Guano as proxy for paleoclimate studies: Examples from Romania

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Paleoenvironmental studies using guano-derived $\delta^{13}C$ and $\delta^{2}H$ isotopic data are currently the focus of an increasing attention within the scientific community [1-3]. This is primarily because combining them with other environmental proxy data recovered from guano deposits (i.e., $\delta^{18}O$, pollen, charcoal, magnetic susceptibility, C/N ratio, and trace elements) one can better characterize paleoclimate changes in regions with limited environmental archives [1-3].

Here we present the guano $\delta^{13}C$ isotopic data from four caves (Zidită [4], Huda lui Papara [5], Gaura cu Muscă [3, 4], and Măgurici [6]), all located in Romania. The radiocarbon ages of the investigated guano deposits indicate they accumulated over the last 9,500 years. However, none of these organic deposits span this entire time interval. The depositional gaps are important and may indicate some type of environmental changes. The isotope data are presented along with pollen analysis, $\delta^{18}O$ and $\delta^{13}C$ (from stalagmites), as well as major and trace element analysis on guano. The guano $\delta^{13}C$ isotopic values (preliminary data) range between -24.07 and -27.61 ‰ (Zidită Cave), -25.23 and -27.12 ‰ (Gaura cu Muscă Cave), and from -25.75 to -27.00 ‰ in Huda lui Papara Cave. Based on the available results we identified two major climatic shifts, namely the Medieval Warm Period and the Little Ice Age, respectively) and also documented short intervals characterized by either wet or dry conditions. The alternating dry/wet periods is further supported by the pollen assemblage (older-middle to younger Subatlantic Period) described from a nearby cave. All these guano-inferred information are valuable to further refine the very few existing Holocene paleoclimate studies in Romania.

[1] Bird *et al* (2007) *Earth Env. Sci. Trans. Royal Soc. Edinburgh* **98**, 59-69. [2] Wurster *et al* (2008) *Geology* **36**, 683-686. [3] Onac *et al* (2013) Env. Earth Sciences doi: 10.1007/s12665-013-2789-x. [4] Giurgiu & Tămaş (2013) *Studia UBB Geologia* **58**, 13-18. [5] Nagy & Postawa (2011) *Anim. Conserv.* **14**, 74-86. [6] Geantă *et al* (2012) Rev. *Palaeobot. Palynol.* **174**, 57-66.