The analysis of hydrocarbon properties' difference of two typical buried hill reservoirs by GC-MS, in Chexi sag, Bohai bay basin

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Introduction

The buried hill reservoir is a very important type of oil reservoir in the fault basin. According to the oil properties of different buried hill reservoirs, the studying of reservoir formation difference has important indicative significance for the exploration of buried hill reservoirs in the future. The Chegu20 buried hill reservoir (Cg20) and the Che57 buried hill reservoir (C57) are two high yield fields, located in Chexi sag, Jiyang depression.

The oil bearing series of Cg20 and C57 are both carbonate formation of Lower Paleozoic, furthermore, oil-source correlation shows that the oil of two buried hill reservoirs are both from the third section of Shahejie formation in Chexi sag (Haigang Lao, Yongshi Wang, Yixian Shan, et al., 2019) .This paper focuses on the factors that lead to the oil properties' differences in the two buried hills reservoirs by GC-MS.

Results

The oil properties of two buried hill reservoirs are quite different, the gas-oil ratio of the oil in Cg20 is significantly smaller than that of C57, and its oil density is obviously larger than the C57 buried hill reservoir (Fig. 1a).

Analysis of hydrocarbon composition from different buried hills by GC-MS showed that biodegradation may be the cause of differences in their hydrocarbon properties: (i) Strong biodegradation results in a significant decrease in C19/C23 tricyclic terpane parameters. According to the results of mass spectrometry analysis of saturated hydrocarbons, the C19/C23 tricyclic decane parameter of Cg20 is 21.2%, while C57 is 45.7%. It can be seen that the oil of Cg20 is subject to a certain degree of biodegradation. (ii) In addition, the Pr/nC17 and Ph/nC18 will increase as the degree of biodegradation increases (Youjun Tang, Cen Lv et al., 2018). In comparison, the Pr/nC17 and Ph/nC18 of oil in Cg20 are larger than C57 (Fig. 1b). It is speculated that the oil of Cg20 was subjected to a low degree of biodegradation. (iii) A significant baseline shift in the gas chromatogram of the oil-saturated hydrocarbons of the oil from Cg20 can also indicate a certain degree of biodegradation (Fig. 1c).

Conclusions

Based on the analysis of geological background, there are two reasons for the hydrocarbon properties' difference of two typical buried hill reservoir:(i) In terms of hydrocarbon migration, the C57 buried hill is near the source rock (Fig. 1a), and light hydrocarbon components first aggregate because of the short transport distance. While the Cg20 buried hill is far from the oil source, and oil is mainly transported through faults and sand bodies over long distances. In the process of transport, light hydrocarbon group dispersion loss and hydrocarbon may be biodegraded during long-distance migration, this leads to an increase of oil density and a decrease of gas-oil ratio. (ii) In terms of structure, the buried of Cg20 is shallower than C57, and there are more faults with intense structural activities in the later stage in the upper part of the Cg20 buried hill, which provides possible conditions for biodegradation.

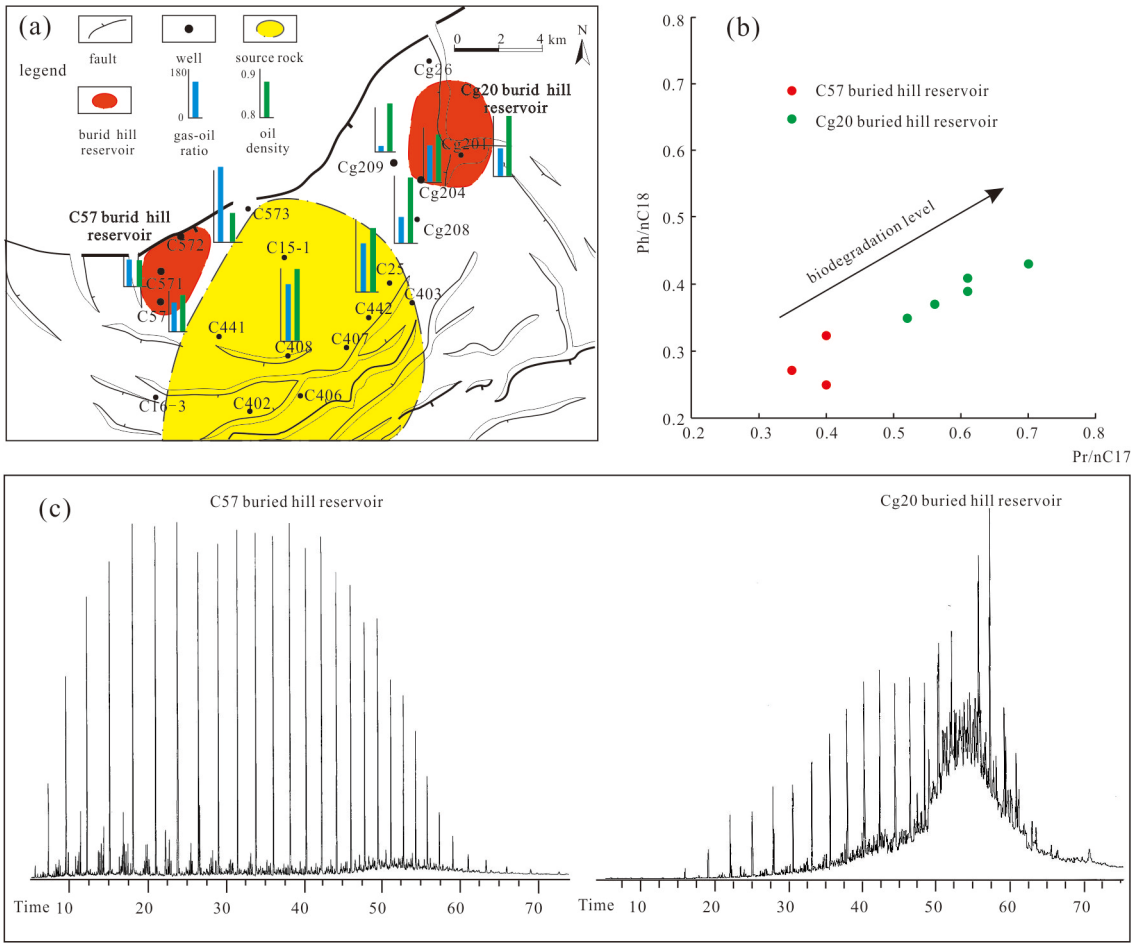

Figure 1: (a) Crude oil properties of the Chegu20 buried hill reservoir and the Che57 buried hill reservoir. (b) The cross plot of Ph/nC18 and Pr/nC17. (c) The saturated hydrocarbon gas chromatography of the Chegu20 buried hill reservoir and the Che57 buried hill reservoir.

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