Publicación Electrónica
ASOCIACIÓN PALEONTOLÓGICA ARGENTINA

www.peapaleontologica.org.ar

Reassessing the fossil record of *Lagostomus incisus* Ameghino, 1888 (Rodentia, Caviomorpha) from the late Neogene of southern South America

LUCIANO LUIS RASIA[1]

1. División Paleontología Vertebrados, Museo de La Plata. Paseo del Bosque s/n, B1900FWA La Plata, Buenos Aires, Argentina; CONICET.

Recibido: 4 de junio 2021 - **Aceptado:** 26 de agosto 2021 - **Publicado:** 13 de octubre 2021

Para citar este artículo: Luciano Luis Rasia (2021). Reassessing the fossil record of Lagostomus incisus Ameghino, 1888 (Rodentia, Caviomorpha) from the late Neogene of southern South America. *Publicación Electrónica de la Asociación Paleontológica Argentina* 21 (2): 53–61.

Link a este artículo: http://dx.doi.org/10.5710/PEAPA.26.08.2021.393

ISSN 2469-0228

Asociación Paleontológica Argentina
Maipú 645 1° piso, C1006ACG, Buenos Aires
República Argentina
Tel/Fax (54-11) 4326-7563
Web: www.apaleontologica.org.ar

Publicación Electrónica
ASOCIACIÓN PALEONTOLÓGICA ARGENTINA
Año 2021 - 21(2): 53–61
ARTÍCULO

REASSESSING THE FOSSIL RECORD OF *LAGOSTOMUS INCISUS* AMEGHINO, 1888 (RODENTIA, CAVIOMORPHA) FROM THE LATE NEOGENE OF SOUTHERN SOUTH AMERICA

LUCIANO LUIS RASIA[1]

[1]División Paleontología Vertebrados, Museo de La Plata. Paseo del Bosque s/n, B1900FWA La Plata, Buenos Aires, Argentina; CONICET. *lucianorasia@conicet.gov.ar*

LLR: https://orcid.org/0000-0002-0300-4918

Abstract. The extinct vizcacha *Lagostomus incisus* is a rodent recorded in Pliocene sediments of Buenos Aires Province (Argentina), including the montehermosan Monte Hermoso Formation and sediments bearing the "Irenean" Fauna, and the chapadmalalan Chapadmalal Formation. Its characteristic skull and cheek teeth anatomy permit to easily identify it even with fragmentary material. In this work, the fossil record of *L. incisus* is reassessed, being recognized in several units where it had not been reported before: the Unit 2 of the Saldungaray Formation, the Quequén Grande Local Fauna, and the Barker Formation in Buenos Aires Province (Argentina), and the San José Member of the Raigón Formation in Maldonado Department (Uruguay). These new records extend the distribution of *L. incisus* to most of central and southern Buenos Aires Province in Argentina and southern Uruguay. Additionally, the recent radiometric dates of some of the units with records of *L. incisus* permit to confidently limit the temporal range of this species to the late early–early late Pliocene.

Key words. Chinchillidae. Cenozoic. Pliocene. Biostratigraphy. Argentina. Uruguay.

Resumen. REEVALUANDO EL REGISTRO FÓSIL DE *LAGOSTOMUS INCISUS* AMEGHINO, 1888 (RODENTIA, CAVIOMORPHA) DEL NEÓGENO TARDÍO DEL SUR DE AMÉRICA DEL SUR. La vizcacha extinta *Lagostomus incisus* es un roedor registrado en sedimentos pliocenos de la provincia de Buenos Aires (Argentina), incluyendo las montehermosenses Formación Monte Hermoso y sedimentos portadores de la Fauna "Irenense" y a la chapadmalalense Formación Chapadmalal. Su característica anatomía craneana y dentaria permite identificarla fácilmente, aun tratándose de material fragmentario. En este trabajo, el registro fósil de *L. incisus* es reevaluado, siendo reconocida en varias unidades en las que no había sido reportada con anterioridad: Unidad 2 de la Formación Saldungaray, Fauna Local Quequén Grande y Formación Barker en la provincia de Buenos Aires (Argentina), y en el Miembro San José de la Formación Raigón en el Departamento de Maldonado (Uruguay). Estos nuevos registros extienden la distribución de *L. incisus* a la mayor parte del centro y sur de la provincia de Buenos Aires en Argentina, y al sur de Uruguay. Además, las recientes dataciones radiométricas de algunas de las unidades con registros de *L. incisus* permiten limitar con confianza el rango temporal de esta especie al Plioceno temprano tardío–Plioceno tardío temprano.

Palabras clave. Chinchillidae. Cenozoico. Plioceno. Bioestratigrafía. Argentina. Uruguay.

THE EXTANT vizcacha, *Lagostomus maximus* (Desmarest, 1817), is a remarkable mammal of the Neotropic given peculiar aspects of its external and skeletal anatomy (*e.g.*, Vucetich, 1975; Jackson *et al.*, 1996), behavior (*e.g.*, Branch, 1993a, 1993b; Rafuse *et al.*, 2017; Tomassini *et al.*, 2019), population dynamics (Gariboldi *et al.*, 2019) and reproductive anatomy and physiology (*e.g.*, Flamini *et al.*, 2009, 2020; Acuña *et al.*, 2020; Barbeito *et al.*, 2021). It is a large gregarious caviomorph rodent, with a notable sexual dimorphism, that lives in complex burrow systems (*e.g.*, Llanos & Crespo, 1952; Weir, 1974). It inhabits scrubs and grasslands of Argentina, western Paraguay and southern Bolivia, which encompasses the Pampas, Monte and Chaquenean regions (Jackson *et al.*, 1996; Spotorno & Patton, 2015; Fig. 1.1). It is the only living member of Lagostominae, which conform along with chinchillas and mountain vizcachas the family Chinchillidae (*e.g.*, Spotorno & Patton, 2015; Spotorno & Valladares Faúndez, 2016); although a recent study includes Lagostominae and Chinchillinae, together with several extinct taxa, within pan-Chinchillidae (Rasia *et al.*, 2021).

Notwithstanding being represented in recent times by a single species, the fossil record of *Lagostomus* Brookes, 1828 extends to the Chasicoan Stage/Age (late Miocene; Rasia & Candela, 2017a), counting numerous extinct species

(*e.g.*, Ameghino, 1889; Rovereto, 1914; Rasia & Candela, 2013, 2017a, 2017b; Rasia *et al.*, 2020).

