Source of ore fluids of the Yangshan gold deposit, Western Qinling belt, China: evidence from microthermo-metry, noble gas isotopes and in-situ sulfur isotopes of Au-bearing pyrite

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The issue of ore-forming fluids sources and genesis model of sediment-hosted disseminated gold deposits including Carlin-type and some orogenic gold deposits has been debated for several decades. Although Yangshan gold deposit was taken as the largest Carlin-type gold deposit in China ten years ago, there are still experts who propose that Yangshan belongs to orogenic type gold deposit [1].

The microthermometric measurements show the homogenization temperature from 221°C to 303.5 °C and low salinities of 2.0~7.2 wt.% NaCl equiv of the H2O-CO2 system. 3He/4He ratios of fluid inclusions ranging from 0.0330 to 0.0809 Ra, shows no mantle sources. The measured 40Ar/36Ar values of fluid inclusion in pyrite and quartz range from 434.1 to 863, higher than the ratio of 40Ar/36Ar of air-saturated water (295.5). The 40Ar*/36Ar values for the pyrite samples are far below the crustal and mantle values (0.2 and 0.5 respectively).The in-situ sulfur isotopes of Au-bearing pyrite results using Nano-SIMS is as the following: framboidal pyrites show low δ34S values of -23.8~-20.9‰; the pyrites from mineralized plagiogranite dikes have a narrow δ34S range of -4.4~1.3‰; and the inner part of zoned pyrites form the main ore rocks of black carbonaceous phyllites have the similar δ34S feature to the framboidal pyrites, whereas the rims enriched in gold have δ34S values around 0‰, similar to the pyrites in mineralized plagiogranite dikes.

Based on the characteristics mentioned above, we concluded that: first, ore-forming fluids own typical feature of orogenic gold deposit; second, recycled meteoric water heated by magmatic heat source may be a component of ore fluids instead of mantle matter involvement; third, in-situ sulfur isotope analyses indicate that the exact ore-related sulfur sources are magmatic sulfur.