Pyrhotite Re-Os Dating and Its Significance in the Maoling Gold Deposit, North China Craton

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Eastern North China Craton (NCC) is an important concentration of non-ferrous and precious metals. The Maoling gold deposit, which has a proven reserve of 25 t Au at an average grade of 3.2 g/t, is one of the most important Au deposit in the eastern NCC. Researchers had serials of studies on geological features, ore-forming materials sources, ore-forming fluid, genetic type, metallogenic epoch, metallogenic model and structural revolution. Much cognition was got while some different ideas on metallogenic epoch and genetic issues of this deposit remained. Whether the deposit was formed in Paleoproterozoic or Mesozoic is not clear. There are three kinds of views on ore-forming fluid of the deposit, view A insists the deposit was formed mainly by metamorphic geo-fluid, with some magma fluid mixed in, view B believes the deposit shows typical magma oriented fluid features while view C suggests metamorphic fluid in the only one in the deposit. Based on resolve the predominant problem on metallogenic epoch of the deposit, we chose pyrhotite in sulfides to test Re-Os isotope characters. Ore-forming materials and genesis of the deposit were also studied.

1 Sample Collation and Analysis

All samples are straight quartz-polymetallic sulfide veins which collected from ZKHJD-008 drill in No.1 ore belt. Samples were grinded then screened under minus 100 meshes, then chosen by electromagnetism and gravity discrimination machines to purity over 98%. helped to got pyrhotite in sulfides to test Re-Os isotope characters. Ore-forming materials and genesis of the deposit were also studied.

2 Results

Re-Os tests results on pyrrhotite showed lower Re and Os contents, Re content ranges from 0.359 to 2.325ng/g, Os content varies from 0.0051 to 0.0100ng/g. Tested pyrrhotite normal isochronal age got by ISOPLOT program is 270±57Ma, with decay constant $\lambda$ chooses 1.666×10^{-11}a^{-1}. Primary $^{187}$Os/$^{188}$Os ratio is 2.8±1.9, and mean weighted dispersion is 4.5. Five tested samples’ result shows good fittings property and distributes near the same normal isochronal line (Fig.1).

$\gamma_{Os}$ content was calculated by the formula Walker recommended. $\gamma_{Os}$ of chondrite $^{187}$Os/$^{188}$Os(270Ma) is 0.12522, of which 270Ma is the pyrrhotite forming age. The ultimate $\gamma_{Os}$ of pyrrhotite is 299.293 to 2577.558.

3 Discussions and Conclusions

Previous researchers had focused on the metallogenic epoch of the Maoling deposit. Yu, et al., tested gold-bearing arsenopyrite by Re-Os isotope dating method and got normal isochronal age of 2316±140Ma. Based on studies in outdoors, regional geology settings and ore-controlling structure analysis, Qiu et al., suggested Maoling gold deposit showed paleo-proterozoic epoch mineralization characteristics. Straight quartz-polymetallic sulfide veins studied in this paper showed another metallogenic epoch of 270±57Ma, much later than previous researches. We had found an important phenomenon in outdoors that straight quartz-polymetallic sulfide veins cut the folded quartz-polymetallic sulfide veins. Due to this clue, an early mineralization was suggested happened in...
paleo-proterozoic epoch which was connected with the metamorphism of folded polymetallic sulfide veins. A secondary mineralization was recognized as the straight polymetallic sulfide veins by magma activities, which was corresponding with the result in our research. But detailed study still needed before final conclusion. Due to our study in this paper, Maoling gold deposit is formed by metamorphous fluid, and superimposed reformed by magmatism fluid.

Re-Os isotope system is a vigorous tracer in sulfides formation and a sensitive indicator on mixture degree of crust materials in mineralization. $\gamma_{Os}$ is an important parameter on crustal materials mixed in mineralization system. Re/Os had high ratio on crust, thus the more crustal materials mixed in magmatism or mineralization system the higher positive value $\gamma_{Os}$ would be. $\gamma_{Os}$ had negative value only on the loss of Re. $\gamma_{Os}$ value in this research on pyrrhotite is +299.293~+2577.558, with an average value of 1022.375. Primary 187Os/188Os ratio from Re-Os isochronal line is 2.8±1.9, much higher than the 187Os/188Os of mantle (0.12~0.13). Liu et al., tested sulfur isotope features in Maoling gold deposit, the sulfur value varied from +4.3 to +10.5% with average of 7.74%. Such results showed heavy sulfur characters and met the sulfur isotope characters in Liaohe group layers. Take the primary ratio of 187Os/188Os and $\gamma_{Os}$ value into consideration; we conclude the ore-forming materials mainly from strata.

References


