IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 06, Issue 04 (April. 2016), ||V1|| PP 08-14

Yitong Basin Moliqing fault depression Yi 11 well burial hill oil source research and its significance

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Abstract：- Aimed at the first bite of Yitong basin buried hill industrial oil flow well Yi 11 well oil source is unknown.Of Yitong basin Moliqing fault depression of the source rocks of the abundance, type, maturity evaluation.The results showed that only the dark mudstone of E_2s developed as mature source rocks in Yitong Basin Moliqing Fault Depression.Among them, E_2s_1 was more advantageous to hydrocarbon generation both in organic matter types and maturity.And analysis of saturated hydrocarbon and aromatic hydrocarbon by gchromatography mass spectrometry.Data show that the Yi 11 well crude oil was mature,what showed that the oil should be from E_2s.Light hydrocarbon and monomer hydrocarbon isotope data confirmed this conjecture.The parameters of the further comparison between pristane and phytane it is concluded that the Yi 11 well's oil was from E_2S_1.The reservoir space of Yi 11 well's buried hill structure was formed by weathering and some other effects.The buried hill are contacted with the source bed in Shuangyang Formation by faulting,and accept for lateral hydrocarbon. The oil in Yi 11 well was from E_2s_1, which had the largest hydrocarbon generation ability. It meant the buried hill of Moliqing Fault Depression should have great exploration potential，and also indicated that the widely distributed buried hill in Yitong Basin are worth exploring.

Keywords：Yitong basin；Moliqing fault；burial hill；oil- source rock correlation

I. INTRODUCTION

Burial hill oil and gas reservoir is one of the most important oil and gas exploration fields.Found in the process of oil exploration in our country the first buried hill is Jiuxi basin Yaerxia Silurian burial hill(1959).According to statistics,Bohai bay basin known 61 buried hill oil and gas reservoir of proved reserves accounting for 10.4% of the total reserves of the basin;Among them, 8 of the burial hill oil and gas reservoirs in Liaohe depression accounted for 20.3% of the total oil and gas reserves in the depression;Jiyang depression (20) accounted for 14.8%;Jizhong depression (21) accounted for 59.7%.Thus it can be seen,Buried hill can be a important oil and gas gathering place.It established the newly generated ancient reservoir model to guide the practice of oil exploration.

Yitong Basin is located in the Jilin province between Jilin city and Changchun city.Is located in the northern section of tanlu fault zone in its construction of yilan - ytong fault zone in the middle,extending to the Northeast,area of about 2500 km^2;Total drill in seven buried hill (figure 1), covers an area of 600 km^2;Formation main development within it from bottom to top have third lines. The paleogene of Eocene series Shuangyang formation （E_2s）1,2,3 period，Sheling formation（E_2sh）1,2 period，Yongji formation（E_2s）1,2,3,4 period, the Paleogene Oligocene Wanchang formation（E_3w）Qijia formation（E_3q）, and the Neogene Chaluhe formation (Nc) [2].

Fig.1 Burial hill distribution of Yitong basin

Buried hill can according to the causes, lithology, structure, morphology and formation can make many kinds of classification on buried hill[3-6].In this paper, we study the buried hill is refers to the top of the bedrock for tectonic movement formed fault block, fault terrace.Bedrock weathering crust under unconformity surface as the main reservoir space of buried hill.By 2012 only Moliqing fault depression drill in bedrock buried hill weathering crust 45 wells,36 wind measurement data of Wells only seven Wells have abnormal.The five-star tectonic belt drill in bedrock have spirit 25 Wells of measurement data,only seven Wells have abnormal.And the measured values is less than 2.6%.Because of ytong basin buried hill weathering crust general oil and gas shows level is not high, the upper stratum accumulation,the weathering crust is difficult to be reservoir and so on.Prospector once thought buried hill weathering crust reservoir potential.

