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The Applying of Light Hydrocarbon Parameters in Total Hydrocarbon Geochemical to Analysis Hydrocarbon Accumulation

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Abstract: - Light hydrocarbon is a very important component of natural gas and crude oil, it generally refers to the molecule of carbon number of C5-C10 compounds, contains a lot of geological and geochemical information (jin-Xing dai, 1992). According to its component features for oil and gas type, maturity, hydrocarbon migration direction of oil and gas source, and secondary research. According to the need, here only study the issue of parent material source and maturity.In Chang 51 well, Xing 31 well, light hydrocarbon compounds of crude oil show completely, as shown in figure 1, 3,crude oil of Yi 11 Wells, compound content is too low, as shown in figure 2,we can not get accurate data about certain compounds.

Keywords: *Light Hydrocarbon analysis Principle Evaluation Parameters*

I. TEST METHODS AND CONDITIONS

The three samples of hydrocarbon gas chromatographic analysis. Sample gas chromatography on PE Clarus500 type gas chromatograph, use the PE - 1 column (30 m * 0.32 mm * 0.32um), carrier gas is nitrogen, flow rate is 1.0 mL/min, sample using shunt model, diversion ratio is 1:100. Temperature program: 40 ℃ keep 10 min, with 3℃/min to 320℃, keep the 30 min here with conditions of uncertainty.

By figure, chromatograms of Chang 51 and Xing 31 are showing good light hydrocarbon composition characteristics (figure 1, 3), and judgment of Chang 51 and Xing 31 commonly used oil hydrocarbon generation parent material types and the distribution of maturity parameters in good condition, but part of Yi 11 wells lack.

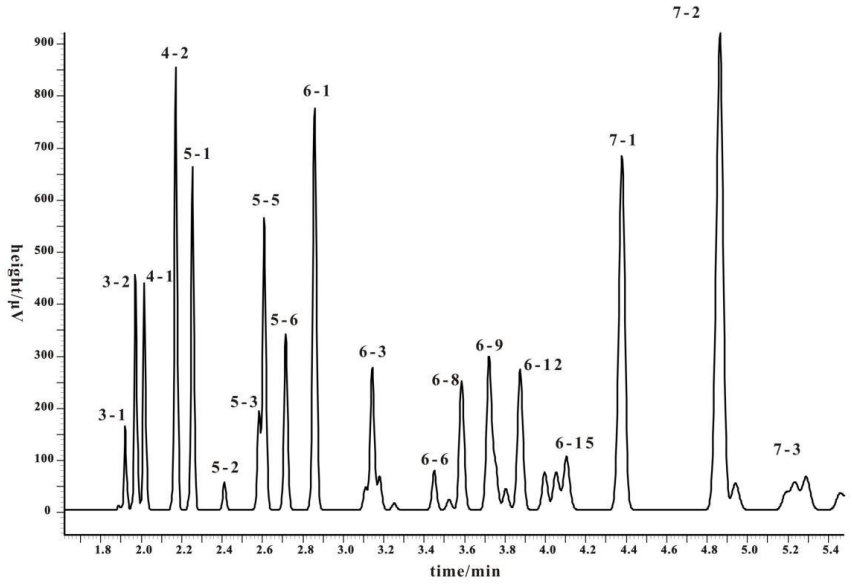

FIG. 1 The part of light hydrocarbon in Chang 51 total hydrocarbon gas chromatography figure

