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Coal-derived Gas Accumulation Characteristics and Exploration Prospects of Upper Paleozoic in Eastern Lingqing Depression

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1 Introduction

Bohai Bay Basin is the highest oil production basin in China, but the proven reserves and production of natural gas is far less than the size of the oil. In recent years, petroleum geologists found one after another in Wenan Slope of Jizhong Depression, Kongxi and Wumaying buried hills of Huanghua Depression, Gubei-Bonan buried hill of Jiyang Depression, Wenliu buried hill of Dongpu Depression oil and gas from coal-bearing source rock of Upper Paleozoic. It shows that Upper Paleozoic of Bohai Bay Basin has good exploration prospects.

It has been low level of exploration in Eastern Linqing Depression. It has coal-derived gas show only in Well

Degu 2 and Kanggu 4 in a long period. During the exploration in 2007, petroleum geologists found industrial oil and gas flow in Well Gaogu 4, which produced natural gas $2.1 \times 10^4 \text{ m}^3/\text{d}$, oil 30.18t/d coal-bearing source rock of Upper Paleozoic (Fig.1) after reservoir fracturing, proving Eastern Linqing Depression to be another potential area of coal-derived gas exploration.

However, the types of buried-history of the secondary structural belts were different because Eastern Linqing Depression experienced superposition of tectonic movements since Early Palaeozoic, resulting in different hydrocarbon generation and accumulation evolutions in different areas. This article mainly describes the reservoir-forming conditions and the potential of hydrocarbon

