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The organic matter abundance evaluation of Shuangyang group in Chaluhe fault depression of Yitong basin

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Abstract：Chaluhe area of Yitong Basin has been explorated several times. But all explorations have not make an substantive breakthrough yet. Based on the collected data of hydrocarbon source rocks of Chaluhe area, systematic sampling, we conducted a sampling system. Samples were analyzed for TOC, "A", $S_1 + S_2$ and other indicators to evaluate the organic matter abundance. The results show that the dark mudstone most develops in shuangyang group in middle shallow layer of Chaluhe area, where has high abundance of organic matter and can be an effective source rock. Complex the above analysis, we predict for favorable exploration area and laid the foundation for further exploration to deploy Chaluhe region.

Key words：*Yitong basin; Source rock of hydrocarbon;Organic matter abundance*

I. INTRODUCTION

Yitong basin is located in between changchun and jilin. It is developed on the basis of the tanlu fault zone of the strike-slip - stretching basin, north and south long 160 km, 10 ~ 20 km wide, covers an area about 2200km^2,developes Chaluhe fault depression, Luxiang fault depression and Moliqing fault depression from north to south[1].Yitong graben is mainly for the tertiary fault basin, strata thickness is 2000-6000 m generally, developed jurassic - cretaceous strata, shuangyang group、sheling group、yongji group、wanchang group、qijia group and chaluhe group of the tertiary stratum from top to bottom. The shuangyang group and luxiang group are for the main purposes of this layer, there is only a little bit oil and gas shows of yongji group、wanchang group、qijia group in Chaluhe fault depression[2].

After years of exploration in Yitong basin, Changchun oil field and Moliqing oil field have been found in Wuxing tectonic zone of Luxiang fault depression and Moliqing fault respectively, but the proven reserves is insufficient to 15% of the predict geological reserves[3]. Chaluhe fault depression is one of the biggest fault depression in Yitong basin, it has large exploration ability ,with most of the oil and gas resources is yet to be developed. Compared with the Luxiang fault depression and Moliqing fault depression, it's mudstone thickness is relatively well, hydrocarbon source rock organic carbon content is relatively small and maturity is high. It gives priority to Generate gas, has high maturity and low density of the crude oil.

The resource evaluation results which had been found by predecessors shows that the oil and gas resource are huge, but the exploration prospect is not very clear. In order to meet the conditions of the oil and gas accumulation and distribution, deploy the next round of exploration work, as soon as possible to obtain the substantive breakthrough in prospecting oil and gas, it is necessary to comprehensive new well data, with the predecessors' achievements for comparative analysis, sum up of the system.It can objectively reveal the oil and gas resource potential, distribution and the direction in chaluhe area.

II. SAMPLES AND TEST DATA

From existing data collected Geochemical data of more than 170 Wells, including the organic carbon data 1936, pyrolysis data 2529, rock chloroform bitumen "A" data 634. We Collected more than 10 copies of multimedia and research reports about Yitong basin.Our team got a total of 99 coring samples of 15 wells, 300 rock waste samples of 24 wells.

III. DEVELOPMENT AND DISTRIBUTION OF DARK MUSTONES

It is generally believed that under the condition of terrestrial facies, mudstone are the main hydrocarbon source rocks, the dark mudstone is the most favorable among them. The dark mudstone of each fault depression in Yitong graben are mainly distributed in Paleogene system shuangyang group、sheling group and yongji group.Shuangyang group is present on shuang1 segment、shuang2 segment and shuang3 segment. Each section of the dark mudstone in each area have changes on the thickness of the lateral , the largest statistical thickness almost above 150 m, most of them are more than 200 m, the thickest can reach more than 600 m[4].

Combining with seismic, well logging, mud logging data to draw the dark mudstone isopach map(figure 1-figure 3), we analyze that the dark mustone in shuangyang group of chalauhe area is

development, shuang1 segment among them develeps better than shuang2 and shuang3 segment, the average thickness is 135 m. The thickness of xinanpu sag is larger than botai sag.

