Emplacement, uplift and exhumation histories of Tibetan porphyry Cu–Mo–Au deposits

J.-F. Xu[1], B.I.A. McInnes[2], N.J. Evans[2], W.L. Griffin[3]

[1]Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China (jifengxu@gig.ac.cn)
[2]CSIRO Exploration and Mining, ARRC, Kensington, WA, Australia (brent.mcinnes@csiro.au; noreen.evans@csiro.au)
[3]GEMOC Key Centre, Earth and Planetary Sciences, Macquarie University, NSW 2109, Australia (wgriffin@els.mq.edu.au)

The Jiama, Nanmu and Lakang'e porphyry intrusions and associated Cu–Mo–Au deposits in the Lhasa terrane of southern Tibet were emplaced along north-trending extensional faults conjugate to the Yarlung-Zangbo suture zone during post-collisional magmatism. Using zircon U–Pb, zircon (U–Th)/He (Zr_{He}) and apatite (U–Th)/He (Ap_{He}) geochronology and inverse numerical modelling methods, we quantitatively constrain the thermal and exhumation history of Cu–Mo–Au mineralization in the context of continental collision and tectonic uplift processes.

The Jiama porphyry dykes have zircon U–Pb ages of 15.9 Ma, Zr_{He} ages ranging from 13.9 to 14.4 Ma, and Ap_{He} ages of 13.3–14.0 Ma. The Lakang'e porphyry has a zircon U–Pb age of 15.7 Ma, Zr_{He} age of 15.0 Ma and an Ap_{He} age of 14.6 Ma. The Nanmu porphyry has a zircon U–Pb age of 12.9 Ma, Zr_{He} age of 12.6 Ma and an Ap_{He} age of 11.9 Ma. The zircon U–Pb ages indicate that partial melting of the lower crust or/and subducted continental crust was occurring throughout the mid-Miocene. Numerical modeling of U–Pb–He data indicates that the dykes were rapidly cooled following emplacement 2.0–2.7 km below the paleosurface.

The Ap_{He} data from the intrusions indicates a minimum denudation rate of 130 m/my and maximum denudation rate of 230 m/my for the Lhasa terrane and the southern Tibetan plateau since intrusion emplacement in the mid-Miocene. This compares with previous minimum estimates by other workers of 100 m/my based on fission track data.