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Systematic palaeontology (Vertebrate palaeontology)

First record and description of an exceptional unborn specimen of Cingulata Glyptodontidae: *Glyptodon* Owen (Xenarthra)

Alfredo Eduardo Zurita [a,*], Angel R. Miño-Boilini [a], Esteban Soibelzon [b], Gustavo J. Scillato-Yané [b], Germán M. Gasparini [b], Freddy Paredes-Ríos [c]

[a] *Centro de Ecología Aplicada del Litoral (CECOAL-CONICET) and Universidad Nacional del Nordeste Ruta 5, km. 2.5, 3400 Corrientes, Argentina*
[b] *División Paleontología de Vertebrados, Museo de La Plata, Facultad de Ciencias Naturales y Museo, Paseo del Bosque s/n°, 1900 La Plata, Argentina*
[c] *Museo Nacional Paleontológico-Arqueológico, Universidad Autónoma Juan Misael Saracho, calle General Trigo 402, casilla 51, Tarija, Bolivia*

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Abstract

In this article, we report the first finding and description of an unborn specimen of Cingulata Glyptodontidae. This specimen was found inside a well-preserved dorsal carapace assignable to *Glyptodon* cf. *G. elongatus*, partially articulated and located in the pelvic portion. It was exhumed from the Pleistocene sediments of Monte Cercado city, Tarija Valley (Bolivia), and it consists of, mainly, a partial skull, a mandible with some molariforms (m4-m8), the distal half of both scapulae, the diaphysis of both femora and other undetermined remains. From an anatomical viewpoint, the presence in this specimen of some characters, especially in the skull, that are very similar to those present in fully developed individuals (i.e. subtriangular outline of the narial aperture) is remarkable; however, the ascending ramus of the mandible describes an angle close to 90° with respect to the horizontal ramus. The only previous mention of an unborn Glyptodontidae comes also from Tarija Valley, but that material is lost. ***To cite this article: A.E. Zurita et al., C. R. Palevol 8 (2009).***

Résumé

Première mention et description d'un specimen exceptionnel non-né de Cingulata Glyptodontidae: *Glyptodon* Owen (Xenarthra). Dans cet article, nous rapportons les premières découvertes et descriptions d'un specimen non-né de Cingulata Glyptodontidae. Ce spécimen a été trouvé dans une carapace dorsale bien préservée attribuable à *Glyptodon* cf. *G. elongatus,* partiellement articulé et localisé dans la région pelvienne. Il a été exhumé de sédiments pléistocènes de la ville de Monte Cercado, Vallée de Tarija (Bolivie) et consiste principalement en un crâne partiel, une mandibule avec quelques molariformes (m4-m8), la moitié distale des deux scapulas, la dyaphyse des deux fémurs et d'autres restes indéterminés. D'un point de vue anatomique, la présence, dans ce spécimen, et particulièrement dans le crâne, de caractères très semblables à ceux que l'on observe dans des individus complètement développés (i.e. le contour subtriangulaire de l'ouverture nariale) est remarquable ; cependant, la branche ascendante

* Corresponding author.
E-mail address: azurita@cecoal.com.ar (A.E. Zurita).

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de la mandibule décrit un angle proche de 90° par rapport à la branche horizontale. L'unique autre mention d'un Glyptodontidae non-né provient également de la vallée de Tarija, mais ce matériel a été perdu. ***Pour citer cet article : A.E. Zurita et al., C. R. Palevol 8 (2009).***

Keywords: Bolivia; Tarija Valley; Pleistocene; Anatomy; Unborn; *Glyptodon* Owen

Mots clés : Bolivie ; Vallée de Tarija ; Pléistocène ; Anatomie ; Embryon ; *Glyptodon* Owen

1. Abbreviations

CORD-PZ Córdoba Paleozoología, Museo de Paleontología de la Universidad Nacional de Córdoba, Córdoba, Argentina

LIL-PZ Paleontología Vertebrados Lillo, Facultad de Ciencias Naturales e Instituto "Miguel Lillo". Universidad Nacional de Tucumán, San Miguel de Tucumán, Argentina

MACN Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (Buenos Aires, Argentina)

MLP División Paleontología Vertebrados, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Buenos Aires, Argentina

MMP Museo Municipal de Ciencias Naturales de Mar del Plata "Lorenzo Scaglia", Buenos Aires, Argentina

MCA Museo de Ciencias Naturales "Carlos Ameghino" (Mercedes, Buenos Aires, Argentina)

