Three-dimensional structural characteristics of the Zhaxikang ore-concentration area based on multiple attribute constraints

Xin Jiang1, Xuben Wang1, Guangming Li2, Yanjie Jiao2, Gang Min1, Fantao Kong1, Xiecheng Zhang1 and Panpan Cai1

1 Chengdu University of Technology Key Lab of Earth Exploration & Information Techniques of Ministry of Education, Chengdu, China.
2 Chengdu Center, China Geological Survey, Chengdu, China
E-mail: 767560833@qq.com

Abstract. The Zhaxikang ore-concentration area (ZOCA) is in the Gangdese metallogenic belt in the southern Tibet Plateau. It has huge prospecting potential. Most of the mineral resources on the Gangdese metallogenic belt are controlled by the dome and fault. The deep structure and the coupling relationship between the Cuonadong dome and the deep structure are of great significance for understanding ore-controlling structures and hydrothermal channels. Existing studies have been controversial in the study of whether there are hidden structures in the deep part of the Zhaxikang deposit, and whether the Cuonadong dome extends to the bottom of the Zhaxikang deposit in the Gangdese metallogenic belt. Therefore, we comprehensively analyzed a large number of gravities, magnetic, and magnetotelluric data in the Zhaxikang area and carried out a fusion display of multiple information in the Zhaxikang ore-concentration area. Understand the relationship between the Cuonadong dome, fault system and deep hydrothermal channel through fusion display to analyze the background of Zhaxikang metallogenesis. The deep structure of the Cuonadong dome was identified, and it was found that there was a hidden structure at the bottom of Zhaxikang that was not connected to the Cuonadong dome. These findings are a great significance for further theoretical research and breakthroughs in ore prospecting.

1. Introduction
The research area (The Zhaxikang ore-concentration area) was located south of the Yarlung Zangbo River suture zone (ITSZ) and north of the South Tibet Detachment System (STDS), and was structurally located in the Tethyan Himalayan tectonic zone. One of the areas with the most resource potential in the ore belt [1]. The mineral types in The Zhaxikang ore-concentration area (ZOCA) included hydrothermal minerals such as Pb−Zn and Sb−Au, as well as medium and high temperature minerals such as Be−W−Sn [2]. The Zhaxikang area is rich in mineral types, and the reserves of various minerals are huge. It is a very important mineral resource-rich area in China and has huge prospecting potential. Due to the relatively large and complex tectonic structure in this area and the relatively high tectonic deformation, the degree of geophysical work carried out in the mining area is not high, and the deep structure and geological information were not clear enough, which seriously restricts the research of the mineralization and potential problem on Important Geological Issues.
2. Research status of The Zhaxikang ore-concentration area

In recent years, the Chengdu Center, China Geological Survey has carried out resistivity methods such as magnetotelluric sounding (MT), audiomagnetotelluric method (AMT), induced polarization method, multi-electrode resistivity method and other electrical methods and also carried out 1: 50,000 area gravity and magnetic measurements [3]. Predecessors carried out some geophysical exploration work on geological problems such as deep structures (Figure 1). However, a single geophysical method was extremely prone to multiple solutions in complex geological environments, the results obtained by different geophysical methods were different. Seismic exploration found no sign of hidden rock masses at a shallow location 4km below the deposit [4]. The results of the magnetotelluric inversion showed that there was a hidden rock mass beneath the Zhaxikang deposit, and the hidden rock mass is not connected to the Cuonadong dome [5]. Jiao et al., considered that the hidden rock mass was caused by the extension of the Cuonadong dome to the north of the Zhaxikang deposit based on gravity and magnetic data. Therefore, we comprehensively analyze the existing geophysical data and use GOCAD software to perform three-dimensional fusion display to explore the spatial morphology of the Cuonadong dome, the relationship between the Cuonadong dome and the fault system and deep hydrothermal channels. The analysis of the Zhaxikang metallogenic background by this method provides a basis for further research on the metallogenic theory.

![Figure 1. Gravity, magnetic, magnetotelluric exploration range and survey line distribution.](image)

3. Comprehensive evaluation of multiple information and three-dimensional spatial display

This article collected three Magnetotelluric profile (NWGM1, NEGM1, EWM2) above the Cuonadong dome, passing through the dome from northwest, northeast, and east-west respectively, and collected an Magnetotelluric profile SNM1 that passed through the Cuonadong dome and the Zhaxikang ore-concentration area. Comprehensively revealed the deep structure of the the Zhaxikang ore-concentration area.

Predecessor statistics of rock physical properties show that a large amount of leucogranites in the core of Cuonadong dome has high-resistance and low-density features, and the three geomagnetic profiles above the Cuonadong dome also showed high-resistance features inside the dome (Guo et al., 2019). According to the shape of the dome boundary and the deep structure of the dome revealed by the Magnetotelluric profile, the electrical structure inside the dome is a high-resistance body as a
whole. However, the high-resistance body is not a complete whole, it can be divided into several parts, showing the characteristics of block and partition. According to the comprehensive comparison of the shape of the dome boundary revealed by the magnetotelluric profile and the 1: 50,000 area gravity and magnetic data, the range of the Cuonadong dome was delineated in GOCAD.

We used 3D inversion data of gravity, continuation of magnetic data, and magnetotelluric profile to display 3D model in GOCAD (Figure 2). It can be seen that there is a low-density anomaly below mineral deposit, and a strip-shaped low-density anomaly exists in the north-south direction. The northern of the strip anomaly appears to protrude towards the Zhaxikang deposit, indicating that the low-density body beneath the Zhaxikang deposit may be caused by the Yufeng fault. Looking at the deep underground electrical structure revealed by the magnetotelluric profile, there was a high-resistance body anomaly beneath the Zhaxikang deposit. Gravity data and magnetotelluric data together show that hidden rock masses in the deep part of the Zhaxikang deposit were present, with overall characteristics of high resistance and low density. The Cuonadong dome and the hidden rock mass are independent of each other, and the Cuonadong dome does not extend below the Zhaxikang deposit and there is no tendency to connect. Through the fusion of the magnetotelluric profile and gravity data and magnetic survey data, we can see that there are two magma channels in the deep part of the Zhaxikang deposit and the Cuonadong dome. The three-dimensional fusion display showed the spatial morphology of the Cuonadong dome, the relationship between the Cuonadong dome and the fault system and the deep hydrothermal channel, which provided a basis for the subsequent research on the mineralization theory of The Zhaxikang ore-concentration area.

![Figure 2. Gravity, magnetic, magnetotelluric fusion display.](image)

**4. Conclusions**

1) The Cuonadong dome structure is characterized by low magnetic, low density, and high resistivity properties. The three-dimensional fusion showed that the high-resistance body inside the dome was not a complete whole but presents the characteristics of block and partition.

2) Measurements of gravity, magnetic and magnetotelluric show that there was a geological body with high resistivity and low density in the deep part of Zhaxikang. Combined with the core of Cuonadong dome, the core is also high-resistance and low-density, so it can be judged that the geological body below the deposit is a hidden intrusive rock body.

3) The fusion of multiple geophysical methods shows that there is a hidden structure at the bottom of Zhaxikang that is not connected to the Cuonadong dome, and there are two magma channels in the Tashikang Mine Concentration Area and the deep part of the Cuonadong dome. The mutual constraint of multiple geophysical methods can improve the accuracy of understanding the study area and further ensure the authenticity of deep structures.

**References**

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