Mg isotopic composition of submarine vent fluids from arc and back-arc hydrothermal systems in the western Pacific

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The major source of dissolved Mg to the ocean is continental weathering of carbonate and silicate minerals, mostly carried by rivers and groundwaters. Since only almost half of Mg from the river is buried into the sediments, hydrothermal circulation is thought to be clearly an important mechanism for Mg removal from the seawater in that Mg is completely removed during high-temperature seawater-rock interaction. However, its role in global geochemical mass balances is still highly uncertain and no research has been reported about Mg isotopes in hydrothermal solution yet. We analyzed Mg isotopic compositions of hydrothermal water samples collected from 11 sites at five arc and back-arc hydrothermal systems in the western Pacific and investigated Mg isotopic exchange between fluids and rock/sediments during hydrothermal circulation. The results showed that the Mg concentrations ranged from 0.8 mmol/kg to 46.3 mmol/kg and that the Mg isotopic ratios are from -1.18 ‰to -0.80 ‰. Especially, sediment-starved hydrothermal solution showed that the Mg isotopic compositions tend to have lower compositions as the Mg concentrations decrease. On the other hand, sediment-hosted hydrothermal solution (e.g., CLAM site) had Mg isotopic composition of -0.81 ‰and -0.80‰, slightly higher than that of seawater (-0.83 ‰). Particularly, sample which had near zero concentration of Mg (e.g, sediment-starved hydrothermal system: Suiyo Seamount) showed the lightest Mg isotopic compositions (-1.18 ‰) in our data.

Keywords: Mg isotope, hydrothermal vent fluid