MNPA-v Museo Nacional Paleontológico-Arqueológico (Tarija, Bolivia)

m lower molariforms; all measurements are in milimetres

2. Introduction

Within the framework of the knowledge of the fossil Xenarthra (Mammalia) from the Pleistocene (ca. 2.6–0.011 Ma sensu [13]), the works about or mentions of unborn, newborn or juvenile specimens are very scarce. However, the occurrence of juvenile specimens in paleontological collections is relatively frequent, especially regarding the Cingulata Glyptodontidae and Tardigrada Mylodontidae and Megatheriidae (e.g. MACN 1840, 2288, 2345, 8618, 10826, 10834, 10880, 17637; MLP 04-V-2-176, 04-V-2-177, 2-61 "ex-type" of *Megatherium silenum* [3]; 228 MMP S, 218 S, 433 S; LIL-Pz 1478, 1479).

In this context, Rusconi [18] was one of the first authors to carry out a brief but interesting contribution on juvenile individuals belonging to the genus *Scelidotherium* Owen (Phyllophaga, Scelidotheriinae), exhumed from the Ensenadan Stage of "Toscas del Río de La Plata" (Early Pleistocene, ca. 1.07–0.98 Ma; [19,21]), Buenos Aires, Argentina. Cartelle [9] mentioned the presence of a fossilized embryo of the Nothrotheriinae *Nothrotherium maquinense* (Lund), coming from the Late Pleistocene of Minas Gerais, Brazil; although he did not contribute significant data about this material.

Later, Tonni et al. [23] mentioned and illustrated an unborn or newborn specimen of *Mylodon* Owen (Phyllophaga, Mylodontidae) coming from the Latest Pleistocene–Early Holocene (ca. 13–10 ka) of the "Cueva del Mylodon" in southern Chile.

Finally, Cartelle and De Iuliis [10] studied the ontogeny of *Eremotherium laurillardi* (Lund) (Phyllophaga, Megatheriinae), providing valuable information, mainly related to the changes occurring in the teeth and cranial sutures.

The goal of this article is to present the first record and description of an unborn specimen of Cingulata Glyptodontidae, assigned to the genus *Glyptodon* Owen. This specimen comes from outcrops of Monte Cercado locality (21° 28' S and 64° 43' W), Tarija Valley, Bolivia (Pleistocene) (Fig. 1).

The material described here was found inside the dorsal carapace of a large specimen (F.P.R. pers. obs) clearly assignable to the genus *Glyptodon* (Section 4). Taking into account the good state of preservation of the dorsal carapace (which suggests the latter did not undergo significant post-mortem transportation), and considering that the specimen described here was found partially articulated inside the larger one, in the pelvic region, clearly suggests that the specimen is an unborn individual.

In this context, it is noteworthy that the only previous mention of an unborn Glyptodontidae individual corresponds also to materials from Tarija Valley, Bolivia. This earlier record was reported within a series of systematic studies on the fossil Pleistocene mammals of the Tarija Valley by Takai et al. ([22], p. 71]), who made a very brief comment about the finding of "*pequeños huesillos como así de rosetas y de espinas caudales diminutas en el interior de la coraza, piezas asociadas con los restos*

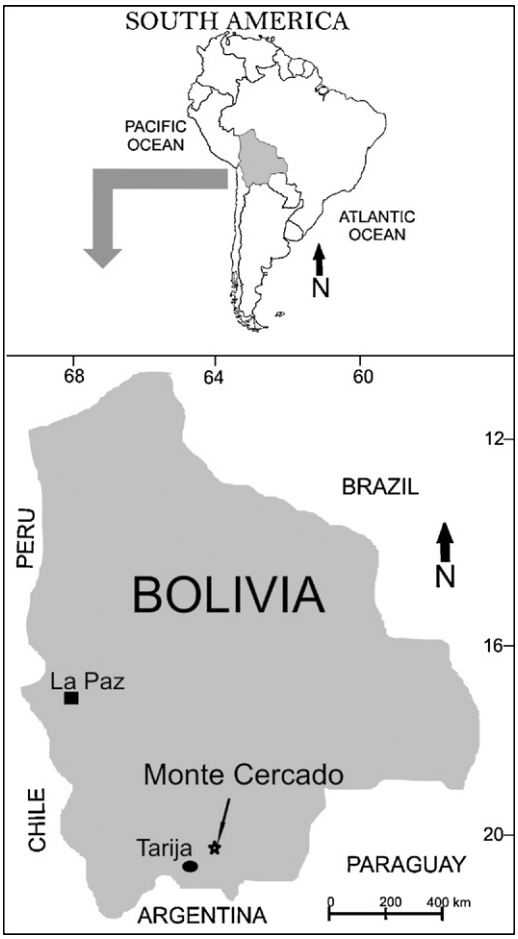

Fig. 1. Map showing location of Tarija and Monte Cercado localities (Bolivia).
Fig. 1. Carte montrant l'emplacement des villes de Tarija et Monte Cercado (Bolivie).

del esqueleto del Glyptodon, sugiriendo tratarse de un individuo bebé". This material, collected at the locality of San Pedro, Tarija (Bolivia) is currently lost [F.P.R., pers. obs].

