Constraints of lithium isotope on petrogenesis of the Ryukyu arc magmatism

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Li concentration and stable isotope ratio, i.e. $^{7}Li/^{6}Li$ or $\delta^{7}Li$, of the liquid phase both relatively increase during near-surface rock-fluid interactions, and thus they have been supposed to be potential tracers of fluid and/or crustal material in the arc magmatism. However, such application remains obscure since some observations of arc volcanics show inconsistent variation between Li isotopes and fluid indicators, e.g. Pb/Ce. For better understanding the evolution of Li in the subduction zone, the abundance of Li in volcanic rocks of the Ryukyu arc, as a case study, were determined and compiled with data of their major elements, trace elements, and Sr-Nd isotopes. Samples studied are basalt and basaltic andesite (SiO_2 <56 wt.%) located in the volcanic front with Miocene age (21~13Ma and 6~4 Ma) in the central Ryukyu arc, and Quaternary age in the north and south Ryukyu arc. Our preliminary results show Li isotopic ratios of volcanics in the Ryukyu arc are variable ($\delta^{7}Li$: 0 ~ +5), though still within similar range of the MORB, and show a lack of correlation with Li ([Li]: 4.5 ~ 13.0 ppm) and slab-fluid proxies. Li concentration varies with Nd isotopes ($\varepsilon_{Nd}(T)$: -1.5 ~ +4.0) and Li/Y, but other fluid indicators, e.g. Ba/La, regardless of silicate contents of rocks. The correlation between Li concentration and Nd isotopic value demonstrates two prevailing magma components in the Ryukyu arc. The one with relative high Li and low Nd isotopic value shows significantly crustal affinity; the other end member with radiogenic $^{143}Nd/^{144}Nd$ value (+4.0) and the MORB-like Li concentration (~4 ppm) is supposed to represent the mantle underneath the Ryukyu arc. A factor at least in addition to the two-component magma mixing and the fluid contribution, is needed to interprete the Li isotopic feature of the Ryukyu volcanics.

Keywords: lithium, lithium isotope; Ryukyu arc.