From fabric microstratigraphy of stalagmites to environmental changes affecting the process of calcite precipitation. A case study from two caves in N Spain.

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Speleothems have been broadly studied as archives of the Quaternary climate. One of the proxies preserved in stalagmites corresponds to the stratigraphic patterns of carbonate microfabrics. These fabrics are strongly dependent of a wide range of factors that include environmental parameters from outside the caves (such as rainfall, vegetation type, and soil thickness), from the epikarst (residence time of the water in the aquifer and water-rock interactions) and from within the cave itself (e.g. humidity, microbial activity…). As these are modulated by global, regional, and local climatic/environmental changes, the fabric microstratigraphy of the speleothems can be used as a tool for their reconstruction.

In the last few years, some progress has been done in the task of deciphering speleothem microstratigraphy (Muñoz-García et al., 2006; Martín-Chivelet et al., 2013). Lately, Frisia (2015) has summarized her previous works to generate a method for obtaining "standardized" microstratigraphic logs of fabrics to allow comparison of records obtained from different stalagmites. The codes proposed by Frisia (2015) comprise all the so-far known microfabrics in calcitic and aragonitic stalagmites and flowstones. Hence, the factors invoked to explain the genesis of the different fabrics are of very different nature (drip rate, Mg concentration, presence of organic matter…).

This work aims to test this method in four calcite stalagmites that present only some of the most common fabrics. This designedly narrowing in the variety of fabrics allows introducing a slight alteration to the codes proposed by Frisia (2015) in order to obtain microstratigraphic logs that can be related to changes in humidity only, likely derived from shifts in the hydric balance above the cave. This enhances the possibility of comparing these logs with independent proxies, such as stable isotope or trace element records. The studied specimens were recovered from two different karst systems: Sierra de Atapuerca and Ojo Guareña, both located in the province of Burgos, in northern

Spain. For this preliminary test of the method a relatively short period of time has been selected (2200 to 900 yr BP).

References

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These layers affect the chemical equilibrium of the hydration products calcium hydroxide, calcium aluminium hydrates and calcium aluminium iron hydrate. It is a very complex process due to the many chemical reactions involved.Â CO_2 to cause precipitation of $CaCO_3$ from solution and form rafts visible to the naked eye (up to 0.5mm across). During periods of almost no air movement when the drip rate was very slow (>12 minutes between.Â The sheared-off micro rafts allowed a film of solution to be drawn several millimetres further up the outside of the straw and complete the cementing of micro rafts to the strawâ€™s outer surface.Â site, showing no sign of calcite rafts. Typical for drip rates of one drip per minute of faster. It is formed by a process of rapid precipitation of calcium carbonate, often at the mouth of a hot spring or in a limestone cave. can form stalactites, stalagmites. frequently used in Italy and elsewhere as a building material. a terrestrial sedimentary rock, formed by the precipitation of carbonate minerals from solution in ground and surface waters, and/or geothermally heated hot-springs. shale.Â These changes happen at relatively low temperatures and pressures and result in changes to the rock's original mineralogy and texture.Â Calcite is calcium carbonate or $CaCO_3$. It forms under reasonably deep marine conditions from the gradual accumulation of minute calcite plates shed from micro-organisms. diatomite. Stalagmites are formed by the gradual accumulation of calcite from a drip emanating from the point where a water flowpath through the aquifer intersects a void space. Groundwater in karst aquifers typically has very high levels of dissolved carbon dioxide and calcium due to contact with the soil derived CO_2 (Murthy et al.Â 2007) has demonstrated that cave air PCO_2 greatly affects the rate of calcite deposition, characterization of cave air PCO_2 variability is required to aid in interpretation of any climate records produced.Â subsequently leading to increased calcite precipitation above the stalagmite. Because of low partition coefficients in calcite of Mg and Sr, this process reduces drip water $[Ca^{2+}]$ but does not impact drip water $[Mg^{2+}]$ and $[Sr^{2+}]$, resulting in elevated ratios.