

## First record of *Chaetophractus villosus* (Mammalia, Dasypodidae) in the late Pleistocene of Corrientes Province (Argentina)

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**ABSTRACT.** *Chaetophractus villosus* is recorded from the Chapadmalalian (middle Pliocene) to present. This species shows one of the widest distributions of living dasypodids, but its current and past ranges do not include the provinces of the argentinean Mesopotamia (Entre Ríos, Corrientes and Misiones Provinces). We report the first record of *Chaetophractus villosus* in the Quaternary of Corrientes Province. These Quaternary deposits are exposed along the banks of the Paraná River and are represented by two successive upper Pleistocene formations: the Toropí Formation and Yupoí Formation. During the Pleistocene the southern end of South America has experienced climatic fluctuations, with alternations of short humid and warm periods and arid/semiarid and cold periods, leading to contraction or expansion of the biota from neighboring areas. The presence of *Chaetophractus villosus* in the late Pleistocene of argentinean Mesopotamia provides new evidence of periods with more arid and colder climatic conditions than the present.

**Key words:** *armadillos, paleoclimates, Quaternary, Xenarthra, Mesopotamian region.*

**RESUMEN.** Primer registro de *Chaetophractus villosus* (Mammalia, Dasypodidae) en el Pleistoceno tardío de la provincia de Corrientes

(Argentina). *Chaetophractus villosus* se registra desde el Chapadmalalense (Plioceno medio) a la actualidad. Esta especie muestra una de las distribuciones más amplias entre los dasipódidos vivos, pero sus rangos de distribución actuales y pasados no incluyen a las provincias de la Mesopotamia argentina (Entre Ríos, Corrientes y Misiones). En la presente contribución damos a conocer el primer registro de *Chaetophractus villosus* en el Cuaternario de la provincia de Corrientes. Estos depósitos cuaternarios están expuestos a lo largo de las orillas del río Paraná y están representados por dos formaciones sucesivas asignadas al Pleistoceno superior: la Formación Toropí y la Formación Yupoi. Durante el Pleistoceno el extremo sur de América del Sur ha experimentado fluctuaciones climáticas, con la alternancia de cortos períodos húmedos y cálidos y períodos áridos/semiáridos y fríos, lo que llevó a la retracción o expansión de las biotas de áreas vecinas. La presencia de *Chaetophractus villosus* en el Pleistoceno tardío de la Mesopotamia argentina proporciona una nueva evidencia de la existencia de períodos con condiciones climáticas más áridas y frías que en la actualidad.

