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Zoned Triple Oxygen Isotope Record in UHP Garnet from Dora-Maira

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Fluids in continental subduction zones mediate metasomatism and mass transfer at depth, yet constraints on fluid involvement during ultrahigh-pressure (UHP) metamorphism remain limited. We present triple oxygen isotope measurements (^{18}O, ^{17}O, $\Delta'^{17}O$) from micromilled, compositionally distinct growth domains in a Dora-Maira whiteschist garnet megablast. Across a ~5 cm transect, ^{18}O increases from 3.6‰ in the inner mantle to 6.2‰ near the rim whereas $\Delta'^{17}O$ shows no systematic variation between −0.03‰ and −0.08‰. The rim ^{18}O values are similar to those reported from smaller Dora-Maira garnet that formed at the same time and P-T conditions[1]. The ~2.5‰ increase from garnet interior to rim suggests infiltration of a fluid with heavier ^{18}O during garnet growth.

In $'^{17}O$ - $'^{18}O$ space, mass-dependent fractionation of oxygen isotopes plots with a positive slope of ~0.528. Garnet zonal groupings define linear arrays with slopes of 0.5130 ± 0.0033 (mantle, 12 zones, n=22), 0.5415 ± 0.0070 (inner rim, 7 zones, n=10), and 0.562 ± 0.015 (outer rim, 5 zones, n=7), documenting systematic steepening in $'^{17}O$ - $'^{18}O$ space toward the rim. In $'^{18}O$ - $\Delta'^{17}O$ reference space, the dataset forms a V-shaped geometry with rimward compositions extending to higher $'^{18}O$ and less negative $\Delta'^{17}O$. These changes suggest a progressive shift to a different equilibrium or kinetic fractionation process during garnet growth and fluid infiltration.

These results demonstrate resolvable, spatially structured triple oxygen isotope variability within a single UHP garnet megablast and provide constraints on oxygen isotope systematics relevant to fluid-rock exchange in the Dora-Maira continental UHP massif.

[1] Gauthiez-Putallaz, L., Rubatto, D., and Hermann, J. (2016), *Contributions to Mineralogy and Petrology,* 171(2), 15.