Triple oxygen isotope compositions of the ~3.0 Ga Fiskefjord peridotites, SW Greenland

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Earth likely accreted from planetesimals that had variable mass-independent oxygen isotope compositions [1]. According to their W isotope compositions, some Archean rocks may have tapped a mantle source that had remained isolated from the last <2% of accreting materials [e.g. 2]. In search of a pre-late accretion signature in the oxygen isotope record, we analysed $^{18}O/^{16}O$ and $^{17}O/^{16}O$ in olivine from ~3.0 Ga peridotite lenses, possibly of cumulate origin, from the Fiskefjord region, SW Greenland [3]. Olivine from Cenozoic mantle xenoliths and basalts were analysed as reference for the post-Archean mantle. To improve interlaboratory comparison of the data with respect to the non-linearity effects of different mass spectrometers, we report our measurements relative to O_2 extracted by fluorination from IAEA water standards VSMOW2 and SLAP2, using a normalization scheme similar to [4] but relative to a reference line with slope $\lambda = 0.5305$ and zero intercept. The $\Delta'^{17}O_{VSMOW2\text{-}SLAP2}$ of olivine of most of the Fiskefjord samples is indistinguishable from the average value of post-Archean samples ($\Delta'^{17}O_{VSMOW2\text{-}SLAP2}$ = -51 ± 8 ppm 1σ; n=11), in good agreement with earlier data on the >3.81 Ga Ujaragssuit Nunât instrusion [5] and data by [6] on samples from the Ancient Gneiss complex. If these rocks or their presursors indeed sampled a pre-late veneer mantle source, the presence of the following components during late accrretion can be excluded: >0.2% CO, CV, CM, CR chondrites, >0.7-0.9% ordinary chondrites. Interestingly, some of the Fiskefjord peridotites have olivine with up to ~20 ppm higher $\Delta'^{17}O_{VSMOW2\text{-}SLAP2}$ and ~0.3‰ lower $\delta^{18}O_{VSMOW2\text{-}SLAP2}$ that inversely correlates with Y/Ho in the bulk rocks. Amphibole in these samples displays elevated Cl/F relative to mantle amphibole, suggesting a possible sea water origin of their halogens. We suggest that the parental magmas of some of the Fiskefjord peridotites were enriched in a hydrothermally altered mafic crustal component, supporting a possible origin in a hydrous arc-related setting [3].

[1] Kaib & Cowan 2015 *Icarus* **252** 161-174 [2] Willbold et al. 2015 *EPSL* **419** 168-177 [3] Szilas et al. 2015 *GeoResj* **7** 22-34 [4] Schoenemann et al. 2013, *RCM* **27.5** 582-590 [5] Peters et al. 2015 *Goldschmidt* **2469** [6] Rumble et al. 2013 *G*^{3} **14.6** 1929-1939