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Formation environment of organic-rich mixed sedimentary rocks in the Lucaogou Formation, Jimsar Sag, Junggar Basin

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Formation environment of organic-rich mixed sedimentary rocks in the Lucaogou Formation, Jimsar Sag, Junggar Basin

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Purposes and Methods

Recently, abundant unconventional oil and gas resources have been found in the mixed sedimentary strata of the Lucaogou Formation in the Jimsar Sag [1]. However, the formation mechanism of organic-rich mixed sedimentary rocks of the Lucaogou Formation have not been well studied, which limits the prediction of high-quality source rocks. In this study, organic petrology, geochemistry were used to reveal the paleo-environment and paleo-productivity of organic-rich mixed sedimentary rocks in the Lucaogou Formation, aiming to clarify the key factors controlling the formation of organic-rich mixed sedimentary rocks in the saline lake basin, and to provide geochemical basis for the prediction of distribution characteristics of high-quality source rocks.

Discussion of Results

The results showed that the organic-rich mixed sedimentary rocks of the Lucaogou Formation in the Jimsar Sag were formed in semi-arid-humid and arid-hot conditions. Under the arid-hot paleoclimate condition, the salinity of the lake water increased due to evaporation, resulting in the deposit of mixed sedimentary rocks in freshwater to salt water environments. In addition, the higher salinity of lake water promotes the stratification of water column and the formation of suboxic to weak anoxic bottom water environment, which was conducive to the preservation of organic matter. The correlation between TOC and paleoclimate, palesalinity and redox parameters is weak, while a positive correlation between TOC and paleo-productivity parameters, indicating that organic matter enrichment in source rocks was significantly controlled by paleo-productivity. In addition, the productivity of mixed sedimentary rocks of the same type fluctuated greatly, which is obviously influenced by the large-scale volcanic activity of Permian in Junggar Basin. In summary, the improvement in the paleo-productivity caused by volcanic activity is the key factor for the enrichment of organic matter, rather than the preservation condition of organic matter.

References

[1] Ding et al., 2020. Int. J. Coal Geol. 219, 103373.