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## Additions to the knowledge of the ground sloth *Catonyx tarijensis* (Xenarthra, Pilosa) in the Pleistocene of Argentina

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**Abstract** Quaternary Scelidotheriinae (Mammalia, Xenarthra, Mylodontidae) are represented by three genera: *Scelidotherium* Owen, *Valgipes* Gervais, and *Catonyx* Ameghino. The genus *Catonyx* includes three species of ground sloths: *C. cuvieri* (Lund), *C. tarijensis* (Gervais and Ameghino), and *C. chiliensis* (Lydekker). *Catonyx tarijensis* and *C. chiliensis* were present during the Quaternary of Argentina. The aim of this contribution is to improve the knowledge of *C. tarijensis* of Argentina from a morphological, systematic, and biostratigraphic point of view. The presence of *C. tarijensis* is recorded in the Ensenadan–Lujanian South American Land Mammal Ages (SALMAs) (Early Pleistocene–Late Pleistocene) of Buenos Aires Province, in the Lujanian SALMA (Late Pleistocene) of Corrientes Province, and in the Pleistocene of Córdoba and Salta Provinces. Outside Argentina, this species is recorded in the Late Pleistocene of Bolivia and Uruguay.

**Keywords** Mammalia · Scelidotheriinae · South American · Systematic · Quaternary

**Kurzfassung** Quartäre Scelidotheriinae (Mammalia, Xenarthra, Mylodontidae) sind durch drei Gattungen vertreten: *Scelidotherium* Owen, *Valgipes* Gervais und *Catonyx* Ameghino. Die Gattung *Catonyx* beinhaltet drei Arten von Faultieren: *C. cuvieri* (Lund), *C. tarijensis* (Gervais und Ameghino) und *C. chiliensis* (Lydekker). *C. tarijensis* und *C. chiliensis* sind aus dem Quartär Argentiniens bekannt. Das Ziel dieser Mitteilung ist es, die Kenntniss

von *C. tarijensis* aus Argentinien in Hinsicht auf ihre Morphologie, Systematik und Biostratigraphie zu verbessern. Die Art *C. tarijensis* ist aus den Ensenadan - Lujanian South American Land Mammal Ages (SALMAs) (frühes bis spätes Pleistozän) der Provinz Buenos Aires, der Lujanian SALMA (spätes Pleistozän) der Provinz Corrientes und dem Pleistozän der Provinzen Córdoba und Salta bekannt. Außerhalb Argentiniens wurde diese Art bisher im Pleistozän von Bolivien und Uruguay gefunden

**Schlüsselwörter** Mammalia · Scelidotheriinae · Südamerika · Systematik · Quartär

### Introduction

The subfamily Scelidotheriinae Ameghino (1904) (Mammalia, Xenarthra, Pilosa) is represented from the Middle Miocene to the Early Holocene in Argentina, Bolivia, Brazil, Chile, Ecuador, Peru, and Uruguay (Miño-Boilini and Carlini 2009). During the Quaternary [ca. 2.588–0.011 million years ago (Ma)] this subfamily of extinct ground sloths was represented by three genera: *Scelidotherium* Owen 1839, *Valgipes* Gervais 1874, and *Catonyx* Ameghino 1891 (see Corona et al. 2013). The genus *Catonyx* (= *Scelidodon*) is distributed in the Pleistocene of Argentina, Bolivia, Uruguay, Chile, Peru, Ecuador, and Brazil (Miño-Boilini and Carlini 2009; Corona et al. 2013), and includes three species: *C. cuvieri* (Lund 1839), *C. tarijensis* (Gervais and Ameghino 1880), and *C. chiliensis* (Lydekker 1886) (see Corona et al. 2013). Knowledge of the morphology of *Catonyx* is based largely on the remains of *C. chiliensis* (see Sefve 1915a; Pujos 2000; Miño-Boilini et al. 2009) and *C. cuvieri* (see Cartelle et al. 2009; Corona et al. 2013).

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In Argentina, *C. tarijensis* has been recorded in the Ensenadan–Bonaerian South American Land Mammal Ages (SALMAs, Early–Middle Pleistocene) of Buenos Aires Province and in the Pleistocene of Córdoba Province (Miño-Boilini and Carlini 2009), *C. chiliensis* in the Lujanian SALMA (Late Pleistocene) of San Luis Province (Miño-Boilini et al. 2009), and *C. cuvieri* from the Late Pleistocene of Brazil and Uruguay (Cartelle et al. 2009; Corona et al. 2013).

In this context, the aim of this contribution is to improve the knowledge of *C. tarijensis* of Argentina from a morphological, systematic, and biostratigraphic point of view.

## Materials and methods

The chrono and biostratigraphic scheme adopted in this work follows Cione and Tonni (2005) and Tonni (2009). The skull and postcranial elements of the *C. tarijensis* ( $n = 27$ ) are described and compared with all well-known Quaternary Scelidotheriinae in order to increase knowledge (e.g., provide an emended diagnoses for the species) and assess variation within the species.

