

Papéis Avulsos de Zoologia

Museu de Zoologia da Universidade de São Paulo

Volume 57(3):23-29, 2017

www.mz.usp.br/publicacoes
www.revistas.usp.br/paz

ISSN impresso: 0031-1049
ISSN on-line: 1807-0205

FIRST RECORD OF THE *NEOLICAPHRIUM RECENS* FRENGUELLI, 1921 (MAMMALIA, LITOPTERNA) IN THE PLEISTOCENE OF SANTIAGO DEL ESTERO PROVINCE, ARGENTINA

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ABSTRACT

The first record of the Neolicaphrium recens Frenguelli, 1921 (Mammalia, Litopterna) from Pleistocene deposits of the Río Dulce, Río Hondo Department, Santiago del Estero Province, Argentina, is reported. The morphology and morphometry observed in the specimen MPAT073 is coincident with the diagnostic characteristics of that species. This finding represents the northernmost and westernmost record of the species, and thus extends its geographical distribution. Geological data suggest that the material comes from a still unnamed Pleistocene stratigraphic unit.

KEY-WORDS: Proterotheriidae; Termas de Río Hondo; Northwestern Argentina; Río Dulce; Quaternary.

INTRODUCTION

Proterotheriidae is one of the endemic families of South American mammals (Bond *et al.*, 1995; Soria, 2001) recorded from the early Paleocene to the late Pleistocene (Bond *et al.*, 2001; Villafañe *et al.*, 2006). Remains of proterotheriids have been found mainly in Argentina, but also in Colombia, Peru, Bolivia (Soria, 2001), Venezuela (Linares, 2004), Brazil (Cifelli, 1983; Scherer *et al.*, 2009; Aires & Lopes,

2012) and Uruguay (Ubilla *et al.*, 2004, 2011). After the late Miocene this group becomes severely reduced in diversity and frequency and the family survives until the Pleistocene with a single genus, *Neolicaphrium* Frenguelli, 1921.

Two species of *Neolicaphrium* are recognized: *N. recens* Frenguelli, 1921 and *N. major* Soria, 2001. The first one was recorded in Middle-Upper Pleistocene sediments cropping out at Argentina, Uruguay and Brazil (Tauber, 2000; Bond *et al.*, 2001; Ubilla

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et al., 2011; Scherer *et al.*, 2009), and the latter is exclusive to the Pliocene (Chapadmalalan age, Miramar Formation) of the Pampean Region (Argentina) (Soria, 2001).

In Argentina, *N. recens* is recorded in Córdoba Province (middle-late Pleistocene; see Frenguelli, 1921; Tauber, 2000), Corrientes Province (Toropí/Yupoí Formation; late Pleistocene, see Tonni, 2004;

Tonni *et al.*, 2005; Francia *et al.*, 2012; Francia, 2014; Francia *et al.*, 2015), and Santa Fe Province (Tezanos Pinto Formation; late Pleistocene-early Holocene; see Vezzosi *et al.*, 2009). In Brazil there are records in Rio Grande do Sul (late Pleistocene; Scherer *et al.*, 2009), and in Uruguay it is recorded in Salto and Tacuarembó departments (Sopas Formation; late Pleistocene; see Bond *et al.*, 2001; Ubilla *et al.*, 2011) (Figure 1).

