# NOTE ON THE OCCURRENCE OF PHYLLOSTOMIDAE FROM THE LATE HOLOCENE AT LAPA GRANDE DE TAQUARAÇU SITE, LAGOA SANTA, STATE OF MINAS GERAIS, BRAZIL

# *NOTA SOBRE A OCORRÊNCIA DE PHYLLOSTOMIDAE DO HOLOCENO TARDIO NO SÍTIO LAPA GRANDE DE TAQUARAÇU, LAGOA SANTA, ESTADO DE MINAS GERAIS, BRASIL*

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**RESUMO**

A região de Lagoa Santa, localizada no centro do Brasil, é rica em fósseis e abriga importantes sítios arqueológicos e paleontológicos, como a Lapa Grande de Taquaraçu. Este sítio foi estudado arqueologicamente, mas a análise da arqueofauna foi preliminar. O presente estudo apresenta um exemplar bem preservado de *Chrotopterus auritus*, encontrado em depósitos datados do Holoceno Final. O material analisado consiste em uma mandíbula fragmentada (com os dentes esquerdo e direito) e um úmero esquerdo, ambos pertencentes ao mesmo indivíduo. A espécie *Chrotopterus auritus* é encontrada em florestas tropicais úmidas da América Central e do Sul, incluindo o sul do Brasil. Trata-se de uma das maiores espécies da família Phyllostomidae, com uma dieta predominantemente carnívora e insetívora. A presença do exemplar no sítio arqueológico da Lapa Grande de Taquaraçu não possui relação direta com as comunidades humanas da região, uma vez que não foram identificados sinais de atividade humana nos ossos. É possível que o espécime tenha habitado o local após o abandono por populações humanas.

**PALAVRAS-CHAVE**: Mamíferos, Taxonomia¸ Chiroptera, Quaternário, Arqueofauna.

**ABSTRACT**

The Lagoa Santa region, located in central Brazil, is rich in fossils and hosts important archaeological and paleontological sites, such as Lapa Grande de Taquaraçu. This site has been archaeologically studied, but the analysis of the archaeofauna remains preliminary. The present study reports a well-preserved specimen of *Chrotopterus auritus*, found in deposits dated to the Late Holocene. The analyzed material consists of a fragmented mandible (with left and right teeth) and a left humerus, both belonging to the same individual. The species *Chrotopterus auritus* is found in humid tropical forests of Central and South America, including southern Brazil. It is one of the largest species of the

Phyllostomidae family, with a predominantly carnivorous and insectivorous diet. The presence of this specimen at the Lapa Grande de Taquaraçu archaeological site has no direct connection with the human communities of the region, as no signs of human activity were identified on the bones. It is possible that the specimen inhabited the site after its abandonment by human populations.
**KEYWORDS**: Mammals, Taxonomy, Chiroptera, Quaternary, Archaeofauna

## INTRODUCTION

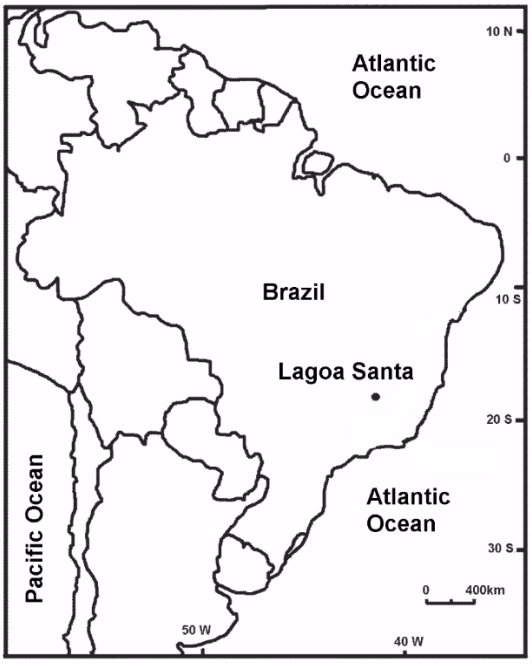
The Late Holocene (4,200 years ago to the present) corresponds to the most recent stage of the Quaternary. The Lagoa Santa region, located in central Brazil (Figure 1), hosts a karst system widely recognized for its rich fossil record, encompassing Holocene deposits found in various archaeological and paleontological sites.

