir in Toutai oil field is mainly from the lower direction of the southwest. 2)To underwater distributary channel as the center, to both sides of the sedimentary granularity is tapering, followed by the development of subject sheet sand, sheet sand, the inner edge of sheet sand and the outer edge of sheet sand at the outer edge of the, and around the river, the main sheet sand and sheet sand was arborization and banded distribution; 3) in the absence of channel distribution area, sheet sand body and sheet sand was patchily distributed, sinnett margin and sheet

edge in the study area showed a large area of flake

distribution. (Fig.4)



Fig-4: The figure of microfacies in plane of F I 3a

## CONCLUSION

- Based on core, logging and testing data, the analysis shows that the study area for important sedimentary unit developed delta plain and delta front sub phase and further classified as water distributary channel, abandoned channel, overflow sand body, overflow shore sand, interdistributary bay and water diversion channel, sand sheet between the main body, seats like sand, the inner edge of sheet sand, seats and outer edges of the shunt bay microfacies.
- Sedimentary microfacies distribution: in under the control of the channel energy, delta plain sub phase is to underwater distributary channel as the center, on both sides of the water energy is to weaken, followed by development of water distributary channel, abandoned channel, overflow sand body, overflow shore sand, interdistributary bay, and delta front to both sides successively developed underwater distributary bay river, sheet sand body, seats like sand, the inner edge of sheet sand, seats and outer edges of the shunt.
- Sedimentary microfacies control sandstone development and distribution, reservoir continuity and connectivity, storage layer, so as to control the movement of underground fluid and remaining oil distribution. Suggestion that under the further development and adjustment in Toutai oil field give full consideration to the sedimentary microfacies research results.

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