

## **Enhancement of archaeological heritage. El Risco de las Cuevas at Perales de Tajuña, Madrid (Spain)**

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Heritage conservation has a great impact on the economy of a country. The enhancement of archaeological sites is an investment that promotes tourism and culture. The interdisciplinary knowledge of heritage should be the basis of its management. Preventive actions, non-destructive analytical techniques and monitoring for the conservation of these assets should be promoted.

“El Risco de las Cuevas” is a highly decayed and nearly vertical gypsum escarpment which contains a series of dwellings excavated during the Chalcolithic and much more recent times. It is located at Perales de Tajuña, 40 km southeast of Madrid, Spain. This monument is approximately 70 metres high and 500 metres wide. It was listed as a cultural and monumental heritage site by the regional government of Madrid in 1998.

The gypsum escarpment housing the dwellings forms part of a lower Miocene unit (Madrid Basin). Debris cones with a mixture of debris from the lower, medium and upper units are found at the bottom of the rockwall. The vulnerability of this monument to atmospheric agents has been studied using "in situ" monitoring techniques of humidity, temperature and rate of rockfalls. Drones have been used for aerial photography in the highest areas of the escarpment and have provided an information network of fractures likely to cause rockfall.

Gypsum artificial accelerated ageing has been carried out in the laboratory, including freeze/thaw, wet/dry, thermal shock and dissolution tests. To determine the response of these accelerated ageing processes, density, micro-roughness, ultrasound velocities ( $V_p$  and  $V_s$ ), air permeability and microscopy measurements were made before, during and after ageing tests.

Geomorphological studies, rates of decay, material characteristics and durability tests indicate that the decay is controlled by the mineralogy, clay content and porosity of the gypsum rock, as well as microclimate, temperature changes and rock fractures. Rockfalls are particularly relevant in the safety of the monument and visitors.

The enhancement of El Risco de las Cuevas has involved both local government (City council of Perales de Tajuña) and regional one (General Directorate of Historical Heritage of the Community of Madrid), besides the Institute of Geosciences IGEO (CSIC-UCM). Thanks to the collaboration of these agencies an interpretation centre has been created, preserving El Risco de las Cuevas in an educational and user-friendly manner. By conducting tours during the Science week of Madrid this promotes citizen participation, dissemination and social transfer, which are essential to preserve heritage. A project has been designed to monitor and ensure control and stability of the monument

Acknowledgements: Community of Madrid for financing Geomateriales2 program (P2013/MIT2914), CEI-Moncloa UCM-UPM, Applied Petrology for Heritage Stone Materials Conservation Research Group and local government of Perales de Tajuña.