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ABSTRACT BOOK

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Biocorrosion of speleothems driven by lampenflora: preliminary observations in Bossea show cave (NW-Italy)

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Speleothems in show caves are often subjected to tourism-driven alterations, including corrosion due to CO_2 increase, undersaturated water and photosynthetic biofilms (e.g., Piano et al., 2015; Pulido-Bosch et al., 1997; White et al., 2021). In particular, the growth of the so-called "lampenflora" causes physical, chemical and aesthetic damage to speleothems (Piano et al., 2015). In this work we investigated for the first time the biocorrosion of speleothems at microscopic level due to lampenflora in Bossea Show cave (NW-Italy).

In this cave, the presence of lampenflora was previously documented in Piano et al. (2015) and biocorrosion on speleothems can be observed in different areas along the touristic path. In this work, a first tentative to describe the possible related biocorrosion from a geo-mineralogical point of view was made. Four superficial samples of 1x1 cm of 0.5 maximum thickness were collected on speleothems along the tourist path, in close proximity of halogen lamps. During in situ sampling, the concentration of the main photosynthetic groups composing lampenflora (cyanobacteria, diatoms, and green algae) was measured with Benthotorch®, a portable fluorimeter. The substrate samples were analysed in laboratory by means of scanning electron microscopy (SEM) with Energy Dispersive X-ray spectroscopy (EDX), in order to assess the alteration degree and the presence of lampenflora possibly responsible of biocorrosion. SEM images of some speleothem samples show high abundance of diatom frustules and the presence of bacteria, algae and fungi. Fluorimeter measures of cyanobacteria, diatoms and green algae amount were then compared to SEM images and EDX results showing in some cases a relation between the speleothems features visible to the naked eyes, the in situ measurements, the degree of alteration of calcite and the presence of bacteria and diatoms frustules at microscope.

Moreover, in light of a long-term study aiming at evaluating changes in calcite crystal habits over time, a homogenous speleothem was collected and divided into several parts, observed and photographed with SEM and placed along the tourist path in areas colonized by lampenflora, near the new LED lamps, where they will remain for about a year. The samples will then be collected and re-examined at SEM to verify and eventually quantify the degree of biocorrosion due to the flashlight after at least one year of exposition.

Piano E., Bona F., Falasco E., La Morgia V., Badino G. & Isaia M. (2015) - Environmental drivers of phototrophic biofilms in an Alpine show cave (SW-Italian Alps). Sci. Total Environ., 536, 1007-1018.

Pulido-Bosch A., Martin-Rosales W., López-Chicano M., Rodriguez-Navarro C. & Vallejos A. (1997) - Human impact in a tourist karstic cave (Aracena, Spain). Environ. Geol., 31, 142-149.

White J.H., Domínguez-Villar D. & Hartland A. (2021) - Condensation corrosion alters the oxygen and carbon isotope ratios of speleothem and limestone surfaces. Res. Geochem., 2, 100008.