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Sedimentary facies analysis of Es3 in Jiangjiadian area of Linnan sag

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Abstract: *Based on the investigation of the complex sedimentary system of Es3 in Jiangjiadian area of Linnan depression, the petrological characteristics, sedimentary facies types and characteristics of the upper, middle and lower sub sections of Es3 area are studied in depth and detail by combining the geological data of core, thin section and logging. The results show that Es3 in Jiangjiadian area is influenced by Xiakou fault. The lithic feldspar sandstone is relatively developed with low composition maturity. The gap filling is mainly clay minerals, kaolinite and Yimeng mixed layer are the main components. The sedimentary structure type is mainly bedding structure, and a few of them are developed in the stratification layer and biogenetic structure. The sedimentary facies is mainly delta facies and lake facies.*

Keywords: *Es3, Petrological characteristics, Sedimentary structure, sedimentary facies.*

1. Regional geological survey

Linnan depression is located in the southwest of Huimin depression, and it is an important oil-gas rich structural unit with an exploration area of 1300km^2. During the evolution of Linnan depression, the Cenozoic strata are preserved completely, and the Paleogene kondian formation (EK), Shahejie Formation (Es) are developed successively from the bottom up (can be divided into four sections), Dongying Formation (Ed), Neogene Guantao Formation (Ng), Minghuazhen Formation (Nm) and Quaternary plain group (Q). Shahejie formation is the most important reservoir development section in Linnan depression. Jiangjiadian area (Fig. 1) is located in Jiangjiadian nose structure north of Xiakou fault and south of yingzijie fault, with an exploration area of about 300km^2 [1-2].

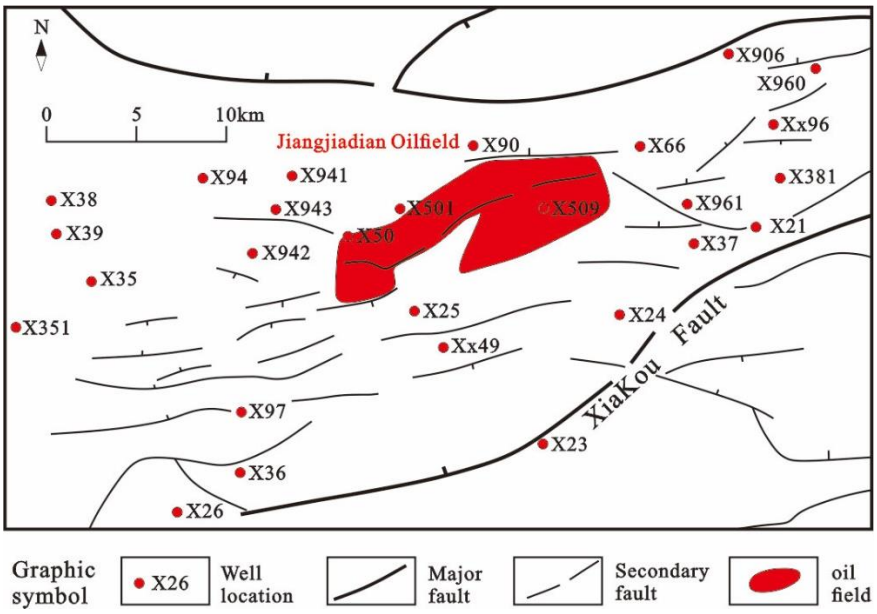

Figure 1: Regional structure

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2. Petrological characteristics

2.1 characteristics of debris composition

Through core observation and thin section identification analysis, it is concluded that the sandstone type of Es3 is mainly lithic feldspathic sandstone, a very small amount of arkose (Fig. 2). The clastic composition is mainly quartz, feldspar and rock cuttings, quartz content is the most, feldspar is the second, and the rock cuttings content is the least. The content of quartz is 35%-62%, and the average content is 44.5%; The content of feldspar is 15%-39%, the average content is 33.8%, of which the content of K-feldspar is higher than plagioclase, and the weathering degree of feldspar is moderate; The content of cuttings is 11%-33%, and the average content is 21.6%. The main rock cuttings are metamorphic rock cuttings, followed by magmatic rock cuttings, the least of sedimentary rock cuttings.

2.2 characteristics of the gap

The types and contents of the filler affect the reservoir performance [3]. The gap filler is divided into two parts: miscellaneous base and cement. The sandstone gap filler in the study area is mainly clay minerals, which are filled in the inter particle pores, which affect the fluid seepage [4].

According to the distribution chart of clay mineral content (Fig. 2), clay minerals are mainly kaolinite, Yimeng mixed layer, illite and chlorite. The kaolinite and Yimeng mixed layer are the main components, the kaolinite content is 19.00% to 73.25%, and the average content is 42.14%; The content of mixed layer in Yimeng is 11.00% to 59.00%, and the average content is 30.19%; Illite content is 8.00% to 28.81%, and the average content is 15.99%; Chlorite content is 4.91% to 37.33%, and the average content is 11.06%.