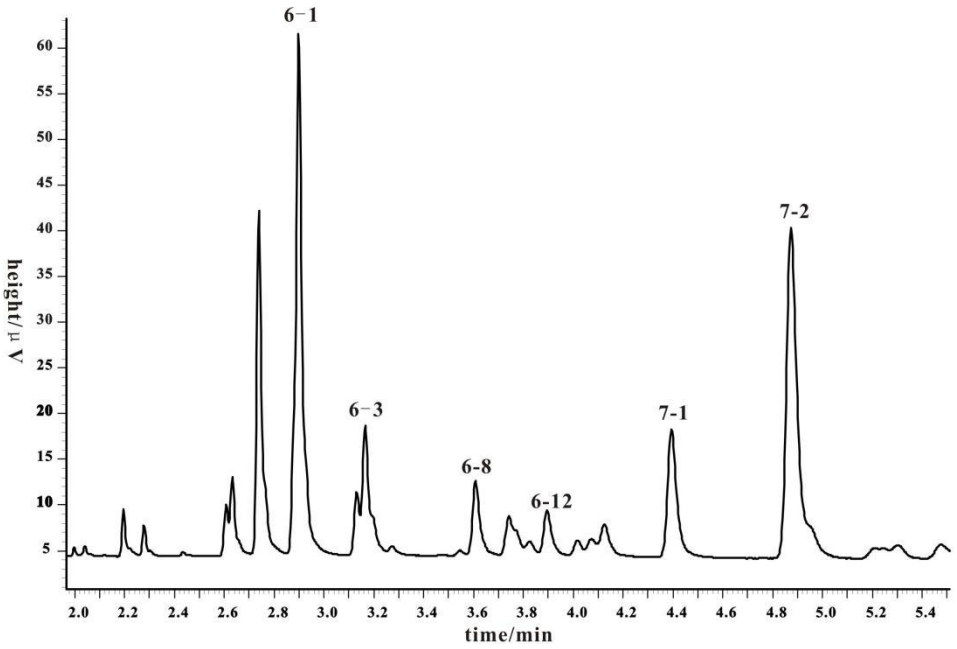

FIG. 2 the part of light hydrocarbon in Yi 11 total hydrocarbon gas chromatography figure

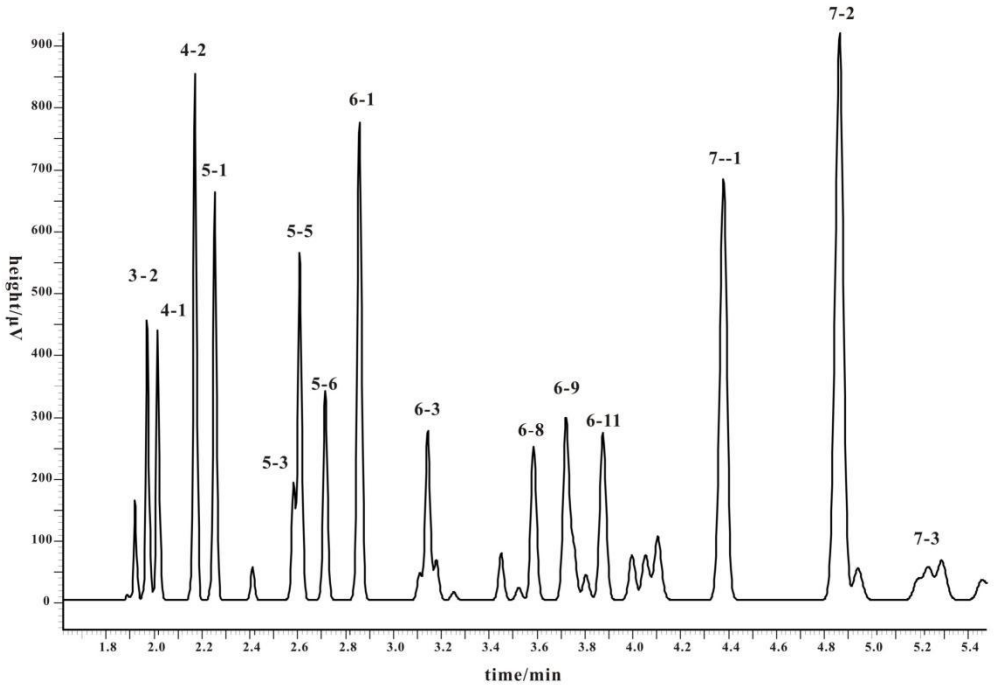

FIG. 3 the part of light hydrocarbon in Xing 31 total hydrocarbon gas chromatography figure

Each peak representative compounds are shown in table 1 below:

