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⁴⁰Ar-³⁹Ar AGES OF HYPOGENE AND SUPERGENE MINERALIZATION IN THE CERRO VERDE-SANTA ROSA PORPHYRY Cu-Mo CLUSTER, AREQUIPA, PERU

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Abstract

The contiguous Cerro Verde and Santa Rosa porphyry copper deposits are hosted by Paleogene granitoid rocks and Precambrian gneiss, and spatially associated with 61 ± 1 Ma (U-Pb zircon: Mukasa, 1986) dacitic porphyry stocks. The age of hydrothermal activity is constrained by laser-induced incremental-heating ⁴⁰Ar-³⁹Ar sericite (muscovite-2M₁) dates of 61.8 ± 0.7 (2σ) and 62.0 ± 1.1 Ma for Cerro Verde, and 62.2 ± 2.9 Ma for Santa Rosa, representing the terminal event in the Arequipa segment of the Coastal batholith.

The deposits crop out on the Santa Rosa erosional pediment, which itself is incised into the older La Caldera surface. Two populations, of ages 36.1 to 38.8 Ma and 24.4 to 28.0 Ma, are identified by multiple analyses of a sample from Cerro Verde comprising alunite partially replaced by natroalunite, demonstrating that supergene activity had commenced by the latest Eocene, during the Incaic orogeny, thereafter continuing through the Oligocene. In the Santa Rosa deposit, deep (ca. 300–350 m) leaching in the late Oligocene is recorded by ca. 26 Ma natroalunite that is inferred to have formed beneath the La Caldera surface. At the top of the Cerro Verde pit (2738 m bench), veins of alunite (ca. 23 Ma) and natroalunite (ca. 21 Ma) in a hematitic leached zone are truncated by the Santa Rosa surface, which is inferred to have developed after 21 Ma. Decreasing ages of alunite-group minerals with increasing depth in the Cerro Verde pit (e.g., ca. 12 Ma at the 2648 m level, and 4.9–6.7 Ma at the 2618 m level) are evidence for deepening of the supergene profile through the Miocene beneath this pediment. Jarosite dates (0.7–1.3 Ma) record the persistence of minor supergene activity into the Pleistocene.

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