

Preliminary study on treatment methods of environmental geological disasters in abandoned mines

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Abstract: The destructive power of geological disasters is quite large, which will not only seriously threaten the safety of life and property of the country and people, but also cause great pollution and damage to the ecological environment. Therefore, it is very necessary and urgent to strengthen the treatment of geological disasters in the abandoned mine environment. This paper will analyze the types of environmental geological disasters in abandoned mines, and put forward the principles, ideas and Strategies of controlling geological disasters, hoping to greatly improve the treatment effect and curb the occurrence of geological disasters, so as to create favorable conditions for the restoration of mine environment.

1. Introduction

China is rich in mineral resources. Through the development of minerals, enterprises can improve the level of interests of enterprises and maintain the continuity of enterprise production. However, in the process of mine development, mountains will be damaged, crushed stones and waste residues will be stacked near the mine, causing water and soil loss. In the rainy season, slopes will be damaged, a large number of crushed stones will be inclined, and the lives of surrounding residents will be endangered. The above problems often occur in abandoned mines, which also highlights the importance of environmental geological disaster treatment in abandoned mines. Relevant units need to attach great importance to this work and implement relevant work in practical work. Underground iron ore mining causes geological disasters such as mountain collapse, ground fissures, collapse and slope instability, which threaten the safety of people's lives and property, and cause ecological environment problems such as soil erosion, topographic landscape damage and vegetation damage. Relevant measures need to be taken to further eliminate the hidden dangers of geological disasters and restore the ecological environment. These measures have achieved remarkable control results, which can provide reference for comprehensive management and ecological restoration of mine geological disasters in similar areas^[1-2].

2. Types of environmental geological hazards in abandoned mines

2.1 Ground and Goaf Collapse

It mainly occurs in underground mines mined by shaft. As some ore bodies are distributed on the shallow surface, the stratum structure is damaged after mining, resulting in surface voids, thus forming the mine goaf. The goaf is close to the ground and its bearing capacity is weak, so it is very easy to collapse in the goaf. In addition, although the soil layer in the goaf of the deep ore body has a certain thickness, if it exceeds its bearing range or the stratum is under uneven stress, it will also suffer the geological disaster of ground or Goaf Collapse. Such geological disasters have a wide range of influence and strong destructive power, which usually lead to serious damage to ground buildings, transportation equipment and facilities, destruction of underground tunnels, and even destruction of cultivated land and water resources.

2.2 Hydrogeological pollution

Water pollution is one of the main geological disasters caused by abandoned mines. As a large

amount of groundwater is stored in the deep part of the mine, the groundwater resources are continuously used during the mining process, resulting in the continuous decline of its water level. With the gradual disappearance of the ore body, the water resources are collected again after the mine is abandoned, and the water level rises gradually. Once it contacts with the pollutants of the abandoned mine, it will cause new pollution, which will have an impact on the hydrological environment in the area. In addition, during mining, some pollutants infiltrate into the stratum with rainwater scouring and integrate with other water bearing strata, resulting in the rapid expansion of the polluted area. After the mine is abandoned, the original drainage system can not play a role. Because some polluted water can not be effectively discharged, it then flows into rivers and lakes through surface runoff, resulting in more serious pollution. For example, at the end of the 20th century, dozens of abandoned coal mines in Shaanxi Province in China once caused hydrogeological pollution. Due to the collapse of goaf and ground, the water level continued to rise, resulting in the pollution of water resources. The polluted water body flowed into the river through the surface, resulting in the sharp rise and overflow of water level, thus destroying a large number of farmland and swamping the surrounding soil, Seriously pollute the ecological environment.



Figure 1 Hydrogeological pollution

2.3 Air pollution

Due to the change of stratum structure during mining, the shallow surface above the goaf is prone to cracks and even ground collapse. However, effective measures have not been taken after the mine is abandoned, resulting in a large number of harmful gases and dust, thus forming an air pollution source. The abandoned mine goaf has become the best gathering place for air pollution sources. In the long run, harmful gases Dust spreads with ground cracks or Goaf Collapse, and fully blends with the external air, resulting in air pollution. At the same time, some minerals can spontaneously produce methane and other toxic gases in a closed environment. Because their emissions reach the upper limit, they will seriously threaten the life and property safety of the surrounding people after entering the atmosphere.

