

Geochemical studies of Pabdeh formation in Kupal oil field and determination Of oil production

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Abstract

The main aim of this study is to analyze Pabdeh formation geochemical and find out the amount of oil production in this area. Gurpi and Kazhdumi formations are also mentioned in this study as adjacent or lateral and completion of the information in the field and comparison of foundation rocks. According to results obtained from the above analysis by (Rock-Eval) and geochemical studies on the foundation rocks samples, there is possibility that Pabdeh formation in Kupal oil field has not yet reached exploitation and maturity, but since its T_{max} is equal to 438 C^0 , we can say that this formation is located at the beginning of oil window. Frequency of organic material and kind of Kerogen available in them have graded the formation as good foundation rocks and even it is been classed in a very high grade. According to studies conducted for analysis of Biomarkers and carbon Isotopes, it is been well known that the main foundation rocks for Asmari and Bangestan oil depositories (reservoirs) in Kupal field, Kazhdumi formation were completely matured. But Pabdeh formation in Anticline ruffs is producing oil since it is located near Bangestan reservoir. If at any case this formation reached its maturity, it can produce hydrocarbon. The results from this study show that brown shells in this formation with maximum of T_{oc} (Total organic carbon) appear more from east to west in the dept which shows that there is deeper sedimentary rocks in the area.

Introduction

Analysis of foundation rocks, determination of organic material specifications, analysis of degree of its maturity and characteristics of oil productivity actions are from the matters which should be geo chemically analyzed and evaluated in the oil field. A part from geophysical exploitation and geological study, the results obtained by geo chemical studies play important role in determination of oil and gas exploitation. Today, without geo chemical organic information drilling of formations for exploitation of oil and gas is very expensive. The best method to get geo chemical information is the use of (Rock-Eval 6) as the best and latest method since it has very good precision for analyzing and evaluating the foundation rocks, and also use of gas chromatography and can play an important role in completion of information.

Geology of the region:

Kupal oil field is located in the north of Khuzestan province and in the middle part of Dezfol Graben basin and 60 Km East of Ahvaz. A structural dimension on the Bangestan horizon is calculated as 32 km length and 4.5 km width. Kupal structure is symmetrical and long

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anticline with two north and south humps. The south hump consists of Kupal main reservoir structure (Fig 1). At present Kupal oil field consists of 32 oil well and the amount of wells which complete Bangistan reservoir is 14 wells (Ghalavand, 1382). Bangistan oil reservoir with the capacity of 3800 barrels a day is being exploited. Kupal Bangistan oil reservoir consists of light oil (API: 34.5) and even lighter than Asmari oil. These two reservoirs have no relation with each other in regard to pressure. Kazhdumi formation is a part of Bangistan group. The name Bangistan group comes from Bangistan Mountain which is located in the north east of Behbahan city. This formation has two different complexions with the main formation is dark in color (Darvish zadeh, 1374). This formation goes back from the period of Albian to Cenomanain (KH.Tehrani, 1381).

Gurpi formation looks like shale with the same slope located on Ilam formation, this formation sometimes appear like Marn and shale. According to fossils find, the age of this formation will go back to Eocene (KH.Tehrani, 1381).

Pabdeh formation consists of shale and clay lime stone. The age of this formation is Late Paleocene – Eocene to Oligocene (Motiei, 1374).

Considering the studies conducted in the Graben area of Dezfol's Pabdeh formation, there is rich carbonic horizontal shale which consists of clay and Kazhdumi formation is suggested as the main foundation rocks, but regarding Gurpi formation as a rock foundation there is uncertainty.

