

Laramide Porphyry Cu-Mo Mineralization in Northern Mexico: Age Constraints from Re-Os Geochronology in Molybdenite

FERNANDO BARRA,[†]

*Department of Geosciences, University of Arizona, Tucson, Arizona 85721, and Instituto Geología Económica Aplicada,
Universidad de Concepción, Concepción, Chile*

JOAQUIN RUIZ, VICTOR A. VALENCIA,

Department of Geosciences, University of Arizona, Tucson, Arizona 85721

LUCAS OCHOA-LANDÍN,

Departamento de Geología, Universidad de Sonora, Hermosillo, Mexico

JOHN T. CHESLEY, AND LUKAS ZURCHER

Department of Geosciences, University of Arizona, Tucson, Arizona 85721

Abstract

Twenty-five new Re-Os molybdenite ages for nine porphyry copper-molybdenum deposits from northern Mexico constrain the timing of mineralization and the longevity of porphyry systems in this region. The ages of all the deposits are between 50 and 61 Ma (i.e., Paleocene to early Eocene) and are associated with the Laramide orogeny. The oldest deposits are those from the Cananea district and include the El Alacrán prospect (~61 Ma), the Maria deposit (60 Ma), the current Cananea mine, and La Colorada breccia (~59 Ma). The age of mineralization at Cumobabi also is 59 Ma, and it was followed by the emplacement of deposits at Suaqui Verde and Cuatro Hermanos at about 57 to 56 Ma. The Malpica prospect, the southernmost porphyry copper prospect in western Mexico, was emplaced at 54 Ma. The La Caridad deposit in Nacozari and the El Crestón prospect both have Re-Os molybdenite ages of 54 Ma. The Tameapa prospect has a protracted hydrothermal mineralization history with multiple molybdenite mineralization events at ~57, 52 to 53, and 50 Ma.

Total Re and ¹⁸⁷Os concentrations for molybdenites range from 10,424 to 26 ppm and from 6,641 to 14 ppb, respectively. The deposit with the highest Re and Os concentrations is El Alacrán, and the lowest concentrations are found in El Crestón. The ages determined support the formation of porphyry copper deposits in northern Mexico during the Laramide orogeny. In general, the ages of porphyry copper deposits in the North American province range from ~76 Ma at Bagdad, Arizona, to ~50 Ma at Tameapa, Sinaloa. The ages also show that porphyry copper mineralization occurred continuously between these two dates, with two main episodes at ~60 Ma (Cananea district, México, and Sierrita and Copper Creek, United States) and at ~54 Ma (La Caridad, El Crestón, Malpica in Mexico and Morenci, United States).

[†] Corresponding author: e-mail: fbarra@geo.arizona.edu