Lagostomus incisus was described by Ameghino (1888) for the Monte Hermoso Formation (early Pliocene, Montehermosan Stage/Age; see Tomassini *et al.*, 2013), along with '*Lagostomus spicatus*' Ameghino, 1888. Later, Ameghino (1908) mentioned a similar species to '*Lagostomus spicatus*' in the Chapadmalal Formation (late Pliocene, Chapadmalalan Stage/Age; see Prevosti *et al.*, 2021). Recently, '*Lagostomus spicatus*' was synonymized with *L. incisus*, and the latter was also confirmed in the Chapadmalal Formation and "Irenean" Fauna, both in Buenos Aires Province (Rasia & Candela, 2013). A record of '*Lagostomus spicatus*' from Uruguay (Francis & Mones, 1965) was rejected by Rasia & Candela (2013), indicating that the material did not belong to *Lagostomus incisus*, pending a broader systematic study for a precise specific status —it is noteworthy that Rasia & Candela (2013) did not questioned the inclusion of this material in *Lagostomus*—.

As was noted by Rasia & Candela (2013, 2017b), the anatomy of *Lagostomus incisus*, particularly that of the cheek teeth, is quite distinguishable from other species of the genus, and permits an easy identification even with very fragmentary material. This feature, along with the restricted stratigraphic range of this species (Pliocene, Montehermosan–Chapadmalalan stages/ages), make it an exceptional tool for biostratigraphic studies (see Rasia & Candela, 2013, 2017b; Rasia *et al.*, 2020).

Until recent works, the precise age of late Neogene sediments of the Pampean area—where *Lagostomus incisus* has been recorded—rely almost exclusively on biostratigraphic studies (*e.g.*, Cione & Tonni, 1995; Deschamps *et al.*, 2012; Tomassini *et al.*, 2013; Pardiñas *et al.*, 2017), being the Chapadmalal Formation the only dated unit (Schultz *et al.*, 1998). Recently, the sediments bearing the "Irenean" Fauna and the Chapadmalal Formation has been dated with radiometric methods (Prevosti *et al.*, 2021), permitting to recalibrate the age of most of late Neogene units of the Pampean area.

In this work, the fossil record of this conspicuous species is reevaluated, within the context of recent progress regarding the chronostratigraphy/geochronology of the Pampean area in southern South America.

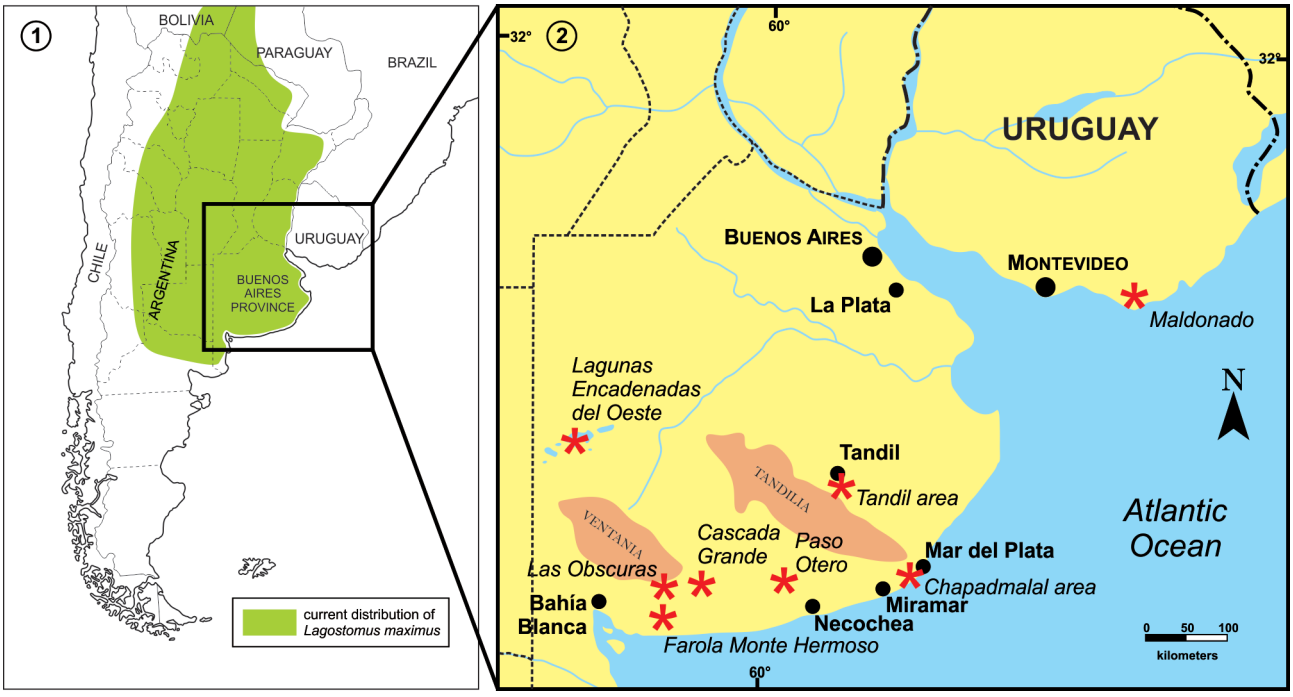


Figure 1. Geographic maps. **1,** Map of southern South America showing current distribution of ***Lagostomus maximus*** (modified from Jackson *et al.*, 1996). **2,** Location map of fossil localities mentioned in the text.

MATERIAL AND METHODS

Published records of lagostomines were analyzed, and the material was morphologically compared with that of all recognized species of *Lagostomus* (see Marshall & Patterson, 1981; Nasif *et al.*, 2013; Rasia & Candela, 2013, 2017b; Ubilla & Rinderknecht, 2016 for recent synonymy of *Lagostomus* species). For detail of the material see Appendix 1.

To test the morphological analysis and taxonomic identification of the material, principal component analyses (PCA) were performed. Two measurements of the cheek teeth were used (see Supplementary Material), mesio-distal and labio-lingual width (mdw and llw respectively). The measurements were log-transformed and two PCA based on a correlation matrix were carried out independently for upper and lower cheek teeth. Missing values were imputed by Iterative Imputation. The analyses were performed using Past 3.05 (Hammer *et al.*, 2001).

It is worth clarifying that the morphological comparison was made with adult specimens, given that diagnoses and descriptions of the species are based on adult individuals, but for the PCA, juvenile specimens of the living *Lagostomus maximus* were included in order to take into account the ontogenetic variability.

Institutional acronyms. MLP, Museo de La Plata, La Plata, Argentina; MACN-Ma, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Ciudad de Buenos Aires, Argentina, Mastozoological Collection; MACN-A, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Ameghino Collection; MACN-Pv, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Vertebrate Paleontological Collection; UNSGH, Cátedra de Geología Histórica, Universidad Nacional del Sur, Bahía Blanca, Argentina; MHTL, Museo de Historia y Tradición de Lobería, Lobería, Argentina; SPV-FHC, Facultad de Humanidades y Ciencias, Montevideo, Uruguay.

