Magnesium and iron isotopic compositions of subduction-zone fluids

Jian Huang[1], Shun Guo[2], Fang Huang[1]

[1]School of Earth and Space Sciences, University of Science and Technology of China (jianhuang@ustc.edu.cn).

[2]Institute of Geology and Geophysics, Chinese Academy of Sciences.

Subduction-zone metamorphic fluids released by breakdown of hydrous minerals in downgoing slabs can initiate metasomatism and partial melting of the mantle wedge and genesis of island arc lavas. Magnesium and iron isotopic systematics of island arc lavas have been thought to record the addition of fluids derived from the subducting slabs [1, 2]. However, direct constraints on the Mg-Fe isotopic compositions of subduction-zone metamorphic fluids are scarce. High/ultrahigh pressure (HP/UHP) veins within HP/UHP metamorphic rocks are the products of fluid-rock interactions and can be used to trace the compositional evolutions of subduction-zone fluids.

Here, we have determined the Mg-Fe isotopic compositions of internally-derived UHP veins and their hosting eclogites from Ganghe and Hualiangting, Dabieshan (China) to directly constrain the Mg-Fe isotopic compositions of metamorphic fluids. The δ^{26}Mg and δ^{56}Fe of UHP veins range from -0.07 to 0.15‰ and 0.04 to 0.21‰, respectively, higher than those of the hosting eclogites (-0.36 to -0.07‰ and -0.02 to 0.10‰, respectively). In addition, the veins first crystallized from solute-rich vein-forming fluids have heavier Mg-Fe isotopic compositions than those of the late-stage veins. These results suggest that Mg-Fe isotopes fractionate significantly during fluid-rock interactions. Incorporation of slab-derived fluids with heavy Mg-Fe isotopic compositions is likely to elevate the δ^{26}Mg and δ^{56}Fe of the mantle wedge sources of island arc lavas.

[1] Teng et al. (2016, PNAS, 113: 7082-7087); [2] Nebel et al. (2015, EPSL, 432: 142-151).

Finally supported by Natural National Science Foundation of China (NO. 41573018)