Geophysical Research Abstracts
Vol. 21, EGU2019-13857, 2019
EGU General Assembly 2019

Tracing the terrestrial lithium cycle beneath the middle Okinawa Trough

Chia-Yi Lin (1), Mei-Fei Chu (1), and Ryuichi Shinjo (2)

(1) Institute of Oceanography, National Taiwan University, Taipei, Taiwan, (2) Department of Physics and Earth Sciences, University of the Ryukyus, Okinawa, Japan

Subduction is the dominant path of modern earth for recycling crustal materials back to mantle. Lithium, a lithophile trace element in silicate rocks, has high solubility in aqueous fluid, and its stable isotopes, 6Li and 7Li, significantly fractionate during the near-surface fluid-rock interaction. The lithium concentration and isotopic value (d7Li) thus show potential in tracing terrestrial components in the juvenile magma. For better understanding the evolution of lithium during and after subduction, new lithium contents and isotopic data of representative Quaternary basalts (SiO_2 <53 wt.%) from the middle Okinawa Trough, a back-arc basin located behind the Ryukyu arc, were determined in this study. These basalts have been classified into two types based on their well-characterized trace elemental compositions and Nd-Sr isotopes. Type-I basalts have E-MORB-like geochemical features (eNd(0) = +3.9 - +5.8; ISr = 0.703892 – 0.703961). Type-II basalts, in contrast, have lower Nd isotopic ratios (eNd(0) = +1.5 – +3.8) and radiogenic Sr isotopes (0.704044 – 0.704540) as a result of the involvement of subduction component associated with the Central Ryukyu Arc magmatism. Our analytical results show that type-II basalts (n = 4) have higher Li/Yb (1.8 - 2.2) comparing with type-I basalts (Li/Yb = 1.2 – 1.8; n = 8). However, the fluid indicators, e.g. U/Th, B/Th, Sr/Th and Pb/Ce, are lower in type-II basalts, and show no correlation with Li/Yb. The higher values of sediment-melt indicators, e.g. Th/Yb and La/Sm, in type-II basalts than those in type-I basalts thus demonstrate that origin of the elevated Li content derived from the subducted materials was sediments. In contrast with the significant differences in other geochemical data between type-I and type-II basalts, Li isotopic compositions in both types are consistent (d7Li = +2.1 - +2.9). This suggests the subducted sediments carried Li isotopic ratios similar to the previous enriched mantle beneath the middle Okinawa Trough. In summary, subducted sediments play a critical role in the lithium cycle, and this subduction component retained in mantle underneath the Ryukyu arc-trench system after subduction, is characterized by relatively higher Li concentration and mantle-like Li isotopic ratio.