Lapa Grande de Taquaraçu, an important archaeological site in the Lagoa Santa region, has been the subject of numerous archaeological studies (Hermenegildo, 2009; Angeles Flores et al., 2023). However, the archaeofauna identified at the site has only been preliminarily analyzed (Chim, 2018) through quantitative zooarchaeological studies, lacking detailed descriptions, illustrations, or comprehensive interpretations of the recovered specimens. Among the underexplored taxa, bats (Chiroptera) stand out, as their remains are present at the site.

Chiropterans are the only mammals capable of active flight and represent the second most diverse order within the class Mammalia (Paula Couto, 1979). Although they are frequently recorded in caves and natural shelters, their skeletal remains are relatively rare in archaeological and paleontological contexts.

At Lapa Grande de Taquaraçu, skeletal remains dating from the Early and Late Holocene have been recovered. This study aims to present an exceptionally well-preserved specimen of *Chrotopterus auritus* Peters, 1856, identified in deposits attributed to the Late Holocene.

Figure 1. Location of the Lagoa Santa area.




## MATERIALS AND METHODS

The Lapa Grande de Taquaraçu archaeological site is located on the banks of the Taquaraçu River, between Lagoa Santa and Serra do Cipó, in the municipality of Taquaraçu de Minas, state of Minas Gerais, Brazil. The rock shelter, formed in carbonate rocks, is situated outside the main karst zone of the Lagoa Santa Environmental Protection Area (APA). The site measures 30 meters in length and 9 meters in width, facing west. The total sheltered area is 255 m², with an excavated area of 7 m².

The archaeological deposits are predominantly anthropogenic, composed mainly of wood ash, with minor contributions of silt and clay from the Taquaraçu River, located approximately 7 meters away. Excavations reached a maximum depth of 1 meter.

Excavations at Lapa Grande de Taquaraçu were conducted in multiple grid squares, revealing facies variations. The material analyzed in this study comes from

facies 2 of grid square G7, dated to 1,160 ± 60 BP (before present) or 1,075 ± 81 calibrated years (Angeles Flores et al., 2023).

Taxonomic identification of the specimen was carried out by comparing it with previously described bat specimens in the specialized literature and consulting reference works, including Medellín (1989), Kiser (1995), Best, Kiser and Rainey, (1997), Salles et al. (2014), Ruelas (2017), Brandão and Hingst-Zaher (2021), Sánchez and Carrizo (2021), Ubilla, Gaudioso and Perea (2021), and Gaudioso et al. (2023). The skeletal specimens are curated and housed at the Laboratory for Human Evolutionary Studies (LEEH) of the Institute of Biosciences, University of São Paulo (IB-USP).

## RESULTS

The material analyzed consists of a fragmented mandible and a left humerus, both belonging to the same individual. The specimen was identified as Order Chiroptera Blumenbach, 1779; Family Phyllostomidae Gray, 1825; Genus *Chrotopterus* Peters, 1865; Species *Chrotopterus auritus* (Peters, 1856) (Figures 2 and 3).

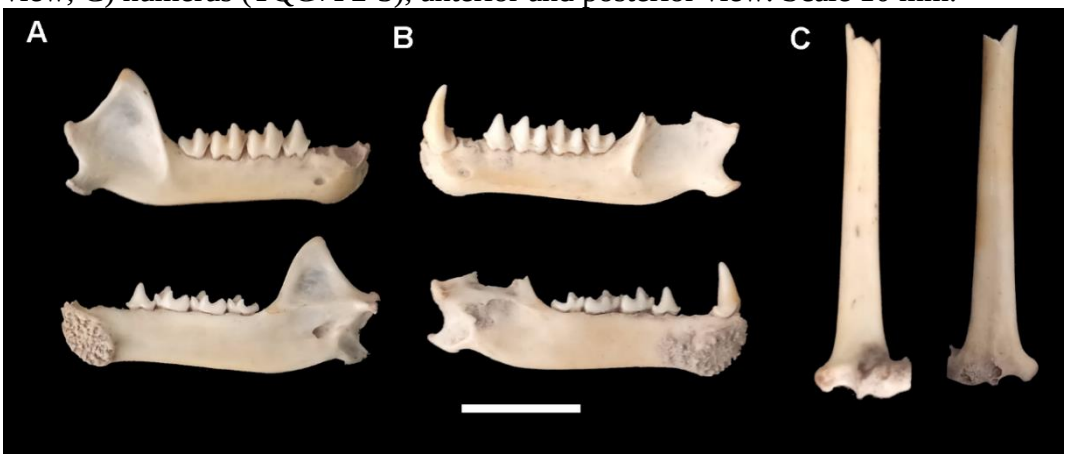
Material**:** A fragmented mandible, consisting of the left and right dentaries (TQG7F2-1 and TQG7F2-2), along with a left humerus (TQG7F2-3) belonging to the same individual.

