In situ sulfur and lead isotope analyses of the Jinlongshan gold deposit in Southern Qinling Orogen, China: Implications for ore-forming source

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The Jinlongshan gold deposit, Shaanxi province, central China, is a large gold deposit (>150 t Au) in the Southern Qinling Orogen. Structurally controlled gold mineralization is hosted in Upper Devonian to Lower Carboniferous carbonaceous clastic-carbonate sequences. Although it had been widely studied by geologists, ore-forming sources of deposit remains debatable, while both intrusion-linked and non-intrusion linked models have been proposed [1, 2].

In this paper, in situ sulfur and lead isotope analysis were performed on a diverse set of sulfides of different generations to trace the ore-forming sources as well as the genetic mechanism of Au mineralization. Three stage sulfides were identified from Jinlongshan gold deposit. Sulfur isotope analyses of sulfides by LA–MC–ICPMS show a wide range of $\delta^{34}S$ values from –29.9‰ to +48.4‰. Pre-ore stage pyrite ($\delta^{34}S_{Py1}$ = –29.9‰ to +42‰) formed by bacterial sulfate reduction of Upper Devonian marine sulfate. Ore stage sulfides ($\delta^{34}S_{Py2}$ = 10.1‰ to 15.3‰, $\delta^{34}S_{Apy}$ = 9.6‰ to 13.8‰, $\delta^{34}S_{Snt}$ = 13.9‰ to 14.3‰) have restricted range of $\delta^{34}S$ values that are interpreted to result from the underlying Paleozoic sedimentary rocks by decomposition of pyrite and/or inorganic reduction of sulfate. Post-ore stage pyrite ($\delta^{34}S_{Py3}$ = –4.4‰ to +48.4‰) formed by mixing of shallow meteoric water with sedimentary components (negative $\delta^{34}S$ values) and deep fluids (extremely high $\delta^{34}S$ values). Likewise, the Pb isotope compositions of ore stage sulfides resemble those of underlying Paleozoic sedimentary rocks, but are different from Precambrian metamorphic basement rocks and granitoids in the basin. From these observations, we proposed the sulfur and ore metals of the Jinlongshan gold deposit were sourced from the underlying Paleozoic sedimentary rocks.

[1] Chen (2015) MD 50, 643-656. [2] Liu (2015) J Asian Earth Sci 103, 40-69.