

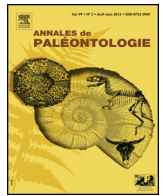


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Original article

The new taxonomic status of *Rhea anchorenensis* (Ameghino and Rusconi, 1932) (Aves, Palaeognathae) from the Pleistocene of Argentina

Le nouveau statut taxonomique de Rhea anchorenensis (Ameghino et Rusconi, 1932) (Aves, Palaeognathae) du Pléistocène d'Argentine

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ABSTRACT

Rhea anchorenensis (Ameghino and Rusconi, 1932) is an extinct species of Rheidae (Aves, Palaeognathae) from the Pleistocene of Buenos Aires province, Argentina, only known for a distal fragment of a left tarsometatarsus. Since its description in 1932, this specimen was not analyzed in an adequately comparative framework with the extant species. This study provides a re-description of this specimen and a comparison with the extant species of Rheidae with the aim of reevaluating its taxonomic identity. The morphological characteristics of the fossil specimen are very similar to those of the extant species *Rhea americana*. Consequently, their status as a different species of the genus *Rhea* is no longer valid and *Rhea anchorenensis* must be considered as junior synonym of *R. americana*.

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RÉSUMÉ

Rhea anchorenensis (Ameghino et Rusconi, 1932) est une espèce éteinte de Rheidae (Aves, Palaeognathae) du Pléistocène de la province de Buenos Aires, Argentine, connue seulement par un fragment distal de tarsométatarse gauche. Depuis sa description en 1932, ce spécimen n'a pas été analysé dans un cadre comparatif approprié comprenant les espèces existantes. Cette étude apporte une nouvelle description de ce spécimen et une comparaison avec les espèces actuelles de Rheidae, avec pour objectif de réévaluer son identité taxonomique. Les caractéristiques morphologiques du spécimen fossile sont très semblables à celles de l'espèce actuelle *Rhea americana*. Par conséquent, son statut comme une espèce différente du genre *Rhea* n'est plus valide et *Rhea anchorenensis* doit être considérée comme synonyme junior de *R. americana*.

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1. Introduction

Rheas (Rheidae, Ratitae, Palaeognathae) exclusively inhabit South America (Folch, 1992) and are large (0.92–1.40 m), flightless and cursorial birds that can reach speeds of 60 km/h. Traditionally, *Rhea americana* (greater rhea) and *Rhea pennata* (lesser rhea);

formerly *Pterocnemia pennata*, SACC, 2008) have been the two recognized extant species and, recently, del Hoyo et al. (2016) proposed a third species, *Rhea tarapacensis* (puna rhea, formerly considered a subspecies of *R. pennata*). Rheidae inhabits mainly open areas, *R. americana* prefers tall grasslands (such as the Pampean region) and savanna-type habitats with vegetation, while *R. pennata* prefers arid steppes (Folch, 1992). In Argentina, both *R. americana* and *R. pennata* are present, the former inhabits large part of the north, center and east of the country, whereas *R. pennata* inhabits the south (the Patagonian region) and the west (the

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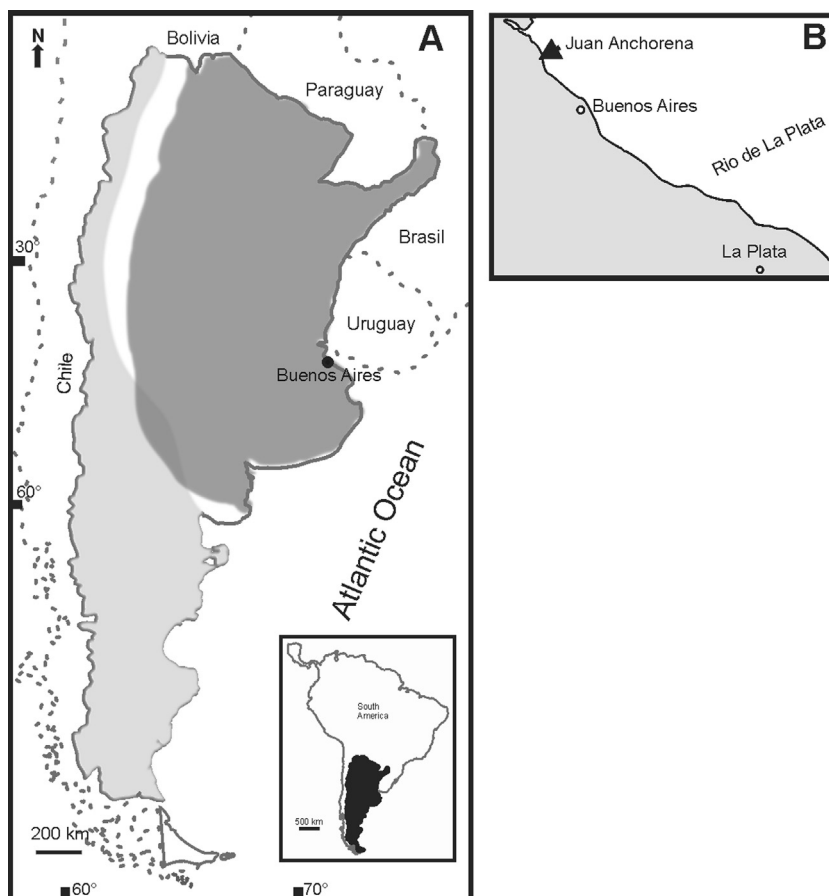