## Institutional abbreviations

CTES-PZ, Paleozoología Corrientes, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Corrientes Province, Argentina; FCS, Facultad de Ciencias Sociales, Universidad Nacional del Centro, Olavarría, Buenos Aires Province, Argentina; FMNH P, Field Museum of Natural History, Chicago, USA; MACN, Sección Paleontología Vertebrados, Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires Province, Argentina; MCL, Museu de Ciências Naturais da Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Brazil; MD, Museo Municipal “Carlos Darwin”, Punta Alta, Buenos Aires Province, Argentina; MDVS-PV, Museo Dalmacio Vélez Sársfield Paleontología Vertebrados, Córdoba Province, Argentina; MLP, Museo de La Plata, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Buenos Aires Province, Argentina; MMP, Museo Municipal de Ciencias Naturales de Mar del Plata “Lorenzo Scaglia”, Buenos Aires Province, Argentina; MNHN, Muséum national d’histoire naturelle, Paris, France, MPH-P, Museo Municipal Punta Hermengo, Miramar, Buenos Aires Province, Argentina; PIMUZ, Päläontologisches Institut und Museum der Universität Zürich, Switzerland.

## Anatomical abbreviations

Mf/mf, upper and lower molariform, respectively.

## Other abbreviations

SALMA, South American Land Mammal Age.

## Systematic paleontology

Superorder Xenarthra Cope 1889.

Order Tardigrada Latham and Davies in Forster 1795.

Subfamily Scelidotheriinae Ameghino 1904.

Genus *Catonyx* Ameghino 1891.

## Synonyms

*Scelidodon* Ameghino 1881 (McDonald and Perea 2002).

*Type species* *Platyonyx brongniartii* Lund 1842 (see Ameghino 1891).

*Catonyx tarijensis* (Gervais and Ameghino 1880).

Figures 1a–g, 2a–g, 3

## Synonyms

*Scelidotherium magnum* Bravard 1857:16 (nomen nudum).

*Scelidotherium tarijensis* Gervais and Ameghino 1880:148–149 (original description).

*Scelidotherium capellini* Gervais and Ameghino 1880:148–151 (original description).

*Scelidotherium magnum* Burmeister 1886:103–110.

*Scelidotherium capellini = tarijensis?* Nordeskjöld, 1902:265.

*Scelidotherium capellini* Sefve 1915b:12.

*Scelidodon tarijensis* Miño-Boilini and Carlini 2009:97, fig. 1C.

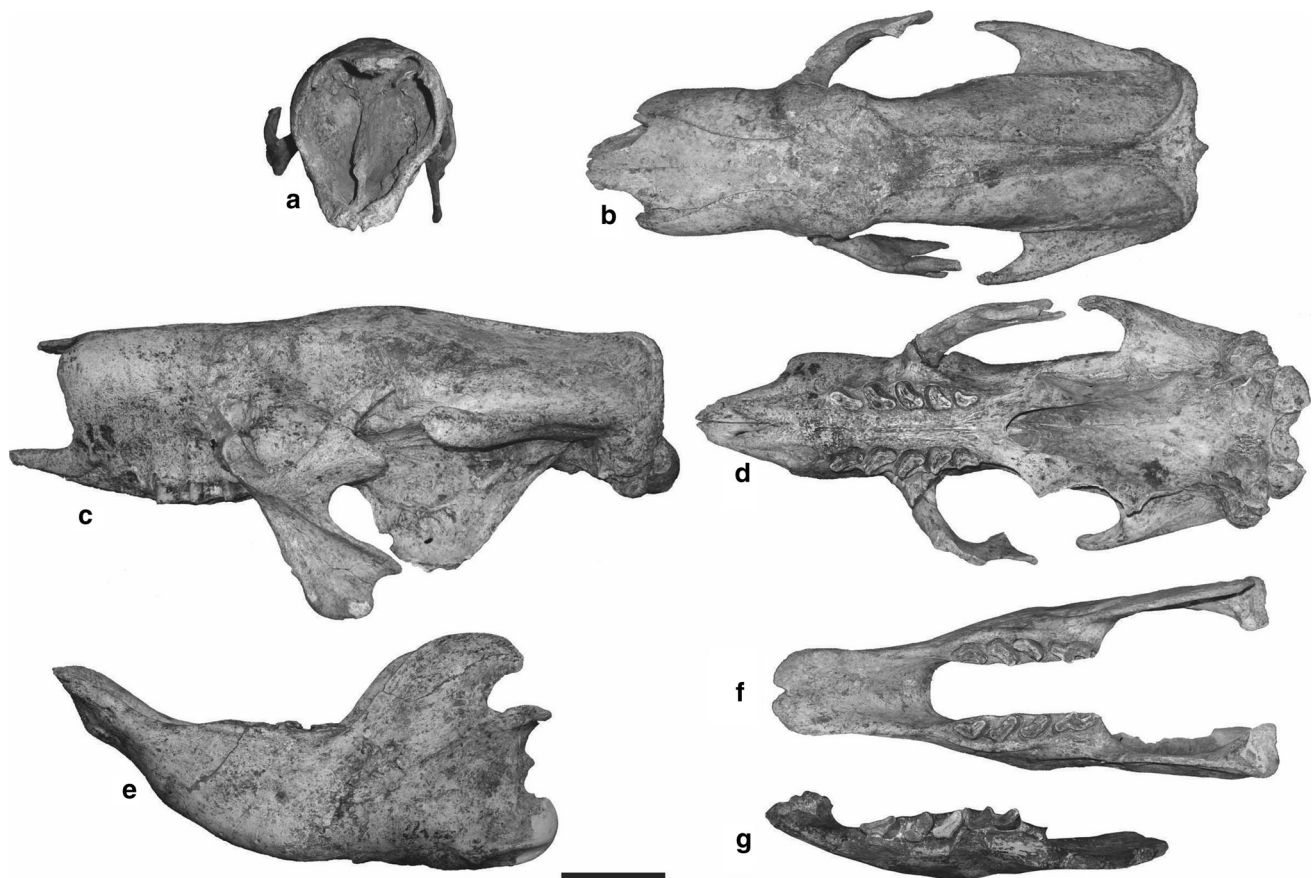
*Scelidodon tarijensis* Miño-Boilini et al. 2009:375.

