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Scientific Note

THE SMALL CANIDAE FROM CUVIERI CAVE (QUATERNARY, PLEISTOCENE), LAGOA SANTA, EASTERN BRAZIL

ARTUR CHAHUD
Laboratório de Estudos Evolutivos Humanos, Departamento de Genética e Biologia Evolutiva, Instituto de Biociências, Universidade de São Paulo, Rua do Matão, 277, 05508-090, São Paulo, SP, Brazil.
arturchahud@yahoo.com (Corresponding author)

ABSTRACT – The Lagoa Santa region is an important karst complex, known for its large number of caves containing abundant fossil and subfossil osteological material. Among the Pleistocene fossils identified in this important area are various paleovertebrate remains, including members of the order Carnivora. This study describes two fragmented dentaries from a small Canidae of the genus *Speothos*, found in Cuvieri Cave. The specimens likely belonged to the same individual, whose first molar had not yet erupted, indicating that it was a juvenile. Although the presence of canids has previously been reported in the region, this is the first identification of *Speothos* in the Pleistocene deposits of Cuvieri Cave. It is believed that the animal entered the cave in search of prey, such as rodents and other mammals present at the site, and eventually became trapped within the cavity.

Keywords: *Speothos*, Carnivora, Cuvieri cave, taxonomy, mammals.

INTRODUCTION

The Lagoa Santa region, in the State of Minas Gerais, eastern Brazil, stands out for its karst complex of great paleontological significance. This environment is characterized by an abundance of osteological materials that have supported numerous studies in recent years (Chahud *et al*., 2021; Fabris *et al*., 2025).

The family Canidae Gray, 1821, belonging to the order Carnivora, has its earliest fossil records from the Oligocene of North America and Europe (Wang & Rothschild, 1992; Wang *et al*., 2022), and remains present in these regions today. Currently, canids are also found in Africa, Asia, South America, and Australia, the latter likely due to introduction by the first humans who arrived in the region (Fillios & Taçon, 2016).

In Lagoa Santa, Lund (1839, 1842) identified, among the Pleistocene fossil remains from the caves of the Rio das Velhas valley, vestiges attributed to various canid species, most of which belong to recent and still extant species. Among the identified specimens, Lund (1839, 1842) recorded five species of South American canids, including the only known fossils of the genus *Speothos* (Lund, 1839; 1842; Winge, 1895; Paula Couto, 1979; Berta, 1984; Hansen, 2012; Ruiz *et al.*, 2024b). Currently, this genus is recognized by two species (Berta, 1984; Ruiz *et al.*, 2024b): one extant, *Speothos venaticus* (Lund, 1842), and one extinct, *Speothos pacivorus* (Lund, 1839).

The Cuvieri Cave, part of the Lagoa Santa karst complex, has revealed a significant volume of osteological material, providing a basis for various studies on mammal paleontology (Mayer *et al*., 2016; Chahud, 2020; Chahud *et al*., 2023a, b; Chahud & Okumura, 2021a, b, 2023). However, until now, no representative of the Canidae family had been conclusively identified in the Pleistocene deposits of the region.

This study describes two small fragmented dentaries attributed to a juvenile *Speothos*, contributing to the knowledge of this genus in the Pleistocene.

MATERIAL AND METHODS

Cuvieri Cave is predominantly horizontal, comprising three small vertical cavities designated as *Loci* 1, 2, and 3 (Figure 1), with respective depths of 16, 4, and 8 meters. The materials analyzed in this study originate from *Locus* 3 and have been dated to the Late Pleistocene (Mayer *et al*., 2016; Haddad-Martim *et al*., 2017).

In *Locus* 3, radiocarbon dating was conducted using the AMS ^{14}C technique. One of the dated faunal remains was a Tapiridae bone recovered near the excavation surface, which yielded an age range of 14,100–14,710 BP. A second specimen, a bone of *Catonyx cuvieri*, was recovered from a stratigraphic layer underlying the Tapiridae remain and yielded an age range of 14,230–15,040 BP (Haddad-Martim *et al*., 2017). The two dentaries were recovered from the same stratigraphic level and intermediate positions within *Locus* 3 of Cuvieri Cave. These specimens occur below two dated samples from *Locus* 3, which are attributed to the Late Pleistocene (Haddad-Martim *et al*., 2017); therefore, they can also be considered to belong to this period.

