Zinc isotope systematics in subduction zones - insights from Tonga arc lavas

CAROLINA ROSCA[1*], STEPHAN KÖNIG[1], MARIE-LAURE PONS[1,2], RONNY SCHOENBERG[1]

[1]Department of Geosciences, University of Tübingen, Germany
*carolina.rosca@uni-tuebingen.de (presenting author)
[2]CEREGE, Aix Marseille Université, France

Transition metal stable isotope systematics of terrestrial igneous reservoirs may help to better understand the recycling behavior of these elements through Earth's interior. However, isotopic variations of 'heavy' elements caused by magmatic processes are subtle and difficult to resolve. Within this scope we have improved our precision on MC-ICP-MS Zn isotope measurements to < ±0.02 ‰ on $\delta^{66/64}$Zn for single runs (2SD, multiple digestions of reference materials) using a ^{64}Zn-^{67}Zn double spike. With this step forward we investigated the systematics governing the Zn transport and isotope fractionation at subduction zones. For this study, the focus was set on volcanic rocks from the Tongan subduction zone - where the pre-subduction mantle wedge composition (Sm/La>1) is amongst the most depleted for worldwide arc settings. Additional analyses of samples from IODP site 595 provide an insight to the input to this subduction factory. Primitive lavas (basalts and basaltic andesites; MgO>5 %) display subtle, yet resolvable Zn isotopic variations between the central Tonga islands Tofua, Late, Kao and Ata, as well as differences to $\delta^{66/64}$Zn values of MORB and the subduction input. In addition, Zn-isotopes and Zn/La are correlated with fluid indices such as Ba/Th, suggesting potential mobilization of Zn from the subducting plate and/or overlying sediments into the mantle wedge prior to melting. Yet, negative correlations observed between Zn-isotopes and Sm/La of the lavas point towards a link between Zn-isotopic composition and relative mantle depletion beneath individual volcanic edifices. Concomitant occurrence of these features complicates a straighforward deconvolution of the Zn-isotope variations seen in arc lavas and fluid-iduced transport cannot be simply ruled out.

In this presentation we will discuss and expand the Zn-isotope fractionation problematic in subduction settings aiming to address the following: *i)* what are the main mechanisms triggering Zn-isotope fractionation and what is the result of their combined effects? *ii)* can we identify and possibly quantify the subduction component from the Zn-isotope composition of the arc lavas? *iii)* what are the long-term effects of Zn recycling into the mantle on the evolution of the terestrial Zn signal?