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Metallogenesis of the Nongtun Large-scale Pb–Zn Deposit in Guangxi, South China: a Preliminary Study on the Fluid Inclusion

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The Nongtun ore deposit, located in the northwest of the Ag–Pb–Zn polymetallic district in Xidamingshan, Guangxi, is a large-scale Pb–Zn deposit. It is a newly discovered deposit in the southwest edge of the Qin–Hang metallogenic belt, for which some aspects of its genesis are still poorly understood, such as the origin and evolution of the mineralizing fluids, the precipitation mechanisms, and the genetic type. This paper draws on detailed field investigations together with new data from fluid inclusions, with a view to understanding the characteristics of ore-forming fluid and the genetic types of ore deposit.

1 Types of Mineralization

Two types of mineralization are distinguished in Nongtun Pb–Zn deposit: vein-type and laminated-type mineralization. Vein-type mineralization is closely related to faults and principally distributed in the exploratory line (271~232) south of the ore district. The ore body generally occurs as a series of steeply-dipping (20°~60°), subparallel veins that develop along the NE–SW or roughly E–W trending faults. The structures of ores generally are vein, brecciated, or disseminated. The metallic minerals are dominated by sphalerite, pyrite, and galena, with a small quantity of chalcopyrite, and the gangue minerals are quartz, calcite, and so on. Laminated-type mineralization is weakly related to faults and mainly distributed in the exploratory line (00~16) east of the ore district. The ore body of this type is in a subparallel formation with a low-angle (<30°). The ores mainly show a laminated structure. The metallic minerals are sphalerite and pyrite, and the gangue minerals are quartz and calcite.

2 Fluid Inclusion Studies

Three types of fluid inclusions are recognized in calcite and quartz in Nongtun Pb–Zn deposit: two-phase, liquid-rich inclusions; two-phase, vapor-rich inclusions; and liquid-only inclusions. For the vein-type mineralization, fluid inclusions in calcite typically show rectangular, square, rhombic, tubular, or negative crystal shapes, and those in quartz are oval or irregular. The size of fluid inclusions ranges from 3 to 16 μm (longest length) with vapor–liquid ratios of 5%~45%. For the laminated-type mineralization, fluid inclusions in calcite typically show rectangular, square, rhombic, tubular, or oval shapes, and those in quartz are difficult to find. This type of inclusion ranges in size from 3 to 13 μm (longest length), with vapor–liquid ratios of 5%~60%.

The temperatures associated with vein-type mineralization mainly range from 120 to 340 °C, concentrating in 120~200 °C and 220~280 °C, respectively, with only a few inclusions ranging around 400 °C (Fig. 1, a). The temperatures related to laminated-type mineralization mainly range from 200 to 375 °C, concentrating in 200~325 °C and 350~375 °C, respectively, with only a few inclusions exceeding 400 °C (Fig. 1, b). The temperatures of laminated-type mineralization are noticeably higher than those of vein-type from our microthermometric study.

The calculated salinities associated with vein-type mineralization mostly range from 1 to 13 wt.% NaCl equiv, concentrating in 5~10 wt.% NaCl equiv, with only a few inclusions ranging around 15 wt.% NaCl equiv (Fig. 2, a). The calculated salinities related to laminated-type mineralization mostly range from 3 to 12 wt.% NaCl equiv, whose distribution is relatively concentrated, with only a few inclusions exceeding 15 wt.% NaCl equiv (Fig. 2, b). The salinity results indicate that there are no

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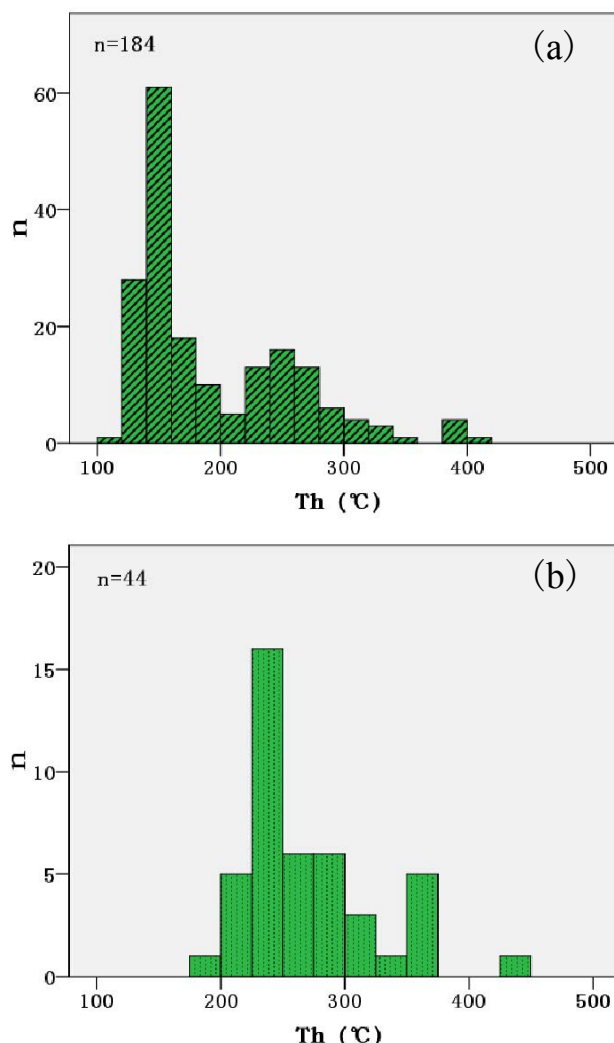


Fig.1 Histograms of homogenization temperature of fluid inclusions (a–Vein; b–Laminated).

significant discrepancies between the two types of mineralization.

