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Macro heterogeneity of high porosity and permeability reservoir- in Bozhong 25-1 oil field under section as an example

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Abstract: *in order to improve the development effect of oilfield, in the Bohai Bay Basin Bozhong depression on the basis of sedimentary setting and tectonic background, sedimentary environment of, make use of the existing data of core, logging, seismic exploration and development and laboratory analysis, the storage layer, interlayer and plane heterogeneity, determine the reservoir types and characters, thus to study sedimentary reservoir characteristics have a more comprehensive and in-depth understanding, Bozhong depression depression Bozhong 25-1S oilfield geological fine anatomy, potential of oilfield provides solid geological basis.*
Keywords: *shallow water delta; sedimentary microfacies; interlayer; interlayer; reservoir heterogeneity*

I. Introduction

Reservoir heterogeneity study is reservoir description in the core content, is the main geological factors of remaining oil distribution is the foundation and key to improve the oil and gas reserves, reservoir heterogeneity due to reservoir properties (lithology, electrical, and oil and gas properties and microscopic pore structure) varies with the spatial position and change the attributes. The heterogeneity of the heterogeneity and the void space of the rock mass is mainly expressed in the rock mass. Because of the difference of the sedimentary and diagenesis, the rock mineral composition, the content of the matrix and the content of cement are not the same, which affect the change of the shape and size of the pores and the reservoir physical properties. In the development of oil field, the reservoir permeability is an important factor that influences the development of oil field.

II. Geological Survey

On the south 25-1 oil field in the bohai regional structure is located in the south of bohai sea bohai bump south west pitching end, east near bohai sea south sag, the north and the bohai oil source sag phase, the south 25-1 oilfield in bohai for Ming town, the main research purpose layer under the group, is an important part of the sag in bohai oil combination, 25 to 1 s in the bohai sea area is located in the bohai sea, south low bulge west pitching end sag in bohai (source) and concave boundary river estuary place, is the bohai sea found large neogene conventional heavy oil fields.

South 25-1 oilfield in bohai sea sedimentary environment as a whole for shallow water delta depositional system, mainly include distributary channel, overflow shore sand, natural levee microfacies. Medium - small distributary channel, most large and super large less distributary channel, channel direction mainly concentrated in the north by east 40 ~ 60 °; Local extension direction nearly north-south river.

III. Layer Heterogeneity

Intraformational heterogeneity refers to a single internal vertical sand size changes in reservoir properties. It is directly affect and control the thickness of single sand layer in the inland waters flooded sweep efficiency, the key of geological factors, and cause the internal contradictions inside the production. This study mainly from the granularity of rhythm and permeability rhythm, pore permeability heterogeneity, interlayer inside the detailed study on three aspects, such as the south 25-1 oilfield in bohai intraformational heterogeneity.

1) size permeability rhythm and rhythm

Granularity rhythm studies is the study of sand body interior lithology thickness change rule, reflect a flow or more change characteristics of water energy, permeability rhythm refers to the changes in size in vertical permeability, granularity, rhythm and permeability rhythm study is an important part of the study of reservoir heterogeneity.

(1) the rhythm type distribution

IV, V, VI three oil groups: use 101 Wells 905 sand compiled the south 25-1 in bohai oilfield, IV, V, VI three oil group size rhythm and permeability rhythm statistical histogram (figure 2), histogram revealed that three key oil group in the study area size rhythm and permeability rhythm obviously is given priority to with positive rhythm, respectively 57.35%, 48.07%, compound rhythm and the rhythm times, homogeneous rhythm, rarely proportion was only 3.09%, 3.09% respectively. Granularity rhythm and permeability rhythm, positive rhythm + compound positive rhythm of 69.17% and 69.17% respectively, reflect the distributary channel development, compound rhythm four class, give priority to with compound positive rhythm, respectively 11.82%, 16.69%, anyway, rhythm, proportion of 5.86%, 6.85% respectively, positive and negative rhythm and composite reverse rhythm is relatively small. Histogram and related statistical data also show that the particle size of rhythm and permeability rhythm correlation is good, various types of rhythm and main rhythm type are basically identical.

