

# **Controls on trace element incorporation into carbonates grown in cave-analogue conditions in the laboratory**

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An increasing number of studies report temporal trace element variation in speleothems. This variation is controlled by diverse environmental variables such as temperature, drip-water chemistry and prior precipitation. Despite there being many cave-based studies, few of these have attempted to understand these environmental controls quantitatively in the laboratory. Such quantitative data linking cave-carbonate chemistry with environmental controls offers strong potential for palaeoclimate reconstruction.

In this study we have grown carbonates in karst-analogue conditions. Calcite is dissolved in deionized water in a high  $p\text{CO}_2$  atmosphere. Approximately 10 mg of carbonate is then precipitated by dripping the dissolved calcite solution onto a concave surface in a lower  $p\text{CO}_2$  environment. The two stages, dissolution and precipitation, are carried out in separate culture flasks immersed in a water bath to maintain constant temperature. Temperature,  $p\text{CO}_2$  and drip rate are varied systematically in a sequence of experiments to mimic the range of conditions experienced in natural caves.  $p\text{CO}_2$  is controlled by pumping gas mixtures of known  $p\text{CO}_2$  through the flasks and a peristaltic pump is used to control the drip rate within the precipitation flask. Inclusion of Mg, Sr, Ba, Li, Na, P, U, Cd and Co within the initial solution allows us to study the incorporation of these elements within the precipitated carbonate. Characterization of resulting samples for their trace metal and stable isotope ratios will allow quantification of the role of drip-rate,  $p\text{CO}_2$  and temperature in setting the chemistry of cave carbonates and will allow better understanding of palaeoclimate records.