Fig. 1. (A) Map of Argentina showing the geographic distribution of the extant *Rhea americana* (dark grey) and *Rhea pennata* (light grey); (B) map showing the geographical location of the Juan Anchorena station train where the fossil specimen PVL 1286 was discovered.

(A) Carte d'Argentine indiquant l'emplacement géographique des espèces actuelles *Rhea americana* (gris foncé) et *Rhea pennata* (gris clair); (B) carte montrant l'emplacement géographique de la gare ferroviaire Juan Anchorena où le spécimen fossile PVL 1286 a été découvert.

Andean region) of the country. Fossil representatives of this family are found in the Paleogene and the Neogene of Argentina and Brazil (Agnolin and Noriega, 2012; Picasso and Mosto, 2016) and the Neogene of Chile (Martínez et al., 2009) (for details see Tambussi, 1995; Agnolin and Noriega, 2012; Picasso and Mosto, 2016).

The fossil Rheidae from the Pliocene and Pleistocene of the Pampean region comprised several extinct species; most of them were first described in the late 19th and early 20th century (Ameghino, 1891; Moreno and Mercerat, 1891; Rovereto, 1914; Ameghino and Rusconi, 1932) and were found in various localities of Buenos Aires province. In the early Pliocene (Monte Hermoso Formation, Deschamps et al., 2012; Tomassini et al., 2013), *Heterorhea dabbeni* was described by Rovereto (1914), and later, in the 1990s, a new taxon was found in this same locality: *Hinasuri nehuensis* Tambussi, 1995. The first occurrence of the genus *Rhea* in the fossil record is found in the Pleistocene. The most ancient record belongs to the specimen here studied, *Rhea americana anchorenensis*. It was described by Ameghino and Rusconi (1932) for the Ensenadean levels, lower-middle Pleistocene (Soibelzon et al., 2008a, b; Cione et al., 2015). Another species, *Rhea pampeana* was described by Moreno and Mercerat (1891) for the Lujanian levels, late Pleistocene–early Holocene (Cione et al., 2015) and it is now considered as a synonym of *Rhea americana* (Picasso, 2016). Also, the fossil record for *Rhea americana* is abundant in Pleistocene archaeological sites (Tambussi, 1995; Agnolin and Noriega, 2012).

The species considered in this work, *Rhea anchorenensis*, was collected in the Juan Anchorena railway station of the Martínez Locality, San Isidro district, Buenos Aires province, Argentina (Fig. 1

A–C). This site was part of the historic fossiliferous deposits known as “Toscas del Río de La Plata” located along the shores of the Río de la Plata in Buenos Aires (Soibelzon et al., 2008a; Cione et al., 2015). This fossil bird is only known from a distal fragment of a left tarsometatarsus and was first named by Ameghino and Rusconi (1932) as *Rhea americana anchorenensis*. Later, it was changed to *Rhea anchorenensis* by Brodkorb (1963) without providing an explanation of this taxonomic decision. Tonni (1980) briefly mentioned this species restating the proposal of Brodkorb (1963). In the following years, the fossil could not be located in any collection to be re-studied, therefore this taxonomic proposal was the one followed by Tambussi (1995). It is noteworthy that, for more than 80 years, the only description of *Rhea anchorenensis* was performed by Ameghino and Rusconi in 1932. Thus, a new description and taxonomic revision of this paleospecies is necessary to achieve a better understanding of the past biodiversity of the Rheidae. In turn, a more accurate taxonomic identification of fossil specimens helps to improve the studies of biodiversity in a long-term perspective (Smith, 2003).

