Geology of the Chimborazo Project, Escondida District, Antofagasta, Chile

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Mineralization in the Chimborazo project, located approximately 15 km northwest of the Escondida deposit, northern Chile, corresponds to porphyry Cu-Mo, associated with an extensive advanced argillic alteration zone.

The geology of the project is characterized by the presence of a volcanopyroclastic sequence of dacitic tuffs interbedded with andesitic flows of Upper Cretaceous-Eocene age, which is cut by a series of intrusives with ages between 42 and 36 Ma. This magmatism is represented by a premineral phase of monzodioritic composition and a productive phase characterized by a granodioritic porphyry, in addition to the development of a late-intermineral phase termed Chimborazo intrusive complex, consisting of a series of different intrusives with dioritic to granodioritic compositions and ages between 39.7 and 36.9 Ma. Finally, a number of late andesitic to dacitic dikes are recognized, representing the end of magmatism in the system. A number of hydrothermal breccias related to the hydrothermal stages have been identified, ranging from anhydrite and tourmaline phases at depth to gypsum-advanced argillic phase toward the top of the breccia column. Extensive gravel covers the area, showing a constant deepening toward the northern part of the project, probably related to a NW-directed lineament.

The most representative hydrothermal alteration stage is shown in the advanced argillic event, composed of alunite, dickite, pyrophyllite, and quartz, locally incorporating amounts of green tourmaline, dumortierite, andalusite, and diaspore—these last ones, related with the deep advanced argillic roots, in some cases can reach depths close to 1,200 m. This alteration transitions to a phyllic zone, composed of sericite, quartz, and black tourmaline, or crosses directly to an intermediate argillic alteration or SCC, consisting of chlorite, sericite, and illite. The early hydrothermal development is located in the deep part of the system and consists of a discrete K-feldspar zone developed in the porphyry and surrounded by an extensive hydrothermal biotite stage to the host rock, both cut by localized orthoclase-quartz associations (KSil) and by a gray-green sericite event.

The upper mineralized zone consists of an extensive leached level close to 100 m thick composed of a core of hematite partially coexisting with jarosite, and transitioning toward the edges to a domain of goethite. Scattered, localized zones of copper oxides are known in the area and mainly include brochantite, occasionally accompanied by chalcanthite or atacamite. Arsenates like chenevixite and ceruleite occur toward the west-central edge, while varying amounts of exotic black oxides have been identified in ferrocretes levels developed toward the north zone. The greatest economic interest in the area is currently a secondary enrichment blanket, composed mainly of chalcocite, which averages 100 m thick, extending in some cases to depths near 300 m due to a strong structural control. The primary mineralization consists of high and intermediate sulfidation associations; the first of these associations includes tennantite, enargite, bornite, and covellite, normally arranged in the upper parts of the system and directly related to the

presence of acidic fluids. At depth, the primary mineralization consists mainly of chalcopyrite, which may or may not be accompanied by bornite, magnetite, and pyrite.

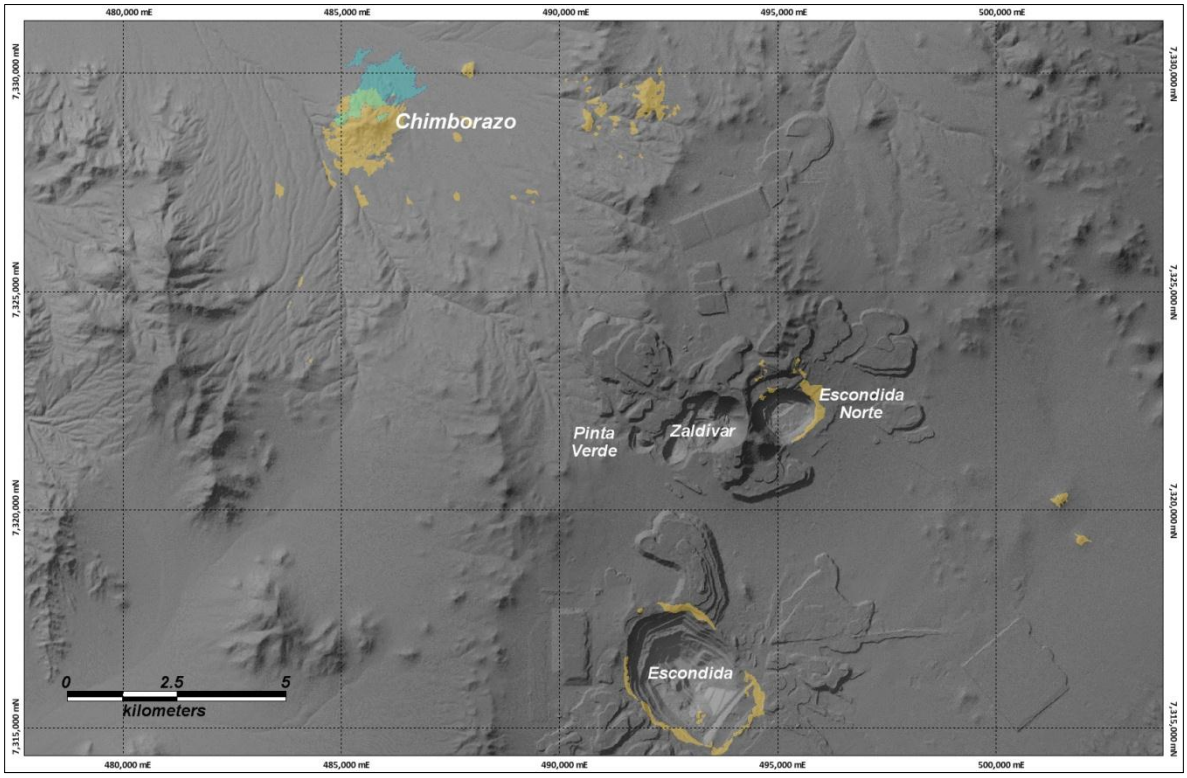

Fig. 1. Location map of Chimborazo project in the Escondida district showing the distribution of major advanced argillic alteration (yellow-brown) and the projection of the Chimborazo secondary enrichment blanket (blue).