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$^{17}O_{excess}$ in Soreq Cave Speleothems

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Speleothems $d^{18}O$ is a common tool that provides information about regional paleoclimate. However, $d^{18}O$ depends on both the temperature and the water isotopic composition, making it difficult to partition these parameters. Even when temperature is constrained by clumped isotopes, $d^{18}O$ of cave water reflects a complex combination of hydrological several processes. The new proxy $^{17}O_{excess}$ can provide additional paleo hydrological information. $^{17}O_{excess}$ is defined as the deviation of $d^{17}O$ from a generally accepted ^{17}O-^{18}O mass dependent reference line. In carbonates, it records mostly the $^{17}O_{excess}$ of the parent water. In the case of rainfall, $^{17}O_{excess}$ varies with normalized relative humidity in the region of moisture formation, with lower relative humidity corresponding to higher $^{17}O_{excess}$ in the rainfall. As such, $^{17}O_{excess}$ is analogous to rainfall d-excess.

Here, we measure $^{17}O_{excess}$ in ancient speleothems from Soreq Cave (Israel). The Soreq Cave speleothem record provides continuous information about the climate in the last 250 ky, through the measurements of $d^{18}O$ and Δ_{47} that together reconstruct temperature and rainfall $d^{18}O$. $^{17}O_{excess}$ values of paleo rainwater were reconstructed from $^{17}O_{excess}$ in Soreq Cave speleothems, at an age range of 0-160 ka, using samples that were mostly previously measured for clumped isotopes. Using the expected $^{17}O_{excess}$ values for a range of the modern trajectories of Mediterranean cyclones, we estimate possible storm trajectories and relative humidity in the past. Most samples fall within the range of the modern trajectories, with a tendency to more Westerly track, with higher relative humidity, during the last Glacial. $^{17}O_{excess}$ in the LGM, on the other hand, indicated low relative humidity.