The Application of Seismic Exploration and Electrical Prospecting in Coalfield Survey

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Keywords: Seismic exploration; electrical exploration; coalfield survey

Abstract: In recent years, China's society has made continuous progress and outstanding achievements in many fields. Among them, great progress has been made in the mining and census of mineral resources. In coalfield survey, seismic exploration and electrical prospecting technology are gradually used universally, and corresponding excellent results have been achieved. The joint application of these two technologies provides reliable data for the development of coalfield survey and ensures the effectiveness of the survey. This paper will analyze the principles and application modes of these two prospecting technologies, and explore their related applications in coalfield survey.

With the development of the times, China's social development is more and more towards comprehensive development. In our country, mineral exploitation is the most important industrial component, whose development has received important attention. Among them, the application of seismic and electrical prospecting technology in coalfield survey has gradually become more extensive. With the use of two-dimensional and three-dimensional seismic exploration technology, the seismic data interpretation link provides the basis for stratum depth and enriches drilling data. At the same time, the combination of data analysis and seismic data in electrical prospecting technology reflects the development of reflection wave effectively and provides effective data for the situation of coal seam in exploration area.

1. The Application of Seismic Exploration Technology in Coalfield Survey

1.1 The application of two-dimensional seismic exploration

1.1.1 The principle of two-dimensional seismic exploration

In the coalfield census, the exploration workers use the relevant methods to stimulate the seismic waves on the surface and continue to propagate to the underground. When it encounters the interface of the rock layers with different media properties, reflection and refraction will occur and be captured by the detector. According to the data processing analysis of characteristics, location of detection points, the properties and structural characteristics of underground rock strata can be known. On this basis, a two-dimensional seismic section of depth and length is formed, which can restore the properties and morphological characteristics of the underground rock strata to a large extent.

1.1.2 The operational analysis of two-dimensional seismic exploration in practical applications

(1) The development of field production

In the field production process of the coalfield survey, it is necessary to do a good job in the layout of the survey lines in the detection area, and the seismic wave measuring instrument is used to collect the seismic wave information. In this process, attention should be paid to the selection of survey points in the exploration area. It is necessary to ensure the reliability of scientific exploration and the effectiveness of exploration results. Before the drilling and firing work is carried out, the appropriate conditions for the selected excitation point position should be comprehensively studied to ensure that the excitation effect under different conditions of well depth and the combination of multi-well meets the specified requirements, and the measured experimental dose is controlled to ensure that it can be achieved the best effect of exciting seismic waves.

(2) The development of data processing

In the process of coalfield exploration, it is necessary to analyze a large number of measured data to study the characteristics of seismic wave. For seismic data processing, computer is a necessary for processing. Among them, the data are processed by professional software, the relevant parameters of seismic wave are recorded well, and the relationship between seismic time and geological structure in exploration area is analyzed.

(3) The implementation of data interpretation

The interpretation of two-dimensional seismic wave exploration data refers to the collection of seismic raw data and the transformation of geological exploration results by professional software, can produce charts reflecting the basic geological conditions in the exploration area. At the same time, the seismic wave time profile is further studied and analyzed by combining with the geological structure and underground lithology information in the exploration area, and the relationship between the reflected wave and the geological layer is further inferred, to determine the characteristics of the reflected wave and to obtain a more scientific and accurate measurement of parameter indicators.

1.2 The application of three-dimensional seismic exploration in coalfield survey

1.2.1 The principle of three-dimensional seismic exploration

The three-dimensional seismic exploration technology is applied on the basis of two-dimensional seismic exploration. It can not only obtain the two-dimensional seismic wave profile generated by the two-dimensional seismic exploration method, but also establish the data volume in three-dimensional space. The density of information points can reach 12.5m x 12.5m, which provides abundant seismic exploration information, and has the characteristics of high precision acquisition.

1.2.2 The operational analysis of three-dimensional seismic exploration in actual applications

Different from two-dimensional seismic exploration technology, three-dimensional seismic exploration technology pays more attention to the correct position and shape of underground geological bodies. On this basis, it solves the problem of continuous tracking of geological bodies (interfaces) and transforms the process of seismic data interpretation into identification to reduce the pluralistic problems and strengthen reliability and accuracy.

