Metallogenic Prediction of the Peripheral Areas of the Xiyi Concealed Lead-Zinc Deposit in Baoshan City, Yunnan Province

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The newly-discovered Xiyi lead-zinc deposit is a large deposit located in the north central Baoshan block of the southern Sanjiang metallogenic belt section, Southwest China. The surface of the deposit is mainly covered by eluvial-deluvial lateritic layer, without any mineralized outcrops. The main concealed orebody V3 is buried in the depth of 300~500m. The orebodies are controlled by certain stratigraphic horizons, and most are cut by strata with a high angle, while a few occur along the strata. The direct wall rocks are calcisilite, calcilithite, bioclastic calcarenite, structural breccia and karst breccia, and some veins are hosted in the lithologic conversion interfaces between the carbonate rocks and clastic rocks. The orebody roofs are mostly black carbonaceous argillaceous micritic limestones or carbonaceous calcareous mudstones, and mainly occurs in the structural fracture zones F17 (Fig. 1). The element vertical distribution of primary halo from the borehole along the prospecting line I-II illustrates that the elements display from low-temperature (Hg-Sb-As), medium temperature (Ag-Pb-Zn-Cu) to high temperature (W-Bi-Ni-Ti-Fe) from shallow to deep. Moreover, different stages of calcite veins intersect with each other in the deposit, indicative of multi-stage of hydrothermal activities. A comprehensive analysis of the measured geological, geophysical and borehole primary halo data indicates that this deposit may be a hydrothermal one controlled by structures. The element vertical distribution of primary halos from the boreholes along the prospecting line I-II illustrates that the elements display from low-temperature (Hg-Sb-As), medium temperature (Ag-Pb-Zn-Cu) to high temperature (W-Bi-Ni-Ti-Fe) from shallow to deep. Moreover, different stages of calcite veins intersect with each other in the deposit, indicative of multi-stage of hydrothermal activities.

The orebody in Dongjiazi block is mainly chosen to conduct comprehensive geophysical and geochemical tests, such as Audio Magnetotelluric Sounding (AMT), Controlled Source Audio-Magneteto Telluric (CSAMT), Time-domain induced polarization (TDIP), complex resistivity (CR), and borehole primary halo. As a result, a comprehensive geological-geophysical-geochemical prospecting model was established as following.

1) Geological signs: (1) Structure: high angle NE- and NW-trending ore-controlling structures; (2) Stratum: ore-hosting strata of mainly carbonate rocks; (3) Alteration: mainly dolomitization and silicification; (4) Vein minerals: mainly barite, dolomite, calcite and quartz.

2) Geochemical signs: (1) Geochemical anomalies of Pb, Zn and Ag that delineated from the 1:25000 soil geochemical survey; (2) Vertical zonation of the borehole primary halo: halo of the hanging wall (Hg-Sb-As), near ore halo (Ag-Pb-Zn-Cu) and footwall halo (W-Bi-Ni-Ti-Fe).

3) Geochemical signs: (1) Deep concealed ore-passing structures and lithology mutation interfaces delineated from AMT data (Figs.1f); (2) Induced polarization anomalies delineated from intermediate gradient TDIP survey (Fig.1d); (3) IP anomaly (Fig.1d, e).

A comprehensive effective prospecting method is summarized as following: (1) Favorable mineralization positions of deep concealed ore-conduit structures and lithology mutation interfaces delineated from AMT data in the geochemical anomaly targets of Pb, Zn, Ag (Fig.1f); (2) Ore-induced IP anomalies determined from TDIP intermediate gradient scanning along and nearby the ore-passing structures deduced from AMT (Fig.1f); (3) The depths and strikes of the polarization bodies deduced from IP sounding in the ore-inducing IP anomaly positions (Fig.1e); (4) Engineering verification when the Pb and Zn anomalies, the deduced concealed ore-passing structures by the magnetotelluric survey, and the IP anomalies are well consistent.

Based on the comprehensive prospecting model and method above, as well as the existed geochemical anomalies, we carried out the prospecting work in the peripheral areas, including profile AMT measurement (10 km), IP intermediate gradient (170 km) and IP sounding (60 points). As a result, we determined the positions and strikes of the primary ore-controlling structures in the Zhaohuai and Lutu ore blocks, and delineated three IP anomalies of Hongtuzhai, Lutu and Dabakou. The verification drilling suggested that the newly increased

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lead-zinc reserves in Zhaozhai ore block amount to about 100,000 tons, meanwhile, a deep lead-zinc (silver) orebody was newly discovered in the ore block of Hongtu village. We also deduced from IP anomalies that the main ore-passing structures of Lutu ore block were in the west, which will be further proved.

Through three years of field tests, we found that seasonal factors have a influence on the high-power induced polarization effect and data acquisition quality in the laterite-covered areas of Baoshan, Yunnan Province. The power supply effect influences the delineated IP anomalies, and the moisture content of the surface directly affects the power supply effect. Too dry or too wet surface will both result in an unsatisfactory power supply effect. In the last 50 years, the rainfalls in Baoshan mainly concentrated during June–September, and a satisfactory period for IP fieldwork is within three months after the rainy season.

In summary, the research in Xiuyi lead-zinc deposit established a comprehensive prospecting model and method, and discovered some prospecting signs through metallogenic prediction. The research achievements provide significant instructions and references for the peripheral prospecting work. The proposal that the seasonal factor has a influence on the high-power induced polarization effect and data acquisition quality in laterite-covered areas is of important practical meaning for the ore-inducing polarization anomalies delineation. The new understanding that the structures control the orebodies will provide a new thought and technical supporting for the theoretical research of mineralization, prospecting evaluation and prospecting prediction in the integrated Baoshan-Longling lead-zinc exploration area.