*Scelidodon tarijensis* Zurita et al. 2014:81, fig. 2B.

*Holotype* MNHN TAR 1260, skull and mandible articulated.

*Type locality and age* Departament of Tarija, Bolivia, Tolomosa Formation, Late Pleistocene (between 44 and 21 ka, C<sup>14</sup>, see Coltorti et al. 2007).

*Diagnosis* (emended from McDonald 1987 and Miño-Boilini 2012) Largest species of the genus. Skull with temporal ridges and sagittal crest well developed and more evident than in *C. chiliensis* and *C. cuvieri*. First upper molariform more extended mesiodistally and lingual lobe well developed as in *C. cuvieri*. Robust mandible, high horizontal ramus, ventral margin markedly convex, and mandibular keel very evident compared with those of *C. chiliensis* and *C. cuvieri*. First lower molariform with labial lobe having a slightly longitudinal groove. Robust and massive humerus



**Fig. 1** Cranial remains of *Catonyx tarijensis* (Gervais and Ameghino, 1880). **a–d** Skull in anterior, **b** in dorsal, **c** in lateral, **d** in ventral views, **e–f** Dentary, **e** in lateral, **f** in occlusal views (**a–f** MMP 1267),

**g** Dentary in occlusal view (MNHP PAM 231, holotype of *Scelidotherium capellini* Gervais and Ameghino 1880). The scale bars represent 100 mm

with deltoid tuberosity more developed, and with more robust diaphysis than those of *C. chiliensis* and *C. cuvieri*. Radius and ulna more robust than those of *C. chiliensis* and *C. cuvieri*. Femur with femoral neck underdeveloped as in *C. chiliensis*, whereas is more developed in *C. cuvieri*.

#### Referred material, stratigraphic and geographic precedence

*Buenos Aires Province* FCS 96.II5/1/2, partial skull, mandible, right humerus, right radius, right femur, right tibia, and right astragalus, Olavarría, Pleistocene; FMNH P 14301, left humerus, right humerus, left ulna, right ulna, left tibia, left femur, and right radius, río Quequén, Pleistocene; MACN 994, mostly restored skull, Olivos, Ensenadan SALMA (Early–Middle Pleistocene, ca. 1.07–0.98 My); MACN 1041, right dentary, probably associated with the skull; MACN 994, Olivos, Ensenadan SALMA; MACN 995, skull and right dentary, Olivos, Ensenadan SALMA; MACN 10159, right dentary, left humerus, Florida, Ensenadan SALMA; MACN 9653, left dentary, río Quequén Salado, Paso del Médano,

Lujanian SALMA (Late Pleistocene, ca. 120–0.11 ka); MACN 5110, left astragalus, Tandil, “Upper Pampean” (Bonaerian or Lujanian SALMAs?); MACN 18223, skull and mandible associated, San Nicolás, “Upper Pampean” (Bonaerian SALMA or Lujanian SALMA?); MD-97-23, skull, Playa del Barco, Pehuen Co, Bonaerian–Lujanian SALMAs (Middle Pleistocene–Early Holocene); MLP 3-479, left humerus, left scapula, and left ulna, Ensenadan SALMA; MLP 03-IV-1-10, right dentary, Punta Piedras, Partido de Punta Indio, Ensenadan SALMA; MLP 3-427, left dentary, “Upper Pampean” (Bonaerian SALMA or Lujanian SALMA?); MLP 3-576, left astragalus and left and right calcaneus, Lujan, “Upper Pampean” (Lujanian SALMA); MLP 3-403, left dentary, Pleistocene; MLP 3-428, left dentary, “Pampean” (Pleistocene); MMP 3989, posterior portion of the skull, Mar del Plata, Ensenadan SALMA (Early–Middle Pleistocene, ca. 0.78 Ma); MMP 1267, skull, mandible, right humerus, right ulna, and right radius, Mar del Plata, Bonaerian SALMA (Middle Pleistocene, ca. 0.4 Ma); MMP 1143, left dentary, Necochea, Pleistocene; MNHP PAM 231 (holotype of *Scelidotherium capellini* Gervais and Ameghino



