Application of Computer Program Combined with Magnetic Prospecting in Polymetallic Ore Prospecting

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Abstract. With the continuous progress and growth of human social and economic activities, the demand and consumption of polymetallic mineral resources are increasing. The current exploration and survey of polymetallic mineral resources has been difficult to meet the needs of human development, and there is an urgent need for technological upgrading and reform. Based on this, this paper first studies the characteristics of magnetic survey of polymetallic deposits, then analyzes the judgment and interpretation of magnetic anomalies of polymetallic ores, and finally gives the application of magnetic prospecting based on computer program in the survey of polymetallic deposits.

Keywords: Computer Program, Magnetic Prospect, Polymetallic Ore Prospecting

1. Introduction
With the development of social economy, the consumption of all kinds of mineral resources is increasing, especially the consumption of metal mineral resources, which is an important guarantee resource for the construction of all walks of life in society, continues to increase. In this context, how to improve the development and utilization of metal mineral resources has become the focus and hotspot of current research [1]. Generally speaking, the exploration and utilization of polymetallic mineral resources have several characteristics as shown in Figure 1 below, so higher exploration means are needed for efficient mineral resources survey.

![High risk](image)

Long cycle ↔ Difficult

Figure 1. The exploration and utilization of polymetallic mineral resources

The improvement of industrial mining technology has effectively promoted the efficiency of exploration and utilization of metal mineral resources, especially the development of computer
intelligence and automation technology, which makes the exploration of polymetallic mineral resources with higher pertinence and accuracy[2]. The combination of computer and magnetic exploration method can significantly improve the exploration efficiency and reduce the exploration cost. Therefore, it is of great practical value to study the application of computer program combined with magnetic method in the survey of polymetallic deposits.

2. Characteristics of Magnetic Survey for Polymetallic Deposits

2.1. Principle of magnetic survey
Due to the strong magnetism of large-scale polymetallic deposits, the application of magnetic exploration methods has brought a large space. The application principle of magnetic survey in polymetallic mines is mainly based on the detection of the magnetic field intensity on the ground. In the process of magnetic survey, the magnetic field on the ground is scanned symmetrically, so as to analyze the change of magnetic field in each cycle. If the magnetic field is symmetrical, it means that there is no external magnetic field[3]. If the magnetic field is asymmetric and one side reaches saturation more quickly, it indicates that there is an applied magnetic field along the axis. Based on this, the size of external magnetic field can be determined, so it is widely used in the exploration of polymetallic ore.

2.2. Characteristics of magnetic survey
The application of magnetic survey in the survey of polymetallic deposits has the characteristics of high efficiency, strong practicability, convenience and economy, as shown in Figure 2 below. Among them, the high efficiency is due to the high magnetic properties of most metal minerals, so it often affects the distribution of normal magnetic field around[4]. The application of magnetic survey can accurately and quickly identify the attributes of polymetallic ores, so it has a higher survey efficiency. Secondly, because the distribution of polymetallic ore is relatively scattered, and the proportion of each metal resource is also different, the application of traditional survey methods based on electrodes and wires is greatly restricted. However, the influence of external environment on magnetic survey is small, so it has high practicability.

![Figure 2. Characteristics of magnetic survey](image)

In addition, due to the traditional survey means need to rely on a large number of survey tools for assistance, not only low efficiency and poor accuracy, but also computer-based magnetic survey can directly output survey data, the process automation is high, accurate and convenient[5]. Magnetic survey based on computer can not only measure the state of polymetallic ore body, but also make a more feasible judgment on its attributes, so it does not need more auxiliary equipment and has higher economy.

2.3. Geophysical characteristics of polymetallic deposits
Through the analysis of the geophysical characteristics of polymetallic deposits, it can be found that the magnetic field characteristics of different metals are different. For example, the magnetism of magnets is the strongest, while the magnetism of different rocks is quite different. The magnetic difference parameters are shown in Table 1.

