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New developments in laser ablation Lu-Hf geochronology

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Laser ablation Lu-Hf dating using reaction-cell mass-spectrometry[1] has recently been demonstrated on garnet[2, 3], apatite[4, 5] and calcite[6] and allows to rapidly obtain primary age constraints on the timing of igneous, metamorphic and hydrothermal processes. Here, we present new method developments and applications, including the first ever Lu-Hf dates for (hydrothermal) fluorite, dolomite and epidote (at ~1-2% 2σ uncertainty for Proterozoic samples, <3% 2σ uncertainty for Palaeozoic samples). Our results illustrate great potential of the *in situ* method to rapidly age constrain mineralizing fluid flow events, including remobilization of metals from basement towards strata-bound deposits. In addition, we have systematically investigated the Lu-Hf systematics of apatite, confirming theoretical calculations of a closure temperature of ~660 – 730 °C for volume diffusion in typical apatite grain sizes (~0.01 – 0.03 mm^2). The U-Pb dates are all systematically younger than the Lu-Hf dates, suggesting Lu-Hf dating is a superior method to obtain primary apatite crystallization ages. However, in strongly foliated rocks, the Lu-Hf system dates the timing of apatite recrystallization. Finally, we present long-term multi-session Lu-Hf results for new Lu-rich (up to 1 wt%) garnet reference material candidates, sourced from the Norwegian Tørdal pegmatites. For these garnets, isochron and weighted mean age uncertainties can be as low as 0.3% (2σ), but analysis needs to be conducted in analogue detector mode. We will discuss strategies for P/A corrections when analysing standards and samples in different detector modes within the same analytical session.

References:

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