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Longdong area Erdos basin Yanchang 7 reservoir evaluation standard and its application

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Abstract: -The comprehensive classification and evaluation of reservoir is a very important comprehensive work in reservoir research. In synthesis, pore types and image analysis the individual evaluation technology based on, all kinds of methods to provide information on reservoir in a systematic, comprehensive analysis, reservoir to the objective interval layer characteristics to put forward the evaluation opinions, according to the requirements of different wells type is proposed for regional prediction opinions. The main content of the evaluation is to evaluate the value of the reservoir by the range of values and the characteristics of certain properties.

Keywords: - *Reservoir prediction,Geological statistics inversion,Reliability evaluation*

I. INTRODUCTION

In order to understand the overall potential of clastic reservoir in the area of the palace area,we need to carry out the research on the characterization technique of gas reservoir,the formation of stratigraphic division,sedimentary characteristics,reservoir characteristics and reservoir characteristics.Therefore,it is necessary to carry out seismic inversion and prediction in the study area.

II. EVALUATION CRITERIA FOR TIGHT SANDSTONE RESERVOIR

Reservoir classification evaluation method is a lot, the general trend is from qualitative to quantitative, from macro to micro. Can be used for reservoir classification and evaluation of qualitative and quantitative parameters related to the lithology, lithofacies, Cheng Yan role, physical properties, pore structure, oil, electricity, heterogeneity, thickness, capacity, and many other items. And each project includes several or even more than a dozen parameters. Together, it is very complex, so in these complex parameters, can play a key role in the reservoir classification evaluation parameters, different regions, different levels, different geological conditions have different selection criteria.

The Chang 7 reservoir is different from the other layers of the extension group, the lithology is unusually dense and the average permeability is only 0.2mD. The reservoir classification evaluation criteria of the Chang 4+5- Chang reservoir is 8. Therefore, this study is to establish a Chang 4+5- Chang 8 reservoir classification evaluation criteria, combined with the reservoir characteristics, and increase the number of parameters of micro pore structure, such as the mainstream throat radius and movable fluid saturation of 7 reservoir. Initially established Chang 7 reservoir classification and evaluation standard, the Chang 7 reservoirs are classified as class I, class II, III, IV types of storage reservoir (Table 1).

I reservoir: For single or multi period underwater distributary channel and turbidite channel sand body, the thickness of sand, generally above 10m; the compaction effect is relatively weak, preserved intergranular pore diagenetic period to create the conditions for the acidic water in the pore flow between, in some favorable parts of feldspar and other soluble minerals after the dissolution of the formation of secondary pores, residual intergranular pores and secondary pores are relatively developed, mixed pore combination often form, face higher rates, generally above 2.5%; the average pore aperture, generally in more than 40 m, the pore connectivity between good, mainstream throat radius in more than 0.5. M, the displacement pressure is low, generally not more than 1.5Mpa, and there are some obvious pressure mercury curve on the platform; this kind of good reservoir properties, porosity, permeability and porosity are relatively high, generally above 10%, penetration The ratio of the rate is greater than 0.3mD, and the movable fluid saturation is more than 40%, which shows good flowing property, and belongs to the good reservoir.

Fig 1 The classification criteria of the Chang 7 reservoir in the Ordos Basin

		Reservoir classification			
		Ⅰ	Ⅱ	Ⅲ	Ⅳ
Sedimentary characteristics	Laminated micro phase	Underwater diversion channel	Turbid product channel		Turbidity channel and front
	Grain size （mm）	Fine sandstone	Fine sandstone, fine sandstone		Fine sandstone
	Sandstone thickness （m）	＞15	15~10		＜10
Physical properties	（%）	＞10	12~9	10~8	＜8
	K（mD）	＞0.3	0.3~0.2	0.2~0.1	＜0.1
The amount of interstitial material （%）		＜13	15~11	16~14	＞15
Pore type	Apparent porosity （%）	＞2.5	3~1.5		＜2
	Average pore size （μm）	＞40	40~30	30~20	＜25
	Pore combination type	Intergranular pore and dissolution	Dissolved pore	Dissolved pore	Dissolved pores and micro pores
Pore structure	Mainstream throat radius （μm）	＞0.5	0.5~0.3		＜0.3
	Saturated flow volume （%）	＞40	40~30		＜30
	Displacement pressure （MPa）	＜1.5	1.5~2.5	2.0~3.5	＞3.5
	Median radius （μm）	＞0.15	0.2~0.1		＜0.1
	Mercury withdrawal efficiency （%）	30~28	28~25		＜25
	Pore structure type	Ⅰ~ⅡType	Ⅱ~ⅢType		ⅣType
Reservoir evaluation		Good	Slightly better	General	Poor

II reservoir: the main single phase or multi phase of the muddy channel sand body, sand body thickness after class I reservoir, or its equivalent, the I reservoir is similar to the 15m reservoir, diagenesis is relatively strong, and the residual intergranular pores are not developed, but feldspar and other soluble minerals are formed after 10 ~ 1.5, the average pore diameter between ~ 3%, the average pore size between ~ 1.5%, the average pore diameter between ~ 0.3, the average pore diameter between 40 ~ 30, the mainstream throat radius between ~ 0.5 m. The reservoir physical property is relatively good, and the porosity is generally between 9% and 12%, the permeability is between 0.2mD ~ 0.3mD, and the movable fluid saturation is between 40% and 30%, Show good seepage characteristics, is a good reservoir.

