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The Underground Karst Laboratories of Bossea Cave: more than 50 years of collaborations and research

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Abstract

The Bossea Cave, Piedmont, is the first show cave of Italy, opened to the public in 1874. The cavity develops for about 2800 m in the tectonic contact between the Middle Triassic dolostone and carbonate rocks, and Permotriassic metavolcanics. A main water collector (Mora River) and several water supplies are present inside the cave. Different underground karst laboratories to study hydrogeology, climatology, radon activity and subterranean biology are located in the cave, managed by a multidisciplinary group from Struttura Operativa Bossea C.A.I., DIATI - Politecnico di Torino, and Biologia Sotterranea Piemonte - Gruppo di Ricerca, working together with ARPA Piemonte, ARPA Valle d'Aosta and INRiM. The first laboratory was built in 1969 by volunteers of Gruppo Speleologico Alpi Marittime; over the years, more than 60 sophisticated data logger and sensors were positioned in different touristic and non-touristic areas of the cavity, thanks to the contribution of volunteers, associations and public authorities.

The hydrogeological research concerns both the flow hydrodynamics and the water geochemistry. Mora River is continuously monitored since 1983, and water sampling under different hydrodynamic conditions are carried out to chemical analyses. Tracing experiments from surface watercourses to spring waters have been done to understand the recharge area of the karst aquifer.

Different environmental parameters are continuously monitored in the cave, such as air circulation, air, rock and water temperature, relative humidity, air and water CO concentration. Rainfall and snowmelt are monitored too, above and inside the cave, evidencing the infiltration events.

Radon (^{222}Rn) derive from the radioactive ^{238}U decay, spreading rapidly into the cave atmosphere and waters. The gas exchange dynamics between rock, water and atmosphere are studied, testing also different equipments for the radon monitoring.

Subterranean biology investigations started in 1970, discovering over the years more than 125 different species of hypogean fauna in the system (75 in the last 30 years), of which four

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endemics, and six new species to science.

A strong contribution to the dissemination of the results was done by the operators, organizing training courses, activities for schools, environmental education, seminars, conferences, and online updates. The fundamental collaboration with the cave managers has allowed to carry out innovative research in this cavity, and to disseminate the discoveries to a not purely scientific or speleological public. Research allows a greater knowledge of the peculiarities and problems of the system, considering the cave not only a tourist attraction, but an important ecosystem to preserve.

Keywords: show cave, monitoring, multidisciplinary, underground laboratory, research