



## **The role of environmental change in the expansion of early modern humans in the Levant – what we can learn from mollusc shells**

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Humans respond to changes in their local environment on daily to seasonal timescales. Therefore, a robust assessment of the impact of environmental change on human behaviour requires an understanding of local environmental change at seasonal to sub-seasonal resolution. Stable isotope records from mollusc shells provide one of the few sub-seasonally resolved palaeoenvironmental proxies in the Mediterranean. Obtaining these records from molluscs that were consumed by people enables the reconstruction of a more detailed picture of how humans responded to changing climatic regimes in the past and ensures that the resulting palaeoenvironmental records are directly linked with human activity. Here we present sub-monthly resolved environmental reconstructions from stable isotope analyses of mollusc shells from the Upper Palaeolithic assemblages of the archaeological sites of Ksār Akil in Lebanon and Manot Cave in Israel. These highly resolved environmental records, coupled with well-dated archaeological sequences provide a framework for assessing the complex interplay between early modern humans and their local environments. We found evidence for fluctuating temperature, rainfall and seasonality regimes throughout marine isotope stages (MIS) 4 to 2, some of which appear to be linked to northern hemisphere millennial-scale climate oscillations. The archaeological records show human occupation of these sites occurred during both warmer and cooler phases and during both high and low seasonality regimes, indicating that modern human populations were somewhat resilient to the resource uncertainty that would have accompanied these changing temperature and seasonality regimes. These paired cultural-environmental records have enabled an examination of hominin-environment interactions during critical periods of the late Pleistocene in a region with comparatively few high-resolution climate records.