2.4 Stope slope instability, landslide and rockfall

Such geological disasters mainly occur in open-pit mines and their excavation sites, which are usually caused by a series of unreasonable mining technologies, such as excessive mining, imbalance of mining and stripping, improper slope support of mining site and so on. In addition, it is closely related to the natural environment, geological conditions and engineering characteristics. Due to the long mining duration, too steep slope angle and extremely poor stability, coupled with the serious damage of mountain vegetation and a large amount of gravel on the surface, it is very easy to cause landslides and rock avalanches under the impact of storm and rain.

2.5 Instability of yard and reservoir

Tailings dam contains a large amount of waste and slag, and its collapse is the culprit of debris flow. If response measures are not taken in advance, nearby residents will have no ability to resist debris flow, suffer immeasurable losses, and environmental problems will accelerate the deterioration.

3. Causes of geological disasters

3.1 Mining technical problems

The mining process of mines is often accompanied by the pollution of water resources and the destruction of stratum structure, which seriously affects the surrounding hydrogeological environment and groundwater operation system. In addition, the mining of minerals, such as coal mining, will destroy the coal strata in the stratum, and the water continues to go deep into the goaf after the mining of the coal strata, and has a series of physicochemical reactions with the materials of the coal strata, which makes the composition of the water more complex, and then causes water pollution. This is mainly due to the mining technology. During the mining process, the necessary technical measures are not taken, or the technical measures are not enough, which makes the water resources continuously polluted. On the other hand, it is also due to the failure to take technical measures in time after the mine is abandoned, which makes the goaf of the mine unstable, easy to collapse or crack, and further pollutes the water resources.

3.2 Weak awareness of environmental protection

Mining enterprises only care about the economic benefits brought by mining, but are indifferent to the environmental problems brought by mining. In addition, due to the weak supervision of the state, they have formed a high mining enthusiasm and blindly carried out mining. Even some individual enterprises adopt primitive mining technology, let alone the implementation of environmental protection measures, It was abandoned after mining, and there was no assessment of geological damage and implementation of treatment measures, which were caused by people's indifference to environmental protection.

3.3 Impact of environmental factors

Mines are mostly distributed in mountains, plateaus and other places. Their stratigraphic structure and geographical terrain are relatively complex, with more steep slopes and many geological faults. Under the influence of the natural environment, such as wind erosion, rain leaching and sun erosion, the rock mass is broken and separated, which is easy to cause rockfall disaster. In addition, due to the lack of corresponding environmental protection measures in the mining process, the vegetation in the mining area is greatly damaged, and the water and soil loss in the mining area is easy. In serious cases, landslide, collapse, debris flow and other disasters are more likely to occur, which are the adverse consequences caused by the destruction of the natural environment.

Table 1 Classification and development approaches of deep geothermal resources.

environmental factor	category
Natural factors	Wind erosion, rain immersion and sun exposure
Mining factors	Landslide, collapse and debris flow

4. Principles for environmental geological disaster treatment of abandoned mines

4.1 People oriented

In the process of controlling the environmental geological disasters of abandoned mines, it is

necessary to respect the needs of local residents, focus on the areas where residents' production activities are frequent, pay attention to the protection of the lives and property of local residents and construction personnel, and set up targeted avoidance measures. In case of sudden situations, workers can not evacuate in time, they can use avoidance measures to wait for rescue, Avoid casualties.

4.2 Principle of adjusting measures to local conditions

The geological conditions of abandoned mines are special. Some areas are suitable for cultivated land, some areas are suitable for planting trees, and some areas are suitable for fish farming. Before the treatment of environmental geological disasters of abandoned mines, staff need to comprehensively consider the land environment of abandoned mines, use appropriate measures to restore the ecosystem of abandoned mines, and highlight the effect of environmental treatment.