3. Systematic paleontology

Superorder Xenarthra Cope, 1889
Order Cingulata Illiger, 1811
Family Glyptodontidae Gray, 1869
Subfamily Glyptodontinae Gray, 1869
Genus *Glyptodon* Owen, 1839 [17]
Glyptodon cf. *G. elongatus* Burmeister, 1866

3.1. Referred material

MNAP-v 6146, dorsal carapace belonging to an adult specimen of great size. The following MNAP-v materials have been exhumed from inside the carapace and they are under the MNAP-v 6146a collection number: skull represented by both maxillas preserving the labial side of the alveoli, descending process of the maxilla and infraorbital foramina; in addition, the right maxillary preserves the distal-most lateral margin of the narial apertures and the anterior and lower margin of the orbital notch. Left hemimandible almost complete, with molariforms m4-m8; the distal third of right hemimandible without molariforms. Proximal half of both scapulae (the left one more complete). Diaphysis of both femora. Other undetermined remains (Fig. 2).

3.2. Geographical and stratigraphical provenance

Monte Cercado (21° 28' 43 S and 64° 43' W) locality, located approximately 10 km to the north of Tarija city, Bolivia (Fig. 1). The material was exhumed from the upper levels of the sequence of the San Jacinto Unit [11]. Recently, these authors have provided new evidence supporting an age assignable to the Latest Pleistocene (ca. 44–21 ka) for all the Quaternary sequence in the Tarija Valley. This substantially differs from previous proposals [2,14–16,24].

4. Description

4.1. Adult specimen (MNAP-v 6146)

4.1.1. Dorsal carapace

It is 1850 mm long (along the sagittal axis). The osteoderms are characterized by a primitive ornamentation pattern comprising a circular or subcircular central figure encircled by a row of polygonal peripheral figures always smaller than the central one, as in *Glyptotherium* Osborn [5]. Each osteoderm presents a rough and very punctuate exposed surface, with numerous perforations [1]. The sulci surrounding adjacent figures are wide, with nearly vertical walls and flat bottom, "U"-shaped [6] contrasting with the "V"-shaped sulci of Propalaehoplophorinae and Hoplophorinae Hoplophorini [25]. At the margins of the carapace, the osteoderms are conical. This character probably constitutes a synapomorphy of the Glyptodontinae [4]. The systematic of the Glyptodontidae Glyptodontinae is in need of a modern revision. Nevertheless, the morphology of the dorsal carapace and its dorsal profile shows certain similarity to those assigned to the species *Glyptodon elongatus* from the Pampean region of Argentina [12]. In addition to this, the total length of this dorsal carapace is very similar to that observed in the pampean forms of *G. elongatus* [1]. The lack of a modern systematic revision of the South

