

Lecture Abstract:

Cave monitoring - key parameters, methods, sampling and instrumentation

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In this session I will discuss why knowledge of the microphysical environment of the cave interior is a prerequisite for the interpretation of speleothem proxy records and how a monitoring program can be designed and carried out. The precipitation of calcite from groundwater in the cave environment is controlled by a range of local processes that affect the way that surface climate is recorded as chemical proxies in speleothem calcite. The most important controls on the rate of calcite precipitation and the capture of chemical proxies include 1) vegetation and the properties of the soil zone, 2) the hydrological characteristics of the karst aquifer and the pathways that feed drip sources 3) drip water chemistry 4) drip water discharge rates 4) cave wall rock temperature 5) cave air temperature and humidity 6) cave air pCO₂. All of these local properties may vary from place to place within a cave and change on a synoptic, seasonal or inter-annual time scale.

An ideal monitoring program would simultaneously measure surface meteorology, soil properties (temperature, soil water chemistry, soil pCO₂), and the properties of the cave interior at speleothem sampling sites and selected locations that provide a picture of how the cave system behaves as a whole. The monitoring strategy may be in the form of regular visits for measurements and taking of spot samples for analysis, or by deploying monitoring instruments that record continuously over long periods and/or automatically collect samples.

The lecture will discuss the technology and strategies for monitoring temperature, humidity, pCO₂ in soil and cave air, assessing ventilation and air movement, measurement of drip water discharge rates, on-site measurements of water chemistry and options for automatic sampling.

Suggested reading

Fairchild, I. J. and A. Baker (2012). "Speleothem Science. From Process to Past Environment." Wiley-Blackwell: 450pp. (Chapter 4)

Matthey, D. P., et al. (2010). "Seasonal microclimate control of calcite fabrics, stable isotopes and trace elements in modern speleothem from St. Michaels Cave, Gibraltar." In: Tufas and Speleothems: Unravelling the Microbial and Physical Controls, edited by M. Rogerson. Geological Society of London Special Volume 336: 323-344.

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