Constraining ore-forming model of Dongxiang deposit, South China: Evidence from Rb-Sr dating

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1 Introduction

The Dongxiang Cu deposit (E116°36′34″-116°39′41″, N28°17′15″-28°17′55″) is located 43 km northeast of Fuzhou City, Jiangxi Province (the northeastern region of Jiangxi Province), South China (Figure1). The ore-forming model of the Dongxiang copper deposit was controversial. Some researchers supposed that it was Carbonifer-
uous sedimentary exhalative deposit, and others argued that it was Jurassic magmatic hydrothermal deposit (Hsu, et al., 1990; Wang, et al., 2012; Zhou, & Yue, 1998). Precise dating on the mineralization and associated intrusive rocks is crucial for understanding the ore-forming model. Rb–Sr isochron method within quartz samples from the massive sulfide ores and zircon U-Pb dating method were applied to obtain the ore-forming and rock-forming ages.

2 Fluid-inclusion petrography

The samples in this study for analysis are quartz which coexist with massive sulfide ore; mostly distribute the surrounding of chalcopyrite and pyrite. Petrographic evidence reveals that type 1 and 3 fluid inclusions coexist in the main ore-forming stage Cu-bearing quartz veins. Type 1 inclusions with rich gas are often isolated or appear in groups, the proportion of gas to the volume of inclusions is from 15% to 30%. Type 1 inclusions have homogenization temperatures peaks ranging from 300–340°C and salinity values of 0.35–5.86 wt%, and type 3 inclusions have homogenization temperatures peaks ranging from 280–320°C and salinity values of 29.4–41.9 wt%. They show similar homogenization temperature ranges but different salinity values. The homogenization temperature of type 2 inclusions are 272–392°C, the temperature peaks are 320–380°C, the salt contents are mainly 5–8 wt%NaCl (Cai, et al., 2011). As described above, such occurrences, temperatures and homogenization behaviors of fluid inclusions indicate that a boiling process has taken place during the main ore-forming stage. The characteristics captured under boiling conditions are of typical hydrothermal solution of magmatic.

The high homogenization temperatures and salinities of some fluid inclusions indicate the initial existence of a dense brine, probably of magmatic origin. The coexistence of liquid- and gas-rich fluid inclusions (sometimes in well-defined concentric or parallel growth zones) suggests that these fluid inclusions (fluids 1 and 3) resulted either from the trapping of boiling fluids or represent two immiscible fluids (a vapour-rich fluid and a hypersaline fluid) derived directly from a magma, as described in other intrusion-related deposits.

3 Conclusions

The precise mineralization age was obtained by ore fluid Rb-Sr dating method. It was 161.8±9.6 Ma (MSDW=1.3). The granodiorite-porphyries have Middle and Late Jurassic crystallization age (U-Pb) of 164.3±1.6 Ma (MSDW=1.7) and 160.3±1 Ma (MSDW=0.89) and the quartz porphyry yields a crystallization age (U-Pb) of 142.1±1.2 Ma (MSDW=0.67). It implies that the mineralization of the deposit is temporally closely associated with the granodiorite-porphyries. The study of fluid inclusions and H-O isotope also suggested a magmatic source for ore fluids. Another interpretation of the origin of the deposit is sedimentary exhalative deposit (SEDEX), which mainly supported by the following evidences (Gu, et al., 2007; Gu, & Zheng, 1990): 1) the orebodies show considerable lateral extension and are strictly strata-bound in the Late Palaeozoic sequence are conformable to the host sedimentary rocks; 2) all the strata-bound orebodies are dominated by massive sulphide ores with sulphide minerals amounting to more than 60 vol.%, although banded, laminated, and dis-
Sedimentary ores are also commonly seen, particularly at the edges of the massive sulphide bodies. So we supposed that the Dongxiang Cu deposit was a SEDEX-with magmatic hydrothermal superimposition deposit. Combined with previous studies, we suggest that mineralization of the Dongxiang deposit is related to Mesozoic large-scale lithosphere extension.

References


