Sulfur Isotope Implications for the Genesis of Orogenic Gold Deposits in Southeastern Guizhou Province, China

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The gold district in Southeastern Guizhou Province is a famous and long-term gold producer. It shares many geological features with the Victorian gold province in Australia and has been primarily thought of as an orogenic gold deposit district. Despite decades of research in this area, the source of metals is still under debate. In this paper we present S isotope data from Pingqiu gold deposit, the second biggest in this area, and compare these results with those from Victoria and other typical orogenic gold deposits, to determine the source of metals and contribute to a better understanding of ore genesis.

Sulfur isotope compositions were determined on 24 mineral separates, including pyrite and arsenopyrite from the auriferous veins stage 1–4 and the adjacent alteration zone. The $\delta^{34}S$ values of vein arsenopyrite span -0.97 to +0.77‰, with one value of +3.08‰. Analysis of pyrite in auriferous veins and alteration zone yield $\delta^{34}S$ values between -1.86 and 1.29‰, with two values of 4.14 and 4.55‰.

Most $\delta^{34}S$ values of pyrite and arsenopyrite from gold-bearing ores of Pingqiu gold deposit range between -2 and +2‰, which similar to that of pyrite from alteration zone, indicating a same sulfur reservoir for the fluids. These values overlap with some of the sediment-hosted orogenic gold deposits, such as $\delta^{34}S$= -0.13~+7.30‰ in Amantaytau gold deposit in Uzbekistan, $\delta^{34}S$= -5.0~+2.3‰ in Macraes gold deposit in New Zealand, and $\delta^{34}S$= -6.3~+2.6‰ in Natalka gold deposit in Russia. These $\delta^{34}S$ values are compared to other lode gold deposits. Although the near-zero $\delta^{34}S$ values indicate a possible magmatic source in many magmatic-hydrothermal deposits, mineralogical, geochemical, and fluid inclusion studies of the Pingqiu gold deposit preclude this conclusion. Sulfides in the host sediments are commonly ^{34}S-depleted and generated low $\delta^{34}S$ values (<-5‰) of ore forming fluids during the sulfur fractionation in Bendigo and Juneau gold deposits. Nevertheless, sulfides in sedimentary rocks may have a wide span of $\delta^{34}S$ due to biological isotope fractionation and some sulfides in sediment-hosted deposits could be significantly enriched in ^{34}S compared to $\delta^{34}S$-depleted sulfides. Hence, the narrow $\delta^{34}S$ range at Pingqiu gold deposit probably indicates a sediment source of rather than a magmatic source.