Hydrogeological Condition Analyses of Shatan'sNianfa Coal Mine in Huairen, Guizhou Province

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Abstract. Hydrogeology condition of Shatan'sNianfa Coal Mine in Huairen, Guizhou province was analyzed in this paper. The study shows that: 1) the main water bearing strata of mineral deposit are Longtan group (P3l) and Maokou group (P2m) with the water-abundance weak to moderate; 2) the coal mine takes water filling in karst aquifer as the principle thing, with water inrush from seam floor and mineral deposits with karst water of simple but partial medium hydrogeological conditions as the main thing; 3) Regional structure mainly is faultage; Most place of coal mine located in the hydrogeological unit drainage area with the layer distributed as single and inclined shape and the structure has no feature of rich water; 4) Within the mining area, terrain landform is complex with mining hydrogeological conditions is simple partial medium.

1. Introduction

Coal is an important resource, and the power system of China relies much on coal[1-2]. Coal mining is a high risk work[3-4], so the project geological analysis of coal mine is a necessary work. Guizhou province is rich in coal mine, so this paper has analyzed hydrologic geology conditions of Nianfa coal mine project at Shatan, Huairen city, Guizhou province, and gives guidance to coal mining.

2. Geological background

Nianfa coal mine locates at Shatan town, Huairen city, Guizhou province, and belongs to Shatantown, Huairen city. The mine and surrounding area stays at west side of Erlang syncline Yangzi (Pt) paraplatform (Z-T2), north Guizhouplatformuprise, north Zunyi (D-C) broken archtectonic deformation region (the detail is showed in the region geological map). It mainly includes carbonatite and clastic rocksdeposition, and the direction of strata is north east, the tendency is south east, the dip angle is 14 to 20°. The exposure strata of this area, from ancient to new, are: Cambrian system, Ordovician, silurian system, Dyas, triassic system, Jurassic system, quaternary system, which are sporadically distributed at the strata of different eras (Fig.1). Coal measures are longtan formation, which are siltstone clay rock with carbonatite and coal (seam) multilayers.

In the middle part of syncline, north and west part develops form north and east direction into Masangping fault and Huangnipo fracture, whose features are as follows: erlang syncline dam starts from Guantian dam at the south and west direction to erlang dam at the north side, which shows the trend from north and east direction to south and west side for about 28 km. The strata of both wings are symmetry, the core strata is Jurassic system Shaximiao team (J_2s), the exposure field at two sides is Jurassic system artesian well group ($J_{1\text{-}2}zl$), triassicsystemXujiahe team (T_3xj), Songzikan team (T_2s), Maocaopu team (T_1m), Yelang formation (T_1y), DyasShangtongChangxing team (P_3c), Longtan formation(P_3l),ZhongtongMaokou formation (P_2m), Xixia team (P_2q), silurian system (S_1). The coal seam is in the strata of DouShangtong and Longtan formation.

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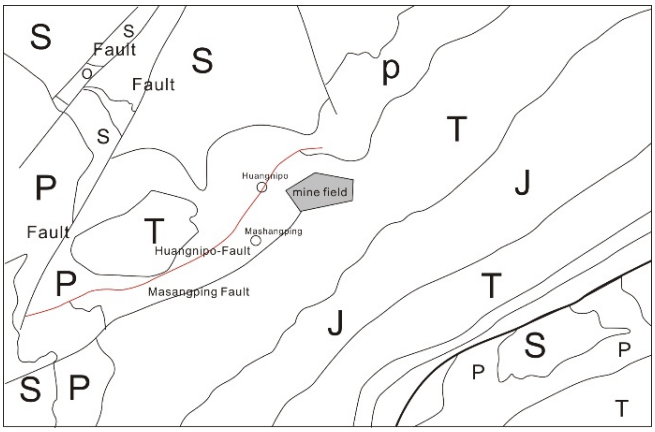

Fig.1 the geological map in the researched area

3. Topography and hydrology

Erosional ladder-like terraced landscape is the main character in the coal mine with entrench valley and large slope. Overall terrain in this area is south is higher than that in north with the highest elevation of 1095.3m (Nver Cliff) and the lowest 340m (Tongzi River) with the maximum altitude difference of 755.3m. The first mining area is 335m elevation in shallow with the lowest elevation control of deposit at 240m. There is no shallow ground and river distribution in the mining area with TongZi valley located in the north of the coal mine and Chishui River to the southwest with water in Tongzi River flowing into Chishui from east to west. All the surface water in mining area is discharged into Tongzi River. In the coal mine area, the karst cave is relatively abundant. Based on the survey, there are 4 springs and 5 karst caves in this region. The flow of the spring is between 0.002-3.058L/s and the karst cave depth is between 1.2-10m.

4. Aquifer (Aquiclude) in mine lot

According to the aquifer properties, aquifer (Aquiclude) in mine lot can be divided into the following several parts: Quaternary unconsolidated rock pore water aquifer, carbonate rock karst water aquifer of Lower Triassic thatched group, Lower Triassic Yelang Formation of yulong mountain, Upper Permian Changxing Formation, Permian middle Maokou Formation and Qixia Formation. Clastic rock fissure water aquifer of Lower Triassic Yelang Formation Section 9 beach, Shabao bay section and Upper Permian Longtan Group and Upper Silurian Hanjiadian Formation. The systematic analysis shows that underground water of the Quaternary unconsolidated rock pore water aquifer would pose no threat to water filling of the deposit, underground water of the carbonate rock karst water aquifer of Lower Triassic thatched group usually exists in the karst in the space through the form of pipe water with extremely uneven distribution and strong watery. Water abundance of clastic rock fissure water aquifer of Lower Triassic Yelang Formation Section 9 beach is weak which can be seemed as the relative impermeable layer. Carbonate rock karst water aquifer of Lower Triassic Yelang Formation of Yulong Mountain is one of the main aquifer. Carbonate rock karst water aquifer of Upper Permian Changxing Formation is covered in coal-bearing rock series and has constitutes the indirect water filling aquifer among the deposits. Clastic rock fissure water aquifer of Upper Permian Longtan Group has constitutes the immediate roof of the deposits series and has become the direct filling water of the deposit. Carbonate rock karst water aquifer of Permian middle Maokou Formation is one strong aquifer which characterized by a high degree of karst development and large water-bearing capacity and has become the indirect water filling for the deposit water filling.