Table 1 The chromatographic qualitative of crude oil light hydrocarbon

Wave number	compound	Wave number	compound
3-2	iso-butane	6-6	benzene
4-1	n-butane	6-7	3, 3 - dimethylpentane
4-2	isopentane	6-8	cyclohexane
5-1	n-pentane	6-9	2-methylhexane
5-2	2, 2 - dimethylbutane	6-10	2, 3 - dimethylpentane
5-3	cyclopentane	6-11	1, 1-dimethylcyclopentane
5-4	2, 3 - dimethylbutane	6-12	3 - methylhexane
5-5	2-methylpentane	6-13	dimethylcyclopentane
5-6	3-methyl pentane	6-14	dimethylcyclopentane
6-1	n-hexane	6-15	3 - ethylpentane
6-2	2, 2 - dimethyl pentane	6-16	dimethylcyclopentane
6-3	methylcyclopentane	7-1	n-heptane
6-4	2, 4 - dimethyl pentane	7-2	methyl cyclohexane
6-5	2, 2, 3 - trimethyl butane	7-3	ethylcyclopentane

II. DETERMINE THE MATURITY OF ORGANIC MATTER

2.1 The principle and process of light hydrocarbon analysis technique

Philippi found by the study the condensate oil of the California basin that the alkylation of condensate oil light hydrocarbon will increase with the increase of maturity (Philippi G T, 1975). Thoposn analyzed the composition characteristics of cuttings and core adsorption light dydrocarbon then pointed out that: some of the light hydrocarbon composition characteristics associated with the highest temperature of sedimentary rock in the burial history of experience,it can be used as a crude maturity characterization parameters (Thompson, 1979). In 1983,he put forward the relation of heptane value and heptane value between two parameters, the calculation formula are:

$$\text{庚烷值} = \frac{\text{n}C_7}{\sum(\text{CYC}_6 - \text{MCYC}_6)} \times 100\ \%$$

Type: ∑ (CYC6 ~ MCYC6) - the sum distillate of cyclohexane to methyl cyclohexane, %.

$$\text{异庚烷值} = \frac{2-\text{MC}_6 + 3-\text{MC}_6}{\sum \text{DMCYC}_5}$$

Type: 2 - MC6-2 - methyl hexane, %;

3 - MC6-3 - methyl hexane, %;

∑ DMCYC5 - the sum of two methyl cyclopentane, %.

In 1987 ke-ming cheng, etc.,though that continental oil and gas condensate was divided into four categories by using relative size of different heptane value and heptane: low mature crude oil, its Isoheptane value < 1.0, heptane value < 20%; Normal crude oil, its Isoheptane value 1 ~ 3, heptane value is 20% ~ 30%; High maturity of crude oil (light oil), its Isoheptane value is 3 ~ 10, heptane value is 30% ~ 40%; A mature oil, its Isoheptane value > 10, heptane value > 40%. Heptane value and heptane value of crude oil in the Chang 51, Yi 11 and Xing 31 well below.