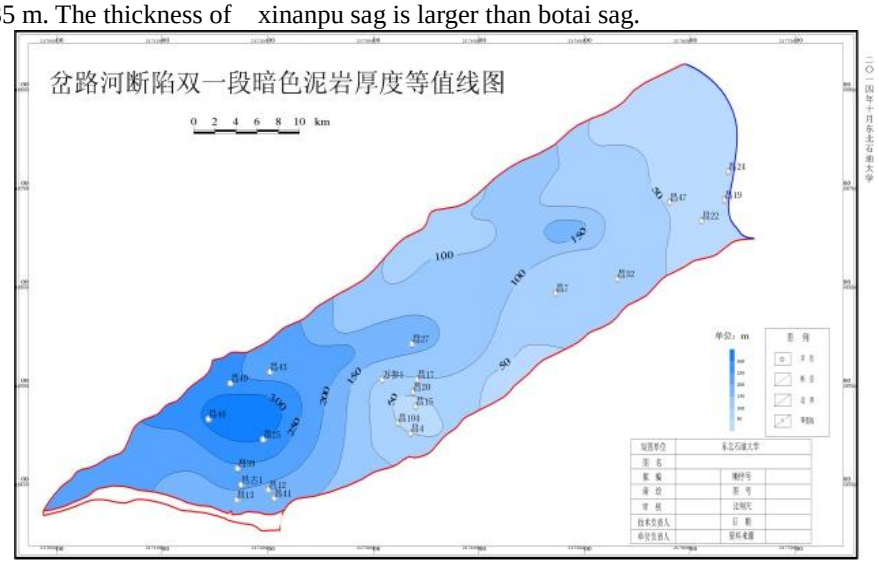

Fig.1 The dark mustone isopach map of Shuang1 segment in Chaluhe fault depression

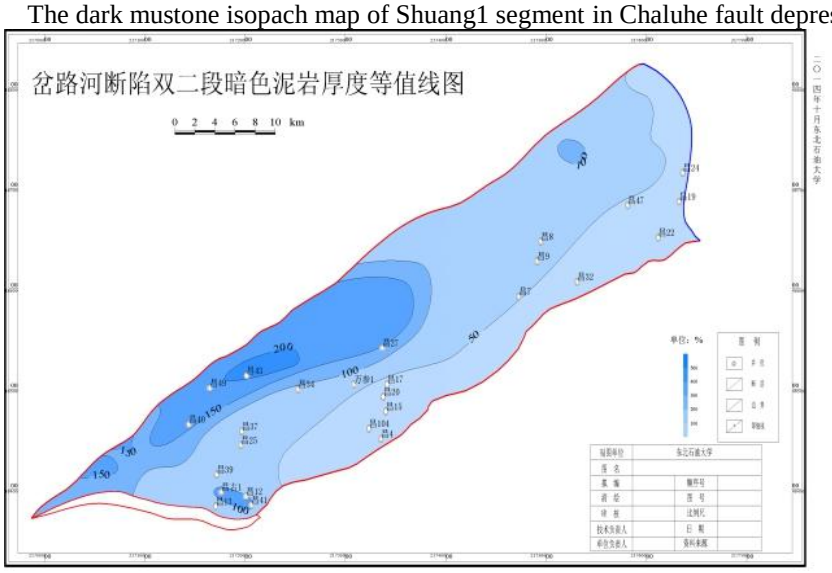

Fig.2 The dark mustone isopach map of Shuang1 segment in Chaluhe fault depression

