

# Exploring Mine Engineering Geological Prospecting and Geological Disaster Control Countermeasures

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**Abstract:** Over the years, China's mining efforts of mineral resources has been continuously strengthened, and more and more complex mining has been mined by people, providing a large number of raw materials for China's industrial production. However, because some mines are loose managed and there is no unified control system, many mines may cause safety problems and even geological disasters in the process of mining. By analyzing the mine geological exploration work, it gives some disaster prevention countermeasures, hoping to provide some help to the mine exploration and mining.

**Keywords:** Mine engineering; Geological exploration; Geological disaster; Management countermeasures

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## 1. Introduction

China's industrial development has a very close relationship with various mineral resources. Only with sufficient mineral resources can there be enough raw materials for industrial production. In recent years, the frequency of mine exploration in China has been continuously increasing. Such exploration work is not only an exploration of mineral deposits, but also a basic judgment on the safety of mines, and a safety guarantee for mineral mining. Especially in some mines with complex geological conditions, the probability of safety accidents is relatively high. Once a safety accident occurs due to the lack of advance prevention of safety accidents, it will cause serious damage to the life and safety of workers in the mine. Therefore, mine exploration work is a necessary safety work before mineral mining, and it is a guarantee for the lives of workers.

## 2. Geological Survey before Mining

Generally, the geological survey work of the mine will be carried out before the official mining. It requires the staff to use the exploration equipment to detect and record the geological conditions of the mine, and combine the detected data to analyze the probability of a safety accident in the mine and the post-safety accident Severity. After

completing these judgments, the corresponding safety prevention and control work can be carried out on the mining site.

In the survey work, the staff will first conduct a comprehensive survey and mapping of the mine. This is the first survey task in the entire survey work and is the basis for all subsequent survey work. Therefore, in the process of surveying and mapping, it is necessary to ensure that the surveying and mapping data of the mine is accurate and detailed in order to ensure that the subsequent survey can proceed smoothly. After the surveying and mapping are completed, the mine needs to be surveyed. The staff will survey the actual construction site environment to determine the direction of the veins inside the mine and the distribution of minerals to lay the foundation for subsequent mining work. After completing these steps, finally, staff are required to measure and calculate the uncertain conditions such as groundwater in the mine to eliminate possible safety hazards<sup>[1]</sup>.

## 3. Geological Disasters during Mining

### 3.1 Collapse of the Ground and Mine Tunnel

In the mining process of the mine, because the rock strata will vibrate frequently, it is easy to cause collapse.

If the roof placement in the mine tunnel is not scientific enough or the strength of the roof and pillars is insufficient, it may cause the ground to collapse. In severe cases, it will even cause the collapse of the entire mine road, which will have a serious impact on the life and safety of the miners. In this regard, it is necessary to survey the mined-out areas in the mine in advance, and reinforce or landfill the mined-out areas in advance to prevent the mined-out areas from collapsing during subsequent mining. If the ground or mine has collapsed, it needs to be landfilled in time to avoid secondary collapse due to unstable structure.

### 3.2 Collapse Caused by Changes in Geological Structure

In the process of developing the mine, the vibration generated during the development process and the cavity generated during the process of excavating the mine tunnel will have an irreversible impact on the original geological structure of the mine. These internal structural changes will eventually become the inducement of geological disasters, leading to the collapse of the main structure of the mine. During the mining process, the mechanical structure of the mine is generally not excessively affected. The cause of the accident is generally the small cavity generated during the mining process and the force between the roof and the pillar built in the mine tunnel in advance. , Causing small changes in the internal structure of the mine tunnel, which in turn led to the collapse of the mine tunnel. After the completion of development and mining, the internal structure of the mine will undergo major changes, and there is a possibility of safety accidents. If the initial design of the internal mine pit is not scientific enough, and the internal roof is subject to excessive pressure for a long time, once these roofs are broken, they will generate a very large force in the rock, causing a rock burst, which is a kind of accident with greater damage<sup>[2]</sup>.

### 3.3 Water Inrush from the Mine

The problem of water inrush in the mine is relatively high during the mining process, and there will be no obvious phenomenon to remind the mining personnel before it occurs, which also makes the harm caused by the water inrush relatively serious. For this kind of problem, it is necessary to pay attention to the exploration of the mine, to investigate the distribution of groundwater and the goaf in the mine in advance, and to pay attention to these locations during the mining process to avoid the rapid influx of water into the mine. Affect the life safety of mining

personnel. During the exploration process, it is necessary for the investigators to record the distribution area and depth data of the groundwater inside the mine in advance, and check the water depth regularly during the mining process. If the water depth changes suddenly or the water depth exceeds the original safe range , It is necessary to promptly investigate the reasons for the increase in depth, and mining cannot be carried out unless the reason is confirmed. In addition to the sudden change in water depth, it may also cause the surrounding ground to settle and cause certain safety hazards. At the same time, with the advancement of mining progress, it is necessary to adjust the safe water level of groundwater, because under normal circumstances, with the continuous advancement of mining, the height of the groundwater level will continue to decrease. This situation will cause certain changes in the soil quality on the ground. The ground is more susceptible to changes in the water level, so it is necessary to strictly monitor the water level during the mining process.

