**Typical Geological Features of Rich Zn-Pb-(Ge-Ag) Deposits in Northeastern Yunnan, China**

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1 Introduction

The large clusters of mineral deposits in northeastern Yunnan, located in the southwestern margin of the Yangtze Block, is an important part of Sichuan—Yunnan—Guizhou Zn-Pb Poly-metallic Mineralization Province. The deposition concentration district is surrounded by NE-trending Mile-Shizong fault belt, SN-trending Xiaojiang fault belt and NW-trending Ziyun-Yadu fault belt. Major metallogenic age is late Indo-China which is constrained by tectonic deformation screening, tectonic stress measuring and isotopes (Han et al, 2007, 2012).

2 Unique Features of Deposits

Detailed geological studies from the super-large-sized Huize_Pb-Zn-(Ge-Ag) deposit and Lemachang Pb-Zn-Ag deposits, large-scale zhaotong, Maozu, Lehong, Jinshachang and Fulechang Pb-Zn deposits show that these deposits have unique geological features which are different from the domestic and foreign known typical MVT-type Pb-Zn deposits as following:

1) The deposits are characterized as high Zn+Pb grade (normally ≥25%, locally >50%). The survey shows that there are rare.
2) The Zn-Pb ore of these deposits have high content of germanium, cadmium, indium, and argentie. For example, the contents of germanium and argentie in the Huize deposit are from 1.49 to 256ppm and 0.576 to 309ppm respectively. Zn, Pb and Ag, Ge, Cd reserves of single ore-body may reach large-scale deposit.
3) The deposits are close genetic relation with thrust-fold structures. And left-hand compresso-shear faults control the ore-bodies in space. Figure 1 show the typical deposits that are controlled by thrust-fold structures. The trending length of ore-bodies is less than deep extent.
4) About four hundred Zn-Pb deposits or occurrences have identified in SYG. Host rocks of the deposit are HTD dolomite or dolomitic limestone with geological ages from Sinian to Permian.
5) These deposits have apparent mineral assemblage from the hanging-wall to the foot-wall with mineral assemblage of marmatite-pyrite–quartz-ferrro-dolomite → sphalerite–galena → pyrite–dolomite-calcite.
6) Unmixing bearing-LCO₂ fluid inclusion features in 6 kinds of fluid inclusions indicate that CO₂ fluid had generated ebullition in ore-controlling structures. The homogenization temperature and salinity of fluid inclusions for sphalerite and calcite is: (183~221)°C and (13~18) wt% NaCl; (255~355)°C and (1.8~4.0) wt% NaCl. Ore-forming hydrothermal solution was mainly derived from deep source fluid and metamorphic basement by geochemistry of Sr-Pb, C-H-O, S isotopes(Han et al. 2006).

3 Mineralization Model of Deposits

Leach et al. (2010), Mao et al. (2005) and Liu et al. (2008) proposed that the typical MVT-type deposits mainly formed in the stretch background, and ore-controlling structure is normal faults. However, these deposits in the SYG are controlled by left-hand compresso-shear thrust faults. Thrust faults relate to Tethys closure in the late Indo-China period in the region. All kind of deposits are located in carbonate platform at foreland in the orogenic belt. These geological features are clearly different from known types of Pb-Zn deposits. This paper, which is defined a new genesis type of Pb-Zn deposit as the Huize type (HZT). They formed under
compressive tectonic background, and strictly controlled by thrust-fold structure in the ore-hosted carbonate, and ore-forming rich gas (ie. CO₂) fluid with medium-high temperature and medium-low salinity penetrated to form the deposits.

The metallogenic process roughly experienced three stages: A) the formation of thrust-fold structures and fluid large-scale fluid migration; B) ore-forming fluid penetration, gas-liquid differentiation and the formation of ore-rich fluid; C) rich fluid unloading and tectonic-fluid coupling mineralization. (Fig. 2)

4 Conclusions

1) The special geological features of deposits in the district are different from known types of lead-zinc deposits worldwide.

2) The formation of the HZT-type deposits was related to the late Indosinian orogenic extrusion. Ore-bodies are controlled by left-hand compresso-shear thrust faults. Structure-fluid 'penetration' mineralization model of HZT-type deposits is undoubtedly of great importance in studying SYG Zn-Pb poly-metallic mineralization province, and making new breakthrough in the exploration and evaluation for similar deposits in the world.

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