Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36958

Geochemical modifications in speleothems associated with past bat occupations (Demoiselles and Roquette caves, Gard, France).

HÉLÈNE CASSAGNE[1,2], EDWIGE PONS BRANCHU[1], JOCELYN BARBARAND[2], ERIC DOUVILLE[1], DELPHINE THOMAS[1], JULIUS NOUET[2] AND LAURENT BRUXELLES[3,4]

[1]LSCE (UMR CEA/CNRS/UVSQ)
[2]Université Paris-Saclay, CNRS, GEOPS
[3]Institut Français d'Afrique du Sud IFAS-Recherche (USR 3336)
[4]University of the Witwatersrand, Evolutionary Studies Institute

The presence of bats in caves can significantly alter cave morphologies. This phenomenon known as biocorrosion, occurs in caves at both low latitudes, where bat colonies are highly abundant, and higher latitudes, where past occupations are recorded. These modifications result from both the mechanical effects of bat presence and environmental changes induced by respiration and guano deposition. Such changes include increased temperature, humidity, CO_2 levels, and the introduction of acids (nitric, sulfuric, phosphoric) associated with guano and urine. These processes lead to the dissolution of cave walls and speleothems, creating distinctive morphological features. A specific chemistry and mineralogy are associated with these morphologies, primarily linked to the chemical composition of guano (rich in N, P, S).

The objective of this study is to understand the chemical and mineralogical modifications occurring in speleothems due to bat presence. Samples were collected from the Demoiselles cave (Gard, France) and from the Roquette cave (Gard, France), where biocorrosion alterations are observed. Bat occupation phases were identified through mineralogical analysis by SEM, revealing the preservation of phosphates in speleothems (mineralized guano). U-Th dating of calcite surrounding these phosphates (from the Demoiselles cave) indicates occupations spanning the Quaternary, from the last few thousand years to over 150 ka. Major and trace element analyses revealed elevated concentrations of elements (e.g. U, Mg, Sr, Cu, Zn) and especially REE. These elemental concentrations are hosted in the phosphate phase but are also carried by the associated detrital phase, which is likewise introduced through biocorrosion.

This study provides insights into the timing of bat occupations in Demoiselles cave, linking them to past climatic conditions. Bats congregate in large numbers primarily during warm, humid climates, where nutrient availability (insects) is highest. Geochemical analyses highlight that biocorrosion induced by bats affects the mineralogical and chemical composition of speleothems, with mobilisation and/or addition of some elements. This can compromise at least in the levels affected, the use of trace elements in speleothem as a proxy for paleoclimate or their precise chronology.