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Using the δ^{18}O values of rodent teeth to generate new millennial-scale climate records for archaeological cave sites

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Caves commonly contain important archives of mammalian and archaeological remains that can provide crucial information about faunal and human responses to past environmental changes. However, the value of these archives is often limited by a lack of independent, quantitative climate records with which fossil assemblages can be directly compared. Small mammal remains are frequently abundant within caves, and isotopic analyses of these remains can potentially fill in the gaps in our current climate records for these sites. Nevertheless, research in this area has thus far been limited

Westbury Cave in Somerset, UK, contains a well-stratified sedimentary sequence with highly abundant small mammal remains. The upper deposits date to the Middle Pleistocene, and have been assigned to a late Cromerian Complex interglacial (likely Interglacial IV) (Stringer et al., 1996; Schreve et al., 1999), now widely correlated with MIS 13 (Candy et al., 2015). This interglacial is the first stage for which we have widespread evidence for the presence of early humans in the UK (Candy et al., 2015), underlining the importance of this time period for understanding hominin responses to environmental change. Stratigraphic variations in the small mammal assemblages from Westbury suggest that millennial-scale climatic fluctuations may have occurred during this interglacial (Andrews, 1990; Stringer et al., 1996). However, this evidence has yet to be corroborated by quantitative climate reconstructions for the site

Here, we present preliminary isotope results for vole teeth from Westbury Cave. A modern analogue study was first undertaken to demonstrate that the δ^{18}O compositions of vole teeth correlate with the δ^{18}O of meteoric water and climate. This modern relationship was then applied to the Westbury isotope data to generate a millennial-scale climate record for the site. The initial results indicate that fluctuations in tooth δ^{18}O values generally coincide with variations in the small mammal assemblages. This may signify that short-term climatic changes occurred during the accumulation of the Westbury sequence. Isotopic analyses of rodent teeth may therefore provide useful climate records for other cave sequences, and especially for sites that contain important archaeological evidence.

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