Paper Number: 2259

Geochronology of the giant Beiya gold–polymetallic deposit in Yunnan Province, Southwest China and its relationship with the petrogenesis of alkaline porphyry

Fu, Y.[1], Sun, X.M.[1,2,3]*, Lin, H.[1] and Zhou H.Y.[2]

[1] School of Marine Sciences, Sun Yat-sen University, Guangzhou 510006, China

[2] School of Earth Science and Geological Engineering, Sun Yat-sen University, Guangzhou 510006, China

[3] Key Laboratory of Marine Resources and Coastal Engineering in Guangdong Province, Guangzhou 510006, China

*Corresponding author, email: eessxm@mail.sysu.edu.cn

The Beiya gold–polymetallic deposit, located at the junction of the "Sanjiang" Tethys–Himalaya orogenic belt and the Yangtze craton in southwestern China, is the largest gold deposit in the region. Mineralization mainly occurs in skarn, which formed along the contacts between porphyry intrusions and Middle Triassic limestone host rocks. The ore formation process is suggested to be closely related to the Himalayan age alkaline porphyries. U–Pb dating of magmatic zircons from the Beiya quartz syenite porphyry yields a weighted average $^{206}Pb/^{238}U$ ages of 36.07 ± 0.43 Ma (n = 25, MSWD = 1.17). Calculated isochron age of five molybdenite samples from Beiya is 34.7 ± 1.6 Ma (MSWD = 0.99, initial ^{187}Os of 0.21 ± 0.16 ppb), which indicates that mineralization is coeval with the intrusion of the Beiya alkaline porphyry. This age is also in agreement with the results of *In-situ* magmatic titanite U-Pb dating which has yielded an Eocene age of 36.0 ± 5.9 Ma and apatite fission track analysis in the porphyry. The mineralization age is slightly younger than the porphyry emplacement, indicating that the Beiya metallogeny was likely to be a post-magmatic hydrothermal product of the Himalayan orogenic event. Magmatic zircon $\varepsilon_{Hf}(t)$ values range from −7.4 to +0.1, which correspond to the two-stage Hf model with ages between 1112 Ma and 1588 Ma. This finding suggests that the main source of porphyry was probably melting of thickened Mesoproterozoic lower crust triggered by partial melting of the lithospheric mantle. Zircon Ce (IV)/Ce (III) ratios of ore-related porphyry are high (given that all Eu_N/Eu_N* ratios are above 0.4), which demonstrates that the magma source of the porphyry was highly oxidized, which was favorable for Cu–Au mineralization. The REE characteristics of hydrothermal titanite also reveal that the ore forming fluids may have been derived from a highly oxidized magma. The medium Re concentrations in molybdenite (Re = 2.08 – 20.54 ppm) implies the addition of a deeper source component to the ore-forming materials. Fission track dating of apatite in the porphyry indicates fast cooling of the system to less than ca. 100ºC, indicative of rapid exhumation associated with active faulting, which is generally related to formation of high-grade Cu–Au porphyry (-skarn) mineralization. Mineralization event in the Beiya deposit occurred during the India–Eurasia post-collision stage. As the convergent margin settings evolved into a collisional orogen, selective fertile selective partial melts were formed and rapidly emplaced from a deep level through crustal-scale regional faulting and local transpression. The deep-sourced magmatism may have provided the metallogenic materials, as well as the

driving force and heat for the mineralization fluids.

References:

[1] Fu Y et al. (2016) Ore Geol Rev 71: 138-149
[2] Li W C et al. (2016) Ore Geol Rev 73: 241-252
[3] Deng J et al. (2015) Ore Geol Rev 70: 457-485
[4] He W Y et al.(2015) Econ Geol 110: 1625-1641.