EGU24-8463, updated on 15 Mar 2024
https://doi.org/10.5194/egusphere-egu24-8463
EGU General Assembly 2024

A new insight of the MIS 3 Dansgaard-Oeschger climate oscillations in western Europe from the study of a Belgium isotopically equilibrated speleothem

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The Marine Isotope Stage (MIS) 3 records abrupt transitions from cold stadial to temperate interstadial climate conditions, termed Dansgaard-Oeschger (DO) events. Reconstructing these rapid climate changes is crucial for documenting the prevailing climatic conditions in Europe. However, only few continental records are available to define the continental climatic responses to DO changes. Here, the elemental and stable isotope compositions of a flowstone speleothem in Belgium covering the MIS 3 are documented. This speleothem precipitated under equilibrium conditions based on Δ_{48} thermometry, allowing the use of Δ_{47} thermometry with confidence. The acquired unique thermometry paleoclimatic dataset enables the reconstruction of temperature based on the hydrological information (oxygen-18 of drip water; δ^{18}Ow) and sheds new light on the DO climate variations. A temperature differential of ~7°C is associated with alternating temperate warm and wet Interstadials to cold and dry stadials. The DO-12 is the most pronounced MIS 3 interstadial in the record and appears to be marked by a delay of 1000 years between climate enhancement (warmer temperature) and water availability (moisture increase). By combining our speleothem record with other continental and marine archive, the spatial variability of DO changes in western Europe during the MIS 3 is defined. A gradual climate deterioration with colder and drier conditions, associated with the Heinrich 4 event, progressed southwards through Europe. Interestngly, this spatial climatic degradation occured during the last phase of Neanderthal populations occupation in Europe. Our data provides better understanding on proxy interpretation thanks to our clumped isotope measurement but also on environmental constraints

for human mobility models.