(1) Data collection

In coalfield exploration, three-dimensional seismic exploration has higher accuracy and completeness in data acquisition. In the exploration process, the CDP grid of three-dimensional seismic exploration can reach up to 5 m × 5 m (that is, the data points are arranged every 5 m on the plane). Compared with the line distance of two-dimensional exploration, the data collection is more meticulous and precise, and the phenomenon of errors and omissions is reduced. In the exploration area with complex topography, more precise three-dimensional seismic exploration methods are usually chosen.

(2) Data processing

Different from two-dimensional seismic exploration, data processing of three-dimensional seismic exploration is carried out through three-dimensional geophysical model. With this more comprehensive processing method, the errors that cannot be found in two-dimensional seismic exploration are reduced or eliminated, the accuracy of data is improved to a certain extent, and the exploration results are guaranteed.

(3) Data interpretation

Compared with two-dimensional seismic data interpretation, three-dimensional seismic data interpretation process is more comprehensive. In the data analysis of geological body interface or fault plane in exploration area, continuous tracing can be realized through three-dimensional space, avoiding the phenomenon of empirical inference in two-dimensional seismic exploration data. Instead, three-dimensional seismic data are identified and checked by interpreters according to experience in data interpretation, which improves the error of data interpretation results effectively and reduces the influence of human factors. It improves the accuracy.

2. The Application of Electrical Exploration in Coalfield Survey

2.1 The analysis of principle

The electrical exploration method mainly relies on the electrical difference of the rock material. By measuring the resistivity of the rock and mineral in the underground rock and combining the data of the combined profile, the underground composition of the exploration area is roughly analyzed. In the measurement process, it is necessary to continuously move according to the section transformation, continuously move the survey points, obtain the survey data at the corresponding geological locations in stages, measure the resistivity, and analyze the exploration according to the intersection of the resistivity curve and the profile curve. Know the geology of the area and the stratification of the rock formation, and understand the address composition of the exploration area.

2.2 The operational analysis of electrical exploration in practical applications

In the actual coalfield exploration process, the measured profile needs to be selected based on the relevant initial data of the address. In this process, it is necessary to ensure that the measured section contains a masking area to ensure that the associated geological boundaries of the exploration area, the structural lines under the main frame, and the boundaries of the various types of defrock can be controlled. In the operation process, the transmitters of different frequencies are used to launch the detection of different frequencies, and the specific conditions in the survey area are analyzed and detected to obtain the buried depth of the coal seam inside the exploration area. In this process, multiple exploration paths can be established to perform detailed exploration for the detection points of the DC power. When selecting electrical detection, it is necessary to pay attention to the common application of multiple detection methods. For example, combined with seismic exploration technology, the geological structure of the exploration area is combined and analyzed to eliminate the error; at the same time, the coal seam stratum under various levels in the exploration area can be understood by combining the mapping method.

In the process of conducting electrical exploration, the accuracy of the survey data must be strictly controlled. Therefore, in the process of exploration work, it is necessary to minimize manual operation errors and carry out work in strict accordance with relevant work standards. Since the exploration of coal fields is usually in the wild environment, it will be affected by many factors such as the environment and the weather. In the field construction, the influences of these factors should be fully considered. For different types of stratigraphic exploration, it is necessary to strictly follow the procedures to set the fixed-point positioning properly. In the terms of the position of the electrode buried, it is first necessary to do the drilling work and fill in the specific standard brine to enhance the original measurement signal. At the same time, for various kinds of mutation points and twist points, multiple methods of averaging are taken to reduce the errors caused by the mutation points and the twist points.

3. Conclusion

In the current coalfield survey, support of effective exploration technology is indispensable. Among them, seismic exploration and electrical exploration technology can effectively meet most of the topographical features and exploration requirements, and have been effectively used in the current mineral census process. Relevant personnel should pay attention to strictly follow the procedures to ensure the exploration results and effectiveness and accuracy.

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