**Fig. 2** Postcranial remains of *Catonyx tarijensis* (Gervais and Ameghino 1880). **a** Left humerus in anterior view, **b** Left radius in anterior view, **c** Left ulna in anterior view (**a–c** MMP 1267), **d** Right femur in anterior view, **e** Right tibia in anterior view, (**d–e** FMNH P 14301), **f** Left astragalus in fibular view (MACN 5110), **g** Left calcaneum in medial view (MLP 3-576). The scale bars represent 100 mm



**Fig. 3** Geographic distribution of *Catonyx tarijensis* (Gervais and Ameghino 1880) in Argentina. 1 arroyo Maciel, 2 “Toscas” del Río de La Plata, 3 Ciudad Autónoma de Buenos Aires, 4 La Plata, 5 Mar del Plata, 6 Miramar, 7 Olavarría, 8 río Quequén Salado, 9 Playa del Barco, 10 Necochea, 11 río Quequén, 12 Lavalle, 13 Bella Vista, 14 Río Tercero, 15 Guachipas

1880), left dentary, Pleistocene; MPH-P 091, right dentary, Miramar, Ensenadan SALMA; PIMUZ A/V 0512, partial skull, arroyo Maciel, “Intermediate Pampean”.

Corrientes Province CTES-PZ 7151, partial skull, Lavalle, Toropí/Yupoí Formation, Lujanian SALMA, Late Pleistocene; CTES-PZ 1690, partial skull, Bella Vista, Toropí/Yupoí Formation, Lujanian SALMA, Late Pleistocene.

Córdoba Province MDVS-PV 0025, left dentary, Río Tercero, Pleistocene.

Salta Province MLP 89-XII-6-5, left femur, left tibia, left astragalus, Guachipas, Pampa Grande, Pleistocene.

Measurements, see Table 1.

## Description and comparison

### Skull

In anterior view (Fig. 1a), the nasal opening of *C. tarijensis* is circular in cross section. In *C. chiliensis* (see Miño-Boilini et al. 2009, Fig. 2A) and *C. cuvieri* (MCL 4278), the nasal opening has a slightly subcircular contour. In contrast, in *Scelidotherium leptcephalum* Owen 1839, *Scelidotherium bravardi* Lydekker 1886, and *Valgipes bucklandi* (Lund 1839), the nasal opening has a sub-triangular contour (Miño-Boilini 2012; Miño-Boilini et al. 2014a).

In dorsal view (Fig. 1b), the nasals and maxillaries of *C. tarijensis*, *C. chiliensis*, and *C. cuvieri* are short and inflated (McDonald 1987). In contrast, *S. leptcephalum*, *S. bravardi*, and *V. bucklandi* have a slight constriction in the maxillary (see Cartelle et al. 2009 Fig. 1C; and Miño-Boilini et al. 2014a). Also, the skull of *C. tarijensis* (Fig. 1b) has a sub-rectangular contour as in *C. chiliensis*, and the temporal crests begin in the nuchal ridge and end in the postorbital processes, as in all Quaternary Scelidotheriinae (Miño-Boilini and Zurita 2015). In *C. tarijensis* and *C. chiliensis* (see Pujos and Salas 2004, Fig. 3; Miño-Boilini et al. 2009, Fig. 2C), the anterior process of the nasals extends beyond the anterior margin of the maxillaries, and going slightly downward distally. In *C. cuvieri* (see Miño-Boilini 2012, pl. 38.1), the anterior nasals process is less developed than in *C. tarijensis* and *C. chiliensis*. The sagittal crest is much more developed in *C. tarijensis* than in *C. chiliensis*, *C. cuvieri*, and *V. bucklandi*. By contrast, *S. leptcephalum* and *S. bravardi* do not have a sagittal crest (see Miño-Boilini and Zurita 2015). In both *C. tarijensis* and all Quaternary Scelidotheriinae, the parietal suture with the frontal lags behind the anterior portion of the zygomatic process of the squamous (see Pujos 2000, Fig. 2B; Pujos and Salas 2004, Fig. 3C; Miño-Boilini et al. 2009, Fig. 2C; Corona et al. 2013, Fig. 3C).

