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The organic matter type determination and significance of Shuangyang group in Yitong basin

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Abstract：- Yitong basin is one of the important oil and gas resources in Jilin oilfield which belongs to the ancient near system small fault basin and is composed of three fault depression. Exploration results show that the whole basin has oily slant light in common, at the same time, the ratio of oil and gas is pretty different among three fault depression. The reason was not been reasonably explained, which affects the overall grasp of the distribution of oil and gas in the basin. To this end, the samples and analysis of the three fault depression systems, including TOC, pyrolysis chromatography, microscopic examination of the kerogen, measurement of Ro and a small amount of the whole rock. Combined with the analysis of possible secondary change, it is showed that the kerogen mainly contains humic amorphous and non fluorescent vitrinite has the characteristics of readily production of light hydrocarbons. This is the main reason why Yitong basin shows the feature of lighter oil; The difference of maturity is the major cause of the diverse ratio of oil and gas among three fault depression. The secondary change of oil and migration process has little effect on the composition of crude oil. The exploration practice proves that the style of Ⅲkerogen mainly contains humic amorphous and non fluorescent vitrinite not only has theoretical significance, also can form valuable oil and gas accumulation.

Key words：*- Yitong basin; organic matter type; micro component;*

I. INTRODUCTION

Yitong basin 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 2200km2. Basin from north to south developed Chaluhe fault depression, Luxiang fault depression and Moliqing fault depression [1]. Yitong Basin were drilled 175 exploratory wells,54 wells for industrial oil flow, a small amount of oil and gas wells 38.Moliqing fault depression have 62 wells test, Oil layer display 23, gas shows 2; A total of 53 wells test in Chaluhe fault depression, Oil layer display 5, gas shows 10; A total of 29 wells test in Luxiang fault depression, Oil layer display 6, gas shows 5. It can be seen that Moliqing fault depression is given priority to with oil, Chaluhet fault depression is given priority to with gas, Luxiang fault depression in between. Three fault depression density of crude oil are mainly concentrated in between 0.82 g/cm3 and 0.82 g/cm3, belongs to the scope of light oil.

Yitong basin belongs to tertiary basin, basin scale is not big, why the same basin clear difference ratio of oil and gas, and oil generally lighter, is caused by the differences of hydrocarbon generation materials or maturity differences caused by, or for other reasons?

The type of organic matter is a direct effect on hydrocarbon generation ability and one of the factors of hydrocarbon generation type, influence the proportion of oil and gas. In 2001, Wang Yongchun [2]based on the data of microscopic examination of the kerogen by Ding Zhengyan and Tian Shicheng, combining elements analysis and pyrolysis analysis (Rock -- the Eval).The result shows that Yitong organic matter mainly is lacustrine basin of organic matter, mainly Ⅱ2~Ⅲ type, which Moliqing and Luxiang fault depression organic matter was slightly better than the Chuluhe fault depression.In 2009, Hou Qijun[3]obtain the organic matter type of shuangyang group in Chuluhe fault depression is mainly Ⅱ2, a small number of Ⅱ1 and Ⅲaccording to rock pyrolysis analysis. Moliqing fault depression shuangyang group is mainly Ⅱ2, a small number of Ⅱ1, Luxiang fault depression shuangyang group is mainly Ⅱ2 and Ⅲ, a few Ⅱ1, kerogen element analysis and kerogen carbon isotope data also reflect the same conclusion. Classification is from two people, but from the overall, the organic matter type of three fault depression, mainly Ⅱ2 ~ Ⅲ, there is no significant difference, therefore the organic matter type classification does not explain Yitong basin clear difference ratio of oil and gas and oily slant light problem.

