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A Cautionary Note on the Value of Guano Deposits in Caves

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Bat guano has played an important role in human history, from the extraction of saltpeter for gunpowder during the American Civil War to the harvest of natural fertilizer. Not surprisingly, this rich substance boasts yet another use as a window into the past, but only if left undisturbed¹.

Intact accumulations are goldmines of scientific value. In addition to supporting entire ecosystems of life found nowhere else, guano deposits contain invaluable records of past conditions. These records sometimes date back thousands of years, revealing changes in climate, vegetation, pollution, and much more¹⁻⁴.

In a recent study published in the journal of *Paleogeography, Paleoclimatology, Paleoecology*, a team of researchers analyzed a 129-centimeter-long (4.2 ft) guano core preserved in a Jamaican cave⁴. Led by Ph.D. student, Lauren Gallant, the team traced a detailed history of accumulating atmospheric pollutants, changes in plant life, and evolving industrial and agricultural practices. The far-reaching impacts of human activity were traced over 4,300 years. They even detected the introduction of synthetic fertilizers, the onset of nuclear weapons testing, and the Industrial Revolution.

But what makes guano such a uniquely powerful environmental indicator?

Clues about the past are frozen in glaciers, buried in sediment beneath oceans and lakes, and recorded in tree rings. These natural archives carry biosignatures, such as isotopes of carbon and nitrogen, that allow scientists to view fluctuations in temperature, precipitation, and the chemical composition of our environment¹⁻⁴. Bat guano is an especially attractive medium for paleoclimatologists because it can provide longer-term records than tree cores and unlike glaciers, is found on almost every continent¹. Gallant and her team found a better record of environmental contaminants in guano than in nearby lake sediments³. Especially in tropical regions, caves can provide shelter from fluctuations in heat and humidity that degrade these historical records. In fact, in many places, bat guano may be the only proxy available for scientists to reconstruct the past.

Cave-roosting bats are typically colonial and can consistently deposit substantial quantities of guano, year after year. It is often laid down in a series of identifiable strata, each layer representing a distinct time period². These layers carry information about environmental conditions and the flora and fauna bats consumed¹⁻³.

Insect bodies contain carbon ratios

indicative of the plants they feed on. Insectivorous bats then pass those ratios through their feces into guano deposits⁵. The same follows for fruit and nectar-eating bats. Because these ratios vary among plant communities, Gallant suggests they may provide critical information about long-term changes in climate and/or agriculture³. For example, C3 carbon ratios are found mostly in forests and in wheat, rye, and oats. C4 ratios are found in arid climates or crops such as corn, sugarcane, or sorghum, and often correspond to periods of drought and deforestation^{3,5}.

Several researchers have used guano cores to document the large proportions of agricultural pests consumed by bats^{4,6}. In Jamaica, Gallant and her team found a shift towards C4 plants that correlated with increased sugarcane production, suggesting bat suppression of sugarcane pests³. As bat populations worldwide experience stress from habitat loss and human activities, such evidence supports arguments for conservation.

To serve as historical indicators, guano deposits spanning even a few years can prove helpful, but they must remain intact. Unfortunately, as a result of human extraction and careless disturbance, few remain^{1,3}. Those that do should be carefully protected.

Systems are needed for identifying, reporting, and conserving undisturbed guano deposits. Such information may be used to preserve potentially important deposits and the bats that contribute to them. Careless footsteps can destroy hundreds or even thousands of years of invaluable records.

Next time you encounter a guano deposit, afford it the same respect as a rare speleothem. Strictly limit disturbance by walking around them or sticking to a single trail that will cause the least damage.

For more information, please visit our resource titled, *Finding, Protecting, and Restoring America's Historic Bat Caves*, at MerlinTuttle.org.

References

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An eroded ancient guano deposit reveals annual layering. Photo by Merlin Tuttle

