

## Bat guano $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values as climate proxy

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Geochemical studies of cave guano using stable isotopes can provide paleoecological and paleoclimate (mainly precipitation) records. Cave guano  $\delta^{13}\text{C}$  values reflect the dietary preferences of bats that are largely controlled by local vegetation dynamics, which in turn depend on local climatic conditions.

The aim of the present study is to demonstrate the usefulness of stable carbon and nitrogen isotopes in bat guano as proxies for paleoclimate changes. We show a 2500-year record of environmental change in Romania using  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ , and (C:N) derived from precisely  $^{14}\text{C}$ -dated bat guano cores recovered from Gaura cu Musca (GM), Zidită (ZC), and Magurici (MC) caves.

$\delta^{13}\text{C}$  values in guano at the Medieval Warm Period (MWP) - Little Ice Age (LIA) transition changed markedly only in the GM record. In the other two caves the carbon isotopic values indicate a steady onset of LIA at around AD 1200 but without significant climatic changes before ~ AD 1450 and abruptly ending between ca. AD1870 and 1900. The beginning of the 20th century is characterized by an average of  $\delta^{13}\text{C}$  value of  $-25.2\text{‰}$  up to ca. AD 1965 (which indicate a moderate change toward warmer period). More rapid changes in  $\delta^{13}\text{C}$  values are recorded after AD 1970. These rapid changes by 0.5 to 1.5‰ were recorded within a few years. In this general picture, these indicate swings between several cold and warm events.

$\delta^{15}\text{N}$  values of guano can be utilized as an integrator of past states of the local nitrogen cycle. A  $\delta^{15}\text{N}$  record from a 1.5-m core of bat guano deposit from Zidită Cave provides a record of climatic and anthropogenic influence on the regional nitrogen pool. The  $\delta^{15}\text{N}$  values of guano has decreased from 12.5‰ to 7‰ since AD 1950, suggesting the N-cycle has been trending towards a more conservative state in response to lower water availability.

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