### 3.4 Gas Explosion

During the mining process, because the mine tunnel is relatively narrow and deep, the ventilation in the mine tunnel is poor, and a large amount of gas often accumulates in the mine tunnel. If the mining personnel make mistakes in the mining process, it is likely to cause a gas explosion, causing a large area of casualties. If there is sulfide near the explosion, it will cause a fire after the explosion, which will cause a secondary explosion, which will have a serious impact on the overall structure of the mine.

## 4. Treatment Countermeasures for Mine Engineering Geological Disasters

### 4.1 Prospecting the Mine in Advance

Before the mining of the mine, the geological environment of the mine and the actual situation in the mine road should be surveyed in advance, the possible accidents should be prevented in advance, and the emergency response plan after the accident should be formulated to avoid the expansion of the accident damage. In the survey work, the staff need to check the equipment first, and use the survey equipment in accordance with the prescribed steps to avoid the accuracy of the survey due to operational errors or equipment failures. For the mined-out areas, key surveys are required in the survey work, because these locations often cause the collapse of the mine due to the imbalance of the forces, which are areas with higher risks. During the survey process, the staff will use the high-density resistance method to judge changes in geological

conditions based on the difference in resistance. Using this technology, in metal mines, due to the conductivity of metals and the low power transmission efficiency of air, it is possible to adjust the position that cannot be surveyed and judge its internal structure [3].

#### 4.2 Use 3S Technology for Survey

In today's geological survey process, the most commonly used is to use 3S technology to conduct surveys. The three Ss in 3S technology refer to GPS, RS, and GIS respectively. Among them, GPS technology is used to accurately locate some special geological environments inside the mine. RS technology is used to judge the damage to the geological environment, and simply express the damage in the form of data, which is convenient for subsequent processing. GIS technology is to analyze the data generated by geological disasters collected during the survey process. The application of these technologies can allow prospectors to have a more intuitive understanding of the geological environment of the mine, and reduce potential safety hazards during the mining process. If the mine has not been developed and mined yet, if you want to conduct an exploration in advance, you need to use geophysical prospecting technology to make simple detection of the environmental conditions inside the mine through ultrasonic or electromagnetic waves, to determine the geological conditions in the mine, and to avoid invalid development.

#### 4.3 Adopt a Combination of Long-term Exploration and Short-term Exploration

In the process of digging a mine tunnel, a combination of long exploration and short exploration should be adopted. First try a longer drilling machine to drill holes in the mine tunnel, and then use excavating equipment to expand the mine tunnel. In the process of excavation, it is necessary to keep the long exploration in front of the short exploration, play a role in the exploration of the geology in front of the mine, and reduce the possibility of safety accidents such as collapse. At the same time, during the survey process, if there is a geological disaster, the actual situation needs to be accurately recorded. The data should be as accurate as possible. If necessary, some pictures and other information on the site can be combined with the measurement data to form a geological disaster. The report material [4]. Finally, after the survey is completed, the survey results can be recorded in the format of a chart, as a simple database, so that the staff can use experience to judge some safety hazards in the future survey work, reduce the difficulty of the survey work, and improve the survey efficient.

#### 4.4 Establish an Automated Prevention and Control System for Geological Disasters

The prevention and control of geological disasters requires not only strict data statistics and judgments by investigators, but also a combination of automation and information technology to establish an automated prevention and control system for geological disasters. After the survey personnel collect the on-site data, they directly upload it to the prevention and control system. The prevention system calculates and analyzes the survey data based on big data technology to determine possible safety hazards and countermeasures. At the same time, GIS technology can be used to upload the geological conditions of the mining site to the prevention and control system in real time. When the data fluctuates severely, the prevention and control system can activate the alarm as soon as possible, allowing the mining personnel on the site to evacuate quickly and avoiding problems in the mine. Safety accidents caused large-scale casualties [5].

#### 5. Conclusions

Due to the needs of industrial development, China's development of mineral resources has been accelerating in recent years. However, the mining process of minerals is often accompanied by certain hidden safety hazards. It is necessary to carry out geological surveys in advance to avoid or deal with these hidden safety hazards to avoid the impact of these safety issues on the lives and safety of miners and accelerate the development of China's mineral resources. Promote the development of China's economy.

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