The fossil identification was conducted through comparisons with known specimens present in the Renato Kipnis reference collection of the Laboratory for Human Evolutionary Studies and Canidae specimens found in the Lagoa Santa region (Chahud *et al*., 2021) and consultation of specialized bibliographic references (Paula Couto, 1979; Berta, 1984; Hansen, 2012; Brandão & HingstZaher, 2021; Ruiz *et al.*, 2022, 2024a, b).

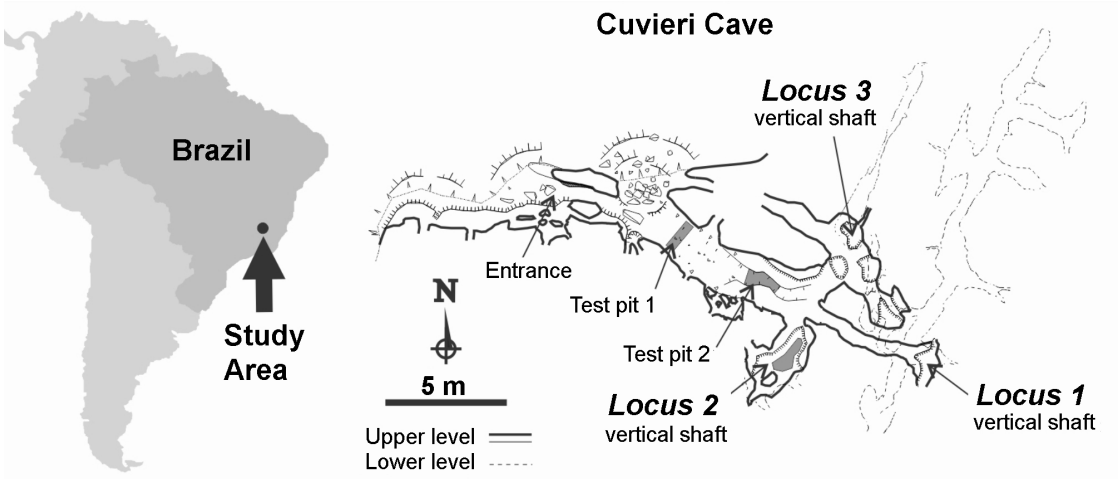

Figure 1. Geographic location of the study area and of Cuvieri Cave (UTM coordinates 23K 7846105S and 0603756E) showing the position of Loci 1, 2 and 3 (map courtesy of Alex Hubbe and Grupo Bambuí for Speleological Research).