5. Hydrogeological feature of structured fault belt

According to the survey, large-scale fault F1 is only cultivated in the north-west wing of the mining with F1 distributed along the laoweng Grave and Xinwuji; fault trend is 35～50°north by east and tendency 125～140°and inclination angle 45～60°with the nature as high angle normal faults. The fault throw is 300～345m. Due to the large fault throw of F2, there is a certain guide of water-bearing strata and coal bearing strata. However, it is discovered through the ZK101 drill that floor level of the C15 coal bed is 515.5m and it is also found out that water level of Maokou group is 359m by ZK101 drill based on the data analysis of water level of Maokou group, which is far lower than that of C15 coal seam floor elevation in the nearby. Therefore, there would be little influence towards the coal bed exploitation in this section.

6. Groundwater flow field in mine lot analysis

Water stage stabilization and observation towards the coal beds, overlying the underlying and the Maokou group among the five drills in the construction have been done in this study and points are mentioned as below (Table 1-2): Mining lot is located in the drainage area, which is a non-holonomic hydrogeological unit. Mine groundwater recharge areas are mainly distributed in the Tongzi River which is located in the northeast of the mine lot. Besides, groundwater flow condition in general is controlled by Tongzi River, which left groundwater stream flow from southwest to northeast as a whole and set Tongzi River valley as the final discharge place of underground water in mine area. The existence, runoff and discharge of groundwater in the mine area are strictly controlled by geological structure and characteristics of karst development. Hydrogeological conditions combination in mine lot and local part formed the specific deposit hydrogeological conditions and groundwater flow field in the mine lot and plays an important role in controlling the future mine water filling conditions. From the vertical direction, it can be reflected from the simple hydrology observation data during the exploration drilling construction in the mine lot that underground water level in the drill dropped with the increase of the drilling depth and the underground hydraulic connection among aquifers manifested that the upper layer supplies the lower strata. This also indicates that mining area locates at the drainage area of the hydrogeological unit and mining area groundwater flow from southwest to northeast and eventually discharged into Tongzi River.

Table1 T1y2～P3c and P3l Static level statistics in Nianfa mine lot

Drilling No.	Opening elevation (m)	Static water level elevation (m)
ZK101	809.11	519.10
ZK102	968.62	539.06
ZK201	1006.78	524.65
ZK301	440.84	410.73
ZK302	594.42	453.14

Table2 P2m Static level statistics in Nianfa mine lot

Drilling No.	Opening elevation (m)	Static water level elevation (m)
ZK101	809.11	359.13
ZK102	968.62	362.83
ZK201	1006.78	356.82
ZK301	440.84	349.82
ZK302	594.42	351.27

7. Surface water and its influence on deposit water filling

Surface water in the mine area is the Tongzi River which is located in the northeast outside the mine lot. Most of the running-through formation of Tongzi River is Maokou group (P2m) which is

the direct floor of the bottom layer the Coal. In the future, when the mining elevation is lower than riverbed elevation (340m), the river water may cross though the dissolution fractures and karst pipe of Maokou group and thus cause water filling of mine. Therefore, it should be paid attention to the prevention and treatment of floor water inrush when mining elevation is lower than 340m.

8. Hydrogeological characteristics of old mine area

There are totally 6 old mine areas in coal outcrop line area. According to the visit and investigation, the coal mining has a long history; however, the scale is generally smaller due to the mining technical conditions is relatively backward and it is mainly for the excavation by local people and with few of them outbound. Even some of the well has been blasted or shut down. The location of cropline aperture of the old mine lot is relatively higher with the tunnel depth no larger than 30m which is located above the underground water level and within the seasonal change belt. Water accumulation in the tunnel mainly comes from underground water of the coal beds. Due to the weak watery and small gob area, the volume of water is relatively small, all of which are located above the mining elevation and most of the old mine water has been transmitted along with the main adit.

9. Conclusions

Through the comprehensive study of hydrological geology, it can be concluded that: 1) Most of the ore bodies in the mine lot are located above the local minimum base level of erosion (elevation 340 m) and the primary aquifer and plenum of the ore deposit are Longtan group (P3l) and the Maokou group (P2m), with the watery weak to moderate. Among them, the coal beds has little effect on water filling deposit coal beds and Tongzi river is the surface water body in the mine area with the limestone of the Maokou Formation as the flowing-through formation. Besides, when the mining level is lower than the river bed elevation, the river may go through karst fissure and karst pipe and thus make influence on water filling deposit; 2) the coal mine takes water filling in karst aquifer as the principle thing, with water inrush from seam floor and mineral deposits with karst water of simple but partial medium hydrogeological conditions as the main thing; 3) Regional structure mainly is faultage; Most place of coal mine located in the hydrogeological unit drainage area with the layer distributed as single and inclined shape and the structure has no feature of rich water; 4) Within the mining area, terrain landform is complex with Tongzi River as the surface water body in the region and thus the river may go through karst fissure and karst pipe and thus make influence on water filling deposit when the mining level is lower than the river bed elevation. Comprehensive analysis reveals that mining hydrogeological conditions is simple partial medium.

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