Due to three fault depression with different burial history on one set hydrocarbon source rock causing on the same set of hydrocarbon source rock maturity is different.Different mature stages exist differences in chemical composition of crude oil. Wang Yongchun [2]analysis of the hydrocarbon source rock maturity is 0.6% ~ 1.0% of huangyang group in Moliqing fault depression;Luxiang fault depression shuangyang group maturity is 0.7% ~1.1%; Chaluhe fault depression shuangyang group maturity is 1.1% ~ 1.5%. Hou Qijun[3]

hydrocarbon source rocks vitrinite reflectance analysis showed that Moliqing and Luxiang fault depression shuangyang group source rocks Ro is 0.5%~ 1.1%;Chaluhe fault depression shuangyang group of hydrocarbon source rock maturity is generally higher, Ro generally greater than 0.8%. Thus the Moliqing and Luxiang fault depression have near maturity, at the low-mature and mature stage, Chaluhe fault depression ai maturity - high-mature stage, and Moliqing and Luxiang fault depression organic matter type is better than Chaluhe fault depression, so Moliqing and Luxiang fault depression ratio of oil and gas is bigger than the Chaluhe fault depression,.Due to the Moliqing and Luxiang fault depression close to organic type and maturity, so no obvious distinguish ratio of oil and gas, Yitong basin oil lighter problem is also difficult to explain.

To detect how Yitong basin oily slant generally light and three fault depression basin large difference of gas-oil ratio, especially for the sampling and testing system. Compared to the previous studies, the same is on the type and maturity of organic matter, we adopt a similar research method, the difference is we to the region characteristics of hydrocarbon generation done on the possible factors of complement and more in-depth analysis, in the microscopic examination of the kerogen, also particularly opposite hydrocarbon plays a main contribution of microscopic and submicroscopic components made important to investigate the characteristics of hydrocarbon generation. Considering the yongji group and sheling group's contribution to the oil and gas basin is not big, the shuangyang group as the research object in this paper.

II. SAMPLES AND TEST DATA

From existing data collected Geochemical data of more than 170 Wells, including the kerogen maceral data 139, Chaluhe fault depression 56, ;Luxiang fault depression 14, Moliqing fault depression 69.Core library in jilin oilfield has chosen 300 dark mudstone samples and 12 pieces core samples in shuangyang group from 24 Wells of three fault depression. All samples take part in the Rock Eval pyrolysis and determination of organic carbon, and 61 samples has carried on the microscopic examination of the kerogen, 66 did the Ro determination,12 core samples did the whole Rock maceral analysis.

III. THE TYPE OF ORGANIC MATTER

3.1 Rock pyrolysis

Collection existing and the experimental TOC, pyrolysis data compiled IH - Tmax figure (figure 1-figure 3) shows that Moliqing fault depression organic matter type is mainly Ⅲ~Ⅱ2, a few Ⅱ1. Luxiang fault depression shuangyang group of organic matter type is Ⅱ2~Ⅲ, and magority is Ⅱ2.The organic matter type of kerogen of Chaluhe fault depression shuangyang group is mainly Ⅱ2~Ⅲ, a small amount of Ⅱ1.