In lateral view (Fig. 1c), the skull of *C. tarijensis* has a subrectangular contour, as in all Quaternary Scelidotheriinae (Miño-Boilini 2012). The pterygoid is like a plane

**Table 1** Measurements of *Catonyx tarijensis* (Gervais and Ameghino 1880)

Specimen	LMC	LDS	MWP	WS	HS	OMf5L	WB
<b>Skull</b>							
CTES-PZ 7151	540	120	97	123	113	300	120
MMP 1267	540	135	90	110	140	283	125
MD-97-23	465	112	90	100	117	285	112
PIMUZ A/V 0512	504	131	110	97	136	303	116
FCS 96.115/1/2	–	120	–	140	110	–	–
Specimen	TRL	MBH	HI				
<b>Dentary</b>							
MACN 1041	128	91	71				
MACN 9653	126	97	76				
MACN 10159	126	97	76				
MLP 3-428	130	100	76				
MMP 1267	135	100	74				
MLP 03-IV-1-1 <sup>b</sup>	84	72	85				
MLP 995 <sup>b</sup>	60	85	70				
MPH-P 091	124	123	100				
MNHP PAM 231	130	–	–				
FCS 96.115/1/2	129	90	69				
Specimen	L	PW	DW				
<b>Humerus</b>							
MACN 10159	420	195	200				
MMP 1267	410	180	200				
MLP 3-479	410	180	210				
FCS 96.115/1/2	390	180	220				
FMNH P14301	520	230	235				
Specimen	L						
<b>Radius</b>							
FCS 96.115/1/2	310						
MMP 1267	320						
Specimen	L						
<b>Ulna</b>							
FMNH P14301	520						
MLP 3-429	375 <sup>a</sup>						
MMP 1267	440						
Specimen	L	PW	DW				
<b>Femur</b>							
FMNH P14301	680	330	360				
MLP 89-XII-6-5	490	250	245				
Specimen	L						
<b>Tibia</b>							
FMNH P14301	400						
FCS 96.115/1/2	320						
MLP 89-XII-6-5	300						



**Table 1** continued

Specimen	L
Astragalus	
MACN 5110	150 <sup>a</sup>
FCS 96.115/1/2	120
Specimen	
L	
Calcaneum	
FCS 96.115/1/2	220
MLP 3-576	275

All measurements are in mm, except hypsodonty index

*DW* distal width, *HI* hypsodonty index, *HS* height of snout, *L* greatest proximodistal length, *LDS* length of dental series, *LMC* length maxillary-condyle, *MBH* maximal height of mandibular body, *MWP* minimum postorbital width, *OMf5L* distance between the occipital condyles and the posterior edge of molariform 5, *PW* proximal width, *TRL* tooth row length, *WB* bicondylar width, *WS* width of snout

<sup>a</sup> Estimated, <sup>b</sup> Juvenile

leaf, as in all Scelidotheriinae (Miño-Boilini et al. 2009). However, in *C. tarijensis*, it is much more developed than in other Quaternary Scelidotheriinae (see Miño-Boilini et al. 2009; Miño-Boilini 2012; Corona et al. 2013; Miño-Boilini et al. 2014a). The occipital condyles project ventrally as is typical in *Catonyx* (Corona et al. 2013).

In palatal view (Fig. 1d), the pre-maxillaries of *C. tarijensis* are less developed and acute in their sagittal suture, as in *C. cuvieri* and *C. chiliensis* (see Miño-Boilini 2012, pl. 38. 3; Sefve 1915b, pl. X, Fig. 2, respectively). In *V. bucklandi*, the premaxilla is unknown, whereas the premaxillary in *S. leptocephalum* and *S. bravardi* are very developed (Miño-Boilini et al. 2014a). The pre-dental region of the maxillary of *C. tarijensis* is shorter than the length of the series of molariforms, as characteristic of the genus *Catonyx* and *V. bucklandi* (Cartelle et al. 2009; Miño-Boilini 2012). In *S. leptocephalum* and *S. bravardi*, the pre-dental region is longer than the dental series of the maxillary (Miño-Boilini et al. 2014a). In *C. tarijensis*, the palatal surface has a strong groove (McDonald and Perea 2002). This groove is also present in *C. chiliensis*, *V. bucklandi*, and *C. cuvieri* (see also Miño-Boilini et al. 2009, Fig. 2E; Miño-Boilini 2012, pl. 37. 3. and pl. 38. 3). *S. leptocephalum* and *S. bravardi* do not have a groove (Miño-Boilini 2012, pl. 17, Fig. 3; pl. 22, Fig. 3).