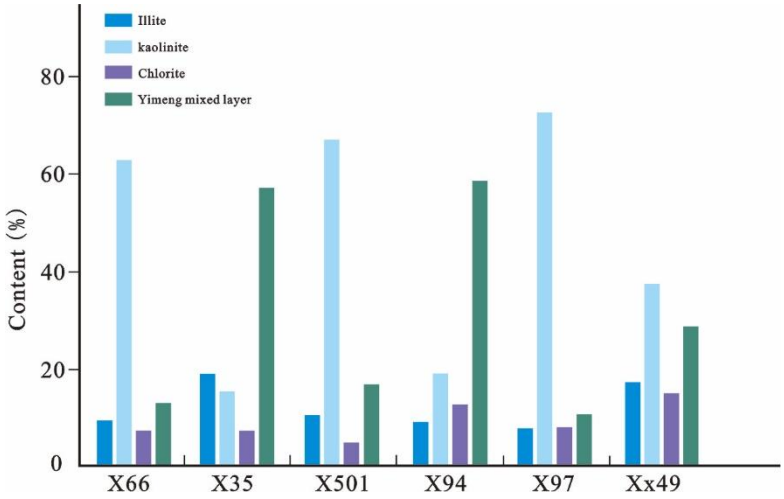

Figure 2: Clay mineral content chart

3. Sedimentary structure

Sedimentary structure is a macroscopic feature with composition and structural heterogeneity in sediments in sedimentary period or later stage by means of physical chemistry and biology[5]. Through core observation and description of 10 core wells in Jiangjiadian area, the sedimentary structure of the study area is sorted and analyzed. According to the genetic morphology classification, the sedimentary structure in the area can be divided into bedding, stratification, and biogenetic sedimentary structures.

Bedding structure is a layered structure developed in sedimentary rocks, while the layer structure is different types of structures developed in the inner layer of the rock.

(1) Parallel bedding: each layer is parallel and near horizontal. The thickness of the general striated layer is larger than that of horizontal bedding, mainly in the environment with strong hydrodynamic force, and generally occurs in sandstone (Fig. 3-a). Parallel bedding is very developed in the research area, almost appears in all core wells. Moreover, parallel bedding sandstone generally has better oil bearing properties, which are oil spots and oil immersed sandstone.

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(2) Interlacing bedding: the interlacing bedding of Es3 is relatively developed (Fig. 3-c), mainly wedge-shaped and trough like interlayers. Wedge interlacing bedding is generally found in delta sedimentary facies, and the sequence changes are in the same plane but not parallel, and the sequence thickness changes are wedge-shaped (Fig. 3-b); Trough like interlayers are usually found in the underwater branch channel of delta front, sometimes the bottom of the sequence is obvious.

(3) Wave marks: traces of waves formed by turbulence of water flow on the surface of sediment are common in shallow water areas and estuaries at the front of braided delta (Fig. 3-d).

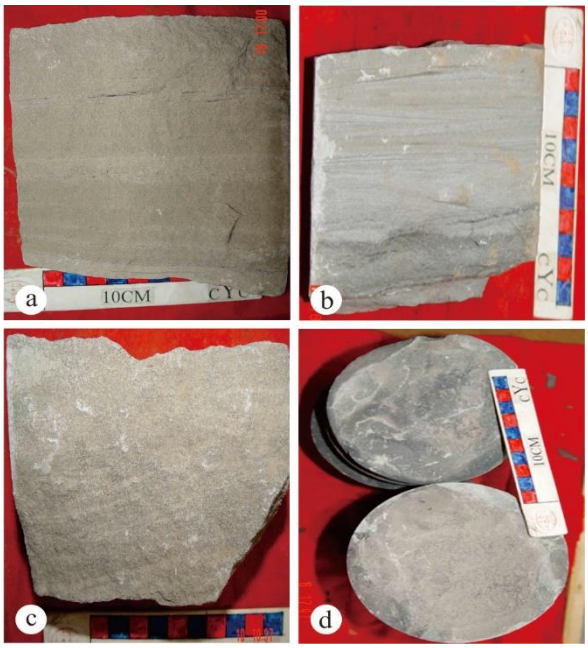

Figure 3: Sedimentary structure type

a-x510,3172.82m, parallel bedding; b-x511,3346.3m, wedge-shaped interlaced bedding;

c-x501,3520.14m, interlaced bedding; d-x511,3346.9m, wave marks – impression

4. Sedimentary facies analysis

According to the sedimentary facies division marks such as lithology, sedimentary structure and logging curve, combined with core data, it is concluded that the sedimentary facies of Es3 in Jiangjiadian mainly include delta facies and lake facies (Fig. 4).