Geographic Distribution: The species *Chrotopterus auritus* inhabits humid and cloud forests, ranging from sea level to altitudes of approximately 2,000 meters. Its distribution extends from southern Mexico to northern Argentina, including parts of southern Brazil (Medellín, 1989, Barquez et al., 2015).

Fossil Record: The fossil records of *Chrotopterus auritus* are rare. In Brazil, they include an almost complete skull from the Iporanga region in the state of São Paulo, as well as occurrences in Lagoa Santa (Minas Gerais), Serra da Mesa (Goiás), and Chapada Diamantina (Bahia) (Ameghino, 1907, Salles et al., 2014).

Outside Brazil, fossil records are attributed to the Late Pleistocene and Holocene of Mexico (Medellín, 1989).

Figure 2. Identified bone parts of *Chrotopterus auritus*. A) Right dentary (TQG7F2-1), external and internal view; B) Left dentary (TQG7F2-2), external and internal view; C) humerus (TQG7F2-3), anterior and posterior view. Scale 10 mm.



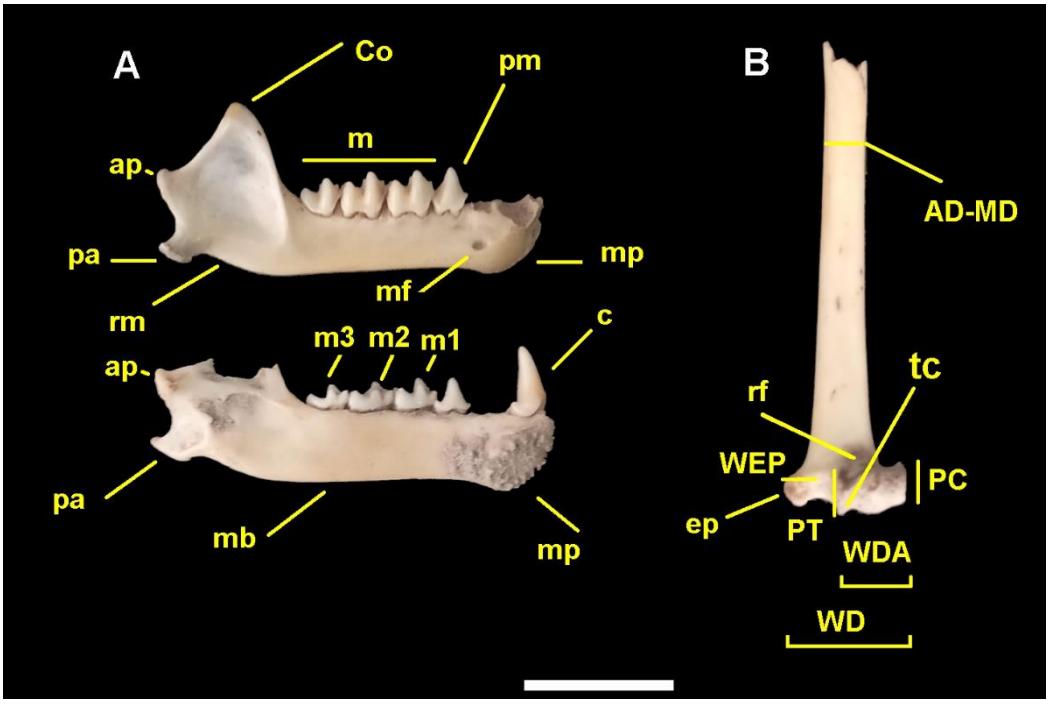

The dentaries belong to the same individual and were separated while still at the archaeological site. They are thin and elongated structures, featuring a relatively high coronoid process (projecting above the height of the canine), which is slender and preserved only on one of the dentaries.

