Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11367

H_2O contents of melt inclusions in zircons from the Rhyolite of Laguna del Maule

KEI SHIMIZU, JEFF HANNON, TYLER BLUM, CHLOE BONAMICI, JOHN H. FOURNELLE, NORIKO T. KITA, JACOB KLUG, WILLIAM O. NACHLAS, BRAD SINGER, MICHAEL J. SPICUZZA, BRYAN WATHEN AND JOHN W. VALLEY

University of Wisconsin-Madison

Presenting Author: kshimizu4@wisc.edu

Melt inclusions in zircons (MIZs) can record the composition as well as the P-T conditions of magmas at the time of entrapment. Laguna del Maule (LdM) volcanic field in the southern Andes is among the most active Pleistocene-Holocene rhyolitic volcanic centers worldwide and a potentially hazardous system possessing inflation rates >25cm/yr (Singer et al., 2014). We separated zircons from the earliest known postglacial rhyolite (rdm, 19.5-22ka, Fierstein, 2018), and measured the major element composition, H_2O content, $\delta^{18}O$ of MIZs by SIMS, Raman, and EPMA. 20 homogeneous, glassy MIZs (5-25μm diameter) were identified using SEM-BSE imaging of polished surfaces of zircons. EPMA of 11 elements including oxygen shows 66-76wt.%SiO_2 and 0.6-7.8wt.%H_2O (based on excess O). H_2O contents measured by Raman micro-analysis (532nm laser, ~3100–3800cm^{-1} band) indicates the presence of H_2O and OH species in the glass. Integrated intensities (~3100-3800cm^{-1}) were corrected for zircon photoluminescence and calibrated against a set of hydrous rhyolitic glass standards. Raman measurements of water range from 1.2-4.3wt.%H_2O. Finally, H_2O contents of the MIZs were analyzed by SIMS, yielding 2.0-6.6wt.%. H_2O contents by SIMS and EPMA agree to within 25% on average despite significant scatter, while H_2O contents by Raman consistently underestimate the SIMS H_2O contents by ~40%, likely due to an imperfect correction for zircon photoluminescence. The $\delta^{18}O$ of the MIZs are 2.2±0.6‰ heavier than the zircons consistent with the predicted equilibrium fractionation (Lackey et al., 2008). The SiO_2 (66-76wt.%SiO_2) and SIMS H_2O contents of the MIZs define a negative correlation that is consistent with those of rdm plagioclase and quartz MIs indicating decompression-driven fractional crystallization from ~14 to 4km consistent with geophysical constraints of magma storage depths (Klug et al., 2020). Rdm zircons have been dated by U-Th (19-59ka, SIMS, Andersen et al., 2019), while Mg zonation indicates that plagioclase resided in the magma only decades prior to eruption (Andersen et al., 2018). Hence, many rdm zircons are likely early-grown antecrysts but the range of MIZs H_2O contents imply that storage conditions and the process of upward melt percolation through crystal mush, fractional crystallization, and decompression of rhyolite varied little during the last ~60ka.