

Low-rank Coal Reservoir Character and CBM Exploration Potential in Junggar Basin---A new exploration frontier case from Xinjiang, NW China

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Summary

Low-rank coalbed methane (CBM) in Junggar Basin has recently become a new exploration frontier across Xinjiang, Northwest China. The low-rank coal reservoir mainly develops in Badaowan Fm. (J₁b) and Xishanyao Fm. (J₂x) coal measures, especially featuring stable distribution, great thickness and moderate burial depth^[1], which is favorable of CBM accumulation.

The pores of Jurassic coalbed reservoirs are mainly small-micro (<100nm) and large ones, among which the large and medium sizes account for a high proportion; and macroscopic and microscopic fissures are well developed in the reservoirs, leading to a great variation of the permeability. The shallow coal reservoirs are mostly undersaturated, and the gas saturation tends to increase toward the deep coalbed. The low rank coalbed reservoirs have strong ability to adsorb and accumulate CBM. In terms of horizon, the J₂x coalbed reservoir has a stronger methane adsorption and storage capacity than J₁b and better physical properties, making CBM recovery easier. In terms of region, the coalbed reservoirs in Changji--Urumqi--Fukang areas in the southern margin of the basin^[2], Cainan--Balikun coalmine regions in the eastern part as well as the hinterland of the basin reach the level with methane-rich to extremely methane-rich coal beds and have strong ability to adsorb and store CBM.

Coalbeds of the basin have gas shows in common and good gas-bearing property^[3]. The low rank CBM takes a large proportion of the CBM resource, with huge potential. In light of Langmuir's volume obtained by Isothermal adsorption experiment of coal samples, the gas provinces are classified into four types: poor CBM zone (<8m³/t), CBM-bearing zone (8-15m³/t), relatively rich CBM zone (15-20m³/t), and rich CBM zone (>20m³/t). From the point of geographical distribution, the relatively rich CBM zones cover Wellblock Qing 1 to Qi 8, Changji--Urumqi--Fukang area and slope belt of northwest margin--basin hinterland; while the rich CBM zones include eastern Junggar basin and Balikun coalmine region. These areas together with the adjacent thick coal region and hinterland have a great potential in deep CBM development.

Since 2005, Changji Liuhuanggou block in the south Junggar basin has been selected as PSC block for venture exploration, and a series of CBM projects and researches have been carried out successively. Recently the CBM extraction from Dahuangshan coal mine in the south Junggar, industrial gas flow from the exploration well in the western Baiyanghe of Fukang block, and deep CBM exploration breakthrough

in Baijiahai of the east Junggar demonstrated good progress in exploration and proved the huge potential of low rank CBM development^[4]. And now Xinjiang has become the third largest CBM development heat spot area in China.

Theory and/or Method

Based on methods of geological survey and statistical, microscopic observation and mercury pressure analysis, calculation of measured data and gas gradient, as well as experimental analysis of methane isothermal adsorption, low-rank Coal Reservoir Character and CBM Exploration Potential in Junggar Basin are studied and discussed.

Conclusions

- (1) Relatively favorable low-rank coal reservoir: 2 sets of coal seams i.e. the middle Jurassic Xishanyao Fm.(J₂x) and the lower Jurassic Baidaowan Fm.(J₁b); Stable and thick coalbed distribution in southern and eastern basin, moderate burial depth and high gas content; Dominated by middle-low ash content, low sulfur content, low rank and long flame coal, with high coal rank/type in the south and east, while low in the northern and west regions; High CBM adsorption and gathering capacity, J₂x is better than that of J₁b.
- (2) Relatively good low-rank CBM potential: Many coal mine gas, gas seepage at outcrops, CBM in well show and discovery; Low to moderately measured gas content, and moderately predicted theoretical gas content; Some cleats and cracks found with certain permeability and medium gas saturation; CBM-rich areas in eastern basin; Slightly CBM-rich areas and CBM-containing areas in middle-east part in southern basin, central basin to slope zone of northwest margin.
- (3) Better Low-rank CBM exploration progress: Deep CBM exploration breakthrough in selected Baijiahai region of eastern Junggar Basin; Industrial gas flow from gas drainage well in Dahuangshan coal mine and CBM well in western Baiyanghe of Fukang coalmine in southern Junggar Basin.

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