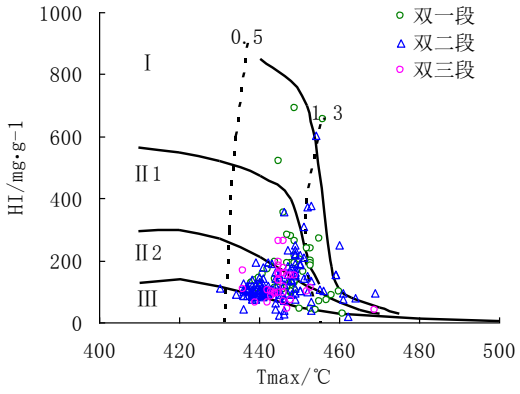

Fig.1 The diagram of Moliqing fault depression IH —Tmax

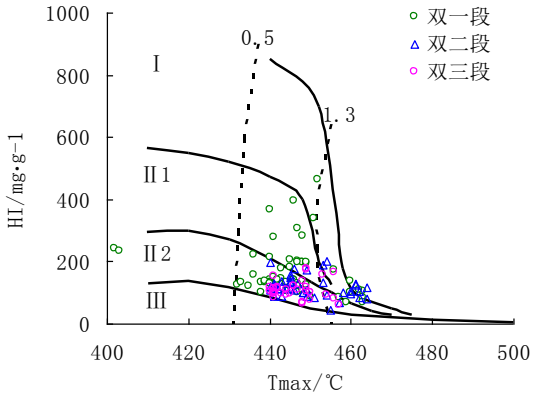

Fig.2 The diagram of Luxiang fault depression IH—Tmax

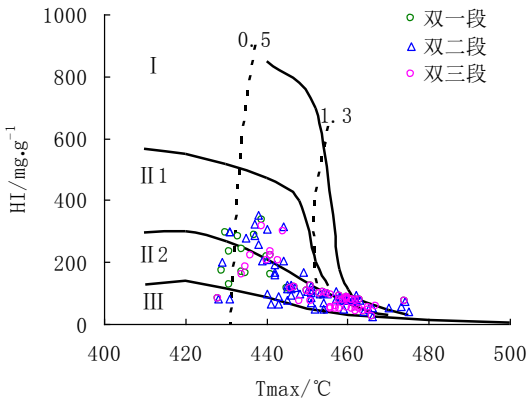

Fig.3 The diagram of Chaluhe fault depression IH—Tmax

The whole of the three fault depression is mainly based on the II 2~ Ⅲ,Chaluhe fault depression's Ⅲ organic matter more than the Moliqing and Luxiang fault depression, the type of organic matter is the worst.Moliqing have more Ⅱ1 than Luxiang fault depression, the type of organic matter is best.

3.2 Microscopic examination of the kerogen

Microscopic examination of the kerogen is generally considered to be divided into organic matter type reliable method. Look from under a microscope, the kerogen is mainly composed of two parts: one part has certain characteristics of morphology and structure; The other part is cellular, amorphous, no structure and amorphous matrix [4]. Kerogen microscopic detection technology can be used to directly observe the organic maceral composition of kerogen and understand the biological sources, so as to determine the type of kerogen.

Moliqing shuangyang group organic matter type of kerogen is Ⅱ2 ~ Ⅲ(figure 4-figure 6).Luxiang fault depression shuangyang group organic matter of kerogen is Ⅱ2~Ⅲ,Chaluhe fault depression shuangyang group organic matter of kerogen is Ⅱ2 ~ Ⅲ Ⅱ, few Ⅱ1. By comparison, Moliqing organic matter type is best in, Chaluhe organic matter type is worst, Luxiang organic matter type between the two.

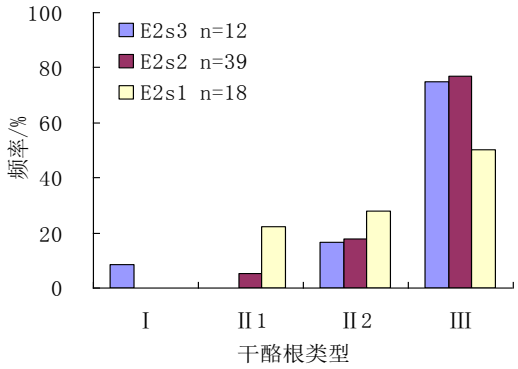

Fig.4 The diagram of the frequency distribution in Moliqing fault depression

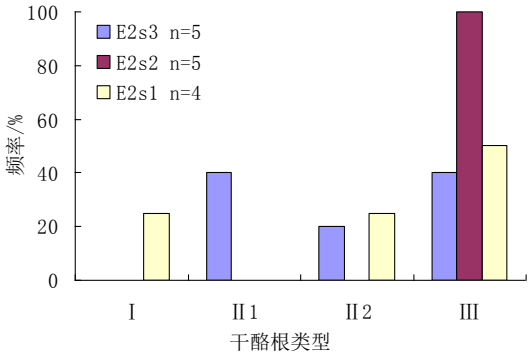

Fig.5 The diagram of the frequency distribution in Luxiang fault depression

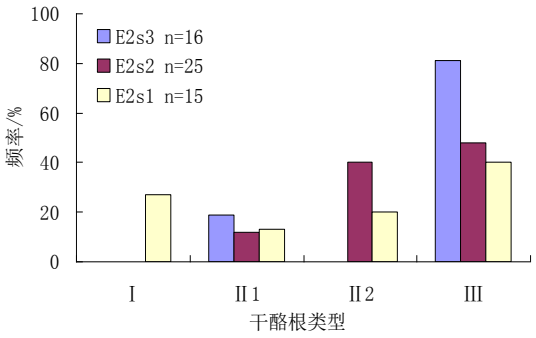

Fig.6 The diagram of the frequency distribution in Chaluhe fault depression

Rock pyrolysis and kerogen maceral method determining organic matter types, rock pyrolysis [5] prominent advantage is that rapid economic, but the results have great influences on the heat evolution. The microscopic identification of maceral advantage can directly provide information about the source of organic matter, and relatively speaking, when the evolution degree is not high, the smaller the influence of thermal evolution degree, but some components is difficult to determine students under mirror, such as the amorphous not sure from the hydrocarbon production ability of aquatic organisms. As a result, many indicators are difficult to or high evolution degree of the organic matter type of the sample. In general, is often a variety of methods combining with the application, supporting each other.