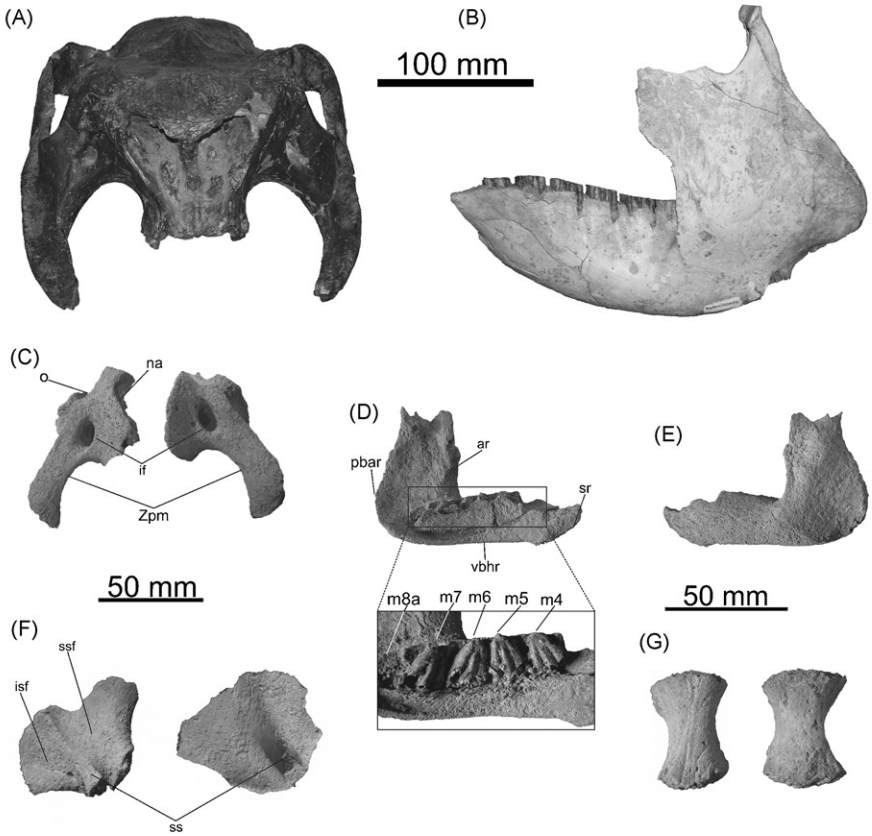

Fig. 2. **A**. Skull of *Glyptodon* sp. in frontal view (MNPA-V 006084). **B**. Mandible of *Glyptodon* sp. in lateral view (MNPA-V 006104). Scale bar: 100 mm. **C**. Partial skull of an unborn specimen in frontal view (MNAP-V 6146a). **D**. Left hemimandible in internal lateral view showing the m4-m7 molariforms. **E**. Left hemimandible in external lateral view. **F**. Left and right scapulae in external lateral view. **G**. Diaphysis of both femora. Abbreviations: ar, ascending ramus; if, infraorbital foramina; isf; infraspinous fossae; m4-m8, molariform teeth; na, narial aperture; o, orbital notch; pbar; posterior border of ascending ramus; ss, scapula spine; ssf, supraspinous fossae; sr, symphyseal region; vbhr; ventral border of the horizontal ramus; zpm, zygomatic process of maxilla. Scale bar: 50 mm.

Fig. 2. **A**. Crâne de *Glyptodon* sp. en vue frontale (MNPA-V 006084). **B**. Mandibule de *Glyptodon* sp, en vue latérale (MNPA-V 006104). Échelle 100 mm. **C**. Crâne partiel d'un individu non-né en vue frontale (MNAP-V 6146a). **D**. Hémimandibule gauche en vue latérale interne qui permet d'observer les molariformes m4-m7 ; la même hémimandibule en vue latérale externe. **F**. Omoplates gauche et droit en vue latérale externe. **G**. Diaphyses des fémurs en vue latérale. Abréviations : ar : branche de la mandibule ; if : foramen infraorbitaire ; isf : fosse infraépineuse ; m4-m8 : molariformes ; na : bord des nasaux ; o : bord orbitaire ; pbar : bord postérieur de la branche de la mandibule ; ss : épine scapulaire ; ssf : fosse supraépineuse ; sr : région symphysaire ; vbhr : bord ventral du corps de la mandibule ; zpm : processus descendants des arches maxillaires et zygomatiques. Échelle : 50 mm.

American Glyptodontinae Glyptodontidae [5] together with the differences observed between the materials from Tarija Valley and those from the Pampean region preclude a specific systematic determination. As previously mentioned, the remains of a very small individual have been recovered from inside the dorsal carapace, including the following.

4.2. *Unborn specimen (MNAP-v 6146a)*

4.2.1. *Skull*

The bones present a clearly spongy aspect. The length of the preserved portion is 51 mm approximately. The lateral margin of the right naris (in frontal view) is 15 mm high, i.e. approximately 20% of the height reached in an adult specimen (∼75 mm). It is subtriangular in outline (Fig. 2C), as in adult specimens of *Glyptodon* [1,20] (Fig. 2A) and unlike *Paraglyptodon uquiensis* (MACN 5377), in which the narial aperture tend to be more rectangular in outline [7]. This lateral margin forms an acute angle of nearly 30° with respect to the sagittal plane. The infraorbital foramina are markedly oval in outline, with their greater axis oriented in dorso-ventral direction (Fig. 2C). They show large diameter in relation to the size of the specimen, being 7.5 mm high and 4.5 mm wide, and as in the Lujanian species of *Glyptodon*, these struc-

tures are located more laterally than in *Paraglyptodon uquiensis* and *G. munizi* (MMP 3985; GCF 10) [7,20]. On the right side, immediately above the infraorbital foramen, the anterior margin of the orbital notch is visible (Fig. 2C). As in the adult samples of *P. uquiensis* and *Glyptodon* (Fig. 2A), its anterior edge forms an acute angle of approximately 20° with respect to the sagittal plane. The descending processes of the maxillae have a dorsoventral diameter of 37 mm (Fig. 2C). Morphologically, these processes resemble those of adult samples of *Glyptodon* (Fig. 2A). Although in transverse direction, its ventral end tends to be slightly more expanded, as observed in *Glyptotherium* cf. *G. cylindricum* [5].

