Heterogeneous Mg isotope compositions of volcanic rocks from the Hailar basin, NE China

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Abundant volcanic rocks formed during the late Mesozoic lithosphere extension after the accretion of the Central Asian Orogenic Belt [1] [2], reflecting continental crust growth involving melting of underplated mafic protoliths or juvenile crustal protoliths. However, the source of the Mesozoic Hailar volcanic rocks is still not clear. Magnesium isotopes may be an excellent tracer to identify the source of crustal rocks because the mantle and crustal materials (such as carbonates and clay-rich sediments) have distinct Mg isotope compositions (e.g. 3-5]).

To constrain the sources of volcanic rocks forming during the intra-crust re-working and growth, we analyzed Mg isotopes for a series of volcanic rocks from the Hailar basin, NE China. Samples include three groups: basaltic trachyandesite, trachyte and I-type rhyodacite, and A-type rhyolite. The basaltic trachyandesites exhibit a large δ^{26}Mg variation (-0.291 ± 0.039 to 0.313 ± 0.028‰), correlating positively with the chemical index of alteration (CIA) and negatively with MgO contents. This indicates their Mg isotopes were modified by weathering processes due to losing light Mg isotopes.

The δ^{26}Mg of the trachytes and I-type rhyodacites vary from -0.452 ± 0.044‰ to 0.264 ± 0.046‰, and the δ^{26}Mg of A-type rhyolites vary from -0.432 ± 0.044‰ to 0.056 ± 0.051‰. Both heavier and lighter Mg isotopes than the mantle value were observed in these two groups of samples. Because of the low CIA (49 - 55) and no correlations between δ^{26}Mg and CIA or MgO contents, Mg isotope compositions of both groups were not affected by weathering processes. Instead, the heterogeneous δ^{26}Mg of trachytes, rhyodacites, and rhyolites most likely reflect their source signature. Heavy δ^{26}Mg might inherit from clastic sediment, while the light δ^{26}Mg shows contribution of carbonates to their source.

[1] Graham et al., 2012. Regional Geology and Tectonics: Phanerozoic Rift Systems and Sedimentary Basins, 443-461. [2] Ren et al., 2002. *Tectonophysics* **344**, 175–205. [3] Galy et al., 2002. *EPSL* **201**, 105-115. [4] Teng et al., 2007. *EPSL* **261**, 84-92. [5] Tipper et al., 2006. *EPSL* **247**, 267-279.