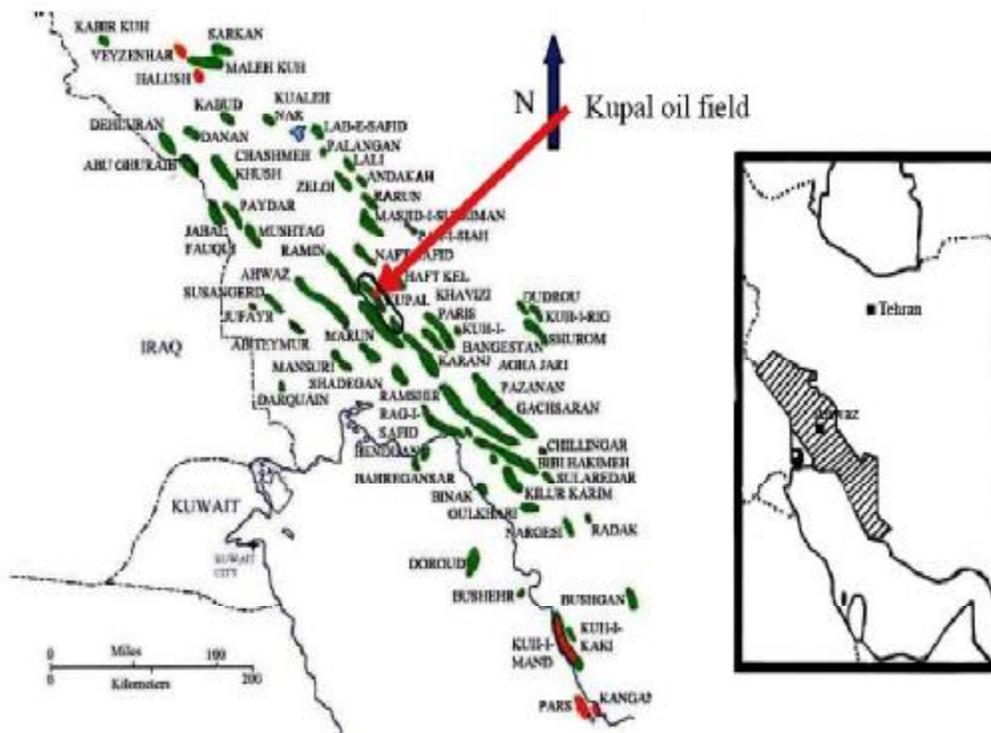


Fig-1) Situation of kupal oil field in others oil field in Iran.

Methods of study

To conduct this study 27 cutting from Pabdeh and Gurpi formations in the Kupal oil field (8 samples) and Pabdeh, Gurpi and Kazhdumi in Ahvaz Maroon and Haftkel fields (19 samples) were used. About 50-70 milligram from each sample was treated and homogenized and then they were analyzed with the Pyrolysis Rock machine to find out the amount of organic carbon (Toc) and kind of Kerogen. Of course apart from using Rock-Eval, the other methods were also used which the summery of them are as follows: exploitation of organic matters solvable in chloroform, separation of Asphaltic from bitumen, separation of saturated aromas- resin, gas Pyrolysis Chromatograph and Binocular Microscope for study of microscopic samples of the rocks. From the important parameters calculated by Rock-Eval, the following can be said:

S1: the amount of free hydrocarbon evaporated in 300C⁰ (degree centigrade) and in mg (mg Hc/g rock) in each gram of rock have been mentioned.

S2: the amount of hydrocarbon presented in each rock with the temperature of 300 to 650C⁰ is separated because of thermal cracking which is shown according to (mg Hc/g Rock).

T max: the pick temperature of S2 reaches maximum and one of the parameters evaluates by main matured thermal rocks.

Index for oxygen (oxygen index, OI) is the ratio of S3/Toc according to (mg G2/g Toc).

Hydrogen index (hydrogen index, HT) is the ratio of S2/Toc according to (mg G2/g Toc).

