Extremely light K isotopes enriched in subducted low-T altered oceanic crust: Implications for K recycling in the subduction zone

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To investigate the behaviour of potassium (K) isotopes during metamorphic dehydration and to further constrain their implications for K recycling in the subduction zone, we measured K isotopic compositions of whole-rocks from Sumdo eclogites, Tibet. Our data reveal that $\delta^{41}K$ of the eclogite whole rocks (−1.64 to −0.24) display dramatically lower values than observed in fresh MORB (−0.43 ±0.16) and altered MORB (−0.76 to −0.11). In addition, $\delta^{41}K$ values and K_2O contents (also K/Nb ratios) of eclogites show positive correlations, which suggests that the low $\delta^{41}K$ values were most likely caused by dehydration during subduction. Thus isotopically heavy K may be released into the mantle wedge, while the light K is subducted into the deep mantle. Therefore, K isotope systems have the potential to trace subducted crustal materials and to create heterogeneity of mantle compositions.

Mineral separates from Sumdo eclogites are highly heterogeneous in K isotopic compositions. However, phengites generally show heavier K isotopic compositions than the coexisting omphacites and amphiboles, which is consistent with the coordination number of K in phengite (6), omphacite (7-8), and amphibole (8).