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Magnesium Isotopic Behavior during Continental Subduction

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To better understanding the Mg isotopic behavior during metamorphic dehydration process in continental subduction, Mg isotopic compositions of 75 samples including Neoproterozoic bimodal volcanic rocks in the north margin of South China Block (SCB), amphibolites-facies meta-basaltic rocks in Beihuaiyang metamorphic zone (BHY) and eclogites in Dabie-Sulu ultra-high pressure metamorphic (UHPM) zone, East China, were investigated. Neoproterozoic bimodal volcanic rocks are overprinted by greenschist-facies metamorphism, causing highly fluid mobile elements (e.g., Rb, K, Cs) depletion in various degree but insignificant Mg isotope fractionation. Neoproterozoic basaltic rocks (greenschists) have average Mg isotopic composition of -0.196 ± 0.044‰ (2SD), slightly heavier than the mantle value (-0.25 ± 0.07‰). Coupled variations of δ^{26}Mg values against Nb/U ratios and MgO contents indicate crustal contamination during magma generation as the major cause for the δ^{26}Mg elevation of the greenschists. Meta-basaltic rocks in BHY have experienced amphibolites-facies metamorphism during crustal subduction. Rocks with cumulate origin (Group I meta-basaltic rocks) have average Mg isotopic composition of -0.215 ± 0.048‰, slightly heavier than the mantle value, which could be produced by clinopyroxene accumulation. Rocks with arc-like geochemical features (Group II meta-basaltic rocks) have average Mg isotopic composition of -0.291 ± 0.040‰, slightly lighter than mantle value, which could be either caused by crustal contamination of isotopically lighter components (e.g., carbonates) or inherited from the source characteristics. Eclogites in Dabie UHPM zone have Mg isotopic compositions ranging from -0.348 ± 0.041 to -0.137 ± 0.063‰, with an average value of -0.226 ± 0.044‰. The Mg isotopic variations exhibited by the eclogites are independent on the biased sampling or syn-exhumation host-eclogite interaction, and thus reflect the source heterogeneities. Collectively, the similarity of Mg isotopic compositions and variations within errors among the un-subducted greenschists and subducted amphibolites- to eclogite-facies meta-basaltic rocks, together with the lack of correlations between δ^{26}Mg values and MgO contents of the rocks, gives direct evidence that Mg isotope fractionation during metamorphic dehydration in continental subduction, if any, is limited.

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