

Analysis of the Environment and Characteristics of Mine Geological Disasters in Muhedete Region, Qinghai Province

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Keywords: Muhedete region, Qinghai province, Mine geological disasters, Occurring environment, Analysis of characteristics

Abstract: The Muhedete region of Qinghai province is located in the west of China and is the main production area of China's mineral resources. In recent years, relevant departments have begun to focus on the superior geological and metallogenic conditions there, but at the same time, there is also increasing frequency of geological disasters in mines with the continuous strengthening of mining efforts. In response to this situation, it is necessary to analyzed the environment and characteristics of the mine geological disasters in Muhedete region, Qinghai Province. After discussing the environment where mine geological disasters occur in the Muhedete region of Qinghai Province, analysis was given to the characteristics of mine geological disasters there, with the purpose to reduce the probability of mine geological disasters there and provide a theoretical basis for future prospecting and mining work there.

1. Introduction

The Muhedete region in Qinghai is densely covered with ore deposits, and the mineralization geological conditions are very superior there. According to survey data, a total of 478 small ore deposits, 96 medium ore deposits and 42 large ore deposits had been discovered in the Muhedete region of Qinghai Province as of the end of 2018. Based on the geographical characteristics of the Muhedete region of Qinghai Province, this paper conducted a characteristic analysis of the basement and geological surface layer, and pointed out the signs of geological disaster-prone areas there ^[1]. On this basis, the analysis of the environment and characteristics of mine geological disasters in Muhedete region of Qinghai Province will provide the direction for the future prevention and control of mine geological disasters there. According to the analysis of the corresponding laws and characteristics of the occurrence of mine geological disasters in the Muhedete region, advanced technology and diversified exploration techniques are used to further analyze the geological disasters of the mines there. The section of Muhedete region from the Kunlun Mountains to the east into Qinghai is part of the Qinghai silver polymetallic ore. At the same time, the mineralization geological conditions of this region present obvious advantages in western China. Reducing the probability of accidents of mine geological disasters is the focus of this research, and the factors that can directly affect the probability of mine geological disaster accidents include three aspects: hydrogeology, engineering geology and environmental geology. Whether it is a problem in either hydrogeology or engineering geology, it will seriously affect the geological environment of the mines in Muhedete region of Qinghai and cause serious geological disasters, thereby leading to a series of more serious safety accidents, which will result in irreversible damages to regional environment and the whole society ^[2]. Therefore, it is necessary to do a good job of preliminary exploration work and master more comprehensive geological data of Muhedete region of Qinghai Province as much as possible before proceeding to the mine project there. Then, a more sustainable mining engineering can be developed through continuous improvement and perfection of the mining engineering plan, thereby avoiding the occurrence of serious geological disasters. In response to this situation, it is necessary to analyzed the environment and characteristics of the mine geological disasters in Muhedete region of Qinghai Province. The analysis results obtained through more scientific analysis are more conducive to improving the operability of geological disaster protection measures in the Muhedete region of Qinghai, thereby

effectively ensuring the safe development of mineral resources there.

2. The Environment of Mine Geological Disasters in Muhedete Region, Qinghai Province

The Muhedete region totally covers 45.27 million square kilometers, and it is the region with the largest output of mineral resources in western China. According to the classification of landforms, the whole area of this region can be divided into the Hanbuda mountainous area and the Qaidam basin plain. In the environmental analysis of mine geological disasters in this area, it is necessary to clarify the main hidden safety hazards and threats in the construction of mineral resources mining projects. The environment of the mine geological disasters in the Muhedete region of Qinghai province was analyzed from three aspects in this paper: natural geographical environment , hydrogeological environment and geological structure environment.

2.1 The Natural Geographical Environment of the Occurrence of Geological Disasters

The environmental analysis of mine geological disasters in Muhedete region first focused on the natural geographic environment. The Muhedete region of Qinghai lies between $99^{\circ} 02' \sim 99^{\circ} 02'$ east longitude and $36^{\circ} 18' \sim 36^{\circ} 45'$ north latitude, and is located in the southeast corner of the Qaidam Basin. It is cool there, with Inadequate rain all year round, and it belongs to the plateau continental climate. The annual average temperature in Muhedete region is around 4°C , and the average annual precipitation is 228.6 mm. This region is 3128 meters above sea level and presents an oval shape. Muhedete region is one of the top ten mineral resources in Qinghai Province. As many as forty mineral resources have been discovered there, including coal, iron, manganese, copper, lithium, zinc, lead, boron, gold, magnesium salts, potassium salts, graphite, wollastonite, etc. In particular, mineral reserves such as iron, graphite, and wollastonite rank among the top in the province. As most of the landforms in Muhedete region belong to the Hanbuda mountainous area, many problems in geological disaster accidents are systematically related. If there is no comprehensive research and insufficient assessment and cognition of the risk of geological disasters, secondary disasters will result.