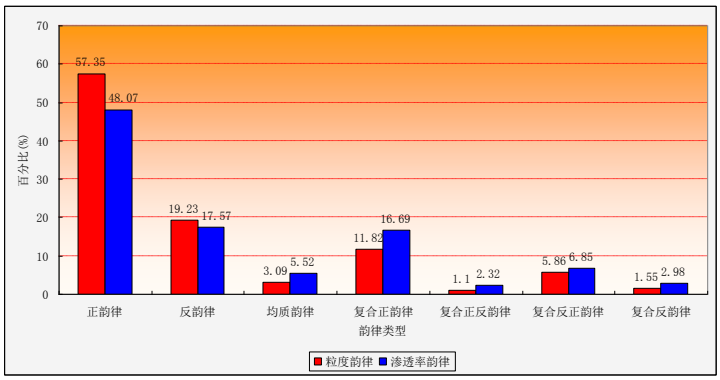

Figure 2 key oil group size rhythm and permeability rhythm statistical histogram

2) permeability heterogeneity

Use of SY/T 6285-1997 holes, permeability classification standard of the study area mainly small layers of oil group was graded porosity, permeability. (table 1) focus on south 25-1 oil field in bohai group 27 small layer porosity is given priority to with high pore obviously, as high as 96.3%, the proportion of pore reservoir is small, only 3.7%, permeability is given priority to with high permeability, high permeability, respectively 40.74%, 55.56%, permeability of reservoir is less, the percentage is only 3.7%. So focus on south 25-1 oil field in bohai group 27 small basic belongs to high porosity and high permeability layer - high permeability reservoir, better properties and more uniform, little hole, the permeability of reservoir.

Permeability heterogeneity: 25-1 south in bohai oilfield, IV, V, VI three group of 27 small layers of oil permeability is given priority to with heterogeneous type, proportion is as high as 80% above, relatively homogeneous and serious heterogeneity of reservoir.

Coefficient of permeability variation coefficient and dash plane distribution, characterization of effect is good, but the differential and coefficient of variation coefficient, dash graphic feature differences, characterization of effect is poorer. Coefficient of variation of main distribution between 0 ~ 1, dash between coefficient is mainly distributed in 0 ~ 4, differential range is larger, between 0 ~ 2000 all have distribution, considering that the small layers of oil reservoir types are in heterogeneous reservoir is given priority to, no significant differences between different microfacies type, overflow shore to thin layer of sand, natural levee microfacies are very strong heterogeneity.

Table 1 by the standard of reservoir heterogeneity

Heterogeneous type	V_k	T_k	J_k
Relatively	<0.5	<2	<2
Heterogeneous	0.5～0.7	2～3	2～6
Severe heterogeneity	>0.7	>3	>6

3) identification and study of interlayer

Using the BZ25-1-7 BZ25-1-8 four take heart well 33.68m core identification a core layer 2, muddy intercalation 24, petrophysical interbed 10, logging out of 17 wells of muddy intercalation 102, material interlayer 28, calcareous interbeds 12, and work together to build a meet Bozhong 25-1S oilfield reservoir characteristics of interlayer recognition criteria (Table 2). The advantages of core calibration and logging identification are as follows: adding a large number of interlayer, which can overcome the disadvantages of core

dissection, and can be more reliable and reliable, and can overcome the disadvantages of the non calcareous interlayer, which can make the standard more comprehensive.

Table 2 insulation sandwich quantitative identification standards

Sandwich type	GR	The rate of return of GR %	RMLL	AC	DEN	CN	identify
interlayer	> 100	> 80%	/	/	/	/	Easy
Argillaceous	> 80	> 20%	0.5-2	> 95	2.1-2.4	24-30	Normal
Physical properties	75-100	10-30%	0.5-2	> 100	2.08-2.22	25-30	Normal
calcium	< 105	< 20%	> 1.8，Obvious peak shape	< 90，Significantly lower	> 2.3	< 23	Easy

(1) Interlayer Identification

GR (return) curves of (return) curves are more sensitive to the characteristics of RMLL, RD and RS. The curve of the curve is more sensitive to the reaction of calcareous layer, and the identification results are more accurate and reliable.

The response of the well logging curves is mainly reflected in the characteristics of mudstone, and the distribution of the mud layer is widely distributed, and the frequency is the highest. GR, RS, RMLL, DEN, AC, CN, RD, and so on, which are based on the curve and its return characteristics. Because of the high quality of the mud layer, it is more difficult to identify the mud layer into a (feature is obvious, the return rate of GR is relatively small, B is not obvious, GR return rate is relatively small, is not easy to identify) two sub categories.

Calcareous interlayer: the distribution of calcareous interlayer has strong randomness, and the frequency is relatively small. The micro lateral resistivity is obviously high, and the time difference of the acoustic wave is obviously lower than that of RD, RS, RMLL, and GR, AC, etc..

The content of the material is high, the nature is complex, and the curve of each curve is between the clay and the calcareous interlayer, and the frequency is not high. GR, RS, RMLL, DEN, AC, CN, RD, and so on, which are based on the curve and its return characteristics.

(2) Plane Distribution Characteristics Of Sandwich Plane

By analyzing the thickness, density and frequency of 27 layers of three small layers, the thickness of the interlayer, the density and the frequency of the three layers are basically the same as the distribution of the parameters. Bozhong 25-1 oilfield in the south region of interlayer in the plane is potato shaped distribution, poor continuity of dissection plane, I see a few layer interlayer contiguous distribution, showing interlayer in the plane does not grow, the distribution of small size. In addition, the study also found, most inner layer interbed distribution in the distributary channel micro facies, overflow shore sand body, crevasse splay, natural levee microfacies layer interlayer distribution is relatively small, but the micro phase if the inner layer interbed development, because of sand body thickness was small, general layer sandwich density, frequency rate is higher, layer heterogeneity is serious.

