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Late stage condensation-corrosion in high mountain marble caves (Val di Scerscen, Bernina Massif, Valtellina, Italy)

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Val di Scerscen is located in the Central Italian Alps (Northern Lombardy), in the scenic setting of Valmalenco. This area is not very rich in caves (only about one hundred, among the over 4800 caves known in Lombardy). Here, oceanic metamorphic rocks, which where uplifted during the Alpine orogenesis, dominate the terrains. A thin lens of whitish dolomitic marbles belonging to the Austroalpine Margna Nappe hosts a few short caves, right at the end of the tongue of the Scerscen glacier, on the southern slopes of Piz Bernina. This glacier and its meltwater probably strongly contributed to the cave evolution. The most important caves, opening at about 2600 m asl, are: Veronica cave (length: 638 m), Morgana cave (348 m), and Tana dei Marsooi (77 m). These are typical epiphreatic caves with juvenile pattern and with adjustment to the water table (Audra and Palmer, 2013), according to the glacier evolution and to the valley incision. With the important retreat of the glacier during the Holocene, the processes of cave evolution have changed. The runoff provided by the glacier became less and less important and the drainage changed with the migration of the tongue of the ice cover. Today, the groundwater flow is mainly active during spring due to snow melting on a restricted catchment. The underground climate is characteristic of alpine caves, with a low mean temperature. Condensation-corrosion processes (James, 2013) presently have a major control on the morphology of the cave passages. The shape of walls and ceilings has changed with the aerosol circulations according to the gradient of temperature between the cave and the exterior. Consequently, condensating waters carved smooth reliefs, notches and bell holes. Ongoing studies are focused on: (i) long term processes (U/Th dating on calcite crusts, cosmonucleide dating on quartz pebbles); (ii) current physical processes of condensation-corrosion, comprising microclimatic monitoring and in situ exposure of limestone tablets, and (iii) assessment of microbially mediated corrosion. In this sense, vermiculations were collected in different sites of Morgana cave and studied by DNA-based analyses and field emission scanning electron microscopy at the IRNAS-CSIC (Seville, Spain). Thanks to the collaboration with Leica Geosystems Italy it has been possible to test, for the first time in a cave, two new 3D mapping instruments: the "BLK360" laser scanner, the smallest and lightest of its kind weighing only 1 kg, and the "Pegasus Backpack", a mobile mapping system which allows making a 3D scan of the environment by simply walking around. The data allowed creating 3D models of the Veronica cave which can be used both for morphological analysis and for virtual tours with educational purposes.

References:

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