

Causes of Colour and Fluorescence in Speleothems

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Speleothems fluoresce, when illuminated with UV light, between 410-460 nm. In this study we attempted to determine the nature of the fluorophores, thought to be either trace elements or organic matter trapped in the calcite. Fluorescence of solid speleothems and organic species extracted from the calcite were measured to quantify their contribution to the observed fluorescence of the speleothems. All speleothems and extracts gave similar spectra with broad emission maxima centred around 410-430 nm, and two excitation maxima at approximately 255 nm and 330 nm. The organic compounds were partly characterized using fulvic acid - humic acid separation and molecular size fractionation. Trace elements, determined by neutron activation analysis, do not appear to be responsible for the observed spectra. Organic matter, particularly fulvic acids, were found to be the dominant fluorophore in the calcite. Of the fulvic acid, the dominant fractions were the hydrophilics. Darker speleothems, although having higher concentrations of fulvic acid and humic acid than light speleothems, had lower emission intensities, due to self-absorption. Average particulate organic matter, fulvic acid, humic acid and total organic matter concentrations for the dark speleothems were twice that of their light counterparts.