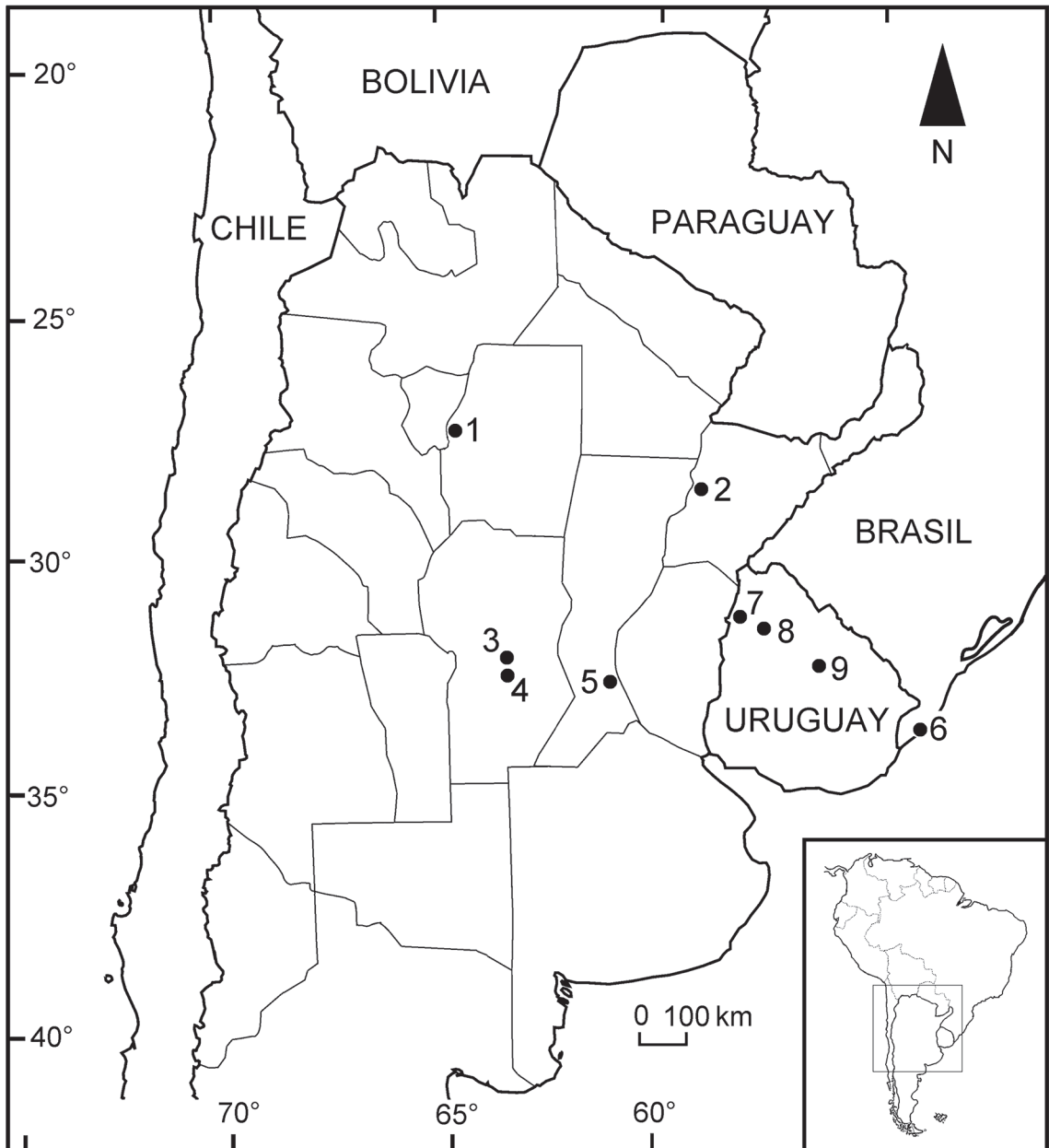


FIGURE 1: Geographic distribution of *Neolicaphrium recens*. ARGENTINA: (1) Río Dulce, Río Hondo Department, Santiago del Estero Province; (2) Arroyo Toropí, near Bella Vista locality, Bella Vista Department, Corrientes Province; (3) Right margin of Río Primero, about 3.5 km East of Córdoba Station, Altos de San Vicente, Córdoba; (4) 2 km North of Corralito, Tercero Arriba Department, Córdoba Province; (5) Tezanos Pinto Formation, South of Santa Fe Province. BRAZIL: (6) Playa Hermenegildo, Santa Victoria do Palmar municipality, Rio Grande do Sul State. URUGUAY: (7) Río Arapey, Salto Department; (8) Arroyo Sopas, Salto Department; (9) Arroyo Malo, Tacuarembó Department.

The main objective of this contribution is to present the first record of *Neolicaphrium recens* Frenguelli, 1921 in Pleistocene sediments of Santiago del Estero Province, Argentina.

Geological Context

The fossil comes from the Río Dulce, between Cañada de la Costa and Sotelo localities (27°28'42"S; 64°45'16"W), Río Hondo Department, Santiago del Estero Province, Argentina (Figure 1). This site corresponds to one of the Pleistocene units cropping out in the area that has been mentioned, with different treatment in the literature, but without an appropriate stratigraphic systematization (Beder, 1928; Battaglia, 1982; Gramajo, 1992). All these units have a similar lithology: they are gray and light brown sandy gravels, sands, fluvial and lacunar sandy silts, and loess. According to the record of *Glyptodon clavipes*, *Panochthus tuberculatus*, *Doedicurus clavicaudatus*, and *Megatherium americanum* in the area, Gramajo (1992) and Powell & Deraco (2003) assigned the bearing sediments to the Lujanian Stage. Recently, Alberdi *et al.* (2008) analyzed remains of *Stegomastodon platensis* from Río Dulce, in Los Quiroga locality, a site close to the studied locality and, based on one dating of $19,900 \pm 120$ radiocarbon years before present (RCYBP), they assigned a late Pleistocene age to the fossiliferous levels. Later, Chimento & Agnolin (2011) analyzed a vertebrate assemblage from the same locality and accepted the age given by Alberdi *et al.* (2008).

