ISSN: 2472-3703 DOI: 10.6911/WSRJ.202301_9(1).0014

Research on a New Round of Geological Mineral Exploration and Breakthrough Strategy of Prospecting Technology

Zhouyuan Zhang[1, a]

[1]Shaanxi provincial land engineering construction group, Shaanxi, China

[a]393855200@qq.com

Abstract

Under the new situation that the difficulty of prospecting is increasing day by day, how to make a new breakthrough in geological prospecting is really a problem that every geologist, especially the leader, needs to seriously consider. It is of great significance to implement the strategic action of prospecting breakthrough. There is a reason why there is no breakthrough in geological prospecting. The objective reason is that prospecting is becoming more and more difficult. At present, geological prospecting is in a transitional period, and it is inevitable that the prospecting effect is not good. This paper expounds the problems that need to be solved urgently in implementing the strategic action of prospecting breakthrough in the current situation from two aspects: the significance of geological and mineral exploration and prospecting techniques, and the commonly used geological and mineral exploration and prospecting techniques.

Keywords

Geological mineral exploration; Prospecting technology; Strategic.

1. INTRODUCTION

With the explosive increase of population, resources have become the primary problem that people need to solve at present. The exploration and exploitation of mineral resources is of great significance for promoting the continuous progress of the economy and society, and it is necessary to use scientific and reasonable methods when exploiting mineral resources [1]. Under the impetus of the new situation, China's requirements for mineral development technology are gradually increasing, and as the demand for mineral resources in China is gradually increasing, it is very important to find new minerals and conduct exploration.

Under the new situation that the difficulty of prospecting is increasing day by day, how to make a new breakthrough in geological prospecting is really a problem that every geologist, especially the leader, needs to seriously consider. The application of geological mineral exploration and prospecting technology has great influence on mineral exploration, and is an important guarantee for finding ideal mines. Therefore, it is of great and far-reaching significance to the improvement of geological and mineral exploration and prospecting technology.

2. THE SIGNIFICANCE OF GEOLOGICAL EXPLORATION AND PROSPECTING TECHNOLOGY

The main work of the pre-survey stage is to look for mineral resources, that is, mineral geological prospectors predict and analyze the pre-survey mining area to determine whether there are mineral resources in the area. At this stage, detailed records of pre-survey work are

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202301_9(1).0014

required, including mineral and non-mineral areas. With the increasing demand for mineral resources in various fields, the current exploration and prospecting technology is relatively backward, which makes the situation of energy shortage worse. Therefore, how to reasonably apply more advanced scientific and technological means to mineral exploration and prospecting has become a huge challenge in this field.

There are many factors that need to be considered in the process of mineral resources development, including population distribution, subsequent land use, infrastructure construction of mineral resources development, topography and geological structure of the place where mineral resources are developed, etc. All factors are considered in the development of mineral resources. If we want to achieve more suitable geological and economic effects of mineral deposits, we must proceed from the actual situation of mineral deposits and carry out all the exploration work according to the actual needs of mineral resources development. However, once there is a situation that is divorced from the actual deposit and only works by subjective speculation, there will be many difficulties in the process of mineral exploration [2-3].

In the process of exploration, we must fully understand the specific distribution of minerals, correctly guide the exploration and development, and ensure the smooth progress of geological exploration. China has a vast territory and rich mineral resources, so it is necessary to coordinate the geological exploration work according to the actual situation.

3. CURRENT COMMONLY USED GEOLOGICAL AND MINERAL EXPLORATION AND PROSPECTING TECHNIQUES

3.1. Application of remote sensing technology

Remote sensing mineral exploration and prospecting technology refers to the way to find deposits formed under different metallogenic conditions through remote sensing images of various geological bodies. The technology of remote sensing mineral prospecting is very comprehensive, so the first step for the relevant staff to do when applying this technology formally is to strengthen the field geological work.

Using remote sensing technology to search for concealed ore is mainly based on the movement principle of geodynamics and hydrodynamics, which reflects the existence of various geological phenomena in the process of mineralization on the surface. The ring structure or ring structure combination that can be used to identify concealed ore in remote sensing image prospecting information includes two types: tone ring structure formed by the plane change of rock structure caused by thermal alteration and texture ring structure formed by the ring and radial uneven fracture of the affected rock caused by tectonic action [4].

