HILL PUBLISHING

Geophysics and Geology, 2024, 1(1), 21-25
https://www.hillpublisher.com/Journals/geo/
ISSN Online:
ISSN Print:

Research on Geological Experiment Testing Methods in Geological Prospecting

Qiang Liu

Sichuan Metallurgical Geological Exploration Bureau 605th Team, Meishan 620860, Sichuan, China.

How to cite this paper: Qiang Liu. (2024). Research on Geological Experiment Testing Methods in Geological Prospecting. *Geophysics and Geology*, 1(1), 21-25.
DOI: 10.26855/geo.2024.12.005

Received: October 12, 2024
Accepted: November 2, 2024
Published: November 23, 2024

***Corresponding author:** Qiang Liu, Sichuan Metallurgical Geological Exploration Bureau 605th Team, Meishan 620860, Sichuan, China.

Abstract

The enhancement of environmental protection awareness in modern society has brought new challenges to the development and utilization of resources. Under the background of tightening resource constraints and increasing environmental protection pressure, it is not only necessary to ensure the safety of energy and minerals, but also to strengthen in-depth prospecting. It is necessary to combine technical means to improve the level of prospecting and prediction. In the current geological prospecting work, the geological experimental test method can effectively improve the exploration and mining capabilities of mineral resources and energy, and help to conduct three-dimensional geological analysis and comprehensive information prospecting prediction.

Keywords

Geological prospecting; geological experimental testing; method

1. Introduction

Through the investigation and research of previous mine water conservancy and environmental geological exploration technologies, it is found that many advanced scientific and technological means have not been fully applied in the exploration process. In actual exploration work, due to the lack of technical support, general mine water conservancy and environmental geological exploration technology cannot be effectively applied, which makes the technology unable to be truly utilized, the exploration efficiency is low, and it also indirectly affects the inaccurate analysis data of the number of mines and geological conditions in China, restricting the advancement and development, correctness and popularity of China's geological exploration technology [1]. Geological experimental testing technology is a general term for a series of tests on geological samples to confirm whether there are minerals in the sample source from information such as sample composition. It does not refer to a single technology, so geological experimental testing technology has many forms. In this case, when mining personnel use geological experimental testing technology for geological prospecting, they must carry out their work according to the requirements of different technical forms, such as selecting representative and special samples, ensuring sample accuracy, and making good preparations before testing to avoid inaccurate test results. In general, the use of geological experimental testing technology in geological prospecting requires high requirements and has a certain degree of complexity. Therefore, in order to give full play to the role of this technology, it is necessary to carry out relevant research [2].

2. Work content and basic requirements of geological experimental testing methods

2.1 Work content

The main work content of geological experimental testing technology Geological experimental testing technology is the first link in geological prospecting. Its purpose is to confirm whether there are mineral deposits and the type of mineral deposits in the place of origin of the sample. This provides direction for subsequent mineral mining.

Therefore, it is very important to do a good job in this technology. The main work content of geological experimental testing technology can be divided into four parts: the first is geological exploration, that is, on the premise of confirming the prospecting destination, geological exploration should be carried out on the destination. Through the exploration, important parameters such as geological structure, hydrology, soil quality, and lithology are obtained. These parameters are very important for subsequent experimental testing. If there are errors or omissions in the parameters, the final experimental test results will inevitably be inaccurate. Therefore, these parameters must be guaranteed to be complete and accurate; the second is chemical prospecting, that is, after the geological survey is completed, it can be confirmed whether there are mineral deposits in the area. If so, the general location of the mineral deposit needs to be confirmed. At this time, chemical prospecting methods must be used, such as rock geochemical measurement, soil geochemical measurement, water system geochemical measurement, etc. Different methods have different application requirements (because these methods do not match the topic of this article, so they are not included). To elaborate on this), careful selection is required. When the method is correct, the approximate location of the mineral deposit in the area can be known, and the location has a certain degree of accuracy; the third is sampling, that is, based on the results of chemical prospecting, the staff needs to take samples at the location of the mineral deposit. The samples taken must be representative. If there are special circumstances, the samples must also be special. The samples must then be properly preserved to prevent damage or deterioration during transportation. If such a situation occurs, the samples will no longer have geological experimental testing value and need to be re-taken; the fourth is experimental testing, that is, selecting the corresponding geological experimental testing method according to the sample type, and carrying out relevant testing work. The test results can tell the type, nature, and content of the mineral deposits in the sample's origin. Based on these results, it can be determined whether the mineral deposit has mining value or used for a specified mining plan. It is worth noting that although the geological experimental testing technology has relatively few working steps and the content seems simple, the testing work is actually very complicated. The reason is that the samples encountered in the testing process come from different collection points and there are intricate relationships between them, which makes the testing more difficult. At the same time, the testing process will inevitably be affected by some unfavorable factors, which may make the test results inaccurate. Therefore, how to avoid and minimize the adverse effects of factors is also a major challenge in the testing work. To achieve this, it is necessary to understand the application requirements of geological experimental testing technology in geological prospecting [3].

