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Farmed calcite $\delta^{18}O$, $\delta^{13}C$, and $\Delta47$ at Ascunsă cave, Romania

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Ascunsă cave (Romania) is the subject of a monitoring program since 2012. While the cave air temperature was very stable around 7°C for most of the time, it experienced in 2019 a 3°C rise, and remained high until the present.

We present here $\delta^{18}O$, $\delta^{13}C$, and clumped isotope results from calcite farmed at two drip points inside the cave (POM X and POM 2). POM X has a slower drip rate than POM 2 and deposits calcite more continuously. Calcite deposition has been shown to depend on cave air CO_2 concentration, which controls the drip water pH and, further, the calcite saturation index.

In 2019, $\delta^{18}O$ values at both sites quickly shifted to lower values as a response to the increase in temperature. At POM X, values were situated between approximately -7.2‰ and -7.6‰ before this transition, whereas in 2019 they shifted to -7.8‰ - -8.0‰. At POM 2, where values were generally lower, they shifted from -7.5‰ to -7.8‰ to -8.0‰.

Clumped isotope temperature estimates mostly agree, within measurement error, with measured cave temperature. This agreement is notable given that strong offsets are commonly observed in mid-latitude caves, reflecting kinetic fractionation effects. However, intervals with deviations from cave temperature are also observed, suggesting variations in isotopic disequilibrium conditions with time.

Here we will discuss these isotope changes in relation to cave air temperature and CO_2 concentration, drip water isotope values and elemental chemistry, as well as in relation to drip rates, in order to improve our understanding of calcite precipitation and isotope effects in caves.