The coronoid process has the shape of an equilateral triangle, slightly inclined toward the anterior portion of the dentary. The anterior margin is gently convex, whereas the posterior margin is slightly concave. The articular or condylar process is partially preserved in the dentary, which displays a completely preserved coronoid process. Despite the preservation conditions, it was possible to measure a width of less than 4 mm. The angular process is rectangular in shape and curves laterally, with a straight-edged tip projecting downward relative to the mandibular ramus base.

The lower incisors were lost during disarticulation, with only portions of their alveoli preserved. Based on these structures, it is inferred that the incisors were small and positioned between the canines. Only one canine was preserved, showing basal contact with both the incisors and premolars.

The anterior border of the ascending ramus has a posterior inclination and a concave morphology. The mental foramen is located below the first premolar.

Figura 3. Bone parts of *Chrotopterus auritus*.




A) Dentaries; B) Humerus. Scale 10mm. Identified anatomical parts; **ap**: articular process, **pa**: angular process, **rm**: mandibular ramus, **Co**: coronoid process, **m**: molars, **pm**: premolar, **mp**: mental protuberance, **mf**: mental forâmen, **mb**: mandibular body, **m1**: molar 1, **m2**: molar 2: **m3**: molar 3, **c**: canine, **ep**: epitrochlea, **rf**: radial fossa, **tc:** trochlea. Measurements; **AD**: anteroposterior diameter at the middle of the diaphysis; **MD:** mediolateral diameter at the middle of the diaphysis, **PC**: Proximo-distal diameter of the lateral ridge of the capitulum, **PT**, proximo-distal diameter of the trochlea, **WD**: greatest width of the distal region, **WDA**: width of distal articular surface, **WEP**: difference between WD and WDA. Scale 10mm.

Two humeri were found, but only one preserved its distal extremity, allowing for taxonomic characterization. The analysis of this portion revealed morphology consistent with the family Phyllostomidae. The epitrochlea has a trapezoidal shape and is laterally oriented in the humerus. The trochlea, in turn, is not as pronounced as in the genera *Desmodus* and *Vampyrum*, but aligns with the

expected characteristics for the genus *Chrotopterus* (Salles et al. 2014, Sánchez; Carrizo, 2021, Gaudioso et al., 2023). Additionally, the lateral crest of the capitulum is more prominent than in specimens of *Noctilio leporinus* (Salles et al. 2014). The obtained measurements are presented in Table 1.

Table 2. Measures obtained from the dentaries, teeth, and humerus of the specimen from Lapa Grande de Taquaraçu.

| | Left dentary | Right dentary |
|---|---|---|
| Lingual-labial canine | 2.7 | - |
| Anteroposterior canine | 3.1 | - |
| Height canine | 5.2 | - |
| Length m1-m3 | 8.5 | 8.5 |
| Depth below m3 | 4.1 | 4.1 |
| Length p2 | 2.4 | 2.5 |
| Width p2 | 1.6 | 1.6 |
| Height p1 | 3.9 | 3.8 |
| Length m1 | 2.8 | 2.9 |
| Width m1 | 2.15 | 2.1 |
| Height m1 | 3.53 | 3.6 |
| Length m2 | 2.8 | 2.9 |
| Width m2 | 2.1 | 2.1 |
| Height m2 | 3.3 | 3.4 |
| Length m3 | 2.4 | 2.2 |
| Width m3 | 1.6 | 1.6 |
| Height m3 | 3.12 | 2.9 |
| Height coronoid process to the base | - | 10.9 |
| | Humerus | |
| Proximo-distal diameter of the lateral ridge of the capitulum, | 2.7 | |
| Proximo-distal diameter of the trochlea | 3.2 | |
| Greatest width of the distal region | 7.9 | |
| Width of distal articular surface | 5.1 | |
| Difference between WD and WDA | 2.8 | |
| Anteroposterior diameter at the middle of the diaphysis | 2.9 | |
| Mediolateral diameter at the middle of the diaphysis | 3.0 | |

