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Gallium isotopes as an effective proxy for continental weathering: insight from the basaltic latosol profile

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Recently, numerous stable isotope systems have been developed and proven to be useful for accessing surface weathering processes, such as K, Os, Sr, Li, Ca, Mg and Si isotopes. As each isotope system has a unique fractionation mechanism and may be impacted by variable environmental factors such as the biological activities and redox processes, multiple isotope systems or new isotope proxy should be developed and employed to better constrain the surface weathering dynamics.

The recently-developed Gallium (Ga) isotope system is a good candidate for tracing surface weathering. Previous studies showed a large variation of δ^{71}Ga up to 2‰ for industrial and geological materials and reported significant fractionation of Ga isotopes during Ga adsorption on minerals such as calcite and goethite, thus providing new insight on the Ga geochemistry. Moreover, Ga exists only in a trivalent state (Ga^{3+}) in nature, and is rarely influenced by the redox process. Meanwhile, Ga is not a biologically essential element for most organisms, indicating less interference of biological input than many other elements (such as Zn, Cu, Fe, etc.). Therefore, Ga isotopes could be potentially used to trace the biogeochemical cycle of Ga (and the monoisotope element Al), and provide additional information for exploring the surface geochemical processes. Using our newly develpoed method, Ga isotopic composition are measured in a latosol profile for investigating and testing its usefulness for tracing continental weathering. Our results show significant fractionation of Ga isotopes (0.20‰), with δ^{71}Ga values decreasing from the bottom to the top, and a preferential leaching out of heavy Ga isotopes. Our data suggest that this fractionation is likely triggered by the dissolution of Ga-bearing minerals, together with Ga adsorption and incorporation into secondary minerals, implying the potential of Ga isotopes in weathering study.

[1] Yuan et al. (2016), *Analytical Chemistry* 88, 9606-9613. [2] Yuan et al. (2018), *Geochimica et Cosmochimica Acta* 223, 350-383.