Discussion and analysis

In geo chemical studies and evaluation of main rock (rock of origin) three factors of quality, quantity, and maturity of the organic matter have been notified. The results obtained from studies of Pyrolysis Rock-Eval show that the main (origin) rocks in the wells of Kupal fields and its adjacent fields such as Pabdeh formation in Kupal well no. 20, there is a relatively good Toc and produces well and according to the amount of its T_{max} which is about 430 C⁰, still it is not matured completely (Tabatabaei, 1384). Regarding Kazhdumi formation adjacent to Kupal oil well, the formation is used in this field since it has not been drilled yet. The results of analysis of samples of Toc are very good for the formations located in adjacent to Kupal field (Ahvaz-Maroon). On the other hand the method of increase of degree of maturity of Kazhdumi formation in Kupal field is minimum equal to 443 C⁰ or even more than that and as a result, in this field the Kazhdumi formation is matured and produces light oil. With regard to analysis conducted, main rocks of Kerogen has been studied from two marine points of view (type II), except for one sample of Pabdeh formation in Haftkel field which shows the marine environment as well as land organic matters (type III). And also Type (II/III) have no oxidation or biochemical changes on samples, considering all marine samples studied from the highest point of anticlines. Therefore they have bared the minimum degree of maturity. The quality or kind of organic matters is introduced combined with the diagram of hydrogen index to oxygen index and also diagram of hydrogen index to T_{max} and Kerogen II and III. (Fig 2).

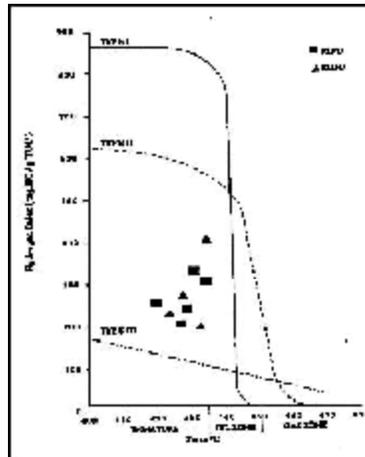


Fig.2) Standard diagram ratio of coefficients HI to T_{max} in main rocks samples of Kupal oil field wells

The results obtained from studies and analysis of geo chemical of oil reservoir in Asmari and Sarvak from Kupal field show plant of light saturated compounds and low Asphalting for this oil with the result that this situation caused increase in API or lightness of the oil. According to standard curves from geochemical studies in IB zone or sedimentary marine environment all oil has clay lime Facies and rich sulfide compounds (Tabatabaei,1384) (Fig 3).

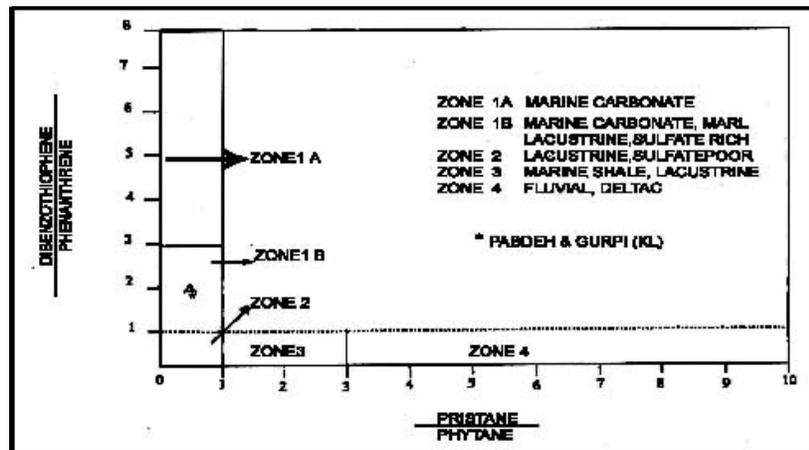


Fig.3) ratio of geochemical parameters for Kupal oil field wells which shows main rocks of sedimentary and Facies environment.

According to and considering more precise studies of geochemical curves it seems that all samples of oil studied according to sulfide compound weight and the degree of maturity are high and there is a little wax compound. To find out better about the degree of maturity geochemical parameters of aromatic compounds have been used. The results obtained show the maximum degree for maturity belong to oil samples of Sarvak reservoir and minimum degree of maturity belong to oil samples from Asmari from Kupal field. On the other hand the

degree for maturity of different oil reservoirs of Sarvak in Kupal field is different from each other (Fig 4).

