Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.3685

First *in situ* analyses of nitrogen in primitive subduction-related melts

EVELYN FÜRI[1], MAXIM V. PORTNYAGIN[2], NIKITA MIRONOV[3], CÉCILE DELIGNY[4], ANDREY GURENKO[4], ROMAN BOTCHARNIKOV[5] AND FRANCOIS HOLTZ[6]

[1]Université de Lorraine/CNRS
[2]GEOMAR Helmholtz Centre for Ocean Research Kiel
[3]V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry
[4]Université de Lorraine
[5]Johannes Gutenberg Universität Mainz
[6]Leibniz Universität Hannover

Presenting Author: efueri@crpg.cnrs-nancy.fr

A quantitative understanding of nitrogen fluxes and pre-eruptive magmatic concentrations in subduction zones is key for constraining the N recycling efficiency between Earth's internal and external reservoirs. Although the three-component mixing model of Sano et al. [1], for example, provides a means to estimate the relative contributions from air, subducted sediments, and the mantle to the total N content of gas and/or water samples from arc volcanoes and associated hydrothermal systems, assessing the N content of primitive arc magmas and their mantle source remains a challenge. Given that melt inclusions (MIs) in Mg-rich olivine represent the best proxies for primary arc melts, we applied, for the first time, an *in situ* high-resolution secondary ion mass spectrometry (SIMS) method [2] to determine the N concentration in olivine-hosted MIs from Klyuchevskoy volcano in Kamchatka. To reverse the effects of post-entrapment modification processes, the MIs were partially to completely homogenized at high temperatures (1150–1400°C) and pressures ranging from 0.1 to 500 MPa under dry to H_2O-saturated conditions at variable oxygen fugacities (CCO to QFM+3.3) [3]. After the experiments, N concentrations in water-rich MI glasses correlate positively with H_2O and CO_2 contents as well as with N/CO_2 ratios, and negatively with the volume of the remaining fluid bubble. Glasses of completely homogenized (fluid bubble-free) MIs contain up to 25.7 ± 0.5 ppm N, whereas glasses of three unheated (natural, glassy) MIs have significantly lower N concentrations of ~1 ± 0.3 ppm. The N-CO_2 characteristics of completely homogenized MIs indicate that melts feeding Klyuchevskoy volcano are strongly enriched in both N and CO_2 compared to primary mid-ocean ridge melts, thus indicating subduction of large amounts of N and its (partial) return to the crust and atmosphere by arc-related magmatism.

[1] Sano et al. (1998), *GRL* 25, 2289–2292. [2] Füri et al. (2018), *Chem Geol* 493, 327–337. [3] Mironov et al. (2015), *EPSL* 425, 1–11.