



## Speleothem archives in their biogeochemical context

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Over the last decade there has been major advances in understanding of a variety of terrestrial proxies. Work on calcareous speleothem deposits in karstic caves for example has established that chemical variations can be ascribed to a range of forcing factors, including atmospheric variability, vegetation and soil parameters, style of carbonate dissolution and seasonal variability in cave environment, in addition to local post-depositional effects. Both long-term variations and high-resolution (meteorological event- to seasonal-scale) processes are represented, allowing individual speleothems to record processes of a maximum possible range of 7 orders of magnitude of variation of time ( $10^{-2}$  to  $10^{-5}$  years).

The parameters traditionally studied in speleothems have been oxygen and carbon isotope records, but Sr and U isotopes, and a variety of trace elements are increasingly studied. Oxygen isotopes can faithfully represent long-term behaviour of monsoon system as well as decadal to centennial-scale meteorological fluctuations. Carbon isotope variations can reflect relative abundances of plants with different photosynthetic modes, or total vegetational abundance, or relative importance of degassing (which can be seasonally modulated). The flux of atmospheric dust may be reflected in parameters such as Sr isotopes or soluble silica, whilst sulphate can record the flux of atmospheric aerosol pollution. In recent work we are developing comparisons between speleothems and tree chemistry, with a particular focus on the behaviour of sulphur. Some caves experience seasonal pulses of colloiddally-transported elements from the soil which appear to be more distinct when vegetation cover is sparse.