Petroleum Research

Petroleum Research 2018(June-July), Vol. 28, No. 99. 18-21

10.22078/pr.2017.2789.2293

Investigation of Hydrocarbon Generation Process for Kazhdumi Source Rock in Kitchen Area of Darquain Oil Field in the Abadan Plain

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Received: May/11/2017 Accepted: November/06/2017

Abstract

There are several Jurassic and Cretaceous hydrocarbon source rocks in the Abadan Plain, including the organic-rich Albian Kazhdumi Formation which has a favorable geochemical characteristics for oil and gas generation. In this study, basin modeling used to investigate and compare petroleum generation from the Kazhdumi Formation of a well drilled on the Darquain anticline as well as a hypothetical constructed well for the deepest part of the kitchen area. The thermal history of the studied wells reconstructed using the basin modeling software and oil generation stage of the source rock were obtained. Modeling results have been investigated and differences in the history of the oil production processes in the drilled well and the deep part of the kitchen area are discussed. Results showed that temperature, maturity, transformation ratio, and hydrocarbon expulsion quantity increase from the anticline toward the hypothetical well. However, In the geological past, however, Kazhdumi temperature and maturity in the hypothetical well were less than anticline position. In the drilled well, hydrocarbon expulsion from Kazhdumi occurred from 20 Ma, and it is not reach to peak of oil generation stage. This source rock passed peak of oil generation in the hypothetical well area where the hydrocarbon expulsion occurred from 10 Ma, and expulsion quantity was about 75 percent more than anticline.

Keywords: Kazhdumi Source Rock, Darquain Oil Field, Basin Modeling, Burial History, Oil Generation.

Introduction

Organic-rich zones, as source rock, are the key element in the occurrence of petroleum systems or hydrocarbon resources. Evaluation of source rocks and processes associated with them is great importance in the petroleum system assessment of a region. The quantity of hydrocarbon generated in organic-rich zones indicates the amount of hydrocarbons which can be migrated and accumulated [1,2]. Study of petroleum generation of these zones has a significant effect on the exploration and production of hydrocarbon in an area.

Methodology

In this study, the burial history and thermal history of the formations in a drilled well and a hypothetical well in the kitchen area of the Darquain were reconstructed (Fig. 1). The hypothetical well is considered in the deepest part of the kitchen area. In the modeling of the hypothetical well, the depth of the formations derived from the drilled wells in the Darquain anticline and seismic data, and geochemical data have been extracted from previous studies [3-7].

Discussion and Results

This research shows that the Cretaceous Kazhdumi Formation (Fig. 2) is present in different hydrocarbon generation states in studied situations. Considering that the age of the Kazhdumi Formation is the same in the two studied wells, but differences in the maturity of the organic matters has shown by thermal history. At present, the temperature difference of this formation in two wells is about 29°C. Given that every 10°C increases in temperature, the rate of conversion of organic matter to the oil is almost doubled [8]. The difference in temperature caused the oil generation process to be in the deepest part at a more advanced stage in comparison with the anticline part. Consequently, the Kazhdumi Formation in the hypothetical well passed the peak of the oil generation, while it did not reach the peak of the oil generation at the anticline. Based on this study, quantity of the hydrocarbon generation of the Kazhdumi source rock increase approximately 75% from the anticline toward the deepest part of the kitchen area (from 8 to 14 mg /g rock) (Figs 3 and 4).

