Geology, Mineral Alteration and Mineralization of the Santa Cecilia Porphyry Au-Cu Deposit, Maricunga Belt, Northern Chile.

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The Cerro del Medio system, within the Santa Cecilia-Caspiche district of the Maricunga Belt, records magmatic and hydrothermal processes from the late Oligocene to early Miocene (25.2–24.7 Ma). It lies adjacent to the Caspiche deposit (1,091 Mt @ 0.55 g/t Au), separated by a 250 m-wide valley, and formed during the late Oligocene (~25 Ma). This study aims to refine the nature of ore mineralization at the Cerro del Medio target while ongoing research continues on other targets within Santa Cecilia. The objectives include identifying mineral assemblages and the timing of hydrothermal alteration, evaluating Cu-Au grades across alteration stages, and analyzing relationships between alteration and mineralization centers using petrographic, mineralogical, geochemical, and isotopic techniques. The results indicate that Cerro del Medio exhibits a complete porphyry copper-style vertical alteration zonation, consisting of four main zones: (1) biotite-magnetite (potassic), hosting the highest Cu grades; (2) chlorite-white mica (chlorite-sericite); (3) white mica (sericitic); and (4) aluminosilicate (advanced argillic lithocap), with the latter suggesting deeper porphyry-style mineralization potential. Three mineralization stages were identified: (1) magnetite-quartz, with chalcopyrite-rich magnetite veinlets introducing copper; (2) quartz-rich, where disseminated chalcopyrite occurs in quartz veinlets; and (3) sulfide-sulfate, dominated by pyrite-anhydrite veining, which remobilized and diluted copper mineralization. The impact of the sulfide-sulfate stage on copper grade highlights the importance of targeting zones unaffected by this overprint. Comparisons with Caspiche reveal similar alteration and mineralization patterns, suggesting that both systems share a common magma chamber as the source of the porphyry copper systems. This genetic link underscores the regional significance of magmatism in driving hydrothermal activity and highlights the potential for additional high-grade Cu-Au mineralization at Cerro del Medio and the broader Santa Cecilia property. Further studies at the Pircas and Gemelos targets will refine the deposit model and improve the understanding of its magmatic, hydrothermal, and structural evolution.