

Research on Sedimentary Microfacies of Member 1 of Yao Formation in Puxi Oilfield

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Abstract: Puxi Oilfield has entered a period of development in the late; in order to improve oil recovery, urgently clarify the subsurface fine geology and fine sedimentary microfacies study, which aims to provide a solid foundation of geology. With the core, outcrop, cast sheet observed data, combined with the study of logging, laboratory analysis data, the results indicate that the area belongs to delta front subfacies, further identify underwater distributary channel, sheet sand body, sheet sand, inner edge of sheet sand, outer edge of sheet sand, the outer edge and interdistributary bay six sedimentary microfacies. Analysis the flat depositional characteristic of important time unit, which helps to correctly understand the distribution of favorable facies, and laid the foundation for tapping the potential of remaining oil.

Keywords: Puxi Oilfield, Sedimentary microfacies, Feature of microfacies.

INTRODUCTION

Puxi Oilfield is located in Zhaoyuan County of Heilongjiang Province and Duerbote Mongolian Autonomous County[1]. Structural position is in the south of Puxi nose structure, Qijia - Gulongsag, Central Depression of Songliao Basin area, which belongs to the delta front facies [2], the main layer of development is Putaohua oil layer, Member 1 of Yao Formation belongs to the system under the Cretaceous period [3]. The geological situation is complex, belonging to lithologic reservoir. Fine study of sedimentary microfacies to clarify the geological situation provides a solid foundation of geology.

The identification of microfacies

In the case of most oil wells have been developed without coring and logging. Coring data have become the directest and the most comprehensive information in the study of the underground sedimentary facies and other geological research. Especially in the research to sedimentary microfacies. Coring wells determine microfacies in the study areas with the help of the logging [4].

In the analysis of the core data of the two coring wells X16 and X14, with the study of rock color, texture, structure, lithology, cyclicity, composition, authigenic minerals, fossils and depositional system background. Finding that the study area is under the

delta front depositional system of the condition of gentle slope. Six microfacies have been identified in Member 1 of Yao Formation.

The characteristic of delta front subfacies

Delta front Subfacies are controlled by the energy of the distributary river and lake. The general features are following: ①The color of mudstone is gray and gray-based, greatly reducing color of oxidation. ②Developing obvious and fine bedding, such as wavy, wavy oblique, rhythm, lenticular bedding, agitation, structure and other soft wrinkle; ③Lithology is fine to siltstone; ④Sandstone and mudstone have fine and interbedded features; ⑤Authigenic minerals are found commonly, such as pyrite and siderite; ⑥The fossil of ostracods is visible. ⑦Underwater distributary channel is thin and narrow with bedding of lake with weak erosion.

The characteristic of microfacies

There are six kinds of microfacies in study area

(1). Underwater distributary channel: The feature of underwater distributary channel have several aspects (Fig.1). First, it has a obvious bottom surface erosion and channel floor lag. Second, there is a large trough cross bedding and horizontal bedding. Third, the thickness of sandstone changes largely. Fourth, it has positive rhythm.



A. large trough cross bedding



B. channel floor lag

Fig.1: The figure of characteristic of underwater distributary channel in X14

(2)The microfacies of sheet sand body: The feature of sheet sand body have several aspects. First, Developed on both sides of the river, dominant sector is siltstone. Second, The thickness of sand is smaller than the distributary channel. Third, The characteristic of sand is narrow, and the size of particle is small. Finally, There are phoria bedding and bedding with small scale (Fig. 2).

(3)The microfacies of sheet sand: The feature of sheet sand also have several aspects. First, dominant sector is siltstone and shale siltstone. Second, there are small anti-rhythm, positive rhythm or homogeneous rhythm. Third, it has many kinds of bedding, such as wavy, lenticular, horizontal wavy and gentle cross-bedding. Finally, there is a mutation in the top of sand.



Fig. 2. The core of sheet sand body of X16

(4)The microfacies of inner edge of sheet sand: The feature of inner edge of sheet sand have three aspects. First, it have thin layer. Second, The dominant sector is silty mudstone with energy of lake. Third, it is a small reverse rhythm .

(5)The microfacies of outer edge of sheet body: The feature of outer edge of sheet body have several aspects. First, The dominant sector is mudstone. Second, The color of stone is gray-green, gray or dark. Third, The main structure are horizontal wavy and massive bedding. Forth, it concludes calcium, iron briquettes, and occasionally the mass of sand.

(6)The microfacies of interdistributary bay: The feature of interdistributary bay have three aspects. First, the dominant sector is mudstone. Second, the color of stone is gray-green. Third, the structure of it is wavy bedding.

The establishment of logging pattern of microfacies

Due to the limit of coring information in the study area, and logging data become the main data for the study of microfacies in order to establish logging pattern of microfacies.