IV. THE MAIN REASON FOR THE EXPLORATION OF OIL LIGHTER V. AND LARGER GAS OIL RATIO

4.1 Analysis of macerals and sub maceral characteristics of hydrocarbon generation

61 kerogen microscopy results (according to the industry standard SY/T5125-1996 [6]) as shown in figure 7, the vitrinite content most in kerogen maceral, exinite inferior to vitrinite, sapropel group and inertinite content is less. Law of hydrocarbon generation of Organic matter is controlled by the composition of the organic maceral, the different types of hydrocarbon source rocks in nature generally consists of several different types of maceral by different mixture ratio.That is to say, the contribution of various macerals hydrocarbon generation composite decided to hydrocarbon source rock potential of hydrocarbon generation model and [7]. Vitrinite and exinite in the study of maceral content more than 90%, so the mirror, exinite and the hydrocarbon generation potential of the macerals and the hydrocarbon generation type of research to help explain the source characteristics are particularly important.

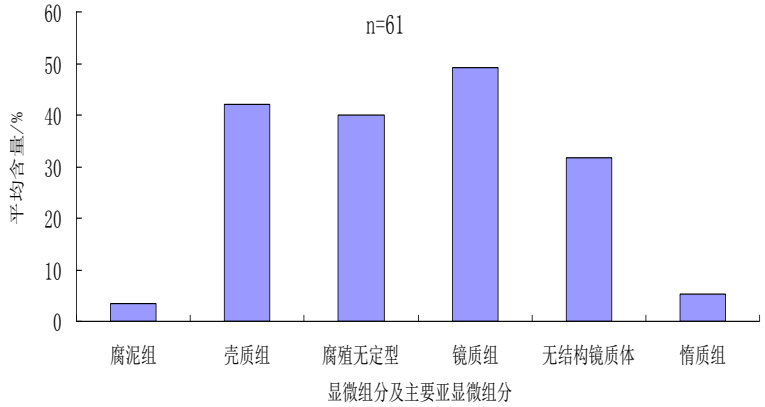

Fig.7 The diagram of kerogen's maceral and primate submaceral content distribution

4.1.1 Vitrinite and exinite and submaceral characteristics of hydrocarbon generation

Different maceral, submicroscopic groups of kerogen all have certain ability of hydrocarbon generation, but for different components, the composition of the product of hydrocarbon generation, hydrocarbon generation, hydrocarbon generation ability has the obvious difference [8].

Under the condition of the same maturity, exinite have larger hydrocarbon generation ability, give priority to with raw light liquid hydrocarbon, hydrocarbon generation temperature range is relatively narrow. Exinite pyrolysis hydrocarbon have the characteristics that hydrocarbon generation time is short, a hydrocarbon interval is small, the large amount of hydrocarbon generation [9]. Also its hydrocarbon generation will have obvious difference. This is undoubtedly related to the submaceral and its content of exinite. Kerogen microscopy results showed that the content of humus amorphous of exinite is very large (figure 7), reached 1% to 84% of the total amount of maceral, an average of 39.89%, accounting for 95% of the total content of exinite. Humus amorphous [10] mainly by higher plants epidermal tissue, part of the vascular tissue and basic organization, to constitute Ⅱ kerogen mainly organic maceral. Rich in humus amorphous exinite, can form a gaseous hydrocarbon and can form a certain amount of liquid hydrocarbon [11].

Hydrocarbon generation ability of vitrinite is related to the content of desmocollinite and homocollinite and their degree of hydrogen rich. Vitrinite can be divided into anthraxylon, collinite and fragmental vitrinite [12-14]. In the study of kerogen samples, collinite content accounted for 4% ~ 90% of the total amount of maceral, an average of 31.72%, accounting for 65% of the total amount of vitrinite. Collinite was obvious advantages. According to the forms and causes of vitrinite and collinite can be divided into desmocollinite, homocollinite, gelcollinite and corpocollinite. In these submaceral, desmocollinite and homocollinite are most common [15-19]. Desmocollinite and homocollinite are important material of hydrocarbon generation, but its hydrocarbon generation ability changed a lot (especially matrix) and related to the degree of its rich hydrogen.

