Fluid inclusion data reveal that the Sandaowanzi ores precipitated from moderate-temperature (225° to 265 °C) and low to moderate salinity (0.2 to 14.2 wt.% NaCl equiv.) hydrothermal fluids. The δ^{34}S_{H\text{2}S} (-2.2 to -0.2 ‰) values indicate a leached sulfur by meteoric water from the host volcanic rocks and the δ^{18}O_{H\text{2}O} (-13.6 to -7.6 ‰) and δD_{H\text{2}O} (-127 to -96 ‰) values consistently determine significant amounts of meteoric waters in hydrothermal fluid. The lead isotopes of sulfides suggest a mantle or magmatic origin for Pb, which was isotopically inherited from the host volcanic rocks by fluid-rock interactions.

Figure 1: Physicochemical constraints for the ore fluids

In situ LA-ICP-MS analyses of different quartz generations show that Ti contents in later veins successively decrease, implying that the temperature of the hydrothermal fluids decreased through time during the evolution of the system. Physicochemical conditions for deposition of tellurides (Fig. 1) are...
pH = 3.01 to 5.95, $f_{S_2} = 10^{-14.1}$ to $10^{-9.3}$, $f_{O_2} = 10^{-38.8}$ to $10^{-31}$ and $f_{Te_2} = 10^{-11.6}$ to $10^{-7.0}$. The transport and deposition of Au and Ag in solution can be summarized as the following two reactions:

$$2Ag(HS)_{2(aq)} + HTe^{-}_{(aq)} = 4HS^{-}_{(aq)} + Ag_2Te(s) + H^+_{(aq)}$$

$$Au(HS)_{2(aq)} + 2HTe^{-}_{(aq)} + H_2O(l) + H^+_{(aq)} = 2HS^{-}_{(aq)} + AuTe_2(s) + 0.5O_2(g) + 2.5H_2(aq)$$

An increase of $\alpha_{HTe}^{-}_{(aq)}$ coupled with pH neutralization ($\alpha_{H^+}^{-}_{(aq)}$ decrease) could favor hessite precipitation, and coupled with $f_{O_2}$ decrease could have also promoted calaverite deposition. Accordingly, we propose that a pH and $\alpha_{HTe}^{-}_{(aq)}/\alpha_{HS}^{-}_{(aq)}$ increase coupled with a $f_{O_2}$ decrease due to episodic boiling and subsequent condensation are plausible mechanisms for precipitation of the abundant Au- and Ag-telluride ores.