
LA-ICP-MS Trace Elements Analysis of Colloidal Pyrites from Xinqiao Cu-S-Fe Deposit in Tongling, Anhui Province

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Xinqiao Cu-S-Fe Deposit is one of the most important deposits in Tongling Ore Cluster Area, the Middle-lower Yangtze metallogenic belt. The study achievements of the deposit, such as petrogenic age, ore-forming elements zoning, characteristics of ore-forming fluids, Ore-controlling factors, metallogenic regularity and so on, have been obtained(Zhang, 1982; Wang, 1991; Xie et al., 1995; Zhou et al., 2000; Wang et al., 2004; Zang et al., 2004, 2007; Li et al., 2005; Xu et al., 2009). But the genesis has been on discussion because the genesis of the special mineral, the colloidal pyrite, is not clear. So we test in situ major elemnts (Fe, S) and trace elements (Co, Ni, Cu, Zn, As, Se, Te, Pb, Au, Ag, Ba, W and Bi) of colloidal pyrites by EPMA and LA-ICP-MS to analyze the genesis of colloidal pyrites based on the geochemical characteristics and provide reasons for the genesis study of the deposit.

1 Geological Setting

Located in the transition zone between North China Platform and Jiangnan Geanticline, Xinqiao Cu-S-Fe Deposit is controlled by the fracture zone between Huanglong Group and Chuanshan Group in middle Carboniferous. The SW trending Antcline Shuijiadian and the SW trending Antcline Dachengshan plunge opposite and in the plunging crown is the Syncline Shenchong, which causes that these three folds forms useful room for rock mass’ and ore bodies’ taking place. The main rock mass within the mining area is Jitou Rock Strains, the exposed area and the lithology of which is 0.5km² and quartz diorite, respectively.

Orebody 1 is the main orebody of the Xinqiao orebodies. The shape of the orebody is mainly layered and stratified. The primary Ore minerals includes pyrite, magnetite, chalcopyrite, colloidal pyrite, siderite and pyrrhotite; gangue mineral includes calcite, dolomite, chlorite and quartz. The ore texture includes granular texture, colloidal texture, metasomatic texture, reticular texture, nervation texture, zonal texture, lamellar texture, scrunch texture, crush texture etc. The ore structure includes massive, disseminated structure, nerve structure, curl structure, mesh-vein structure etc. Wall rock alteration includes skarn alteration, potassic alteration, silicification, carbonatization, sericitization, kaolinization and chloritization etc.

2 Sampling and Analytical Method

The colloidal pyrites tested are from Stope No.E106 in -270m mining level in Xinqiao Cu-S-Fe Deposit. And the colloidal pyrite with rough plane and concentric ring structure is earthy yellow.

Analysis of the work were completed at the Akita University in Japan. The main analysis methods are EPMA analysis and LA-ICP-MS analysis. Microscope was used firstly for Sample observation and then EPMA was used for particles or region analysis. Electron probe analysis (EPMA) condition: experimental load is 20kV, the electron beam energy is 20nA, spot beam diameter is 5µm. LA-ICP-MS analysis were used in the same location to the same particles after calculation of the EPMA analysis results. Analytical instruments for the work are Agilent 7500i quadrupole mass spectrometers and New Wave Research 5906 laser ablation system. In the process of the experiment, He was carrier gas of eroded material. Laser beam which frequency is 6Hz, diameter is 45 µm and laser energy is 6.5J/cm² were used on the sample spot denudation. Analysis time of each sample point is 90s, including determination of background value of 30s before erosion, next to 30s to measure the tuning standard values and then 30s to denude sample. Finally, effectively
Analyze data will be got. All analytical data will be calibrated with USG MASS-1 samples values, and after every 10 samples analyzed, background values and standard values will be measured again.

3 Results

The measurement showed that the S and Fe content of colloidal pyrites (×10^{-2}) are 50.839-53.099, 43.639-47.679, and average values are 52.016 and 46.289, respectively. Trace elements Co, Ni, Cu, As, Pb, Au, Ag, Ba, W, Bi content (×10^{-6}) are above the detection limit, and Zn, Se, Te in some measurement points are below the detection limit. Among them, Co, Ni and As content are 0.90~2.31, 0.48~2.07 and 219.79~867.95, and average value are 1.82, 1.33 and 533.50, respectively.

4 Discussions

MEI (2000) reported that the S and Fe content of sedimentary-type pyrites are similar with the theoretical value or the S is slightly higher than the theoretical values. However, the S content of hydrothermal-type pyrite in Cu deposit is less than the theoretical value. The w(Fe)/w(S) of colloidal pyrites from Xinqiao is from 0.836 to 0.922, average 0.890. Only one data of all data (13) is less than the w(Fe)/w(S) theoretical values (0.857), which indicates that the characteristics of iron rich is very obvious, so colloidal pyrites formed because of hydrothermal.

Bralia A et al. (1979) conducted a systematic study of the Co, Ni content in the pyrite and pointed out that w(Co)/w(Ni) <1 in the sedimentary-type pyrite as well as w(Co)/w(Ni) between 1 and 3 in the hydrothermal-type pyrite. The w(Co)/w(Ni) value of pyrite in Xinqiao is between 0.67 and 2.94, which shows that colloidal pyrites forms because of the hydrothermal in the figure of the w(Co)-w(Ni) relationship map.

CHEN et al. (1998) pointed out that the pyrite formed because of hydrothermal sedimentation when w(Zn)/[w(Zn)+w(Pb)] of pyrites is close to 1. w(Zn)/[w(Zn)+w(Pb)] of the colloidal from Xinqiao deposit is from 0.001 to 0.164, which indicates that the colloidal pyrite has no geochemical characteristics of hydrothermal sedimentation, and that colloidal pyrites have no relationship with submarine exhalative-sedimentation.

5 Conclusions

Colloidal pyrites have characteristics that the S content is less than the theoretical value of pyrites, and that the w(Co)/w(Ni) is from 0.67 to 2.94, which shows that colloidal pyrite formed because of the hydrothermal. And it indicates colloidal pyrites’ forming without submarine exhalative-sedimentation that the w(Zn)/[w(Zn)+w(Pb)] is from 0.001 to 0.164.

References


