U Isotope Systematics in Four European Stalagmites: New Insights and Implications for Palaeoclimatic Reconstruction

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U-series dates have been used to provide the chronology for many recent studies of continental palaeoclimate as recorded by speleothems. However, the accompanying precisely measured 234U/238U ratios, as records of the U isotopic composition in cave drip-water, contain additional insights that have yet to be explored fully. A recent study by Kaufman et al. (1998) for example, revealed that time-series variations in (234U/238U)i in speleothems from the Soreq cave in Israel exhibit a broad positive correlation with δ18O, such that drier conditions produced higher (234U/238U)i and higher δ18O. Here we present new data for four European Holocene speleothems to explore further the possibility that U isotope ratios can provide useful palaeoclimatic information.

U contents and (234U/238U)i ratios vary widely between the four stalagmites, but intra-stalagmite ranges are quite restricted. Typical ranges are listed in Table 1.

In contrast with all of the other stalagmites studied here, the (234U/238U)i ratios in the Grotta di Ernesto (N.E. Italy) stalagmite show a clear negative correlation with Th/U ratio and Th contents. New dissolved organic carbon (DOC) data indicate that organic material incorporated into this low-U stalagmite may be responsible for the observed variations in (234U/238U)i and Th concentrations. Overall, this study offers new insights into the factors that control U isotope ratios in stalagmites and shows that site-specific effects must be well understood before this proxy can be reliably applied.