RESULTS

Systematic identification

A taxonomic revision allowed to identify the presence of *Lagostomus incisus* in several localities and geological units where it has not been mentioned in previous works (see Rasia & Candela, 2013, 2017b), based on the morphology of the skull and mandibles (smaller than *Lagostomus maximus*, maxillae more expanded transversely, palatines reduced in ventral view, posterior palatine apophysis of the premaxillae very reduced and not at the same dorsoventral level as the diastema, clearly differing from *L. pretrichodactyla* (Rovereto, 1914), *L. euplasius* (Ameghino, 1908), *L. compressidens* (Ameghino, 1908), and *L. maximus*, and particularly of the cheek teeth (upper cheek teeth more obliquely implanted in the maxillae than in *L. pretrichodactyla*, *L. euplasius*, *L. compressidens*, and *L. maximus*; lower cheek teeth more compressed mesio-distally and more obliquely implanted in the mandible than in *L. antiquus* Ameghino, 1883, *L. euplasius*, *L. compressidens*, *L. debilis* Ameghino, 1889, *L. heterogenidens* Ameghino, 1889, *L. minimus* Ameghino, 1889, and *L. maximus*.

As was stated above, *Lagostomus incisus* was previously recorded in the Monte Hermoso Formation (Montehermosan Stage/Age, early Pliocene) at Farola Monte Hermoso, the "Irenean" Fauna at Cascada Grande (early Pliocene), and the Chapadmalal Formation (Chapadmalalan Stage/Age, late Pliocene) between Mar del Plata and Miramar, being also recognized in sediments of unknown age (late Miocene to Pliocene) of the Lagunas Encadenadas del Oeste (Ameghino, 1888; Rasia & Candela, 2013, 2017b; Bonini *et al.*, 2017). The new records of *L. incisus* (based in previous reports of lagostomines) come from the following units and localities:

1) From the Unit 2 of the Saldungaray Formation (Montehermosan Stage/Age) at Las Obscuras (Buenos Aires, Argentina; Fig. 1.2), Deschamps (2003, 2005) and Deschamps *et al.* (1989) reported remains (UNSGH 408, UNSGH 457) of lagostomines —as *Lagostomopsis* sp. and *Lagostomus* (*Lagostomopsis*) sp.—, which are here attributed to *L. incisus*.

2) In the Barker Formation (Montehermosan/Chapadmalalan Stage/Age, late Miocene–Pliocene) near Tandil (Buenos Aires, Argentina; Fig. 1.2), Gómez Samus *et al.* (2017) reported *Lagostomus* sp. —as *Lagostomus* (*Lagostomopsis*) sp.— represented by two mandibles with complete dentition (without collection number) that were considered by the authors as similar to *L. incisus* and *L. laminosus*. The material is here recognized as *L. incisus*, being the identification as *L. laminosus* discarded because of its much smaller size (see Nasif *et al.*, 2013).

3) In the Quequén Grande Local Fauna (Lower

Chapadmalalan Stage/Age, early Pliocene *sensu* Cione & Tonni, 1995; Montehermosan Stage/Age *sensu* Tomassini *et al.*, 2013) at Paso Otero (Buenos Aires, Argentina; Fig. 1.2), Prado & Cerdeño (1998) reported several remains of lagostomines (as *Lagostomopsis* sp.). At least three specimens (MHTL P-240, MLP 87-V-20-21 and MLP 87-V-20-22) are here recognized as *Lagostomus incisus*.

4) Francis & Mones (1966) reported the presence of *Lagostomus euplasius* —as *Lagostomus* (*Lagostomopsis*) *euplasius*—from the Maldonado Formation (Pliocene of Uruguay; Fig. 1.2, but see below). The material consist of two specimens, SPV-FHC 20-VII-62-1 and SPV-FHC 10-V-64-1. The specimen SPV-FHC 20-VII-62-1, a partially preserved skull with right P4-M3 and left P4-M1, correspond to *Lagostomus euplasius*; but the other specimen (SPV-FHC 10-V-64-1, a partially preserved skull and right mandible with full dentition) is here referred to *Lagostomus incisus*.

Quantitative analyses

In both analyses (PCA including upper and lower cheek teeth) the PC1 represents mainly variations in size, given that all the variables have similar positive loadings, and the PC2 represents mainly proportions between mesio-distal and labio-lingual width of each teeth, given positive (for llw) and negative (for mdw) loadings (Fig. 2).

The PCAs grouped the specimens of Las Obscuras, Paso Otero, Tandil area and Maldonado with those previously identified as *Lagostomus incisus* from Chapadmalal area, Farola Monte Hermoso, Cascada Grande and Lagunas Encadenadas del Oeste, clearly differing from the other species (Fig. 2).

Age of the units with records of *Lagostomus incisus*

Although most of the units where remains of *Lagostomus incisus* have been recovered are not dated, many of them have estimated ages based mainly on vertebrate fauna (*e.g.*, Cione & Tonni, 1995; Tomassini *et al.*, 2013; Pardiñas *et al.*, 2017), and recent works have adjusted the age with new radiometric dates (*e.g.*, Prevosti *et al.* 2021). The age of each unit (see Fig. 3), from west to east localities, is discussed below.

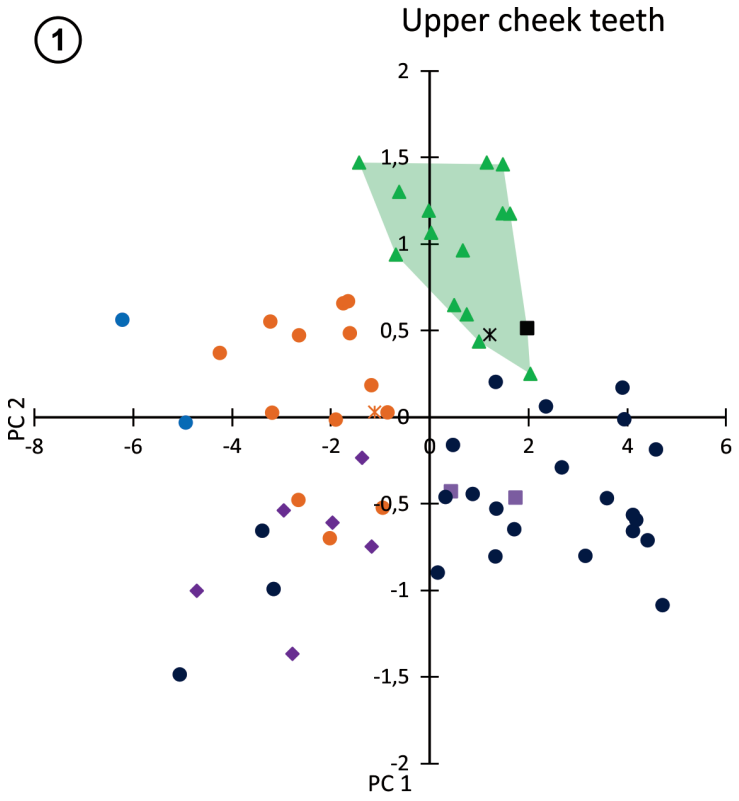
The fauna recovered from sediments at Lagunas Encadenadas del Oeste (Buenos Aires, Argentina) has been considered of late Miocene to Pliocene age (Bonini *et al.*, 2017). The specimens of *Lagostomus incisus* come from a locality with other typical Pliocene taxa (*e.g.*, *Actenomys priscus* (Owen, 1840), *Paedotherium typicum* Ameghino, 1887; Bonini *et al.*, 2017).

