Original Research Article

Study on the precipitation effect of geological events and the relationship between geological profile and seismic profile

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Abstract: This study focuses on the key role of geological event precipitation in the surface geological process, emphasizing its importance in revealing the crustal structure, sedimentary environment and resource exploration. This paper analyzes the characteristics of geological event precipitation, and discusses the application value of geological profiles and seismic profiles in studying such effects. By comparing and correlating these two profile techniques, this paper reveals their interaction and complementarity in understanding the precipitation process of geological events, thus providing a scientific basis for deepening the theoretical study of the precipitation effect of geological events. The research results can help to improve the accuracy of geological exploration, and provide theoretical support for the development of geological resources and the prevention and control of geological disasters.

Keywords: Geological events; precipitation effect; Geological profile; Seismic profile; Relationship exploration

1. Introduction

The precipitation of geological events, as a process of surface material deposition and accumulation driven by tectonic movement, climate change, and biological action in a specific geological period, is crucial to understanding the evolutionary history and tectonic changes of the earth's surface. This process not only records the dynamic changes of the earth, but also provides valuable information for the reconstruction of the sedimentary environment and the prediction of resource distribution. In geological research, geological profile and seismic profile, as two core exploration means, each provide key evidence to reveal the precipitation effect of geological events with their unique perspective and technical advantages. The geological profile provides us with detailed stratigraphic sequence and sedimentary structure information through direct rock and strata observation, and it reveals the tectonic morphology and sedimentary characteristics of the deep underground through the propagation characteristics of seismic waves. These two profile techniques complement and verify each other in the geological research, and together constitute a multi-dimensional research framework for the precipitation effect of geological events.

2. Overview of the precipitation effect of geological events

2.1. Type of geological events

Geological events refer to a series of changes in the surface and internal surface of the earth caused by various internal and external forces in the long history of the earth. These events are of various types, mainly including tectonic movement, volcanic activity, sedimentation, and biological events. Tectonic movement refers to the process of movement, folding and fracture of the crust plate, which directly affects the morphology

and structure of the crust, and is one of the most influential types of geological events. Volcanic activity is a form of heat release within the earth, which not only shapes the surface landscape, but also affects the global climate and environment. Dedimitation refers to the geological record of weathering, erosion, transport and deposition of surface material, which reflects the sedimentary environment and climate change on the surface of the earth. Biological events cover the process of biological interactions such as biological evolution, mass extinction and geological environment. These geological events leave a rich geological record on the surface of the earth, providing valuable information and clues for geologists to study the earth's history, tectonic changes, environmental evolution, and resource formation.

2.2. Precipitation effect and its influencing factors

Precipitation is an important link in geological events, which refers to the process of transforming the earth surface material from suspension or flow to sedimentary state under the action of gravity. This process is the basis of sedimentary rock formation and is important for understanding the sedimentary environment and resource distribution. There are many factors affecting precipitation, mainly including the following aspects: (1) tectonic movement is an important factor affecting precipitation. The tectonic activities such as uplift, settlement, fracture and folding of the crust directly change the transport path and sedimentation environment of the sediment, thus affecting the type and distribution of precipitation.(2) Climate change has a profound impact on precipitation. Global or regional climate change leads to environmental changes such as sea level rise, river diversion, and desert expansion, which directly affect the source, nature, and deposition rate of the sediment[1].(3) Biological effects are also an influencing factor that cannot be ignored. The survival and activities of organisms are not only directly involved in the formation of sediment, such as coral reefs, shell layer and other biological deposition, but also the death and decomposition of organisms can affect the composition and structure of sediment.(4) Sediment media, such as water and wind, also have a significant impact on precipitation. Different sedimentary media have different handling capabilities and deposition characteristics, thus forming diversified sedimentary structures and sedimentary facies.

3. Overview of the geological profiles and seismic profiles

3.1. Geological profile

Geological profile is one of the basic tools of geological research. It directly shows the distribution, structure, structure and the relationship between the geological bodies below the surface through field investigation, drilling, mountain engineering and other means. Geological profiles usually include many types, including topographic, stratigraphic, and structural profiles, each of which focus on different geological information[2]. The compilation process of geological profile involves a lot of field work and indoor analysis, through the observation and description of geological phenomena such as rock type, stratum sequence, strata contact relationship, faults and folds.

The intuition and comprehensiveness of the geological profile make it widely used in geological research. In regional geological survey, geological profile helps to reveal the spatial distribution law and regional tectonic framework; in sedimentary research, it can help to analyze the change of sedimentary environment and the distribution of sedimentary phase; in resource exploration, geological profile is an important means to identify the occurrence conditions of mineral resources and evaluate the form of mineral bodies. In addition, geological profiles also play an important role in geological disaster assessment, site selection for engineering construction,

and environmental protection.

