Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23409

Magnesium isotope variation in the subduction channel

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The study on magnesium isotope variations in the subduction channel and its controls are important to understand the carbonate cycling in subduction zones and the contribution of the slab-derived fluids to arc magma source. Here we presented Mg isotope data for a metabasaltic block from Tianshan ultrahigh pressure metamorphic belt, southwest of China, which is the most representative outcrop for the subducted oceanic lithosphere on the Earth. The metabasaltic block well preserved a pillow-like structure, and each “pillow” can be classified into three parts rimwards, i.e., the omphacite-rich interior, glaucophane-rich veins and the transitional part. All the block is rich in fluid soluble elements (Ba-Rb-Cs) as the result of first-stage rehydration after the eclogization. Compared with the omphacite-rich interior, the glaucophane-rich vein and transitional part with more calcite and epidote, indicating the infiltration of externally-derived Ca-rich fluids at the second stage. Noticeably, abundant dolomite has been found to replace calcite in the transitional part.

The δ^{26}Mg value of the whole metabasaltic block is commonly lower (-0.34 ~ -0.71‰) than oceanic crust (- 0.25±0.06‰), which indicate the decrease of δ^{26}Mg values of the subducted oceanic crust with the eclogitization, possibly resulting from the liberation of fluids rich in heavier Mg isotope. Furthermore, the lighter Mg isotope composition of the transitional part and glaucophane-rich veins may be caused by the reprecipitation of garnet and carbonate from the external fluids, which have the lowest δ^{26}Mg values than other minerals in eclogite. The modelled heavier Mg isotope composition of fluids in the subduction channel is consistent with the heavier Mg isotope composition of arc magmas relative to oceanic basalts. In addition, the recrystallization of dolomite in the subduction channel could suppress the influence of subducted carbonate rich in lighter Mg isotope on Mg isotope signatures of arc magma sources, but transfer more carbonate into the deep mantle.