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Study on the Controlling Factors of Coal Seam Distribution in Jurassic Yan'an Formation in Longdong Area in Ordos Basin

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Abstract. The distribution characteristics of coal seams and the main controlling factors of coal accumulation of the Middle Jurassic Yan'an Formation in Longdong area are analyzed in this paper based on geophysical logging data, drilling data and sedimentation background. The results show that the central and western parts of Longdong are the main development areas of coal seams, the coal seams are thick in the west and south, while they are thin in the east and north, and thickness of coal seams in this area ranges from 10m to 30m. The characteristics of sedimentary structure indicate that the warm and humid climate, palaeogeographic environment of swamp facies, palaeo-vegetation and late tectonic movement influenced the formation and distribution of coal in Longdong area. The study suggests that the coal resource in Longdong area is rich and preserved well, and its structure is simple, so it is favourable for exploration and has great economic potential.

1. Introduction

Ordos Basin is a huge multi-energy mineral basin developed on a stable craton, which contains abundant coal, oil, natural gas and other resources [1,2]. The complex tectonic evolution of the basin has resulted in the development of Carboniferous-Permian, Triassic, Jurassic Yan'an Formations and other coal-bearing strata.

Longdong area is located in the southwestern part of the Ordos Basin, mainly spanning two primary structural units of the Tianhuan Depression and the Yishan Slope (Fig. 1), with an area of about $5 \times 10^4 \text{ km}^2$. The amount of coal resources predicted exceeded $2000 \times 10^8 \text{ t}$, accounting for 95% of the total coal resources in Gansu province[3]. Researching the thickness of the coal seam in the study area and analyzing the controlling mechanism of coal seam development will provide an important guidance for the coal exploration in Longdong area.



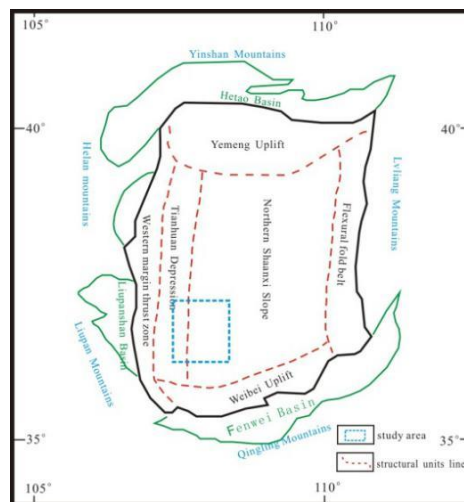


Figure 1. The study area in Ordos Basin

2. The distribution characteristic of coal seam

Yan'an Formation is the most important coal-bearing stratum in Longdong area and the total thickness of coal seams can be over 40m[4].

In the vertical direction, coal seams 9 #, 8 #, 6 #, 5 # and 2 # are developed from bottom to top. Coal seam 8 # is located in the low part of Yan'an Formation, the thickness of it ranges from 3m to 8m, which is a main area for exploration and has great economic value. The coal seam 6 # and 5 # located in the upper part of coal seam 8 # are medium-thin, the exploration potential of them is less than coal seam 8 #. The coal seam 2 # in the top part of Yan'an Formation is so thin that it is unfavorable for exploration.

In the horizontal direction, the coal seams of Yan'an Formation are thick in the west and south, while they are thin in the east and north. The west of Qingcheng-Heshui is the main area of coal resources distribution, while the east of Zhengning-Huachi is the area with little coal seam development. There are several accumulation centers in the western region of the study area, such as Huanxian area, where the maximum thickness is up to 20m, in the northern part of Zhenyuan the thickness of the coal seam is over 25m, and in the southern part of Longdong area, the thickness can reach 30m, such as in Huating area, which is a coal accumulation center, the maximum thickness here can reach 40m. It can be seen that the coal seams of middle Jurassic Yan'an Formation are widely developed in Longdong area, and there are many coal-accumulating centers(fig.2).



