Calcium isotopic fractionation between clinopyroxene and orthopyroxen in mantle xenoliths from Eastern China

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Several studies have revealed heterogenous Ca isotope composition of the upper mantle[1-3]. However, the fractionation mechanism is not clear at mineral or bulk rock scales. In order to explore the Ca isotopic composition of upper mantle, and better understand Ca isotope fractionation among co-existing mantle minerals, we have analyzed Ca and Fe isotope of 9 co-existing pyroxene pairs and 1 olivine from seven peridotite and two pyroxenite xenoliths which were collected from eastern China.

Ca isotopes were measured using a Triton-TIMS double spike method at the Guangzhou Institue of Geochemistry, CAS, reported as $\delta^{44}Ca$ (relative to NIST SRM 915a). Results of geostandard are consistent with reported values. 2 stand deviations of analyzed NIST SRM 915a is 0.12‰ (n=33). $\delta^{44}Ca$ of clinopyroxene ranges from 0.71 to 1.03‰, whereas opx yields a wide range from 0.95 to 1.82‰. $\Delta^{44}Ca_{opx\text{-}cpx}$ (defined as $\delta^{44}Ca_{opx}$-$\delta^{44}Ca_{cpx}$) shows a large variation from -0.01 to 1.11‰. The olivine has a $\delta^{44}Ca$ of 1.16‰±0.08 (2se, n=3), identical to the co-existing orthopyroxene (olivine from P-15 spinel lherzolite).

Elemental data and Fe isotope compositions of minerals suggest that cpx and opx are in chemical equilibrium. Therefore, the variable inter-mineral Ca isotopic offset between pyroxene pairs should also reflect equilibrium fractionation. Correlation between $\Delta^{44}Ca_{opx\text{-}cpx}$ and Ca/Mg (atomic ratio) of opx indicates the compositional control on inter-mineral fractionation[4]. Finally, estimated $\delta^{44}Ca$ of bulk peridotites and pyroxenites range from 0.76 to 1.04‰. We proposed that this variation in bulk rocks could be generated by carbonate-metasomatism followed melt extraction.

[1] Amini et al (2009) *GGR* **33** [2] Huang et al (2010) *EPSL* **292** [3]Chen et al (2014) goldschmidt 2014 400 [4] Feng et al (2014) *GCA* **143**