Magnesium isotopic compositions of abyssal peridotite

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To constrain further the Mg isotopic composition of the oceanic mantle, investigate Mg isotopic fractionation of abyssal peridotite during serpentinization and weathering, and assess Mg budget in the ocean, a suite of abyssal peridotite samples from the Gakkel Ridge and Southwest Indian Ridge (SWIR) has been selected for high-precision Mg isotopic analyses. Most of the abyssal peridotites in this study have been intensively altered, dominated by serpentinization or weathering. A few relatively fresh samples contain olivine with δ^{26}Mg varying from -0.30 to -0.12 ‰, orthopyroxene with δ^{26}Mg varying from -0.32 to -0.16 ‰, and clinopyroxene with δ^{26}Mg varying from -0.23 to -0.09 ‰. Whole-rock δ^{26}Mg values of thirty abyssal peridotites display wide variations from -0.24 to 0.10 ‰ with an average value of -0.12 ± 0.14 ‰ (2SD, n = 30). In particular, Mg isotopic composition of serpentinization-dominated rocks have lower average δ^{26}Mg values (δ^{26}Mg = -0.19 ± 0.07 ‰, n=7, 2SD) compared with weathering-dominated ones (δ^{26}Mg = -0.10 ± 0.13 ‰, n=23, 2SD). These indicate that the oceanic mantle may have slightly different Mg isotopic compositions at current analytical uncertainty. Post-magmatic serpentinization does not fractionate Mg isotopes of abyssal peridotite whereas low-T weathering and the formation of clay is the main cause for enrichment of heavy Mg isotopes in abyssal peridotite. The significance of this study is that the Mg isotopic composition of a rock has no essential correlation with Mg content and Mg isotopic composition of the reacting melt/fluids, but is strongly dependent on the secondary minerals formed. Release of light Mg isotope into the ocean during alteration of abyssal peridotite should be considered as an important influx of Mg in the seawater Mg budget. Abyssal peridotites with heavy Mg isotopic signature can be recycled into the mantle in subduction zones and thus may be potential source for arc magmas with heavy Mg isotopes.