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Geochemical and geothermal factors controlling the origin of coal-bed methane in Qinshui Basin, China

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Introduction

Qinshui Basin is one of the major regions in which coal and coal-bed gases resources are rich in China. The basin, located in the southern part of Shanxi Province, N-China, is a structural basin in which the amount of coal-bed methane produced in Carboniferous Period strata is estimated at $2.4 \times 10^4 \text{ km}^3$.

Coal-bed gases are the products of coalification that is controlled by burial history of coal beds, regional structural history, the history of magmatic activities and geothermal evolution. In the study, geochemical and geothermal factors controlling the formation of coal-seam methane in Qinshui Basin are discussed.

Organic geochemistry of coal

The maceral content of major coal beds varies from 83% to 99%, mostly from 90% to 97%. The values are generally higher in the southern part than those in the northern part of the basin. The minerals found in the coal beds are mostly clay minerals with minor pyrite and calcite. The mineral content changes from 1% to 17%.

Of the major coal beds in the basin, the vitrinite reflectance $R_{o, \max}$ ranges from 0.85% to 4.20%, and the coal ranks varies very greatly, from gas coal to anthracite. Generally, the $R_{o, \max}$ values are higher in the south and the east than those in the north and the west of the basin. The highest values are found in the south. The evidence reveals that the capability of hydrocarbon-generation of coal increases from the north and the west to the south and the east [1].

Paleogeothermal field

By EASR/R method, the paleogeotemperatures and paleogeothermal gradients at the end of Jurassic Period in the basin are estimated at 147 ± 237 and 5.9 ± 7.5 /100m respectively. The geothermal parameters also show the trend "higher in the south and the east, and Lower in the north and the west" of the basin.

Conclusion

Geochemical and geothermal studies suggest that the southern part of the basin seems to be the favorable target area for coal-bed methane exploration.

Acknowledgements

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References

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Characterising the organic facies of Cretaceous and Tertiary sediments in the Mackenzie delta, Northwest Territories (Canada)

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Gas hydrate occurrences are widespread in the near subsurface of the Mackenzie Delta (Northern Canada). The area is also a major petroleum province for both – oil and gas. Tertiary and Cretaceous sediments have been proposed to be the major origin for hydrocarbons in that area. The specific goal of the present study is to characterise organic rich sediments within the Mackenzie Delta and to identify possible facies variations as well as the consequences for hydrocarbons generation timing within the delta sediments.

Therefore 77 samples which cover the whole area of the delta and represent lignites/coals in five sequences (Kugmallit, Richards, Taglu, Aklak and Smoking Hills Sequence), taken from the delta plain to the basin plain, have been studied. Their structural features and hydrocarbon potential was evaluated by Rock-Eval pyrolysis, organic petrography, pyrolysis-GC (open system) and pyrolysis-GC-MS. 8 samples were submitted to open-system programmed temperature pyrolysis at different heating rates in order to determine kinetic parameters.

The studied sample set shows, that the organic rich sediments in the Mackenzie Delta are extremely heterogeneous in terms of depositional environment and hydrocarbon generation (e.g. gas generation) behaviour. Especially the organic matter preserved in the Smoking Hills Sequence, the Taglu Sequence as well as the Kugmallit Sequence range from type III to more type II organic matter: This in turn has strong impact on the petroleum formation predictions, with onset temperature which range from 70°C to around 100°C under geological conditions, depending on the locations and the depths of studied samples.

Based on these results we will present a preliminary pattern of organic facies characteristic of organic rich Cretaceous and Tertiary sediments in the Mackenzie Delta.