Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37436

Partial isotope reset of Lu-Hf in apatite from the Western Gneiss Region, Norway.

ALEA ZOE KAEHNE[1], JACK GILLESPIE[1], RENÉE TAMBLYN[1] AND JO MOORE[2]

[1]University of Lausanne
[2]Freie Universität Berlin

Apatite incorporates a wide range of geochemical information upon crystallisation, and is suited to dating by a variety of isotope decay systems, including Lu-Hf. It is a common accessory phase in a variety of lithologies, including felsic igneous rocks, which constitute a significant proportion of both modern and Archean continental crust. Therefore, apatite is a valuable tool to better understand the formation and evolution of the continental crust through time. Lu-Hf dating of apatite is especially robust, as it is less sensitive to re-equilibration compared to U-Pb. However, to reliably apply the Lu-Hf system in apatite, it is essential to determine the factors controlling the redistribution of Lu-Hf isotopes in apatite under mid- to lower crustal conditions.

This study focuses on apatite from felsic gneisses of the Western Gneiss Region (WGR), Norway. The basement formed at ~ 1.6 Ga and was subsequently overprinted under Sveconorwegian granulite facies, followed by westward subduction during the late Caledonian. Therefore, the WGR is characterised by increasing pressure and temperature gradients toward the northwest, enabling sampling across a range of pressure-temperature conditions characteristic of the middle to lower crust. By applying in situ Lu-Hf microbeam geochronology to apatite [1] and comparing the results with U-Pb ages, along with trace element data and compositional mapping, we aim to better constrain processes that control Lu-Hf isotope redistribution in apatite.

We find a range of Lu-Hf ages across the WGR, with some samples recording only Caledonian ages, while others preserve Sveconorwegian ages. This distribution is consistent with regional geological age patterns and agrees with titanite U–Pb ages from the same area [2]. Particularly intriguing are samples in which a range of Lu-Hf ages are observed within single thin sections, and even individual apatite grains.

This new dataset furthers our understanding of the mechanisms responsible for Lu and Hf isotope resetting in apatite under mid- to lower crustal conditions. This will enhance the applicability of apatite as a robust tool for investigating the formation and evolution of the continental crust through time.

[1] Simpson et al. (2021), Chemical Geology, 577.
[2] Spencer et al. (2013), Chemical Geology, 341.