

Characteristics of the Sedimentary Microfacies of Fuyu Reservoir in Yushulin Oilfield, Songliao Basin

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Abstract: - Fuyu Reservoir is the major oil-bearing horizon of the Member 4 of the Lower Cretaceous Quantou Formation of the Yushulin Oilfield of the Songliao Basin, China. The Yushulin Oilfield developed large shallow-water deltas. There are problems of complicated oil distribution, ambiguous oil-water relationship, halfway research of sedimentary microfacies and so on in Fuyu oil layer of Block Shu 8 of the Yushulin Oilfield at present. Based on 212 well loggings, by ways and principles of Sequence Stratigraphy, single-well facies, logging facies, connecting-wells and plane sedimentary microfacies, guiding ideologies of sedimentary cycle, method of self potential, natural gamma, Acoustic time, resistivity logging and other typical curves, the Fuyang Reservoir Fuyu was finally divided into 3 single layers, 30 sedimentary timing cells and construct stratigraphy framework basically. On this basis, F I oil layer of the research area, developed delta front, delta plain subfacies, underwater distributary channel, sand sheet, distributary channel, crevasse splay, overbank sand and abandoned channel micro facies.

Key words: Songliao Basin, Yushulin Oilfield, Fuyu Reservoir, delta sedimentary, Sedimentary microfacies

I. TECTONIC AND DEPOSITIONAL SETTINGS

The Songliao Basin is a large continental petroliferous sedimentary basin formed in Meso-Cenozoic. It is NNE trending, long 750km, width 330~370km, an area of about $26.1 \times 10^4 \text{km}^2$. It mainly develop the Cenozoic Meso-Cretaceous strata with maximum thickness 10000m. From shallow to deep, oil and gas constitute the multiple sets of combinations^[1].

Yushulin areas of Heilongjiang province near the town of Changwu of Zhaodong city include the Yushulin oil field and Shangjia oil fields, north, West, South three surface respectively adjacent Wangjiatun gas Field, Shengping, Xujiaweizi and Chaoyanggou oil Field, area of about 900km², regional structure which is located in East Wing monoclinic of Sanzhao depression and in northeast uplift area of Suihua depression is a nose structure on Shangjia in the central depression of Songliao basin. The main oil layers of Yushulin area are Putaohua oil layer and Fuyang oil layer. Fuyang oil layer consists of Fuyu and Yangdachengzi oil layer.

The study area is Fuyu oil layer of Shu 8 area of Yushulin oil field. Shu 8 area is located in the south of Yushulin oil field (Fig.1).

