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A Younger Dryas temperature reconstruction from alpine speleothems

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Speleothems from the Bärenhöhle cave system, Austria, provide a replicated, high-resolution record of the Younger Dryas paleoclimate. Stable isotopes measured at bi-annual resolution reveal a marked negative excursion of nearly 2‰ in d18Ocalcite between 12.9±0.1 and 11.7±0.1 ka b2k, comparable in timing and structure to the Greenland Stadial 1. The high degree of similarity with benthic ostracod isotope records from perialpine lake sediments implies that the Bärenhöhle speleothem data largely record the d18O value of meteoric precipitation, which scales with the mean annual air temperature (MAAT). Based on detailed cave monitoring data we quantify the Younger Dryas MAAT at Bärenhöhle to 2.5 ± 1.6 °C, some 5.5°C lower than the modern cave air temperature.

Whilst carbonate isotope analyses provide an integrated signal of the hydrological year, petrographic studies demonstrate that fluid inclusions are chiefly restricted to the summer laminae. Much in contrast to the carbonate isotope signal, d2H of fluid inclusions shows a rapid recovery to initial values at 12.3 ka pointing to a strong change in seasonality with increased continentality during the second part of the Younger Dryas. Here, we discuss the uncertainties and error propagation involved in the seasonal temperature reconstruction. Our results are compared to other reconstructions from the greater Alpine region and discussed with respect to paleoclimatological implications.