Mg isotopes in Roberts Victor xenolithic eclogites: No crustal origin

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Mg experiences detectable isotopic fractionation in different geological conditions, especially low-T environments, which makes Mg isotopes an excellent tracer of geochemical processes and Earth evolution. However, its behaviour in the mantle is still mysterious.

Extensive studies of a suite of mantle eclogites from the Roberts Victor kimberlite, South Africa has documented[1] that Type II (IIA and IIB) eclogites were heavily metasomatized by carbonatitic-kimberlitic melts/fluids to produce the more abundant Type IA and IB eclogites.

The Mg isotopic compositions of the garnet and omphacite were analyzed by solution MC-ICPMS, to reconstruct the whole-rock compositions. The δ^{26}Mg of Type IA and IB eclogites ranges from -0.61 to -0.19‰, and -0.60 to -0.30‰ (mean -0.44±0.12‰) while Type IIA ranges from -1.09 to -0.17‰ (mean -0.69±0.41‰); one Type IIB gives data of -0.37‰. Type I samples thus have more "homogeneous" δ^{26}Mg than Type II, and their mean δ^{26}Mg is lighter than that of the "mantle" value (-0.25±0.07‰), suggesting that the Mg-rich metasomatic melts/fluids modified δ^{26}Mg values of original eclogites and may have lower δ^{26}Mg.

Type II eclogites show a large variation in δ^{26}Mg; the light values are lower than that of seawater (-0.83±0.09‰) or oceanic basalts (-0.25 ± 0.06‰). Type II eclogites thus cannot have been formed by the metamorphism of oceanic basalts even if they interacted heavily with seawater, as it has been documented[2] that Mg isotopes do not fractionate during metamorphism.

[1] Huang J.-X et al. 2012. *Lithos* [2] Wang S-J et al. 2014. *GCA*