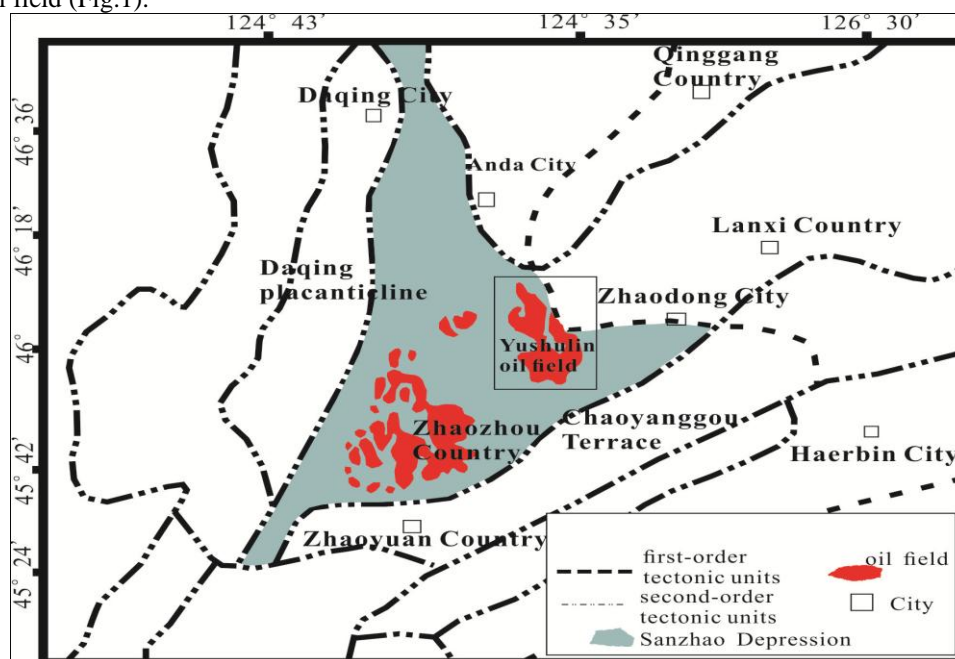


Fig 1: Structural and geographical location map of Yushulin oil field

II. SEDIMENTARY FACIES SYMBOL

2.1 Lithological characteristics

Rock types is an important symbol of the analysis of rock formation environment and hydrodynamic conditions^[2] (Fig.2) . The study area mainly developed terrigenous clastic rock. Rock types include fine siltstone, argillaceous siltstone, shale sandstone, silty mudstone, shale, and the transitional type^[3].

2.2 Colour coding

Colour is the most striking sign of the identification of rocks, stratigraphic division and correlation. It's an important basis for analysis to determine the paleoclimatic and paleogeographic conditions^[4].The original colour of rocks has a good reflection on physical and chemical conditions of the water at the time of deposit formation. The colour of Fuyu rock is gray, grey-green and fuchsia. This indicates that the purpose layer of the study area segments in shallow-deep water environments during the deposition.

2.3 Sedimentary structures

Clastic sedimentary structure characteristics react the dominant sedimentary medium and energy conditions directly, when clastic rocks deposit. It is one of the most important symbols of the cause of clastic rock for a long time. Fuyu reservoir rocks of the study area varied bedding structure with horizontal bedding, wavy bedding, cross bedding and deformation structure (Fig.3) .

