



Vegetation productivity during Termination III inferred from a speleothem $\delta^{13}\text{C}$ record (Ejulve Cave, NE Spain)

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The timing of Termination III, in contrast to TI and TII, is poorly known. Although TIII has been described in pollen sequences from marine cores whose chronology was tuned to orbital parameters, only few continental records with absolute dates have been published. Then, new records of this period are particularly required to test the hypothetical synchronicity at planetary scale of this event or to explore leads and lags between different proxies. Here we present the record of ARTEMISA stalagmite from Ejulve cave (NE Spain) that covers this period with exceptional resolution and constrained by a robust chronological framework obtained from 24 U-Th dates. The largest shift in $\delta^{13}\text{C}$ record (3 per mil of variation) occurs at 241 ± 2.3 kyr evidencing the TIII inception, in agreement with both Sanbao Cave record in China (within age uncertainties) and the shift to interglacial values of CH_4 and CO_2 in Antarctica, thus supporting its global synchrony.

Interpreting $\delta^{13}\text{C}$ data in Ejulve Cave is supported by 3 years of monitoring tasks allowing the association of this proxy with vegetation productivity. Thus, more positive values of $\delta^{13}\text{C}$, together with higher values in Mg/Ca and Sr/Ca in present-day farmed calcite occurred during dry summer seasons. Besides, these periods are also characterized by the lowest amount of calcite precipitating in the cave. On the contrary, more negative values are obtained during wetter periods, even if they are cooler, showing the highest calcite precipitation rates. During TIII, a spectacular increase in growth rate in the stalagmite is observed, that reaches its maximum (20-30 mm/kyr) during the following 4 kyr. Coherently, both $\delta^{13}\text{C}$ and trace elements ratios (Mg/Ca and Sr/Ca) mark an increase in humidity at 242 kyr that would last until 227 kyr BP delineating the duration of Stage 7e in this Mediterranean region. Other dry events highlighted by this record are shown at 247 kyr, 245-243 kyr and 221-219 kyr BP suggesting periods of forest reduction.

Ejulve speleothem represents the first time that TIII is described through $\delta^{13}\text{C}$ variation enriching the discussion about the timing and duration of humidity phases during that glacial-interglacial transition. Besides, Ejulve record, in coherence with other records such as Sanbao Cave, marks the existence of a dry event before TIII, following a YD-III and BA-III pattern, thus supporting the previously evidenced similarities between TI and TIII.