**Palabras clave:** *armadillos, paleoclimas, Cuaternario, Xenarthra, región Mesopotámica.*

## Introduction

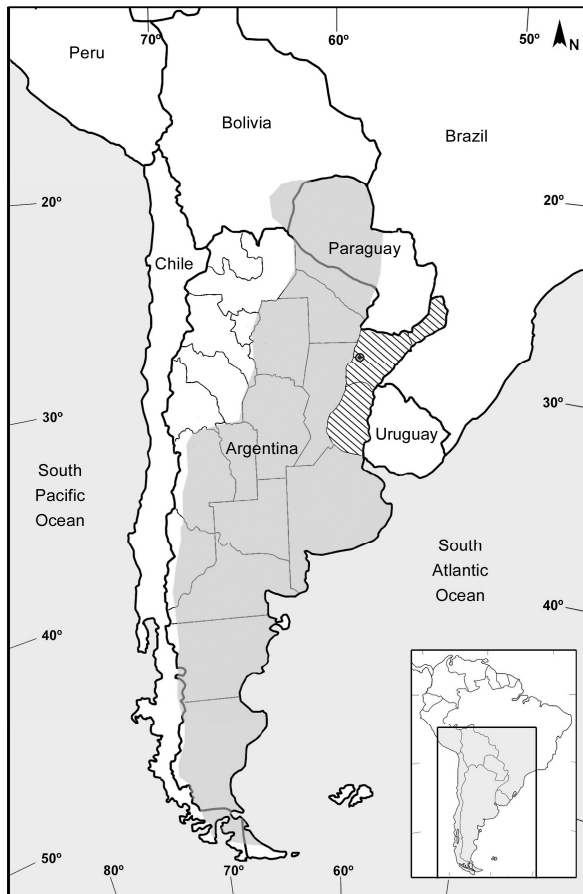
The armadillos (Cingulata, Dasypodidae) are the xenarthrans with the greatest temporal and geographic distribution (Krpmotic *et al.* 2009a and references therein). Currently in Argentina they are represented by eight genera and 21 species (Wetzel 1982, 1985, Nowak 1999, Parera 2002), divided in three subfamilies (Euphractinae, Dasypodinae, and Tolypeutinae; McKenna & Bell 1997). The Euphractinae are represented by three genera exclusively from South America: *Chaetophractus*, *Euphractus* y *Zaedyus*. *Chaetophractus* includes four nominal species: three extant species, *C. villosus* (Desmarest 1804), *C. vellerosus* (Gray 1865), and *C. nationi* (Thomas 1894); and one is extinct, *C. tarijensis* (Ameghino 1902). *Euphractus* includes a unique species, *Euphractus sexcinctus* (Linnaeus 1758).

The Corrientes Province composes, together with Misiones and Entre Ríos Provinces, the Mesopotamian region (Figure 1), which (except for the extreme north of Misiones) is delimited by the Paraná and Uruguay rivers (Herbst & Santa Cruz 1999). Currently the Euphractinae diversity in this region includes only *Euphractus sexcinctus*, while, until the present contribution, in the quaternary of the above-mentioned region, the Euphractinae were represented by *Euphractus* aff. *sexcinctus* (Francia *et al.* 2010) and *Eutatus seguini* (Ferrero & Noriega 2009).

The Corrientes Province encompasses an area of approximately 88,000 km<sup>2</sup>; the Quaternary deposits are exposed along the banks of Paraná River and are represented by two successive formations (Herbst & Álvarez 1977, Herbst & Santa Cruz 1999) of the late Pleistocene. Recently it was tried to obtain absolute dates for this units in study, the first dating OSL made in the area of Arroyo Toropí were dated between ca. 50,000-35,000 yBP for the Toropí-Yupoi sequence (Tonni *et al.* 2005), recalibrated in ca. 52,000-36,000 yBP (OIS 3) (Francia *et al.*

2012b). Nevertheless, the last OSL dating performed in the same area, gave ages between ca. 98,400 - 131,600 yBP (OIS 5) for the same sequence (Francia et al. 2012b).

In this contribution we report the first record of *Chaetophractus villosus* in the Quaternary of Corrientes Province (Fig. 1), particularly in the late Pleistocene, based on one osteoderm of the pelvic buckler and discuss their presence from a paleoenvironmental point of view. In addition, it compares the external morphology of the osteoderms of *Chaetophractus villosus* with those of other congeneric species and *Euphractus sexcinctus*.



**Figure 1.** Map with the current distribution of *Chaetophractus villosus* (shaded zone) and Mesopotamian region (striped zone); the black dot indicates the record of CTES-PZ 7568 in the late Pleistocene of Corrientes Province.

## Material and methods

The specimen under study is housed at the collection of Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Corrientes, Argentina. For the identification we used carapaces of the extant species *Chaetophractus vellerosus* (AAC 166, AAC 167, AAC 168, AAC169, AAC 170), *C. villosus* (AAC 98, AAC 100, AAC 105, AAC 106, AAC 122), *C. nationi* (CML 7079) and *Euphractus sexcinctus* (AAC 183, AAC 184), besides of specific literature (Scillato-Yané 1982, Soibelzon *et al.* 2006, 2010, 2012, Krmpotic *et al.* 2009a).

