

A multi-year monitoring project of the high-altitude Cenote ice cave, Dolomites, Italy

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The Cenote ice cave hosts one of the most voluminous cave glaciers of the Dolomites. This 280 m-deep abyss was discovered in 1994 after the entrance had opened as a result of the abrupt emptying of a small lake at 2940 m a.s.l. in the Regional Park of Fanes, Sennes and Braies. The cave consists of a massive, 130 m-thick layered ice deposit carved by meltwater tunnels and chimneys excavated from below by ascending air. At the lower limit of the cave glacier a shaft opens – ice-free and 165 m deep – leading into a dome occupied by a cave rock glacier with typical terminal tongue embankments.

A research project was launched to monitor long-term movements and volume changes of this ice deposit as well as to understand the cave microclimate and the potential for future palaeoclimate studies.

During October 2015 a first expedition performed a complete survey of the final chamber using a Leica HDS7000, a phase difference laser scanner equipped with a dual axis compensator, on-board control, a wavelength of 1.5 microns, a laser "CLASS 1" with a flow rate of 187 m and a resolution of 0.1 mm. A scan station was performed also at 110 m above the bottom of the shaft to map in detail the lower side of the hanging ice glacier. This survey has provided the detailed volume of the chamber (420,000 m³) as well as a first record of the position of the ice masses hanging on the ceiling and of the rock glacier at the bottom. Barometric, temperature and humidity dataloggers have been installed in the cave to record the microclimate. In addition pollen traps have been installed to study the present flux of pollen at the surface and inside the cave, while preliminary analyses on pollen grains preserved in the ice are being carried out.

The Cenote ice cave research project aims to shed light on the climate evolution of the Dolomites during the last hundreds or possibly thousands of years, as well as on the more recent environmental changes that lead to the upward melting of the cave glacier and the consequent opening of the cave to the surface.