2.2 Experimental operation requirements

Experimental operation Taking silicate rock as an example, the composition should be taken into account when analyzing the content of different substances in it, because silicate rock is a composite of multiple minerals, including kaolin, asbestos, etc., and many of the elemental compositions and chemical compositions are different. Therefore, more scientific and standardized experimental testing techniques should be adopted to ensure the accuracy of the results. In the selection of standard substances, the first thing is to control the preparation of the solution. Generally speaking, the water used to prepare the solution has high requirements, and the solution must reach a stable purity. The actual selection of the benchmark is determined by the average value and range data in the average test link, so that the standard substance meets the quality standard and avoids the adverse effects of impurities. In the sample decomposition stage, acid dissolution, melting and other methods are common decomposition methods of silicate materials, but melting is more widely used than acid dissolution. It can decompose many samples of different types, which is achieved by the double decomposition process of acidic and alkaline solutions. The solvent used is also an alkaline solvent (such as sodium hydroxide, etc.), so as to achieve a good dissolution effect. If the sample is of the same type, it is also necessary to pay attention to performing two measurements to obtain more accurate and stable data. When determining the metal content, the solution required for the determination should be heated to boiling, then reduced to room temperature through reduction treatment, and then the indicator should be added as required before the determination. The relevant steps and operating specifications of the experiment should be adjusted according to the possible differences in the sample itself. Blank value analysis determines the test result based on the number of different solutions added, and two tests must be performed to determine the accuracy of the test [4].

3. Technical experimental application of geological prospecting

3.1 3D geological modeling

With the deepening of current geological and mineral research and the increase in the difficulty of shallow prospecting, the traditional prospecting methods and the display forms of results can no longer meet the needs of deep

prospecting in some cases. Therefore, modern technology can be used to obtain deeper geological information, and then relevant results can be obtained through geological experiments. Three-dimensional visualization and analysis technology is a reference model. It is based on surface geological surveys and combines other technical means. At present, three-dimensional spatial positioning and quantitative prediction of mineral deposits have become the research focus in related fields. Three-dimensional geological modeling refers to the use of visualization technology to express effective three-dimensional spatial data models in space, and then conduct data management, spatial analysis and other processes. It involves experimental research at multiple disciplines and technical levels. Compared with traditional expressions, this method will be more intuitive and accurate for the expression of spatial geological bodies, and the amount of information conveyed will be rich and real. From the method point of view, drilling is the main source of information. After obtaining samples through drilling, the samples can be analyzed and analyzed to show the spatial collection position and trajectory morphology of the samples. At the same time, attribute information related to the geological body can be stored, such as the stratigraphic lithology information revealed by the samples, but the engineering investment cost is relatively high. Modeling based on profiles can play a stabilizing role in expressing deep geological information, while modeling methods based on discrete points can extract information from databases. In the future, hybrid modeling supported by human-computer interaction can be considered to prepare data [5].