## Abbreviations

**AAC**, Colección Alfredo A. Carlini at Museo de La Plata (La Plata, Argentina); **CTES-PZ**, Colección Paleozoología Corrientes, Facultad de Ciencias Exactas y Naturales y Agrimensura,

Universidad Nacional del Nordeste (Corrientes, Argentina); **CML** Colección Mamíferos Lillo, (Tucumán, Argentina) **OSL**, Optically Stimulated Luminescence; **ca.**, *circa*; **yBP**, years before present (before 1950 by convention); **OIS**, Oxygen Isotope Stages.

### Systematic Paleontology

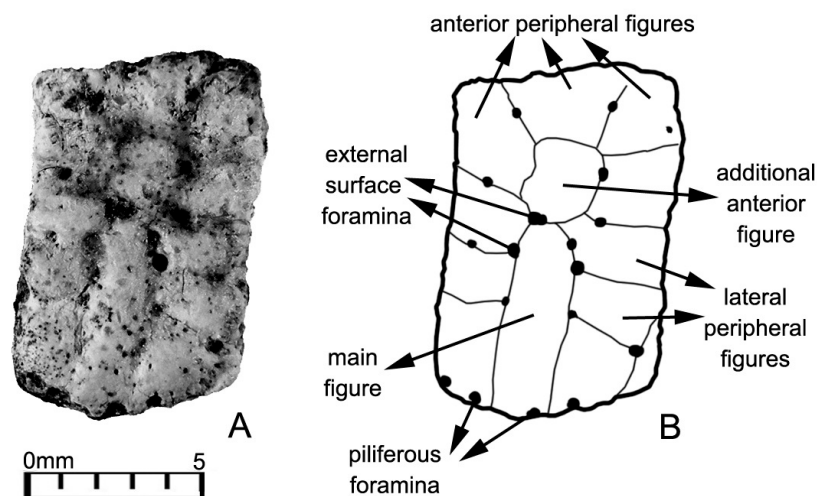
Class MAMMALIA Linnaeus, 1758  
 Superorder XENARTHRA Cope, 1889  
 Order CINGULATA Illiger, 1811  
 Family DASYPODIDAE Gray, 1821  
 Subfamily EUPHRACTINAE Winge, 1923  
 Tribe EUPHRACTINI Winge, 1923  
 Genera *Chaetophractus* Fitzinger, 1871

**Type Species:** *Chaetophractus villosus* (Desmarest, 1804) Fitzinger, 1871  
*Chaetophractus villosus* (Desmarest, 1804)

**Referred Material:** (CTES-PZ 7568) one osteoderm of the pelvic buckler (Fig. 2A).

**Stratigraphic and geographic provenance:** The material assigned to *Chaetophractus villosus* comes from sediments of the Toropí Fm. (late Pleistocene) in the area of Arroyo Toropí (28°36' S and 59°02' W), Bella Vista Department, Corrientes Province.

