

Study on Conditions for Coalbed Methane Accumulation in Hegang Basin

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Abstract. The degree of metamorphism of coal seams in Hegang basin is mainly to medium coal rank. The macrolithotype of coal is rather excellent., given priority to half light type. In addition, there are a great number of thick coal seams in Hegang basin and the average thickness of the major coal seam can be more than 10 m. Furthermore its gas content is high, and it is superior in quality of coalbed methane and conditions for Generating coalbed methane. However the permeability of the reservoir changes a lot, the lithology is unfavourable in top and bottom of reservoir which is exactly in favor of local caprock sealing ability. There are two main differences in north and south of the basin, the coal rank and the preservation conditions. The coal rank and permeability of north is high, and it has developed favorable caprock. In contrary, the coal rank in south is low and it hasn't buried deeply enough. It also lack favorable caprock. Based on Comprehensive analysis on these factors, the conditions for coalbed methane accumulation is superior to the south. It is better to explore the north of Hegang basin firstly.

Introduction

Hegang coal field is located in the northeast of Helongjiang Province, which is 6km from east to west and 42km from north to south. It has an area of 2800 square metres[1] with 48.12×10^8 t of coal resources and $631 \times 10^8 \text{m}^3$ predicted coalbed methane[2],and its abundance of resources is $1.5 \text{m}^3/\text{km}^2$ [3]. The coalbed methane in Hegang coal field has been explored for 13 years, but there is no remarkable progress. Only Nanshan mining area has been produced formally of nine mines in this basin currently, whose annual coalbed methane output is $0.2 \times 10^8 \text{m}^3$ [4]. Hence one can see that there is great potential in coalbed methane of Hegang basin. But the unclear conditions for coalbed methane accumulation has seriously prevented the exploration of coalbed methane in Hegang basin. Therefore, we analyse the conditions for coalbed methane accumulation from many factors, such as characteristics of coal seams, coal , coal reservoir and the preservation conditions to choos the prospective target area for coabed methane exploration and production.

Characteristics of coal seams

Hegang basin is a monoclinial structure with north-south trend, Strike direction of N25E and dip between $10^\circ \sim 35^\circ$ (Fig 1). The structure is complex and developed large and medium-sized fault in this area where developed 91 faults with over 100m fault throw. However its hydrogeological conditions are simple, besides the connection between coal seam and hydraulic power in overlying aquifers and coal internal aquifers is weak. So it is favorable to exploration and development of coalbed methane.

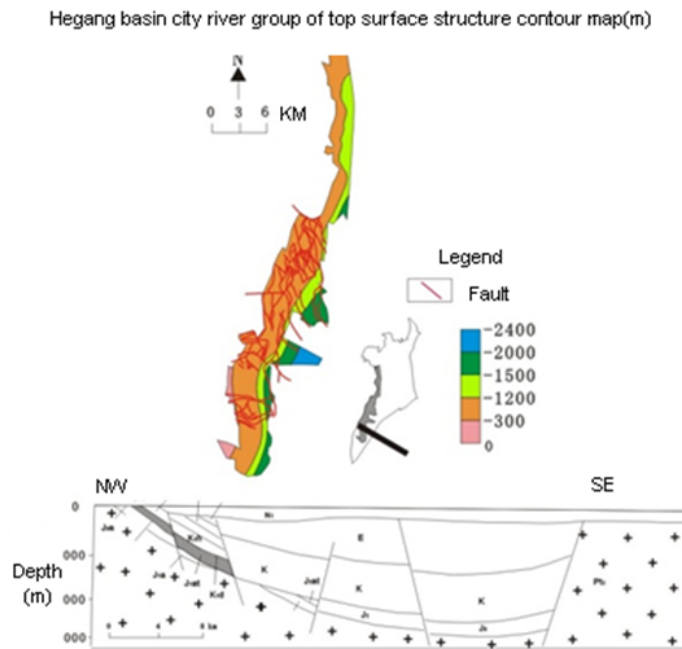


Fig. 1 Structure Contour map of strata Chengzihe upper surface in Hegang basin

The total thickness of strata Chengzihe formation is 700~1310 m, containing a total of over 40 coal layers, including 36 exploiting and locally exploiting layers. The coal cumulative thickness is between 30~70m, of which most are thick and medium thick coal layers and a few are especially thick. Strata Muleng covered on the strata Chengzihe, whose total thickness is 600~955 m, containing 5~18 thin coal layers, including 4~5 exploiting layers, conformably contacting with strata Chengzihe[4].