3.2 Information and image processing

From the basic requirements of information and image processing, this aspect is to analyze the characteristics of remote sensing information, so as to obtain land satellite images and present the material composition and surface structure of various types of ground objects. In terms of basic image processing, the key to obtaining a good color composite image is to develop band combination, among which the color synthesis scheme should be the most critical synthesis processing work. The variance of the bands participating in the band combination should be as large as possible, and the smaller the correlation coefficient, the better. In this way, the color composite image can be guaranteed to have clear images and distinct three-dimensional characteristics as the basic remote sensing image. From the perspective of image enhancement, the purpose of image enhancement is to highlight the valuable information and expand the differences between different influencing features. For example, when analyzing geological structures and geomorphological features, it is also necessary to do a good job of edge enhancement and information planning at structural features, so as to provide a reference basis for prospecting for the comprehensive analysis of mineralization geological conditions and mineralization prediction information. For example, principal component analysis is one of the most critical parts, which can distribute and arrange the information and content of different components in space, and do a good job of subsequent ratio processing to eliminate the relative value differences of geological bodies caused by terrain, and finally reflect the differences in interface image characteristics through combination processing. In terms of alteration information processing, alteration is a mineralization sign produced by mineralization. Mineralization fossil metamorphism remote sensing information extraction is based on spectral characteristics, and spectral differences and band combination transformations are used to select characteristic factors to extract alteration information. For mineral prospecting, altered rocks and normal rocks have differences in color and texture in many aspects such as mineral composition and rock structure. Extracting useful mineralization information is the focus of this work. For the obtained results, unsupervised classification processing can be carried out on the filtered images to provide corresponding reference basis for geological prospecting.

3.3 Extraction of mining-induced anomaly information

ore-induced anomaly information can reflect the rich state of the ore body. Taking the primary halo as an example, during the formation of the ore body, the ore-bearing solution is constantly diffusing and infiltrating. The distribution range of the high-content zone of elements developed in the hydrothermal deposit is very large. The zoning law can reflect the rich state of the deep ore body. For example, if there is an abnormal problem of ore elements at the tail of a known ore body, and the front halo and tail halo of the tail have strong abnormal states, it means that there are blind ore bodies at the depth of the known ore body, and it indicates that the ore body may be extended to a large extent. According to these mineralization and halo mechanisms, the front halo can be used as a geochemical sign for discovering and evaluating hidden minerals, and the geochemical parameters can be used to reflect the parameter information of the front halo element combination and the tail halo combination, reflecting the geochemical characteristics of mineralization. According to the complexity of actual mineralization, the primary halo of the drill hole is only a

kind of ore-induced anomaly information reflected by the ore body. In order to make a comprehensive information prediction, it is necessary to do a good job in geological experiments, and combine the parameters such as the ore body anomaly and the deep anomaly delineated by the main mineralization element anomaly and the main mineralization factor anomaly to form a comprehensive anomaly. Mineralization is a complex, multi-stage, nonlinear process. The main mineralizing elements in the ore field will also show uneven characteristics. The corresponding results can be obtained by extracting the mineralization anomaly information of the mineralization factors and conducting experimental evaluation [6].

