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Paleoenvironment Reconstruction and distribution of dolomite beach in the Jialingjiang Formation of the Sichuan Basin, Insights from multiple geochemical parameters

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The dolomite beach in the Jialingjiang Formation of the Triassic period is an important potential hydyocarbon exploration area in the Sichuan Basin, but it also faces challenges such as strong heterogeneity of carbonate reservoirs and difficulty in predicting thin dolomite beach. The reconstruction of paleoenvironments and the distribution of dolomite beach are key scientific issues constraining hydyocarbon exploration.

A systematic study of the paleoenvironment and sedimentary characteristics of the Jialingjiang Formation was conducted based on huge samples of core, field outcrops, thin sections, and seismic data analysis. Multi geochemical parameters such as strontium isotopes, C/O isotopes, and laser in-situ U-Pb dating were comprehensively analyzed to study the characteristics and genesis mechanisms of high-quality reservoirs. Seismic response characteristics of dolomite reservoir and fault activities were analyzed with the high-quality 2D and 3D seismic data.

(1) Systematic studies on elemental geochemistry, paleontology, and organic petrology reveal that the Jialingjiang Formation is characterized by a semi-restricted, evaporite shallow-water carbonate platform environment, with the development of three major grain shoal systems in the Chuandong, Chuanzhong, and South of Sichuan basin. (2) The reservoir lithology is dominated by residual grainy crystalline dolomite, and the quasi-syngenetic atmospheric freshwater leaching and dolomitization processes are key factors to the formation and preservation of high-quality reservoir pores. The single stage dolomite beach reservoir is about 0.2m-5m thick, with a cumulative thickness of 3m-35m. Dolomite beach reservoir is widely distributed in the large ancient uplift slope belts, with a favorable exploration area of up to $2.4x10^4km^2$. (3) The large scale dolomite beach and faults that puncture source rocks are key factors for the hydrocarbon accumulation in the Jialingjiang Formation. The source rocks are mainly from the Permian and Silurian. The three major hydrocarbon generation centers are well positioned in time and space with the three major dolomite beach systems.

It is suggested that the dolomite beach in the large ancient uplift slope zone of the Jialingjiang Formation is an important hydyocarbon exploration area.