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Northern Spain temperature constrained by fluid inclusion water isotopes in speleothems during the abrupt oscillations of the last deglaciation period

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The last deglaciation (from ≈19 kyr BP to the onset of the Holocene) is a time interval characterized by major and abrupt climate changes mostly caused by the Atlantic Meridional Overturning Circulation (AMOC) which is responsible for redistributing heat on a planetary scale, including the Iberian Peninsula. This study is focused in the Western Pyrenees, northern Spain, a southern European region key to understand Northern Hemisphere climate teleconnections associated to several warming and cooling events that took place abruptly. It is especially important to know when precisely these events occurred and what their amplitude was to better understand their causes and impacts on the regional environment.

The climatic events mentioned above are recorded in lake and marine sediments in the central and southern Europe denoting the importance of these records in the transitional zone between the Atlantic and the Mediterranean climatic realms. The glacial-interglacial transition was also identified in isotopic values of speleothems at this latitude, where differences and similarities with the patterns identified in the Greenland record during the last deglaciation are analysed. Even so, there is still no continental record of temperature reconstruction during part of the last deglaciation in the Iberian Peninsula that can be compared with the latest record of fluid inclusions in speleothems in central Europe (Affolter et al., 2019).

In this new study, three stalagmites from Ostolo Cave in the Western Pyrenees were analysed to identify and characterize the timing of the climate variability along the abrupt changes that punctuated the last deglaciation and subsequently generate a reconstruction of the past

temperature with the help of fluid inclusion water isotopes. The samples were dated at high precision and cover almost continuously the same period (16.5-10 kyr BP) with a high degree of replication. The speleothem $\delta^{18}O$ and fluid inclusion water isotopes (δD) records follow closely the well-known changes from high latitudes showing more negative values during GS-1 and H1, related to colder climates, while more positive values were reached during GI-1 and the Early Holocene, pointing towards warmer temperatures. Our Ostolo Cave fluid inclusion temperature record resembles Greenland and Mediterranean sea surface temperature trends and allows for the first time and from a continental record, a continuous reconstruction of temperature throughout the last deglaciation in southern Europe.