

Elemental and Isotope Geochemistry of Gallium

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Over the past decades, significant advancements about Ga geochemistry have been achieved based mainly on the analysis of Ga concentration and species. Ga can be used to 1) distinguish the terrigenous from marine environment in paleoclimate research, 2) identify the material source, physicochemical condition, and dynamic processes during core-mantle differentiation of earth in geology, 3) classify iron meteorites in cosmochemistry, 4) make medical device materials and therapeutic drugs in Medicine. For example, Ga has similar chemical characteristics as Al and is frequently used as a geochemical analogue of Al. Meanwhile, the small differences between Ga and Al chemical characteristics have been used to investigate the transport and behaviors of trace elements in the ocean, rivers, and during weathering processes. However, little is known about the global Ga geochemical cycle, thus the application of Ga in geochemistry is worth further exploring.

As one of the last isotope systems to be developed in the periodic table of elements, Ga isotope ratio could be precisely measured only in 2016. Previous studies indicate Ga isotopes could be an effective tracer of sources and biogeochemical processes in nature. One of the most interesting applications of Ga isotopes is as a geochemical analog for Al and an effective weathering proxy, because unlike Al which has only one naturally-occurring stable isotope (²⁷Al), Ga has two stable isotopes (⁶⁹Ga and ⁷¹Ga). Thus, more research is required to better understand the biogeochemical behaviors of Ga and its isotopes during catchment weathering processes, and further explore the potential application of Ga isotope system in other earth science researches such as ocean biogeochemistry and even cosmochemistry.

[1] Yuan et al. (2016) *Analytical Chemistry*, **88**(19), 9606-9613.

[2] Yuan et al. (2018) *Geochimica et Cosmochimica Acta*, **223**, 350-383.