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Research on Deep Exploration Integration Technology Application in Gold Deposits Based on 3D Geological Spatial Information System

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1 Introduction

Deposits are the products of geological processes, and substance field, thermal field and structure field having close relationship to the formation of deposits will appear corresponding geological information in geological body (Robb, 2005; Pirajno, 2010). How to effectively identify and use all kinds of mineralized anomaly information becomes the research problem with deep mine metallogenic prediction progresses. Paishanlou gold deposit developed in complex geological conditions of Archean ductile shear zone, and the found of shallow ore bodies depends on the geological and geochemical results, and mineralized anomaly in the deep tend to be fuzzy and is hard to recognize, causing exploration risks increased and prospecting effect not well. By years of research and practice, this paper carried out the research on deep exploration integration and application technology in gold deposits based on 3d geological spatial information system. The core is to set up 3d geological spatial information system based on the basic geological study, and digitize deposits geological, geophysical and geochemical metallogenic information, to do target detection by remote sensing technology, geophysical technology and deep-penetrating geochemistry and realize digitalization, informatization and visualization of the deep geological exploration and evaluation (Cameron, 1998; Mike and Rob, 2003; Robert et al., 2007).

2 Principle of Deep Prospecting Information Integration Technology (DPIIT)

Deep prospecting information integration technology

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(DPIIT) is not a simple superposition and comprehensive of prospecting anomaly information technology, but grasp the internal relation among the information technology to make them a organic whole to realize concealed orebodies prospecting breakthrough in the deep and periphery. Specifically, elements forms material, material forms material field, and geological field is visual material field. The abnormal expression of geological field is the place of deposit, and appears by the phenomenon of mineralization and alteration. After deposits anomalous field is materials anomalous field, and physical properties anomalies can be shown by geophysical detection. Materials anomalies can be shown by abnormal gathered elements or compounds and by geochemical methods. That is to say, geological anomaly, geophysical field and geochemical anomaly field can be linked together through abnormal material field, and we can explore and discover abnormal material field and deposits by geological and geophysical - geochemical organic integration. As the most primitive form of material field, geological field is the direct field, and geophysical and geochemical field work through ecological field and are indirect fields. So basic geological study is the first step, is the most crucial step and determines the success or failure of technology when we apply deep prospecting information integration technology.

3 Establishment of 3D Geological Spatial Information Models

The establishment of deposits geology entity 3d models, which can interpret information of ore bodies such as buried depth, thickness, geological grade and the thickness of the overburden, etc, need to digitize research objects such as topography, geomorphology, geological

structures, ore bodies and surrounding rocks etc., and to integrate multiple functions such as 3d entity deposit modeling, surface topography analogue system, establishment of the geological database module, cutting technology and Geological probe techniques, etc. The surface topography simulation modeling uses 3d geological modeling technology and combines GIS, computer graphics technology to realize 3d simulation modeling terrain surface. Ore bodies modeling established by 3DM system is based on the combination of drilling, ore body section and horizontal section to form 3d entity deposit modeling. The progress: firstly, geological professionals get geological drilling data, and correct geological record results by borehole correction program, and import corrected data into the system database; secondly, invoke the same exploration drilling data from the geological module, and make sure ore bodies boundary by the industrial index according to responsible ore bodies characteristics, formation, occurrence, beneficial and harmful occurrence regularity, sample analysis results etc; thirdly, apply system mathematical model and expert system to connect section, link horizontal sectional drawing by certain level elevation according to sections using expert system; fourthly, get ore bodies trajectory in horizon and section through automatic data acquisition system, and save obtained data information to a special database, and proceed ore bodies modeling by original scribe key, and finally realize the true representation of deposits occurrence state, scale, and attitude in 3d space.

4 Application Basis of DPIIT

Applying integration deep prospecting information technology for prospecting, we need divide the relations and connections of the gold metallogenic material field, structure field and thermal field: (1)basic geological research is the premise and key of technology application, and deposits geological structures are the basis of the 3d model establishment and carrier basis of metallogenic prediction information, and geological research breakthrough can be achieved with prospecting breakthrough; (2)the determination of remote sensing information is based on rock characteristics and structural characteristics, and the application of remote sensing in the field of geological prospecting mainly showing in information extraction of metallogenic representation, that is metallotectonic extraction and analysis, the lithology information extraction and the source bed analysis, alteration information extraction and other characterization information, such as biogeochemical

remote sensing analysis, etc; (3)attention to identify deep ore bodies information showed by lower abnormal, and the application of geophysical methods should take basic geological study as the guidance and starting point in the geophysics premise; (4)the application of deep penetrating geochemical methods should take geochemical characteristics of mineralized anomaly as the basement to do the related measurement and interpretation work; (5) integrate geological, geophysical and geochemical information, and realize effective compound and organic integration of exception information, as far as possible to find mineralized anomaly, delineating the target area and find the deep and concealed ore bodies.

5 Application of DPIIT in the Paishanlou Gold Deposit

As a typical ductile shear zone type gold deposit, the metallogenic geologic characteristics of Paishanlou gold deposit is different from other gold deposits, and used prospecting methods and means are widely different from other gold deposits as well as having its own characteristics. This paper realized prospecting breakthrough and effectively delineation of the target area in the premise of basic geological research breakthroughs applying geological-geophysical-geochemical-remote sensing deep detection integration technology.

According to the basic geological research, there exist two different directions metallogenic belts in Paishanlou gold deposit, which correspond to two sets of dolomitic mylonite. Starting from this point, looking for the space distribution of two metallogenic belts becomes the key to realize Paishanlou gold deposit breakthrough, and the related wall rock alteration, mineralization and orebody occurrence space location and the geophysical anomaly characteristics provides premises for the application of geophysical detection technology. At the same time, Paishanlou gold deposit is a hydrothermal deposit and a series of characteristics of hydrothermal deposit provides premises for the application of the geochemical methods, and this has been proved verification.

Based on the above analysis and research, we developed deep detection integration information technology in Paishanlou gold deposit, which is based on basic geological ore-controlling factors such as metallogenic structure, alteration, mineralization etc, and by means of geophysical techniques (magnetic and electromagnetic method) and geochemical prospecting methods (primary halos, mercury adsorption state, the organic hydrocarbon and radon survey). This technology take advantage of

some methods such as magnetic method to distinguish the lithology and structure, electromagnetic method to distinguish the ore-controlling structure, organic alkanes to distinguish the gas halo anomalies, and primary halos to intuitively predictive mine, and we got ideal deep prospecting prediction effect in Paishanlou gold deposit by this technology.

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