Towards new constraints on the origin and budget of terrestrial N

E. FÜRI[1*], E. DELOULE[1], C. DALOU[2]

[1] CRPG-CNRS, Univ. de Lorraine, Vandoeuvre-les Nancy, France (*correspondence: efueri@crpg.cnrs-nancy.fr)

[2] University of Minnesota, Department of Earth Sciences, Minneapolis, USA

Nitrogen isotopes have become the tracer of choice for investigating the origin of volatiles trapped in the interior and at the surface of planetary bodies because the relative proportion of ^{14}N and ^{15}N shows outstanding variability across the Solar System [1]. In addition, the large nitrogen isotopic contrast between the terrestrial surface (atmosphere, biomass, sediments) and mantle reservoirs gives nitrogen potential as a tracer of volatile fluxes between the (near-) surface, shallow mantle, and deep mantle [2]. However, the study of nitrogen in mantle-derived silicate samples is complicated by its low abundance (ppm levels), which makes this element sensitive to contamination by atmospheric and surface-derived (organic) nitrogen. Consequently, the distribution of nitrogen and its isotopes among the "deep" volatile reservoirs remains a matter of debate. Melt inclusions – potentially undegassed pockets of melt trapped in early-formed minerals – are key for investigating the volatile characteristics of the deep Earth, but current analytical techniques do not allow targeted measurements of nitrogen to be made in these micron-sized samples.

We have developed a new protocol for *in situ* nitrogen abundance and isotope analyses of silicate samples by secondary ionization mass spectrometry (SIMS). We hold a suite of 14 (C-) N-bearing basaltic glasses, whose nitrogen concentrations and $^{15}N/^{14}N$ ratios have been determined by CO_2 laser extraction static mass spectrometry. These glasses are used as standards for nitrogen measurements using the CAMECA IMS 1280 HR2 at the Centre de Recherches Pétrographiques et Géochimiques (Nancy, France). Given that this instrument can achieve a very high mass resolving power, potential isobaric interferences on the CN^-, NO^-, AlN^-, and SiN^- signals can be resolved. By targeting these secondary molecular ions, nitrogen abundances can be detected down to the ppm level in both carbon-bearing and carbon-free basaltic glasses. Uncertainties on isotope ratios are on the order of only a few permil for samples containing tens of ppm nitrogen. Thus, this technique will be key for the study of nitrogen in (basaltic) melt inclusions and is expected to provide new insights into the origin, evolution, and budget of nitrogen trapped in Earth's interior.

[1] Füri and Marty (2015) *Nat. Geosci. 8, 515-520.* [2] Cartigny and Marty (2013) *Elements 9, 359-366.*