Oxygen isotopes in Kankan super-deep diamond inclusions reveal variable slab-mantle interaction

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Inclusions in super-deep diamonds provide a unique window to the sublithospheric mantle (e.g. [1-4]). Here we present oxygen isotopes for Kankan majoritic garnet and former bridgmanite inclusions. The clustering of Kankan majorites around a $\delta^{18}O$ of +9‰ is nearly identical to those reported from Jagersfontein [1]. This elevated and nearly constant $\delta^{18}O$ signal indicates homogenization of partial melts from the uppermost part of altered basaltic slabs. Conversely, $\delta^{18}O$ values in Juina majorites are highly variable [2] due to crystallization from small, discrete melt pockets in a heterogeneous eclogitic source. While all these majorites have eclogitic/pyroxenitic Cr_2O_3 and CaO contents, charge-balance for $Si^{[VI]}$ is achieved very differently, with Jagersfontein [3], Kankan [4], and Juina [2] majorites transitioning from eclogitic $Na^{[VIII]}Si^{[VI]}$ to peridotitic-pyroxenitic [5] $Mg^{[VI]}Si^{[VI]}$ substitutions. We interpret this shift as the result of homogenized eclogitic partial melts infiltrating and reacting with adjacent pyrolitic mantle at Kankan and Jagersfontein. Increases in Mg# and Cr_2O_3 with reductions in $\delta^{18}O$ support this reaction. This model is in agreement with recent experiments in which majorites and diamonds form from a reaction of slab-derived carbonatite with reduced pyrolite at 300-700 km depth [6].

The Kankan diamonds also provide an opportunity to establish the chemical environment of the lower mantle. Four inclusions of $MgSiO_3$, inferred to be former bridgmanite [4], provide the first-measured $\delta^{18}O$ values for lower mantle samples. These values suggest derivation from primitive mantle, or unaltered subducted oceanic lithospheric mantle. The Kankan super-deep inclusions thus provide a cross-section of deep mantle that highlights slab-pyrolite reactions in the asthenosphere and primitive compositions in the lower mantle.

[1] Ickert et al. (2015), *Geochem Perspect Letters,* 1, 65-74. [2] Burnham et al. (2015), *EPSL,* 432, 374-380. [3] Tappert et al. (2005), *Contr Min Pet,* 150, 505-522. [4] Stachel (2000), *Contributions Mineral Petrol,* 140, 16-27. [5] Kisseva et al. (2013) *Geology,* 41, 883-886. [6] Thomson et al. (2016), *Nature,* 529, 76-79.