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Potassium isotope geochemistry - *Earl Ingerson Lecture*

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Non-traditional stable isotope geochemistry refers to isotopic studies of elements other than those traditionally analyzed by gas source mass spectrometers (C, H, O, N, and S), including, but not limited to, Li, Mg, K, Ca, Fe, Cu, Zn, and Tl. This field has evolved greatly over the past three decades due to advances in analytical techniques, notably the invention and development of MC-ICP-MS. With these advancements, studies have revealed new processes and mechanisms of stable isotope fractionation, such as significant equilibrium isotope fractionation at high temperatures, diffusion-, evaporation-, and condensation-induced kinetic isotope fractionation, and mass-independent isotope fractionation. These new findings have opened up new opportunities for using non-traditional stable isotope geochemistry to address fundamental questions in Earth and planetary sciences, including the origin of the solar system, planetary differentiation and evolution, interactions between Earth reservoirs, paleoclimate and paleoenvironment reconstruction, environmental change, and the exploration of economically important metal resources.

Potassium isotope geochemistry emerges as a noteworthy development in non-traditional stable isotope geochemistry. As an essential component in rocks, sediments, and oceans, K and its isotopes are heterogeneously distributed on Earth and among terrestrial planetary bodies. This variability reflects the moderate volatility of K during nebular and accretionary processes, as well as its solubility during chemical weathering, incorporation into clays, and fluid mobility during global geochemical cycling. This talk provides an overview of recent developments in K isotope geochemistry, focusing on seminal studies that shaped our understanding of K isotope fractionation and novel applications that provided new insights into Earth and planetary sciences. At the end of the presentation, challenges remaining in studies of K isotope geochemistry are discussed.