In the image elements, the hue is closely related to the spectral characteristics of mineralized altered rocks. The geometry of texture reflects the geometry of structure. Through the extraction of prospecting information from remote sensing images, a large number of ring structures with clear tones, rings and radial shadows have been found in a specific area, which often overlap each other and are distributed centrally, indicating that there have been many metallogenic geological processes or magmatic activities in this area.

Mineral (spectrum) identification is the process of converting the measured spectrum into mineral composition information on the basis of a certain spectrum library. Since the development of rock and mineral spectrum testing technology, there have been two spectrum identification ideas, namely, spectrum analysis models based on "pure pixel" and "mixed pixel" [5]. At the stage of multispectral application, the measured spectral resolution is limited, and it is difficult to reflect the mixed features of various alterations. There are roughly two solutions

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202301_9(1).0014

to the mixed pixel problem, namely linear mixed model and nonlinear mixed model. Fig. 1 is a physical schematic diagram of spectral mixing linear model.

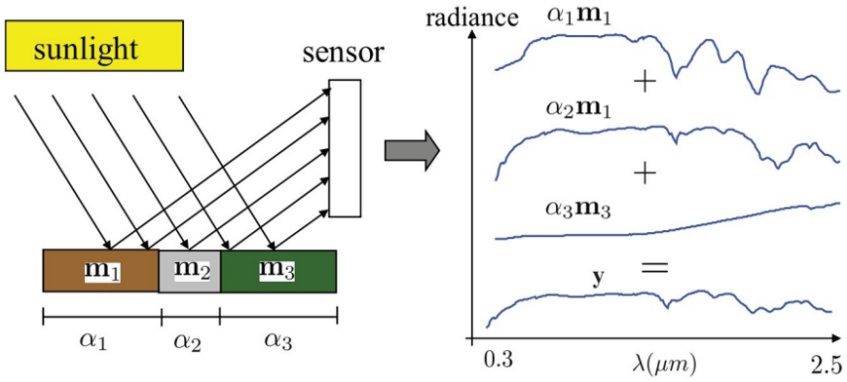

Figure 1. Principle of linear spectral mixing model

Mathematically, the linear model can be expressed as:

$$M = A\alpha + B\beta + C\gamma \tag{1}$$

The more generalized expression is as follows:

$$R = MC + \rho = \sum_{i=1}^{n} \vec{s}_i C_i + \rho \tag{2}$$

Where R is the mixed spectrum vector; M is the terminal matrix; C is the abundance matrix; $\vec{s}_i$ is the end-member spectral vector; C_i is the corresponding abundance of end members; ρ is the error term.

There are many linear end-member extraction methods, such as sparse constraint, maximum volume constraint, non-negative constraint and other end-member extraction algorithms according to different constraints, and imaging data end-member extraction and measured data end-member extraction according to data types [6-8].

3.2. Geomagnetic measurement technology

As an important branch of seismology research, seismic wave imaging technology is the most important technical means to illuminate the earth's interior and structural features by using waveform data which records abundant information of the earth's interior structure. There are also three kinds of velocity imaging methods, namely waveform fitting inversion, receiving function method and natural seismic wave tomography. The rapid development of computer technology in recent ten years has provided a foundation for the wide application of waveform fitting, and it is possible to obtain three-dimensional velocity structure.

The simplest and most direct way of joint inversion of geophysical methods is to increase the arrangement of broadband seismic stations in blank areas and improve the first-hand observation data, which is the most effective way to improve the imaging of the earth's interior. The changes and functions of physics and chemistry in the deep earth sphere drive the whole process from the superficial to the deep earth, and make the earth a dynamic system. But mineral resources are only the products of this system, serving human beings. Therefore, it is a very effective research method to use seismic tomography technology to see through the deep

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202301_9(1).0014

structural characteristics of the central uplift and its periphery of the geology and mineral resources. Because the natural seismic wave contains rich information about its propagation path structure.

