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A general ore formation model for metasediment-hosted Sb-(Au-W) mineralization of the Woxi and Banxi deposits in South China

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Metasediment-hosted Sb-(Au-W) ores are important sources of precious and strategic metals worldwide, despite controversies concerning metal provenance and fluid evolutionary processes. In this study, two typical Sb-(Au-W) deposits (Woxi and Banxi) from the Jiangnan Orogen (South China) were studied by in-situ geochemical and geochronological analyses of sulfides to establish a general ore formation model for this type of deposit. Two stages of gold-related pyrite (Py1 and Py2) and one stage of stibnite in the Woxi Sb-(Au-W) deposit, and two stages of arsenopyrite (Apy1 and Apy2) and stibnite (Stb1 and Stb2) in the Banxi Sb deposit were differentiated. Compared to Py1, Py2 is depleted in V but enriched in Au, As, Bi, Pb and Ag, with more negative $\delta^{34}S_{v\text{-}CDT}$ and lower Pb isotopic values. Compared with stibnite at Woxi, stibnite at Banxi has higher but more variable contents of most trace elements (e.g., Li, Mg, Al, Si, Cu, Pb, Co, Ni, Fe, Sr and Mn, except for As) and lower Pb isotopic ratios. At Banxi, Stb2 has lower Fe, Cu, Pb, Co, Ni, Sr and Mn contents than Stb1, and Apy2 has higher Co, Ni, Zr, Ti, and Nb contents than Apy1. Analyses of Re-Os isotopes in four samples yielded an isochron age of 443 ± 4 Ma (2σ) for Apy1, with an initial $^{187}Os/^{188}Os$ of 0.3376 ± 0.0009. The above results indicate that early-stage Au mineralization at Woxi may have been orogeny-related, and that ore metals were derived mainly from local epimetamorphic sedimentary rocks with limited input from magmatic fluids. In contrast, the late-stage Sb mineralization at Banxi may have been influenced by deep granitic magmatism. We propose that the common temporal and spatial mineralization sequence of metasediment-hosted Sb-(Au-W) ores is: orogenic-type gold (early stage; at deep levels of the ore field) → orogenic + magmatic-hydrothermal W (middle stage; at middle levels) → magmatic-hydrothermal + meteoric water Sb (late stage; at shallow levels). Both local metasedimentary rocks and granite magmatism provide metals and ligands for mineralization, with magmatic fluids playing an essential role in late-stage ore formation. Metasediment-hosted Sb-(Au-W) ores exhibit similarities to both orogenic-type and intrusion-related gold systems.