Ytong basin is the main exploration target strata of E_2s and E_2sh,considering the experience of our country's buried hill exploration,noticed the tear in the buried hill in the early years of basin exploration and dissolved pore development and the possibility of accumulation[7],Destination in buried hill exploration targets began in 2008,and at the Chaluhe Qijia buried hill C 37 well for industrial air flow.For the first time confirmed that the buried hill exploration potential,think covered on buried hill of double a is both hydrocarbon source rocks and good cover.E2s1 is widely distributed, mud than high, is important material source of buried hill reservoir and sealing barrier[8].The following years exploration of buried hill has not ideal effect,Oil fields in the buried hill lithology, physical property, origin, distribution and so on basic research work,The buried hill exploration emphasis to Moliqing fault depression[9].In 2013 Moliqing buried hill have 2 Wells for industrial oil flow[10].In 2014, according to the result of old well review the old well of 11 Wells in 1990 buried hill fracturing in 2480~2530m of daily output 30 m^3 production flow,this important breakthrough to buried hill was placed greater expectations,some details of the buried hill reservoir is also on the agenda,such as buried hill oil source is E_2s_1 or E_2s, for lateral hydrocarbon or top for hydrocarbon?When buried hill trap formed?When accumulation?And so on.Ytong buried hill exploration experience tells us that this kind of questions will help to deepen the buried hill reservoir meet and guide the next exploration.

This paper mainly discusses the Yi 11 Wells of oil source problem,through to the Moliqing fault qualitative evaluation on the hydrocarbon source rocks, to determine the main hydrocarbon source rocks in the horizontal and vertical distribution;For hydrocarbon source rocks and crude oil samples saturated hydrocarbon, aromatic hydrocarbon chromatography mass spectrometry,from the aspects such as maturity, sedimentary environment, and monomer hydrocarbon isotope prove a crude oil from Moliqing E_2s_1.And buried hill reservoir according to the results to talk about some understanding.

II. HYDROCARBON SOURCE ROCKS GEOCHEMISTRY CHARACTERISTICS

2.1 Hydrocarbon source rock distribution

Moliqing fault depression of the hydrocarbon source rock development mainly in in fault depression period,received about 1200m thick mainly lacustrine facies mudstone deposition[11],give priority to with E_2s, E_2sh with E_2y take second place; E2s of dark mudstone are mainly distributed in the northwest,the E_2s_1、E_2s_2、E_2s_3 dark mudstone average thickness of 100m, 288m and 138m respectively；Dark mudstone thickness and formation thickness ratio of not less than 50%, the highest 75%.Figure 2 shows the double a dark mudstone thickness distribution.

2.2 The hydrocarbon source rock organic matter abundance

According to the industry standard (SY/T 5735-1995),for Moliqing fault depression sag layers of hydrocarbon source rocks from the total organic carbon and chloroform bitumen "A", total hydrocarbon and hydrocarbon generation potential(S_1+S_2)and so on four aspects is evaluated.

The evaluation results show that，Moliqing downfaulted E_2s_1、E_2s_3 organic matter abundance of the good hydrocarbon source rock in standard, E_2s_2 for medium to good hydrocarbon source rock;E_2sh reached a good hydrocarbon source rock. E_2s_1 of organic carbon of high value area is located in the Midwest and the north,E_2s_2 high value area is located in the central position,E_2s_3 main high value area is located in the Midwest;The high value area is located in north-central E_2sh.

2.3 The hydrocarbon source rock maturity

Establishment of the Ro contour map display,Moliqing E2s Ro distribution in 0.3% ~ 0.3%.E_2s_1、E_2s_2、E_2s_3 Ro a maximum of 1.3%, 1.1%, 0.9%.Paragraphs of the Ro values high value area is located in the northwest part of fault depression,E_2s_3 parts have a small range of Ro values greater than 0.7,and the E_2sh and above basic low mature area formation.The E_2s_1 of mudstone thickness of high value area Ro high value area distribution,as shown in figure 2,they are excellent matching relationship.Therefore, Moliqing fault depression should be limited to E_2s mature hydrocarbon source rock, and E_2s_1 is one of the most important hydrocarbon source rocks.

2.4 the hydrocarbon source rock organic matter type

According to the HI - Tmax figure and the result of microscopic examination of the 79 pieces of kerogen samples,E_2s organic matter type is given priority to $Ⅱ_2$-Ⅲ kerogen ,A small type $Ⅱ_1$,E_2s_1 a slightly better than

E_2s_2、E_2s_3(figure 3, figure 4).

A small amount of whole rock maceral data (table 1) also supports kerogen maceral and rock pyrolysis set of results.