3.4 Comprehensive information prospecting prediction

Mineralization prediction is an important task in geological prospecting. It applies basic geological theory and ore deposit geological theory and technical methods to explore the mineralization conditions and mineralization information in the area and determine the target area for prospecting. The traditional prediction method is to make empirical predictions, but through geological experiments, systematic planning can be carried out with the help of information means. Different mineral resources will undergo the formation, change and preservation process of ore deposits in a certain geological environment to form different types of rock and mineral combinations, and various characteristics will be formed and presented through different rock constructions. This information can be obtained by geological experiments, geochemical exploration, etc., and modern exploration methods can be used to determine the physical and chemical parameters of geological bodies and rock and mineral information to carry out a comprehensive analysis of mineralization geological conditions. It emphasizes the comprehensive evaluation of information fusion and internal connections to complete prospecting prediction work, such as completing information fusion and information analysis through the powerful information prediction function of GIS. For example, large-scale three-dimensional prediction of mining areas can analyze the mineralization geological conditions and spatial distribution laws of ore deposits based on three-dimensional geological modeling, make full use of the existing two-dimensional geological surveys to carry out visual geological modeling, and then establish a comprehensive prospecting model to select specific elements to achieve the prediction and evaluation of peripheral mineral resources. For typical ore deposits, we can study the spatial distribution characteristics of known ore bodies and metallogenic geological elements, and then explore the connection and occurrence law at the genetic level. Under the guidance of theories such as geological anomalies and comprehensive information evaluation, comprehensive information such as remote sensing and other prospecting information can be used to finally extract a comprehensive prospecting model. In addition, information prediction will also involve a comprehensive discussion of metallogenic laws. At present, many disciplines have clarified the direction of geological conversion in research, and use remote sensing technology to assist in prospecting, with direct methods or indirect methods as technical standards. Among them, the direct prospecting method is to directly use remote sensing images to identify mineralization signs, and the indirect method is to summarize the geological characteristics of favorable areas based on the interpretation and analysis results of metallogenic geological conditions. However, considering that the geological characteristics of some areas are relatively special, such as the surface mineralization signs in areas with severe vegetation coverage or land desertification are not obvious, it is difficult to directly use remote sensing images to prospect. In this regard, it is possible to consider discussing the results of geochemical work based on known mineral points, and making prospecting predictions based on linear structures, ductile shear zones and annular structural characteristics. In terms of linear structures, the formation time of different structures is different. The formed structures will be activated and cut each other under the influence of tectonic movement. The regional linear structure reflects the characteristics of the fault structure and the main linear structure in the region. It can play a good role to estimate the content of mineral precipitation according to the characteristics of the area. Based on the content of the ductile shear zone, the ductile deformation zone and shear zone of some old metamorphic rock areas are closely related to mineralization. During the ductile deformation, since there is no large-scale fluid activity, some elements will be more enriched. However, after the fluid has a sudden reaction, a metamorphic zone will be formed. The greater the activity, the stronger the later degradation. The enrichment of elements in some areas of the ductile deformation zone will form ore bodies. From the perspective of annular structure, there are differences in the development morphology of annular structures in the prospecting area, and the causes are different, but they are all related to magmatic or tectonic action, and have certain regularity in spatial distribution. There may be hidden rocks under the surface of some annular structures. The weak crust formed by tectonic movement can provide relatively favorable conditions for mineralization and prospecting, and even be related to magmatic intrusion. It should be noted that if the subsequent work area is an uninhabited area or an area with

poor working conditions, it will be difficult to carry out field verification. Therefore, it is necessary to focus on the geological phenomena and remote sensing image features in key areas as well as other information anomalies as the focus of comparative research. Combined with the existing results and data, the prospecting work can be completed from point to surface to provide information support for subsequent research.

4. Conclusion

Mineral resources are the material basis for economic and social development and scientific progress. The significance and role of geological experiments and tests in geological work are very prominent, and they are the key technical guarantee for geological science research. Therefore, the standardization and standardization of geological experiments should be given high attention. The continuous development of geological work has made the work results more closely related to geological experimental technology. Various experimental measures have changed and adjusted in both methods and techniques. This indicates that my country's geological exploration and scientific research can obtain more in-depth theoretical support, and it also shows that domestic geological work will enter a new stage of development. Geological prospecting work can also use experimental tests to obtain accurate data support to ensure work efficiency and work quality.

References

[1] Qi Xin. Discussion on the importance of geological experimental testing methods in geological prospecting[J]. Jushe, 2020(05):86.

[2] Qi Xiaomin. A brief analysis of the importance of geological experimental testing methods in geological prospecting[J]. Contemporary Chemical Engineering Research, 2019(16):42-43.

[3] Liu Xiuli, Guo Jia, Sun Fengchun. A brief analysis of the importance of geological experimental testing methods in geological prospecting[J]. World Nonferrous Metals, 2019(15):70-71.

[4] Yang Wenchang, Tang Ling, Han Liang. Discussion on the importance of geological experimental testing methods in geological prospecting[J]. World Nonferrous Metals, 2019(13):289-290.

[5] Wang Tianhao. A brief analysis of the importance of geological experimental testing methods in geological prospecting[J]. Southern Entrepreneur, 2018(02):227.

[6] Dong Yang, Kuang Huiqun, Li Hui. Brief analysis on the importance of geological experimental testing methods in geological prospecting[J]. World Nonferrous Metals, 2017(04):132+139.