A general section between the Río Hondo dam and the area of Sotelillo, approximately 20 km long, shows the following sequence. From the normal river level upwards, first appears the Las Cañas Formation constituted by red and brown silty sandstones, with variable thickness between 6 and 10 meters, covered in several places by one or two hardened tuff levels (Battaglia, 1982). This is followed by about 10 meters of coarse to medium and fine sands, in part conglomeratic, and grey and beige fine or sandy silts from which come the fossils reported here. At the top of this sequence, 7-8 m of loess covers the whole region. Probably, most of the Pleistocene fossils cited in the literature, correspond to the above mentioned sands and gravels.

MATERIALS AND METHODS

The studied specimen (MPAT073) is housed at the Paleoantropological Museum "Rincón de Ataca-

ma" (MPAT), in Las Termas de Río Hondo, Santiago del Estero Province, Argentina.

Measurements were taken with digital calipers with 0.01 mm accuracy; all measurements are in millimeters.

The chronostratigraphic and geochronologic references correspond to the schemes of Cione & Tonni (2005).

Institutional Abbreviations: **Ctes-PZ UNNE:** Paleozoología Corrientes, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Corrientes, Argentina; **FC-DPV:** colección de Paleontología de Vertebrados de la Facultad de Ciencias, Universidad de la República, Montevideo, Uruguay; **MLP:** Museo de La Plata, Buenos Aires, Argentina.

Abbreviations: **m1**, first lower molar; **m2**, second lower molar; **m3**, third lower molar; **pm1**, first lower premolar; **pm2**, second lower premolar; **pm3**, third lower premolar; **pm4**, fourth lower premolar.

SYSTEMATIC PALAEONTOLOGY

Order Litopterna Ameghino, 1889

Superfamily Protherotherioidea Cifelli, 1983

Family Protherotheriidae Ameghino, 1887

Subfamily Protherotheriinae Ameghino, 1885

Genus *Neolicaphrium* Frenguelli, 1921

Neolicaphrium recens Frenguelli, 1921

Figures 2-4

Studied material

MPAT073: Right hemimandible with the symphyseal region and incomplete cheek teeth series, preserving only the m1 *in situ*, the alveoli of pm1, pm2, pm3, pm4, and m3 (Figures 2 and 3), and an isolated m2 (Figure 4).

Geographic and stratigraphic provenance

Río Dulce, Río Hondo Department, Santiago del Estero Province, Argentina (27°28'42"S; 64°45'16"W); Pleistocene (Figure 1).

Description

The right hemimandible is incomplete and fragmented. It preserves the symphyseal region and the horizontal ramus, broken at the level of pm3 and m3,

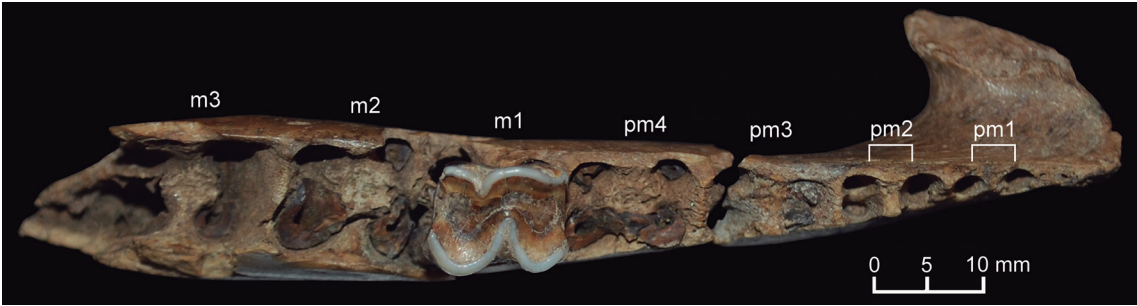


FIGURE 2: *Neolicaphrium recens*. Occlusal view of the right hemimandible (MPAT073).

