

AGE OF INTRUSION-RELATED CU(-FE) MINERALIZATION IN THE PUNTA DEL COBRE DISTRICT, NORTHERN CHILE

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The Cu(-Fe) district of Punta del Cobre is located south of Copiapó, northern Chile (Fig. 1). Copper ore is mined from breccia bodies, veins, stockworks, and concordant lens-shaped bodies hosted by the largely volcanic pre-upper Valanginian Punta del Cobre Formation. The hypogene mineralization consists of chalcopyrite, pyrite, magnetite, and hematite. Average ore grades are 1.1 to 2 % Cu, 0.2 to 0.6 g/t Au, and 2 to 8 g/t Ag. Massive magnetite occurs as veins and irregularly shaped bodies. The ore is spatially associated with alkali metasomatism and in particular with potassic alteration. Ore formation temperatures of 400° to 500°C were estimated by HOPF (1990) based on paragenetic relationships.

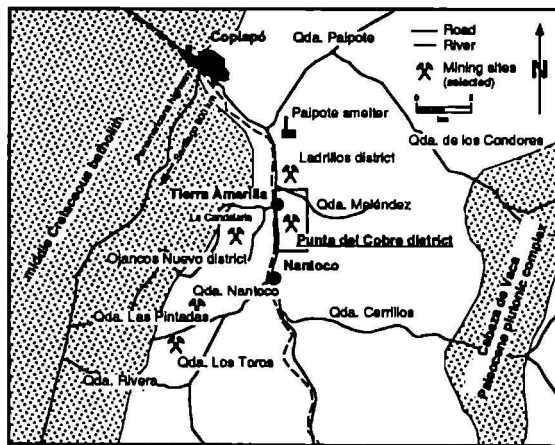


Fig. 1:
Location of the Punta del Cobre district. The position of major intrusive complexes is indicated.

The present investigation shows that the mineralization is related to the earlier emplacement stages of the middle Cretaceous Coastal Batholith exposed about 3–4 km west of the Punta del Cobre district.

An $^{40}\text{Ar}/^{39}\text{Ar}$ incremental-heating experiment on hydrothermal biotite, considered to be formed synchronous with the Cu(-Fe) mineralization, yielded an inverse isochron age of 114.9 ± 0.5 Ma (Fig. 2 and 3). This is consistent with a Rb-Sr isochron of 116.8 ± 1.4 Ma, which also represents the age of potassic alteration that accompanies mineralization (MARSCHIK et al., 1996). Available ages for the middle Cretaceous batholith near the

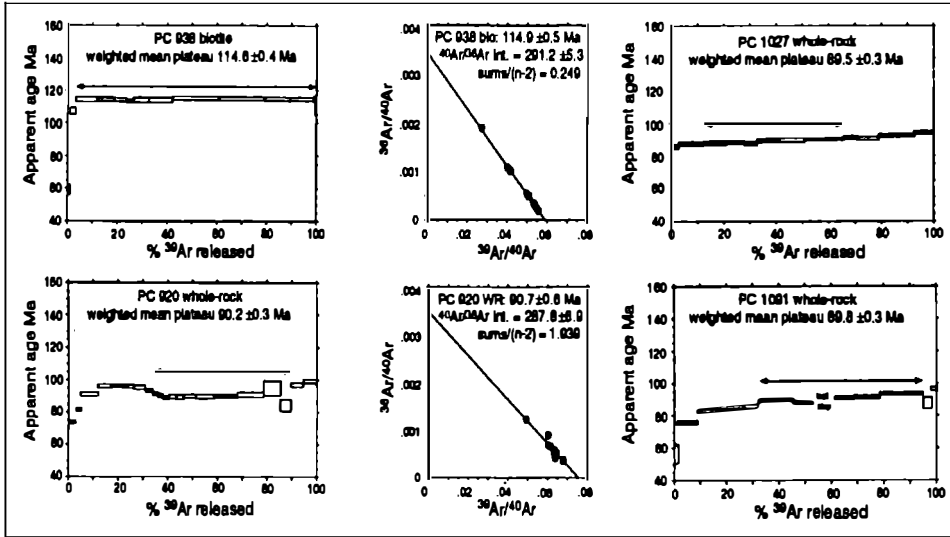


Fig. 2: Age spectra obtained from $^{40}\text{Ar}/^{39}\text{Ar}$ incremental heating analyses and corresponding inverse isochron correlation diagrams for samples PC 938 and PC 920 ($\pm 1\sigma$ errors).

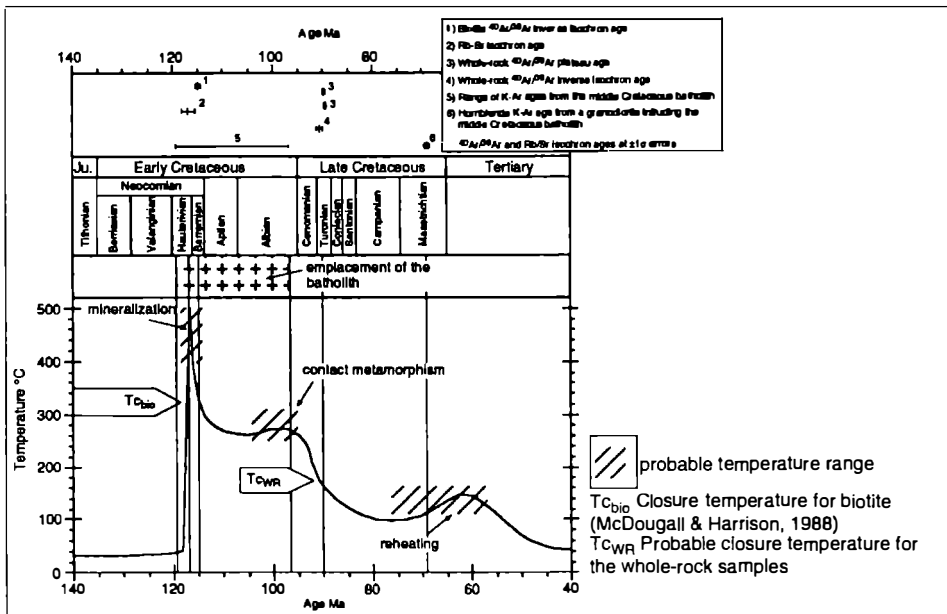


Fig. 3: Schematic representation of the Cretaceous to Paleocene thermal and metasomatic history of Punta del Cobre district.

Punta del Cobre district are between 119 and 97 Ma (FARRAR et al., 1970; ARÉVALO, 1994, 1995; Fig. 3). The biotite age spectrum (Fig. 2) indicates that during contact metamorphic overprint produced by the later stages of batholith emplacement, the Punta del Cobre district, east of the Copiapó river, was not affected by temperatures above ~300°–350°C, the closure temperature for argon in biotite (McDOUGALL & HARRISON, 1988; Fig. 3).

This study further showed that the area cooled to about 200°–150°C, the argon closure temperature of the K-feldspar dominated whole-rock samples, at ~90 Ma due to regional uplift. Three $^{40}\text{Ar}/^{39}\text{Ar}$ age spectra suggest that the area was reheated at ~70–60 Ma. This is consistent with a K–Ar hornblende age of 69 Ma for a granodiorite intruding the middle Cretaceous batholith (ARÉVALO, 1994) and an Early Paleocene magmatic period recognized in northern Chile (FARRAR et al., 1970).

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