

Lead isotope constraints on the genetic relationship between Cu-Zn-Pb ores and S ores in the Dongshengmiao deposit, northern China

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The giant Dongshengmiao deposit represents the largest known Proterozoic SEDEX-type Cu-Zn-Pb deposit in China. It is a complex polymetallic hydrothermal deposit characterized by a wide range of styles. A detailed investigation on their Pb isotope compositions has been carried out to constrain the genetic relationship between Cu-Zn-Pb ores and S ores. Pb isotope ratios of all the massive sulfides comprising multiple ore horizons are characterized by a relative unradiogenic isotope composition. Importantly, the substantial similarity of the Pb isotope compositions between the brecciated Cu-Zn-Pb ores and massive S ores suggests that they belong to the same polymetallic metallogenic system. Vein-type Cu-Zn-Pb ores show relative scattered Pb isotope signatures that fall along a linear trend, whereas their less radiogenic end member projects towards the Pb isotope compositions of the overlying brecciated ores. These characteristics, together with geological features of the related orebodies, imply that such vein-type ores were most likely the feeders of the overlying orebodies. The overall Pb isotope compositions of vein-type ores have shown an apparent overlap with the radiogenic disseminated pyrites in the mica schists, indicating their radiogenic Pb most likely originated from host rocks which contributed radiogenic Pb to the latter. On the other hand, the Pb isotopic compositions previously reported for the Hercynian feldspars are too high to explain the radiogenic Pb admixed in vein-type sulfide ores. Therefore, Cu-Zn-Pb ores and S ores at Dongshengmiao belong to an integrated hydrothermal ore-forming system of the Proterozoic age, and then a part of the vein-type sulfide ores and associated disseminated pyrites experienced a minor addition of evolved rock lead during subsequent greenschist facies metamorphism. However, a wholesale introduction of metal by younger fluids is unlikely to have played an important role on the metal endowment at Dongshengmiao.