Controlled source audio magnetotelluric method (CSAMT) is a frequency domain sounding method to study the characteristics of underground geological structures by observing the response of alternating electromagnetic fields excited by artificial field sources in the earth. CSAMT method is widely used, and has achieved good geological results in geothermal resources exploration, searching for concealed metal deposits, oil and gas resources exploration, geological engineering and other application fields. CSAMT observation data are normalized to reduce the influence of terrain; Far plane wave field has little influence on topography and is easy to correct [9].

Generally, the dipole moment of CSAMT emitter is about 1-3km long, and the receiving-transmitting distance is set at 5-10km according to the exploration depth. According to the measurement method, the layout of emission sources and the components of electromagnetic field received by measuring points are determined. Schematic diagram of CSAMT field layout is shown in Figure 2:

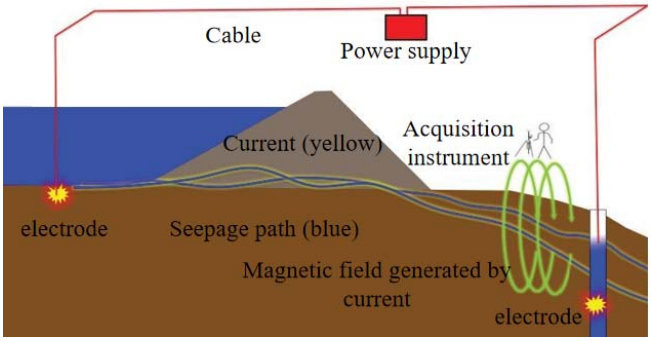

Figure 2. Schematic diagram of CSAMT field layout

The equatorial device is usually used for field measurement, and the measurement area is called the vertical area. Axial devices can also be used, and the measuring area is called axial area. During the field survey, the measured data of the above-mentioned electrical instruments all keep good stability and high signal-to-noise ratio, and they are the most widely used multifunctional electrical instruments for CSAMT measurement at present.

3.3. GIS technology

GIS (geographical information system) technology is a computer system that collects, stores, manages, analyzes, displays and describes geospatial data [10], and it is one of the important emerging technologies in the new century. The application and development of GIS technology make the regional geographical environment better managed, and can also meet the future environmental requirements. At present, China's GIS technology is developing steadily, and its application scope is also expanding. It is no longer limited to the traditional environment, land and public security, but has developed into various industries such as finance, communication and commerce.

Using GIS technology to complete geological and mineral exploration is an advanced technology, which mainly uses radio and satellite to locate a fixed material, and then sends accurate coordinate information. Through GIS technology, the specific location of the mining area can be accurately determined, and the obtained results can lay a reference for engineering practice.

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202301_9(1).0014

GIS technology can integrate a large amount of data from multiple sources, correlate spatial data with maps, and then visually display the trend with visualization technology, which greatly simplifies the original geographic environment management with many factors, high complexity, large amount of information and wide dimensions. By using the noise diffusion model combined with basic data, building distribution and noise source analysis, a graded noise mapping can be generated. Using GIS to build the model can save the traditional long-term evaluation and heavy workload analysis.

4. PROBLEMS TO BE SOLVED IN IMPLEMENTING THE BREAKTHROUGH STRATEGY OF PROSPECTING

4.1. Unified administration

Up to now, different departments have invested a lot of small and medium-scale geological survey and mineral survey in different areas, and the data formed by these works provide basic data for mineral exploration. It can be said that each exploration unit has applied regional geological and mineral survey data in different degrees in previous exploration work.

Complete exploration is a big project, which can not be completed by one unit alone, and it needs to concentrate a lot of manpower, financial resources, material resources and other factors, and needs unified management. In accordance with the principle of scientific planning and unified management, we will concentrate manpower, financial resources, material resources and other factors, carry out geological prospecting work, strive to achieve a major breakthrough in prospecting, and discover and evaluate a number of effective forms of large or extra-large mineral areas with great influence.

