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Soil evolution processes during Holocene period explained by fluorescence of organic matter in speleothems

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Speleothems are widely used to provide paleoclimate information. Indeed, inorganic proxies, notably 18O, are the most common tools used to evaluate climate variations during past periods. However, recent studies currently develop the use of organic proxies due to the high potential information provided by organic matter such as vegetation cover variations, organic matter fluxes, landuse modifications, changes in precipitation and in the system hydrology. These proxies enable a paleoenvironmental reconstruction which can be coupled to paleoclimatic signal in order to better interpret inorganic proxies. The development of geochemical technics allows nowadays the analyses of elements ordinary used in sediments or soils cores studies. Indeed, numerous biomarkers as lipids have shown interesting results. However, these analyses generally require high amounts of material that implies a lower resolution. The fluorescence of organic matter represents a non-destructive proxy. Fluorescent lamina in speleothems have been widely used as a chronological tool or as a complementary information on paleoclimate. Fluorescent organic matter trapped in speleothems is mainly coming from soils. Modifications of the fluorescence signal represent modifications of organic matter fluxes, and so reflect soils dynamics above the cavity. Few studies used fluorescence as paleoenvironmental proxy to differentiate vegetation regimes or correlate with surface wetness and precipitation. Here, we used a fluorescence induced by laser excitation to obtain the organic matter fluorescence signal of two Holocene stalagmites of the Bauges massif, in the French western Prealps. These mountain environments are particularly sensitive to climatic changes and are marked by important modifications of environment as clearing, deforestation, or agricultural practices during this period. Two lasers with an excitation wavelength of 266 and 325 nm were used in order to record humic and proteic domains of fluorescence. The particularity of this analysis is the decomposition of the fluorescence signal in different fluorophores which enables the distinction between the different types of organic matter joining the system. Coupling data on organic matter quantity and quality provides precisions on organic matter fluxes and sources. They are influenced by pluviometry, soils saturation, soils type, vegetation cover themselves controlled by climatic forcing and anthropic impacts. These results were correlated with other organic and inorganic proxies as 13C and trace elements signal to assess soil dynamics variations in mountain environments.