(3) Statistical Characteristics Of Sandwich Layers

The characteristics of different microfacies are: the development of micro facies controlling layer, thickness, frequency and density of different sedimentary micro facies are different (Table 3). The research shows that the total number of the main layer is large, the interlayer is thick and the interlayer is small, but the frequency and thickness are small. So the interlayer frequency and density are small. Concluded that from the main river - a river - River - other microfacies, interlayer in total and single microfacies sand body interlayer number gradually decreased, but inner layer interbed frequency and density gradually increased, resulting in caused by the interlayer intralayer heterogeneity is gradually enhanced.

Table 3 different microfacies layer within the interlayer TAB

Microfacies types	Sand layer	number of sandwich	Sand thickness	Intercalation characteristics			
				number	thickness	frequency	density
Channel main body	109	296	9.796	2.716	1.759	0.278	0.177
A class	181	356	5.899	1.967	1.373	0.344	0.221
B class	99	133	3.333	1.333	0.95	0.433	0.271
others	63	88	3.4	1.365	1.398	0.461	0.368

3 Reservoir Heterogeneity

The sandstone thickness and sandstone drill meeting rate and stratification coefficient, and permeability of sandstone density non homogeneous parameter layer, spacer layer thickness of multiple characterization parameters from the reservoir interlayer heterogeneity evaluation and interlayer interlayer distribution of two aspects research fine reservoir interlayer heterogeneity.

1) Reservoir Heterogeneity Evaluation

The stratification coefficient, sand density, permeability variation coefficient, onrush of permeability coefficient and permeability difference 5 characterization parameters were oil group level, small level two levels of reservoir interlayer heterogeneity evaluation, start with IV oil group, stratification coefficient, permeability variation coefficient, onrush coefficient of permeability, permeability gradually become larger, show that the reservoir interlayer heterogeneity is gradually enhanced.

2) Distribution Of Interlayer Between Layers

Use by well and layer identification and throughout all the region of a plurality of combined well profile analysis combined, to determine the Bozhong 25-1S oilfield IV, V, VI three oil layer spacer, to identify a total of six relatively stable layer spacer development period, the six layer between compartment three key oil group longitudinally divided into seven sandstone section (Table 3).

Table 3 layer spacing development statistics

layers	0～5m		5～8m		8～10m		10～12m		12～15m		>15m		The average	Distribution
	Well	（%）	Well	（%）	Well	（%）	Well	（%）	Well	（%）	Well	（%）		
Base of IV1～Base of IV2	0	0	2	1.44	6	4.32	9	6.47	25	17.99	97	69.78	15.08	stable
Base of IV3～Base of IV4.2	6	4.32	21	15.11	22	15.83	89	64.03	1	0.72	0	0	9.78	Relatively stable
Base of IV5.2～Base of IV7	18	12.95	15	10.79	29	20.86	77	55.4	0	0	0	0	8.95	Relatively stable
Base of V1.1～Base of V2	4	3.13	10	7.81	13	10.16	17	13.28	49	38.28	35	27.34	12.51	stable
Base of V4～Base of V5.2	10	8.4	13	10.92	16	13.45	18	15.13	62	52.1	0	0	10.8	Relatively stable
Base of VI2～Base of VI4	1	1.25	5	6.25	8	10	5	6.25	18	22.5	43	53.75	14.28	stable

3) Interval Layer Basic Characteristics

From top to bottom, 6 layer spacing development horizon respectively IV1 small layer bottom ~ IV2 small bottom, small IV3 ~ IV4.2 layer bottom layer bottom, small IV5.2 ~ IV7 layer bottom layer bottom, small V1.1 ~ V2 layer bottom layer bottom, small V4 ~ V5.2 layer bottom layer bottom, VI2 small layer bottom ~ 957359 VI4 small layer bottom, 6 layer between the electrical characteristics, all show the characteristics of mudstone, GR curve significantly higher value, return to baseline, mudstone SP curve RD and RS curve significantly undervalued; Interval layer thickness and surface stability is slightly different, these small layer bottom ~ IV2 small bottom IV1, small V1.1 layer bottom ~ V2 small bottom, small VI2 layer bottom ~ VI4 small bottom three layer interval quality pure, such as big thickness, stable plane distribution, thickness of single well average 15.08 m, 12.51 m, 14.28 m, to stabilize the distribution layer insulation, small IV3 layer bottom ~ IV4.2 layer bottom, small IV5.2 ~ IV7 layer bottom layer bottom, small V4 layer bottom ~ V5.2 small bottom three interval layer thickness is larger, such as plane distribution is stable, single well average thickness were 9.78 m, 8.95 m, 10.8 m, is a more stable distribution layer insulation. Comprehensive analysis, the south 25-1 oilfield in bohai interval layer development, six the thickness of the layer spacing is bigger, these small layer bottom ~ IV2 small bottom IV1, small V1.1 layer bottom ~ V2 small bottom, small VI2 layer bottom ~ VI4 such as bottom layer three layer interval to stabilize the distribution layer insulation, small IV3 layer bottom ~ IV4.2 layer bottom, small IV5.2 ~ IV7 layer bottom layer bottom, small V4 layer bottom ~ V5.2 such as bottom layer three layer spacing for interlayer relatively stable distribution.