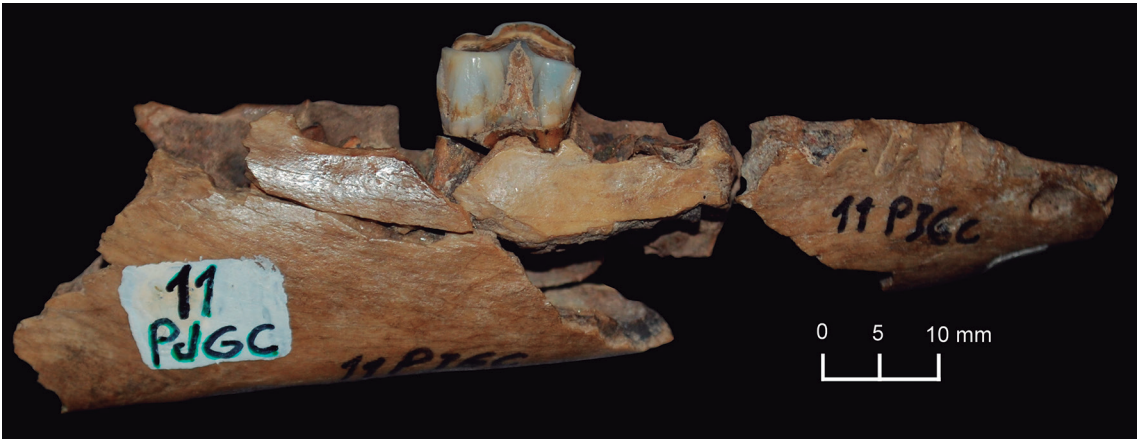


FIGURE 3: *Neolicaphrium recens*. Labial view of the right hemimandible (MPAT073).

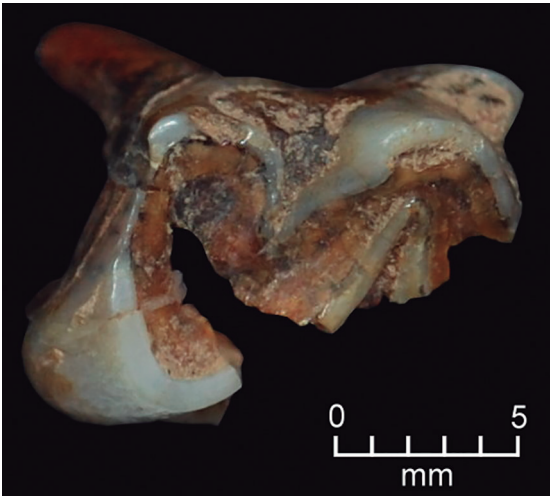


FIGURE 4: *Neolicaphrium recens*. Occlusal view of the isolated m2.

with the alveoli of pm1, pm2, pm3, pm4 and m3, complete m1, and fragmented m2, detached to the dentary. Considering the degree of wear, the specimen was an adult individual. The alveolar morphology of pm1-4 is coincident with the detailed description given by Frenguelli (1921) for the anatomy of roots of the premolars of *N. recens*.

The occlusal surfaces of m1 and m2 have a well-developed layer of cement, typical of *Neolicaphrium recens* (Bond *et al.*, 2001). The mesial and distal sides of m1 have no enamel due to the wide contact with the pm4 and m2. The m2 is fragmented and its characteristics cannot be clearly seen. The alveolar region of the m3 is quite damaged but four separate alveoli, two mesial and two distal, can be observed. The morphology of the walls separating these alveoli is similar to what is observed in the pm4.

In dorsal view, the mandibular symphysis reaches posteriorly the level of the anterior end of the alveolus of pm2. The mental foramen is located slightly forward to the anterior part of the alveolus of pm1.

Measurements

Table 1.

DISCUSSION

The specimen MPAT073 is assigned to *N. recens* according to the morphologic and morphometrical features mentioned by Frenguelli (1921),

TABLE 1: Measurements of MPAT073, and other specimens of *Neolicaphrium recens* from literature: MLP-34-V-22-12 (Holotype, Córdoba Province, Argentina); FC-DPV-776 (Salto Department, Uruguay); CTES-PZ-UNNE 1604 (Corrientes Province, Argentina).

