Geochronology of the Xiaoxinancha Cu-Au deposit in NE China: Insights from molybdenite Re-Os dating

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There is still a divergence on metallogenic age of the Xiaoxinancha large copper-gold deposit associated with the Mesozoic granitic intrusion. The ^{40}Ar-^{39}Ar isochrone age of Cu-Au-quartz veins is 123.35±0.8Ma [1], whereas the SHRIMP U-Pb dating of zircons constrained the emplacement of ore-hosting granitic complex between 112Ma and 104Ma [2].

A molybdenite-quartz vein discovered recently supplies a more appropriate isotopic dating to the deposit. It occurs within the granitic intrusion and parallel to adjacent lode Cu-Au ore bodies, indicating that they are controlled by the common structure system. In the ore, metal minerals are dominated by molybdenite, pyrite, chalcopyrite and minor arsenopyrite, which are accordant to mineral assemble of the early stage of Xiaoxinanxha deposit. Primary inclusions in quartz grains from the vein include low-density gas, high-density aqueous two-phase and daughter mineral inclusions. They are coexistent and their homogeneous temperature is approximate (340~380°C), leading to a conclusion that the fluid evolved the similar process of boiling as ore-forming fluid in the early stage of major Cu-Au mineralization [3].

Molybdenite Re-Os dating of six samples obtains the model ages from 109.2±3.4Ma to 110.8±4.0Ma and an isochrone age of 111.1±3.1Ma, which are consisting with newly isotopic dating of ore-forming granitic intrusions. It suggests that the large copper-gold mineralization take place at the end of the early Cretaceous and resulted from the subduction of the Pacific Ocean slab to the Eurasia plate.

[1] Meng *et al*. (2001) Jilin Sci.& Tec. Pub. House: 44-77. [2] Sun *et al*. (2008). *Mineral Deposits*, **27**(3): 319-328. [3] Li & Chen (1995). *Mineral Deposits*, **14**(2):151-173 (in Chinese).

Improved calibration of the $^{40}Ar/^{39}Ar$ geochronometer: Consequences for thermochronology

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Thermochronology almost invariably involves comparison of data from different radioisotopic systems, and the extent to which these different chronometers are accurately intercalibrated poses limits on the validity of thermal histories derived from multi-system data sets. The $^{40}Ar/^{39}Ar$ system is pivotal to many thermochronologic studies because ample diffusion data and models exist for various minerals with closure temperatures between ~200 and ~500 °C. A new calibration of the $^{40}Ar/^{39}Ar$ system (Renne *et al*. this conference) renders older ages than most previously used decay constants, the magnitude increasing with age. Consequently, discrepancies e.g. between $^{40}Ar/^{39}Ar$ biotite and U/Pb zircon ages for granitoids decrease by an amount that increases with age. Previously inferred mean cooling rates over the ~800 to ~300 °C range turn out to be higher than previously inferred, the more so with age. For example, consider two hypothetical plutons intruded at equivalent depth in a coherent terrane with U/Pb zircon ages of 1527 Ma and 2860 Ma, and biotite $^{40}Ar/^{39}Ar$ cooling ages of 1502 Ma and 2835 Ma respectively, based on the decay constants of Steiger and Jäger (1977) and standard calibration of Renne *et al*. (1998). The $^{40}Ar/^{39}Ar$ ages recalculate to 1512 Ma and 2848 Ma, respectively. Assuming 800°C zircon saturation temperatures and a 300 °C closure temperature for biotite, mean cooling rates of 20 °C/Ma for both the younger and older plutons based on the old calibration recalculate to 33 °C/Ma and 42 °C/Ma, respectively. Thus one might infer exhumation/uplift or a decreasing thermal gradient over the time spanned by the two intrusions, whereas thermochronology previously betrayed no changes in cooling rates over the same temperature interval. Old meteorites are especially sensitive to the new calibration, though not as much as allowed by decay constant uncertainties based on activity data (e.g. Renne, 2000) because the revision indicates an increase in the probability of β^- and decrease in probability of electron capture decays. An age of 4543 Ma based on Steiger and Jäger (1977) and 1073 Ma for the Hb3gr standard (now 1080 Ma) is revised to 4556 Ma, thus imposing a speed limit for rapidly cooled meteorites.