1 Introduction

The Pingshui deposit, located in Southeastern China, is a Cu-Zn deposit with metal reserves of 0.45 million tons grading 1.03 wt.% Cu and 1.83 wt.% Zn. It is currently the largest known copper ore in Zhejiang Province. Recent exploration in the depth of the Pingshui mine, gold orebodies were found in the ductile shear zone adjacent to the copper orebodies. The wall rocks exposed around Pingshui mine is the Proterozoic Pingshui Formation volcanic rocks (Fig. 1). Quartz diorites, plagioclase granites and granites intruded the Pingshui volcanic rocks. The major structures developed in the Pingshui deposit are faults and ductile shear zone (Fig. 1). The NE-trending faults control the occurrences of the copper orebodies, while the nearly parallel ductile shear zone hosts the gold orebodies.

Fluid inclusions present in mineralized systems probably can indicate the ore deposit genetic type. A systematic summary has been conducted by many fluid inclusion researchers (Roedder, 1984). Fluid inclusion studies suggest that massive sulfide deposits generally show moderate temperatures (200-350°C) and low to moderate salinities (1~8.4wt% NaCl) (Wilkinson, 2001). Orogenic gold deposits have moderate temperature (commonly 200 to 350°C), low-salinity (<10% wt.% NaCl equivalent) and CO2-rich fluid inclusions (Zhao et al., 2013).

2 Fluid inclusions studies

2.1 The Cu-Zn ore body

In this study, a detailed investigation of fluid inclusions in quartz from massive and banded sulfide ore. Two types of fluid inclusions can be recognized in the studied quartz samples: primary two-phase aqueous fluid inclusions (type I) and secondary two-phase aqueous fluid inclusions (type II). Two-phase aqueous fluid inclusions (type I) occur as individual inclusions and random groups. Type II fluid inclusions occur along healed micro-fractures crosscutting mineral grain boundaries. Type I inclusions showed melting of ice in the range of −3.5 to −1.9°C, and correspond to salinities from 3.2 to 5.7 wt.% NaCl equivalent. In addition, this inclusions show final homogenization to liquid at temperatures between 217 and 328°C. Type II inclusions showed melting of ice in the range of −2.8 to −1.6°C, and correspond to salinities from 2.8 to 4.6wt.% NaCl equivalent. In addition, this inclusions show final homogenization to liquid at temperatures between 148 and 189°C. The Laser Raman spectroscopy analysis of type I and II inclusions showed that H2O is the dominant composition, without other compressive volatile compositions.

Our detailed microthermometry and Raman analysis demonstrate that homogenization temperature, salinity, type of fluid inclusions of these deposits are same to the typical volcanic massive sulfide deposits that formed in submarine environments. Therefore, fluid inclusions from quartz associated with ores suggest that mineralizing...
fluids at Pingshui are mainly seawater, just like most modern and ancient worldwide VMS deposits.

2.2 The gold ore bodies

The samples from the gold-bearing quartz veins were gained from the drill holes. Two types of fluid inclusions can be identified in the studied quartz samples: H₂O–CO₂ inclusions (type I) and aqueous fluid inclusions (type II). Type I inclusions show variable CO₂ phase volumetric proportions. Some type I inclusions have two or three phases (liquid H₂O + liquid CO₂ ± vapor CO₂) at room temperature, and some others have > 90% only contain little water. Aqueous fluid inclusions (type II) usually include an aqueous liquid and a small vapor phase and appear with a filling degree of 80 to 90 volumetric percent liquid. Melting of the CO₂ clathrate occurred between 6.8 and 9.4°C, and calculated salinities of the aqueous phase in the inclusions ranged from 1.2 to 6.0 wt.% NaCl equivalent. Partial homogenization of CO₂ liquid + CO₂ vapor to vapor CO₂ happened at temperatures between 17.6 and 26.3°C. They showed final homogenization temperatures to liquid phase from 225 to 282°C. Ice melting of type II inclusions took place at temperatures of −5.6 to −1.6°C, and correspond to salinities between 2.7 and 8.7 wt.% NaCl equivalent. Moreover, these inclusions finally homogenized to liquid phase at temperatures of 214 to 271°C.

Petrography evidences reveal that type I and II fluid inclusions coexist in the gold-bearing veins. Type I and II fluid inclusions show similar homogenization temperature range but contrasting salinity values. Behaviors during heating process demonstrated that type II inclusions homogenized to liquid phase, whereas type I inclusions homogenized to gas phase. Fluid immiscibility is the most possible mechanism for gold deposition of Pingshui deposits.

Fluid inclusions in auriferous quartz veins are characterized by moderate temperature, low-salinity and CO₂-rich fluid inclusions, thus ore fluids might be orogenic origin. The Pingshui deposits have experienced extensively NE-trending ductile shear deformation.

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