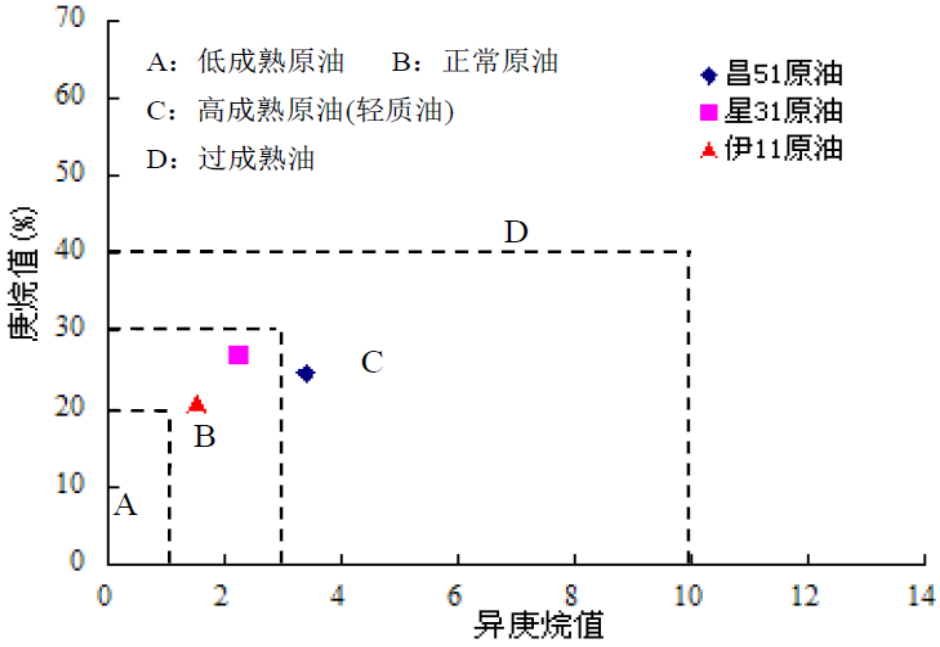

图 4　昌 51、星 31 及伊 11 原油庚烷值与异庚烷值关系图

Shown above,Xing 31,Yi 11 belongs to mature crude oil, and Chang 51 belongs to high maturity of crude oil.But this conclusion have some differences with the results of aromatics judge maturity. Figure 5 judged the maturity of crude oil aromatics in three wells. Among them, F1, F2 is methylphenanthrene ratio.

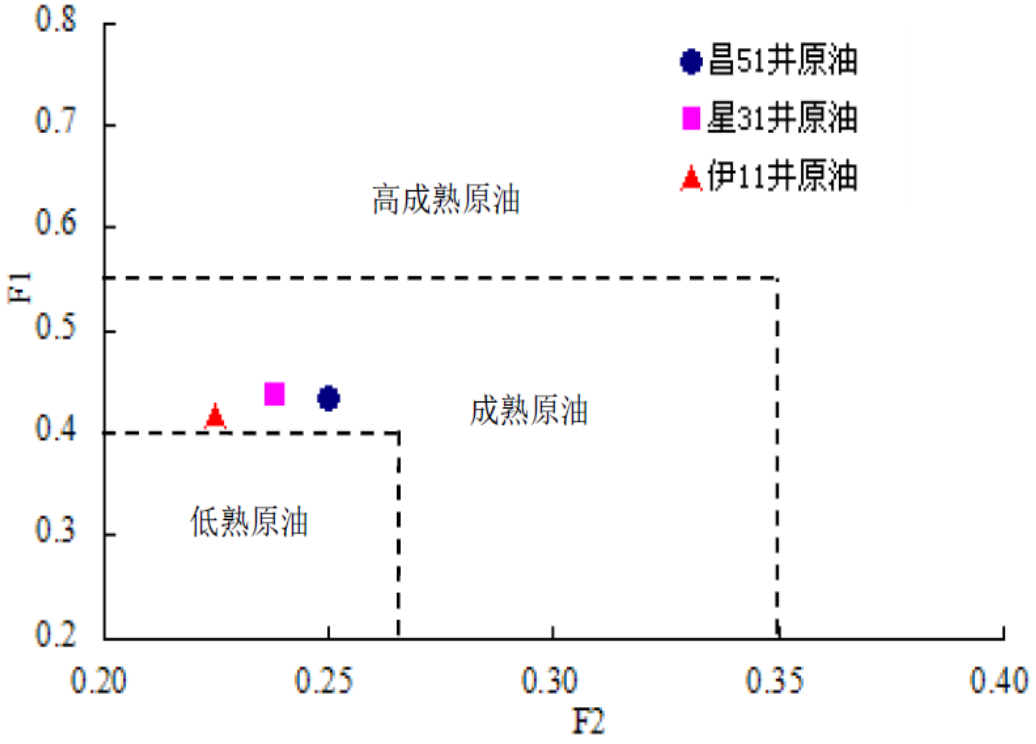

图 5　昌 51、星 31 及伊 11 原油成熟度 F1-F2 关系图

By figure 5 can see, the crude oil in Chang 51 using aromatic to judge is matured oil, and maturity is not particularly high,it is unavoidable that controdict with the result by light hydrocarbons.By studies information of Chang 51 crude oil found the following phenomenas: Chang 51 mainly output the natural gas, crude oil was part