The optimization of logging curve

Logging curves can reflect the relationship of lithology, physical property and oiliness, content of shale, lithologic interface and the contact relationship of top and bottom, cyclicity [5]. Through the fine rock electrical contrast of coring well, conclusion is that SP 、 GR 、 AC 、 RMN/RMG and RLLD/RLLS can respond well to the characteristic of microfacies, so that microfaices is identified well in the study area.

Logging pattern of microfacies

Based on the fine analysis of microfacies in coring interval of single well, the feature of logging pattern is concluded by the characteristic of coring interval of single well .Thereby 1 phase 1 sub-phase 6 microfacies are established (Fig.3), characterized as follows: ①Microfacies of underwater distributary channel: overall high amplitude, high difference of amplitude with stable value; typical bell-shaped (or box-shaped); the thick layer of sandstone with the thickness of more than 1.5m; the bottom of the mutation, the top of the gradient; ②Microfacies of sheet sand body: high

amplitude, middle difference of amplitude ; characteristics of the larger finger; the thickness of sandstone is more than 1.5m. ③ Microfacies of sheet sand: overall middle amplitude; low difference of amplitude; the characteristic of single or multiple smaller fingers. Thickness of sandstone is located 0.5 ~ 1.5m. ④ Microfacies of inner edge of sheet sand:

overall low amplitude, low difference of amplitude; forward or reverse toothed with a few fingers. Thickness of sandstone is less than 0.5m. ⑤ Microfacies of outer edge of sheet sand: low amplitude, almost no difference of amplitude, forward or reverse tooth. Thickness of sandstone is 0m. ⑥ Interdistributary bay: curves have linear shape.