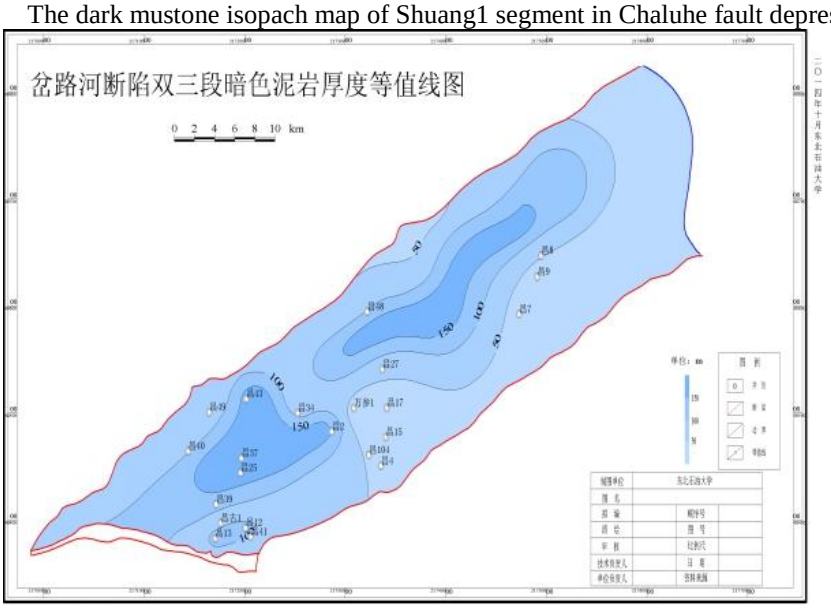

Fig.3 The dark mustone isopach map of Shuang1 segment in Chaluhe fault depression

IV. THE ABUNDANCE OF ORGANIC MATTER

In addition to related to source rock volume (the thickness and distribution), the size of the hydrocarbon mainly depends on the organic matter abundance, type and maturity of the hydrocarbon source rocks. Organic matter in hydrocarbon source rock is the material basis of the formation of oil and gas, it's total depends on its in abundance of hydrocarbon source rock and source rock of effective volume.

Organic matter abundance is refers to the number of units of organic matter in the quality of rock, under the condition of other similar condition,the higher content of organic matter in rocks (abundance) , the stronger its hydrocarbon generation ability. It is the important indicator of measuring hydrocarbon generation material base of the hydrocarbon source rock. Generally we use four indexes: organic carbon content, Chloroform bitumen "A" content, total hydrocarbon content and pyrolysis (Rock - Eval) hydrocarbon generation potential (S1 + S2) to evaluate the organic matter abundance. Yitong sag is one of the most important lacustrine fault basins in northeast China, so we maily use terrestrial facies mudstone organic matter abundance evaluation standard to evaluate the hydrocarbon source rocks[5].

Residual organic carbon refers to the sum of carbon graphite apart from carbonate and graphite in rock. Generally we think that source rock organic matter content in the most of the elements carbon, so we can use residual organic carbon TOC to approximate express the abundance of organic matter in source rocks.

From south to north, chaluhe fault depression developed liangjia tectonic zone, xinanpu sag, wangchang tectonic zone, botai sag, soudengzhan tectonic zone and gudian slope. Black mudstone is mainly distributed in xinanpu sag and botai sag[6]. Therefore, evaluation of the two area of organic matter abundance is representative to the evaluation of the chaluhe fault depression.

As is shown in figure 4, on the whole, each layer of the residual organic carbon of shuangyang group in xinanpu sag reached a good level and the abundance of organic matter is high. Figure 5 is the diagram of the frequency distribution in Botai sag, it shows that the organic matter abundance of shuang1 segment and shuang2 segment in shuangyang group 55% reached a good level, shuang3 segment 85% reached a good level. The organic matter abundance of xinanpu sag is a little higher than it in botai sag. Among them, shuang3 segment achieves a good standard, other sections reach for medium – good level.

