

## A Revised Late Eocene Age for Porphyry Cu Magmatism in the Escondida Area, Northern Chile

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### Abstract

New U-Pb zircon and  $^{40}\text{Ar}/^{39}\text{Ar}$  single-crystal incremental-heating biotite dates are reported for porphyritic rocks from three mineralized centers in the Escondida region of northern Chile; all dates are reported with 2s errors. At the Chimborazo porphyry Cu prospect, a weighted mean  $^{40}\text{Ar}/^{39}\text{Ar}$  plateau age of  $38.09 \pm 0.30$  Ma has been obtained for igneous biotite from a syn- or postmineralization feldspar-biotite-quartz porphyry intrusion. At the Zaldívar porphyry Cu mine, zircon and biotite have been analyzed from a similar synmineralization feldspar-biotite-quartz porphyry (the Llamó porphyry): the zircon U-Pb age is  $38.7 \pm 1.3$  Ma, whereas the weighted mean  $^{40}\text{Ar}/^{39}\text{Ar}$  plateau age of igneous biotite is slightly younger at  $37.40 \pm 0.18$  Ma. U-Pb dating of two other rhyolitic quartz-feldspar porphyry bodies that host much of the ore at Zaldívar shows that these rocks are Paleozoic in age (Antigua porphyry:  $290 \pm 4$  Ma; Zaldívar porphyry: broadly coeval with Antigua but age poorly defined). At the Escondida deposit, the reportedly synmineralization Escondida porphyry is dated by U-Pb at  $37.9 \pm 1.1$  Ma, whereas the reportedly postmineralization Rhyolitic porphyry returned a U-Pb age of  $34.7 \pm 1.7$  Ma.

These results indicate a single pulse of synmineralization magmatism in the Escondida district at ~38 Ma, followed by minor largely nonmineralizing intrusive events. The timing of main-stage porphyry mineralization at Escondida is apparently bracketed by the ages of the Escondida ( $37.9 \pm 1.1$  Ma) and Rhyolitic porphyries ( $34.7 \pm 1.7$  Ma). Previously published K-Ar dates for intrusive rocks and alteration minerals at Escondida, which range from 39 to 31 Ma, are interpreted to reflect variable degrees of disturbance of the K-Ar system by later intrusive events and/or by supergene weathering processes.

An age of ~38 Ma for ore-forming porphyry magmatism in the Escondida region is significantly older than previously accepted best estimates based on K-Ar and U-Pb dating (32–34 Ma) but still falls within the age range of other large porphyry systems within the north-south-trending West Fissure Zone of northern Chile (31–42 Ma). A common feature of the porphyry intrusions at Zaldívar and Escondida, and also at Chuquicamata and El Salvador, is the presence of zircons with inherited upperPaleozoic cores. These cores are interpreted to reflect interaction between arc magmas and crustal rocks during melting, assimilation, storage, and homogenization (MASH) and assimilation and fractional crystallization (AFC) processes at various crustal levels.