Goldschmidt 2023 Abstract
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Garnet chronology: where are we and what's next?

MATTHIJS SMIT

University of British Columbia

Presenting Author: msmit@eoas.ubc.ca

Garnet chronology became a reality in 1980 when the first-ever Sm-Nd garnet ages were published[1]. Following the first Lu-Hf garnet ages – coincidentally out of Lyon[2] – and calibration of the ^{176}Lu decay constant[3,4], the Lu-Hf system soon emerged as a powerful alternative to Sm-Nd with following advantages: generally higher parent/daughter ratios, shorter half-life and lower daughter-element diffusivity[5]. The technique now represents a central means of dating petrological and tectonic processes in cratons, subduction zones and orogenic belts.

Like other radiometric techniques that use isotope dilution, Sm-Nd and Lu-Hf chronology have the advantage of high precision, but the disadvantage of limited spatial resolution. Dating of individual garnet zones with is possible, but only in specific cases[6-8]. Novel in-situ U-Pb[9] and Lu-Hf[10] garnet chronology provides an exciting new addition to the field, with "flipped" advantages and disadvantages: lower precision, but rapid throughput and high spatial resolution.

Garnet chronology is at a very exciting stage of development, with applications diversifying, new techniques emerging, insights into chronometer systematics improving, and the analytical gap between ID and in-situ techniques narrowing. Combined with trace-element mapping, garnet chronology now provides unprecedented insight into how, when and how fast garnet grows in metamorphic and magmatic rocks. So where are we exactly and where are we headed? In this presentation, I will discuss the status-quo anno 2023, and will explore frontier applications of Lu-Hf garnet chronology in dating petrological processes in the crust and cratonic mantle.

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