

**First results from U-Pb-He-Raman  
triple-dating of detrital zircon - *IAG*  
*Early Career Researcher Award*  
*Lecture***

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Resolving the geological history of sedimentary rocks is a complex problem, as they usually contain grains of different provenance and source-rock cooling history, potentially overprinted by later burial and erosion. Extracting meaningful information on the thermal history from sedimentary rocks therefore requires analytical strategies specifically tailored to the geological question.

The development of laser-ablation-based (U-Th)/He (LA-ZHe) dating over the last two decades has the potential to greatly enhance our understanding of the thermal history of sedimentary rocks and individual detrital grains. It enables us to increase the number of dated grains compared to whole-grain dating, making proper analysis of ZHe data in sedimentary rocks possible. The high spatial resolution of laser ablation also unlocks the potential of combining several dating techniques on individual grains.

Paired geo- and thermochronological analyses provide additional benefits: (1) the expected age relationship between geo- and thermochronometers is an internal consistency check; (2) it allows to distinguish between magmatic and exhumational cooling on a grain-by-grain basis; and (3) the cooling history of particular source regions may be traced through the geologic past.

At the Geo-and Thermochronology Lab of the University of Calgary, we have developed a new analytical workflow. It combines zircon U-Pb with LA-ZHe dating and the radiation-damage-based zircon Raman thermochronometer. This triple-dating scheme gives us a crystallization age (U-Pb) and the timing of cooling through  $330 \pm 50$  °C (Raman) and  $180 \pm 20$  °C (ZHe) for each grain. Here we show the first zircon triple-dating results from a Cretaceous sandstone collected on the Mackenzie Plain, representing the foreland basin deposit of the Northern Canadian Cordillera.