2.2 The Hydrogeological Environment of the Occurrence of Geological Disasters,

To analyze the causes of geological disasters in Muhedete region, Qinghai Province, it is needed to first determine the hydrogeological environment of geological disasters there. Corresponding risk assessment factors can help determine the proportion of risk assessment factors, thereby complete the next step of dividing the degree of risk of geological disasters [2]. The hydrogeological environment of the occurrence of geological disasters includes the mine's own geological structure, rock and soil properties, and hydrogeology. The three evaluation factors were used in this paper to analyze the hydrogeological environment of geological disasters in Muhedete region.

In the process of analyzing the hydrogeological environment of mine geological disasters in the Muhedete region of Qinghai, the topography and landform of the mines there are one of the risk assessment factors that cannot be ignored. It is not only necessary to survey the rock formations and rock mass properties in the area where the project needs to be carried out, but also analyze the hydrogeological environment of the geographical location of the construction area from a macro perspective. The investigation of the hydrogeological environment shows that the mines in Muhedete region of Qinghai mainly present slopes, gullies and other topographic structures, which means a high probability of occurrence of geological disasters. Therefore, this area belongs to a relatively high-risk hydrogeological environment. In the process of analyzing the hydrogeological environment of occurrence of geological disasters, it is necessary to scientifically conduct deep hydrogeological exploration on the basis of surveying topography and landforms through advanced technical means, so as to fundamentally reduce the occurrence of high errors in the assessment results of geological disasters caused by ignoring the hydrogeological environment, and thereby improve the accuracy of the assessment of geological disasters. In addition, in the process of assessing the risk of mine hydraulic environment geological disasters, the degree and direction of

the development of geological disasters are also the main risk assessment factors, as well as one of the factors that affect the accuracy of the geological disaster assessment results [3]. In the evaluation process, attention must be paid to the associated reaction between the mutual influences of geological disasters. If the environment of geological disasters in Muhedete region is judged only based on the impact of a small part of the mines in that area, it may lead to more serious engineering accidents. The analysis of the hydrogeological environment of the occurrence of geological disasters can effectively avoid high-risk geological disasters caused by the construction of water conservancy projects, such as loosening of water bodies, collapse, etc., which can greatly reduce the irreversible losses caused by geological disasters to mine projects.

2.3 The Geological Structure Environment of the Occurrence of Geological Disasters

According to the current situation of mining development and geological structural environmental problems in Muhedete region, Qinghai Province, the current situation of mining geological environment is divided into four categories: zones strongly affected by geological environment, zones greatly affected by geological environment, zones affected by geological environment, and zones slightly affected by geological environment. The specific zoning standards are shown in Table 1:

Table 1 the Division Of the Mine Geological Structure Environment in Muhedete Region, Qinghai Province

Division name	Mine type	Geological disaster
Strongly affected zone	Large	Large-scale ground collapse
Affected zone	Middle	Landslides, mudslides
Slightly affected zone	Small	Small-scale ground collapse

It can be seen from Table 1 that in order to completely restore the geological environment of the mines in the Muhedete region of Qinghai Province, new technologies and equipment must be adopted. It is needed to focus on making full use of assessment methods for environmental impacts, and conduct in-depth investigations and studies on low-grade, complex and difficult-to-use mineral resources and the efficient and comprehensive utilization of tailings resources. It is also significant to be committed to solving the problem of landslides caused by vibrations due to engineering construction, and realizing low consumption, low emission and efficient mining of mineral resources in a true sense.

3. Analysis of Characteristics of Mine Geological Disasters in Muhedete Region, Qinghai Province

The occurrence of geological disasters in mines in an area inevitably have certain related characteristics. In the analysis of the characteristics of mine geological disasters in the Muhedete region of Qinghai in this article, attention was first given to the ore-controlling structure of disasters. Then, the author divided the degree of danger of geological disasters by analyzing the fold forms.

3.1 The Ore-Controlling Structure of Geological Disasters

The main content of the ore-controlling structure in Muhedete region in Qinghai refers to the comprehensive and effective control of the ore body shape and scale of mineral resources. Combining the actual factors in the exploration and development process of Muhedete region of Qinghai, it was found that abnormal changes in the fold shape occurred during the exploration of the wing body rock dike [4]. In addition, the deformation of the rock or the surface of the ground leads to a relatively obvious control effect on the metal ore; the northern ore belt in the Dachang area is composed of an overall dorsal syncline and an opposite oblique, and the central axis of the dorsal syncline mainly originates in granite marble; and the rock mass strikes about 45°.

Before the specific implementation of prospecting there, it is necessary to carry out a purposeful analysis of the characteristics of ore-controlling structures in the mining area. The method of fault numbering was used in this article to analyze the characteristics of the ore-controlling structure, and

the corresponding fault strike as well as the fault tendency and controlled subject of mineral resources were taken as the basis to determine the ore-controlling structure of Muhedete region. The specific information of the ore-controlling structure in the Muhedete region of Qinghai Province is shown in Table 2.

