Reproducibility and accuracy of fluid inclusion isotope studies using the CRDS technique.

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Fluid inclusions in speleothems archive the drip water from which they form and can therefore give important insights into paleo-hydrological conditions. We set up a precise method for water isotope analysis of fluid inclusions in speleothems (in close similarity to Affolter, et al. 2014 [1]). In addition, we developed a calibration method that uses µl glass capillaries for high-precision water amount determination (on the order of 10^{-8}l) and isotopic control.
On the sub-modern stalagmite STAM 4 from the Romanian Cloşani Cave we analysed 44 stalagmite samples with an average size of 0.5 g and an average water content of 0.94 µl/g. The isotope data of the water released from these samples are consistent with the global meteoric water line and the average hydrogen and oxygen isotope values correspond to modern drip water.
In summary, with this setup oxygen and hydrogen water isotopes in fluid inclusion can be analysed with a precision of $\delta^{18}O$=±0.5‰ / $\delta^{2}H$=±1.5% for small water amounts (< 1 µl) and of $\delta^{18}O$=±0.25‰ / $\delta^{2}H$=±1.0% for > 1 µl. The remarkable reproducibility is comparable with other labs and different measurement techniques as e.g., continuous flow mass spectrometry.

References:

[1] Affolter, Stéphane, D. Fleitmann, and M. Leuenberger. "New-on-line method for water isotope analysis of speleothem fluid inclusions using laser absorption spectroscopy (WS-CRDS)." *Climate of the Past* 10 (2014): 1291-1304.