Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.9652

Calcium Isotopes as Fluid Tracers during Rodingtization

E HOSTETTLER[1], JAIME D. BARNES[2], JOHN C. LASSITER[1], AARON SATKOSKI[1], BESIM DRAGOVIC[3], PAUL STARR[4] AND ETHAN BAXTER[4]

[1]The University of Texas at Austin

[2]Department of Geological Sciences, University of Texas at Austin

[3]University of South Carolina

[4]Boston College

Presenting Author: eihostettler@utexas.edu

Calcium is present in common minerals and as a major cation (~400 ppm) in seawater making it a non-traditional stable isotope of growing interest for a range of geoscience fields. Rodingites are a Ca-rich, Si-poor rock of mafic origin, which represent the mobilization of Ca^{2+} in serpentinizing fluids from peridotites. Andradite-grossular garnet ($Ca_3Fe^{3+}{}_2Si_3O_{12}$-$Ca_3Al_2Si_3O_{12}$) is the first phase to crystallize during rodingitization, followed by secondary Ca-rich minerals. Given that rodingitization may occur in multiple stages throughout the evolution of an ophiolite from seafloor to emplacement, rodingites may be a useful tool when addressing the Ca cycle by tracing the fluids involved in serpentinization. Using Ca isotopes ($\delta^{44/40}Ca$) to address the origin of fluids for rodingitization and the effect this process may have on the Ca cycle has been reserved to one study that focused on the Leka ophiolite [*1*]. This study concluded that the Leka rodingites formed without the input of seawater with whole-rock and mineral separates ranging from 0.33-0.99‰, close to that of mantle values (0.6-1.1‰; [*3,4*]).

In contrast, our preliminary Ca isotope data ($\delta^{44/40}Ca_{SRM915a}$) of rodingites from the Voltri and Zermatt-Saas ophiolites (Western Alps) are higher than those reported for the Leka ophiolite (**Figure 1**) and may suggest an external Ca source. An obducted rodingite (Apennines, Voltri) has a $\delta^{44/40}Ca_{garnet}$ value of 1.39 ± 0.07‰ suggesting an input from seawater (modern≈1.9‰, [*2*]). A meta-rodingite from Servette (Zermatt-Saas) has a garnet value of 1.08 ± 0.09‰, within the range of mantle values (0.6-1.1‰) [*3,4*]. Lastly, meta-rodingites from the Voltri ophiolite have garnet values of 1.24 ± 0.07‰ for the main meta-rodingite body, 1.74 ± 0.04‰ for a garnetite vein from the former, and 2.21 ± 0.17‰ from the Erro-Tobbio unit. The last value is noteworthy as Ca isotopes tend to not fractionate >0.8‰ during high-temperature processes. These high values suggest an external Ca source contributing to rodingite formation during subduction or exhumation.

[1] Gussone et al. (2020) Chem. Geol., 542, 119598

[2] Fantle & Tipper (2014) *Earth Science Reviews,* 129, 148-177

[3] Huang et al. (2010) *EPSL* 292, 337-344

[4] Kang et al. (2019) *Chem Geo*, 524, 272-282

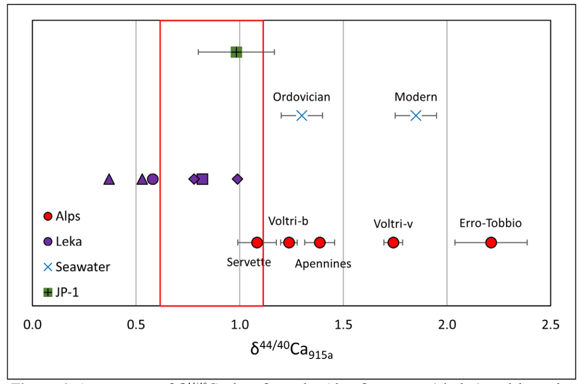

Figure 1. A summary of $\delta^{44/40}Ca$ data from the Alps for garnet (circles) and how they compare to the whole-rock (square) and mineral separates (cpx: triangles, hornblende: diamonds, garnet: circle) of the Ordovician Leka rodingite. Average range for mantle values are indicated by the red box (0.6-1.1‰) [3,4]. $\delta^{44/40}Ca$ of seawater during the Ordovician and modern values are from [1] and [2]. JP-1 (peridotite) was used as the standard (0.98 ± 0.18‰).