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Millennial Scale Cycles from Speleothems of the Gibraltar Caves

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The Rock of Gibraltar contains many solution caves which initially formed near sea level and now span elevations to over 300m as a result of slow uplift over time. In the modern climate, Gibraltar holds an important position near the southern limit of the tracks taken by the depressions that deliver rainfall to Europe from the North Atlantic sector of the atmosphere. Monitoring in St. Michaels and Ragged Staff caves has been carried out since 2004 by monthly sampling and deployment of logging instruments which reveals that speleothem growth is most strongly influenced by seasonally reversing cave ventilation that permeates the entire rock. The results provide unprecedented insight into how cave environments respond to seasonal change, variations in sea level and neotectonic uplift and the ways that regional climate is recorded as chemical proxies in an evolving cave environment.

We present an overview of the results of this proxy record of precipitation, sea level and environmental change, including new analysis within this 500ka record. A general mean isotopic composition of 1ka time slices have been stacked into a preliminary record from over twenty speleothems. Within this we look at higher resolution time slices to examine the occurrence of millennial scale cycles which occur within the Gibraltar record. During glacial maxima, the Gibraltar record shows elevated δ18O and associated higher δ13C caused by greater degassing or lower soil pCO_2 from weakened vegetative activity during cool arid glacials. Highly resolved millennial scale warming events which seem to match the Greenland ice core record give insights into SST changes and atmospheric reorganization at Gibraltar.