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# ABSTRACT BOOK

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## **Environmental parameters monitoring in show caves: some examples from NW Italian show caves**

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Natural cavities are characterized by particular environmental conditions such as no light and the remarkable stability of the air temperature. These distinctive environmental factors have been able to maintain and preserve speleothems, paleontological and archaeological remains, and particular habitats rich in specialized fauna over the centuries (Balestra et al., 2021). The development of a cave into a show cave requires different modification to create the necessary facilities for tourist use and the passage of several hundred visitors a day can irreversibly damage speleothems and ecosystems (Cigna, 2016; Cigna & Forti, 2013), therefore, it is necessary to pay special attentions and monitor environmental parameters over time. The data should be collected before the construction of the tourist facilities, followed by a constant monitoring of the parameters during the tourist use to examine and verify any possible impacts over time affecting the cavity.

In general, there is a lack of data about the studies on cave environmental conditions before and during the tourist use, especially because there are no reference protocols regarding the main environmental parameters to monitor and how these monitoring must be carried out.

In this work, the main environmental parameters of three different show caves in NW Italy (Bossea Cave, Piedmont, Toirano and Borgio Verezzi caves, Liguria) were monitored. These parameters are the main factors characterizing the delicate cave environment balance and they can be significantly modified by the lighting systems and the tourist passage. A series of instruments with high precision probes were installed in every cave, aiming at environmental monitoring, especially hydrogeology, hypogean meteorology (temperature and air circulation) and air carbon dioxide concentrations. These instruments must be able to operate in particularly difficult conditions, such as high relative humidity (usually close to 100% in caves) and to detect even very small parameters variations, such as air velocity variations. The probes must be correctly located in different part of the cavities, especially considering the significant air stratifications that often occur in caves, with consequent vertical variations in air temperature and CO<sub>2</sub> content. The data recording time is a fundamental parameter too, allowing to examine with precision the possible impacts related to the tourist passages in some areas of the show cave.

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