The Unit 2 of the Saldungaray Formation, cropping out at Las Obscuras (Buenos Aires, Argentina) has been partially correlated with the Montehermosan Stage/Age of the Monte Hermoso Formation (see Deschamps, 2005). Deschamps (2005) defined the *Actenomys priscus-Plohophorus cuneiformis* Zone for the Unit 2 of the Saldungaray Formation, with a Lower Montehermosan age.

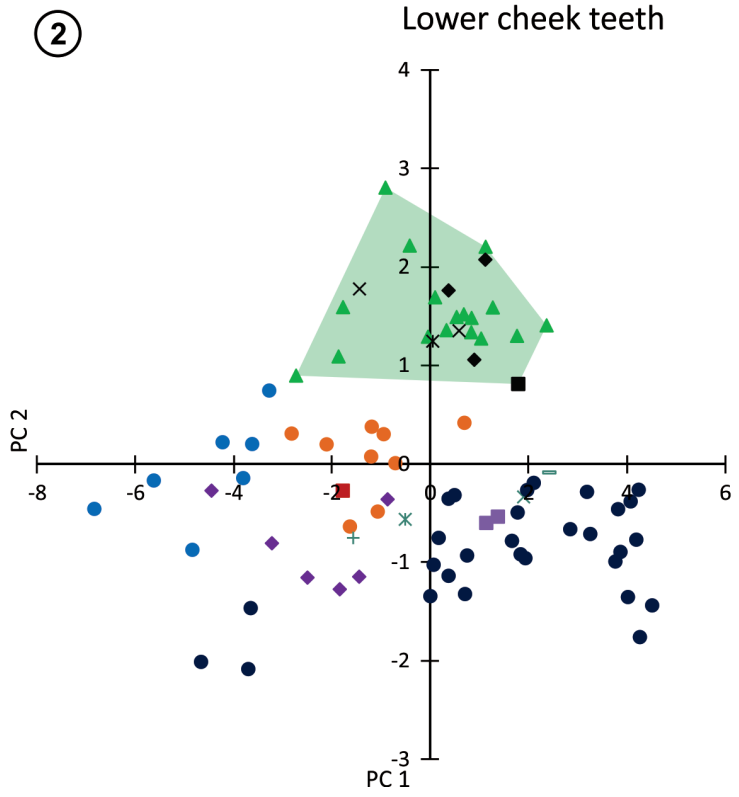
The Monte Hermoso Formation was essentially (see Rasia & Candela, 2013 for more detailed discussion) considered of Montehermosan Age (*e.g.*, Ameghino, 1888; Frenguelli, 1928; Zavala, 1993; Zavala & Navarro, 1993) or encompassing at least two ages (*e.g.*, Vignati, 1925; Leanza, 1948; Bonaparte, 1960; Fidalgo & Tonni, 1982; Cione & Tonni, 1995); but more recent biostratigraphic approaches support a Montehermosan Age for the entire unit (*e.g.*, Deschamps *et al.*, 2012; Tomassini *et al.*, 2013). The age of the Monte Hermoso Formation has been estimated between 5.28 Ma and 4.5/5.0 Ma (Tomassini *et al.*, 2013), so the Montehermosan Stage/Age (*sensu* Tomassini *et al.*, 2013) is restricted to the early Pliocene. However, based on statistical analyses (see Prevosti *et al.*, 2021) a new temporal range to this unit has been inferred between 4.741 and 3.728 Ma, placing it in a slightly younger age, in the late early Pliocene. The material recovered from the Monte Hermoso Formation came from upper levels or do not have precise stratigraphic provenance within the unit (see Rasia & Candela, 2013).

The age of the "Irenean" Fauna has been subject of debate for decades (see Pardiñas *et al.*, 2017 for extensive discussion), and have been recently dated (Prevosti *et al.*, 2021), ending a long lasting controversy. The material of *Lagostomus incisus* recovered from levels bearing the "Irenean" Fauna come from the Cascada Grande locality (Rasia & Candela, 2013), with a probable Montehermosan age (Pardiñas *et al.*, 2017) and a new radiometric date that place it in 4.33 $\pm$ 0.06 Ma (Prevosti *et al.*, 2021).

The Quequén Grande Local Fauna at the locality of Paso Otero (Buenos Aires, Argentina) was considered coeval



	PC 1	PC 2
P4 mdw	0.3474	-0.4278
P4 llw	0.36385	0.19534
M1 mdw	0.35076	-0.36645
M1 llw	0.3593	0.28336
M2 mdw	0.35298	-0.34659
M2 llw	0.35551	0.36828
M3 mdw	0.35874	-0.21689
M3 llw	0.33929	0.51133



- *Lagostomus telenkechanum*
- *L. antiquus*
- *L. pretrichodactyla*
- *L. incisus*
  - FMH-Chap-CG-LEO
  - Las Obscuras
  - Paso Otero
  - Tandil
  - Maldonado
- *L. euplasius*
  - Chapadmalal
  - Maldonado
- *L. compressidens*
- *L. debilis*
- *L. heterogenidens*
- *L. minimus*
- *L. egenus*
- *L. maximus*

	PC 1	PC 2
p4 mdw	0.3654	-0.26667
p4 llw	0.37653	0.14469
m1 mdw	0.34923	-0.37129
m1 llw	0.36119	0.32643
m2 mdw	0.34877	-0.38516
m2 llw	0.33438	0.46017
m3 mdw	0.35315	-0.32548
m3 llw	0.33781	0.4444

Figure 2. Principal Component Analyses (PCA) of cheek teeth measurements of species of ***Lagostomus***. **1,** PCA of upper cheek teeth. **2,** PCA of lower cheek teeth. Tables indicate factor loadings of each variable. Green shaded areas indicates ***Lagostomus incisus*** distribution. Abbreviations: **CG,** Cascada Grande; **Chap,** Chapadmalal area; **FMH,** Farola Monte Hermoso; **LEO,** Lagunas Encadenadas del Oeste; **llw,** labio-lingual width; **mdw,** mesio-distal width.

with the "Irenean" Fauna at Cascada Grande and with the "*limolitas claras*" member of the Monte Hermoso Formation, with a Lower Chapadmalalan age (*sensu* Cione & Tonni, 1995; see Prado & Cerdeño, 1998). The Lower Chapadmalalan was later included in the Montehermosan Stage/Age (Tomassini *et al.*, 2013), so if the Quequén Grande Local Fauna has an equivalent age of the "Irenean" Fauna at Cascada Grande and the Monte Hermoso Formation, it can be assigned to the late early Pliocene.