Figure 2. Contour plot of coal Seam thickness of Yan'an Formation in Longdong area

3. Characteristic of Coal Logging Curve

Different rocks have different characteristic of logging curve. The general characteristics of coal seam logging curve are high resistivity, high neutron porosity, high interval transit time, low density, low natural gamma, low photoelectric capture cross section [5,6]. Yan'an Formation in Longdong area is a continental coal-bearing stratum. It is mainly composed of mudstone, siltstone and fine sandstone, gritstone and coal. The geophysical characteristic of coal is different from that of other rocks, and its logging curve is also different, so its geophysical logging characteristic is easy to be distinguished from others. Low gamma ray, low density and high resistivity are the main logging characteristics of coal, namely “two low and one high” (table 1, fig. 3).

Table 1. Geophysical logging data of coal seams

Logging parameter	Coal seam 2#	Coal seam 5#	Coal seam 8#	Notes
LL3($\Omega \cdot M$)	85-216	106-248	382-1545	Resistivity
GR(Pa/kg)	0.06-0.17	0.08-0.24	0.02-0.06	Gamma ray
DNL(g/cm ³)	1.28-1.56	1.30-1.58	1.32-1.44	Density

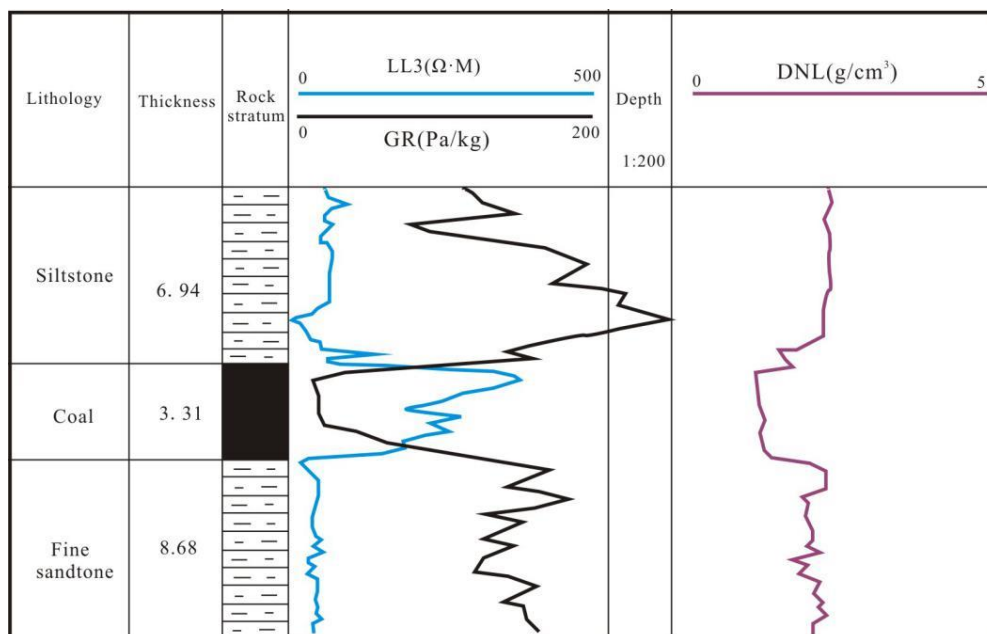


Figure 3. Characteristic of logging curve of coal seam 8# in Yan'an Formation in Longdong area

4. Controlling factors of coal accumulation

In the Middle Jurassic, the climate is humid and the plants are flourishing, Longdong area is in a relatively stable depression stage. The rivers, lakes and swamps are formed (Fig. 4), and the main coal-bearing strata are deposited in the area[7]. However, due to the changes of sedimentary environment and regional heterogeneity, the distribution of coal seams is different in vertical and horizontal direction, the characteristics of different coal seams may vary, and even the same coal seam in different regions has different features. These differences are further showed in the differences in coal seam logging curves.