In occlusal view (Fig. 1d), the Mf1 of *C. tarijensis*, *C. cuvieri*, *S. bravardi*, and *V. bucklandi* has a lingual lobe; by contrast, *C. chiliensis* lacks the lingual lobe (Miño-Boilini 2012, pl. 1). In *C. tarijensis*, the Mf2 and Mf3 lingual groove has two defined lobes and is sub-triangular, as in *C. cuvieri* and *S. bravardi*. *C. cuvieri* and *V. bucklandi* have a strong lingual groove (Cartelle et al. 2009; Corona et al. 2013) and two defined lobes, and the posterior lobe is much more developed in *C. cuvieri*. By contrast, in *V. bucklandi*, the lobes are sub-equal and triangular in occlusal view. In

*C. chiliensis* and *S. leptocephalum*, Mf2 and Mf3 is sub-elliptic (see Miño-Boilini 2012, pl. 1). Mf4 is similar in morphology to Mf2 and Mf3, but has a less deep lingual groove, as in *C. cuvieri*, *C. chiliensis*, *S. leptocephalum*, and *S. bravardi*. In *V. bucklandi*, the Mf4 is triangular in occlusal view, with a strong lingual groove. Mf5 is the smallest, as in all Scelidotheriinae. *C. tarijensis* has a less deep lingual groove, as in other Quaternary Scelidotheriinae, whereas *V. bucklandi* has a strong lingual groove.

### Mandible

In lateral view, the horizontal ramus of *C. tarijensis* (Fig. 1e) is higher (91–123 mm, see Table 1) than those of *C. chiliensis* (60–82 mm), *C. cuvieri* (58 mm) *S. leptocephalum* (80–85 mm), *S. bravardi* (58–80 mm), and *V. bucklandi* (67–71 mm) (see Miño-Boilini 2012, Table 14). Also, in *C. tarijensis*, the ventral margin is markedly convex. In contrast, in *C. chiliensis*, *C. cuvieri*, *V. bucklandi*, *S. leptocephalum*, and *S. bravardi*, the ventral margin is straight or slightly convex (see Cartelle et al. 2009, Fig. 2A, B; Miño-Boilini et al. 2014a, Fig. 1C and Fig. 2D). In *C. tarijensis*, the angle between the spout and the occlusal plane is 20°, as in *C. cuvieri* (see Miño-Boilini 2012, pl. 40 Fig. 4); in *V. bucklandi* (see Miño-Boilini 2012, pl. 40 Fig. 2) the angle is 18°, in *S. leptocephalum* and *S. bravardi* it is between 0° and 17° (see Miño-Boilini 2012, pl. 19 Fig. 3 and 4), and it is 30° in *C. chiliensis* (see Pujos 2000, Fig. 3A).

In occlusal view (Fig. 1f, g), in *C. tarijensis*, the mandibular symphysis is located in front of mf1, as in all Quaternary Scelidotheriinae (see Miño-Boilini 2012, pl. 16. 4, pl. 19. 1 and 2, pl. 40. 1 and 3; Miño-Boilini et al. 2014b). The mandibular symphysis is transversely wider than in *C. chiliensis*, *C. cuvieri*, *S. leptocephalum*, *S.*

*bravardi*, and *V. bucklandi* (see Sefve 1915b; Lydekker 1886; Corona et al. 2013; Miño-Boilini 2012, pl. 40. 1 and 3; Miño-Boilini et al. 2014a). The posterior external opening of the mandibular canal is located behind mf4, as in all Quaternary Scelidotheriinae (see Miño-Boilini 2012, pl. 19, 3 and 4, pl. 26. 1. pl. 40, 2 and 4).

In occlusal view, mf1 has a labiolingual dimension smaller than that of the mesiodistal, as in all Scelidotheriinae (Miño-Boilini et al. 2014b), although it is much more extended mesiodistally than in other Quaternary Scelidotheriinae. The labial side presents a lobe, well developed and located in the middle of the molariform, and the anterior and posterior lobe are sub-equal, as in *S. leptocephalum*, *S. bravardi*, and *C. chiliensis* (see Miño-Boilini 2012, pl. 2). The mf1 of *C. tarijensis* has a labial groove, whereas that of *C. cuvieri* and *V. bucklandi* shows greater lingual curvature (Miño-Boilini 2012, pl. 2; Corona et al. 2013).

In occlusal view, in *C. tarijensis*, the mf2 and mf3 are sub-rectangular, with the greatest dimension oblique to the sagittal plane (Table 1), as in all Scelidotheriinae (Miño-Boilini et al. 2014b).

The mf4 is trilobate, as in all Scelidotheriinae (Corona et al. 2013; Miño-Boilini et al. 2014b), and presents a wider mesiodistal extension than the rest of the molariforms (Table 1). The anterior lobe is more extended mesiodistally than the other two lobes, as in *C. chiliensis*, *C. cuvieri*, *S. bravardi*, and *V. bucklandi* (see Miño-Boilini 2012, pl. 2). The central lobe is slightly developed and in oblique position with respect to the sagittal plane, as in Scelidotheriinae (see Miño-Boilini 2012, pl. 2). The posterior lobe is more curved towards the lingual side, a characteristic present in *C. chiliensis*, *C. cuvieri*, and *S. bravardi*. In contrast, in *S. leptocephalum* and *V. bucklandi*, the lobe is straighter (see Miño-Boilini 2012, pl. 2; Corona et al. 2013, Fig. 5).

