Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30438

# Expansion and contraction of the Patagonian ice sheet and it's influence on magma storage beneath Mocho-Choshuenco volcano, Chile

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Glacial loading and unloading can impact eruptive outputs at mid- to high-latitude arc volcanoes, yet the influence on magma storage conditions remains poorly understood. Mocho-Choshuenco volcano in the Andean Southern Volcanic Zone has been impacted by the advance and retreat of the Patagonian ice sheet (PIS). We present conceptual and numerical models of ice loading and unloading during the most recent glacial-interglacial cycle and use mineral-based thermobarometry and thermodynamic modeling to explore the evolution of the magma plumbing system. Syn-last glacial maximum (LGM) basaltic andesites erupting at 26-18 ka—when ice was thickest—crystallized at depths of 10.6-15.3 km. Crustal assimilation was prominent during this period and a >15 $km^3$ silicic reservoir began to grow at 9.6-14.8 km, similar to the depth of maximum stress increase by ~5.5 MPa caused by PIS loading. Volatile exsolution within the reservoir generated overpressure that initiated diking and propelled two caldera-forming, amphibole-bearing rhyolites at 13.5 and 11.5 ka (>5.3 $km^3$). We propose that lithostatic stress associated with ice loading during the LGM inhibited eruption and promoted growth of the deep silicic reservoir. Explosive eruptions from this reservoir 3-5 kyr following rapid ice unloading likely reflects the interplay of viscous relaxation of crustal wallrocks and delayed, but abrupt, volatile exsolution from rhyolitic melt to generate overpressure and dike formation. This approach can be exported to other glaciated volcanoes and arcs to examine how ice loading and unloading modulate upper crustal magma fluxes that are governed at greater depths by rates of mantle melting.