Fig.2 Moliqing fault depression E2s1 mudstone and Ro contour map

Table 1 Identification results of the whole rock

Well	lithology	Deep /m	horizon	total rock /%		organic components /%				TI index	Organic matter type
				pyrite	total organic matte	sapropelinite	exinite	vitrinoid	inertinite		
YI 63	silty shale	2858.8	E_2s_2	0.2	5.6	26.8	5.4	66.1	1.8	-22	III
YI 63	silty shale	2861.57	E_2s_2	0.2	5	26	6	66	2	-23	III
YI 52	calcareous	2436.6	E_2s_1	2.1	7.4	47.3	43.2	8.1	1.4	61	II_1

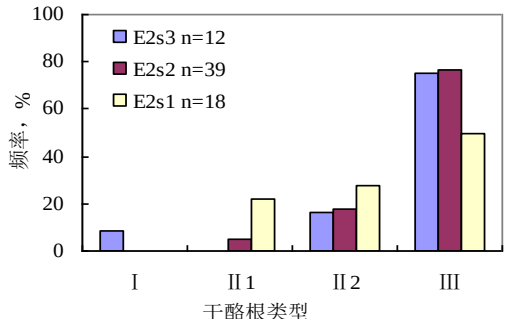

Fig.3 The frequency distribution diagram of Moliqing fault epression E2s1

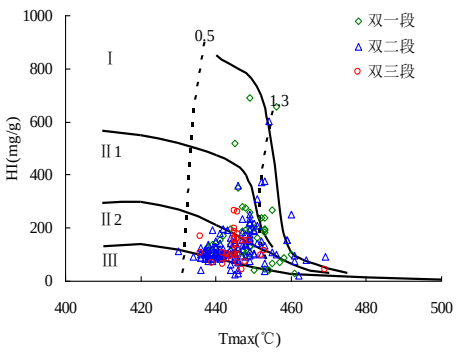

Fig.4 Moliqing fault depression E2s IH —Tmax diagram

Moliqing downfaulted E_2s may be considered as the overall organic matter type is given priority to Ⅱ$_2$,、Ⅲ model ,E_2s_1 organic matter type is better than E_2s_2、E_2s_3。

III. OIL-SOURCE CORRELATION

In order to make clear the oil source problem of Yi 11 well, on the basis of the existing data, and particularly in mature mudstone area to collect 5 Wells ((FIG. 5, Yi 52 well E_2s_1, Yi 66 well E_2s_1, Yi 68 well E_2s_1, Yi 66 well E_2s_2, Yi 63 well E_2s_2, Yi 67 well E_2s_3 , a total of 6 samples)samples, made a targeted analysis, including crude oil light hydrocarbon chromatography, saturated hydrocarbon chromatogram,saturated hydrocarbon mass spectrometry, aromatic hydrocarbon chromatography.

3.1 The 11 well crude oil is a mature crude oil

The saturated hydrocarbon gas chromatography of crude oil (figure 6) shows that crude oil saturated hydrocarbon carbon number range for C_{12} ~ C_{33}, main carbon number for C_{15}, baseline straight, no obvious advantage of parity, OEP is 1.02, as normal mature crude oil.

Aromatics chromatography calculation of methylphenanthrene index and methylphenanthrene ratio as indicating maturity parameters has a wide scope of application, but a study shows methylphenanthrene ratio and the correlation of vitrinite reflectance is better than that of methylphenanthrene index, and is subject to the influence of lithology and organic matter type small [12].So this article uses the F1 and F2 methylphenanthrene ratio, the calculation results are shown in figure 7, shows that crude oil into mature crude oil.

In addition, based on oil light hydrocarbon of isoheptane value of 20.5%, heptane value of 1.8.According to the scheme for dividing the continental oil and gas condensate parameters of light hydrocarbon maturity [13], the 11 well crude oil belongs to the mature crude oil.

Saturated hydrocarbons, aromatic hydrocarbons, calculation results agree that the Yi 11 well crude oil belongs to mature crude oil, and Mo liqing except E_2S, the other layers are immature. therefore, the oil should be derived from E_2S of hydrocarbon source rocks.