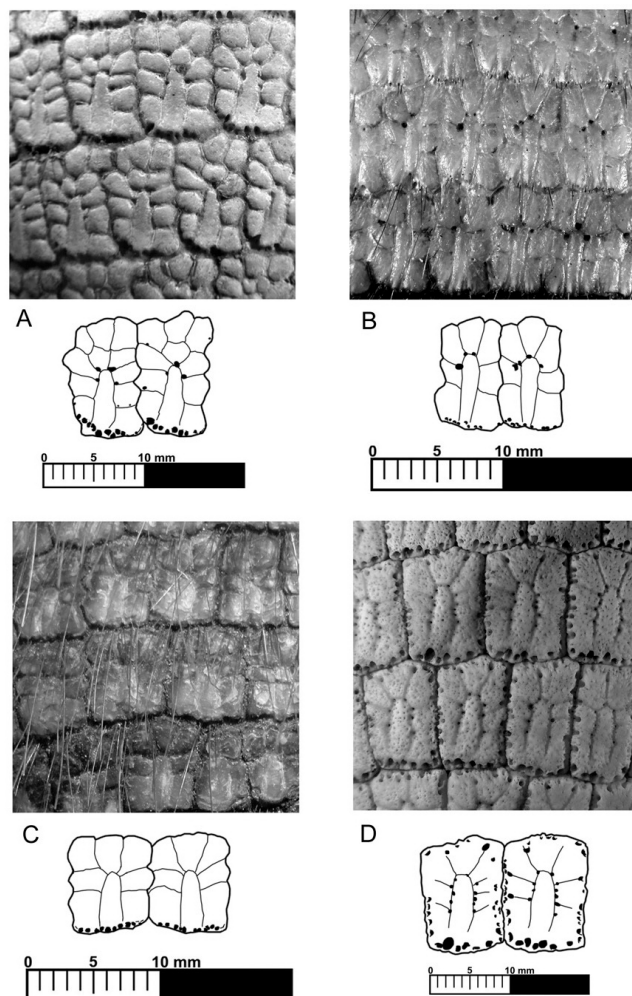
**Description:** the osteoderm has in the external surface an elongated main figure, bordered by small anterior and lateral peripheral figures. The main figure occupies the posterior two thirds of the osteoderm and is surrounded by small foramina that correspond to the aperture of glandular cavities (Krmptić *et al.* 2009a). Parallel to the main figure there are three lateral peripheral figures on each side. Anteriorly to the main figure there are four anterior peripheral figures occupying the anterior and antero-lateral borders, and there is an additional anterior figure between this figures and the main figure (Fig. 2B). The posterior border of the osteoderm bears four small piliferous foramina. The rectangular shape of the osteoderm indicates that it belongs to the pelvic buckler. Moreover, the presence of two rows of anterior peripheral figures is characteristic, and exclusive, of pelvic buckler osteoderms of *Chaetophractus villosus* (Fig. 3A). The orientation of the main figure (inclined towards the left) indicates that it corresponds to an osteoderm from the left lateral of the carapace.



**Figure 2.** A. Osteoderm of *Chaetophractus villosus* (CTES-PZ 7568), B. linear representation of the same osteoderm, showing external structures mentioned in the text.

**Comparative description:** The osteoderms of the pelvic buckler of *Chaetophractus* (Figs. 3A-C) are characterized by its convex figures, bounded by deep sulci, and also by having piliferous foramina restricted to the posterior border, although there may be one or two on the lateral edges in the posterior-most portion. The osteoderms equivalent in *Euphractus sexcinctus* (Fig. 3D) have flat figures, poorly delimited by shallow sulci (Scillato-Yane 1982, Soibelzon *et al.* 2012), and their piliferous foramina are spread on the posterior border, the lateral margins and even in the anterior border. In addition, the osteoderms of *Euphractus sexcinctus* are distinguishable from those of *Chaetophractus*, by its greater size, although there may be some overlap in size with *Ch. villosus*.

The osteoderms of all three extant species of *Chaetophractus* are morphologically similar, but there are some characters that differentiate *C. villosus* from the others. A noticeable feature is the size: the osteoderms (from homologous zones of the carapace) in *Chaetophractus vellerosus* (Fig. 3B) and *C. nationi* (Fig. 3C) are about 20% smaller than *C. villosus*. Also, the osteoderms from the pelvic buckler of *Chaetophractus villosus* present one or two additional anterior figures in front of the main figure (Scillato-Yané 1982), a character absent in the other two living species of the genus. With respect to the extinct *Chaetophractus tarijensis*, the holotype corresponds only to cranial remains, precluding the comparisons with that species.



**Figure 3.** Pelvic buckler portion and linear representation of two pelvic buckler osteoderms of: A. *Chaetophractus villosus* (AAC 122), B. *C. vellerosus* (AAC 169), C. *C. nationi* (CML 7079), and D. *Euphractus sexcinctus* (AAC 183).