The coal seams in Hegang mining area is mainly distributed in 1500m under ground, We always exploit in 900m underground at present. The degree of metamorphism of coal in this area is mainly gas coal and fat coal, and its R_o is 0.65~1.7[4]. The coal seams in Hegang basin is the result of plutonic metamorphism and contact metamorphism. Along with the increase of longitudinal deepness, arising a plurality of Coal accumulation center(coal-forming center) laterally. Part of coal seams are affected by contact metamorphism due to the magmatic intrusion in Yanshanian, forming a series of coal seams of hige coal ranks and resulting in the difference between different coal ranks.

Characteristics of coal

The coal macrolithotype in Hegang mining area is given priority to half light type, then the semidull coal and bright coal. Because of being consist of bright coal, semidull coal, anthraxylous coal and charcoal like coal, the coal is thin banded or medium banded structure. The micropetrological unit of coal is mainly vitrinite, whose content is 52.2%~82.3%, then the semivitrinite content is 2.3%~26.3%, and the exinite content is 0.2%~6.2%[4]. In addition, its ash content is high to 15~30%[5].

Characteristics of coal reservoir

The gas content between 500~1500m in Hegang mining area is 1.6~19m³/t and is high to 8.14~15.4 m³/t in Nanshan and Xinyi mine area[4]. The coalbed methane here has rather high quality with CH₄ concentration high to 95%~98%. The permeability is commonly between 0.055mD and 0.382mD. There is large difference in permeability in different mining area, presenting a trend of low in southwest and high in northeast. This pattern is the common effect of magmatic activity and tectonic movement. Exogenic crack developed well in this coal area, with crack density 2~20 /10cm^[5].

Preservation conditions

Coal measures in Hegang coal field is continental sedimentation, most of whose roof is fine sandstone, only a few is sandy shale or medium sand and farewell rock. In addition, most of its base plate is sandstone, few is medium sand or silt. Thick, densify and siliceous cemented conglomerate in Nanling is favorable local cap rock for its excellent sealing ability [6]. According to statistic single well data in Hegang basin, we can see that the conditions for developing top cap bottom partition sealing type make up 42% of the total(Fig 2). Moreover, the basin is an asymmetric monoclinical structure, with weak hydrodynamic conditions, for which it is easy to form unidirectional hydropower blockage, so that it can preserve the coalbed methane.

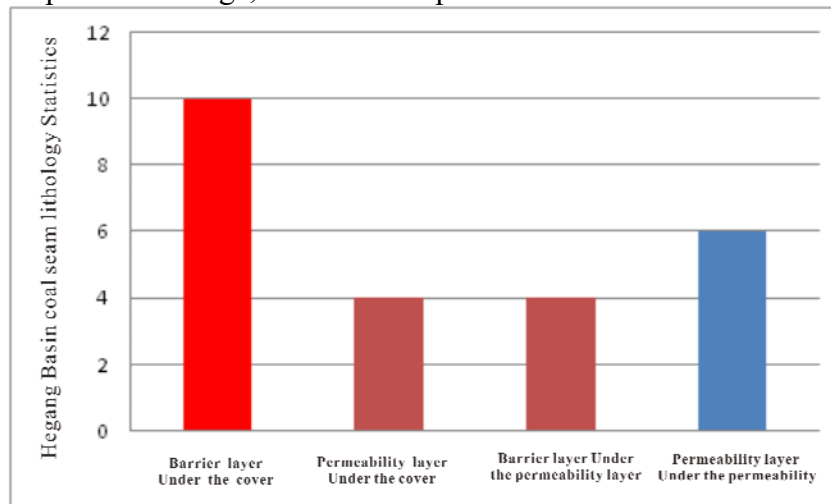


Fig. 2 static map of roof and base plate of coal seams in Hegang basin

Conclusion

- 1) Hegang basin is a monoclinical structure with north-south trend and developed large and medium-sized fault in this area.
- 2) The total thickness of strata Chengzihe formation is 700~1310m, containing over 40 coal layers, including 36 exploiting and local exploiting layers. The coal cumulative thickness is between 30~70m, of which most are thick and medium thick coal layers and a few are especially thick.
- 3) The coal seams in Hegang mining area is mainly distributed in 1500m under ground, but we always exploit in 900m underground at present.
- 4) The coal macrolithotype in Hegang mining area is given priority to half light type, then the semidull coal and bright coal. The micropetrological unit of coal is mainly vitrinite, whose content is 52.2%~82.3%, then the semivitrinite content is 2.3%~26.3%, and the exinite content is 0.2%~6.2%[4]. In addition, its ash content is high to 15~30%[5].
- 5) The gas content between 500~1500m in Hegang mining area is 1.6~19m³/t and is high to 8.14~15.4 m³/t in Nanshan and Xinyi mining area[4].
- 6) According to statistic single well data in Hegang basin, we can see that the conditions for developing top cap bottom partition sealing type make up 42% of the total. Based on Comprehensive analysis these factors, the conditions for coalbed methane accumulation is superior to the south. It is better to explore the north of Hegang basin firstly.

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