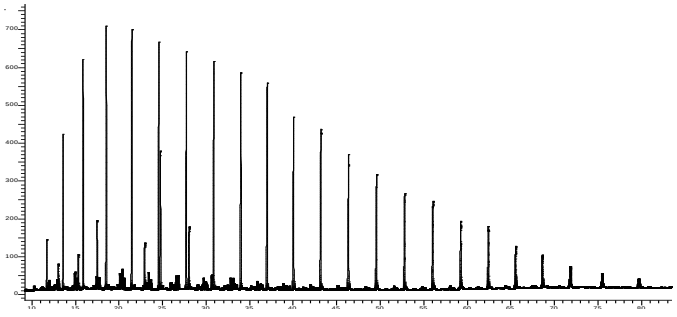

Fig.6 Yi 11 well crude oil saturated hydrocarbon gas chromatogram

3.2 Light hydrocarbon composition showed the oil type of matter should be humic type kerogen

C7 light hydrocarbon compounds including three categories: methyl cyclohexane, normal heptane and dimethylcyclopentane. methylcyclohexane from higher plants, such as lignin, cellulose and carbohydrate, thermodynamic properties is relatively stable, is a compound of reflecting the terrigenous organic types;Dimethyl cyclopentane mainly from aquatic organisms of lipid, much of its existence is a sign of sapropel-type formation oil and gas;N-heptane mainly from algae and bacteria[14].According to methyl cyclohexane, normal heptane and dimethylcyclopentane three parameters of relative content, can be divided organic types of oil and gas. The relative content of methyl cyclohexane if more than 50%, can determine the parent material types of humus.The Yi 11 well crude methyl cyclohexane reached 75%, and the content of dimethylcyclopentane is almost zero, organic matter is the main source of crude oil higher plants, organic types should belong to the humus or partial humic type.

Light hydrocarbon components from the sapropel-type organic are riched in alkanes，Light hydrocarbon from the humic type organic matter are riched in heterogeneous alkanes and aromatic hydrocarbons， light hydrocarbon from the condensate oil which derived from terrigenous are riched in naphthene . The Yi 11 well crude oil alkanes content is 37%, isomerization alkane content is 25%, cycloparafin hydrocarbon content is 38%.According to the definition of literature [15] scheme, the parent material of crude oil also should belong to 11 well humus or partial humic type.

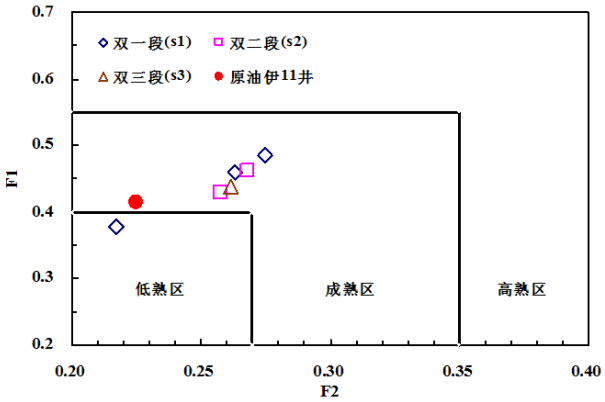

Fig.7 Aromatic hydrocarbon chromatographic maturity index figure

In addition, when methylcyclohexane index than 50±2%, organic types is humic type;Methyl cyclohexane index less than 50±2%, organic types of sapropel type.For cyclohexane index, when this value is less than 27±2%, can be concluded that parent material to sapropel type, and when cyclohexane index is more than 27±2%, organic types shall be the humic type.Though cyclohexane index in the parent material types have a certain value, however, if there are two parameters contradictory situation, should be given priority to with methyl cyclohexane index [16].Yi 11 well crude oil cyclohexane index was 9.38%, methyl cyclohexane index was 75%.The Yi 11 well crude oil of cyclohexane < 27%, but with methyl cyclohexane index is given priority to, so still is humic type.

The above three sets of parameters of light hydrocarbon thinks, organic types of crude oil for humic or partial humic type.The Murray green downfaulted shuangyang group mudstone, organic matter type is given priority to with II_2,III comparable.

