Laramide Porphyry Systems of New Mexico: Geochronology and Critical Mineral Potential

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Southwest New Mexico hosts a number of Laramide age porphyry copper deposits. These deposits are associated with intrusions inferred to be the remnant cores of stratovolcanoes formed by subduction and arc magmatism during the Laramide Orogeny (~75-45 Ma). These porphyry copper deposits are large, low grade (<0.8% Cu), and contain disseminated copper and molybdenum sulfides, breccias, and stockwork veinlets associated with porphyritic intrusions. These deposits also contain many accessory minerals categorized as “critical minerals”, such as PGEs (platinum, palladium, rhodium, iridium, osmium, and ruthenium), tellurium, indium, germanium, gallium, and rhenium. These critical minerals were not the main target of these deposits historically, and are recovered from the anode slimes remaining after copper is refined. New detailed geochronology, mineralogy, geochemistry, along with geologic mapping are refining the location of critical minerals within specific systems and will identify porphyry systems with elevated critical minerals that could become economic once again. A new compilation of the geochronology of these copper porphyry and related districts reveals there are two main pulses of arc magmatism in New Mexico that produced mineralized deposits, ~75-71 Ma and ~58-54 Ma. However, many of these deposits and associated Laramide intrusions have very limited geochronology available. Many of these districts were dated with the older and less precise K-Ar method, while others provide conflicting and/or questionable intrusion emplacement ages. Plutons and mineralized portions of these deposits are currently being prepared for modern, high-precision 40Ar/39Ar geochronology. These new ages will provide more accurate and precise emplacement ages for the plutons. A second set of samples from the mineralization areoles will allow us to assess the timing of mineralization, both hypogene and supergene where present. Updated geochronology combined with new whole rock and trace element geochemistry, along with mineral characterization via electron microprobe analysis will identify which phases bear these critical minerals and their abundance. The ultimate goal is to determine a correlation, if one exists, between these critical minerals and the ages of emplacement and mineralization. Districts we have targeted so far include the Hillsboro district, Tres Hermanas district, Camel Mountain – Eagle’s Nest district, Black Hawk district, and potentially other districts in the future. These districts have a dire need for updated geochronology, exhibit unique mineralogy, and often have conflicting or poor precision dates.

pp. 102, https://doi.org/10.56577/SM-2023.2895

2023 New Mexico Geological Society Annual Spring Meeting
April 21, 2023, Macey Center, Socorro, NM
Online ISSN: 2834-5800