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K isotope composition of IODP 376 drilling cores: implications for hydrothermal alteration in submarine arc volcanoes

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Potassium (K) isotopes show prominent fractionations that are correlated to chemical weathering intensity, therefore have great potential to trace chemical weathering. The input of K from the continents to the ocean are partly balanced by hydrothermal and sedimentary exchange of the oceanic crust. Significant K isotope fractionations are required to compensate the offset of averaged global river $\delta^{41}K$ (-0.22 to -0.38‰) and the modern seawater $\delta^{41}K$ (+0.12‰). However, the limited studies of K isotope fractionations during these processes restricted our complete understanding of K isotope cycling in the modern ocean. To explore the K mobilization and isotope fractionation during hydrothermal alteration of the oceanic crust, here we report K isotope compositions of two drilling cores from the submarine volcano Brothers, U1528 and U1530 (IODP 376). The two cores develop magmatically-influenced and seawater-dominated hydrothermal systems, respectively. Compared to the unaltered dacite ($\delta^{41}K$~-0.5‰), samples from U1528 are strongly depleted in K_2O% and have heavier $\delta^{41}K$ up to +0.21‰, while samples of U1530 are enriched in K_2O% and display $\delta^{41}K$ ranging from -0.83 to -0.21‰. The distinctive K mobility patterns and isotope compositions in different hydrothermal systems may be associated with alteration temperature and mineral assemblage.