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The northernmost record of *Catagonus stenocephalus* (Lund in Reinhardt, 1880) (Mammalia, Cetartiodactyla) and its palaeoenvironmental and palaeobiogeographical significance

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ABSTRACT

During fieldwork carried out in January 2009 at Aurora do Tocantins (Tocantins State, northern Brazil), we recovered a fragmentary right maxilla (UNIRIO-PM 1006) of *Catagonus stenocephalus* from a sedimentary deposit of presumed late Pleistocene age in a karstic cave. This paper aims to: (1) provide the first record of *C. stenocephalus* in the northern region of Brazil (and consequently, also the northernmost one); (2) update the geographic distribution of *C. stenocephalus*; (3) present a date for the specimen; and (4) discuss the palaeoenvironmental and palaeobiogeographical implications of the finding. The species *C. stenocephalus* (Lund) is known from the Bonaerian (middle Pleistocene) and Lujanian (late Pleistocene to earliest Holocene) ages in Argentina, Uruguay, Brazil and Bolivia. The new record presented here extends the geographical distribution of *C. stenocephalus* more than 1000 km north from the former northernmost record (caves of Lagoa Santa region). Peccaries of the genus *Catagonus* have several morphological features associated with cursorial habits in relatively open and dry environments. The new distributional range of *C. stenocephalus* is coincident with the Chacoan subregion, characterized by dry climates and open areas. As the studied material comes from the top of the carbonate layer, this may suggest that the deposition of the *C. stenocephalus* remains described here is synchronous with the onset of a wetter climate phase. This argument is also in accordance with the datation results, around 20 ky BP, just after the last glacial maximum. This increasingly wet climate, which may also be related to the climatic changes that occurred during the late Pleistocene/early Holocene, could be a factor in the extinction of *C. stenocephalus* in South America.

Abbreviations: Dental terminology: PM1, first upper premolar; PM2, second upper premolar; PM3, third upper premolar; PM4, fourth upper premolar; Measurements: LPM2, maximum mesio-distal length of the second upper premolar; APM2, maximum labio-lingual width of second upper premolar; LPM3, maximum mesio-distal length of third upper premolar; APM3, maximum labio-ligual width of third upper premolar; LPM4, maximum mesio-distal length of fourth upper premolar; APM4, maximum labio-lingual width of fourth upper premolar. Institutions; MACN, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"; Buenos Aires, Argentina; MACN-S, Museo de Arqueología y Ciencias Naturales de Salto, Uruguay; MCA, Museo Municipal de Ciencias Naturales "Carlos Ameghino"; Mercedes, Argentina; MCPU-PV, Museu de Ciencias da PUCRS; Geology and Palaeontology Laboratory, Uruguaiana, Brazil; MMP, Museo Municipal de Ciencias Naturales de Mar del Plata "Lorenzo Scaglia" Argentina; MNPA-V, Museo Nacional de Paleontología y Antropología, Tarija, Bolivia; UFPR PV, Departamento de Geología, Universidade Federal do Paraná, Curitiba; PR, Brazil; ZMK, Zoologisk Museum; Copenhagen, Denmark.

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1. Introduction

The rise of the Panamanian Isthmus, dated around 3 Ma before present, resulted in an overland connection between the Americas (Webb, 1985; Woodburne, 2010). This intercontinental "land bridge" opened a two-way migration route between South and North America where the biota dispersed. This biogeographic event, the Great American Biotic Interchange (GABI), heavily influenced the evolution and composition of the Quaternary-Recent mammalian fauna of the Americas (Jones and Hasson, 1985; Stehli and Webb, 1985; Woodburne, 2010).

The Tayassuidae (Mammalia, Cetartiodactyla) represent one of the first mammalian clades that entered South America during the GABI (Webb, 1991; Prevosti et al., 2006; Woodburne et al., 2006; Gasparini, 2010; Woodburne, 2010). The exact timing of their arrival in South America is controversial, however, with some authors placing it in the late Miocene (see Campbell, 2010; Campbell et al., 2010) and others in the middle Pliocene (Gasparini and Ubilla, 2011; Gasparini, 2011).

According to Gasparini (2007), the South American Tayassuidae includes three genera: *Platygonus* Le Conte, 1848 (middle Pliocene to early Pleistocene) with five species; *Tayassu* Fischer, 1814 (middle Pleistocene to Recent) with two extant species; and, *Catagonus* Ameghino, 1904 (late Pliocene? to Recent) with five species (four extinct and one extant).

The family has an extensive fossil record in South America and has been found in sediments exposed in Argentina, Brazil, Uruguay, Bolivia, Colombia, and Peru (Stirton, 1947; Paula Couto, 1975, 1981; Ubilla, 2004; Ubilla et al., 2004; Gasparini et al., 2009a,b, 2010a; Campbell, 2010; Campbell et al., 2010; Gasparini and Ubilla, 2011; Gasparini, 2011).

In Brazil, tayassuids are represented by two genera: *Tayassu* [*T. pecari* (Link, 1795) and *T. tajacu* (Linnaeus, 1758)] and *Catagonus* [*C. stenocephalus* (Lund in Reinhardt, 1880)]. The species *C. stenocephalus* is known from the southern [Rio Grande do Sul (Gasparini et al., 2009a); possibly in Paraná (Dias da Silva et al., 2010)] and southeastern [Minas Gerais (Fonseca, 1979; Paula Couto, 1975, 1981)] regions of Brazil.

