

Testing the validity of fluid inclusion measurements: reproducibility of a new fluid inclusion analytic line using water standards and calcite samples

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The climatic signal extracted from isotopic and trace element measurements in speleothems are not easy to interpret since it depends of many environmental factors. An additional proxy that could greatly improve our understanding of speleothem climatic interpretations is the isotopic measurements of fluid inclusions trapped in speleothem calcite.

Fluid inclusion measurements have been done over the last 30 years. However, this field greatly improved in the recent couple years with the use of CRDS (Cavity Ring-Down Spectroscopy) systems leading to simultaneous analyses of $\delta^{18}\text{O}$ and δD on the same sample. Another advantage of CRDS is that it is a low-cost alternative to previously used IRMS techniques.

However, analytical errors of those new systems are not fully constrained (i.e. variability derived from a) the quantity of water extracted, b) the design of the line, etc.). Therefore, the field is in need of a more detailed discussion of the replicability of both water standards and speleothem measurements in order better assess the validity of fluid inclusions isotopic measurements as climatological tracers.

This study focused on testing the reproducibility of a new analytical line over a range of sample quantities (from 0.1 to 1 μL) and to determine the optimal number of replicates needed to obtain sample reproducibility better than 0.2‰. This was made possible by an analytical line improvement that permits to analyze more than 15 samples in a working day. Additionally, we looked into the possible effect of the non-homogeneity of the fluid inclusion isotopic values, study possible since we collected homogenous speleothem material contemporary to cave environmental monitoring.