High-precision dating of MIS 7 using Austrian Alp stalagmites

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We present a high-precision record of the Penultimate Interglacial (MIS 7) and the Penultimate Glacial inception (MIS 7–6 transition) from Spannagel Cave in the central European Alps (southern Austria). Drip waters in this high-elevation cave are largely sourced from the overlying low-permeability gneiss, giving rise to unusually high uranium concentrations in secondary calcite deposits (up to 200 ppm). The large quantities of $^{234}\text{U}$ and $^{230}\text{Th}$ incorporated in samples can be measured using high-precision spectrometry, resulting in relative age uncertainties as low as 1‰ (2σ) during our study period (~250 to 197 thousand years ago [ka]). Using this unprecedented age control, we revisit Spannagel stalagmite SPA121 that grew continuously throughout MIS 7 and the MIS 7–6 transition. Previous work by Spötl et al. (EPSL 2008) revealed that SPA 121 $\delta^{18}\text{O}$ displays similar timing and structure to global benthic marine $\delta^{18}\text{O}$ during MIS 7, including distinct sub-stages. New dating allows us to constrain the exact timing and duration of MIS 7 sub-stages in the European Alps, including the timing of Terminations (T) III and IIIa. Preliminary results show the onset of MIS 7e at 241.4 ± 0.3 ka, the $\delta^{18}\text{O}$ minima during MIS 7b at 224.5 ± 0.3 ka, and the mid point of TIIIa at ~216.2 ± 0.3 ka. The onset of decreasing $\delta^{18}\text{O}$ associated with the MIS 7a–6e transition occurred no later than 193.0 ± 0.2 ka. Two newly collected stalagmites from this cave (SPA146 & 183) provide two high-resolution replications of the MIS 7a–6e transition. The resulting multi-stalagmite record will provide important chronological constraints on climate shifts in the European Alps during the Penultimate Interglacial and subsequent glacial inception.