Geology and discovery of Escondida Este porphyry Cu-Mo Deposit, Escondida cluster district, northern Chile

Corresponding author: Marco Ipinza, Minera Escondida Ltda, marco.ma.ipinza@bhpbilliton.com

Co-authors:
Alejandro Pizarro, Minera Escondida Ltda, alejandro.aa.pizarro@bhpbilliton.com

Escondida Este (EE) is the most recent of several large porphyry copper-molybdenum deposits discovered in the supergiant Late Eocene-Early Oligocene Escondida district in northern Chile.

Minera Escondida Ltda (57.5% BHP Billiton; 30% Rio Tinto and 12.5% JECO corporation) has been conducting a brownfield exploration program since 2000. Major successes include the discovery of the concealed Pampa Escondida porphyry Cu-Au deposit in late 2006, followed by the discovery of EE deposit in 2009. Both discoveries resulted from reinterpretation of historical data and changing conceptual and geological models developed in recent years. The EE target was successfully tested by deep drill holes, resulting in the discovery of two mineralization zones: the northern orebody in early 2009 and the southern one in late 2010.

EE is located immediately to the east of the Escondida deposit and the two deposits, while distinct in age, overlap with each other at depth. The newly discovered porphyry system, extending 4.5 km north-south by 1 km east-west, is composed of two centers of mineralization that are genetically related to a granodioritic porphyry complex that largely postdate mineralized feldspar porphyries in the Escondida deposit. The northern orebody lies underneath a nearly barren quartz porphyry dome that post-dates Escondida mineralization, whereas the southern mineralization zone is concealed by a sequence of Miocene gravels.

EE porphyry system is hosted by a succession of bimodal volcanic and intrusive rocks of Carboniferous-Permian La Tabla Formation, Paleocene-Eocene andesite of Augusta Victoria Formation and also by the Escondida Intrusive Complex (~38-35 Ma; U-Pb zircon dating). All these units are intruded by the “Escondida Este Intrusive Complex”, which composed of a pre-mineral phase of dioritic-monzodioritic intrusives (~36 Ma; U-Pb zircon dating), an early-mineral intrusive phase characterized by multiple pulses of granodioritic porphyry stocks (34.5-33.7 Ma; U-Pb zircon dating) and a late-mineral porphyry stock of granodioritic composition (33.3 Ma; U-Pb zircon dating).

The bulk of copper mineralization is paragenetically and spatially related to early gray-green sericite alteration (31.8 Ma; Ar-Ar sericite dating) that is the strongest hydrothermal event within the potassic stage and is centered at the top of the early-mineral porphyry stocks. This alteration event overprints early K-feldspar and biotite assemblages and also the eastern side of the older Escondida mineralization system.

Disseminated and vein-hosted hypogene copper mineralization, mostly fractionated in the potassic alteration stage, is dominated by chalcopyrite and bornite with minor chalcocite. The top of the high grade hypogene mineralization zone is encountered approximately 900 meters below the current surface. Although mineralization at EE is predominately hypogene, an immature
supergene chalcocite blanket was developed in the uppermost part of the southern orebody, 150 meters beneath current surface. Three pulses of molybdenum mineralization are recognized by spatial and temporal relations between 34 and 33 Ma (Re-Os molybdenite dating), associated in part with early potassic alteration stage and in part with subsequent intrusion of the late-mineral granodioritic porphyry.

The large size of EE deposit has been interpreted as a hydrothermal system with multiple porphyry phases, which led to continuous metal contribution over a ~2 Ma period.

intracontinental MLYRB.