

## GEOCHRONOLOGICAL STUDIES IN THE CHUQUICAMATA DISTRICT, CHILE: A REVIEW

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The dating and discrimination of significant events in the complex Chuquicamata porphyry copper system have been challenging. The work by others and us indicates that the first mineralizing (Chuqui) porphyries were emplaced at ca. 35 Ma, followed by potassic alteration and various hydrothermal pulses to ca. 33 Ma. This system evolved within a dynamic ductile to brittle shear system. After 1-2 km of exhumation, a discrete mineralizing (quartz-sericitic) event was superimposed at ca. 31 Ma. Relatively slower exhumation followed, allowing for the development and preservation of important supergene blankets (19 to 15 Ma) and exotic copper deposits. The unmineralized Fortuna igneous complex, juxtaposed across the NS (Falla Oeste) fault system, is relatively older than the Chuqui porphyries.

Historically, in the 1960s, Pb-alpha on zircon approximately dated the Paleozoic and Mesozoic hosts to the Chuqui porphyries, and the Eocene Fortuna. In the 1970s and 1980s, conventional K/Ar dated the main potassic alteration at 35 to 33 Ma, and the quartz-sericite alteration at 31-28 Ma. In the 1990s, Rb-Sr accurately dated the major homogenization of the Chuqui system at  $35 \pm 2$  Ma and confirmed that Fortuna is older.  $^{40}\text{Ar}/^{39}\text{Ar}$  defined two thermal pulses and documented thermal overprint by the younger event. U-Pb dating is hindered by the presence of xenocrystic zircon with Paleozoic ages. Recently, ELA-ICP-MS dating of zircon distinguish 3 intrusive phases at 34.8, 33.4 and 33.3 Ma, compatible with a 34.9 Ma age by Re-Os in molybdenite. Re-Os in Cu-Fe sulfides confirms the ca. 31 Ma age of the quartz-sericitic stage. Fission-track data on zircon and apatite, and (U-Th)/He dating, point to extremely fast cooling to  $<100^\circ\text{C}$  after the quartz-sericitic event, and improve exhumation histories. Fission-track data on apatite and ESR of quartz in fault gouge suggest that the Falla Oeste was active into the Pliocene and Pleistocene, respectively.