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# Contemporaneously growing speleothems and their value to decipher in-cave processes

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Speleothems have been developed to be valuable climate archives. Albeit much progress has been made to understand speleothem proxies, it remains difficult to differentiate between a direct climate signal and variations, which occurred due to in-cave processes like prior calcite precipitation, $CO_2$ degassing or C exchange between dissolved inorganic C-species and cave air $CO_2$. Here, we analyse palaeoclimate proxies of contemporaneously growing speleothems, which were extracted from the SISALv2 database (Comas-Bru et al., 2020). We argue that differences in their stable O and C isotopic composition as well as in their growth rate can only arise by differences of drip site specific conditions as climate conditions for pairs of contemporaneously growing speleothems are similar. To better understand differences in the isotopic composition and growth rate of contemporaneously growing speleothems, we investigate the in-cave processes by applying a speleothem isotope and growth model. The model is based on a Rayleigh process, which includes $CO_2$ degassing and $CaCO_3$ precipitation, $HCO_3^-$ <—> $H_2O$ buffering as well as $CO_2$ exchange and is able to calculate growth rates. The model accounts for $CaCO_3$ deposition as prior calcite precipitation as well as $CaCO_3$ deposition at the speleothem. We find that C-exchange processes are necessary to explain the linked isotopic and growth rate differences in speleothems.

## References

Comas-Bru, L., Atsawawaranunt, K., Harrison, S., SISAL working group members (2020): SISAL (Speleothem Isotopes Synthesis and AnaLysis Working Group) database version 2.0. University Of Reading.