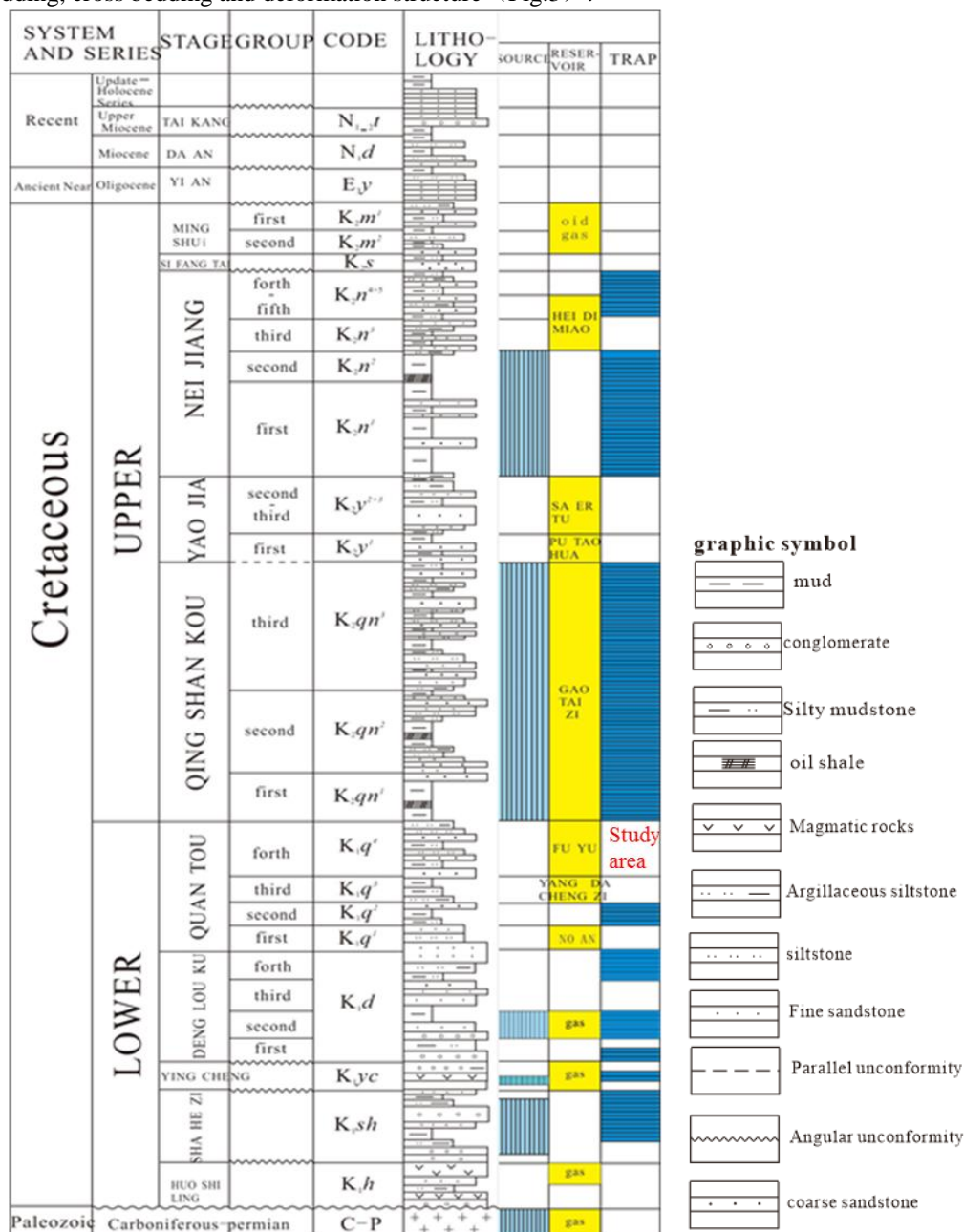


Fig 2 Stratigraphic section of subsurface rocks in Songliao Basin

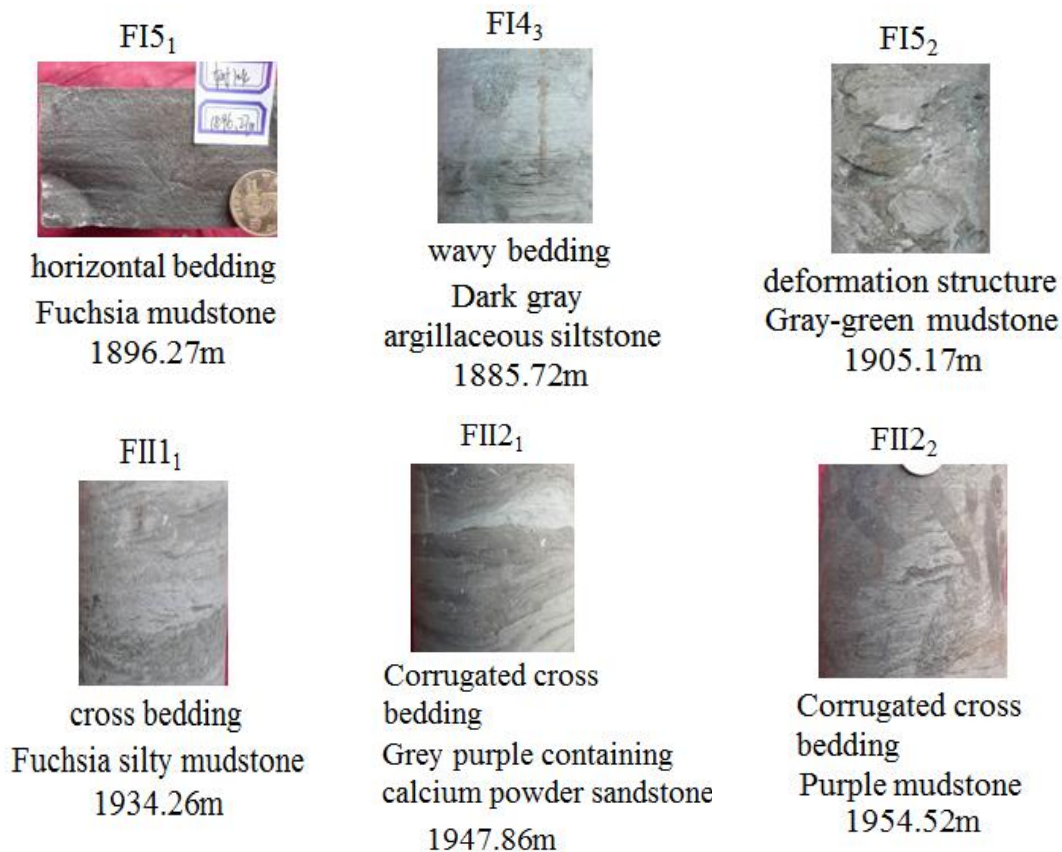


Fig 3 Fuyu reservoir rocks of the study area varied bedding structure

III. FACIES MODEL

3.1 Single well facies analysis

Single well facies analysis is using lithologic characteristics and all kinds of well logging response to identify sedimentary microfacies^[5,6]. Through a single well facies in the study area analysis, we established a depositional model of Fuyu sand group. Then we confirmed that FI1₁-FI3₁ and FIII3₁-FIII5₁ are Delta front subfacies deposits, and FI3₂-FIII2₂ are Delta plane subfacies deposits.

3.2 Establishment of Facies model

