

## Triple O-Isotope analyses of pallasite olivine revisited: A cautionary tale

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Pallasites belong to the stony-iron meteorite group consisting of almost equal amounts of olivine and metal. Precise O-isotope compositions of olivine from 10 main group pallasites are determined using an improved laser fluorination IRMS method [1]. Our data from all pallasites are consistently more enriched than previous studies [2, 3]. However, the  $\Delta^{17}\text{O}$  values are in agreement with [3]. Ziegler & Young [4] obtained similarly enriched  $\delta^{17}\text{O}$  and  $\delta^{18}\text{O}$  values for pallasites and unpublished data from the Carnegie Institution (CIW) in [4] also agrees with our data. To explain the observed discrepancy in delta values for same pallasites, we partially lased Brahin's single olivine grain in 5 steps at increasing degree of laser power. Our hypothesis is the discrepancy in delta values might be due to incomplete reaction of olivine, one of the most resistant minerals to fluorination. The  $\delta^{18}\text{O}$  values are observed to increase  $\sim 1.8\text{‰}$  from the 1<sup>st</sup> (least complete) to 5<sup>th</sup> (most complete) reaction step and the triple O-isotope plot of these data fall on a half-slope line. Our data demonstrate that partial or incomplete reaction causes mass-dependent fractionation and results in lighter  $\delta^{17}\text{O}$  and  $\delta^{18}\text{O}$  values. Our experiment explains the discrepancy of data between reaction of olivine in conventional Ni-tubes [2] and laser reactions with  $\text{BrF}_5$  (this study). Inconsistencies in reaction progress may also help explain differences observed in laser fluorination methods at different labs worldwide [e.g., 3,4]. Our study highlights the importance of considering factors that might affect reaction progress such as: 1) the effect of fluoride residues covering unreacted sample; 2) the sample holder dimple profile (i.e., V-shaped; this study); and 3) the effect of melting the sample before fluorination as adopted by [3]. In our study we utilized a sample size optimized in order to limit the effect of buildup of fluoride residues. We also make use of continuous and blast laser modes to uncover the unreacted sample during the final stages of the reaction. Our specially designed sample holder dimples have a V-shaped profile that concentrate the material in the center to more effectively lase the sample. We are now applying these improvements to a wide variety of pallasites and other meteorites to decipher their origin.

[1] Ali *et al* (2013) *44<sup>th</sup> LPSC*, #2873. [2] Clayton & Mayeda (1996) *GCA* **60**, 1999-2017. [3] Greenwood *et al* (2006) *Science* **313**, 1763-1765. [4] Ziegler & Young (2011) *42<sup>nd</sup> LPSC*, #2414.

## Origin of the orthopyroxene fibrous in the ultrarefractory lithospheric domains beneath easternmost Canary Islands

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The mantle xenoliths from easternmost Canary Islands, exhibit a complex evolutionary history comprising events of depletion, serpentinization, dehydration and enrichment. Each of these events left imprints on both texture and chemistry of the xenoliths. The imprints of depletion event(s) are shown in the complete disappearance of the clinopyroxene porphyroclasts and the ultra-refractory nature of the xenoliths compared to the abyssal peridotites sampled along mid-ocean ridges and oceanic fracture zones. Compositionally, the study xenoliths resemble the recycled oceanic mantle peridotites (OII-u) sampled by worldwide ocean island volcanism. The development of porous clusters of fibrous orthopyroxene at the expense of primary olivine and orthopyroxene characterizes the event of hydrothermal alteration forming serpentine minerals which were later dehydrated into fibrous orthopyroxene. The signature of serpentinization is also shown in the wide variations of several highly incompatible element ratios that might remain constant over variable degrees of melting (e.g. Rb/Ba, U/Th); the poor correlations between several LILE with HFSE and the decoupling between Sr and Nd isotope ratios. During the Canary Islands magmatism, the peridotite xenoliths have been subjected to interaction with silicic carbonatite melt which is shown in the development of clinopyroxene rims and neoblasts at the expense of olivine and orthopyroxene minerals and the enrichment in strongly LREE relative to HREE. The petrographic observations, however, indicate that dehydration of serpentine minerals and formation of anhydrous fibrous domains has occurred long time before the activity of Canarian plume. We therefore favour a model in which serpentinization of the mantle xenoliths might occur when they, like other OII-u peridotites, were parts of a mantle wedge in an old subduction zone fluxed by large volume of aqueous fluids released from downgoing oceanic crust. Dehydration of the xenoliths might occur during their residence for a while in the hot convecting asthenospheric mantle and before their accretion to the present oceanic lithospheric mantle and interaction with Canarian intraplate magmatism.