**Comments:** *ChaetophRACTUS villosus* is recorded from the Chapadmalalian (middle Pliocene; Scillato-Yané 1982, Carlini & Scillato-Yané 1999, Soibelzon *et al.* 2006) to present. Also, this species shows one of the widest distributions among living dasypodids (Wetzel 1982, Nowak 1991, Redford & Eisenberg 1992, Wilson & Reeder 1993), extended from the Gran Chaco of Bolivia and Paraguay to the South of Santa Cruz Province in Argentina, and Bío-bío and Magallanes Provinces in Chile (Azize Atallah 1975, Wetzel 1982, Redford & Eisenberg 1992) (Fig. 1). In Argentina, its distribution is known from Salta (Mares *et al.* 1981) and Chaco Provinces, descending towards the south as a central strip that expands at the level of Santa Fe and Córdoba Provinces, extending almost to the Andean foothills in Mendoza Province and the Atlantic coast in Buenos Aires Province and reaching the extreme south of the extra-Andean Argentinean Patagonia (Parera 2002, Soibelzon *et al.* 2010). Recently, it was reported in Tierra del Fuego Province related to human introduction (Poljak *et al.* 2007).

### Discussion

The genus *ChaetophRACTUS* usually occupies open areas and is well adapted to semidesertic conditions (Nowak 1991). Otherwise, among the Dasypodidae represented in Argentina, *ChaetophRACTUS villosus* is the most widespread species, living in a variety of environments, with diverse climatic conditions and food resources (Gardner 2005). However, the distribution known by the present does not include the provinces of the Argentinean Mesopotamia (Parera 2002, Abba & Vizcaíno 2008); it was only referred doubtfully to Entre Ríos Province (see Bárquez *et al.* 2006, Abba & Vizcaíno 2008, Abba *et al.* 2012 and references therein).

From a paleozoogeographic and zoogeographic point of view, the record of *ChaetophRACTUS villosus* in the late Pleistocene of Corrientes Province evidences variations on its past and present distributions. Similar situation, it was proposed for *ChaetophRACTUS vellerosus*, in which its current disjunctive distribution is a relict of a greater distribution during the late Pleistocene–early Holocene (Carlini & Vizcaíno 1987, Soibelzon *et al.* 2006).

The armadillos are considered good environmental indicators, and the analysis of their records leads to inferences regarding climatic and environmental changes in part of the Quaternary (Vizcaíno & Bargo 1993, Krmpotic *et al.* 2009a and b). *ChaetophRACTUS villosus* is one of the armadillos with the widest range of habitats, but it seems to prefer open grassland environments (Soibelzon *et al.* 2012, Abba *et al.* 2012 and references therein). According to Tonni (1985) in the oriental sector of Tandilia and intermontane area, the association of *ChaetophRACTUS villosus* and *Zaedyus pichiy*, which characterizes the early and late Holocene, responds to arid/semiarid conditions.

To summarize, the presence of *ChaetophRACTUS villosus* gives new evidence to support the occurrence of climatic fluctuations during the late Pleistocene in the Mesopotamian region (Erra *et al.* 2013), with possible alternations of short humid and warm periods with arid/semiarid and cold periods, leading to the retraction or the expansion of the biota from neighboring areas. These conditions are congruent with the scenario proposed for the OIS 3 (ca. 65,000–28,000 yBP) (Iriondo 1999). In the faunistic assemblage recorded in the late Pleistocene of Corrientes Province, there are other taxa currently absent in the area [e.g. *Dolichotis*, see Álvarez (1974) and *Galea*, see Francia *et al.* (2012a)], showing faunistic differences in the Mesopotamian region during the late Pleistocene and the present. Similar scenarios were also recorded in close geographic areas (see Ubilla *et al.* 2008, Kerber *et al.* 2011a and b, Soibelzon *et al.* 2012).

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