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Links Between Mafic Volcanism and Porphyry Gold Mineralization: Insights from the Maricunga Belt, Chile

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The Oligocene to early Miocene Maricunga Belt, located in northern Chile (28°S to 26°S) is renowned for its abundance of porphyry gold and epithermal gold deposits emplaced during short pulses of extension within a long-lived compressional regime. The deposits are typically found within intermediate subvolcanic intrusive centers, and some deposits are copper poor, but others contain both gold and copper. Recent work suggests that the source magmas responsible for mineralization contain an inherent gold-enriched geochemical signature. We will explore the most primitive magmas in the area to gain insights into the magma source beneath the Maricunga Belt and assess its role in the generation of magmas with high fertility to form gold porphyry deposits.

Here, we present a comprehensive study of mafic lavas (basalts to basaltic andesites), including the Segerstrom lavas, in the Maricunga belt, which erupted contemporaneously with gold mineralization. We utilize petrographic analysis, scanning electron microscopy with energy dispersive spectroscopy, and electron microprobe analysis, of both the whole rock and phenocrysts, including olivine, amphibole, pyroxene, and plagioclase. Additionally, we document olivine and amphibole-hosted melt inclusions. We assess the source of the mafic magmas, as either generated via partial melting of either an asthenospheric mantle magmas or subcontinental lithospheric mantle during extension and evaluate recorded redox conditions and degrees of partial melting. By providing a holistic overview of the mafic lavas we gain deeper understanding of the deep mantle-crust processes in the generation of magmas forming porphyry gold deposits both in the Maricunga Belt and gold porphyry deposits more broadly.