



Determination of aragonite trace element partition coefficients from speleothem calcite-aragonite transitions

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Speleothem trace element variability has often been linked to environmental changes. While research has focused on element incorporation into speleothem *calcite*, our current knowledge of trace element variability in speleothem *aragonite* is limited to a few studies only. Here we present, to our knowledge, for the first time quantitative estimates of distribution coefficients for speleothem aragonite (D_{Mg} , D_{Ba} , D_{Sr} , and D_U). These were derived from ten calcite-to-aragonite transitions from seven speleothems from Morocco, Germany, Spain, France and India. Our calculations indicate the following distribution coefficients: $D_{Mg} = 1.01E-04 \pm 9.0E-05$, $D_{Ba(Ar)} = 0.91 \pm 0.53$, $D_{Sr(Ar)} = 1.38 \pm 0.53$, and $D_{U(Ar)} = 6.26 \pm 4.53$. These results are discussed in the context of speleothem growth rates, Rayleigh distillation effects, temperature, drip water elemental composition and drip water pH.

We conclude that speleothem aragonite $D_{Mg(Ar)}$ is below one, $D_{Sr(Ar)}$ is close to unity, and $D_{U(Ar)}$ is above one. For $D_{Ba(Ar)}$, such a conclusion is difficult. Speleothem growth rate may affect aragonite D_{Sr} in samples forming at a growth rate lower than $20 \mu\text{m/a}$. Our results also indicate that calcite D_{Sr} and calcite D_{Ba} are affected by the Mg content of calcite. This has important implications for studies attempting to quantify processes like prior calcite precipitation. In particular, D_{Sr} and D_{Ba} cannot be transferred from caves developed within a limestone host rock to caves developed within a dolostone host rock.