Ca and Zn isotopic compositions of arc lavas from Tonga Rear Arc

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To investigate Ca and Zn isotopic variation during hydrous magma differentiation and evaluate the effects of subduction components, we measured Ca and Zn isotopic ratios of the well-characterized arc basalts and dacites from Niuatahi–Motutahi caldera, Tonga rear arc [1]. These rocks show typical arc characteristics with enrichment of LILE and fluid-mobile elements and high oxygen fugacity [1], indicating a significant input of subduction components into the mantle wedge. The $\delta^{44/40}$Ca in basalts and fresh dacites varies from 0.76 ± 0.09‰ to 0.92 ± 0.09‰ with an average 0.84 ± 0.09‰ (n=12), while the δ^{66}Zn varies from 0.22 ± 0.02‰ to 0.24 ± 0.04‰ with an average 0.23 ± 0.02‰ (n=12).

Both $\delta^{44/40}$Ca and δ^{66}Zn show no correlation with geochemical indicators of magma fractionation (e.g., MgO, CaO, Al_2O_3, FeO_T) and addition of subduction components (e.g., Ba/La and Th/Nb). The results suggest negligible effects of hydrous magmatic differentiation and the input of subduction components on $\delta^{44/40}$Ca and δ^{66}Zn. It may reflect that the subduction slabs bring little Ca and Zn into the mantle wedge and do not noticeably modify $\delta^{44/40}$Ca and δ^{66}Zn of the mantle wedge. The data on altered samples suggest that hydrothermal alteration could strongly affect contents and isotopic compositions of Ca and Zn. The average $\delta^{44/40}$Ca of fresh arc lavas from Tonga is similar to MORB (0.81 ± 0.1‰) [2] and OIB (0.87 ± 0.1‰) [3], indicating similar behavior of Ca isotopes during mantle melting and magmatic differentiation under anhydrous and hydrous systems. The average δ^{66}Zn is slightly lower than MORB (0.28 ± 0.03‰) [4] and OIB (0.30 ± 0.07‰) [5], which can be ascribed to a higher extent of mantle depletion relative to MORB source.

[1] Park et al (2015), JP 1, 59-81 [2] Zhu et al (2018), JGR 123, 1303-1313 [3] Huang et al (2011), GCA 75, 4987-4997 [4] Wang et al (2017), GCA 198, 151-167 [5] Chen et al (2013), EPSL 369-370, 34-42