Mg and Fe isotope geochemistry of garnet peridotites from the Kaapvaal and Siberia Cratons

YA-JUN AN[1]*, FANG HUANG[1], JIN-XIANG HUANG[2], W. L. GRIFFIN[2] AND CHUAN-ZHOU LIU[3]

[1]University of Science and Technology of China, Hefei 230026, Anhui, China (*anyajun@mail.ustc.edu.cn)
[2]ARC Centre of Excellence for Core to Crust Fluid Systems, Macquarie University, Sydney NSW 2109, Australia
[3]State Key Laboratory of Lithospheric Evolution, Institute of Geophysics, CAS, Beijing 100029, China

Fresh mantle xenoliths captured by alkaline basalts, kimberlites, and lamproites can provide direct information on the Mg and Fe isotope composition of the upper mantle. Previous studies have focused on samples derived from shallow upper mantle (<60km) such as basalts and spinel peridotities. Mg and Fe isotope data on deeper mantle samples (e.g., garnet peridotites) are still scarce. Therefore, it is important to measure mantle rocks equilibrated at higher pressure to broaden our understanding of the isotopic composition of the upper mantle. Here, we present high-precision measurements of Mg and Fe isotopic compositions of whole-rock powders and mantle minerals including olivine, cpx, opx, garnet, and phlogopite in well-characterized garnet lherzolites and harzburgites from the Kaapvaal and Siberia Cratons, derived from depths of 130 – 180 km [1].

There is no clear discrepancy in δ^{26}Mg of garnet peridotites between the Kaapvaal and Siberia Cratons. δ^{26}Mg of whole rocks vary from -0.243‰ to -0.204‰ with an average of -0.223 ± 0.035‰ (2SD, n = 20), and δ^{56}Fe from -0.038 to 0.060 with an average of 0.007 ± 0.063‰ (2SD, n = 8). Both Mg and Fe isotope compositions of these whole rock samples are indistinguishable from the fertile upper mantle represented by spinel lherzolite, indicating that there is no significant Mg-Fe isotopic offset between the shallow and deep upper mantle. Our study also suggests that cpx from Kaapvaal Craton xenoliths probably is in isotopic disequilibrium with other minerals, consistent with petrological and geochemical observations. Garnet shows large Mg isotope fractionations (>0.4‰) with ol and opx, reflecting equilibrium fractionation between minerals with different CN of Mg [2]. Finally, Fe isotopic variations in these samples may record later metasomatic processes [3].

[1] Griffin *et al.* (2004) *CG* **208**, 89-118. [2] Huang *et al.* (2013) *EPSL* **367**, 61-70. [3] Polyakov and Mineev (2000) *GCA* **64**, 849-865