Sedimentary pyrite as a potential sulfur source for MVT Pb-Zn deposits: A case study of the Huodehong Pb-Zn deposit, South China

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Sedimentary pyrite plays an important role in the formation of MVT Pb-Zn deposits, but there are few related studies. In the western Yangtze Block, SW China, there are >400 carbonate-hosted epigenetic Pb-Zn deposits, which form the giant Upper Yangtze Pb-Zn metallogenic province with >26 Mt Pb + Zn base metals. Among these Pb-Zn deposits, the Huodehong Devonian carbonate-hosted Pb-Zn deposit is characterized by large amount of the coexisting sedimentary pyrite and low $\delta^{34}S_{sulfides}$ values (-17 to -11‰), which are significantly distinct from those of most other Pb-Zn deposits ($\delta^{34}S_{sulfides}$=2-25‰) in this province. Hence, the Huodehong deposit provided an ideal case study for revealing the role of sedimentary pyrite played in the formation of MVT Pb-Zn deposits.

Mineralogical study identified large amount of pyritic stromatolites, which show zoning structure with micro-nano-sized filamentous/tabular pyrite, stromatolites, organic matters, goethite and dolomite in core, and coarse-grained marcasite, pyrite and sphalerite in rim. This suggests that sedimentary pyrite is an important factor that determined the mineralization location, which means the hydrothermal-reworking mineralization occurred in the Huodehong deposit. NanoSIMS in-situ S isotope analysis shows that $\delta^{34}S$ values of sulfides (sedimentary and hydrothermal pyrite) range from -23 to -7‰, of which sedimentary pyrite grains have $\delta^{34}S$ values ranging from -23 to -10‰, hydrothermal pyrite grains have $\delta^{34}S$ values ranging from -18 to -7‰. This means that sedimentary pyrite may provide the main reduced sulfur for the formation of the Huodehong Pb-Zn deposit through hydrothermal-reworking, although bacteria sulfate reduction (BSR) may also provide some reduced sulfur.

This study demonstrates that sedimentary pyrite acted as a potential sulfur source and the mineralization location-determined factor in the formation of MVT Pb-Zn deposits, which provides new insights for understanding the origin and ore exploration of MVT Pb-Zn deposits worldwide.

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