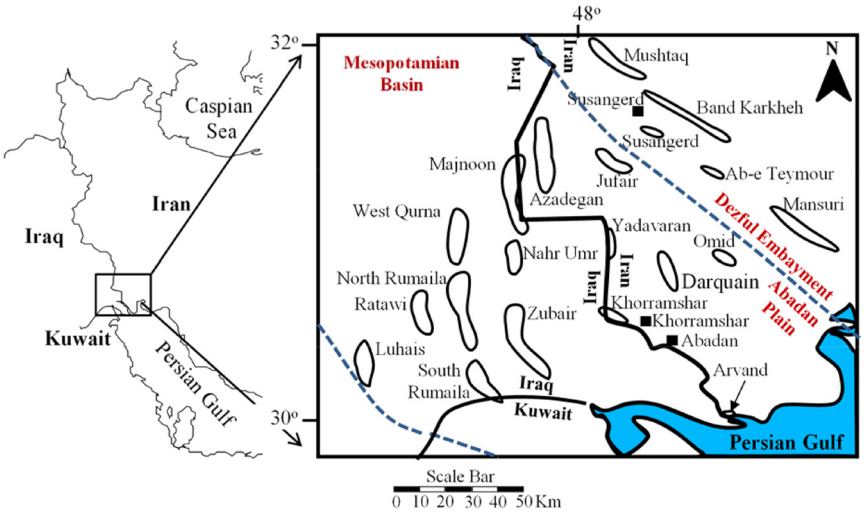

Figure 1: Location map of the Darquain field [3].

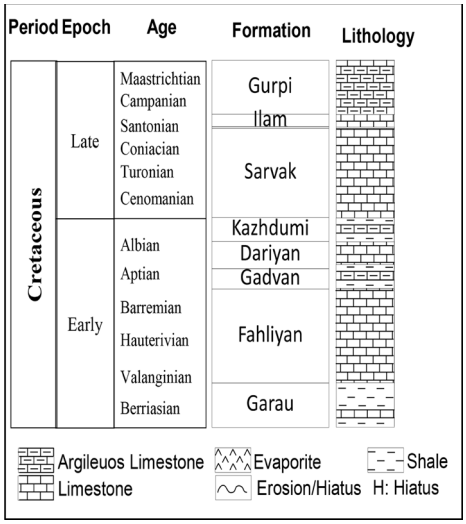

Figure 2. Stratigraphic column of Darquain field.

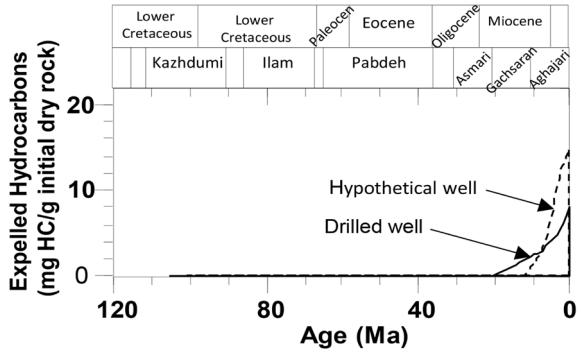

Figure 3. Hydrocarbon expulsion history in the Kazhdumi source rock in drilled and hypothetical wells.

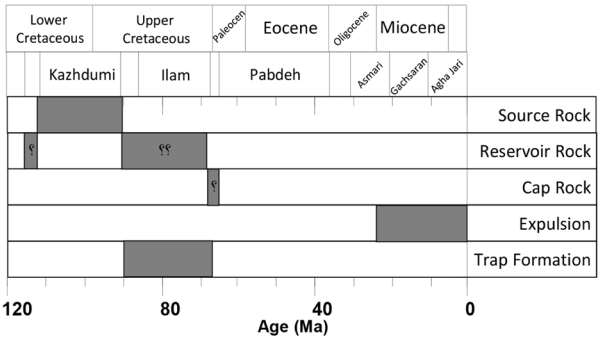

Figure 4. Event chart of the Kazhdumi petroleum system.

Conclusions

The difference in burial depth caused a more advanced hydrocarbon generation process in the deepest part of the kitchen area in companion with the anticline; in addition, the temperature, maturity and transformation ratio increased toward the hypothetical well. Prior to the Oligocene time, there was a different state, and the Kazhdumi Formation in the hypothetical well had a lower degree of temperature and maturity. This study shows that the temperature and maturity of organic matter in different parts of the kitchen area of a field can increase with variety rates throughout geological time.

Oil and gas wells are mainly drilled at the tops of anticlines, and always there is no source

rock samples from the neighboring synclines, therefore modeling techniques are a useful tool for exploring these areas. With proper and accurate information, using basin modeling software, many important information can be identified such as organic material maturity, time of oil generation and amount of hydrocarbon expulsion from the source rock. Certainly, this type of study is very important in recognizing the petroleum system and discovering new hydrocarbon resources, and it significantly reduces the risk of drilling oil and gas wells.

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