According to the regional sedimentary data, the observation of coring well core and the analysis of large amounts of log data, we recognized the sand microfacies types of group development in the study area are underwater distributary channel, crevasse splay, sand sheet and excessive bank sand, etc. By lithology, electrical and physical properties, oil content analysis, we determined the underwater distributary channel sand body is the main reservoir (Fig.4).

On the basis of single well facies analysis, we summarized the microfacies elements characteristics of log facies with each layer of the logging curve. Through multiple well log facies elements of the same microfacies characteristics, we summarized that the microfacies have in common elements characteristics of log facies, logging microfacies model for the setting up of microfacies.

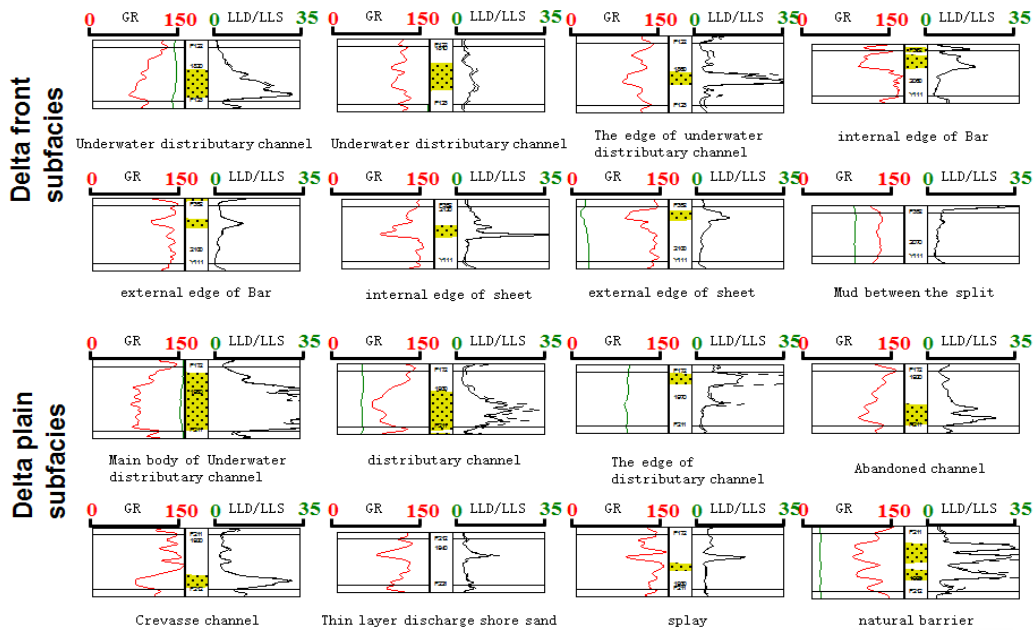
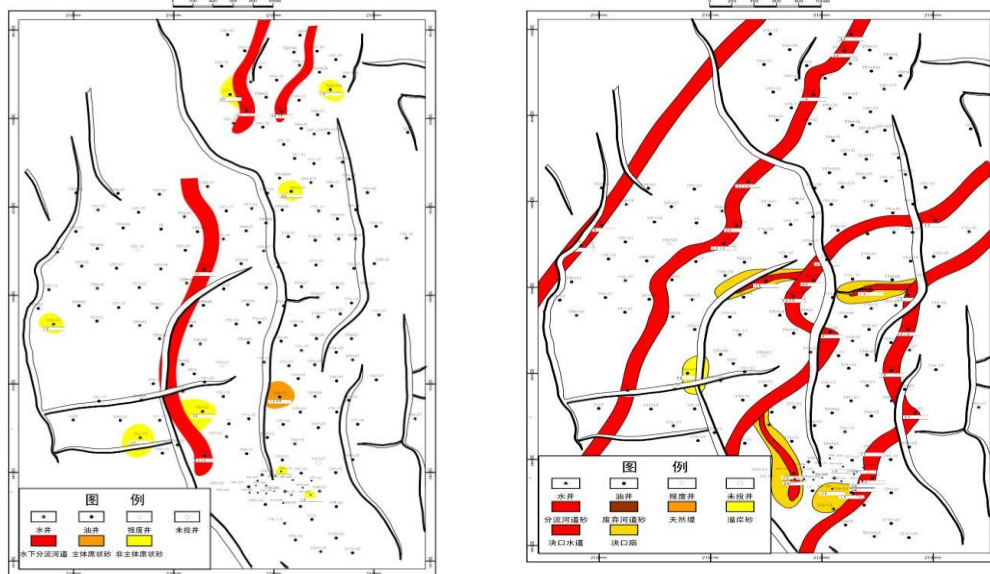


