

## Investigating triple O-isotope exchange in submarine vent fluids and experimental H<sub>2</sub>O-peridotite reaction

DAVID ZAKHAROV<sup>1</sup>, LUKAS P. BAUMGARTNER<sup>2</sup>,  
TORSTEN VENNEMANN<sup>2</sup> AND RACHAEL H JAMES<sup>3</sup>

<sup>1</sup>Western Michigan University

<sup>2</sup>University of Lausanne

<sup>3</sup>School of Ocean and Earth Science, University of Southampton

Presenting Author: david.zakharov@wmich.edu

In recent years combined high-precision  $\delta^{18}\text{O}$ - $\Delta^{17}\text{O}$  measurements of altered rocks have been used to evaluate mass balance of submarine water-rock reactions in the distant past. Yet studies of modern-day reacted fluids, which would help to verify models, remain limited. Here we report a suite of new measurements from hydrothermal vent fluids from the East Scotia back-arc spreading ridge and the submarine Kemp caldera of the South Sandwich Arc. The fluids were collected from diffuse and focused high-temperature vents. The low Mg-samples (<1 mmol/kg Mg) have  $\delta^{18}\text{O}$  values ranging up to 2.1 ‰ higher and  $\Delta^{17}\text{O}$  values ~0.01 ‰ lower than the ambient seawater as a result of reaction with basaltic rocks. Addition of magmatic fluids is also shown to have an effect on the triple O-isotope composition of the fluids.

Equilibrium triple-O isotope mineral-water fractionations have been calibrated for a few relevant systems (e.g., quartz-H<sub>2</sub>O, calcite-H<sub>2</sub>O), while most fractionations are based on ab initio calculations. This study investigates fractionation during an experimental reaction between mantle peridotite and H<sub>2</sub>O. We measure D/H,  $^{17}\text{O}/^{16}\text{O}$  and  $^{18}\text{O}/^{16}\text{O}$  during the reaction at T = 275 °C (P sat. vap.) and mass water/rock ratios (W/R) of 0.6 and 1.8. Starting materials are 98% pure olivine powder with  $\delta^{18}\text{O} = +5.54$  ‰ and fresh deionized water with  $\delta^{18}\text{O} = -12.23$  ‰. The difference in initial  $\Delta^{17}\text{O}$  values is 0.1 ‰. The reacted solid material is dominantly serpentine and brucite. The longest reaction (1300 hrs) at W/R = 0.6 produced fluids with a  $\delta^{18}\text{O} = -3.3$  ‰, approaching ~90% equilibrium exchange. These data provide new insights as to serpentinization of ultramafic rocks and experiments could be extended to explore the triple O-isotope systematics of altered oceanic crust. Further, in some systems the composition of the fluids can disentangle inputs from multiple types of reacting rock (e.g., sediment, peridotite and basalt) and non-isothermal reactions due to the sensitivity of triple O-isotope fractionation factors ( $^{18}\alpha$  and  $\theta$ ).