## DISCUSSION

The coronoid process of the specimen is more developed than those observed in Molossidae, such as *Eumops* and *Molossops* (Kiser, 1995, Best; Kiser; Rainey, 1997). The dentition and morphology of the dentary differ significantly from those found in Mormoopidae, Natalidae, Noctilionidae, Thyropteridae, Vespertilionidae, and various subfamilies of Phyllostomidae, including Desmodontinae, Glossophaginae, Lonchophyllinae, Glyphonycterinae, Lonchorhininae, Micronycterinae, Rhinophyllinae, and Stenodermatinae (Medellín, 1989, Kiser, 1995, Best; Kiser; Rainey, 1997, Salles et al. 2014, Ruelas, 2017, Brandão; Hingst-Zaher, 2021, Sánchez; Carrizo, 2021, Ubilla; Gaudioso; Perea, 2021, Gaudioso et al. 2023). However, *Chrotopterus auritus* exhibits morphological similarities in dentition and overall mandibular shape with species of the subfamily Phyllostominae.

Although the dentition exhibits high crowns and is similar to that observed in Mormoopidae, Natalidae, Noctilionidae, Molossidae, Furipteridae, and Thyropteridae (Medellín, 1989, Kiser, 1995, Best; Kiser; Rainey, 1997, Ruelas, 2017, Brandão; Hingst-Zaher, 2021) , the overall morphology of the dentaries in these families differs in the mandibular body and the coronoid, condylar, and angular processes.

Among Phyllostomidae, the examined dentaries are distinct in both morphology and dentition from those of the subfamilies Stenodermatinae, Glossophaginae, Rhinophyllinae, Desmodontinae, Lonchophyllinae, and Carollinae (Medellín, 1989, Ruelas, 2017, Brandão; Hingst-Zaher, 2021). In subfamilies such as Lonchorhininae, Micronycterinae, Glyphonycterinae, and various other genera within Phyllostominae, the dentition may resemble that of *Chrotopterus auritus* in shape and arrangement; however, the mandibular body and associated processes (coronoid, condylar, and angular) present morphological differences.

When compared to known specimens, both the humerus and dentaries are identical to those of living *Chrotopterus auritus* individuals, including the obtained measurements, which correspond to those observed in extant specimens (Medellín, 1989, Brandão; Hingst-Zaher, 2021, Sánchez; Carrizo, 2021).

*Chrotopterus auritus* is one of the largest species of the family Phyllostomidae in the New World (Medellín, 1989). The species is recorded in humid and cloud forests, usually near streams. This suggests that the Lapa Grande de Taquaraçu shelter could have provided a favorable and secure environment for the bat. However, the absence of evidence of human activity on the bones suggests that the animal did not occupy the shelter while it was inhabited by human communities, but may have used the site after these populations abandoned it.

The species is a generalist, with a predominantly carnivorous and insectivorous diet, preferring small vertebrates (such as reptiles, small birds, rodents, small marsupials, and other bats), as well as insects and, occasionally, fruits (Acosta y Lara, 1951, Tuttle, 1967, Medellín, 1989, Bordignon, 2005, Uieda et al. 2007, Brito et al. 2010). These food items are abundant in the Lagoa Santa region and are frequently observed in various local archaeological sites.

## FINAL CONSIDERATIONS

Although bat remains are not uncommon in caves (Peters, 1856, Winge, 1893, Paula Couto, 1979, Trajano, 1984, Barros Barreto et al. 1982), few specimens have been described in the literature. *Chrotopterus auritus* has previously been recorded in cave deposits in Lagoa Santa, but this is the first time it has been identified in an archaeological site in the region.

The species has also been observed living in the Lagoa Santa area. Given its preference for forests and humid environments, a shelter on the banks of the Taquaraçu River likely provided an ideal habitat for habitation and protection.

The presence of this species is unlikely to be associated with the human communities that once inhabited the region, as there is no evidence of cut marks,

burns, or any other anthropogenic modifications. It is probable that the bat occupied the shelter after the site had been abandoned by human populations, suggesting that the specimen is younger than 1,160 ± 60 BP, unless it originates from a more recent period.

Other small vertebrates, also lacking evidence of human activity, were found at the archaeological site. These animals were likely unrelated to the local human communities and may have used the site solely as a refuge or shelter.

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