Comprehensive Evaluation of Source Rocks Characteristics in Yiliping Area, Qaidam Basin

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Abstract. Yiliping area in the middle of Qaidam Basin is a key area for oil and gas exploration in Qinghai Oilfield in recent years. However, the geochemistry characteristics of source rocks in Neogene are relatively vague, which results in the inaccuracy of hydrocarbon resource potential. Based on the seismic interpretation, well logging results, and analytical tests, the comprehensive characteristics of Neogene source rocks in the Yiliping area have been studied. The results show that the distribution of source rocks varies widely. The kerogen type is II2-III. The total organic content is from 0.2% to 1.96%. The vitrinite reflectance (Ro) is from 0.5% to 1.2%, which reflects a mature stage. The content of (S1+S2) varies from 0.01 mg/g to 89.66 mg/g. Through the comprehensive analysis, the Yiliping area is qualified for hydrocarbon generation, but has a fair resource potential. In the future, it can be considered to exploit when the cost of oilfield development is reduced.

1. Introduction

Comprehensive analysis of source rocks characteristics is extremely vital to the evaluation of the hydrocarbon resource potential [1]. The content of comprehensive analysis commonly included the thickness and distribution of source rocks, kerogen type, vitrinite reflectance, pyrolysis (S1, S2, Tmax) and so on.

At present, the exploration degree of other continental basins in China is high, and a series of exploration theories have been formed. However, the research and evaluation parameters of low exploration degree areas such as saline lacustrine basin are still weak. Qaidam Basin is one of the most important petroliferous basins in Northwest China. As a saline lacustrine basin in Northwest China, more and more scholars begin to pay attention to Qaidam Basin [2, 3, 4, 5]. It needs a certain amount of time to carry out petroleum geology research, and it needs more in-depth use of analysis and test data for comprehensive evaluation.

Yiliping area in the middle of Qaidam Basin is a key area for oil and gas exploration in Qinghai Oilfield in recent years. At present, there is a lack of in-depth understanding of the key hydrocarbon accumulation factors such as source rock, reservoir, structure, migration. This undoubtedly restricts the correct evaluation of the area, so that the natural gas exploration in this study area has not made substantial and breakthrough progress.

In view of the main problems existing in the exploration and research of Yiliping area (Fig 1), this paper comprehensively evaluates the geochemical characteristics and resource potential of source rocks...
in the study area based on the basic data of well logging, seismic and analysis. We hope that our research can provide some theoretical support for the future oil and gas exploration and development in Qaidam Basin.

![Figure 1. Location and structural characteristics of the study area](image)

2. Methods
Several samples were used to analyse the geochemistry characteristics of source rocks in the Yiliping area. The analysis content included Rock-Eval pyrolysis data (S1, S2, S3, Tmax), total organic carbon (TOC) content, vitrinite reflectance (Ro) data, the content of carbon, oxygen, hydrogen elements etc. The details are as follows:

LECO CSe400 analyzer was used to determine the TOC content, and a Leica MPV Compact II reflected-light microscope equipped with a microphotometer and an oil immersion lens to measure the vitrinite reflectance (Ro). A Rock-Eval II instrument was used to perform the Rock-Eval pyrolysis. The element content analysis was performed on Agilent 6890N gas chromatography with flame ion detector and thermal conductivity detector.

3. Results and Discussion
Based on the seismic interpretation and the experiment tests, the distribution and geochemical characteristics of source rocks were analyzed.

3.1. Distribution characteristics
The thickness of source rocks varied widely. The distribution center of source rocks is located in the Yiliping sag, and the thickness reduced from center to surrounding. The maximum thickness of source rocks is almost 3000m, which was distribution in Yiligou.

3.2. Geochemical characteristics
Based on the element analysis and pyrolysis data, the kerogen type can be identified. As shown in Fig.2, the cross-plot between H/C and O/C showed that the kerogen type was II2-III, and the relation between Tmax and HI showed that the kerogen was dominated by type III.
Qaidam Basin is a saline lake basin, the strata accumulated a high salt concentration, which can affect the enrichment of TOC. Therefore, the TOC content of the study area was relatively low, with the value ranging from 0.2% to 1.96%.

Vitrinite reflectance (Ro) can reflect the thermal evolution degree of organic matter. By analyzing 146 data of 13 wells in the study area, the Ro value is mainly from 0.5% to 1.2%, which reflects a mature stage.

3.3. Hydrocarbon generation potential

Adsorption hydrocarbon (S1) and pyrolysis hydrocarbon (S2) can be obtained by source rock analysis, and hydrocarbon generation potential (S1 + S2) was also one of the important parameters to characterize the abundance of organic matter, which can more directly reflect the hydrocarbon generation capacity of a set of source rocks. The hydrocarbon generation potential varied from 0.01 mg/g to 89.66 mg/g. Part of samples was performed less than 0.5 mg/g, which reflected non-source rocks (Fig.3). In general, the hydrocarbon generation potential was fair.

![Figure 2. Identification map of kerogen type in the Yiliping area](image)

![Figure 3. Hydrocarbon generation potential evaluation of source rocks in Yiliping area](image)
4. Conclusion
Hydrocarbon generation potential of source rocks in Yiliping area was fair. In general, the distribution of source rocks was wide, the kerogen type was II2-III, the total organic carbon value was relatively low, and the thermal evolution degree was in the mature stage. Oil fields need to be cautious in commercial oil and gas development.

Acknowledgments
This work was financially supported by National Natural Science Foundation of China.

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