3.2. Seismic profile

Seismic profile is the map of the reflection and refraction information of underground strata obtained by seismic exploration technology to reveal the crustal structure. The seismic profile records the reflection and refraction of different underground interfaces through the propagation characteristics of artificially excited seismic waves in the underground medium, and then deduces the underground geological structure[3]. Compared with geological profile, seismic profile has the advantages of high resolution, large detection depth and wide coverage, especially it plays an irreplaceable role in revealing deep geological structure and complex geological body.

Seismic profiles are widely used in geological research. In the field of oil and gas exploration, seismic profile is the key tool for finding and evaluating oil and gas reservoirs, it can help identify faults and folds, and it provides important information for understanding the geological background of earthquake occurrence. In addition, with the development of seismic exploration technology, the high-precision seismic profile has also shown great application potential in geotechnical engineering, groundwater resource evaluation, urban geological survey and other fields.

In short, geological profile and seismic profile, as two important means of geological research, each have unique advantages and limitations. In practical application, the combination of the two can provide geologists with more comprehensive and in-depth underground geological information, so as to improve the accuracy and efficiency of geological research.

4. The relationship between the precipitation effect of geological events and the geological profile and the seismic profile

4.1. The precipitation effect of geological events in the geological profile

Geological profile is an important means to study the precipitation effect of geological events, which can intuitively show the occurrence process and products of geological events. In the geological profile, the thickness, lithology and structure of the sedimentary rock strata are the key indicators to reflect the precipitation effect of geological events. For example, thickness changes of sedimentary strata can indicate changes in deposition rate and thus reflect hydrodynamic conditions or climatic changes in the sedimentary environment. Changes in lithology, such as the transition from coarse to fine grain, may indicate a decrease in sedimentary energy or changes in the sedimentary environment. In addition, the sedimentary structures, such as bedding, ripple mark, mud crack, etc., can also provide direct evidence of the sedimentary environment. In terms of tectonic movement, the tectonic patterns such as faults and folds in the geological profile are the direct manifestations of the precipitation effect of geological events. The existence of faults is often accompanied by faults of strata, stratum discontinuity and mutation of lithology, which are sedimentary responses under the influence of tectonic movement. Fold action may lead to formation tilt, inversion and even folding, which are clearly visible in the geological profile, and provide important information for the study of geological events.

4.2. Performance of the precipitation effect of geological events in the seismic profile

Seismic profile can reveal the formation interface and tectonic form formed by geological event precipitation through the reflection and refraction characteristics of seismic waves. In the seismic profile, the difference of

the reflection coefficient of different strata is manifested by the intensity and continuity changes of the reflected waveform. For example, the reflected blank band may indicate the presence of coal seams, hydrocarbon layers or other low-speed high resistance layers, which are the product of precipitation of geological events. The fault break, distortion or disappearance of the same-phase axis may indicate the existence of faults, which are often the result of geological events such as tectonic movements. Other phenomena in the seismic profile, such as the abnormal change of the reflected waveforms and the wave impedance interface, can also reflect the precipitation process of geological events. For example, volcanic activity may manifest in seismic profiles as a sudden interruption of the reflected waveform or a significant change in the reflection coefficient. Biological events such as the growth of biological reefs and the formation of paleosoil layers can also leave specific reflection features in the seismic profile.

4.3. The interrelationship between geological profile and seismic profile

Geological profile and seismic profile have a close mutual relationship in the study of geological event precipitation, which is mainly reflected in the following two aspects: (1) mutual complement. The geological profile provides detailed information of the geological body below the surface, including stratigraphic sequence, lithological characteristics, sedimentary structure, etc., while the seismic profile can show the deep structure of the crust, such as faults, folds, magmatic intrusions, etc. The combination of the two can form a three-dimensional geological model from the surface to the deep, so as to more comprehensively understand the precipitation effect of geological events.(2) Mutual verification. The geological profile and the seismic profile are consistent in revealing the precipitation effect of geological events. The reliability of the geological interpretation can be verified by the comparative analysis of the two. For example, the faults identified in the geological profile should have the corresponding reflection wave fault breaking phenomenon in the seismic profile, while the reflective blank band found in the seismic section may correspond to the specific lithology or sedimentary environment in the geological profile. This process of mutual validation helps to improve the accuracy of geological studies and reduce the possible interpretation bias caused by a single approach.

5. Conclusions

This paper deeply discusses the geological events and its performance in the geological profile and seismic profile, the following conclusions: (1) geological event precipitation effect in the earth surface geological action plays a key role, it not only reveals the evolution of tectonic, also reflects the sedimentary environment change, has guiding significance for resource exploration.(2) Geological profile and seismic profile show the characteristics of mutual complementarity and verification in the precipitation of geological events. The former provides detailed information of geological bodies below the surface, while the latter reveals the structural characteristics of the deep crust.(3) Deepening the understanding of the relationship between the precipitation effect of geological events and geological profile and seismic profile can not only improve the overall level of geological research, but also provide solid theoretical basis and technical support for resource exploration, geological disaster prevention and control and other fields. Therefore, the comprehensive application of these two profile techniques is of great significance to promote the progress of geological science.

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