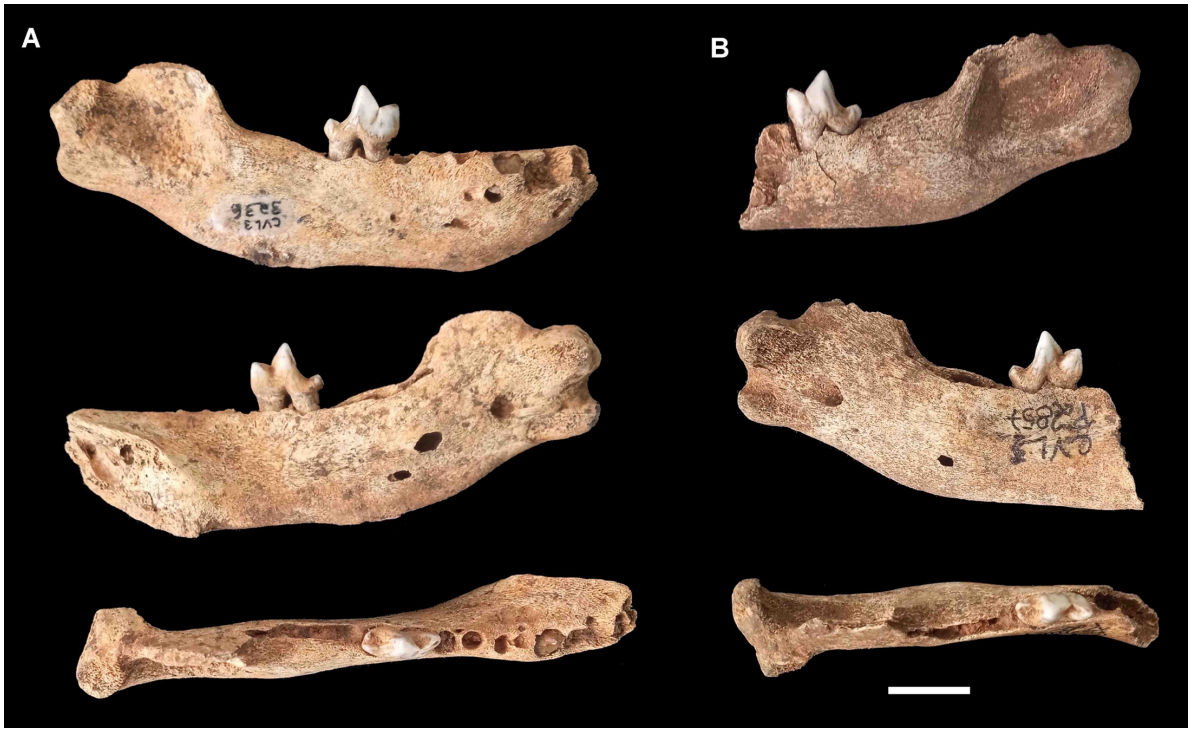

Figure 2. Dentaries of *Speothos* from Cuvieri Cave. **A**, CVL3-3236 (right). **B**, CVL3-P2857 (left). From top to bottom: external (labial) view, internal view, and occlusal view. Scale bar = 10 mm.

The two dentaries are curated at the Laboratory for Human Evolutionary Studies (LEEH) of the Department of Genetics and Evolutionary Biology at the Institute of Biosciences, University of São Paulo.

SYSTEMATIC PALEONTOLOGY

Order CARNIVORA Bowdich, 1821
Family CANIDAE Fischer, 1817

Speothos Lund, 1839

Speothos sp.
(Figure 2–3)

Material. Two fragmented dentaries (Figures 2 and 3) belonging to the same individual, CVL3-3236 (right) and CVL3-P2857 (left).

Remarks. Both dentaries preserve the first molar (m1), part of the mandibular body and ramus, including the masseteric fossa (Figure 2A–B). The morphology of the preserved portions is consistent with that observed in mandibles of the genus *Speothos*.

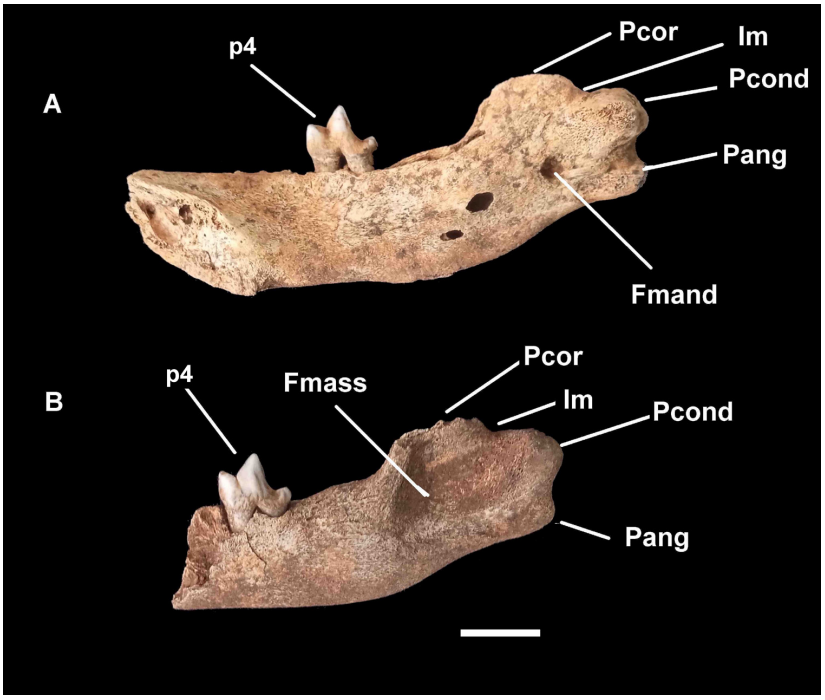

Figure 3. Dentaries of *Speothos* from Cuvieri Cave. **A**, CVL3-3236 (right). **B**, CVL3-P2857 (left). **Abbreviations: Fmand**, mandibular foramen; **Fmass**, masseteric fossa; **Im**, mandibular notch; **p4**, fourth premolar; **Pang**, angular process; **Pcond**, condylar process; **Pcor**, coronoid process. Scale bar = 10 mm.

Table 1. Tooth measurements (p4) of specimens found in Cuvieri Cave.

Specimen	Side	Width (mm)	Length (mm)
CVL3-3236	Right	3.52	8.80
CVL3-P2857	Left	3.55	8.80

The specimens exhibit prominent mandibular foramina (Figure 3A), rounded condylar processes, and relatively small angular processes. The mental foramen is preserved only in dentaries CVL3-3236 and is located below the alveoli of premolars p2 and p3.