4.2.2. Mandible

The left hemimandible is almost complete, with the m4-m7 molariforms (Fig. 2D–E); the coronoid and condylar processes have not been preserved. It is 86 mm long, approximately 27% of the total mandible length in adults (∼320 mm). The right hemimandible only preserves its distal one third, without any molariforms. Significant differences are evident in this element with respect to the morphology observed in adult specimens of *Glyptodon*. In lateral view, the ascending ramus (56 mm high by 35 mm long) describes an angle close to 90° with respect to the horizontal ramus (Fig. 2E). In contrast, in adult specimens of *Glyptodon* this angle ranges approximately between 60 and 70° (Fig. 2B). The ratio between the maximum length of the ascending ramus and the overall length of the mandible is 0.41, a proportion that is very similar to the one in adult specimens.

The ventral margin of the horizontal ramus is almost straight and sub-parallel to the molariform series (Fig. 2E). Its height is 15 mm at the level of the m8 alveolus; 17 mm at m7 level; and 21 mm at the m5 alveolus. This particular morphology is very similar to the one present in specimens from the Late Pleistocene of Venezuela (ca. 14–12 ka) assignable to *Glyptotherium* cf. *G. cylindricum* [5]. In contrast, this lower margin is more convex in *Glyptodon* (Fig. 2B). The m4-m7 molarifoms are conical in outline and do not show evidences of wear. The m4, m5 and m6 bear two deep longitudinal and subparallel grooves on the lingual side; in m7 and m8 these grooves are much less noticeable (Fig. 2D). These grooves have the typical trilobated morphology, characteristic of at least 3 to 8 molariforms of *Glyptodon* (see descriptions in [20]). All the molariforms show a comparable degree of development (Fig. 2D), as observed in other Xenarthra fossils [10] and references cited therein).

4.2.3. Scapula

The proximal half of both scapulae, but without the glenoid cavity is preserved (Fig. 2F). The acromion is slightly better preserved in the right scapula, and delimits the supraspinous and infraspinous fossae.

4.2.4. Femur

The diaphysis of both femora are preserved (Fig. 2G). They are approximately 60 mm long and 25 mm wide at minimum.

5. Discussion and conclusion

This article provides the first description of a Cingulata Glyptodontidae in prenatal ontogenetic state, dug up from the inside of a dorsal carapace assignable to *Glyptodon* cf. *G. elongatus* and coming from the (Late?) Pleistocene of Monte Cercado (21° 28' S and 64° 43' W), Tarija Valley, Bolivia. As stated above, the evidence clearly shows that this is an unborn specimen. Remarkably, the only previous report of the presence of an unborn Glyptodontidae specimen comes also from the Tarija Valley (San Pedro), but that material is currently lost.

As observed in other Xenarthra, especially Phyllophaga (*Mylodon* sp; [23]), the material studied here presents a series of characters that allow its generic allocation, mainly at cranial and mandibular level. These include the subtriangular outline of the narial aperture (Fig. 2C) and the great antero-posterior development of the ascending rami of the mandible (Fig. 2D-E). In addition, the right hemimandible has the m4-m8 molariforms without evidence of eruption, with the probable exception of m5 (Fig. 2D). The available evidence does not allow establishing if the eruption of the molariform teeth occurs during the fetal state or as a postnatal process. It may be noted that Tonni et al. [23] observed a certain wear in the molariforms of the unborn *Mylodon* material, which led them to postulate the probable existence of prenatal masticatory movements. In this sense, it should be mentioned that Cartelle [8] and Cartelle and De Iuliis [10] have observed that the eruption of teeth in *Nothrotherium maquinense* happens at the fetal stage as a simultaneous process. This phenomenon has also been detected in other tardigrades, particularly in the milodontine *Glossotherium lettsomi* and in the scelidotherine *Catonyx cuvieri* [8].

Finally, it is interesting to remark that, from a biogeographical and paleofaunistic point of view, and in contrast to what can be observed in other areas of South America (e.g. Chaco-Pampean region of Argentina, Mesopotamian region, southern Brazil and western

Uruguay), the Cingulata Glyptodontidae from Tarija Valley show certain peculiarities, such as the high frequency of *Glyptodon* records and the absence (*Neosclerocalyptus* Paula Couto) or scarcity of others (e.g. *Panochthus* Burmeister [26]) that are very common in other regions of South America [4].

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