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Characterization of Primary Geochemical Halos and Prediction Pattern of Deep Orebody in Wannian Silver-Gold Deposit, Jiangxi Province, China

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1 Geology and Mineralization

The Wannian silver-gold deposit in Jiangxi province in south China is situated in the middle part of the Qinhang metallogenic belt separating the Yangtze craton and Cathaysian Blocks. Most deposits in this belt including Yinshan polymetallic deposit, Dexing porphyry copper mine and Jinshan orogenic gold deposit nearby are formed in Mesozoic age although they occur along a Precambrian suture (Mao et al., 2011).

The country rock of Wannian silver-gold deposit is low-grade metamorphosed sedimentary and mafic volcanic rocks of the lower Mesoproterozoic Shuangqiaoshan Group. The metamorphic rocks of the Shuangqiaoshan Group are folded and intruded by Mesozoic quartz diorite porphyrite before mineralization. Fault VI and VII are the main ore-controlling structures in the mine area. Minor structures are developed on both sides of these faults. The VII# main orebody has a vein-like form and occurs in the VII fault fracture zone and is strictly limited by it. The strike of VII# orebody is NE and dips SE with a steep dip angle. Silicification and sericitization are the main alteration related to mineralization. Carbonatization, chloritization and pyritization also develop along the ore bodies. The mineral composition at Wannian is complex and the major ore minerals are freibergite, pyrargyrite, argentite-acanthite, stephanite, miargyrite, electrum and native gold (Xu et al., 1993), which distribute in the fractures and inter-granular space of metallic minerals including pyrite, chalcopyrite, galena, sphalerite, and arsenopyrite. The gangue minerals are dominated by quartz, calcite, rhodochrosite, chlorite and sericite. Four metallogenic stages can be recognized: Stage 1 is quartz –

carbonate, Stage 2 is quartz - polymetallic sulfide, Stage 3 is fine particles sulfide and Stage 4 is carbonate.

2 Sample Collection and Analysis

129 samples in this study were taken along the vein at different levels from 65m to –235 m. Each sample is a composite of 3 to 5 pieces of fresh rock collected in 5m range at intervals of 50 to 60 m. The samples were analyzed by the Northeast Laboratory of Bureau of Geological Exploration & Development Hubei Province and 15 trace elements (B, Sn, Au, Ag, Bi, Hg, Mo, W, F, Cu, Cr, Mn, Ni, Pb and Zn) were analyzed.

3 Results and Conclusions

Factor analysis shows the trace elements analyzed could be divided into three clusters: F1 factor (Pb, Sn, Hg, Zn, Cu and little Ag) is the quartz-polymetallic sulfide stage. The typical co-existing metal minerals are pyrite, chalcopyrite, galena, sphalerite and arsenopyrite with freibergite and argentite distributing in the intergrains. F2 factor (Ag, Au, Mn and little Hg, Sn) reflects the later superposed Ag-Au mineralization of fine particles sulfide Stage 3. In this stage ore minerals include stephanite, miargyrite, electrum and native gold occur in the fractures of early minerals. This deposit has a feature of one period of Au mineralization and two periods of Ag mineralization. F3 factor (Ni, Cr, F, B) may represent later hydrothermal activity.

Geochemical profile of orebody vein shows high value zones inclining southeastward, which is consistent with the lateral trend of ore bodies. Multivariate statistical methods combined with geochemical parameters

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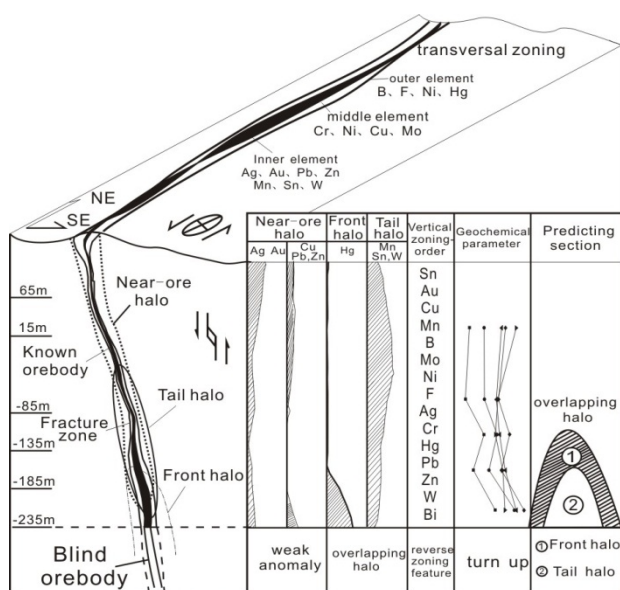


Fig. 1. Schematic diagram of three-dimensional deep prognostication pattern of II Primary halo belt in Wannian silver-gold deposit.

information, shows there are three primary geochemical halo zones developed in the Wannian silver-gold deposit. The I primary halo zone distributes in the west region of Line 6 exploration with strong anomalies of near-halo elements (Ag, Pb and Cu) and weak anomalies of Hg, F, B, Au, Zn, W, Bi, Mn and Sn. The III primary halo zone occurs in the east area of Line 62 exploration: The near-halo elements (Ag, Au and Bi) occur in the upper area while the tail halo (Mo, Mn, Ni, Cr) occurs at depth. The II primary halo zone occurs in the area from line 20 to 56 exploration. There is a distinct accumulation of Mn, Ni, Au in the upper horizon (–35 m to 65 m) of the anomalies. Pb, Zn, Sn, Mn, W accumulate in the middle to deep horizon (–135 m to –235 m) superposed by Front-halo element Hg with a strongly anomaly and not closed down ends nearby the 46th exploration at the depth of –165 m (Fig. 1), which indicates existence of other ore bodies or exist of other ore bodies between two large ore bodies in the area below the elevation of –235 m.

The primary halo research shows there is an obvious reverse zoning feature in the II primary halo belt. The zonation sequences of primary halo from the top are Sn-Au-Cu-Mn-B-Mo-Ni-F-Ag-Cr-Hg-Pb-Zn-W-

Bi (Fig. 1). The high value zonation of Hg and F are located in the middle and underside. The normal zonation

sequences of primary halo of gold deposits in China as reported by Li et al (1999) is B-I-As-Hg-F—Sb-Ba-Pb-Ag-Au-Zn-Cu-W-B—Mo-Mn-Ni-Cr-Co-V-Bi. The typical front halo elements (Hg and F) are enriched in the lower part of the zoning sequence and the distribution patterns of indicator elements are reverse, which is likely to be the head halo of a concealed ore body (Li et al., 1995).

The zoning chemical parameter is an important and efficient indicator in blind orebody exploration (Li, 1999). Ore bodies forming during a first metallogenetic stage with a subsequent ore body formed in a second stage at depth, then tail halo and front halo occur in the same location. The chemical parameter of logarithmic product-ratio of the front halo elements (Hg, F and B), metallogenic elements (Ag and Au) and tail halo elements (Mn, Ni, W, Mo) (i.e. Hg/Mn , Hg/Ni , $(Hg \times F)/(Mn \times Ni)$, $(Hg \times F \times B)/(Mn \times Ni \times W)$ ($Au \times Ag)/(Mn \times Ni)$) show a sudden increase (Fig. 1), which also suggests there is a blind orebody at depth.

Combining the high product of Ag-Au grade and the thickness of ore body and the lateral trend of a thick orebody, we build a deep prognostication pattern (Fig. 1) and make a prediction of blind orebody in the area below the elevation of –235m between 46 to 56 exploration lines. This interpretation presents a clear target for later exploration.

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