Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36795

Potassium isotopic heterogeneity in strongly-peraluminous granites: constraining isotope fractionation during granitic differentiation and evolution

LAUREN TAFLA[1], PENG NI[1], CLAIRE E BUCHOLZ[2] AND EDWARD D. YOUNG[1]

[1]University of California, Los Angeles
[2]California Institute of Technology

Although potassium (K) isotope fractionation appears to drive isotopic heterogeneity during granitic magmatism, the specific mechanisms and the direction of isotope fractionation during differentiation remain unclear. To address this, we present high-precision K isotope data for a suite of granitoids, including members of the same cogenetic crystallization sequence and their K-bearing minerals. We aim to determine whether evolved melts exhibit systematic fractionation patterns and evaluate how the fractionation of K-bearing minerals, specifically micas and feldspars, governs the isotopic evolution of the melt.

Potassium isotopic compositions of whole rocks display measurable variations ($\delta^{41}K$ = –0.54 to 0.17‰). Recent research suggests that granitic magmatism can induce significant K isotope shifts, likely driven by the crystallization and removal of K-bearing phases such as plagioclase, K-feldspar, and mica. We present mineral-specific data to evaluate the precise mechanisms and extent of this control. Furthermore, we explore potential temporal trends in granite evolution, testing the hypothesis that younger granites incorporate greater proportions of sedimentary material. If these younger suites assimilate clay-rich crustal components, they are expected to exhibit lighter K isotopic signatures. Spanning from the Archean to the Phanerozoic eon, we evaluate potential secular variations over geologic time. Fractionation models will be discussed to investigate the role of inter-mineral isotopic exchange to explain the K isotopic variation. Our results provide new insights into the isotopic heterogeneity of granitoids and the chemical evolution of the continental crust.