### Scapula

In lateral view, the general shape of the scapula of *C. tarijensis*, *C. chiliensis*, *S. bravardi*, and *S. leptocephalum* (see Pujos and Salas, 2004, Fig. 4A; Miño-Boilini 2012, pl. 3; Miño-Boilini et al. 2014a, Fig. A and B) approximates an isosceles triangle. No complete scapulas are known for *C. cuvieri* or *V. bucklandi* (see Cartelle et al. 2009).

### Humerus

The humerus of *C. tarijensis* (Fig. 2a) is very similar in morphology to that of other Quaternary Scelidotheriinae (see Miño-Boilini 2012, pl. 4; see also McDonald, 1987). However, in *C. tarijensis* (Fig. 2a), the humeral diaphysis is more robust and massive than in *C. chiliensis*, *C. cuvieri*, *S. leptocephalum*, *S. bravardi*, and *V. bucklandi* (see Miño-

Boilini 2012, pl. 4). *C. tarijensis* presents an entepicondylar foramen and entepicondylar bar, as most Scelidotheriinae (except *C. cuvieri*, see Cartelle et al. 2009, Fig. 3E), as well as in some Mylodontidae, Nothrotheriidae, and Megalonychidae (see McDonald and De Iuliis 2008). In anterior view, the crest deltoid of *C. tarijensis* is more acute than in other Quaternary Scelidotheriinae.

### Radius and ulna

The radius of *C. tarijensis* (Fig. 2b) is more robust and massive than in *S. leptocephalum*, *S. bravardi*, *C. chiliensis*, *C. cuvieri*, and *V. bucklandi* (see Miño-Boilini 2012, pl. 6). Also, the pronator ridge and styloid process are prominent compared with that of other Quaternary Scelidotheriinae. In medial view, the crest pronator of *C. tarijensis* is more acute than in other Quaternary Scelidotheriinae.

The ulna of *C. tarijensis* (Fig. 2c) is very similar in morphology to that of other Quaternary Scelidotheriinae, although it is more robust and massive. In *C. tarijensis*, the olecranon process is robust, as in *C. chiliensis*, *S. leptocephalum*, and *S. bravardi*; in contrast, the olecranon process is gracile in *C. cuvieri* and *V. bucklandi* (see Miño-Boilini 2012, pl. 5). Also, the coronoid process of *C. tarijensis* (Fig. 2c) is more acute than in other Quaternary Scelidotheriinae.

### Femur

The femur of *C. tarijensis* (Fig. 2d) is compressed in an anterior–posterior direction and has a rectangular contour, as is typical in Scelidotheriinae (Pascual et al. 1966; McDonald and Perea 2002). The femur of *C. tarijensis* (Table 1), similar in length to that of *C. chiliensis* (465 mm; see Pujos 2000), is greater than those of *S. leptocephalum* (340–450 mm), *V. bucklandi* (403–450 mm), and *C. cuvieri* (386–406 mm) (see Cartelle et al. 2009, Table 3).

In anterior view, the femoral head of *C. tarijensis* is separated from the diaphysis by an undeveloped neck, whereas that of *C. chiliensis* and *C. cuvieri* is developed (see Miño-Boilini 2012, pl. 8). In *C. tarijensis* and other Scelidotheriinae (except *V. bucklandi*, see Cartelle et al. 2009, Fig. 4A), the patellar trochlea is contiguous to the facets for the tibia (Miño-Boilini et al. 2011). The lateral epicondyle of *C. tarijensis* is more acute than in other Quaternary Scelidotheriinae.

### Tibia

The tibia of *C. tarijensis* is much more robust (see McDonald 1987; Pujos and Salas 2004; Cartelle et al. 2009; Miño-Boilini 2012, pl. 9; Miño-Boilini et al. 2014a)

and has much more developed digital flexor grooves than those of other Quaternary Scelidotheriinae. The tibia is morphologically more conservative than the femur (see MacDonald 1987).

In posterior view, the tibia of *C. tarijensis* (Fig. 2e) has an articular surface for the sesamoid, as in all Quaternary Scelidotheriinae (McDonald 1987; Miño-Boilini et al. 2011) and Megatheriidae (Salas et al. 2005). This sesamoid allows greater rotation at the knee, which is increased by the pedolateral stance of these ground sloths (see also Toledo 1998).

### Astragalus

The Scelidotheriinae are characterized by a concave surface of the cuboid (Pascual et al. 1966). The astragalus of *C. tarijensis* is similar in morphology to that of all Quaternary Scelidotheriinae (see Aramayo 1988; MacDonald 1987). In *C. tarijensis*, it is more robust and massive than in other Quaternary Scelidotheriinae (e.g. *S. leptocephalum*, *S. bravardi*, *C. chiliensis*, *C. cuvieri*, and *V. bucklandi*, see Miño-Boilini 2012, pl. 11). In *C. tarijensis* (Fig. 2f) and *C. chiliensis*, the angle between the discoid facet and odontoid process is 130°, whereas in *S. leptocephalum* and *S. bravardi*, it varies from 150° to 160°, and in *C. cuvieri* and *V. bucklandi* it is 110° (see Miño-Boilini 2012, pl. 11).