The Barker Formation, which crops out in several localities near the city of Tandil (Buenos Aires, Argentina), has been correlated with the Montehermosan–Chapadmalalan Stages/Ages, with a late Miocene–Pliocene age (Gómez Samus *et al.*, 2017). Considering a correlation with the Monte Hermoso and Chapadmalal formations, the age of this unit would be late early to early late Pliocene.

The Chapadmalal Formation has been considered of late Pliocene age, and is the base of the Chapadmalalan Stage/Age (*e.g.*, Cione & Tonni, 1995; see Isla *et al.*, 2015 for a detailed account of changing concept of the Chapadmalal Formation). Dates of the paleosoil 6 (base of the Playa los Lobos Alloformation) indicate an estimated age of 3.27±0.08 Ma (Schultz *et al.*, 1998), and recent radiometric dates of level VI (3.74±0.05 Ma) and level X (3.04±0.06 Ma) place the Chapadmalal Formation undoubtedly in the late Pliocene (Prevosti *et al.*, 2021). *Lagostomus incisus* was recognized mainly in the Playa San Carlos Alloformation (Levels I to VIII), but was also recorded in the lower levels of the Playa los Lobos Alloformation (Levels IX to XII), within the Chapadmalal Formation (see Rasia & Candela, 2017b).

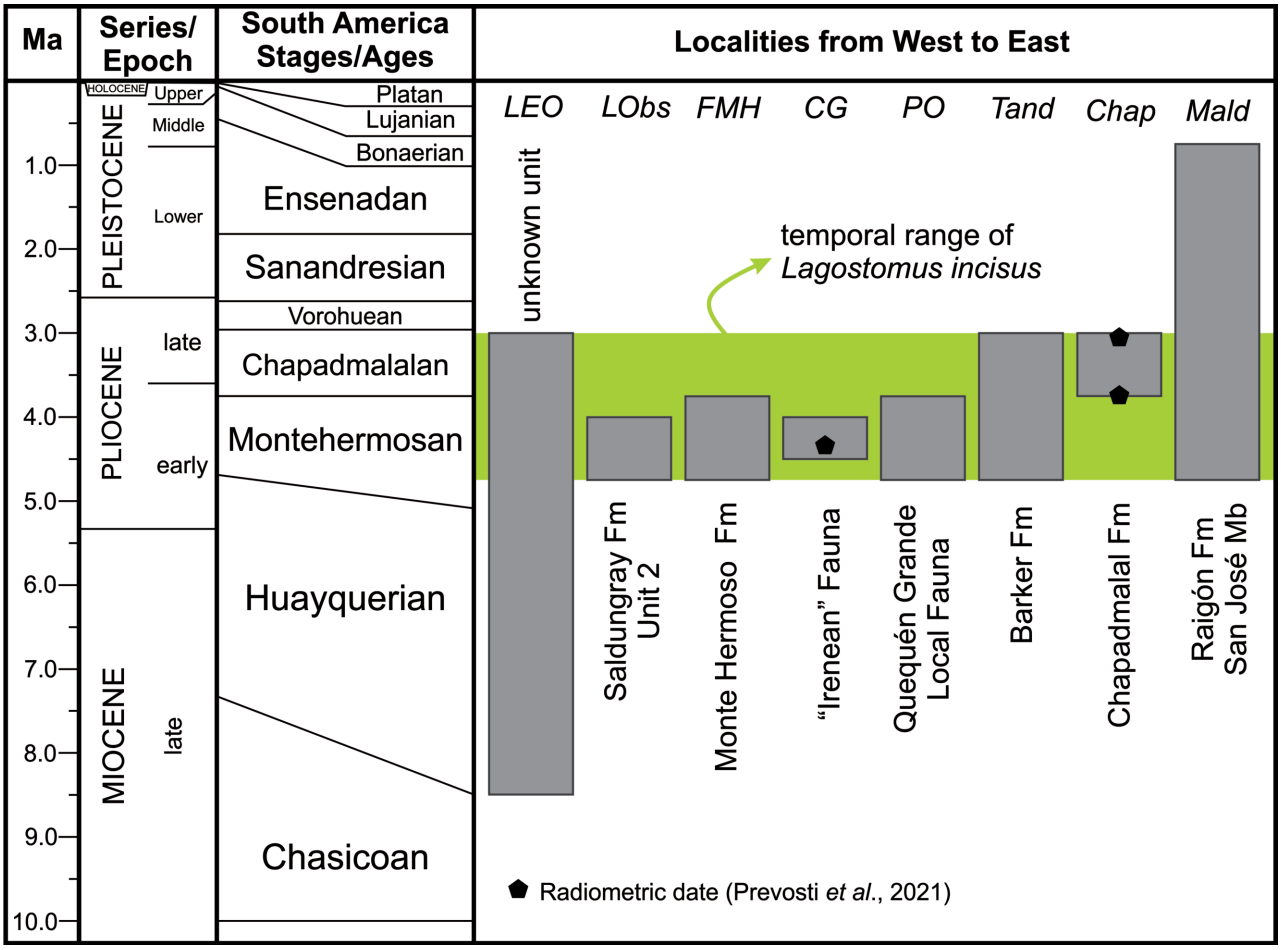


Figure 3. Stratigraphic range of studied units with records of ***Lagostomus incisus***. Abbreviations: **CG,** Cascada Grande; **Chap,** Chapadmalal area; **FMH,** Farola Monte Hermoso; **LEO,** Lagunas Encadenadas del Oeste; **LObs,** Las Obscuras; **Ma,** mega annum; **Mald,** Maldonado; **PO,** Paso Otero; **Tand,** Tandil area.

The Maldonado Formation (Maldonado Department, Uruguay) was correlated with the late Pliocene Chapadmalalan Stage/Age (Francis & Mones, 1966). In recent studies, the "Maldonado Formation" is considered at least partially equivalent to the San José Member of the Raigón Formation, with a Pliocene to Middle Pleistocene age (see Perea *et al.*, 2013). The levels previously considered as Maldonado Formation, which include the record of *Lagostomus incisus*, can be bounded to the late early to early late Pliocene, but it is not known if *L. incisus* is recorded in the rest of the unit (*i.e.*, the San José Member of the Raigón Formation).

