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Contribution of Previously Arc Cumulates to the Post-Subduction Yangla Skarn Cu Deposit, SW China

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The Yangla skarn Cu deposit (150 Mt at 1.03% Cu) is located in the central segment of the Jinshajiang Metallogenic Belt within the Sanjiang (three rivers) region, SW China. The ore associated granodiorite was emplaced at 233.1 ± 1.4 Ma and 231.0 ± 1.6 Ma at 2σ by zircon U-Pb dating (Zhu et al., 2011), coeval to the Cu mineralization (232.0 ± 1.5 Ma; Re-Os dating by molybdenite). Both significantly postdated the Early Triassic collision ($246\text{--}247$ Ma; Zi et al., 2012) between the Qamdo–Simao terrane and the Zhongza terrane along the Jinshajiang Suture following the closure of the Jinshajiang Paleo-Tethys Ocean. Based on their geochemical compositions, two groups of granodiorite have been defined. Group 1 is characterized by relatively low $\epsilon_{\text{Nd}}(t)$ values ($-5.1\text{--}-6.7$) and high initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios ($0.7078\text{--}0.7148$), with ancient two stages Nd isotope model ages ($T_{\text{DM}2} = 1420\text{--}1551$ Ma). In contrast, Group 2 has mantle-like $\epsilon_{\text{Nd}}(t)$ and initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios ($\epsilon_{\text{Nd}}(t) = 1.5\text{--}2.9$; $(^{87}\text{Sr}/^{86}\text{Sr})_i = 0.7042\text{--}0.7047$), with obvious younger $T_{\text{DM}2}$ ages ($769\text{--}882$ Ma). Both of them are enriched in high ion lithophile elements and depleted in high field strength elements, typical subduction signatures. In addition, Group 2 shows higher Sr/Y ratios ($45\text{--}81$) than Group 1 ($\text{Sr}/\text{Y} = 11\text{--}37$), indicative of a hydrous magma source which would suppress plagioclase fractionation and be in favor of hornblende crystallization (Naney, 1983; Richards and Kerrich, 2007). In combination, we propose Group 2 was

probably derived from the melting of previously subduction-modified lithosphere, especially hydrous arc cumulates in the lower crust. However, rocks from Group 1 were derived from a mixing magma from the melting of both residual metasomatic lithosphere and ancient lower crust. The arc cumulates associated with the subduction of the Paleotethys might provide Cu, S, and water for the fertile magmas. For the contribution of the Neoproterozoic slab subduction, further work should be done.

References

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