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Early Holocene climate events recorded in fast growing stalagmites from the SE-fringe of the Alps (Austria)

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Katerloch Cave, one of Austria's most impressive dripstone caves, formed in Devonian limestones of the Styrian Karst Province at the SE-fringe of the Alps (900 m a.s.l.). The rich speleothem decoration mainly comprises several meter high candlestick stalagmites, a morphology suggesting fast and relatively constant growth. The stalagmite forming drip waters originate from a small, well defined infiltration area. Most of the speleothems in Katerloch Cave are inactive today.

Six inactive stalagmites were studied from this cave. Petrographical investigations corroborate high growth rates and reveal a variable lamination consisting of white, porous calcite layers and typically thinner, dense, translucent calcite layers. Stalagmites K1 and K3, 73 and 139 cm in length, respectively, formed during the early Holocene. U-Th analyses along the central stalagmite growth axes allowed constraining precise age models for both stalagmites. Furthermore, the dating results support high mean growth rates of 0.2 to 0.7 mm/yr.

Calcite samples for stable isotope analysis were taken at 1 mm spatial resolution, which corresponds to a temporal resolution of 1-2 yr and 5 yr for stalagmites K3 and K1, respectively. The oxygen isotopic composition of both stalagmites displays pronounced negative shifts of about one per mil at ca. 8.2 and at 9.1 kyr, as well as around 10 kyr BP. These Katerloch stalagmites therefore constitute one of the first detailed records of the 8.2 kyr event in the eastern Alps. The duration of this event at Katerloch Cave was 90 to 100 yr, which is consistent with recent data from annually resolved ice-core data from Greenland (Thomas et al., QSR 2007). Possible explanations for the observed negative isotopic shifts include a response to lower air temperatures,

changes in atmospheric circulation (trajectories of the moisture; Atlantic vs. Mediterranean influence) as well as changes in seasonality (higher contribution of isotopically light winter precipitation to the cave drip waters).

Reference

- Thomas, E.R., Wolff, E.W., Mulvaney, R., Steffensen, J.P., Johnsen, S.J., Arrowsmith, C., White, J.W.C., Vaughn, B., Popp, T., 2007. *The 8.2 ka event from Greenland ice cores*. Quaternary Science Reviews, 26, 70-81.