DISCUSSION AND CONCLUSIONS

The recent radiometric dates of the "Irenean" Fauna at Cascada Grande and the Chapadmalal Formation, and the inferred temporal range of the Monte Hermoso Formation (Prevosti *et al.*, 2021) indicate that *Lagostomus incisus* is restricted to the late early to early late Pliocene, in accordance with previous works (Rasia & Candela, 2013, 2017a). The correlation of the Unit 2 of the Saldungaray Formation and the Quequén Grande Local Fauna with the Monte Hermoso Formation and the "Irenean" Fauna at Cascada Grande place them in the late early Pliocene. The correlation of the "Maldonado Formation" (part of the San José Member of the Raigón Formation) with the Chapadmalal Formation (see Francis & Mones, 1965) place the former in the early late Pliocene, and the presence of *L. incisus* place it in the late early to early late Pliocene, but the age of the San José Member of the Raigón Formation is Pliocene to Middle Pleistocene (Perea *et al.*, 2013), so future studies would confirm if *L. incisus* is only recorded in the lower (Pliocene) levels of the unit or if its record extends to the Middle Pleistocene. The correlation of the Barker Formation with the Monte Hermoso and Chapadmalal formations place the former in the late early to early late Pliocene, not the late Miocene to Pliocene.

The new records of *Lagostomus incisus* extend its geographic distribution to most of central and southern Buenos Aires Province and southern Uruguay, and the evaluation of the stratigraphic provenance of the specimens permits to confirm its age to the late early–early late Pliocene (Montehermosan–Chapadmalalan stages/ages), in accordance with previous works (*e.g.*, Rasia & Candela, 2013, 2017b). This supports the use of *Lagostomus incisus* as a biostratigraphic marker of the Montehermosan and Chapadmalalan stages/ages. Future studies of Pliocene lagostomines recorded elsewhere would confirm if *Lagostomus incisus* had a wider geographical distribution.

ACKNOWLEDGMENTS

I want to thank the curators M. Reguero (MLP), A. Scarano (MLP), D. Verzi, (MLP), I. Olivares (MLP), M. Ezcurra (MACN), L. Chornogubsky (MACN), P. Teta (MACN) and S. Lucero (MACN) for allowing access to material under their care. In addition, I want to thank M. Ubilla for providing photographs of the material from Uruguay. Finally, thanks to the Editors of PE-APA, and anonymous reviewer.

REFERENCES

Acuña, F., Barbeito, C. G., Portiansky, E. L., Ranea, G., Nishida, F., Miglino, M. A., & Flamini, M. A. (2020). Early and natural embryonic death in *Lagostomus maximus*: Association with the uterine glands, vasculature, and musculature. *Journal of Morphology*, *281*(7), 710–724.

Ameghino, F. (1888). *Lista de las especies de mamíferos fósiles del Mioceno superior de Monte Hermoso, hasta ahora conocidas*. Editorial Coni, Buenos Aires.

Ameghino, F. (1889). Contribución al conocimiento de los mamíferos fósiles de la República Argentina. *Actas de la Academia Nacional de Ciencias de Córdoba*, *6*, 1–1027.

Ameghino, F. (1908). Las Formaciones sedimentarias de la región litoral de Mar del Plata y Chapadmalal. *Anales del Museo Nacional de Buenos Aires*, *10*, 342–428.

Barbeito, C. B., Acuña, F., Miglino, M. A., Portiansky, E. L., & Flamini, M. A. (2021). Placentation and embryo death in the plains viscacha (*Lagostomus maximus*). *Placenta*, *108*, 97–102.

Bonaparte, J. F. (1960). La sucesión estratigráfica de Monte Hermoso (Provincia de Buenos Aires). *Acta Geológica Lilloana*, *3*, 273–287.

Bonini, R. A., Scanferla, A. C., Candela, A. M., Rasia, L. L., & Schmidt, G. I. (2017). Estudio preliminar de una nueva fauna de mamíferos del Neógeno de las Lagunas Encadenadas del Oeste de la Provincia de Buenos Aires. *Actas 20° Congreso Geológico Argentino y 4° Simposio del Mioceno-Pleistoceno del Centro y Norte de Argentina* (pp.19–24). San Miguel de Tucumán.

Branch, L. C. (1993a). Social organization and mating system of the plains viscacha (*Lagostomus maximus*). *Journal of Zoology*, *229*, 473–491.

Branch, L. C. (1993b). Intergroup and intragroup spacing in the plains vizcacha, *Lagostomus maximus*. *Journal of Mammalogy*, *74*(4), 890–900.

Cione, A. L. & Tonni, E. P. (1995). Los estratotipos de los pisos Montehermosense y Chapadmalalense (Plioceno) del esquema cronológico sudamericano. *Ameghiniana*, *32*, 369–374.

Deschamps, C. M. (2003). *Estratigrafía y paleoambientes del Cenozoico en el sur de la Provincia de Buenos Aires. El aporte de los vertebrados* [Doctoral Thesis, Universidad Nacional de La Plata].

Deschamps, C. M. (2005). Late Cenozoic mammal biochronostratigraphy in southwestern Buenos Aires province, Argentina. *Ameghiniana*, *42*, 733–750.

Deschamps, C. M., Borromei, A. M., & Zavala, C. A. (1989). Hallazgo de mamíferos fósiles en "sedimentos pampeanos", paraje "Las

Obscuras" (provincia de Buenos Aires). *6° Jornadas Argentinas de Paleontología de Vertebrados* (pp. 90–92). San Juan.

Deschamps, C. M., Vucetich, M. G., Verzi, D. H., & Olivares, A. I. (2012). Biostratigraphy and correlation of the Monte Hermoso Formation (early Pliocene, Argentina): The evidence from caviomorph rodents. *Journal of South American Earth Sciences*, *35*, 1–9.

Desmarest, A. G. (1817). Gerboise première espèce: la grande gerboise *Dipus maximus* Blainv. *Nouveau Dictionnaire d'Histoire Naturelle*, *13*, 117–119.

Fidalgo, F. & Tonni, E. P. (1982). Observaciones geológicas y paleontológicas en las "Barrancas de Monte Hermoso" (provincia de Buenos Aires). *Actas 3° Congreso Argentino de Paleontología y Bioestratigrafía* (pp. 16–17). Corrientes.

Flamini, M. A., Barbeito, C. G., Gimeno, E. J., & Portiansky, E. L. (2009). Histology, histochemistry and morphometry of the ovary of the adult plains viscacha (*Lagostomus maximus*) in different reproductive stages. *Acta Zoologica*, *90*, 390–400.