2.3 Basking shark, phytane parameters shows that crude oil came from E_2s_1

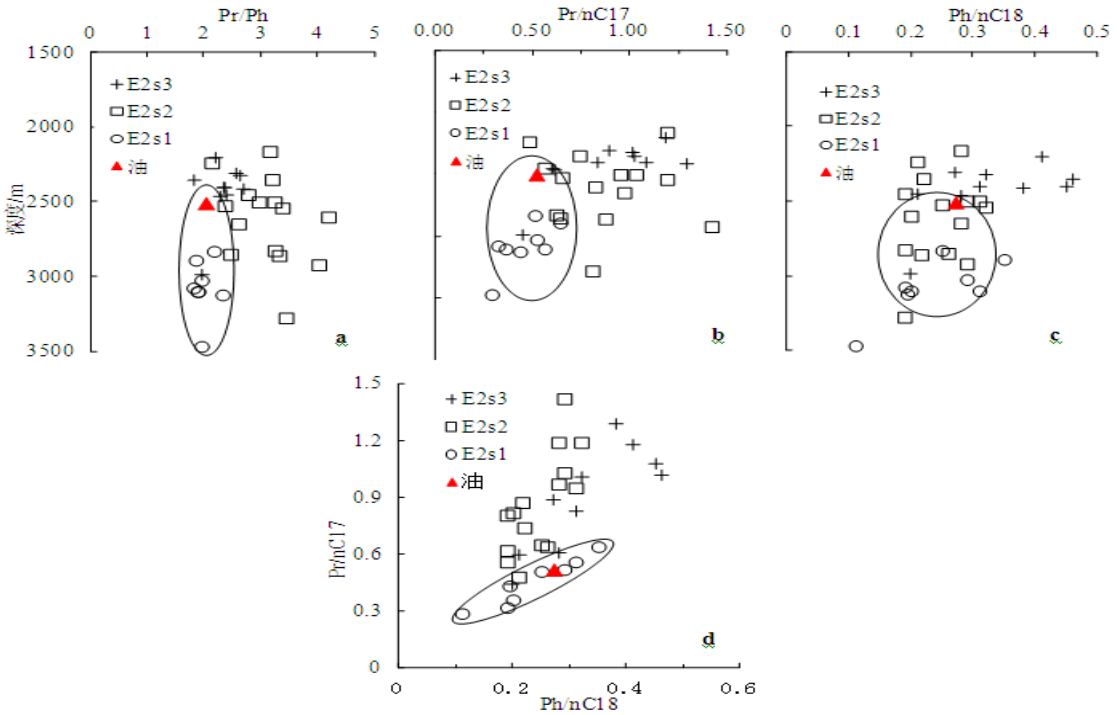

Fig.9 The saturated hydrocarbon gas chromatographic indicator diagram of crude oil and source rock

9a) .The Yi 11 well crude oil Pr/Ph value of 2.03, in the E_2S_1 and E_2S_3 range , But E_2S_2 overall Pr/Ph 1.81 ~ 3.78, with a mean of 2.275, and more close to the sample.Based on the horizontal, vertical variation characteristics of crude oil physical properties known Mo liqing oil from deep to shallow migration on the longitudinal and transverse center in the southeast margin of migration is from oil source sag on [17]. buried hill reservoir buried in about 2500 meters, oil source should be a depth of 2500 meters or deeper, so in figure 9 below 2500 metres part can reflect the relationship between oil source more.Figure 9a and 9b showed that crude oil Pr/Ph and Pr/nC_{17} value and conform to the E_2S_1 distribution trend is significantly;Figure 9c shows that crude oil Ph/c nC_{18} value obviously in E_2S_1andE_2S_2 distribution range;Figure 9d shows that crude oil Pr/nC_{17}-Ph/nC_{18} is clearly falls on the distribution of the double a trend line.

To synthesize the results of the various technical means, the crude oil from E_2S_1, On the west side of the hydrocarbon source rocks of lateral hydrocarbon for buried hill.