### Calcaneum

The calcaneum of *C. tarijensis* (Fig. 2g) is more robust and massive than that of other Quaternary taxa (e.g.: *S. leptocephalum*, *S. bravardi*, *C. chiliensis*, *C. cuvieri*, and *V. bucklandi*, see Miño-Boilini 2012 pl. 12). As in all Quaternary Scelidotheriinae, it presents three facets: calcaneal ectal facet, calcaneal sustentacular facet, and cuboid (Miño-Boilini 2012 pl. 13). In *C. tarijensis*, the calcaneal ectal facet and cuboid are continuous, as in all Quaternary Scelidotheriinae (except *S. leptocephalum*).

### Discussion and conclusions

During the Pleistocene of Argentina, *Catonyx* (= *Scelidodon*) is recorded in Buenos Aires, Corrientes, Córdoba, Salta, Tucumán, Entre Ríos, and San Luis provinces (Miño-Boilini and Carlini 2009; Miño-Boilini 2012). More precisely, from a chronological and biostratigraphic perspective, the hypothesis that considers *Catonyx* (= *Scelidodon*) restricted to Ensenadan SALMAs in the Pampean Region is widely accepted (Cione and Tonni 2005; Tonni 2009). More recently, a *Catonyx* sp. (= *Scelidodon* sp.) was reported in the Late Pleistocene in Tandil and Luján, Buenos Aires Province (Miño-Boilini and Carlini 2009; see

also Kraglievich 1934, and Aramayo 1984: 595, Figs. 1 and 2). According to this report, these Late Pleistocene specimens (MACN 5110, Tandil and MLP 3-576, Luján) are assigned to *C. tarijensis*.

In a revision of the Ensenadan Xenarthra of the Pampean Region, Soibelzon et al. (2010) found *Catonyx* sp. (MACN 994 and MACN 995) and *Catonyx* cf. *tarijensis* (MMP 3989). In this revision, these specimens were studied and assigned to *C. tarijensis*.

A well-preserved specimen (MMP 1267) from the city of Mar del Plata (Bonaerian SALMA) was studied and assigned to *C. tarijensis* (see also Miño-Boilini and Carlini 2009; Miño-Boilini et al. 2009). Another specimen (MD-97-23) from the town of Playa del Barco, Bahía Blanca (Buenos Aires Province), assigned to Bonaerian–Lujanian SALMAs (see also Miño-Boilini and Carlini 2009), and a specimen (MACN 9653) from río Quequén Salado (Lujanian SALMA) were also assigned to *C. tarijensis* (see also Miño-Boilini and Carlini 2009). In summary, *C. tarijensis* (= *Scelidodon capellini*) is distributed in the Pampean Region from the Ensenadan–Lujanian SALMAs, and therefore widens the species biochron.

For Corrientes Province, the specimens CTES-PZ 1690 and CTES-PZ 7151 referred to as *C. tarijensis* come from the Toropí/Yupoí Formation (Late Pleistocene, see Zurita et al. 2014), and are also recorded in the Pleistocene of Salta Province (MLP 89-XII-6-5) and Córdoba Province (MDVS-PV 0025).

According to this review, *C. tarijensis* is recorded in Buenos Aires, Córdoba, Corrientes, and Salta Provinces. Outside the territory of Argentina, this ground sloth is recorded in the Pleistocene of Bolivia (Tarija and Padcaya) (see MacDonald and Perea 2002; Miño-Boilini 2012). Recently, Corona et al. (2013) recorded *C. tarijensis* in the Late Pleistocene of Uruguay. In summary, *C. tarijensis* is endemic to Argentina, Uruguay, and Bolivia, which extends from the Ensenadan–Lujanian SALMAs.

The skull and mandible are the most important elements for the diagnosis of various Scelidotheriinae taxa (see Owen 1839; MacDonald 1987; Miño-Boilini 2012; Miño-Boilini et al. 2011; Corona et al. 2013). Some of the anatomical differences between *C. tarijensis* and other taxa cannot be quantified, since they correspond to qualitative characteristics, but are useful in the differentiation of the Quaternary Scelidotheriinae (see also MacDonald 1987). These qualitative differences are mentioned by other authors for differentiating other Pilosa [e.g. Megatheriidae see De Iuliis 2006; De Iuliis et al. 2009; Brandoni et al. 2008; among others].

The postcranial skeleton (e.g. scapula, humerus, tibia, and ulna) of the Quaternary Scelidotheriinae is conservative, and there are few differences (see MacDonald 1987; Miño-Boilini 2012; Miño-Boilini et al. 2011). This

contribution enhances our knowledge of *C. tarijensis* from a morphological, systematic, and biostratigraphic point of view.

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