Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11181

Damp to super-hydrous magmas recorded by arc root cumulates

BENJAMIN URANN[1], **VÉRONIQUE LE ROUX**[1], OLIVER JAGOUTZ[2], OTHMAR MÜNTENER[3], MARK BEHN[4] AND EMILY CHIN[5]

[1]Woods Hole Oceanographic Institution
[2]Massachusetts Institute of Technology
[3]University of Lausanne
[4]Boston College
[5]Scripps Institution of Oceanography, UC San Diego

Presenting Author: vleroux@whoi.edu

Magmatic volatiles (e.g., H_2O) are abundant in arc melts and exert fundamental controls on magma evolution, eruption dynamics, and the formation of economic ore deposits. To constrain the H_2O content of arc magmas, most studies have relied on measuring extrusive products and mineral-hosted melt inclusions. However, these methods have inherent limitations that obfuscate the full range of H_2O in arc magmas. Here, we report secondary ion mass spectrometry measurements of volatile (H_2O, F, P, S, Cl) abundances in lower crustal cumulate minerals from the Kohistan paleo-arc (NW Pakistan), and determine H_2O abundances of melts from which the cumulates crystallized. Pyroxenes retained magmatic H_2O abundances and record damp to hydrous (<1–10 wt.% H_2O) primitive melts. Subsequent crystal fractionation led to formation of super-hydrous melts with ~12–20 wt.% H_2O, predicted petrologically yet never recorded by melt inclusions. Fluid exsolution from super-hydrous melts during ascent is key to porphry copper deposit formation, while foundering of hydrated lower arc crust provides an effective means of transporting hydrogen back into the mantle.