The aim of this study was to re-examine and compare the material assigned to *Rhea anchorenensis* providing a more detailed description and furthermore, to evaluate its taxonomic identity.

2. Materials and methods

The fossil specimen PVL 1286 is a distal left tarsometatarsus, which belongs to the Colección Paleontología Vertebrados of the Instituto Miguel Lillo (PVL), Tucumán, Argentina. It was compared

with the two extant species of Rheidae: *Rhea americana* and *R. pennata* of the Colección Anexa, División Paleontología Vertebrados, Museo de La Plata (MLP), Buenos Aires, Argentina: *R. americana*: MLP 273, 876, 877, 878, 879, 880, 881, 903 and *R. pennata*: MLP 672, 673, 676, 677, 834, 802. The maximum width at the level of the trochleae was measured with a digital caliper (0.01 mm precision). The anatomical terminology follows [Baumel and Witmer \(1993\)](#).

3. Systematic paleontology

Order Rheiformes ([Forbes, 1884](#))
Family Rheidae ([Bonaparte, 1849](#))
Genus *Rhea* [Brisson, 1760](#)

Rhea americana ([Linnaeus, 1758](#))

Synonymy:

1932 *Rhea americana anchorenensis* Ameghino and Rusconi: p. 4, figure in the same page.

1963 *Rhea anchorenensis* Ameghino and Rusconi; [Brodkorb, 1963](#): p. 201.

1980 *Rhea anchorenensis* Ameghino and Rusconi; [Tonni, 1980](#): p. 110.

1995 *Rhea anchorenensis* Ameghino and Rusconi; [Tambussi, 1995](#): p. 125.

Material: PVL 1286, distal portion of a left tarsometatarsus comprehends the final portion of the corpus tarsometatarsi and the three trochleae metatarsorum ([Fig. 2 A–E](#)).

