

Chillahuita: a torta-type dome in northern Chile

ALEXANDER SCHEINOST^{1,2}, BRUNO SCAILLET³ AND FELIPE AGUILERA^{1,4}

¹Millennium Institute on Volcanic Risk Research – Ckelar Volcanoes

²Programa de doctorado en ciencias mención geología

³Institut des Sciences de la Terre d'Orléans (ISTO), Université d'Orléans, CNRS, BRGM

⁴Departamento de Ciencias Geológicas, Universidad Católica del Norte

Presenting Author: asc021@alumnos.ucn.cl

The Chillahuita (22,16°S; 68,02°W) is a torta-type dome related to the last phase of silicic magmatism in northern Chile (0.2 Ma) [1], which was formed by the eruption of highly viscous dacitic lava at 107.8 ± 6.4 ka [2]. In this study, we present a comprehensive analysis of the morphometry, mineralogy, geochemistry, and petrology of the dome based on samples collected from the vent, center, and talus to better understand the pre-eruptive conditions that led to its formation.

The results suggest that the magma chamber beneath the Chillahuita dome corresponds to a shallow reservoir with an input of less evolved magma (andesitic), which underwent significant mixing/mingling prior to eruption. The resulting crystal-rich, viscous magma played a crucial role in determining the eruptive style (effusive), covering a high area (>13 km²) and volume (>2 km³). The rheological properties indicate a yield strength of $3.32 \cdot 10^5$ Pa. On the other hand, the mineralogical (including amphibole, plagioclase, biotite, quartz, apatite, magnetite, and ilmenite) and geochemical analysis (carried out with SEM and EPMA) suggest the presence of a complex magmatic system with variable pre-eruptive conditions (calculated with thermobarometers for amphibole, biotite, and Fe-oxides). These conditions involved a series of processes, such as equilibrium crystallization followed by magma mixing/mingling, resulting in disequilibrium crystals (e.g., sieve and boxy-cellular textures in plagioclase) and mafic enclaves incorporated in the dome.

Finally, our study provides significant information on the pre-eruptive conditions that led to the formation of a dacitic torta-type dome in northern Chile. Furthermore, they will be correlated with the experimental petrological analyses that are currently carried out.

[1] de Silva, S.L., Self, S., Francis, P.W., Drake, R.E., Ramírez, C. (1994). Effusive silicic volcanism in the Central Andes: the Chao dacite and other young lavas of the Altiplano-Puna volcanic complex. *J. Geophys. Res.* 99 (B9), 17805–17825.

[2] Tierney, C. R., Schmitt, A. K., Lovera, O. M., & de Silva, S. L. (2016). Voluminous plutonism during volcanic quiescence revealed by thermochemical modeling of zircon. *Geology*, 44(8), 683-686.