III reservoir: Was high in the middle of the hole, the average rate of ~ 30 was between 8% ~ 10, the average rate of pore size was between ~ 3%. The average rate of pore size was 10% ~ 20. The average rate of pore size was between ~ 0.3. The average rate was ~ 1.5%. The average rate of pore size was between 0.5 ~ 2. Between 0.1 ~ 0.2mD, the flow characteristic is poor, and the reservoir performance is poor.

IV reservoir: For the muddy channel and muddy channel front sand body, sand body thickness is small, generally in the 10m, or for sand shale thin layer, or although there is a certain thickness, but a strong, resulting in residual intergranular pores, secondary dissolution pores are not well developed, the average pore size is less than 25, the average pore size is less than 0.3 m, the main throat radius is 8% m, the pressure mercury curve is relatively steep, which reflects the poor reservoir physical properties.

III. RESERVOIR CLASSIFICATION EVALUATION RESULTS

According to the statistics, the distribution map of the reservoir evaluation of each small layer, the 7 main types of the main class II, III reservoir. Chang 72 I oil layer is mainly distributed in the western part of the study area the Yanwu area, also in sanshilipu, Heshui, stagecoach also sporadic distribution; class II reservoirs mainly in in the plateau and Heshui - county developed; class III from Hua Qing, Qingcheng and Heshui - a large area of the county development; type IV reservoir development limited, a number of deposition in the edge of sand body. The growth characteristics of 71 types of reservoirs are consistent with that of the Chang 72. Overall (Table 2), the distribution area of class I reservoir is 530km^2, and the distribution area of class II is 4700km^2, and the distribution area of class III reservoir is 13500km^2.

Fig 2 Statistics in Longdong area of Chang 7 reservoir evaluation

Reservoir classification	Horizon	Favorable area（km²）
Ⅰ	Chang 71	270
	Chang 72	260
	Chang 7	530
Ⅱ	Chang 71	2400
	Chang 72	2300
	Chang 7	4700
Class I, II		5230
Ⅲ	Chang 71	7000
	Chang 72	6500
	Chang 7	13500

According to the statistics, the distribution map of the reservoir evaluation of each layer is mainly based on the second and third class reservoirs. Chang 7 is mainly based on the II and III reservoirs, also in sanshilipu, Heshui, stagecoach also sporadic distribution; class II reservoirs mainly in in the plateau and Heshui - county developed; class III from Hua Qing, Qingcheng and Heshui - a large area of the county development; type IV reservoir development limited, a number of deposition in the edge of sand body. The developmental characteristics of 1 different types of reservoir are consistent with that of Chang 7 2. Overall (Table 2), the distribution area of class I reservoir is 530km^2, and the distribution area of class II is 4700km^2, and the distribution area of class III reservoir is 13500km^2.

In 2011, it was carried out in the first class and the second class of the Chang 7, and the experimental results were obtained. The 230 wells in the well mixed water fracturing test of the water in the Chang 7 developed by the 36.72t/d, and the high yield industrial oil flow, compared with the same oil reservoir, is about 3 times of the conventional fracturing reformation. In addition, the volume fracturing horizontal well test was carried out in 233 well area in the west, Yangping 1 well and Hinata 2 wells were obtained the the oil flow high-yield industrial in 105.83t/d 87.64t/d.The successful implementation of these wells, but also determined the confidence of the transformation of the Chang 7 reservoir.

IV. CONCLUSION

To sum up the full text, the main conclusions are as follows:

1 according to the capillary pressure curve will form the pore throat types are divided into four categories, mainly in II, III. Macro Cheng Yanxiang belt and micro pore structure have good correspondence, favorable reservoir physical property is relatively good, the displacement pressure is small, the sorting is good, the maximum inlet mercury saturation is high, and the mercury is high. The pore structure of the illite in the study area is better, and the development of the large area in the plane.

2 Chang 7 is a super low permeability tight sandstone reservoir. Throat is the key factor to determine the physical properties of reservoirs. There are two main factors that affect the pore structure of the reservoir: (1) it is the foundation of the primary porosity of reservoir. (2) the difference is formed in the formation of relative high quality pore throat.
3 the evaluation criterion of the super low permeability tight sandstone reservoir is established, and the reservoir is the main reservoir of the second and third class. The 6 types of relative high quality reservoirs are selected, and the favorable areas are 530km^2 and 4700km^2 respectively.

Through the application of the group of the Royal Palace in the palace of the palace,it is indicated that the geological statistics method can predict the reservoir effectively,and can clearly reflect the variation of the sand body in the well.The sand thickness prediction map is compared with the actual drilling data,the coincidence rate reaches 80%,and the thickness of the sand layer is consistent with the sand body distribution,and the thickness of sandstone is the distribution area of the braided channel and the water diversion channel and the mouth bar microfacies.So the results of this study can be used in the next step to guide the distribution of favorable areas.

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