# Fluid-rock interactions imprinted on lithium isotopes in the Horoman peridotites, Japan

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Lithium has two stable isotopes with large mass difference, and yields large isotope fractionation at low-temperature processes. In addition, lithium is compatible with olivine and could provide us opportunities to detect signals of fluid-rock interaction in mantle lithology; however, even mantle lithology could have hydrothermally altered at sub-seafloor, and subducted into deep mantle. The recycling of subducted materials through the mantle is a crucial process in the Earth's chemical evolution, as shown by geochemical studies on source materials of oceanic island basalts [1], but by what lithium-isotope abundance the 'recycled' mantle lithology is characterized, is unclear so far.

To reveal this issue, preliminary experiments were conducted in a forsterite-water system. As a result, the lithium-isotope fractionation between olivine and aqueous fluid, $\delta^7Li = \delta^7Li_{forsterite} - \delta^7Li_{fluid}$ was estimated to be $-5 \pm 3$ ‰ at 2 GPa and 900 °C, suggesting that 'recycled' mantle lithology, even modified by hydrothermal alteration at sub-seafloor, could be depleted in $^7Li$ than the primitive mantle; this implication was confirmed by lithium isotope analysis of natural samples, the Horoman peridotites in Japan.

The residual peridotites in the Horoman massif preserve chemical signatures of (1) melt extraction followed by sub-seafloor hydrothermal alteration at ~1 Ga, (2) interaction with a geochemically mid-ocean ridge basalt-like melt at ~300 Ma, and (3) a recent (< 50 Ma) slab-derived fluid or melt interaction in subduction zone [2]. Whole-rock and in-situ lithium isotope analysis have successfully traced the recent subduction-zone metasomatism on the peridotites. In addition, the isotope fractionation by the sub-seafloor hydrothermal alteration at ~1 Ga was also detected, even the peridotites have experienced long-term convection in the mantle under high-temperatures.

[1] Hofmann (1997) Nature,385,219-229; Kobayashi et al. (2004) CG,212,143-161; Genske et al. (2014) CG,373,27-36. [2] Yoshikawa et al. (1993) JMPEG,88,121-130; Yoshikawa & Nakamura (2000) JGR, 105,2879-2901; Malaviarachichi et al. (2008) NatureGeo,1,859-863; (2010) JP,51,1417-1445.