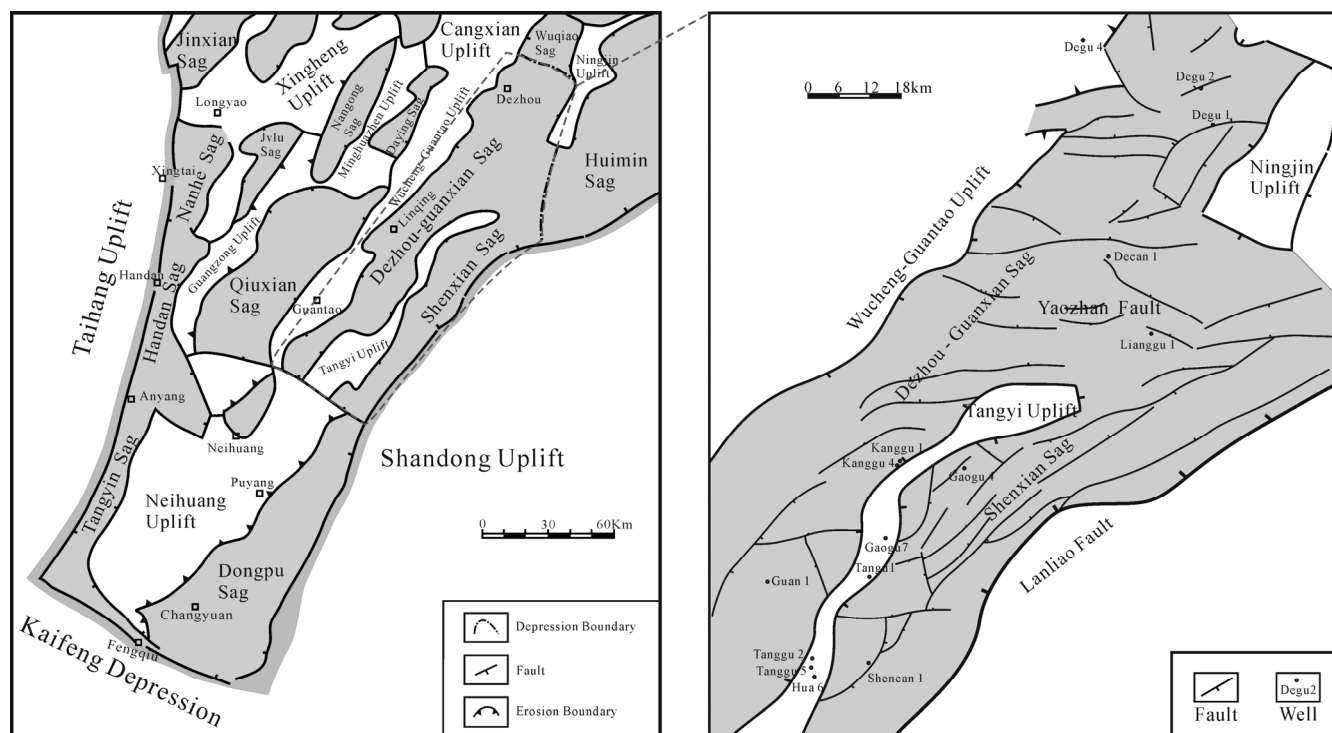


Fig. 1 Location and structural units of Eastern Lingqing Depression

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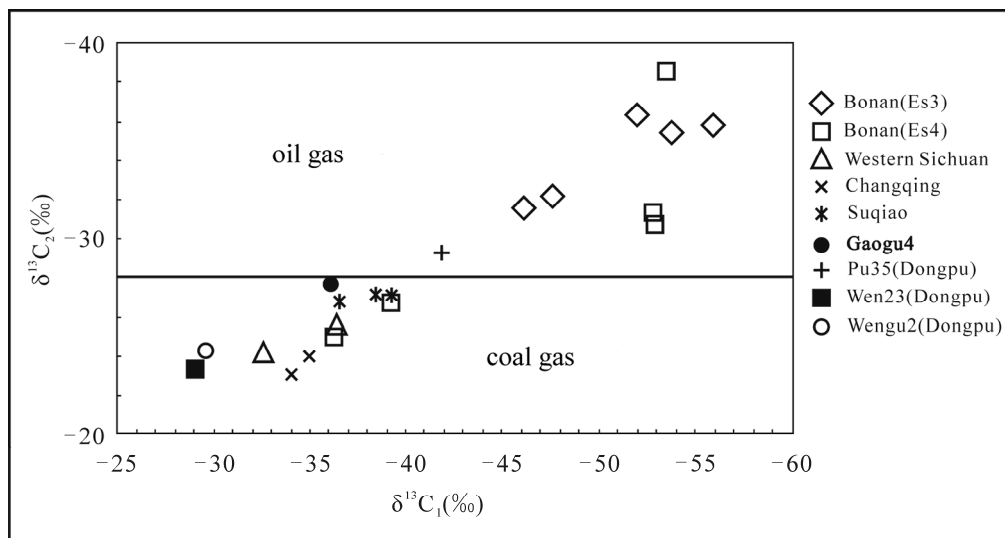


Fig.2 Comparison of carbon isotope of methane and ethane in typical gas reservoirs

generation and accumulation in every secondary structural belt.

2 Coal-derived Gas Accumulation Characteristics and Exploration Prospects

It develops coal-derived gas accumulation conditions in Eastern Linqing Depression (Fig. 2), but the low-degree study has limited its exploration. Using many methods to research the characteristics of the coal-bearing source rock of Upper Paleozoic and its hydrocarbon generating evolution, the combination of reservoir and cap rock, as well as analyze the Gaogu 4 coal-derived gas reservoir. The results show that: The coal and mudstone of Upper Paleozoic could act as source rocks, whose kerogen types are mainly III or II₂, and dominantly generate gas; the evolution of the source rock has gone through 6 stages and classify to 3 burial history types, the area that “shallow buried in Mesozoic, deep buried in Cenozoic” has the greatest potential of hydrocarbon accumulation, followed by the area that “deep buried in Mesozoic, deep buried in Cenozoic”, and the area that “deep buried in Mesozoic, shallow buried in Cenozoic” hardly has the potential; Reservoirs develop from Lower Paleozoic to Paleogene, of which the most important reservoirs in Upper Paleozoic are of low porosity and low permeability, the coal and mudstone which act as cap rocks are of good quality and large-scale distribution; the coal-derived gas in Gaogu 4 Taiyuan Formation reservoir is from the coal-bearing source rock in the same formation, the coal overlying and the mudstone lateral blocking form the fault-block trap, the gas accumulated in Neogene-Quaternary, the Gaogu 4 coal-derived gas reservoir is characterized by “near-source, self-generating, self-preserving”, “favorable lateral blocking condition” and “super-late hydrocarbon

generating and accumulating”. Based on these studies, the key factor to predict favorable hydrocarbon accumulation area is the gas-generating intensity of coal-bearing source rock in Himalayan, the exploration should focus on the “intra-sag uplift” in the hydrocarbon-generating center and the structural high (around the uplift) near the hydrocarbon-generating center in Dezhou-Guanxian Sag and Shenxian Sag.

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