Magmatic sulfur source for the Hatu gold deposit, west Junggar, NW China: Evidence from in situ sulfur isotope

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Hatu with gold reserves of over 50 tons is the largest gold deposit in west Junggar. It is controlled by ENE-trending Anqi and its secondary faults in Lower Carboniferous volcanic-sedimentary rocks. The major wall-rocks are basalt, with small amounts of tuffaceous siltstone and tuff. Carbonaceous tuffaceous siltstone layers containing framboidal pyrite are common in the tuffaceous siltstone. The framboidal pyrite (5-30 μm) displays a texture of microscopic spheroidal pyrite clusters. Chlorite-sericite-pyrite assemblage is widespread in altered basalt. The pyrites are subhedral, and intergrown with chlorite. The orebodies are composed of quartz veins and alteration type. Hydrothermal process was divided into five stages: anhedral pyrite aggregate (Py1)-albite-quartz vein (stage I); fine grained euhedral pyrite (Py2)-albite-quartz vein (stage II); fine grained subhedral pyrite (Py3)-arsenopyrite- carbonate vein (stage III); microgranular subhedral pyrite (Py4)-chalcopyrite-carbonate vein (stage IV); and calcite vein (stage V).

The framboidal pyrite grains have an extremely large range of $\delta^{34}S$ values from -26.71 to 53.98‰ (26 analyses). Pyrite grains intergrown with chlorite in basalt have negative $\delta^{34}S$ values ranging between -26.73 to -12.10‰ (14 analyses). Hydrothermal pyrite grains in different veins have a rather narrow range of $\delta^{34}S$ values near zero (-0.74 to 1.45‰). Py1 grains have positive $\delta^{34}S$ values of 0.66 to 1.45‰ (mean=1.08‰; 11 analyses). $\delta^{34}S$ values of Py2 are -0.24 to 1.24‰ (mean=0.61‰; 13 analyses), and those for Py3 are -0.66 to 0.83‰ (mean=0.27‰; 20 analyses). Py4 grains have negative $\delta^{34}S$ values of -0.74 to -0.12‰, with an average of -0.30‰ (6 analyses). The change of $\delta^{34}S$ values from stage I to stage IV pyrite may reflect gradual change of hydrothermal to a little oxidized condition. The sulfur isotope data indicate that Hatu gold deposit has a sulfur source of mantle by magmatism (Hoefs, 2009), and it is probably a granite-related gold deposit.

References

Hoefs J. 2009. Stable isotope geochemistry. 6th edition. Springer, Berlin