4.2. Improve technical level

With the improvement of mineral exploration degree year by year, there are fewer and fewer outcrop mines and shallow mines. Traditional prospecting techniques and methods can no longer fully meet the needs of modern geological prospecting. Therefore, our technical team should not only be strengthened, but also the technical level should be constantly improved and the prospecting ideas should be constantly updated. In order to meet the needs of modern geological prospecting, we must learn new theories and master new technologies and methods. Only by constantly improving our technical level and learning new theories, technologies and methods will a new breakthrough in geological prospecting be possible.

4.3. Improve the reward system for geological prospecting

First, it is necessary to improve the equipment level and salary of field technicians, improve their working and living conditions in the field, and enable them to actively and actively look for ore; Second, it is necessary to formulate incentive policies and measures for prospecting, introduce incentives for prospecting, and reward meritorious personnel for prospecting. Geological workers who are enthusiastic about prospecting and have achieved geological effects and economic benefits should be vigorously publicized and commended. No matter whether it's a mine reported by the masses or a mine mined by a fellow villager, as long as it's a member of the geological team, whoever first arrives at the mine and confirms its exploration value, and it's confirmed by geological work that it has geological effects later, should be rewarded and credited respectively.

5. CONCLUSIONS

Under the impetus of the new situation, China's requirements for mineral development technology are gradually increasing, and as the demand for mineral resources in China is gradually increasing, it is very important to find new minerals and conduct exploration. In order

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202301_9(1).0014

to further meet the actual demand of the current society for mineral resources, it is necessary to actively and perfectly implement the technical work contents of geological and mineral exploration, and to improve the implementation on the basis of clarifying the work contents of geological and mineral exploration. As long as we have a skilled team, a wealth of new theories, new technologies and new methods, and a stable, harmonious and safe production and living environment, a new breakthrough in geological prospecting will be just around the corner.

REFERENCES

[1] Zhang Zhaowei, Tan Wenjuan, Wang Xiaohong, Peng Suxia, Gao Yongbao, & Jiang Hanbing, etc. (2022). Northwest Geological Survey and Strategic Mineral Prospecting. Northwest Geology, 2022(003), 055.

[2] Zhu Yusheng. (2016). Mineral regionalization-a new form of combining geological scientific research with mineral exploration. Journal of Geology, 90(9), 10.

[3] Feng Jing, Li Fengming, Teng Xuejian, Xiaojun Wang, Xu Shiqi,&Lei Guoming. (2022). Progress of Geological Exploration in Xinjiang in 2021 and Work Focus in 2022. Xinjiang Geology, 2022(001), 040.

[4] Wang Xinchun, Qi Fanyu, Li Xiaolei,&Gao Xuezheng. (2016). Research on data integration and service-taking the geological work of the whole exploration area as an example. China Geology, 43(2), 7.

[5] Liu Rong, Liu Chune,&Liu Jingjing. (2018). Multi-source data fusion technology and its application in geological and mineral exploration. China Manganese Industry, 36(1), 3.

[6] Wang Yan, Li Yongna,&Xiong Shengyun. (2019). Geological characteristics and prospecting criteria of Hamahe gold deposit in Qinghai. Mineral Exploration, 10(1), 7.

[7] Yuan Yangsen, Zhang lei, Chen Lulu, & Yang Jiuding. (2016). Study on Geological Characteristics and Prospecting Methods of Mahega Gold Deposit in Tanzania. Mineral Exploration, 2016(5), 11.

[8] Li Yongsheng, Zhang Shenghui, Zhang Tong, He Jinzhong, Jeffrey Chang,&Du Zezhong. (2020) .1: 50,000 Requirements for Compilation of Mineral Geological Map and Database Construction. China Geology, 47(2), 1-13.

[9] He Junjiang, Zhang Zhiqiang, Li Shien, Li Wenjun, & Wang Ping. (2018). Study on geological characteristics and prospecting criteria of Seri gold deposit in Qinghai Province. China Manganese Industry, 36(5), 5.

[10] Jing Guoqing, Yu Wenming, He Guangyu, Liu Hua, Qu Zhiguang,&Fu Haizhong. (2022). Analysis of geological characteristics and prospecting direction of Taoshan fluorite deposit in Zhenglanqi, Inner Mongolia. Mineral Exploration, 13(9), 9.