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Understanding late-stage rhyolitic magmatism in the Andean Central Volcanic Zone through a melt inclusion geochemical study in silicic lava domes

LORETO HERNÁNDEZ PRAT, PHD CANDIDATE[1,2], DANIEL ASTUDILLO MANOSALVA[3], CLAUDIA CANNATELLI[4], BENIGNO GODOY[5], ANGELO CASTRUCCIO[1,2], DIEGO MORATA[6] AND STEPHEN M ELARDO[3]

[1]Universidad de Chile
[2]Centro de Excelencia en Geotermia de Los Andes (CEGA)
[3]University of Florida
[4]University of Alaska Anchorage
[5]Centro de Excelencia en Geotermia de los Andes (CEGA), Universidad de Chile
[6]Departament of Geology, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile

Presenting Author: loreto.hernandez@ug.uchile.cl

The Altiplano-Puna Volcanic Complex in Central Andes developed through different magmatic stages of flare-up and waning activity [1] in the last 1 Ma, under the influence of the Altiplano-Puna Magma Body [2, 3]. The last stage corresponds to the eruption of young (34-423 Ka) highly silicic and crystal-rich domes (68-72 wt% SiO_2, [4]). Little is known about this kind of magmatism, and an approach through the study of melt inclusions hosted in the main mineral phases of these domes can provide significant new information about their origin and evolution.

We have determined the pre-eruptive major, trace and volatile contents in plagioclase-, amphibole-, biotite-, quartz- and minor pyroxene-hosted melt inclusions (MIs) for domes D, Chao, Cerro La Torta and Chac Inca. MIs are rhyolitic in composition (75-80 wt% SiO_2) with K_2O ranging from 1.5 to 8 wt% and H_2O from 3.3 to 5.7 wt%.

Major elements systematically indicate contemporary crystallization of all mineral phases in Chao and Chac Inca domes. Dome D evolved forming pyroxene, amphibole + quartz, plagioclase + amphibole and, lastly, biotite + plagioclase. Trace element data from La Torta show a more complex evolution, involving a crystalline mush from a previous stage containing amphibole, plagioclase, and minor pyroxene going through various disequilibrium processes which totally or partially melted the amphibole in it. During this process, magma began to ascend through the crust, from 7.3 to 3.6 km, while recrystallizing new amphibole and biotite from the remaining liquid. Amphibole Al-barometry indicates that crystallization of the magmas of all studied domes occurred during a continuous ascension within the crust at similar pressures, suggesting a formation mechanism that is independent of the age of each dome, at least, during the last 450 Ka.

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