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High resolution climate isotopic record of the Last Interglacial provided by a stalagmite in cave entrance from southwest France

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The Last Interglacial is still relatively poorly documented because of archive preservation problems. Its duration and timing depending on regions are still debated, as well as its internal evolution. Comparison between different archives from this period is often tricky because of the lack of reliable chronologies. High-resolution paleoenvironmental data associated with an independent chronology based on accurate and reliable dating are a priority in order to better understand the pattern and the cause of the Last Interglacial climate.

We studied a stalagmite from southwest France (La Chaise de Vouthon, Charente), located in a cave entrance and inserted in the archaeological filling, where Neanderthal remains have been discovered. Despite its location in the cave entrance, where hygrometry and temperature fluctuate, we show that the isotopic record can be interpreted in terms of environmental variations.

TIMS $^{230}Th/^{234}U$ dating constrained the growth period between 127,1 $\pm$ 3,1 ky to 116,7 $\pm$ 2,8 ky but the top being eroded, growth should have stopped around 115,5 $\pm$ 3 ky. That means growth took place during the MIS 5e and stopped near MIS 5e-5d limit.

This last interglacial record shows an early climate optimum, soon after speleothem

growth initiation, between 126,5 $\pm$ 3 ky and 123,5 $\pm$ 3 ky. This optimum is preceded by a short and abrupt cold event, maybe associated to Heinrich 11 event. After the climate optimum, a short degradation follows, for $\sim$ 2 ky, before a new mild and humid period, until 119,5 $\pm$ 3 ky. We remark that the δ^{13}C optima are delayed compared to the δ^{18}O ones. This delay is larger for the first optimum ($\sim$ 2 ky), succeeding to a long and cold period at the end of stage 6.

The morphology of the isotope signal is very similar to the one of EPICA (Antarctic), due to the presence of two period of climate optimum during the Last Interglacial. The cause of this similarity is still questionable. Correlations also exist with proxy records of the Atlantic core MD99-2542. During the climate optimum recorded by calcite isotopes, temperate vegetation on Iberian peninsula increases (as it is recorded by pollens in this core) and planktic δ^{18}O decreases, and conversely during climate degradation (within age errors). Finally, we note that the δ^{18}O isotopic response to climate constraints varies in the same way as other isotopic speleothem records at the same period (Soreq and Peqiin (Israel); Dongge (China)): it decreases during climate warming and increases during deteriorations.

As a conclusion, the isotope record of this stalagmite constitutes a terrestrial paleoclimatic archive with temporal resolution 6 to 10 times better ($i.e.$ $\sim$ 90 yr) than those of marine archives with the best resolution for this period and in this region ($i.e.$ $\sim$ 550 to 900 yr).

This demonstrates that some speleothems developed in cave entrances can be exploited for paleoclimatological interests. In addition, when they are inserted in archeological filling, they can provide complementary information to paleoenvironmental data obtained by classical analyses ($i.e.$ palynology, paleontology, geology, etc.), allowing better knowledge of the natural context of prehistoric populations.