Studying gold solubilities using fused silica capillaries

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Solubilities of metals in geological fluids at elevated temperatures and pressures were conventionally studied with autoclaves. With the advance of analytical technology, new methods are being developed, e.g., synthetic fluid inclusions coupled with LA-ICP-MS analysis [1]. Here we report a new method using fused silica capillaries [2] to study gold (Au) solubilities. We inserted a gold wire into a silica capillary and fused the tube at one end. We then injected a fluid of known composition into the capillary and fused the other end. Four types of samples were prepared: 1) CO_2, 2) CO_2 + H_2O, 3) CH_4 + 10N H_2SO_4 solution, and 4) S (solid) + CH_4, each with a gold wire in the capillary. The samples were then placed into autoclaves and heated to 400-600°C for 3-38 hr. After being examined by Raman spectroscopy for fluid composition, the samples were opened and the gold wire removed. The capillaries were analyzed for Au content (assumed to be on the inner wall of the capillaries) with the LA-ICP-MS and ICP-MS methods. The analytical results were then used to calculate Au solubility in the fluid.

Preliminary experiments indicate that dissolution of Au occurred at least in type 3 and 4 fluids as described above, where H_2S was generated after the heating as indicated by Raman inspection. Gold dissolution is indicated by the change of the gold wire color and reflectance and by the formation of dark coating on the inner wall. Gold solubilities up to 86 ppm have been obtained in some of the runs. Gold solubilities up to several hundred ppb have also been observed for fluids without H_2S, and further analyses need to be done to verify these results. On-going research aims to resolve problems related to the heterogeneous distribution of precipitates on the capillary wall and analytical procedures associated with ICP-MS analysis of very small sample volumes.

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Metallogenic ages of the Shaxi porphyry Cu-Au deposit, Anhui Province

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Yangtze valley is one of the most important metallogenic region in Jurassic-Cretaceous period in East China, where more than 200 polymetallic Cu–Fe–Au, Mo, Zn, Pb, Ag deposits resident [1-3, 8]. Among them, the Shaxi porphyry Cu-Au deposit was one of the importance discoveries of the Cu-Au exploration in the middle-lower Reaches of River in China in 1970's. Its geochemical studies are extensive investigated [4-7]. However, the metallogeic ages are still unknown.

In this study, we hire Le-Os dating method on sulfides. Both pyrite and molybdenite samples from the sulfide ore were collected. These samples were analyzed by the ICP-MS method in National Research Center of Geoanlysis, Chinese Academy of Geological Sciences. The $^{187}Re/^{188}Os$ and $^{187}Os/^{188}Os$ values by the ICP-MS. One isochron age calculated is c.a. 130 Ma with an initial Os ratio of 1.30 or so. We believe that this age represents the ore-forming time of the Shaxi Cu-Au deposit, which is also with accordance with the intrusive Ar-Ar ages from Yang *et al*. [6]. Our study indicates that the Yanshanian magmatism is of great significance for Shaxi Cu-Au mineralization in central Anhui, east China.

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