Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36030

# Lead isotopes in feldspars trace fluid circulation in deforming granitoids

**VERONICA PEVERELLI**[1], DAVID M. CHEW[1], KLAUS MEZGER[2], ALFONS BERGER[3], MARTIN WILLE[3], MAURICE BRODBECK[4], PAUL GUYETT[1] AND MARCO HERWEGH[3]

[1]Trinity College Dublin
[2]University of Bern
[3]Institute of Geological Sciences, University of Bern
[4]University College Dublin

The Pb isotope compositions of crustal fluids are the result of their interaction with different rocks along their pathways. Feldspars, the dominant minerals in the granitic continental crust, typically contain tens of µg/g of Pb but negligible U and Th. Their Pb isotope composition is thus unaffected by radiogenic ingrowth of Pb after their last equilibration with their environment. However, feldspars can readily exchange Pb with fluids during fluid-rock interaction. They thus preserve a record of the Pb isotope compositions of the system at that time, and yield key information on the composition and origin of crustal fluids with which they interacted.

Feldspars from post-Variscan granitoids of the Aar Massif (central Swiss Alps) were selected for analysis. Here, externally derived fluids circulated during Permian–Mesozoic rifting, and the Miocene orogeny. Fluid circulation produced alteration minerals in feldspars, and hydrothermal veins/clefts of Permian and Miocene ages.

The Pb isotope ratios in plagioclase and K-feldspar were analyzed by in-situ laser ablation MC-ICP-MS, avoiding alteration minerals. Due to the isobaric interferences of $^{204}$Hg on $^{204}$Pb, however, only $^{207}$Pb/$^{206}$Pb and $^{208}$Pb/$^{206}$Pb ratios are used for our interpretations. Plagioclase yielded $^{207}$Pb/$^{206}$Pb of 0.835–0.763 and $^{208}$Pb/$^{206}$Pb of 2.064–1.939, while K-feldspar $^{207}$Pb/$^{206}$Pb of 0.8201–0.8024 and $^{208}$Pb/$^{206}$Pb of 2.036–2.012.

Lead isotope ratios in feldspars are more radiogenic than model values at the time of granitoid emplacement (ca. 300 Ma). Feldspar Pb isotope compositions align with those of Permian ($^{207}$Pb/$^{206}$Pb = 0.8326–0.8296; $^{208}$Pb/$^{206}$Pb = 2.064–2.051) and Miocene ($^{207}$Pb/$^{206}$Pb = 0.8118–0.7308; $^{208}$Pb/$^{206}$Pb = 2.021–1.904) fluids, and with the Pb isotope evolution of the host granitoid, calculated using published U and Th concentrations and model values as the granitoid's initial Pb isotope composition. This suggests that small-scale Pb isotope heterogeneities in feldspars reflect fluid-induced redistribution of Pb derived from the granitoids themselves – from U-/Th-rich accessory minerals – rather than the addition of externally sourced Pb, despite multi-stage ingression of externally derived fluids throughout the tectonic evolution of these granitoids. Hence, such heterogeneities do not require mixing of multiple Pb reservoirs but can be produced during hydrothermal alteration of one cogenetic Pb source.