of a few, the crude oil of Chang 51 come from WanChang group 1 piece, the explanation which we give is that the crude oil of Chang 51 is Yongji group,and the natural gas come from Shuangyang group, in this way, the migration of natural gas in time would have preferred to carry light component to accumulate, this makes the calculation of heptane value larger.This assumption can explain the contradictory phenomenon about the above two ways to judge maturity of crude oil,it also can coincide with the conclusion of oil source correlation by monomer hydrocarbon isotope.

III. ORGANIC TYPES AND THE JUDGEMNT OF SEDIMENTARY ENVIRONMENT

3.1The light hydrocarbons about C5–C7

The research shows that the light hydrocarbon component from sapropel-type organic is rich in n-alkanes, the light hydrocarbon component from humic type organic is rich in heterogeneous alkanes and aromatic hydrocarbons, the light hydrocarbon component of gas condensate from terrigenous organic is rich in naphthenic hydrocarbon(Leythauser D, 1979). But these three parameters also have a certain relationship with maturity,if want to use the relative content of three kinds of compounds,we must be sure that the impact of maturity is negligible.Because it has already been produced three oil well are mature crude oil,so the influence of the maturity of the three compounds is almost the same, then the maturity of this factor can be ignored.so we can make figure 6 in regard to statistics of C5 - C7 light hydrocarbons in three wells to get the contents of three components of the triangular figure.