MEASUREMENTS	MPAT 073	MLP-34-V-22-12	FC-DPV-776	CTES-PZ-1604
Height of the ramus at the level of m3, measured at the lingual side	23,04	20		
Height at the level of m1, measured by the inner side	20,13	19		
Height at the level of pm4, measured by the inner side	18,73	16		
Height at the level of pm2, measured by the inner side	12,32	15		
Labio-lingual width at the level of m2	13,05	12,5		
Labio-lingual width at the level of pm4	10,38	11		
Labio-lingual width at the level of pm2	6,4	7,5		
Mesio-distal length of m1	11,32	10,25	11,8	12,5
Labio-lingual width towards the base of the mesial lobe m1	8,61	8	9,7	7,5
Labio-lingual width towards the base of the distal lobe m1	8,84	8	10,5	8
Maximum crown height on the labial side of m1	6,4	6		
Mesio-distal length of m2	(10,07)	14	13,6	13
Labio-lingual width towards the base of the mesial lobe m2	?	8,5	10,3	7,3
Labio-lingual width towards the base of the distal lobe m2	8,76	8,5	9,7	7,8
Maximum crown height on the outside m2	?	7,5		
Mesio-distal length of the mesial lobe of m1	4,42	4,75		
Mesio-distal length of the distal lobe of m1	5,67	5,5		

Measurements of MLP-34-V-22-12 were taken from Frenguelli, 1921; FC-DPV-776 and CTES-PZ-160 taken from Bond *et al.* 2001.

Bond *et al.* (2001), Soria (2001) and references cited therein. These features are: the marked development of a layer of cement on the occlusal surface of m1 and m2, the alveolar morphology of pm1-4, and the measurements of m1 and m2 (see Table 1). It is remarkable that most of the fossil remains belonging to this species correspond to jaw fragments, while postcranial and cranial elements are scarce (Tauber, 2000; Ubilla *et al.*, 2011). Even the holotype consists only of an incomplete left hemimandible with pm2-m3, belonging to a subadult individual. The marked wear of the occlusal region of m1 prevents the observation of the connection between entoconid and hipoconulid, which is a diagnostic feature according to Soria (2001). The m1 and m2 have the particular features of the family Protheroteriidae (Ameghino, 1889; Soria, 2001) and do not differ from previous descriptions of *N. recens* (Bond *et al.*, 2001). Soria (2001) indicates that the main difference between the two recognized species of *Neolicaphrium* is the size, *N. major* being the largest. For this reason we consider that MPAT073 does not belong to *N. major* mainly due to the size of the m1 (antero-posterior length 15 mm, labio-lingual length 9.7 mm) (see Soria, 2001, and Table 1).

Considering the limited geological information available (see Geological context above), we consider the material comes from Pleistocene sediments, until the stratigraphy in the area would be clarify. According to Powell & Deraco (2013), the

bearing sediments are assigned to the Lujanian Stage; however, some remains of ensenadan mammals were also found but they were not found “*in situ*” (Gaudioso *et al.*, in prep.). The specimen here described represents the northernmost and westernmost record of the species and extends its geographical distribution.

The members of the family Protheroteriidae are supposed to have inhabited areas with abundant vegetation, which provided them protection and food (Soria, 2001). According to Bond *et al.* (2001), *N. recens* is a relict of this family that was restricted to South American forested areas with warm climates during the Pleistocene. However, certain dental features suggest that *N. recens* could have been adapted to open environments such as savanna woodlands (Bond *et al.*, 2001). In addition, Vezzosi *et al.* (2009) proposed that this species inhabited open environments with arid climate (*e.g.*, grasslands).

The geographic distribution of *N. recens* contributes to further strengthening the faunal affinities between the Chaco region and the Argentine Mesopotamian region proposed by Chimento & Agnolin (2011), and between the Argentine Mesopotamian region, western Uruguay and southern Brazil proposed by Carlini *et al.* (2004). The record of this species in north-central Argentina, could reflect an extension of their geographic range in certain periods with favorable environmental conditions.

RESUMEN

Se presenta el primer registro del proterotérido *Neolicaphrium recens* Frenguelli, 1921 (Mammalia, Litopterna) en sedimentos del Río Dulce, Departamento Río Hondo, provincia de Santiago del Estero, Argentina. Los rasgos morfológicos y morfométricos observados en el espécimen MPAT073 son coincidentes con los caracteres indicados como diagnósticos de esa especie. Este hallazgo representa el registro más septentrional y occidental reportado hasta el momento para esta especie, y extiende su rango de distribución geográfica conocida. Los datos geológicos disponibles sugieren que el material proviene de una unidad todavía innominada del Pleistoceno.

PALABRAS-CLAVE: Proteroteridae; Termas de Río Hondo; Noroeste argentino; Río Dulce; Cuaternario.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to the family Gaudioso for their support, cooperation and funding the field trips. We also thank Dra. Cecilia Deschamps and Lic. Mariano Bond for their valuable contribution and comments, Facultad de Ciencias Naturales y Museo (UNLP) and the Consejo de Investigaciones Científicas y Técnicas (CONICET).

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Aceito em: 30/11/2016

Publicado em: 16/03/2017

Editor Responsável: Mario de Vivo