Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16831

Early Paleozoic granitic magmatism and mineralization in the Debao Sn-Cu deposit, South China: Constraints from zircon and cassiterite U-Pb geochronology and whole-rock geochemistry

DI ZHANG[1] AND KUIDONG ZHAO[2]

[1]State Key Laboratory of Geological Processes and Mineral Resources, School of Earth Resources, China University of Geosciences, Wuhan, China

[2]State Key Laboratory of Geological Processes and Mineral Resources, Faculty of Earth Resources, China University of Geosciences, Wuhan, China

Presenting Author: zhangdi9374@cug.edu.cn

Numerous W-Sn deposits are developed in South China with the majority related to the Yanshanian granites, while a few W-Sn deposits associated with the Early Paleozoic granites, and their geological significance is poorly understood. The Debao deposit, is a typical skarn Sn-Cu polymetallic deposit, spatially related to the Early Paleozoic Qinjia granites. Zircon U-Pb dating of three lithofacies for the Qinjia granites (coarse-grained biotite, medium-grained porphyritic biotite and fine-grained porphyritic biotite) yielded the emplacement ages of 437.8 ± 3.0 Ma, 440.2 ± 2.0 Ma and 441.0 ± 3.0 Ma, respectively, consistent with cassiterite U-Pb ages of skarn ore (439.6 ± 2.7 Ma), indicating a close genetic relationship between the granitic magmatism and Sn mineralization. Chemical compositions of biotite grains from the Qinjia granites belong to the Ferro-biotite series with relatively high F contents (up to 0.70 wt. %) and plot near the Ni-NiO (NNO) buffer on the Fe^{3+}-Fe^{2+}-Mg^{2+} diagram, suggesting that the Qinjia granites have a relatively low oxygen fugacity. The Qinjia granites are characterized by highly silicious (70.37-72.88 wt. %), high alkali ($Na_2O + K_2O$ = 6.98-8.88 wt. %) and metaluminous to strongly peraluminous with the A/CNK ratios of 0.92-1.21, belonging to the I-S transform-type granites. They are enriched in U, Th, Zr, Nd and Hf, and depleted in Ba, Sr, Nb, Ta and Ti. They display right-declining chondrite-normalized REE patterns with significant negative Eu anomalies (Eu_N/Eu^* = 0.33-0.66), and have low Nb/Ta and K/Rb ratios, indicating that the Qinjia granites experienced a high degree of fractional crystallization. The zircon $\varepsilon_{Hf}(t)$ values (-2.7 to +1.4), together with T_{DM}^C of 1.33 to 1.59 Ga indicate that these granites formed via partial melting of Mesoproterozoic crustal with minor mantle materials. The reduced (fO_2 near NNO and Ce^{4+}/Ce^{3+} ratios of zircon 100), fractionated and volatile-rich magma facilitated the enrichment of Sn in the residual melt and hydrothermal fluids. Combined with previous studies on the Early Paleozoic magmatic rocks and tectonic activities in South China, we suggest that the Qinjia granites and associated Sn-Cu mineralization were likely formed at post-collisional extensional environment of the Wuyi-Yunkai orogeny.