The mudstone samples of E_2S_1,E_2S_2,E_2S_3 Pr/Ph range respectively is 1.81 ~ 2.32, 2.13 ~ 4.18, 1.81 ~ 2.68 (figure 9a) .The Yi 11 well crude oil Pr/Ph value of 2.03, in the E_2S_1 and E_2S_3 range , But E_2S_2 overall Pr/Ph 1.81 ~ 3.78, with a mean of 2.275, and more close to the sample.Based on the horizontal, vertical variation characteristics of crude oil physical properties known Mo liqing oil from deep to shallow migration on the longitudinal and transverse center in the southeast margin of migration is from oil source sag on [17]. buried hill reservoir buried in about 2500 meters, oil source should be a depth of 2500 meters or deeper, so in figure 9 below 2500 metres part can reflect the relationship between oil source more.Figure 9a and 9b showed that crude oil Pr/Ph and Pr/nC17 value and conform to the E_2S_1 distribution trend is significantly;Figure 9c shows that crude oil Ph/c nC18 value obviously in E_2S_1andE_2S_2 distribution range;Figure 9d shows that crude oil Pr/nC17-Ph/nC18 is clearly falls on the distribution of the double a trend line.

To synthesize the results of the various technical means, the crude oil from E_2S_1, On the west side of the hydrocarbon source rocks of lateral hydrocarbon for buried hill.

IV. ANALYZE AND DISCUSS

Moliqing fault depression southeast edge development Maanshan fault terrace zone.The fault terrace zone divided backer sag and the jianshan uplift belt (figure 5, figure 10). The buried hill formation hydrocarbon source rocks of lateral contact with E_2s. $E_2s_1$of hydrocarbon source rocks in the middle of the Eocene epoch to the late Eocene into mature hydrocarbon generation,the early Oligocene to hydrocarbon generation peak,Maanshan fault zone is faulting in this period,match the period of hydrocarbon generating and expelling of hydrocarbon source rock,the activities during the period of fracture can be used as effective hydrocarbon migration channel.Drilling data reveal buried hill is given priority to with granite, phyllite,local development granitic gneiss, marble.Core data confirmed that the structure of the granite, marble and weathering fracture development, can provide enough space for oil reservoir [9].The upper E_2s_1 of mudstone can be used as a cover,provide a good seal performance,to sum up,Yi 11well buried hill have reservoir forming condition of new bed-generating and old bed-storing.

According to the latest resource evaluation of Yitong basin,Moliqing most of oil and gas by E_2s_1 contribution, followed by the E_2s_2.Currently found in the tertiary reserves of crude oil added up to less than half of the resources, there is great potential for looking for oil.The buried hill of Yi11 well breakthrough for next step exploration undoubtedly provides a new direction,Yi11 Wells and oil from the understanding of the hydrocarbon generation quantity of double a more added the prospects of this new field,at the same time provides other Yitong basin buried hill exploration great imagination.

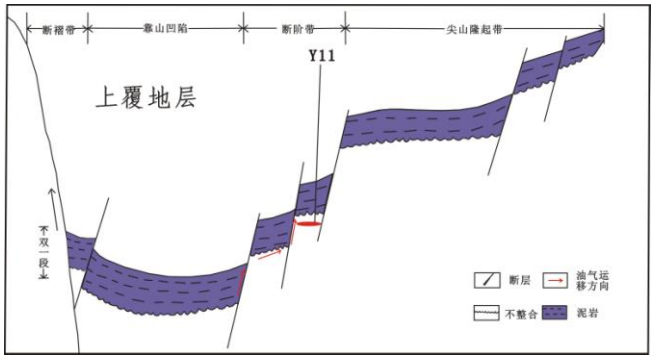

Fig.12 The fault schematic diagram of the Ma anshan terrace belt of the fault in Moliqing fault depression

V. CONCLUSION

(1)Yitong Basin only Shuangyang group reached maturity, the types of organic matter in II and III, which E_2S_1 is the most important oil and gas producing layer, according to the results of the evaluation of hydrocarbon source rocks. A variety of technical means such as saturated hydrocarbon, aromatic hydrocarbon, light hydrocarbon and so on, it is proved that the Qianshan crude oil of the 11 well is the mature oil, the lateral hydrocarbon supply from the E_2S_1, but not the top donor.

(2)E_2S_1 oil and gas accumulation in the Yi 11 well bedrock shows that those positions adjacent to hydrocarbon generation, and has a good reservoir of buried hill can be a favorable accumulation of oil and gas sites. This provides the exploration strategy of Yitong Basin and other fault depression of the buried hill and buried hill oil from the first member enable us to have reason to expect greater Moliqing buried hill.

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