**Table 1. Geophysical characteristics of polymetallic deposits**

| Mine name | Magnetic maximum | Magnetic minimum |
|-----------|------------------|------------------|
| Magnetite | 787342           | 254796           |
| Granite   | 43244            | 0                |
| Gneiss    | 8746             | 0                |
| Dolomite  | 0                | 0                |
| Biotite   | 19342            | 0                |

3. **Judgment and Interpretation of Magnetic Anomalies in Polymetallic Deposits**

3.1. **Judging basis of magnetic anomaly in polymetallic ore deposits**
The judgment and interpretation of magnetic anomalies of polymetallic deposits need to comprehensively consider the geophysical data of geological relics\(^6\). Through the collection, comparison and analysis of these information, the magnetic field information obtained is compared with the data in the known information database, so as to summarize the exploration characteristics and laws of metal deposits, and determine the magnetic anomaly based on this.

3.2. **Interpretation of magnetic anomalies in polymetallic deposits**
Based on the judgment basis of magnetic field anomaly, the magnetic field anomaly of polymetallic ore is inferred, so as to solve the problems of geological anomaly and other geological anomalies. The following table 2 shows the judgment and interpretation of magnetic anomaly caused by discovered ore or polymetallic ore under mining, and the distribution of six magnetic anomalies with high magnetic field intensity is also shown in table 2.

**Table 2. Interpretation of magnetic anomaly caused by polymetallic ore**

| Magnetic anomaly       | Cause of magnetic anomaly                              |
|------------------------|--------------------------------------------------------|
| Magnetic anomaly I     | Caused by the extension of known ore or concealed ore body |
| Magnetic anomaly II    | Caused by known ore or concealed ore body             |
| Magnetic anomaly III   | Caused by granite syenite or concealed ore body       |
| Magnetic anomaly IV    | Caused by biotite granite or concealed ore body       |
| Magnetic anomaly V     | Caused by the known ore body                          |
| Magnetic anomaly VI    | Caused by the known ore body                          |
| Copper tin polymetallic ore | Caused by exposed surface or shallow magnetic geological body |

In addition, the magnetic anomalies of polymetallic deposits are closely related to the exposed strata, and there are many differences in magnetic characteristics between granite bodies and surrounding rocks in polymetallic mining areas. The gradient variation of anomalous morphology in horizontal section is close to the magnetic properties of mineralized rocks, but much greater than that of surrounding rocks. It can be seen that mineralized bodies can also cause magnetic anomalies of polymetallic deposits.

4. **Application of Magnetic Prospecting Based on Computer in Polymetallic Ore Prospecting**

4.1. **Computer based inversion of multi metal magnetic anomalies**
The inversion of magnetic anomalies in polymetallic deposits is based on the simulation of the geological structure and the evolution of magnetic parameters. The inversion of magnetic anomaly of
polymetallic ore based on computer needs to first measure the magnetic anomaly value of characteristic points, and then determine the geological model used for magnetic anomaly inversion. Secondly, based on the initial values of geological model parameters, the theoretical magnetic anomalies of the model are calculated by computer program, and compared with the normal data in the database. In addition, based on the computer program to modify the optimized parameters, the final selection of geological model parameters and magnetization.

4.2. Application effect of computer-based survey of polymetallic deposits
First of all, the application of magnetic prospecting based on computer program in the survey of polymetallic deposits can better complete the process of magnetic anomaly verification of polymetallic ore deposits, so as to more accurately analyze the causes and types of magnetic anomalies. Secondly, the computer program combined with magnetic exploration effectively provides ideas and clues for the search and exploration of metal deposits, which helps to determine the establishment of polymetallic ore target areas, and provides guarantee conditions for further determination of its specific orientation.

5. Conclusion
In summary, with the rapid iteration of computer intelligence and automation technology, its application in the exploration of polymetallic mineral resources has significantly improved the pertinence and accuracy of polymetallic ore prospecting. The combination of computer and magnetic exploration method not only improves the exploration efficiency and reduces the exploration cost, but also helps to determine the polymetallic ore target area, which lays a foundation for determining the specific location of mineral resources. Magnetic prospecting will be further applied and developed in the prospecting of polymetallic deposits in the future with its remarkable advantages and computer programs.

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