

Insights into garnet Lu-Hf and Sm-Nd geochronology using zircon U-Pb

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An understanding of the possible closure temperature difference between Lu-Hf and Sm-Nd garnet geochronology is important to correctly interpret the dates obtained. Whether the dates relate to mineral growth, peak temperatures or cooling is critical to the application of dates to tectonics or metamorphism. Data from 10 samples from the Scottish Northern Highlands record a systematic difference between Lu-Hf and Sm-Nd ages, the latter being 10-20% younger than the former. Garnet cores and rims were dated using Lu-Hf and Sm-Nd and the difference between the cores and rims is very similar for both isotopic systems. Recent work [1] suggests that Lu-Hf ages can be skewed due to faster diffusion of Lu³⁺ relative to Hf⁴⁺. This would lead to pre-garnet growth ages in pelites and post-garnet growth ages in metabasites. As the samples dated are from a variety of lithologies (pelites, amphibolites, eclogites and granulites) and all show the systematic difference in Sm-Nd and Lu-Hf dates it seems likely that this difference is due to the difference in closure temperatures between the two isotopic systems.

To investigate this further, zircons from a pelite have been dated. This sample gave a much larger difference between Lu-Hf and Sm-Nd garnet dates than any other sample analysed within this study. The pelite is part of the basement sequence underlying the Moine Supergroup and is thought to have been to granulite facies so the zircons are metamorphic in appearance. The zircons give the same age as the Lu-Hf garnet date from the same sample with a lower intercept date that corresponds to the Sm-Nd age. This suggests that Lu-Hf garnet ages have a similar closure temperature to zircon U-Pb and that the Sm-Nd age relates to resetting from a lower temperature younger event.

[1] Block and Ganguly (2015) *Contrib Mineral Petrol* **169**:14