Flamini, M. A., da Silva Nunes Barreto, R., de Sá Schiavo Matias, G., Birbrair, A., de Castro Sasahara, T. H., Barbeito, C. G., & Miglino, M. A. (2020). Key characteristics of the ovary and uterus for reproduction with particular reference to poly ovulation in the plains viscacha (*Lagostomus maximus*, Chinchillidae). *Theriogenology*, *142*, 184–195.

Francis, J. C. & Mones, A. (1965). La presencia de vizcachas [*Lagostomus (Lagostomopsis) spicatus* (Amegh.)] en la Formación Kiyú, Dto. de San José, R. O. del Uruguay. *Revista de la Facultad de Humanidades y Ciencias*, *22*, 155–168.

Francis, J. C. & Mones, A. (1966). Las vizcachas, *Lagostomus (Lagostomopsis) euplasius* (Amegh.), de la formación Maldonado, departamento de Maldonado, República Oriental del Uruguay. *Kraglieviana*, *1*, 101–110.

Frenguelli, J. (1928). Observaciones geológicas en la región costanera sur de la Provincia de Buenos Aires. *Anales de la Facultad de Ciencias de la Educación de Paraná*, *2*, 1–145.

Gariboldi, M. C., Inserra, P. I. F., Lucero, S., Failla, M., Pérez, S. I., & Vitullo, A. D. (2019). Unexpected low genetic variation in the South American hystricognath rodent *Lagostomus maximus* (Rodentia: Chinchillidae). *PLoS ONE*, *14*(9), e0221559. https://doi.org/10.1371/journal. pone.0221559

Gómez Samus, M. L., Chimento, N. R., Löffler, J., Rico, Y., Sierra, L., & Bidegain, J. C. (2017). Neogene–Quaternary in Tandilia, South America: litho- bio- magnetostratigraphy. *Journal of Iberian Geology*, *43*(4), 559–581.

Hammer, Ø., Harper, D. A. T., & Ryan, P. D. (2001). PAST: Paleontological Statistics software package for education and data analysis. *Palaeontologia Electronica*, *4*(1), 1–9.

Isla, F., Taglioretti, M., & Dondas, A. (2015). Revisión y nuevos aportes sobre la estratigrafía y sedimentología de los acantilados entre Mar de Cobo y Miramar, provincia de Buenos Aires. *Revista de la Asociación Geológica Argentina*, *72*, 235–250.

Jackson, J. E., Branch, L. C., & Villareal, D. (1996). *Lagostomus maximus*. *Mammalian Species*, *543*, 1–6.

Leanza, A. F. (1948). Nota preliminar sobre la geología de las barrancas de Monte Hermoso (Provincia de Buenos Aires). *Notas del Museo de La Plata*, *13 Geología*, *48*, 3–6.

Llanos, A. C. & Crespo, J. A. (1952). Ecología de la vizcacha (*Lagostomus maximus maximus* Blainv.) en el nordeste de la Provincia de Entre Ríos. *Revista de Investigaciones Agrícolas*, *6*, 289–378.

Marshall, L. G. & Patterson, B. (1981). Geology and geochronology of the mammal-bearing Tertiary of the Valle de Santa María and Río Corral Quemado, Catamarca Province, Argentina. *Fieldiana Geology (New Series)*, *9*, 1–80.

Nasif, N. L., Candela, A., Rasia, L. L., Madozzo Jaén, M. C., & Bonini, R. (2013). Actualización del conocimiento de los roedores del Mioceno tardío de la Mesopotamia Argentina: aspectos sistemáticos, evolutivos y paleobiogeográficos. In D. Brandoni & J. I. Noriega (Eds.), *El Neógeno de la Mesopotamia Argentina. Publicación Especial de la Asociación Paleontológica Argentina*, *14* (pp. 153–169). Buenos Aires.

Pardiñas, U. F. J., Prevosti, F. J., Voglino, D., & Cenizo, M. (2017). A controversial unit within the argentine neogene: the "Irenean" fauna. *Ameghiniana*, *54*, 655–680.

Perea, D., Rinderknecht, A., Ubilla, M., Bostelmann, E., & Martínez, S. (2013). Mamíferos y estratigrafía del Neógeno de Uruguay. In D. Brandoni & J. I. Noriega (Eds.), *El Neógeno de la Mesopotamia Argentina. Publicación Especial de la Asociación Paleontológica Argentina*, *14* (pp. 192–206). Buenos Aires.

Prado, J. L. & Cerdeño, E. (1998). Los mamíferos pliocenos de la Fauna Local Quequén Grande (Provincia de Buenos Aires, Argentina). *Estudios Geológicos*, *54*, 75–83.

Prevosti, F. J., Romano, C. O., Forasiepi, A. M., Hemming, S., Bonini, R., Candela, A. M., Cerdeño, E., Madozzo Jaén, M. C., Ortiz, P., Pujos, F., Rasia, L. L., Schmidt, G. I., Taglioretti, M., MacPhee, R. D. E., & Pardiñas, U. F. J. (2021). New radiometric ^{40}Ar-^{39}Ar dates and faunistic analyses refine evolutionary dynamics of Neogene vertebrate assemblages in southern South America. *Scientific Reports*, *11*, 9830. doi: 10.1038/s41598-021-89135-1

Rafuse, D. J., Kaufmann, C. A., Gutiérrez, M. A., González, M. E., Scheifler, N. A., Álvarez, M. C., & Massigoge, A. (2017). Taphonomy of modern communal burrow systems of the Plains vizcacha (*Lagostomus maximus*, Chinchillidae) in the Pampas region of Argentina: implications for the fossil record. *Historical Biology*, *31*(5), 517–534.

Rasia, L. L., Bonini, R. A., & Candela, A. M. (2020). Nuevos registros de *Lagostomus* Brookes (Rodentia, Chinchillidae) en el Mioceno tardío de Argentina y su importancia bioestratigráfica. *Andean Geology*, *47*(2), 430–445.

Rasia, L. L. & Candela, A. M. (2013). Systematic and biostratigraphic significance of a chinchillid rodent from the Pliocene of eastern Argentina. *Acta Palaeontologica Polonica*, *58*, 241–254.

Rasia, L. L. & Candela, A. M. (2017a). *Lagostomus telenkechanum* sp. nov., a new lagostomine rodent (Caviomorpha, Chinchillidae) from the Arroyo Chasicó Formation (late Miocene; Buenos Aires Province, Argentina). *Journal of Vertebrate Paleontology*, *37*(1), e1239205.

Rasia, L. L. & Candela, A. M. (2017b). Systematic revision of the vizcachas (Rodentia, Caviomorpha, Chinchillidae) from the Chapadmalal Formation, late Pliocene of Buenos Aires Province, Argentina. *Ameghiniana*, *54*, 50–69.