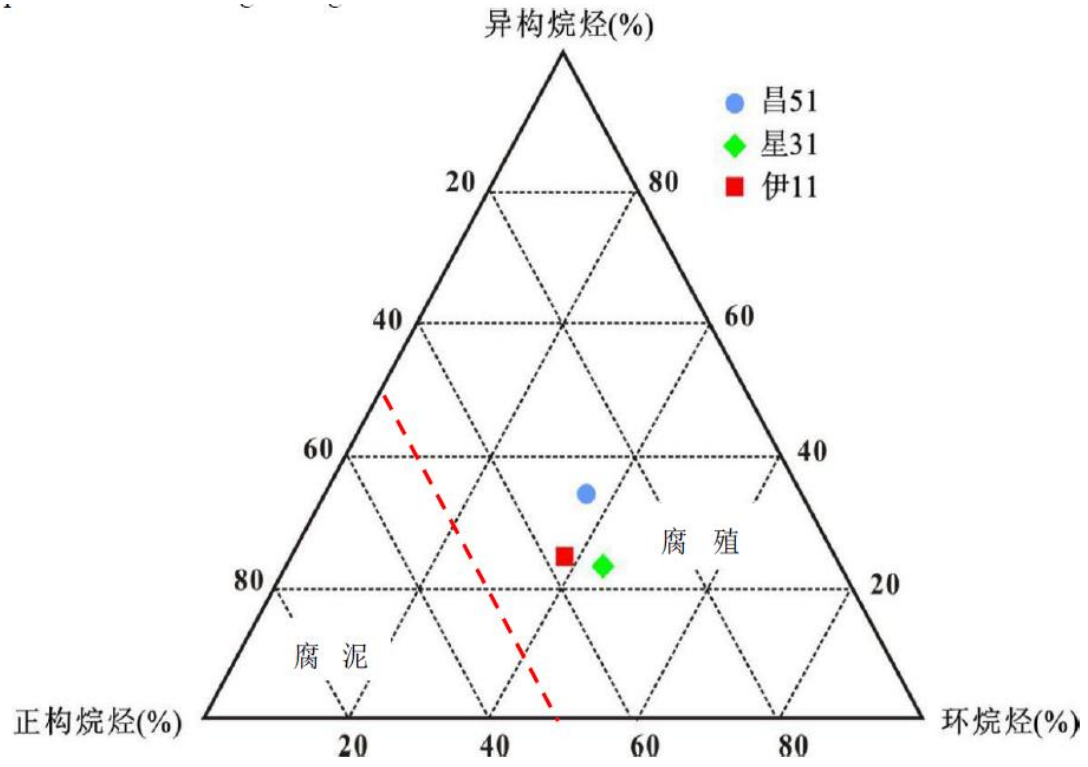

图 6 星 31、昌 51、伊 11 原油正构烷烃、异构烷烃及环烷烃相对含量三角图

By the chart we can see, the composition about three kinds of crude oil and distribution range is very similar. Cycloparaffin and isomerization have the upper hand, the relative content of n-alkanes was between 22.94% and 34.59%. So it can conclude that parent material derived from humic type.

3.2 A series of C7 light hydrocarbons judge the environment of oil generation

C7 light hydrocarbon compounds include three categories:methyl cyclohexane, dimethylcyclopentane and n-heptane. Methylcyclohexane date from lignin of higher plant, cellulose and carbohydrate,etc. thermodynamic properties is relatively stable, reflects the parameters of 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, it is a good maturity index (jin-Xing dai, 1993). So can draw the three parameters of the relative content of the triangular figure about methyl cyclohexane, normal heptane and methyl cyclopentane (figure 7), to distinguish the oil and gas of humic type hydrocarbon and

sapropel type, if the relative content of methyl cyclohexane more than 50%, it can determine that humic type is organic types.

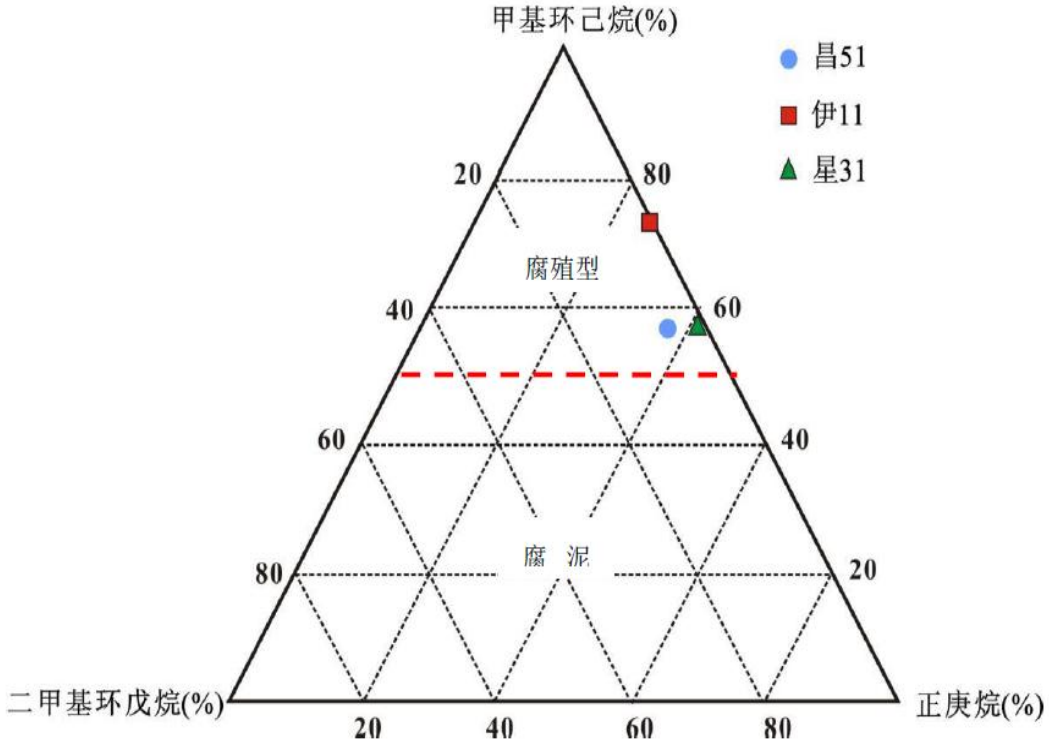

图 7　昌 51、星 31 及伊 11 原油 C7 系列组成特征三角图

By figure 7,The C7 composition of Chang 51,Xing 31and Yi 11 is very similar,so parent material source and sedimentary environment is similar, the content of methyl cyclohexane reign supreme,the content of Chang 51 is 57.26%,the content of Xing 31 is 59.35%,the Yi 11 reached by 75%, and the content of methyl cyclopentane is almost zero.This show that the source organic matter of three kinds of crude oil is mainly higher plants,organic types is humic type.

