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Late Holocene climate and environmental change from Asiul cave speleothems: interpretations in light of modern cave monitoring.

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Northern Iberia offers an excellent location to study fluctuations in North Atlantic Ocean (NA) conditions and the impact that changes in the NA have on atmospheric systems, which dominate Europe's climate. Two speleothems from Cueva de Asiul (Matienzo, N. Spain) have been used to reconstruct rainfall variability in N. Spain throughout the Holocene (Smith et al., 2016a). The carbonate δ18O records from these speleothems are interpreted in the light of a rigorous modern cave monitoring program undertaken at Cueva de Asiul (Smith et al., 2016b). Drip water δ18O reflects a modern rainfall amount effect whilst δ13C appears influenced by Prior Calcite Precipitation (PCP) in the short term and changes in vegetation at long timescales. The speleothem δ18O shows that long duration ($\sim$1500 year) cycles in wetting and drying are prevalent in N. Spain during the Holocene and that dry climate phases are related to the timing of cold events (Bond et al., 2001) in the NA. Here we look in more detail at one of these speleothems, assessing both δ18O and δ13C during the last two thousand years. We show that Cueva de Asiul speleothems not only preserve long duration climate cycles in δ18O, but that they also appear influenced by shorter duration changes in the North Atlantic Oscillation (NAO), in-sync with other NAO archives (Olsen et al., 2012). However, the Cueva de Asiul record does not appear to preserve a predominately positive NAO signal during the Medieval Climate Anomaly (MCA) as is common within many European archives (Trouet et al., 2009), possibly due to the sites' close proximity to the NA and localised oceanic weather systems (Moreno et al., 2012). Alongside climatic changes, the speleothem δ13C shows a clear transition toward higher isotope values around 360 years BP (BP=1950), signalling a major environmental change in the region possibly due to anthropogenic removal of vast swathes of natural forest to support ship building and industry related to the Spanish Armada.

Bond et al., (2001), Science 294, 2130–2136. Moreno et al., (2012), Quat. Sci. Rev. 43, 16–32. Olsen et al., (2012), Nat. Geosci. 5, 1–14. Smith et al., (2016a), Sci. Reports.6:24745. Smith et al., (2016b) Int. J. Speleol. 45, 1–9. Trouet et al., (2009), Science 324, 78–80.