Reevaluating the Schultze Granite: A New Temporal Model for the Globe-Miami Magmatic-Hydrothermal System and Its Implications for Porphyry Exploration

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Porphyry copper deposits form from magmatic-hydrothermal fluids generated by large and long-lived magmatic systems, typically in subduction-related settings. Although extensively studied, our understanding is fragmentary due to a paucity of exposed magmatic root-zones. Key questions remain as to how sufficient volumes of mineralising fluids emanate from parent magmas and are focused into the deposit-forming environment, and over what timescales. To address this, we have integrated the results of field, micro-textural, geochemical and geochronological studies into a self-consistent 4-D framework for the Schultze Granite – previously interpreted to be the exposed root-zone of the Globe-Miami District, Arizona, United States. We show that mineralization within related deposits (Resolution, Pinto Valley, Diamond H and Copper Cities) occurred over a period of ~1.3 Myrs (~65.1-63.8 Ma), which is coincident with the age of a major porphyry dike at Pinto Valley (~64.5 Ma), but significantly pre-dates (by ~1-2 Myrs) emplacement of the Schultze Granite, which occurred rapidly (in <~600 kyrs, from ~62.6 Ma) from an estimated depth of ~20 km. The Schultze Granite did not therefore contribute to the formation of these deposits. Instead, the magma which formed it evolved and upwardly injected aplitic-porphyry dikes which underwent syn-emplacement first-type boiling and fluid exsolution to produce quartz USTs, miarolitic cavities and early DQ and A-type quartz veins. Cu-Mo mineralization occurred where and once these fluids cooled below ~600 °C. The aplitic-porphyry dikes served as fluid conduits for at least 400 kyrs, feeding ~1.1 Myrs (~62.6-61.5 Ma) of hydrothermal mineralization at Miami and the eastward located Ocelot and Old Dominion mineralized system.

Whilst providing significant new constrains for our understanding of hypogene mineralization in porphyry systems worldwide, our new framework demonstrates the value in integrating fundamental field observations with micro-textural study and high-precision geochronology rather than relying on geochemical ratios alone when exploring these multi-faceted systems.