4 Plane Heterogeneity

The plane heterogeneity is the geometric shape, scale and continuity of the reservoir sand body, and the heterogeneity caused by the variation of the porosity and permeability of the reservoir. The results showed that the effect of reservoir heterogeneity on the development of the oil and gas reservoirs, such as single layer, sub - production, and so on. Therefore, this study will be an important part of the plane heterogeneity, and by the establishment of a small layer of sandstone thickness, effective thickness, effective porosity, permeability and other parameters of the equivalent line map of the small sand body, the physical properties of the surface heterogeneity. 27 small layer sand thickness, effective sand thickness, porosity and permeability surface map of three oil groups:

The effective sandstone thickness is similar to the distribution of sandstone thickness, the thickness of the river is thick and the thin layer is thin;

The porosity is between 20 and 30%, the range is small, the change of permeability is large, the surface is not homogeneous and the channel is relatively good.

According to the statistics, it is concluded that the average permeability of 10 main river, 13 a river, 17 second class River, coefficient of variation onrush coefficient and range. Which is 8500.62 average permeability of the main river and the coefficient of variation was 1.67, onrush coefficient is 5.08, with a range of 3319.38; river average permeability is 3645.59 and coefficient of variation for 1.25, onrush coefficient is 3.5, range 349.89; second class River average permeability is 1294.09, the variation coefficient was 1.22, onrush coefficient of 3.39, range 439.82; overflow sand coast average permeability is 804.76 and coefficient of variation was 1.18, onrush coefficient for 2.74. The range is 125.18.

After analysis, the main channel, a kind of river, the two kinds of river, the sand surface heterogeneity of the overflow sand are weakened in turn.

IV. Conclusions

1 Bozhong 25-1 South Tian Ming section in the delta distributary plain subfacies, identified 6 microfacies subdivision, 8 energy units.

2 reservoir with the main stream channel, the sand body of the sand body in the reservoir, identify the sand body of the 129 channel sand bodies and hundreds of overflow banks, and 74.4% of the narrow channel sand bodies of 200-400m.

3. The district is a high porosity and high - special hypertonic, non homogeneous reservoir, reservoir and heterogeneous characteristics of sedimentary micro facies control, by subject, a class, second class River to the main body, a class, second class overbank sand, sand thickness, porosity and permeability differential gradient; interbed frequency, density decreased, number of the sandwiches, thickness increases; coefficient of variation, onrush coefficient, differential reduced.

References

[1]. Quantitative description of characteristics of high-capacity channels in unconsolidated sandstone reservoirs using in situ production data[J]. Petroleum Science,2010,01:106-111.

[2] Wu Guanghui,Yang Haijun,Li Haowu,Sun Lixia. Controlling effects of the Ordovician carbonate pore structure on hydrocarbon reservoirs in the Tarim Basin, China[J]. Petroleum Science,2013,03:282-291.

[3] Deng Shaogui,Wang Yang,Hu Yunyun,Ge Xinmin,He Xuquan. Integrated petrophysical log characterization for tight carbonate reservoir effectiveness: A case study from the Longgang area, Sichuan Basin, China[J]. Petroleum Science,2013,03:336-346.

[4] Sun Liang,Zou Caineng,Liu Xiaoli,Zhu Rukai,Wang Xiaoqi. A static resistance model and the discontinuous pattern of hydrocarbon accumulation in tight oil reservoirs[J]. Petroleum Science,2014,04:469-480.

[5] Jan Einar Ringas. Reservoir Stochastic Modeling Constrained by Quantitative Geological Conceptual Patterns[J]. Petroleum Science,2006,01:27-33.

[6]. Geological Model of Member 3 of Shahejie Formation Reservoir in Liuzan Oilfield, Eastern Hebei Province[J]. Petroleum Science,2006,02:28-33.

[7] Sam Zandong Sun. Fractured reservoir modeling by discrete fracture network and seismic modeling in the Tarim Basin,China[J]. Petroleum Science,2011,04:433-445.