3.2 Generation methyl cyclohexane and cyclohexane index judge parent material types

Ti lin hu proposed that methyl cyclohexane and cyclohexane index,and pointed out when methyl cyclohexane index is more 50%,organic types is humic type;Methyl cyclohexane index is less than 50%, the parent material types is sapropel type, when the value of number is less than 35%,it is a deep lacustrine facies; When the value of number is between 35% ~ 50%, it is shallow lake - half deep lacustrine facies.For cyclohexane index, when this value is less than 27%, can conclude that parent material is sapropel type,when the cyclohexane index is greater than 27%, and organic types shall be the humic type. Though cyclohexane index in the parent material types have a certain value, however, if there is situation of two parameters contradictory,we should be given priority to with methyl cyclohexane index (Ti lin hu, etc.1990). The two index computation formula is as follows:

$$\text{甲基环己烷指数} = \frac{MCYC_6}{nC_7 + \sum RCPC_7 + MCYC_6} \times 100\ \%$$

Type: MCYC6 - methyl cyclohexane, %;NC7-n-heptane, %;∑ PCPC7-1 the 3-dimethyl cyclopentane, 3-dimethyl 1 cyclopentane, 1,2-dimethyl cyclopentane, 1, 1-2 methyl cyclopentane, ethyl cyclopentane, the sum of %.

$$\text{环己烷指数} = \frac{CYC_6}{nC_6 + CYC_6 + MCYC_5}$$

Type: CYC6 - cyclohexane, %; NC6 - n-hexane, %; MCYC5 - methyl cyclopentane, %.

According to the formula to calculate the relevant parameters, as shown in table 2:

Table 2 Crude oil cyclohexane and methylcyclohexane index relative content of Chang 51,Xing 31 and Yi 11

	Cyclohexane index (%)	Methyl cyclohexane index(%)
Yi 11	9.38	75
Chang 51	33.34	52.51
Chang 31	27.27	54.45

Data in the table above shows, both parameters of crude oil samples in Chang 51 and Xing 31 indicates the parent material types are humic type organic matter,the cyclohexane index of Yi 11 Wells< 27%, but methyl cyclohexane index is given priority, so it still is humic type.The composition of C7 and C5 - C7 light hydrocarbons judge anastomosis.

REFERENCES

[1] Jin-Xing dai, PeiXi ancient QiHouFa. China natural gas geology (volume 1) [M]. Beijing: petroleum industry press, 1992.75-80.

[2] Leythauser D,Schaefer R G,weiner B.Generation of low molecular weight Hydr- ocarbons from organic matter in source beds as a function of temperature[J].Chemical Geology,1979,25:95-108.

[3] Jin-Xing dai. Using light hydrocarbon identification of coal-derived gas and oil type gas [J]. Journal of petroleum exploration and development, 1993, 20 (5) 26-32.

[4] Hu Ti cochrane, GeBaoXiong Zhang Yigang, etc. The adsorption hydrocarbon source rock and gas development and application of light hydrocarbon fingerprint parameters.

[5] Philippi G T.The deep subsurface temperature controlled origin of the gaseous and gasoline-range hydrocarbons of petroleum[J].Geochimica Cosmochim,Acta 1975.39(10):1353-1373.

[6] Thompson K F M.Classification and themal history of petroleum based On light hydrocarbons [J].Geochimica et Cosmochimica Acta 1983,47(2) 303-413.

[7] ke-ming cheng, Jin Weiming to zhong hua, and so on. Continental oil and gas condensate light hydrocarbon monomer hydrocarbon composition characteristics and geological significance [J]. Journal of petroleum exploration and development, 1987, 14 (l) : 33-34.