3 Genetic Implications

Fluid inclusion studies play a very important role in understanding ore genesis (Wilkinson, 2001). The study on the nature of ore-forming fluid, with fluid inclusions as the carrier, is helpful to determining the genetic types of deposits (Liu et al., 2010). Previous studies indicated the ore-forming fluid of MVT Pb–Zn deposit is characterized by low temperature (75–200 °C) and high salinity (10–30 wt.%) (Basuki and Spooner, 2004; Kesler et al., 2007; Leach et al., 2010), whereas the SEDEX Pb–Zn deposit is mainly marked by moderate–low temperature (70–260 °C) and moderate–low salinity (1–23 wt.%) (Canet et al., 2003; Large et al., 2005). The skarn Pb–Zn deposit is generally distinguished by moderate–high temperature (200–475 °C) and moderate salinity (6.5–16 wt.%)

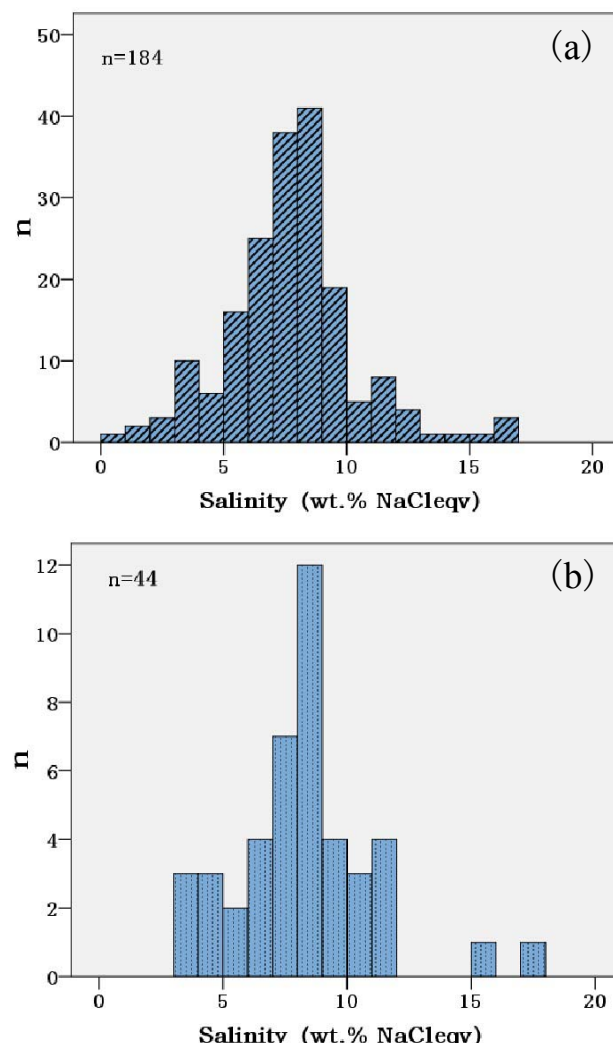


Fig.2 Histograms of salinity of fluid inclusions (a–Vein; b–Laminated).

(González-Partida et al., 2003; Zhao et al., 2003). The hydrothermal vein-type Pb–Zn deposit is generally characterized by moderate–low temperature (110–300 °C) and low salinity (1–10 wt.%) (Marchev et al., 2005; González-Partida and Camprubí, 2006).

Based on the analysis from ore-forming fluid (120–340 °C, 1–13 wt.%) and geological characteristics, we found that the Nongtun Pb–Zn deposit is compatible with the typical hydrothermal vein-type Pb–Zn deposit. In the deposit, the nature of fluid associated with vein-type and laminated-type mineralization is different and may represent the products of different metallogenic stages. The homogenization temperatures and salinities of fluid inclusions associated with laminated-type mineralization are relatively concentrated, ranging from 200 to 375 °C and 3 to 12 wt.%, respectively. The mineralization only shows the assemblages of sphalerite and pyrite, which may represent the products of hydrothermal activity (moderate–high temperature with low salinity) in the early stage. The

distribution of homogenization temperatures and salinities of fluid inclusions related to vein-type mineralization are wide, ranging from 120 to 340°C (concentrating 120~280°C) and 1 to 13wt.% (concentrating 5~10wt.%), respectively. The mineralization shows assemblages of sphalerite, pyrite, galena, and minor amounts of chalcopyrite, which may represent the products of hydrothermal activity (moderate–low temperature and low salinity) in the main and late stages.

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