Iron isotopic compositions of A-type granites

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High-silica A-type granitic rocks (HSAG, SiO_2 > 71.0 wt.%) have systematically heavier Fe isotopic compositions than basaltic and dioritic-granodioritic rocks, commonly explained as a combined result of differentiation and crustal melting [1]. However, it remains unclear whether thermal and/or chemical diffusion play a key role to produce high δ^{56}Fe of HSAG [2]. Combined Fe-Mg-Li isotope data can help to understand this issue, because Mg and Li isotopes fractionate together with Fe isotopes during diffusion, but do not significantly fractionate during equilibrium magmatic processes.

In order to examine the role of diffusion, we measured a set of highly siliceous A-type granites with SiO_2 > 72.0 wt.% from the Xing'an-Mongolia orogenic belt in NE China with known Li and Mg isotopic data [3, 4]. These A-type granites yield δ^{56}Fe ranging from +0.120‰ to +0.388‰ with an average of +0.269 ± 0.172‰ (2SD, N = 19), isotopically heavier than the high-silica granitic rocks (SiO_2 >71.0 wt.%, $\delta^{56}Fe_{average}$ = 0.218 ± 0.154‰, 2SD, N = 84, [5]). No correlation among δ^{56}Fe, δ^{26}Mg and δ^{7}Li rules out a key role of thermal and chemical diffusion. The varying and high δ^{56}Fe of these HSAG could reflect Fe isotope fractionation during differentiation and crustal melting. Co-variation of δ^{56}Fe with ε_{Nd} and I_{Sr} indicates source heterogeneity also contributed to the observed δ^{56}Fe variation.

[1] Foden *et al.* (2015) *Lithos* **212-215**, 32-44. [2] Zhu *et al.* (2015) *Sci. Rep.* **5**, 17561. [3] Wu *et al.* (2002) *CG* **187**, 143-173. [4] Li *et al.* (2010) *GCA* **74**, 6867-6884. [5] Wu *et al.* (2017) *GCA* **198**, 208-217.