Rasia, L. L., Candela, A. M., & Cañón, C. (2021). Comprehensive total evidence phylogeny of chinchillids (Rodentia, Caviomorpha): Cheek teeth anatomy and evolution. *Journal of Anatomy*, *239*(2), 405–423. doi: 10.1111/joa.13430

Rovereto, C. (1914). Los estratos araucanos y sus fósiles. *Anales del Museo Nacional de Historia Natural de Buenos Aires*, *25*, 1–247.

Schultz, P. H., Zárate, M., Hames, W., Camilión, C., & King, J. (1998) A 3.3 Ma impact in Argentina and possible consequences. *Science*, *282*, 2061–2063.

Spotorno, A. E. & Patton, J. L. (2015). Superfamily Chinchilloidea Bennett, 1833. In J. L. Patton, U. F. J. Pardiñas, & G. D'Elía (Eds.), *Mammals of South America. 2, Rodents* (pp. 762–783). Chicago: The University of Chicago Press.

Spotorno, A. E. & Valladares Faúndez, J. (2016). Family Chinchillidae. In D. E. Wilson, T. E. J. Lacherc, & R. A. Mittermeier (Eds.), *Handbook of the Mammals of the World, vol. 6. Lagomorphs and Rodents I* (pp. 462–481). Barcelona: Lynx Edicions.

Tomassini, R. L., Montalvo, C. I., Deschamps, C. M., & Manera, T. (2013). Biostratigraphy and biochronology of the Monte Hermoso Formation (early Pliocene) at its type locality, Buenos Aires Province, Argentina. *Journal of South American Earth Sciences*, *48*, 31–42.

Tomassini, R. L., Montalvo, C. I., Fernandez-Jalvo, Y., Garrone, M. C., & Kin, M. S. (2019). Modern plains vizcacha (*Lagostomus maximus*, Chinchillidae, Rodentia) as a bone accumulating agent in the Argentine Pampas: Application to the study of fossiliferous sites. *Journal of Arid Environments*, 161, 11–24.

Ubilla, M. & Rinderknecht, A. (2016). *Lagostomus maximus* (Desmarest) (Rodentia, Chinchillidae), the extant plains vizcacha in the Late Pleistocene of Uruguay. *Alcheringa*, *40*, 354–365.

Vignati, M. A. (1925). La geología de Monte Hermoso. *Physis*, *8*, 126–127.

Vucetich, M. G. (1975). La anatomía del oído medio como indicadora de relaciones sistemáticas y filogenéticas en algunos grupos de roedores Caviomorpha. *Actas 1° Congreso Argentino de Paleontología y Bioestratigrafía* (pp. 477–494). Buenos Aires.

Weir, B. J. (1974). The tuco-tuco and plains viscacha. In I. W. Rowlands & B. J. Weir (Eds.) *The Biology of Hystricomorph Rodents. Symposia of the Zoological Society of London*, *34*, 113–130.

Zavala, C. (1993). Estratigrafía de la localidad de Farola Monte Hermoso (Plioceno–Reciente). Provincia de Buenos Aires. *Actas 12° Congreso Geológico Argentino y 2° Congreso de Exploración de Hidrocarburos* (pp. 228–235).

Zavala, C. & Navarro, E. (1993). Depósitos fluviales en la Formación Monte Hermoso (Plioceno inferior-medio). Provincia de Buenos Aires. *Actas 12° Congreso Geológico Argentino y 2° Congreso de Exploración de Hidrocarburos* (pp. 236–244).

APPENDIX 1

List of specimens used in the PCA.

Lagostomus telenkechanum Rasia & Candela, 2017 (late Miocene)
MLP 55-IV-28-43, 60-VI-18-100, 60-VI-18-107, 60-VI-18-101, 76-VI-12-47, 55-IV-28-42, 55-IV-28-44, 92-XI-19-1, 57-XII-23-6.

Lagostomus antiquus (late Miocene)
MASP 32.

Lagostomus pretrichodactyla (late Miocene)
MACN-Pv 8294, 8340, 8338, 8212, 8339, 8337, 8341, 8342, 8343, 8345, MLP 65-VII-29-72.

Lagostomus incisus (Pliocene)
MACN-Pv 7388, MACN-A 1112, 1654, MLP 88-VI-1-2, 91-IV-5-258, 01-I-10-30, 01-I-10-31, 01-I-10-32, 01-I-10-33, 01-I-10-34; 01-I-10-35, 01-I-10-38, 01-I-10-41, 01-I-10-44, 01-I-10-47, 01-I-10-54, 91-IV-5-214, 46-V-13-72, 91-III-1-88, 94-II-1-146, 91-III-1-9, 48-XII-16-194, 91-III-1-18, 91-III-1-36, 94-II-1-136, 63-VI-10-59, 87-V-20-21, 87-V-20-22, P126/3, 5, UNSGH 408, 457, MHTL-P 240, SPV-FHC 10-V-64-1.

Lagostomus euplasius (Pliocene)
MACN-Pv 6163, 5986, 5985, MLP 52-IX-28-62, 52-X-1-13, 52-IX-28-68, 52-X-4-21, 52-XI-5-8, 54-X-13-1, 91-IV-5-334, 91-IV-5-350, 88-VI-1-1, 01-I-10-36, 01-I-10-39, 01-I-10-40, 01-I-10-50, 01-I-10-55, 01-I-10-56, SPV-FHC 20-VII-62-1.

Lagostomus compressidens (late Pliocene)
MLP 54-X-13-2, 54-X-13-4, 90-VI-1-1.

Lagostomus debilis (Pleistocene)
MACN-A 1255.

Lagostomus heterogenidens (Pleistocene)
MACN-A 1187.

Lagostomus minimus (Pleistocene)
MACN-A 1098.

Lagostomus egenus (Pleistocene)
MACN-A 417.

Lagostomus maximus (Pleistocene-Recent)
MACN-Ma 49.289, 50.14, 50.15, 50.21, 50.10, 50.13, 50.20, 50.18, 49.291, 50.17, MLP-Ma 14, 19, 37, 38, 39, 41, 42, 45, 54, 59, 61, 64, 230, 254, 269, 338, 379, 565, 720, 1473, 1603, 1604, 1605, 1634, 1642, 1651, 1657, 1659, 1602, 1634, 1651, 1728, MACN-A 1651, 2175 (the last two specimens previously assigned to "*L. cavifrons*", but see Ubilla & Rinderknecht, 2016).

doi: 10.5710/PEAPA.26.08.2021.393

Recibido: 4 de junio 2021
Aceptado: 26 de agosto 2021
Publicado: 13 de octubre 2021