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Hydrogen and oxygen isotopes geochemistry of the Qixiashan Pb-Zn-Ag polymetallic deposit in Nanjing

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Qixiashan deposit is the largest Pb-Zn-Ag polymetallic deposit in East China, which is located in the eastern outskirts of Nanjing, Jiangsu Province. Qixiashan deposit is located in the phase zone between the northern margin of the eastern Yangtze plate and the southern margin of the eastern North China plate.

The ore bodies of the deposit were mainly controlled by the fault (F_2) and the formation (Carboniferous and Permian series-based), they were distributed by stratiform-like and irregular shapes. Galena, sphalerite and pyrite are the main ore minerals, and rhodochrosite, chalcopyrite and magnetite are the minor ore minerals; quartz and calcite are the main gangue minerals, and barite, sericite and chlorite are the minor gangue minerals. The main ore textures are granular texture, mosaic texture, metasomatic texture and microscopic crushing texture, the minor ore textures are droplet-like textures, and microscopic includes textures, etching textures and skeleton crysral textures and so on. Brecciated structures, massive structures, disseminated are the main structures, and vein structure, net vein banding structure and dispersion banding structure are the minor structures. Brecciated ore, massive ore and disseminated ore are the main natural ore types. According to the occurrence characteristics, ore types, components of mineral, wall rock alterations and vein intercalating relationships, the mineralization and alteration epochs can be divided into the three phases: synsedimentary hydrothermal phase, hydrothermal mineralization phase and hypergene mineralization phase. The hydrothermal mineralization phase is the main phase for sulphdes of lead, zinc to form, and galena, sphalerite, pyrite, chalcopyrite, tetrahedrite, Au-Ag all formed in this phase.

The quartz samples for hydrogen and oxygen isotopes research used in this study were collected from the mineralization related quartz veins in the mine area. Quart at main mineralization stage shows that the δD value changes from -81.8‰ to -67‰, the δD value of all the samples are lower than -67‰, locate in -70‰ to -80‰, consistent with the distribution of the δD value of the magmatic water (Lu, 1986). The $\delta^{18}O_{SMOW}$ value changes from 5.80‰ to 13.2‰, consistent with $\delta^{18}O_{SMOW}$ value of quartz in magmatic rocks (8.9‰ ~ 10.3‰, Lu, 1986). The $\delta^{18}O_{H2O}$ value changes from -1.9‰ to 5.5‰, close to $\delta^{18}O_{H2O}$ value of the primary magmatic water (1‰ ~ 6‰). This basically reflects the characteristics of magmatic hydrothermal fluid, the ore-forming fluid has the mixed characteristics of magmatic water and meteoric water (Jiang et al., 1990). We have inferred that the ore-forming fluids are mainly magmatic water, with the addition of a small amount of atmospheric precipitation.

The evident described above indicated that the fluids of Qixiashan deposit were mainly from magmatic water, and showed the features of magmatic water mixing with meteoric water to form the ores with the progress of mineralization, and also the proportion of atmospheric precipitation

participated in mineralization increased, indicating the Qixiashan Pb-Zn-Ag polymetallic deposit was a typical magmatic hydrothermal deposit.