Table 2 the Ore-Controlling Structure of Muhedete Region, Qinghai Province

Fault number	Fault trend	Fault tendency	Controlled subject
F1	NNE	30°	Hanging wall of the fault zone
F7	NWW	18°	Footwall of fault the zone
F9	NWW	60°	Both sides of the fault zone
F10	NNE	50°	Both sides of the fault zone

3.2 The Fold Form of Geological Disasters

The variation of the fold form of geological disasters has positive effects on the output of mineral resources, and thus it is necessary to fully understand the fold form in actual areas. In the fold form analysis of Muhedete region in Qinghai must follow the specific impact of the surrounding environment on the mineral resources. Whether it is from the surface layer of the ground, the state of related fold-deformed rocks, or the trend of mineral resource output changes, the morphological characteristics of the fold-controlling ore in the Muhedete region are as follows.

Due to the different morphology of the metallogenic regions on the north and south sides, the fold mining areas in the Muhedete region of Qinghai Province are from north-by-east to south-by-west, and some areas that produce folds have been damaged or fractured by volcanic rock formations or geological plates that have changed excessively due to different commitments. The Muhedete region presents a fold pattern of geological disasters, and its body layered fold structure is shown in Figure 1 below.

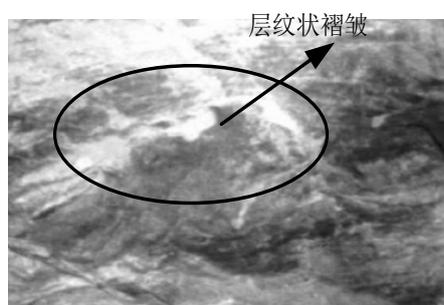


Fig.1 Stratified Striated Fold Structure Rock Mass

According to Figure 1, the fold patterns of ore and rock in Muhedete region in Qinghai Province have different degrees of impacts on metal ore formation or mining area development. The fold form of Gemalong silver polymetallic deposit in East Kunlun, Qinghai, is a special pattern. The main reason for its formation is geological expansion and cracks, and it is widely distributed in the vicinity of Muhedete region. According to the analysis of the fold forms of geological disasters in Muhedete region of Qinghai Province, it is clear that different independent mining areas that do not interfere with each other overlap with the horizontal or vertical cracks at the same time as the mining areas that form the fault zone [5]. Due to the complex topography of the Muhedete region, most of the mine groups are parallel or intersecting each other, which will have certain impacts on the characteristics of mine geological disasters there. Therefore, there is a need to use a combination of a variety of survey methods to maximize the control of the characteristics of geological disasters by analyzing the fold forms, so as to provide a better development space for the prospecting work there and build a theoretical basis for improving the safety of mining work.

3.3 Risk Degree of Geological Disasters

The risk degree of geological disasters is divided based on the analysis of the ore-controlling structure and the fold forms of geological disasters in Muhedete region, Qinghai Province. After determining the risk assessment factors of geological disasters there, it is necessary to clearly divide

the degree of the geological disasters through specific analysis of these factors [5]. Based on the comprehensive consideration of the potential risk assessment factors summarized in this article, the author combined with relevant historical data to classify the risk degree of geological disasters in Muhedete region, Qinghai Province.

Table 3 Standards for The Classification of the Risk Degree of Geological Disasters in Muhedete Region, Qinghai Province

Standard		Parameter	Risk degree
Landform	Topography of the mine presents slope angle	<13°	Low
	Sloping slope is soil	38m~21m	Middle
	Inclined slope is rocky	>25m	High
Hydrogeology	The influence of groundwater on mine rock mass	Small	Low
	The influence of surface water on mine rock mass	Middle	Middle
Geological structure	Development degree of ground fissures	Distance> 1.05m	Low
	Basic magnitude of earthquake	VI	Middle

It can be seen from Table 3 that under the precondition of ensuring the green and sustainable development of Muhedete region, a series of work must be carried out to strengthen the mining safety of local mineral resources while ensuring the personal safety of staff. Therefore, it is of practical significance to analyze the environment and characteristics of mine geological disasters there.

4. Conclusion

In order to solve the problem of insufficient supply of mineral resources in China, it is imperative to carry out a large amount of mineral resources mining in the Muhedete region of Qinghai Province. The analysis of the environment and characteristics of mining geological disasters there provides a good theoretical basis for the prevention and control of geological disasters there. In terms of shortcoming in this paper, there is no in-depth study of the evolution process of mine geological disasters in the analysis of the environment and characteristics of mine geological disasters in Muhedete region in Qinghai. Therefore, the evolution process of mine geological disasters based on the Muhedete region can be used as a relevant future research direction.

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