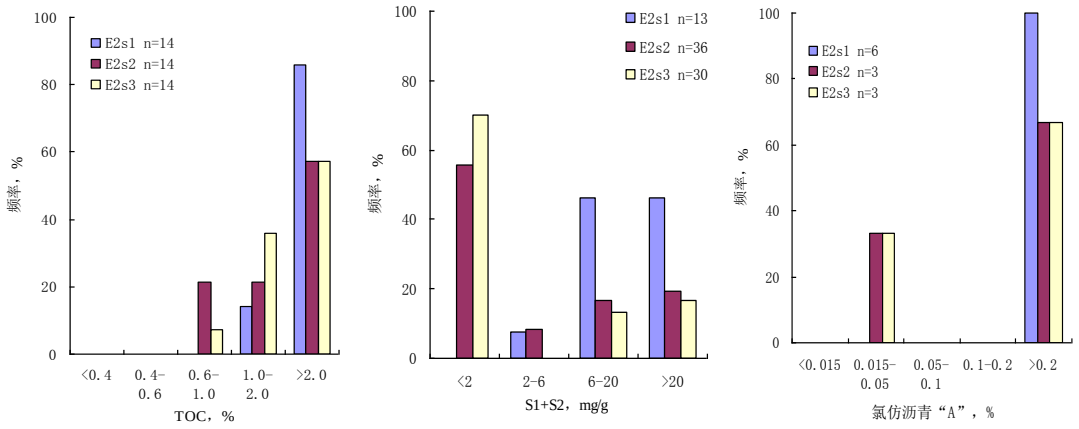

Fig.4 The diagram of the frequency distribution in Xinanpu sag

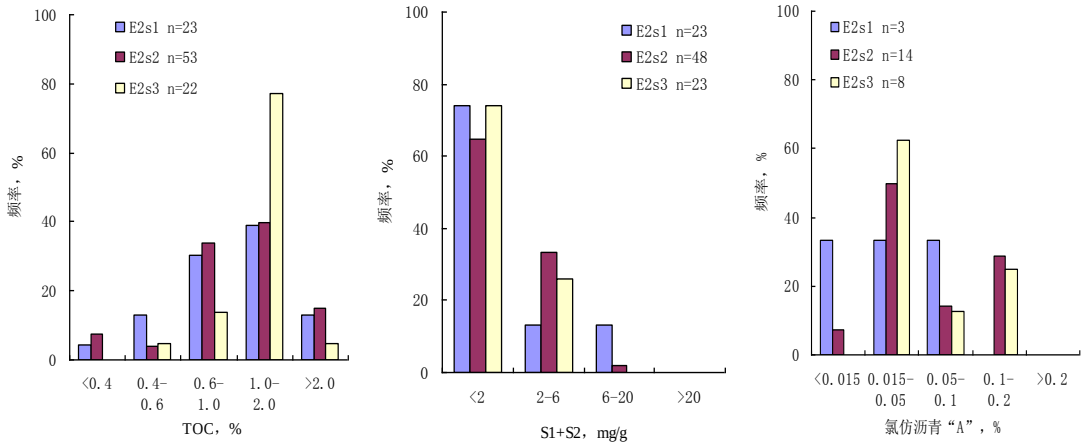

Fig.5 The diagram of the frequency distribution in Botai sag

From the indicators of the chloroform bitumen "A" and the hydrocarbon generation potential, we know that on the whole, the organic matter abundance of yitong basin is medium – poor. This is because the chloroform bitumen "A" reflects the residual of soluble organic matter abundance in hydrocarbon source rock, rather than the total organic matter abundance. Its value is high, maybe not shows the good hydrocarbon generation condition. However, it may indicate the hydrocarbon expulsion condition of hydrocarbon source rock is bad. So its low value does not necessarily show that the hydrocarbon generation of source rock is poor, maybe the condition of hydrocarbon expulsion of source rock is very good, the generated oil and gas has displaced[7]. The hydrocarbon generation potential is the sum of the generated hydrocarbon and potential generated hydrocarbon in the hydrocarbon source rocks, obviously it will reduce gradually with the consumption of organic matter hydrocarbon generation potential and hydrocarbon expulsion process. So the two indicators for deep hydrocarbon source rocks, are not very good abundance evaluation indexs.

From the distribution range of the organic carbon isoline 1.0 in chaluhe fault depression, we know that shuang1 segment > shuang3 segment > shuang2 segment, from the peak district is the same change rule, and the high value area are in the center of the two sag(figure 6-figure 8).

