



Monitoring of Bunker Cave (Sauerland, Germany): preliminary results

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As part of the DAPHNE project Bunker Cave, which developed in Devonian limestones of the Rhenish Slate Mountains of NW Germany, is being monitored with respect to cave air and drip water. These data are required to establish climate-proxy relationships in a parallel study of stalagmites from this cave.

During monthly visits of the cave air temperature and pressure, relative humidity and $p\text{CO}_2$ are measured and samples of the cave air are taken for carbon isotope analysis. Water samples collected at different drip sites are analysed in the cave (electric conductivity, pH, alkalinity) and in the laboratory (cations, anions, stable isotopes). Modern calcite precipitates are collected on watchglasses placed beneath drip sites.

Cave monitoring is complemented by regular soil measurements. Soil water is collected in a lysimeter and is analysed according to the same protocol as cave water samples. Rain water is also collected and analysed for its stable isotopic composition.

Preliminary results:

a. The $\delta^{18}\text{O}$ values of the rainwater show the expected trend of high values in summer and low values in winter. The soil water closely follows this trend, while the drip

water $\delta^{18}\text{O}$ signal is shifted by half a year relative to that of meteoric precipitation, i.e., groundwater travel time is on the order of half a year.

b. The $\delta^{13}\text{C}$ values of the drip water are high in winter and low in summer, reflecting high soil pCO_2 values in summer and vice versa.

c. A similar pattern was also seen in the cave air data. $\delta^{13}\text{C}$ values of the cave air are high during the cold season and low during summer, again most likely related to processes in the soil (and epikarst).

d. A seasonal signal is also observed in the stable isotopic composition of the in-situ growth experiments on the watchglasses. These calcite samples show lower $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values in summer than in winter, i.e. consistent with their drip waters.

e. The shape of the calcite crystals appears to be related to the time the watchglasses remain beneath the drip sites, where by the abundance and mass of these crystal presumably depend on the drip rate, and the degree of supersaturation.