REE and C, O and Sr isotopic compositions of hydrothermal carbonate minerals from Fankou superlarge Lead Zinc deposit, China

HONGFENG LU [1,2], XIAOMING SUN [1,3], MINGYANG MA[1]

[1]Department of Earth Sciences, Sun Yatsen University, Guangzhou, 510275, China (eessxm@zsu.edu.cn)
[2]Institute of Guangzhou Marine Geological Survey, CAGS, Guangzhou, 510760, China
[3]State Key Laboratory of Mineral Deposit Research, Nanjing University, Nanjing, 210093, China

Fankou is the largest Pb-Zn producer in Asia. Its ore bodies are embedded by D_{1-2} and C_1 carbonate strata. Hydrothermal carbonates, mostly calcite, is the major gangue mineral Three stages of hydrothermal carbonates, pre-, syn- and post-metallogenic stages, are recognized in the mine There exist a lot of opinions on its genesis, including "sedimentary-superimposed transformation" (Wu J. et al., 1987), "submarine hot spring outpouring" (Zhu S. et al., 1992); "contemporaneous fault hydrothermal filling and replacement" (Wang P. et al., 1995) and "submarine exhalation and syngenetic sedimentary" (Li Z. et al., 1997) etc. We analysed REE and C, O and Sr isotopic compositions of the hydrothermal carbonates and the results show that:

1.) The syn-stage carbonates posses the highest ΣREE (mostly >120X10^{-6}) and positive Eu anomalies (δEu as high as 6.137), while both the pre- and post-stage carbonates have low ΣREE (mostly < 30X10^{-6}) and negative Eu anomalies, indicating that the ore-forming fluid of the main metallogenic stage is of reduced, Cl^-–riching, and relatively high temperature hot brine;

2.) The $\delta^{13}C$ and $\delta^{18}O$ of the syn-stage carbonates are –2.9~-8.0‰(PDB) and 14.7~19‰(SMOW), which are lower than those of carbonate host rocks (-2.5‰ and 20.5‰ respectively), and are also quite different from pre- and post-stage carbonates, suggesting magmatic (mantle-derived?) water might have been involved in the Pb-Zn metallogenesis;

3.) The Rb content of the hydrothermal carbonates is lower than 1X10^{-6}, that their $^{87}Sr/^{86}Sr$ ratios (0.712336~0.717972) may be used as $(^{87}Sr/^{86}Sr)_0$ of the ore-forming fluids. Sr-isotopic exchange modeling indicates that the ore-forming fluids of Fankou mine mainly composed of basinal hot brine, and the Fankou is probably a basinal hot brine transformed deposit.

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Copper isotope study of copper and gold deposit of Dongguashan, China

JIANJUN LU, RENMIN HUA AND SHAOYONG JIANG

Department of Earth Sciences, Nanjing Univeisity, Nanjing, 210093, P.R.China(lujj@icpms.nju.edu.cn)

The Dongguashan deposit, located in Tongling, Anhui provice, includes both stratiform sulphide (SHMS-type) and skarn orebodies. The massive sulphide ores occure between late devonian sandstones and middle carboniferous carbonates. The skarn orebodies were produced by intrusion of Yanshanian quartz diorite into late palaeozoic carbonates. The $\delta^{65}Cu$ values of clusters of chalcopyrite and ring chalcopyrite around pyrite from massive sulfide ores are 0.45 ‰ and 0.78‰ respectivly. The three disseminated chalcopyrite samples from skarn ores have the $\delta^{65}Cu$ values of 0.09‰, 0.23‰ and 0.83‰. The $\delta^{65}Cu$ values of veilet type quartz-chalcopyrite ocurred in skarn ores and veilet type chalcopyrite from marble ocuurred in contact zone between quartz diorite body and its wall rcoks are 0.36‰ and 0.38‰ respectively. The above copper isotopic compositons of chalcopyrite from the different types of ores are very similar to each other and are compatible with those of chalcopyrite from high-temperature magmatic hydrothermal deposits (Zhu et al., 2000), but are entirely different from those of samples from old inactive black smoker sulphide deposts (Zhu et al., 2000) and those of chalcopyrite in Jinman vein-type copper deposit in which the copper was thought to derive from sedimentary rocks (Jiang Shaoyong et al., 2002). This may implicate that the copper in both massive sulphide ores and skarn ores in the Dongguashan deposit has the same source, and probabbly comes from Yanshanian quartz diorite. According to the above copper isotopic data, together with a study on the geological features (Gu et al., 2000), a two-stage model of the formation of this deposit can be established. The first stage involves the formation of massive sulphide orebodies which contain dominantly pyrite, pyrrhotite and some gangue minerals, but little copper-beraing sulphide during early carboniferous period. In the second stage the Yanshanian magmatic hydrothermal activities on the one hand form the skarn orebodies, on the other hand, overprint early massive sulphide orebodies and induce enrichment of large amounts of copper in these stratiform sulphide ores.

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