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The last glacial inception in continental northwestern Europe: characterization and timing of the Late Eemian Aridity Pulse (LEAP) recorded in multiple Belgian speleothems.

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Interglacial-glacial transitions represent important turnovers in the climate system. In contrast with glacial terminations, they are described as a more gradual cooling. So far, the last interglacial has yielded a wealth of knowledge regarding climate dynamics during past warm periods. On top of the assumed gradual temperature drop starting at ~119 ka, evidence for the presence of a drastic drying/cooling event in northern Europe has been observed.

In lake records from Germany, a distinct shift in pollen assembly at 117.5 ka is interpreted as the consequence of a short dry event lasting ~470 years, defined as the Late Eemian Aridity Pulse (LEAP, Sirocko et al., 2005). In a Belgian stalagmite from Han-sur-Lesse Cave, the LEAP is characterized by a 5‰ increase in δ13C occurring in just 200 years. The δ13C enrichment is dated at 117.5 ka and associated with a vegetation change above the cave, induced by a drying and/or cooling event (Vansteenberge et al., 2016). Also, within North Atlantic sediment cores, an increase in ice rafted debris was linked to the occurrence of a colder period at ~117 ka (Irvali et al., 2016). Its coevality with the LEAP indicates a likely more regional extent than previously thought. Up to now, no independent chronology exists and little is known about the continental climatic expression of the LEAP.

This study aims at 1) constructing an improved and independent chronology for the LEAP event, 2) characterizing this event in terms of its climatic expression and 3) placing the LEAP within the context of an interglacial-glacial transition. For this, two additional speleothems (Han-8, RSM-17) from two different Belgian caves (Han-sur-Lesse, Remouchamps) are added to the existing Han-9 dataset. Exceptionally high growth rates (0.5 mm yr-1) and a presumed annual layering of the RSM-17 sample enable an annual to decadal resolution to investigate the LEAP. U-Th age models covering the glacial inception are constructed with ~25 dates on the three speleothems. All samples are investigated through a multiproxy approach consisting of growth rate, stable isotopes (δ13C and δ18O) and trace elements (Mg, Sr, Ba, Zn, Pb, U). Furthermore, μCT scans with a resolution down to 10μm characterize pronounced changes in speleothem morphology.

First results show the presence of similar δ13C excursions in the two newly analyzed speleothems. The plenitude of U-Th dates now confirms the timing of the LEAP at 117.5 ka, as determined from Han-9 but significantly reduce the age error to 0.4 ka. Also, the various proxies demonstrate that pre-LEAP climate conditions were not reestablished after the event, indicating that, at least in Belgium, the LEAP may have had a more severe impact than previously thought. This study shows that events such as the LEAP are an important feature within the gradual cooling occurring during glacial inceptions, and they contribute to a better understanding of the dynamics of an interglacial-glacial transition.

References:

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