The first molar (m1) is absent in both specimens, as is its alveolar socket, indicating that it had not yet erupted, characterizing a juvenile individual.

In both specimens, the coronoid process is only partially preserved (Figure 3), having fractured during fossilization while still within the cave. In right dentary CVL3-3236, the masseteric fossa is worn, and little remains of the condylar and angular processes (Figure 3A). In left dentary CVL3-P2857, the masseteric fossa is more prominent (Figure 3B), although the anterior portion of the structure was not preserved. The tooth measurements are in Table 1.

DISCUSSION

The absence of the first molar (m1) in both specimens suggests that the individual was juvenile. However, the masseteric fossa extends close to the fourth premolar (p4), aligning with the expected position of m1, a characteristic also observed in other *Speothos* specimens, both extant and extinct (Berta, 1984; Hansen, 2012; Brandão & HingstZaher, 2021; Chahud *et al*., 2021; Ruiz *et al.*, 2022, 2024a, b).

The observed teeth exhibit the paraconid, hypoconid, and protoconid in positions consistent with those expected for a molar m1 of *Speothos*, and they differ morphologically from other South American canids (Berta, 1984; Brandão & HingstZaher, 2021; Ruiz *et al.*, 2022; Lang & Martin, 2024).

The morphology of the mandible, proportionally shorter and deeper than that of other South American canids, supports its attribution to the genus *Speothos* (Berta, 1984; Brandão & HingstZaher, 2021; Ruiz *et al.*, 2022, 2024a, b). Additionally, the analyzed dentaries are less robust compared to extant specimens, resembling the extinct species *S. pacivorus* (Berta, 1984; Ruiz *et al*., 2022, 2024a). According to Ruiz *et al*. (2024a), modern *Speothos* specimens exhibit proportionally deeper mandibles than those of *S. pacivorus*, thereby aligning the Cuvieri Cave specimen more closely with the extinct species. However, the fragmentation of the remains and the juvenile condition of the individual may influence this comparison. Therefore, a parsimonious identification was made, assigning the specimen to *Speothos* sp.

The size and proportions of the two dentaries, together with their occurrence at the same stratigraphic level, indicate that they belonged to the same individual. However, the absence of other skeletal elements suggests that these dentaries represent residual remains resulting from prolonged exposure or reworking. This pattern is consistent with expectations for skeletal elements that are more resistant to transport or reworking, as mandibles and skulls tend to be among the last elements to be remobilized (Voorhies, 1969).

Associated fauna

Despite the remobilization of bone material, various mammals were found in the same stratigraphic level as the analyzed dentaries. Among the identified specimens, fossil remains of small rodents, marsupials, xenarthrans, and large rodents such as *Cuniculus paca* (extant paca), *C. rugiceps* (extinct paca), and *Dasyprocta* sp. were prominent (Mayer *et al*., 2016; Takahashi & Chahud, 2024, 2025), as well as undetermined representatives of Tayassuidae and Tapiridae (Chahud *et al*., 2023a, b).

Large rodents, such as *Cuniculus paca* and *Dasyprocta* sp., are common prey of *Speothos* today. Their frequent occurrence in Cuvieri Cave suggests that the analyzed individual may have been drawn into the cave while pursuing prey. Additionally, remains of extinct megafauna, including ground sloths, were identified (Haddad-Martim *et al*., 2017).

FINAL CONSIDERATIONS

The evidence suggests that the two dentaries belonged to the same individual, which underwent disarticulation and significant remobilization within Cuvieri Cave. The material corresponds to a juvenile *Speothos* individual, whose first molar had not yet erupted.

Canid representatives have been previously recorded in other studies, although occurrences of *Speothos* are relatively rare. The analyzed individual coexisted with species such as *Cuniculus paca*, *C. rugiceps*, *Dasyprocta* sp., Tayassuidae, and Xenarthra and microvertebrates. The exact reason for the animal's entry into the cave remains uncertain, but it was likely drawn in by potential prey present at the site.

DATA AVAILABILITY STATEMENT

The data supporting this study's findings are available from the corresponding author upon reasonable request.

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AUTHOR CONTRIBUTIONS

Artur Chahud: writing – original draft, editing; visualization, investigation, formal analysis, software, resources, methodology, data curation, conceptualization.

DECLARATION OF AI USE

We have not used AI-assisted technologies to create, review, or any part of this article.

ETHICS

This work did not require ethical approval, collecting licenses, or previous authorizations.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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