The South American tayassuids experienced a remarkable decrease (~75%) in their diversity near the Pleistocene-Holocene boundary (Gasparini, 2007; Gasparini, 2011). Only two genera (*Catagonus* and *Tayassu*) and three species survived this boundary. Living members are widely distributed throughout the Americas, from the southwestern United States to north-central Argentina (Gasparini et al., 2006).

During fieldwork carried out in January 2009 at Aurora do Tocantins (Tocantins State, northern Brazil, Fig. 1), we recovered a fragmentary right maxilla (UNIRIO-PM 1006, Fig. 2A–C) of *Catagonus stenocephalus* from a sedimentary deposit of presumed late Pleistocene age in a karstic cave (see Locality, Geology and Age).

This paper aims to: (1) provide the first record of *C. stenocephalus* in the northern region of Brazil (and consequently, also the northernmost in South America); (2) revise the geographic distribution of *C. stenocephalus*; (3) present a date for the specimen; and (4) discuss the palaeoenvironmental and palaeobiogeographical implications of the finding.

2. Locality, geology and age

The specimen under study comes from a thick carbonate deposit in the main room of a limestone cave, Gruta dos Moura, at Aurora de Tocantins (12°42′47″ S and 46°24′28″ W), Tocantins State, northern Brazil (Fig. 1). Access to the plateaus occurs mainly through vicinal roads and paths that cut the vegetation. Currently, the region is situated mainly within the Cerrado biome.

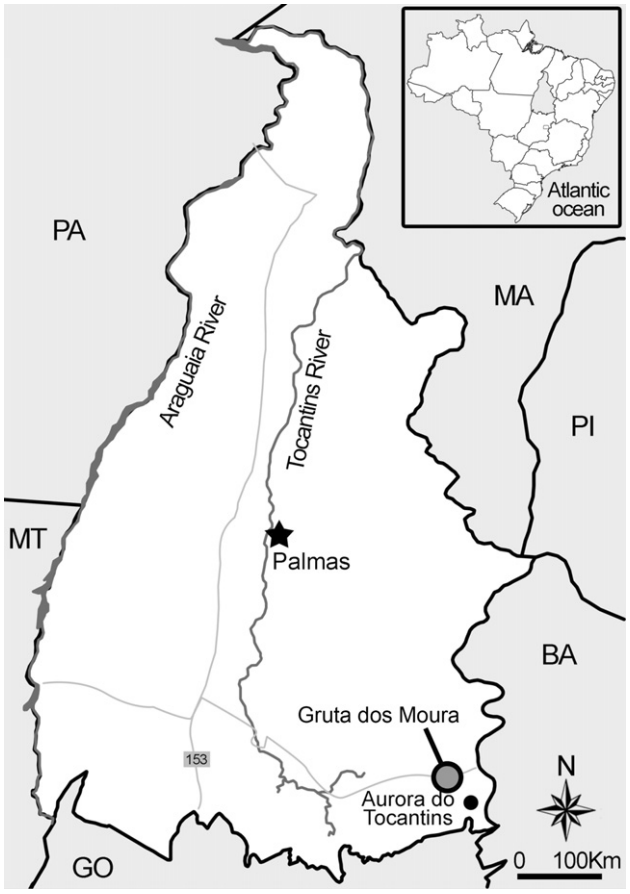

Fig. 1. Location map. At the right top corner, the map of Brazil showing Tocantins state in gray, and the larger map shows Tocantins State in white, emphasizing the study area (12°42′47″ S/46°24′28″ W).

The carbonate rocks in the region of Aurora do Tocantins constitute part of the Speleological Province of the Bambuí Group, where a large number of caves have been found (Zampaulo and Ferreira, 2009). The geology of the study area is still poorly understood. The predominant rocks in the region are rhythmic limestones and siltstones from the Paraopeba Subgroup of Neoproterozoic age, although alluvial deposits might occur locally (Dardene, 1978; Dardene and Walde, 1979).

Online notes from the Serviço Geológico do Brasil (CPRM, 2006) on the geology of the municipality of Aurora de Tocantins report carbonates and terrigenous deposits. The lower portion is represented by the Sete Lagoas Formation, which is composed of thick deposits of mudstones, limestone and dolomites, and siltstone of the Serra de Santa Helena Formation. This carbonate-terrigenous conjunction of rocks is superimposed by dark calcarenites and marls, with organic material from the Lagoa do Jacaré Formation. Superimposed over the Bambuí Group are the Cretaceous sediments of the Urucuia Formation. The cave Gruta dos Moura, as well as other caves in the region, was developed mainly in the limestones of Lagoa do Jacaré Formation, that consist in slightly weathered dark gray metacalcarenites, massive or with horizontal lamination, with sparry calcite (generally in veins), micritic calcite, ooids and small amounts of silica. Interbedded metacalcarenites, mudstones and calcilutites can also occur.

The limestones often form plateaus that rise from the rest of the terrain and comprise a partially active karst system. Most caves occur above the ground level in high portions of the plateaus. The caves originated during a period of formation of karst relief in