4.3 Principle of interest coordination

The treatment of environmental geological disasters in abandoned mines needs to integrate multiple parties, because this work is related to the interests of various units and departments, so it is necessary to coordinate the contradictions of all parties in the environmental treatment work, and the government needs to play the role of a link to deal with the problems in the treatment of environmental geological disasters in abandoned mines in time to avoid infringing on the interests of all parties. (4) Principle of fund saving: in the process of managing the abandoned mine environment, the staff need to design different work plans. The final work plan should have advanced technology and the lowest overall cost, guide the implementation of various management work, use the least cost to ensure comprehensive benefits and safeguard the interests of all participants

5. Prevention and control measures for environmental geological disasters in abandoned mines

5.1 Establish and improve the risk assessment and prediction system of abandoned mines

Mining is an industry with great risks, and abandoned mines also have great risks. Therefore, it is necessary to establish relevant systems to evaluate their risks in order to take effective prevention and control measures. Professional technical considerations such as geological structure detection and rock fault survey around the delineated area are the basic work to effectively establish and improve the risk assessment and prediction system of abandoned mines. To ensure the smooth construction of the system, we must take the road of improving technical means. Through modern scientific and technological methods such as hydrodynamic characteristic observation and permeability medium parameter determination experiment, and through tracking, testing and investigating the change and migration of groundwater quality and the possibility of water self purification, scientifically and accurately analyze and evaluate groundwater flow and its dynamic impact assessment, so as to ensure the implementation of the application of mine risk assessment and prediction system.

5.2 Establishment of abandoned mine risk identification system

There are two aspects of environmental geological disasters caused by abandoned mines: one is man-made, that is, the risk factors caused by man-made mining activities; The second is the objective factors, that is, the geological disasters caused by the long-term impact of the natural environment of abandoned mines. The treatment of environmental geological disasters in abandoned mines requires us to establish an overall risk identification system from the two aspects of Humanities and natural environment, so as to accurately understand the actual situation of disasters and take effective measures for this situation. The prerequisite for the establishment of the abandoned mine risk identification system is to scientifically and completely integrate a large amount of data such as the geological structure of the abandoned mine, the water conservancy characteristics of the aquifer, the climate, temperature and precipitation, the spatial physical form

and the vegetation coverage of the surrounding environment into the system data database in the technical field, and build the abandoned mine risk identification system based on this, Accurately identify the risk level.

5.3 Improve the geological disaster prevention system and introduce advanced prevention technology

Building a perfect geological disaster prevention system and actively introducing advanced prevention and control technology are not only related to the environmental geological disaster treatment of abandoned mines, but also steadily promote the smooth implementation of various safety prevention work before the mine stops mining. First of all, we must strengthen capital investment, such as establishing a special fund for the treatment of environmental geological disasters in abandoned mines, so as to avoid the inability of long-term sustainable treatment due to lack of capital investment, so as to ensure that we can enjoy more sufficient funds in the process of disaster treatment. Secondly, the treatment technology should closely follow the trend of the times, master the latest science and technology in the field of environmental treatment, integrate with international standards, and introduce advanced environmental geological disaster prevention and control technologies, such as filling new special materials in sewage purification projects and constructing hydraulic dams to curb the continuous expansion of pollution surface, so as to solve relevant treatment problems from the technical level.

6. Geological environment monitoring of abandoned mines

6.1 Monitoring tasks

The monitoring of the geological environment of abandoned mines shall cover all slopes within the mining area, and the deformation of slopes shall be monitored and recorded in real time. The monitoring work shall run through the whole construction process. The monitoring personnel shall timely report the problems found, and wait for the superior leaders to formulate and implement the solutions, so as to reduce the construction risk.

6.2 Design principles

The design of treatment scheme shall comply with the principles of reliability, multi-means, multi-level and three-dimensional monitoring, key monitoring of key parts and information feedback; Safety monitoring mainly focuses on safety monitoring during blasting, and blasting gravel splash is the focus of safety monitoring; The safety monitoring during construction and operation shall be combined and closely connected.

7. Conclusion

Abandoned mines can not be effectively treated and utilized, which is easy to cause safety accidents. At present, China's control technology in this field is not mature and has certain defects. Therefore, relevant personnel should strengthen learning and training in all aspects, improve the prevention mechanism of abandoned mines, ensure that the prevention and control work is in place smoothly, fundamentally eliminate the causes of geological disasters and ensure the safety of abandoned mines^[3].

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