LA-MC-ICP-MS Sr isotope analysis of speleothems – choosing the right reference material

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Speleothems are well established palaeoclimate archives and offer a variety of different geochemical proxies. Besides traditional proxies, such as trace elements and $\delta^{13}C$ and $\delta^{18}O$ values, Sr isotope ratios ($^{87}Sr/^{86}Sr$) can provide valuable information about water residence time and the source of the Sr incorporated in a speleothem [1,2].

Due to the fast nature of laser ablation analysis, the coupling with a MC-ICP-MS instrument allows a large throughput of samples, fast data acquisition as well as a high spatial resolution without the need of chemical purification. However, to obtain reliable results, not only the successful correction of potentially interfering elements (i.e., Rb and REEs), but also the careful monitoring of suitable reference materials is crucial for *in-situ* analyses of Sr isotopes by LA-MC-ICP-MS. Preferentially, a reference material with a similar Sr mass fraction should be chosen to monitor the accuracy of the unknown $^{87}Sr/^{86}Sr$ ratio of the samples.

Speleothems usually consist of calcite and reveal rather small mass fractions of Sr in the range of 500 µg/g and below. However, most of the available carbonate reference materials (e.g.,GSJ JCt-1, JCp-1 and USGS MACS-3) have much higher Sr mass fractions (>1400 µg/g). This shows the need of suitable carbonate reference materials for samples with smaller Sr mass fractions. The recently published NanoSr, a synthethic carbonate nanopowder, is a reference material with a Sr mass fraction of ca. 500 µg/g, which is much closer to those of speleothem samples [3].

Here we present Sr isotope data from various speleothem samples, covering different time spans and climate regimes. Due to the small Sr mass fraction of most samples, we used NanoSr to monitor the accuracy of the speleothem $^{87}Sr/^{86}Sr$ data. These results are compared with data from speleothem samples consisting of aragonite and thus providing a larger Sr mass fraction. This allows the comparison with data obained using reference materials with larger mass fractions.

[1] McDermott (2004) *QSR* **23**, 901-918. [2] Banner *et al.* (1996) *Geology* **22**, 687-690. [3] Weber *et al.* (2019) *GGR*.