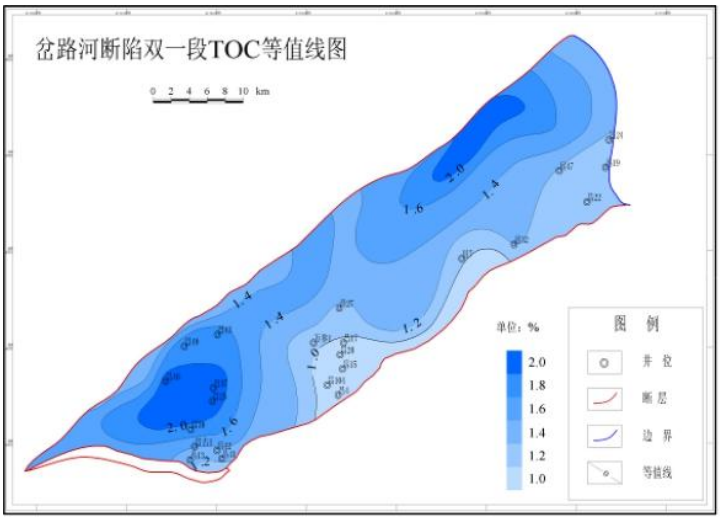

Fig.6 The organic carbon distribution map of shuang1 segment in Chaluhe fault depression

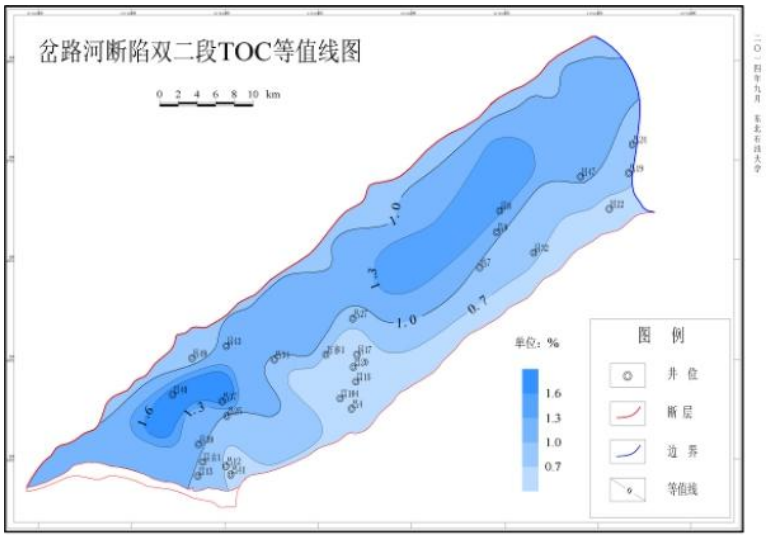

Fig.7 The organic carbon distribution map of shuang2 segment in Chaluhe fault depression

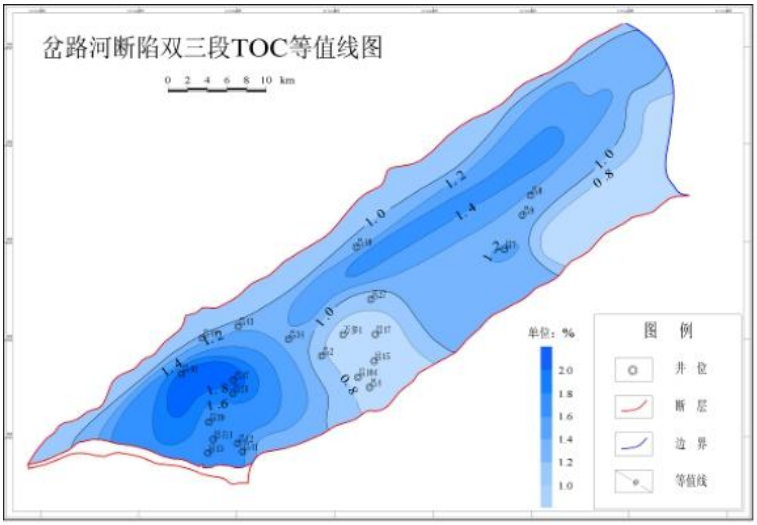

Fig.8 The organic carbon distribution map of shuang2 segment in Chaluhe fault depression

From the above interpretation can be obtained, shuangyang group in chaluhe fault depression have good organic matter abundance, and the good organic carbon are mainly distributed in the middle position of the sag.

V. CONCLUSION

(1) The dark mudstone is the most developed in shuang1 segment of the shallow chaluhe fault depression, shuang2 segment and shuang3 segment are followed by shuang1 segment.

(2) Overall, from the organic matter abundance, chaluhe fault depression in major evaluation horizon can be effective hydrocarbon source rocks.Generally, the high quality source rock areas are near the xinanpu sag and the botai sag which have the high indicators.

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