

Volatiles in fluid inclusions from Sanshandao gold deposit in Jiaodong

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The Sanshandao gold deposit is located in the north part of the Sanshandao-Cangshang fault zone in northwest Jiaodong gold province in China. Ore related hydrothermal alterations include potassic alteration, phyllic alteration, carbonatization and pyritization, with minor arsenopyrite, chalcopyrite, galena and sphalerite. Most of the gold ores occur as phyllic altered granitoid with disseminated pyrite containing native gold. Studies show that the gold deposits in the Jiaodong gold province were formed at about 120Ma [1] by the interaction between lower crust and upper mantle [2].

Boiling has been considered as one of the most important mechanism for gold deposition in hydrothermal process. We analyse volatiles in fluid inclusions from kinds of veins and altered granitoid by laser Raman spectroscopy, and determine the existence of fluid inclusion types of CO₂-H₂O, pure CO₂, CO₂-H₂O-CH₄, CO₂-CH₄ and H₂O. Petrographic evidences show that the pure CO₂ fluid inclusions are the boiling production of the CO₂-H₂O system, while the CO₂-CH₄ fluid inclusions are the boiling production of the CO₂-H₂O-CH₄ system. The H₂O fluid inclusions are post gold secondary fluid system.

Hence, there are at least two boiling events of different fluid systems in the Sanshandao gold deposit. The boiling of CO₂-H₂O system should be responsible for potassic and phyllic alteration, both of which have no direct connection to gold mineralization. The boiling of CO₂-H₂O-CH₄ system should be responsible for pyritization, which show direct association with gold precipitation. The sericite inclusions in pyrite observed by SEM indicate that the CO₂-H₂O system should be earlier than the CO₂-H₂O-CH₄ system.

This work was supported by NSFC (Grant No. 40672064, 40872068, 40572063), CSIRT (No. IRT0075) and 111 Project (No. B07011)

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Rare earth elements and arsenic along a groundwater flow path in the Hetao basin, Inner Mongolia

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Groundwaters and sediments were sampled along a groundwater flow path in the shallow aquifer, the Hetao basin. REE elements and As species were analyzed.

Along the flow path, groundwater evolves from Ca-HCO₃-SO₄ to Na-Cl-HCO₃ from recharge to discharge zone. REE concentrations exhibit less variation along the flow path. The REEs show good correlation with each other, with the exception of Eu and Lu. All groundwaters have positive Eu anomalies (Eu/Eu* = 3.30-254) and slightly negative Ce anomalies (Ce/Ce* = 0.41-1.0). In comparison with aquifer sediments, groundwaters enrich HREE, but deplete LREE (Fig.1). It can be explained that a combination of carbonate complexation acts to stabilize HREEs in solution relative to the LREEs, while greater adsorption of the LREEs to particle surfaces occurs [1]. Arsenic concentration is positively correlated with shale-normalized Eu, while both of them are negatively correlated with Eh. The low redox is believed to favor As mobilization in the Hetao basin [2]. Eu(III) is likely to be the dominant oxidation state in groundwaters [3]. Reductive dissolution of Fe oxyhydroxide may relate to Eu enrichment in high As groundwater. Although As(III) is the main As species (60%-90% total As), reductive desorption is speculated to have less contribution to As release.

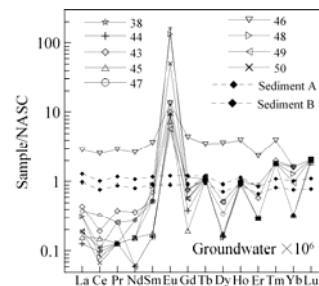


Figure 1: NASC-normalized REE patterns for groundwaters and aquifer sediments (From recharge zone to discharge zone: Well Nos. 43, 45, 47, 46, 48, 49, 50, 38; Aquifer sediments A and B obtained near Well 38 at depths of 22.3 and 23.0 m, respectively).

Acknowledgement: Natural Science Foundation of China (40872160, 40572145)

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