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Soils as environmental fluorescence database to explain the speleothem fluorescence signal.

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In this study, we propose to use soils water-extracted organic matter (OM) as a database of fluorescence signal, to interpret quantitatively the the fluorescence of speleothems OM.

Due to its efficiency to described dissolved organic matter (DOM) characteritics, fluorescence has been used to determined DOM signatures in natural systems, water circulations, OM transfer from soils, OM evolution in soils or recently, DOM changes in engineered treatment systems. Fluorescence has also been used in speleothems studies, mainly as a growth indicator. Only few studies interpret it as an environmental proxy.

Speleothem fluorescence can be used as an environmental proxy, to record the past soil evolutions. Qualitative changes of OM are easily measured. However, it's today complicated to quantify the fluorescence signal of speleothems due to the analytical method generally used. That's why we propose to interpret quantitatively the fluorescence signal of speleothems, using soil fluorescence as a database of fluorescence signal.

3 different samples of stalagmites from french northern Prealps were used. To allow the quantification of the fluorescence signal, we need to measure the fluorescence and the quantity of organic matter on the same sample. OM of speleothems was extracted by an acid digestion method and analysed with a spectrofluorimeter. However, it was not possible to quantify directly the OM, as the extract solvant was a high-concentrated acid. To solve this problem, a calibration using soil extracts was realised. Soils were chosen in order to represent the diversity of OM present in the environment above the caves. Attention was focused on soil and vegetation types, and landuse. Organic material was water extracted from soils and its fluorescence was also measured. Total organic carbon was performed on the same samples. This allow to compare the two fluorescence signals. A range of OM concentrations can be then attributed to the speleothem signal. Fluorescence measurements were also realised on solid samples, using the MUESLI (Muesli Uses Emission Fluorescence for Line scanning and Imaging). Comparison with the two fluorescence signals, will evaluate the adaptability of the concentrations range for solid measurements, generally used.

This method offers the possibility to associate a fluorescence signal on solid speleothem, with a non-destructive method, to an environmental range of organic carbon quantities.

This soil fluorescence database will allow to interpret the past soil evolutions using fluorescence signal as an environmental proxy.