

# New Geochronological Data and Exploration Potential of El Teniente Cu-Mo Porphyry District, Central Andes, Chile

Rubén Pardo Cáceres<sup>†</sup> and Paola Kovacic Villarroel

*Exploraciones Mineras Andinas S.A., Codelco-Chile Filial, Av. Apoquindo 4775, Las Condes, Santiago, Chile*

<sup>†</sup>Corresponding author: e-mail, rpard001@em.codelco.cl

Current exploration carried out by Codelco in the El Teniente district has contributed new ideas for the discovery of further orebodies. After compilation of historical data and new, recently collected evidence, two highly prospective intrusion-related mineralized belts have been identified and characterized by means of 12 new Ar/Ar and U/Pb ages.

The regional magmatic evolution records three intrusive belts; the first one (14–7 Ma) includes two NE-SW-oriented subbelts, referred to as western and eastern, respectively. The western subbelt includes several intrusive bodies, from north to south: Cristales monzodiorite ( $12.27 \pm 0.19$  Ma), Quebrada Mosquito monzonite ( $10.72 \pm 0.17$  Ma), Quebrada Coya monzonitic porphyry ( $9.47 \pm 0.66$  Ma), and Las Cayanas granodiorite ( $10.14 \pm 0.08$  Ma). The eastern subbelt contains tonalites, monzonites, and tonalitic porphyry intrusions ranging in age from  $7.60 \pm 0.09$  to  $7.74 \pm 0.10$  Ma. This last subbelt is SW-NE oriented and located between the Agua Amarga and Piuquenes sectors. The second intrusive belt (6.5–4.5 Ma) incorporates the “Sewell” tonalite, which correlates with porphyry facies of the El Teniente deposit. The third intrusive belt (3.9–2.9 Ma) includes postmineral lamprophyre dikes.

The first mineralized belt is characterized by several centers of advanced argillic alteration (lithocaps) aligned in a NW-SE and NE-SW orientation (Fig. 1); these provide the potential for Cu-Au porphyry exploration at depth. Ar/Ar dating of hypogene alunite from Cristales sector indicates an age of  $13.61 \pm 0.16$  Ma. In Las Cayanas sector, located in the southern part of the district, sericitic alteration returned an Ar/Ar age of  $9.72 \pm 0.06$  Ma, whereas at Piuquenes the sericitic event has an Ar/Ar age of  $7.60 \pm 0.04$  Ma. The earliest hydrothermal alteration of this belt compares with those related to Pimentón-West Wall and Ortiga (Andina-Los Bronces) prospects, respectively. The second mineralized belt (6.5–4.5 Ma) hosts the main Cu-Mo porphyry systems of the Miocene-Pliocene, such as El Teniente, oriented in a general NE-SW direction. This orientation is given by the emplacement of the “Sewell” tonalite, which is the intrusive source of this belt and is concealed below volcanic rocks from the Farellones Formation. Regarding the relationship between these two mineralized belts, both partially overlap and correlate with the above-mentioned first and second intrusive belts, respectively.

In the central Andes, the El Teniente district segment shows several independent tectonic blocks defined by NW-SE and NE-SW fault systems, which are coherent with the location and orientation of the aforementioned mineralized belts. As a consequence, the El Teniente deposit was exposed as the result of structural uplift, controlled by these fault systems, whereas other adjacent mineralized centers were not uplifted and remain covered, generating a cluster-type configuration on a district scale. This result constitutes a relevant exploration guideline for this district and offers a new approach to the traditional geologic model of this sector; it also allows new target areas to be generated within the proposed mineralized belts.