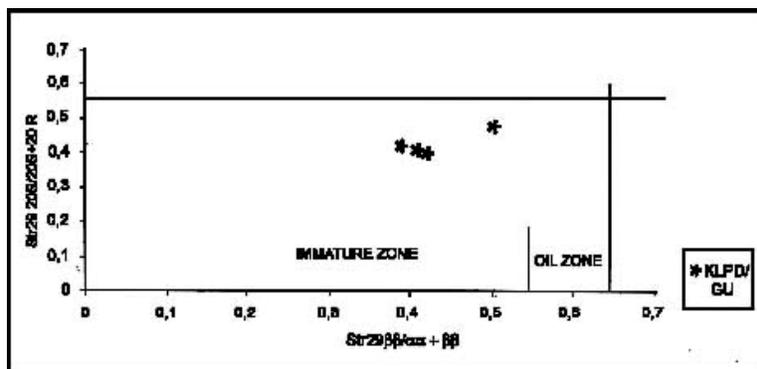


Fig.4) Standard diagram of geochemical oil window for main rocks samples of Kupal oil field wells according to different maturity factors (coefficients).

Study of carbon isotope 13 shows that the amount of isotope of oil adjacent to Asmari and Sarvak reservoir from Kupal field is absolutely same which shows the same type of main rocks. Carbon isotope is used for conformity of oil geo chemical. An interesting point is that the oil produced from Pabdeh formation is mixed with the oil produced from Kazhdumi formation with different ratios and therefore the carbon isotope of these oil reservoirs between Kazhdumi and pabdeh are varied. Another point is availability of Biomarker Oleanane of Cenozoic which can be seen in all samples of oil taken from Sarvak oil reservoir but in samples of oil reservoir in Asmari it is very weak which can be explained as follows:

That pabdeh formation is located in a depth of mane of Kupal field and it is ready to be used and the oil produced moves towards Sarvak reservoirs which is due to availability of rifts.

Conclusion:

According to the results obtained from tests in rock-Evel of Pabdeh and Kazhdumi formations it can be said that the types of rocks are good according to percentage of Toc and they capable of producing, but according to the course of maturity and ripeness of Pabdeh formation most probably they are buried in a shallow part which is not yet ready to be exploited. The samples of Gurpi formation are located in the area of no important rocks which is due to low Toc. The samples of main rocks being studied have regenerated sedimentary environment and no oxidation or biological reaction has taken place on them. Due to availability of Biomarker Oleanane in some of the oil from some reservoirs specially the reservoir of Bangestan in Kupal pal field, it can be said that Pabdeh formation has produced oil in this field. Sedimentary environment of main rocks of oil producing in Sarvak of Kupal reservoir, in sedimentary environment of main reservoir of Asmari field are a little different. The results obtained from gas chromatography in Pyrolysis, Asphaltic produced from oil reservoirs of Bangestan and Asmari in Kupal field show that there is no original Asphaltic in the oil. And the chemical reactions in the wells produces total Asphaltic, and total asphaltling produced in the wells can be the mediator for combination of different oil produced from different layers

in the well. Percentage of Asphaltene in every well is different from the others and with more depth of the well or closures the water to the reservoir, and then the percentage of Asphaltic is more.

References

- Tabatabaei, H, 1384. Sedimento logy and Mineralogy of study of Gurpi and Pabdeh Formation in Kupal oil Zone.
- Motiei, H, 1374. Geology of Iran, Geology of Petroleum. Geology Country Organization.
- KH. Tehrani, Kh, 1381, Stratigraphy of Iran, Publication: Tehran University.
- Darvish Zadeh, A, 1370, Geology of Iran, Publication: Amir Kabir University.
- Ghalavand, H, 1382, Geological study of Bangestan Reserve in Kupal oil field.