Fig 4 Established the Fuyu 2 facies and 16 microfacies reservoir logging microfacies model

IV. THE PLANE DISTRIBUTION CHARACTERISTICS OF SEDIMENTARY MICROFACIES

Because of the difference of deposition conditions, the Fuyu sand group formed in different sedimentary environments of sand body has different combinations of shape, size and characteristics. Sediment source mainly comes from the north. By sedimentary microfacies of sand group, we can clearly see the plane distribution characteristics of sedimentary microfacies of sand group (Fig.5). In F1₁ and F1₃, underwater distributary channel is mainly developing. Natural levee, shore sand, crevasse-splays is also developing.



F I11 Delta front subfacies small distributary channel

F I32 Delta plain subfacies distributary channel

Fig 5 Time unit plane microfacies

V. CONCLUSION

- (1) Sediment source of Fuyu mainly comes from the north. Delta front subfacies deposits and Delta plane subfacies deposits are developing. We recognized the sand microfacies types of group development in the study area are underwater distributary channel, crevasse splay, sand sheet and excessive bank sand.
- (2) Through the research of the sand group the plane distribution characteristics of sedimentary microfacies , summarized distribution of sand body and sedimentary microfacies have good corresponding relation.

REFERENCES

- [1] Guo feng, Chen Shiyue, Wang Dehai, et al. Area of northern Songliao basin marina cretaceous Quantou formation, sedimentary characteristics of the Nenjiang formation[J]. *Journal of daqing petroleum geology and development*, 2007, 26 (1) : 40-44.
- [2] Tissot B P. Thermal history of sedimentary basins, maturation indices, and kinetics of oil and gas generation[J]. *Aapg Bulletin*, 1987, 71(12):1445-1466.
- [3] Hoy R G, Ridgway K D. Sedimentology and sequence stratigraphy of fan-delta and river-delta deposystems, Pennsylvanian Minturn Formation, Colorado[J]. *Aapg Bulletin*, 2003, 87(7):1169-1191.
- [4] Zhao Chenglin, Zhu. Xiaomin Sedimentary petrology [M]. *Beijing: petroleum industry press*, 2005:72-91.
- [5] Zhang X L, Yi D, Jin-Xian H E, et al. Characteristics of the Sedimentary Microfacies and the Oil and Gas Distribution of Chang 2 Reservoir of Yanchang Formation in Linzhen Area, Ordos Basin[J]. *Solid State Communications*, 2006, 137(11):págs. 581-584.
- [6] Zhao R, Tian-Ren L I, Zhou W. Study on sedimentary microfacies of the Hei I sand unit in the Puqian 12 block[J]. *Special Oil & Gas Reservoirs*, 2011, 18(1):16-20.