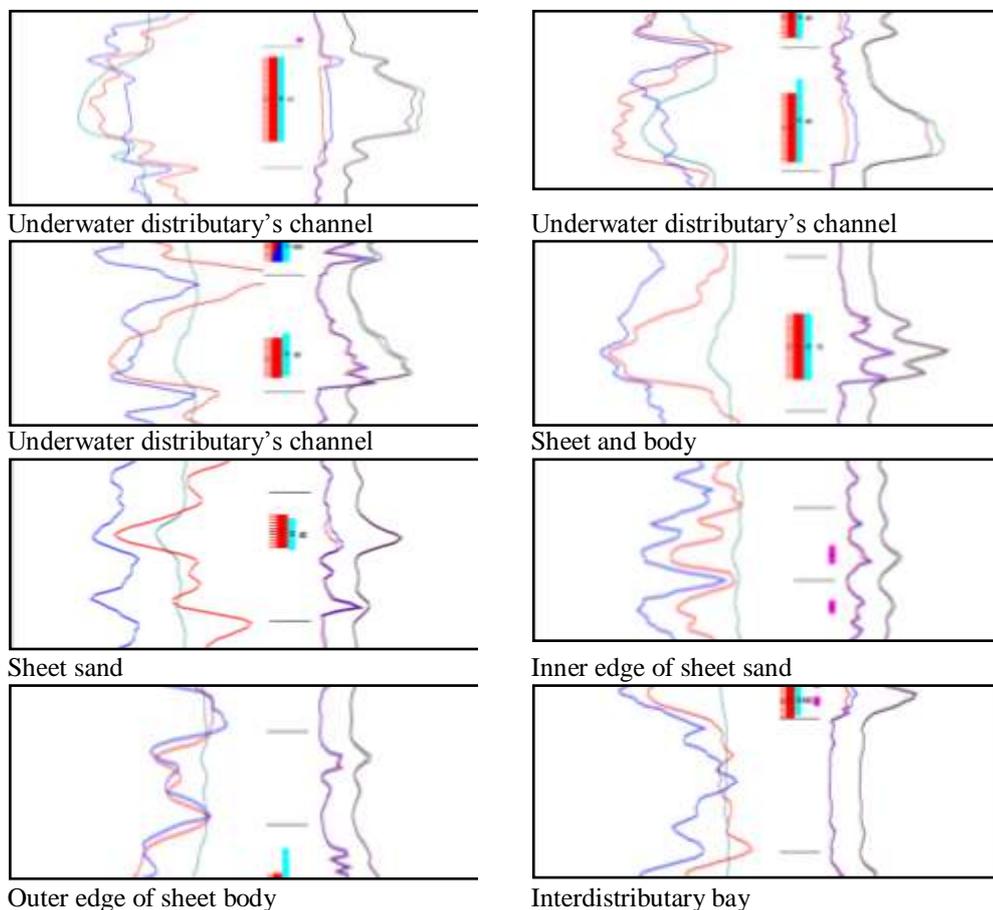


Fig-3: The pattern of microfacies of logging in Putaohua reservoir

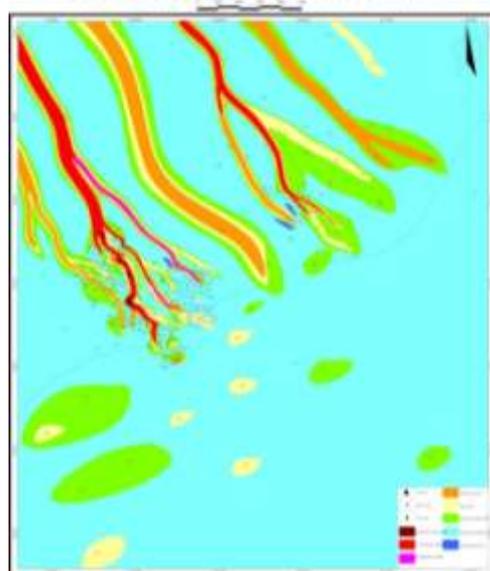


Fig.4 The figure of microfacies in plane of P I 11-1

The distributary characteristic of microfacies in plane of Member 1 of Yao Formation

The study of microfacies of depositional unit of time in Member 1 of Yao Formation is the important basis, which is to recognize the causes of reservoir, distribution of single sand body, plane heterogeneity of reservoir, the change of physical properties and extrapolation forecast [6, 7]. By the analysis of plane distribution of sedimentary microfacies and the corresponding contour map of Member 1 of Yao Formation in Puxi Oilfield. The microfacies have the following characteristic: ① Sandstone reservoirs mainly come from underwater shunt river in the northwest direction, sheet sand body and sheet sand. Among them, the underwater distributary channel is the most favorable reservoir. ② Geometry forms of sand is diverse in plane. Underwater distributary channel is mainly zonal and dendritic in distribution. Sheet sand body and sheet sand along the river channel with zonal or massive distribution, and the distribution area is large. ③ Controlled by strong wave action, sheet sand body and sheet sand have massive distribution in the area of no river, the long axis of the sand is perpendicular to source direction. ④ Influenced by the underwater distributary channel, the energy of water decreases along the both sides of river. Regarding underwater distributary channel as center, there developed body sheet sand, sheet body, inner edge of sheet sand, outer edge of sheet body and interdistributary bay (Fig. 4).

CONCLUSION

1. Integrated the data of core, log and experimental data, find that shallow water delta facie is developed in study area. And can be divided into six microfacies, such as underwater distributary channel, sheet sand body, sheet body, inner edge of sheet body, outer edge of sheet body and interdistributary bay.
2. The distributary characteristic of microfacies in plane is following: controlled by the energy of distributary channel, underwater distributary channel as the center to both sides of the flow of energy gradually weakened, there developed sheet sand body, sheet sand, inner edge of sheet body, outer edge of sheet body and interdistributary bay. In the area of far away from the river, controlled by wave deeply, sheet sand body and sheet sand was massive distribution.
3. Sedimentary microfacies control the development and distribution of sand body, continuity and connectivity of reservoir, reservoir properties, so as to control the movement of underground fluid and distribution of remaining oil. Give full consideration to the deposition of micro phase research in next adjustment in Puxi Oilfield development.

REFERENCES

1. Liu Weilin, Liu Jiang, Zhang Junlong & Zhang Meiling (2003). The study on the Interpretation Chart for Oil and Water Zone Classification in Puxi area. *Petroleum Geology & Oilfield Development in Daqing*, 01, 57-70.
2. Wang Xiaojin (2007). Study on fluids identification and reserves exploitation methods of comprehensive hydrocarbon in Puxi oil field. China university of geosciences (Beijing),
3. Wang Chao (2009). Research on oil and gas reservoir formation law of PuTaoHua oil bearing layer in PuXiarea. Northeast petroleum university.
4. Liu Yuncheng, Ruan Baotao, Li Zhongcheng, Sun Yanbo, Zhang Huiyu (2010). Research on sedimentary microfacies of Member 1 of Lower Cretaceous Quantou Formation in Shuangtuozi gas field of Songliao Basin and reservoir physical property. *Journal of Chengdu university of technology*, 01, 75-81.
5. Shan Xuanlong, Hujinxiang, Ren Lijun, Wang Pujun, Hao Guoli (2008). Characteristics of Sedimentary Facies for the Third Member of Qingshankou Formation in the Qian'an Area of the Songliao Basin. *Acta Geologica Sinica*, 01, 65-71.
6. Wen Huijian (2002). Study of Sedimentary Facies of Gaotaizi Reservoir in the North Part of Daqing Placantieline. Northeast petroleum university.
7. Meng Qingqing (2012). Depositional System and Space Distribution of Single Sand Body in Gu137Area. northeast petroleum university.