Timing of Cu-Mo Mineralization in the Deep Extension of the Giant Chuquicamata Deposit, Northern Chile

Claudio A. Araya, Antonio Arribas
The University of Texas at El Paso, El Paso, TX, USA

The giant Chuquicamata Cu-Mo deposit has a documented complex origin and evolution, like most world-class porphyry copper-type deposits. This deposit evolved within the Chuquicamata intrusive complex through the superimposition of several magmatic and hydrothermal events over a period of ~5 million years that started at ~35 Ma with the intrusion. First, an early event (~34-30.4 Ma) of potassic alteration was developed, which transitioned laterally to propylitic alteration. This was followed by a second magmatic-hydrothermal event of intense potassic alteration, Qz-Mo veining (~32.9-31.7 Ma), and white mica alteration (~31.8-30.5 Ma). This second pulse appears to be responsible for the bulk of metallic mineralization in the deposit. Finally, the upper part of the hypogene alteration/mineralization was altered by a younger Miocene supergene alteration and mineralization enrichment event at ~19 to 15.2 Ma.

This study will consider all previously available geochronological data for Chuquicamata, including U-Pb in zircon from intrusive host rocks, $^{40}Ar/^{39}Ar$ in biotite, K-feldspar, and white mica for potassic and sericitic alteration stages, and Re-Os in molybdenite from Qz-Mo veins. The objective of this research is to better understand the temporal evolution of hydrothermal alteration within the Chuquicamata complex, with emphasis on the precise timing and duration of the main stage of Cu-Mo mineralization in the Deep Extension Chuquicamata deposit, which has not been dated yet. This will be achieved through radiometric dating analyses ($^{40}Ar/^{39}Ar$ and/or K-Ar in biotite and white mica, and Re-Os in molybdenite) of pure mineral separates selected from a collection representative of the various alteration and mineralization stages within the Deep Extension deposit.