Our study has shown that our vitrinite is no fluorescent or weak basic fluorescent vitrinite, low degree of rich hydrogen and have certain ability of hydrocarbon generation, and mainly gas, less oil. Comprehensive kerogen maceral characteristics analysis, the result showed that the material of hydrocarbon generation in Yitong basin is easy to produce light hydrocarbons.

4.2 Analysis of organic matter maturity

Different mature of oil have different chemical composition. Yitong basin hydrocarbon source rocks of shuangyang group vitrinite reflectance analysis showed that Moliqing fault depression Ro greater than 0.7 scope is limited, and maximum of Ro is 1.3%, mainly in Immature-low mature oil and mature oil generation zone. Luxiang fault depression Ro of most areas is greater than 0.7%, and maximum of Ro is 1.7%, in the high mature light oil and mature oil generation zone. Chaluhe fault depression generally have high maturity and Ro generally is greater than 0.8%.So all areas reached mature, most areas reached high-mature level, some areas reached over mature level. Three fault depression hydrocarbon source rock maturity was obviously periodic, Chaluhe fault depression > Luxiang fault depression > Moliqing fault depression. Moliqing fault depression primary produce mature oil, oil more than gas. Chaluhe fault depression primary produce high mature light oil and combination gas, gas more than oil. Luxiang fault depression primary produce mature oil and some high mature light oil. Maturity differences is the main cause of larger gas oil ratio in Yitong basin.

4.3 The influence of the migration process and oil secondary change

In the primary migration of oil and gas, secondary migration process, there is the phenomenon of hydrocarbon selective adsorption by mineral particles, is bound to cause the chemical composition and physical properties of oil and gas show regular change, generally with the migration process of oil and gas migration channel or reservoir unit no branch of physics and chemistry. Yitong basin belongs to tertiary fault sedimentary basin, with a small scale lake basin, close to source, sedimentary - buried the characteristics of fast speed, phase change fast, cause reservoir physical property is poor, poor sorting, sand body connectivity is poor, cannot form effective long-distance migration channel, so the influence of the migration fractionation effect on oil components is very small, not the main reasons of special characteristics of hydrocarbon generation.

The oil in the Yitong basin's reservoir may occur secondary changes, such as thermal alteration and deasphalting can make the oil lighter, but their effects are limited.often Obviously it is not the reason of oil lighter in whole basin. Chaluhe fault depression reservoir buried deeply and temperature is higher, the energy of the water is weak, so it's not suitable for microbial growth and reproduction. Luxiang fault depression and Moliqing fault depression reservoir is relatively shallow, but basin water energy is weak. So oxidation and biodegradation is not obvious. Oxidation and biodegradation can make oil heavier, thus it is clearly not the cause of oil lighter of basin.

VI. CONCLUSIO

(1) The size of the Yitong basin is small , close to source, sedimentary - buried fast, phase change fast, cause reservoir physical property is poor, poor sorting, sand body connectivity is poor. Thus it can not form effective long-distance migration channel, so the influence of the migration fractionation effect on oil components is very small . Oil in the reservoir occurred secondary changes are small and limited, so the effect of secondary change and oil migration process are not the reasons of Yitong basin oil lighter.

(2) According to the comprehensive index of organic matter type, organic matter of Yitong basin three fault depression is Ⅱ2~Ⅲ.Moliqing organic matter type is best, Chaluhe is worst , Luxiang is between the two.

(3) Usually think that type III kerogen hydrocarbon generation ability is very weak,mainly to gas, Most humus amorphous and without fluorescent vitrinite of Ⅲ kerogen in Yitong basin not only have a certain ability to produce oil and oily is lighter.

(4) The three fault depression has obvious stages of maturity of organic matter. Hydrocarbon generation material also has the characteristics of easy to produce light hydrocarbon. The difference of hydrocarbon material and the maturity of three fault depression is the mian reason of gas oil ratio is large and crude oil density is small in the area .

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