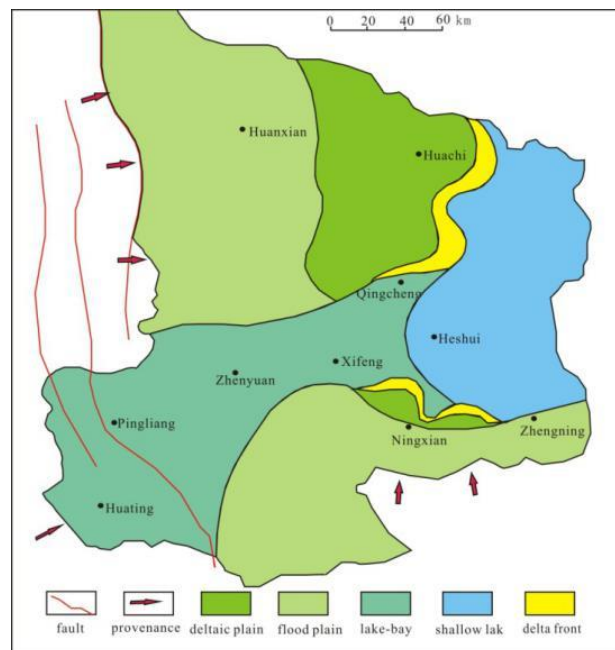


Figure 4. Palaeogeographic plot of Yan'an Formation in Longdong area

In the early period of Yan'an Formation, due to the settlement caused by regional crustal subsidence and differential compaction of sediments, Longdong area entered a relatively stable depression stage, at which, the floodplain became swamped gradually with the rise of the water table. Warm and humid climate makes a lot of vegetation flourish in the vast swamp which evolved into a large peat swamp slowly. Under the influence of climate and paleotopography, Longdong area went through a long period of swamping in which the peat swamp developed steadily. As a result, the coal seam 8 was thick and with good continuity.

During the middle period of Yan'an Formation, the settlement in this basin continued steadily and a large area of lake transgression occurred in the area, which formed a vast delta plain. Swamps were mainly distributed in North-South strips, which provided a basis for the development of coal seam 6#. Subsequently, the stable and gentle settlement made the delta plain become a large area of abandoned swamp, in which the relatively stable coal seam 5 # formed.

In the late period of Yan'an Formation, frequent tectonic movements caused incomplete sedimentation, and the coal-forming swamps last a short period of time and are small. So the coal seam 2# is thin and with a limited area.

5. Conclusion

The central and western Longdong area is the main developing area of coal seams, the coal seams are thick in the west and thin in the east, and thick in the south and thin in the north. The thickness of coal seam in this area ranges from 10m to 30m, so Longdong area has great potential for exploration and economic development. Middle Jurassic Yan'an Formation is the main coal-bearing stratum in Longdong area. Coal seam 8 # is a main area for exploration and has great economic value, the exploration potential of coal seam 6 # and 5 # are less than coal seam 8 #, and coal seam 2 # in the upper part of Yan'an Formation is so thin that it is unfavorable for exploration. The warm and humid climate, palaeogeographic environment of swamp facies, palaeo-vegetation and late tectonic movement influenced the formation and distribution of coal in Longdong area.

Acknowledgments

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References

- [1] Junjie Yang. Tectonic evolution and Oil-gas reservoirs distribution in Ordos Basin. Beijing: Petroleum Industry Press, (2002) 104-108
- [2] Wenhui Huang, Weihua Ao, Chengmin Weng. The characteristics and genesis of Jurassic coal in Ordos basin. *Modern geology*, (2010) 1186-1197
- [3] Pu Wang. Characteristics of coal resources in Gansu Province. *Chinese coal geology*, (2014) 17-22
- [4] Fengjie Li, Duoyun Wang. Sedimentary facies characteristics and sequence stratigraphic analysis of Yanchang Formation in Ordos Basin, *Journal of sedimentation*, (2006) 449-554
- [5] J. A. Martin, geomechanical approach to evaluate brittleness using well logs: Mississippian limestone, Northern Oklahoma. Texas: The University of Texas at Arlington. (2015) 213-219
- [6] Songyang Zhang. Current situation and development trend of coalbed gas geophysical logging technology. *Logging technology*, (2009) 9-15
- [7] Shuangmin Wang, Yuping Zhang. Characteristics of Jurassic Coal Accumulation in Ordos Basin. *Earth Science Frontiers*, (1999) 147-155