(1) Delta facies: Delta is a fan-shaped clastic sedimentary body formed at the confluence of rivers, oceans and lakes. It is influenced by the rise and fall of sedimentary basin, the sea water advance and retreat, and the tectonic action in the early stage of sedimentation. The river velocity is accelerated, the sediment transported by the current increases, and the delta develops rapidly and advances to the basin; In the late stage, the river velocity decreased, and the delta developed slowly, and appeared in the estuarine environment[6].

The delta front subfacies are the most important areas in the delta. It is formed in the intersection of rivers and lakes (sea). This area is the area where rivers meet with sea water. The sandy and muddy sediments brought by rivers accumulate rapidly here. Due to repeated use of rivers and lake waves, sand mud is washed and rolled, and finally a well sorted sand deposition concentration zone is formed[7-8]. The research area mainly develops the microfacies of underwater distributary channel and estuary dam, with siltstone and fine sandstone as the main lithology, with the sedimentary structure characteristics of wave bedding and interlacing bedding.

The underwater distributary channel is an extension of the onshore distributary channel. It is characterized by rhythmic deposition. Dark mudstone and siltstone are common. In the rock, there are traces of biological disturbance and a small amount of plant debris. There are scour marks at the bottom of the river, a small amount of mud and gravel on the upper part, and there are interlaced bedding and other sedimentary structures in the microfacies [9].

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Estuarine sand dam is the most developed sand body in delta sedimentation, and the largest sedimentary microfacies with the largest sand body thickness. It is located at the front of the underwater distributary channel. It is well sorted and pure in quality. The lithology is medium and fine sandstone [10], which generally has interlaced bedding, parallel bedding the sedimentary structures such as structure, vertical anti rhythm, SP curve is dentate [11].

Half deep lake facies: the semi deep lake is located in the deeper part of the water body below the wave base surface, which generally reflects the reduction environment. The sediment is mainly affected by the lake flow. The clay rock is mainly clay rock with thin interbedded or lens of siltstone[12].