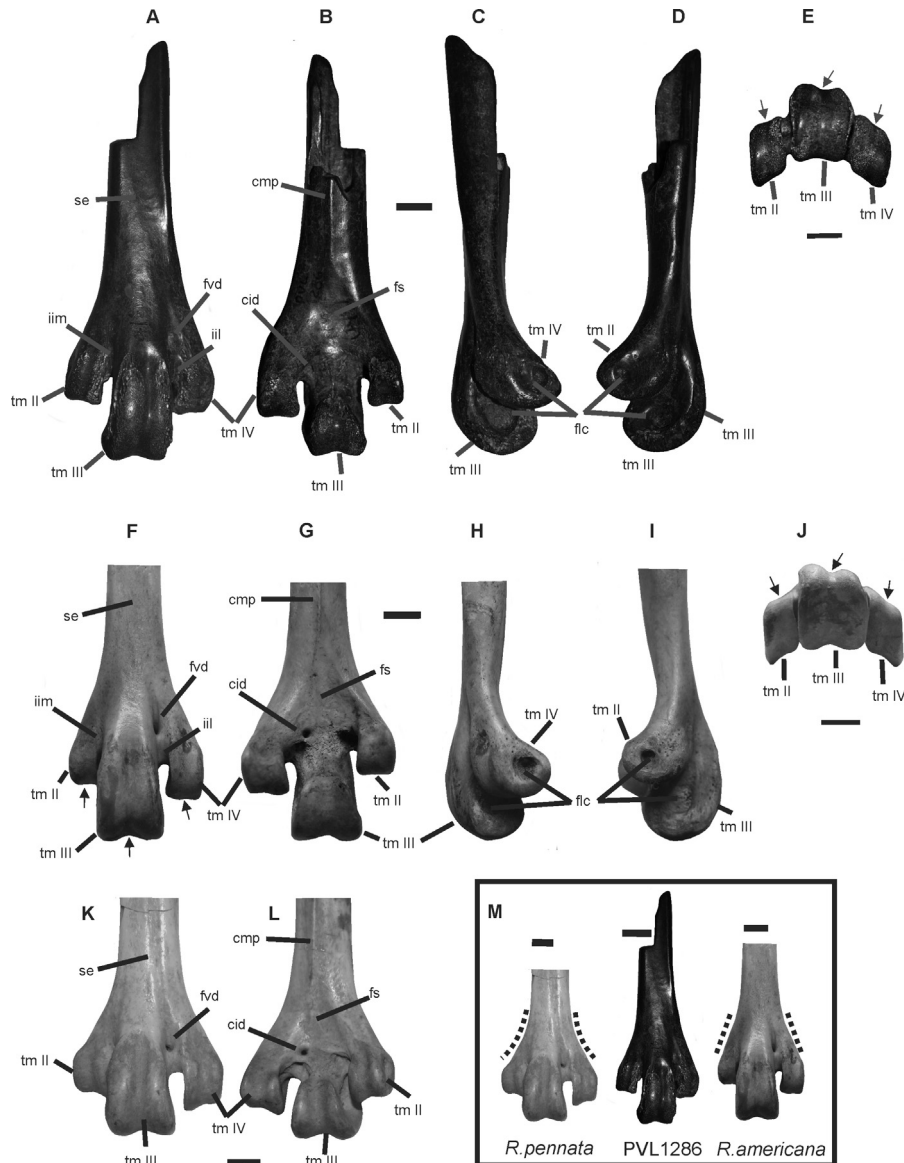


Fig. 2. Tarsometatarsus of PVL 1286 (A–E), *Rhea americana* (MLP 903) (F–J) and *Rhea pennata* (MLP 802) (K, L); (M): detailed comparison in dorsal view between the extant species and PVL 1286; (A, F, K): dorsal view; (B, G, L): plantar view; (C, H): lateral view; (D, I): medial view; (E, J): distal view. Abbreviations: cid: canalis interosseus distalis; flc: fovea ligamentum collateralis; fs: fossa supratrochlearis; fvd: foramen vasculare distale; iil: incisura intertrochlearis lateralis; iim: incisura intertrochlearis medialis; ri: ridge; se: sulcus extensorius; tm II, III, IV: trochlea metatarsi II, III and IV, respectively. Arrows indicate the longitudinal groove of each trochlea. Dotted line in (M) mark the divergence of trochleae II and IV; note the greater divergence in *R. pennata*. Scale bar: 1 cm.

Tarsométatarse de PVL 1286 (A–E), de *R. americana* (F–J) et *R. pennata* (K, L); (M) : comparaison détaillée en vue dorsale entre les espèces actuelles et PVL 1286 ; (A, F) : vue dorsale ; (B, G) : vue plantaire ; (C, H) : vue latérale ; (D, I) : vue médiale ; (E, J) : vue distale. Abréviations : cid : canalis interosseus distalis ; flc : fovea ligamentum collateralis, fs : fossa supratrochlearis, fvd : foramen vasculare distale, iil : incisura intertrochlearis lateralis, iim : incisura intertrochlearis medialis ; ri : ridge ; se : sulcus extensorius ; tm II, III, IV : trochlea metatarsi II, III et IV, respectivement. Les flèches indiquent la rainure longitudinale de chaque trochlée. La ligne pointillée en (M) marque la divergence des trochleae II et IV ; noter la divergence plus marquée chez *R. pennata*. Barre d'échelle : 1 cm.

Table 1
Measures and mean (in mm) of the latero-medial width of the tarsometatarsus of *Rhea americana*, *R. pennata* and PVL 1286.
Mesures et moyenne (en mm) de la largeur latéro-médiale du tarsométatarse de Rhea americana, R. pennata et PVL 1286.

<i>R. americana</i>	<i>R. pennata</i>	<i>R. anchorenensis</i>	
MLP 876	39.74	MLP 834	41.78
MLP 877	38.74	MLP 676	40.68
MLP 878	41.40	MLP 673	38.02
MLP 879	35.98	MLP 672	40.02
MLP 880	53.54	MLP 802	39.98
MLP 881	35.82	MLP 677	40.22
MLP 903	36.74		
MLP 273	44.01		
Mean	40.74	Mean	40.11

Measurements: Maximum width at the level of the trochleae: 40.60 mm.

