Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.32931

The separation mechanism of W and Sn in the Fei'eshan deposit, Southeast China: Insights from trace element and Sn isotope compositions of cassiterite

YU-SONG GUO[1], QIAN LI[1], KUI-DONG ZHAO[1], SHAO-YONG JIANG[1] AND DR. JIA-XIN SHE, PHD[2]

[1]State Key Laboratory of Geological Process and Mineral Resources, Collaborative Innovation Center for Exploration of Strategic Mineral Resources, School of Earth Resources, China University of Geosciences, Wuhan 430074, P. R. China
[2]School of Earth Sciences and Engineering, Nanjing University

The spatial separation of W and Sn mineralization represents a fundamental characteristic of W-Sn deposits. While mechanisms governing regional-scale separation have been extensively studied, processes controlling deposit-scale zonation remain poorly understood. This study investigates the Fei'eshan W-Sn deposit in eastern Guangdong Province, South China, which exhibits a well-defined spatial zoning pattern: (1) proximal greisen-type Sn orebodies and (2) distal quartz vein-type W orebodies. To unravel the controls on this zonation, we conducted an integrated analysis of trace element and Sn isotopic compositions of cassiterite from three ore types: (1) greisen (Cst-G), (2) quartz-wolframite veins (Cst-QWV), and (3) quartz-sulfide veins (Cst-QSV). Progressive depletion of Zr-Hf-Nb-Ta from Cst-G to Cst-QWV and Cst-QSV reflects temperature gradients among ore-forming fluids. Cst-QWV exhibits significant Sc, V, and Ti enrichments, indicating elevated oxygen fugacity and fluid evolution. In situ Sn isotope analyses reveal core-to-rim decreases in $\delta^{122/118}$Sn values within individual cassiterite crystals, attributed to Rayleigh fractionation. Preferential incorporation of heavy Sn isotopes into cassiterite progressively lightens the residual fluid. Systematically decreasing $\delta^{122/118}$Sn values from Cst-G ($\delta^{122/118}Sn_{mean}$= −0.13‰) to Cst-QSV ($\delta^{122/118}Sn_{mean}$= −0.20‰) is consistent with the evolutionary trend. However, Cst-QWV exhibits obviously elevated $\delta^{122/118}$Sn values ($\delta^{122/118}Sn_{mean}$= +0.18‰), implying derivation from a distinct source. Integrated with whole-rock Sn isotope data, this study proposes that W-Sn separation at Fei'eshan was mediated by two ore-forming fluids with contrasting physicochemical properties: (1) a reduced, Sn-rich fluid forming greisen and quartz-sulfide-type ores, and (2) a related oxidized, W-rich fluid precipitating quartz vein-type wolframite ores.