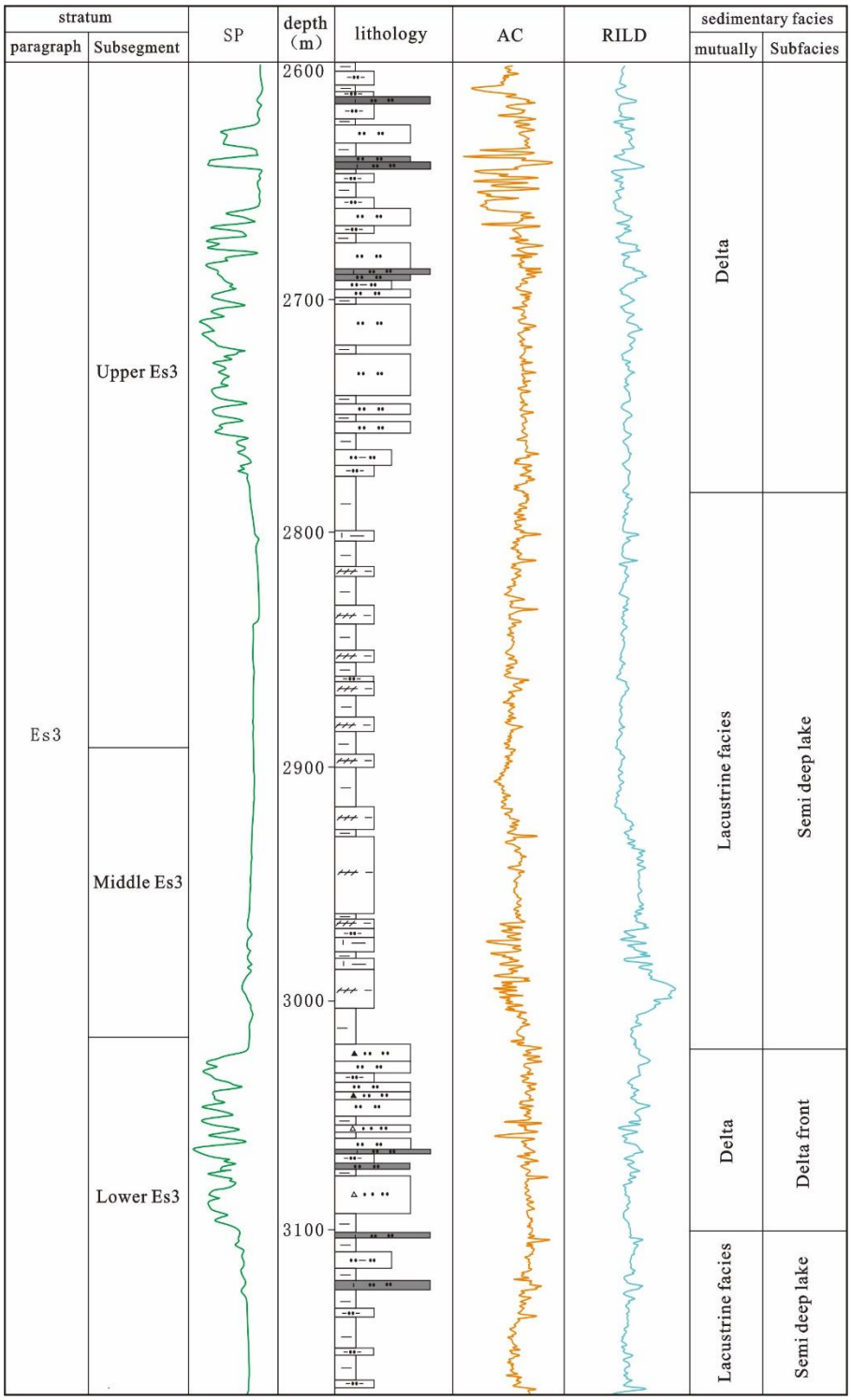

Figure 4: Sedimentary system of the third section of Jiangjiadian

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5. Conclusion

Through the analysis of the petrological characteristics, sedimentary structure and sedimentary facies of Es3 in Jiangjiadian area, it is concluded that the rock types of the third member are mainly lithic feldspar sandstone, mainly bedding structure. The lower part of Es3 is composed of gray sandstone and mudstone, which reflects the delta front subfacies under deep water environment, and the sedimentary microfacies are mainly underwater distributary channel and estuarine dam; The middle and middle segments of Es3 are dark gray, black mudstone and brown oil shale, and turbidite is not developed, mainly in the semi deep lake subfacies; The upper part of Es3 is developed with gray sandstone and mudstone, and the delta sedimentary facies is mainly developed. Jiangjiadian area is affected by Xiakou fault activity, mainly developed lithic arkose, which reflects the sedimentary environment of delta and lake facies.

References

[1] Gao Lihua, xiadi, hanzuozhen, Hanmei, Lihao. Quantitative classification and evaluation of sandy debris flow reservoirs in the middle and middle part of Es3 in the north of Linnan depression [j]. Journal of Shandong University of science and Technology (natural science deition), 2018, 37 (01): 71-81+91.
[2] The reservoir diagenetic fluid evolution of the lower Shasan sub member in Jiangjiadian area of Linnan depression [J]. Xinjiang Petroleum Geology, 2017, 38 (02): 127-132.
[3] Du Shuanghu, qiulongwei, nanjinhao, yangyongqiang. Reservoir characteristics and control factors of the third member of Es3, south slope of Linnan depression [j]. Science and technology and engineering, 2018, 18 (26): 68-76.
[4] Fengdongxiao. Main factors controlling oil and gas enrichment in the lower Es3 sub section of yingzijie area, Linnan depression [J]. Science and technology introduction, 2015, 33 (02): 54-58.
[5] Xia Yun. Diagenetic evolution and formation mechanism of high quality reservoirs in deep sandstone in Shengli oil area [J]. Petrochemical technology, 2017, 24 (11): 142-144
[6] Li Guodong, sunjinlei, Bai Weiwei. Application of fine reservoir comprehensive description technology in yingzijie area [J]. Journal of Shengli Oilfield staff University, 2009, 23 (03): 64-65
[7] Liu Hua. The difference of sedimentary filling in the third member of Nanpo sand in Linnan depression [J]. Oil and gas geology and recovery, 2015, 22 (03): 57-61
[8] Han Shuai, Wang Hao. The control of the structure on the deposition from Kongdian to Es3 in Linnan depression [J]. Journal of Shengli college, University of petroleum, 2013, 27 (04): 1-3+7
[9] Tengjianbin. Lithofacies division and evaluation of fluid rock chemical action control -- Taking the lower sub section of Es3 section in Jiangjiadian Wawu area as an example [J]. Oil and gas geology and recovery, 2017, 24 (03): 1-9
[10] Lu Jinling, zhangshoujun, dongshuangping. Study on the secondary migration system and migration period of oil and gas in Linnan depression [J]. Inner Mongolia petrochemical industry, 2008, 34 (24): 119
[11] Xinquan Lin, Zheng Qing, zhuxiaomin, xupiqin, linzhongyue. Seismic facies and sedimentary facies of the third member of Es3, West Huimin depression [J]. Journal of petroleum, 1988 (03): 18-27
[12] Zhang Yongwang, Gaoxia, Wang Hongliang. High resolution sequence stratigraphy of Es3 member in Jiangjiadian area [J]. Petroleum geophysical prospecting, 2006 (05): 464-471.