



Speleothem records of acid sulphate deposition and organic carbon mobilisation

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Dramatic increases in measured surface water DOC in recent decades have been variously attributed to either temperature rise, or destabilisation of long-term soil carbon pools following sulphur peak emissions status. However, whilst both drivers of DOC dynamics are plausible, they remain difficult to test due to the restricted nature of the available records of riverine DOC flux (1978 to present), and the limited availability of SO₂ emissions inventory data at the regional scale. Speleothems offer long term records of both sulphur and carbon. New techniques to extract sulphur concentrations and isotopes from speleothem calcite have enabled archives of pollution history and environmental acidification to be reconstructed. Due to the large dynamic range in sulphur isotopic values from end member sources (marine aerosol ~ +21 ‰ to continental biogenic emissions ~-30 ‰ and limited environmental fractionation under oxidising conditions, sulphur isotopes form an ideal tracer of industrial pollution and environmental acidification in the palaeo-record. We couple this acidification history to the carbon record, using organic matter fluorescence and trace metals. Trace metal ratios and abundance can be used to infer the type and size of organic ligand and are therefore sensitive to changes in temperature as a driver of organic carbon processing and biodegradation. This allows fluorescent properties and ratios of trace metals in speleothem carbonate to be used to represent both the flux of organic carbon into the cave as well as the degradation pathway. Here we present some of the first results of this work, exploring sulphur acidification as a mechanistic control on carbon solubility and export throughout the twentieth century.