Seasonal meteoric and calcite precipitation recorded in two active stalagmites and cave monitoring data from Katerloch, Austria

M. SAKOPARNIG[1,2*], R. BOCH[1], X. WANG[3], K. LIN[3], C. SPÖTL[4], A. LEIS[5], F. MITTERMAYR[2] & M. DIETZEL[1]

[1] Inst. of Applied Geosciences, Graz Univ. of Technology, Austria (*correspondence: m.sakoparnig@tugraz.at)
[2] IMBT - TVFA, Graz Univ. of Technology, Austria
[3] EOS, Nanyang Technological University, Singapore
[4] Inst. of Geology, University of Innsbruck, Austria
[5] JR-AquaConSol GmbH, Graz, Austria

In the course of a multi-annual and partially automated cave monitoring program we study active sites of carbonate deposition in Katerloch Cave (Austria, SE-rim of the Alps). This includes the collection of two active stalagmites (K8, K10), short stalagmite top drill cores, fresh precipitates on glass substrates (8 yrs growth), data logging of drip rates and air temperatures, as well as the chemical- and isotopic compositions of drip waters. Multiple ^{238}U-^{234}U-^{230}Th ages of stalagmite K10 (71 cm long) revealed several growth intervals starting from 129.1 ±1.2 kyr BP up to now. These are separated by distinct growth interruptions, e.g. around termination of the African Humid Period. The active stalagmite K8 (40 cm) archived a relatively short time interval of the last ca. 1500 yrs. Stable isotope transects micromilled at 0.25 mm resolution from the uppermost 20 cm of K10 (mid- and late Holocene) show $\delta^{13}C$ values from -9.3 to -4.6 ‰ and $\delta^{18}O$ from -8.0 to -5.1 ‰ (VPDB) and K8 (0.1/1 mm res.) revealed values from -11.0 to -3.8 ‰ and -7.4 to -4.5 ‰ for $\delta^{13}C$ and $\delta^{18}O$, respectively. These values are significantly different compared to isotopic compositions of Katerloch stalagmites from older time intervals. The modern stalagmites, however, show a seasonal lamination typical of all investigated Katerloch stalagmites (translucent/dense vs. white/porous), although more regular patterns (K8) are distinguished from samples showing more pronounced inter-annual variability (K10). Calcite $\delta^{18}O$ and $\delta^{13}C$ are variably related to these patterns. Monitored drip rates also allow of some distinction between two different groups depending on modern meteoric precipitation vs. drip response, base flow and snowmelt effect (e.g. drips of K8 vs. K10). Drip water $\delta^{2}H/\delta^{18}O$ values support a major influence of Mediterranean moisture sources to regional precipitation next to dominant Atlantic advection. Moreover, a significant decrease in $\delta^{18}O$ was recorded both in the collected drip waters and associated modern calcite precipitates on artificial substrates during our multi-annual cave monitoring.