Geophysical Research Abstracts
Vol. 14, EGU2012-12273, 2012
EGU General Assembly 2012

Li isotopic constraints from the Erro-Tobbio serpentinites on Alpine subduction processes

M.-F. Chu (1,2), M. Scambelluri (3), W. L. Griffin (1), S. Y. O'Reilly (1), and N. J. Pearson (1)

(1) Australian Research Council Centre of Excellence for Core to Crust Fluid Systems, and GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Sydney, NSW, Australia, (2) Institute of Oceanography, National Taiwan University, Taipei, Taiwan, (3) Dipartimento per lo Studio del Territorio e delle sue Risorse, C.so Europa 26, Genova, Italy

Subduction zones represent a unique feature of the dynamic Earth and provide important constraints on how plate tectonics works. Subduction of serpentinized oceanic lithosphere, characterized by releasing water into the mantle wedge via dehydration, i.e. breakdown of hydrous minerals, plays a critical role in not only the generation of continental crust but also the Earth's water cycle. To track the recycling of water or fluid released by subduction, the stable isotope system of Li, a lithophile and mobile element, shows its high potential because ^{7}Li, relative to ^{6}Li, preferentially moves into the fluid phase when fractionation occurs. Here we present new Li abundance and isotopic compositions of the Erro-Tobbio serpentinized peridotite complex, a remnant mantle slice of the Alpine subduction. Our data indicate that most of the serpentinized ultramafic rocks have uniform Li concentrations, around 1 ppm. These rocks, however, show variable Li isotopic compositions. Among them, the high-pressure antigorite-bearing metaperidotites, formed under a low-strain condition, have a limited range in Li isotopic values, with δ^7Li = +1.5 to +4.0, similar to those of serpentinized peridotites. In contrast, apparently heavier Li isotopes, up to +10.0, are observed in the high-pressure serpentinite mylonites that also contain antigorite but formed in high-strain domains. We note that O-H isotope ratios of the high-pressure ultramafic rocks reported in previous study (Früh-Green et al., 2001, Contrib. Mineral Petrol. 141: 145-159) show insignificant variations between the low- and high-strain domains. This demonstrates the superiority of Li isotope than conventional stable isotope systems in offering critical information about fluid-releasing processes in subduction zones. Moreover, our new data unsupport the general assumption that fluid released from subducted slabs is in favor of extracting ^{7}Li than ^{6}Li, thus capable of forming the much lighter δ^7Li values observed in eclogites or the subducted oceanic crust (e.g. Zack et al., 2003, Earth Planet. Sci. Lett. 208: 279-290). A mechanism aside from dehydration is required to account for the markedly elevated Li isotopic values that we observe from the Alpine subduction zone.