Stratigraphic and geographic origin: the fossil was collected in the Juan Anchorena train railway station, Martinez Locality (Buenos Aires province, Argentina) (Fig. 1 A–C) that corresponds to the Ensenadean Stage (Lower–Middle Pleistocene; Soibelzon et al., 2008a, b).

4. Description

The trochleae metatarsorum II, III and IV are well-preserved, although each trochlea shows damaged or worn edges, this is more pronounced in trochleae II and IV (Fig. 2A, B). The trochlea metatarsi II is the smallest, while the trochlea metatarsi III is the largest and is the most distally extended one (Fig. 2 A, B).

In dorsal view, the three trochleae present a longitudinal groove, which is poorly marked on the trochleae metatarsi II and IV and deeper in the trochlea III (Fig. 2 A, E). This trochlea is also more dorsally extended (Fig. 2C, D, E). The incisurae intertrochleares are deep (Fig. 2 A), and above the incisura intertrochlearis lateralis is the foramen vasculare distale (Fig. 2 A) which is obliterated with sediments. The fovea ligamentum collateralis is observed in the lateral aspects of each trochleae metatarsi (Fig. 2C, D).

In plantar view, the fossa supratrochlearis plantaris is shallow with an almost triangular contour and we observed the canalis interosseus distalis obliterated with sediments (Fig. 2B). The distal portion of the corpus tarsometatarsi presents its facies dorsalis nearly planar, with a wide sulcus extensorius delimited by two low ridges (Fig. 2 A). The facies plantaris is poorly preserved, nonetheless, a medial low crista medianoplantaris can be observed, which fades towards the fossa supratrochlearis plantaris.

The comparison of the fossil with the extant species allows to observe the great similarity between them (Fig. 2 F–J; K, L) e.g. ridges and the sulcus extensorius, fossa supratrochlearis plantaris, general arrangement of the trochleae (Fig. 2 A, F, K and Fig. 2 B, G, L, see also Tambussi and Tonni, 1985; Picasso, 2016). The divergence of trochleae II and IV (Fig. 2M) is the only notable morphological difference between the fossil and *Rhea pennata*. In PVL 1286, the divergence is compatible with that of *R. americana*, which is less divergent with respect to *R. pennata* (Fig. 2M; see also Fig. 2 A, F, K).

Regarding the dimensions of PVL 1286, it can be observed that it is very similar to those of *R. americana* and *R. pennata* (Table 1).

5. Discussion

All the preserved features of the fossil specimen PVL 1286 are very similar and consistent with the morphological features of the extant *Rhea americana*, especially the divergence of the trochleae II and IV. This trait allows to distinguish the extant species *Rhea americana* from *Rhea pennata* (Tambussi and Tonni, 1985; Picasso, 2016) with the divergence being less pronounced in *Rhea americana*. In consequence, there is little evidence to consider this fossil as a

distinct species of the genus *Rhea*, therefore the change performed by Brodkorb (1963) is no longer valid. PVL 1286 corresponds to a fossil specimen of the neospecies *Rhea americana* hence, *R. anchorenensis* must be considered as a junior synonym of *R. americana*.

Regarding the original description of PVL 1286, Ameghino and Rusconi (1932) have noticed great similarity of the fossil specimen with the extant species. However, they used three inconspicuous features to identify the fossil as a subspecies: the greater elevation of the trochlea metatarsi III, the lesser projection of the trochlea metatarsi IV and a marked ridge in the preserved portion of the corpus tarsometatarsi (Ameghino and Rusconi, 1932). Nevertheless, the analysis of several specimens of *R. americana* demonstrate that these features are merely due to intraspecific variability and have no taxonomical value. This validates how important it is to consider the morphological variation of osseous traits in taxonomic decisions, because it is crucial to correctly delineate species boundaries and to avoid an overestimation of species diversity (Dayrat, 2005).

Finally, with this change, the fossil record of Rheidae in the Pleistocene of the Buenos Aires province does not include any paleospecies and it is only composed by fossil representatives of the two neospecies *R. americana* and *R. pennata* (see also Agnolin and Noriega, 2012 and literature cited herein).

Disclosure of interest

The authors declare that they have no competing interest.

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