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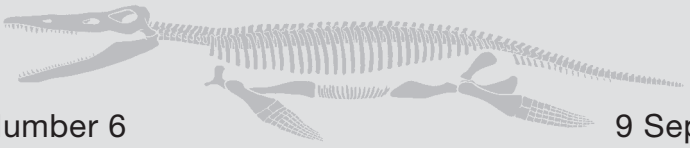

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THE ROMER COLLECTION FROM WEST-CENTRAL ARGENTINA AT THE MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD UNIVERSITY

BÁRBARA VERA[1] AND CHRISTINA BYRD[2]

ABSTRACT. A joint expedition between the Museum of Comparative Zoology of Harvard University (Cambridge, Massachusetts, USA) and the Museo Argentino de Ciencias Naturales (Buenos Aires, Argentina) explored outcrops in west-central Argentina during autumn of 1958. The team led by Alfred S. Romer collected fossils from several Cenozoic outcrops from Mendoza, San Juan, and La Rioja provinces. Some of the recovered fossils were previously published, including gastropods, birds, turtles, and mammals. However, other specimens, which belong to the Vertebrate Paleontology collection at the Museum of Comparative Zoology, remained unknown and even uncatalogued until the present contribution. Here, we present this peculiar collection for the first time, providing an updated taxonomic list of the vertebrate remains. Based on the studied material, we identified 1) Glyptodontidae (cf. *Propalaehoplophorus*), Dasypodidae (*Stenotatus* sp.), Mesotheriidae (cf. *Altitypotherium*), Macraucheniidae (Cramaucheniinae gen. et sp. indet.) and Rodentia indet. in the Aisol Fm.; 2) Megatheriidae (*Pyramiodontotherium* sp.) and Macraucheniidae (Macraucheniinae gen. et sp. indet.) in the Tunuyán Fm.; 3) Dasypodidae indet. in the Mariño Fm.; 4) Hegetotheriidae (*Hemihegetotherium* sp., Pachyrukhinae gen sp. indet., *Paedotherium* sp.) and Rodentia indet. in the Pilona Fm.; and 5) Cingulata indet., Mesotheriidae (*Pseudotypotherium* sp.), Hegetotheriidae (*Tremacyllus* sp.), Chinchiliidae indet., and Hydrochoeridae indet. in the Huachipampa Fm. The reports of the Romer collection from Argentina allow the establishment of biochronological correlations between the lesser-known faunas from west-central Argentina and faunas from other areas of South America.

Key words: Invertebrate and Vertebrate Fossils, Eocene, Miocene, Pliocene, West-central Argentina

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INTRODUCTION

From March to June of 1958, a joint expedition between the Museum of Comparative Zoology (MCZ) of Harvard University (Cambridge, USA) and the Museo Argentino de Ciencias Naturales (MACN; Buenos Aires, Argentina) explored several geologic units in the west-central area of Argentina, including Mendoza, San Juan, and La Rioja provinces (Fig. 1). Alfred S. Romer, who was the curator of the MCZ at that time (1934–1963), led the expedition partially funded by *Life* magazine and the *National Science Foundation* (see Simpson et al., 1962). The expedition team included Prof. Bryan Patterson and fossil preparators Arnie D. Lewis and James A. Jensen from the MCZ, Mrs. Ruth H. Romer (Alfred Romer's wife); and Dr. Rosendo Pascual, Prof. Guillermo del Corro, and Technician Orlando A. Gutiérrez from the MACN (see also Giacchino, 2021, remembering O. A. Gutiérrez).

The paleontological sites explored by this expedition encompassed Paleogene (Eocene) and Neogene (Miocene and Pliocene) geological units (Fig. 1A). The expedition established six camps: in Mendoza Province, the Aisol (Camp 1 at Mina Zitro; Fig. 1B), Tunuyán (Camp 2, Baños de la Salada, Huayquerías de San Carlos; Fig. 1C), Divisadero Largo (Camp 3, Mina Atala; Fig. 1D), Mariño (Camp 4, Agua de las Avispas; Fig. 1E), and La Pilona formations (Puesto Agua del Cajón; Fig. 1E); and in San Juan Province, the Huachipampa For-

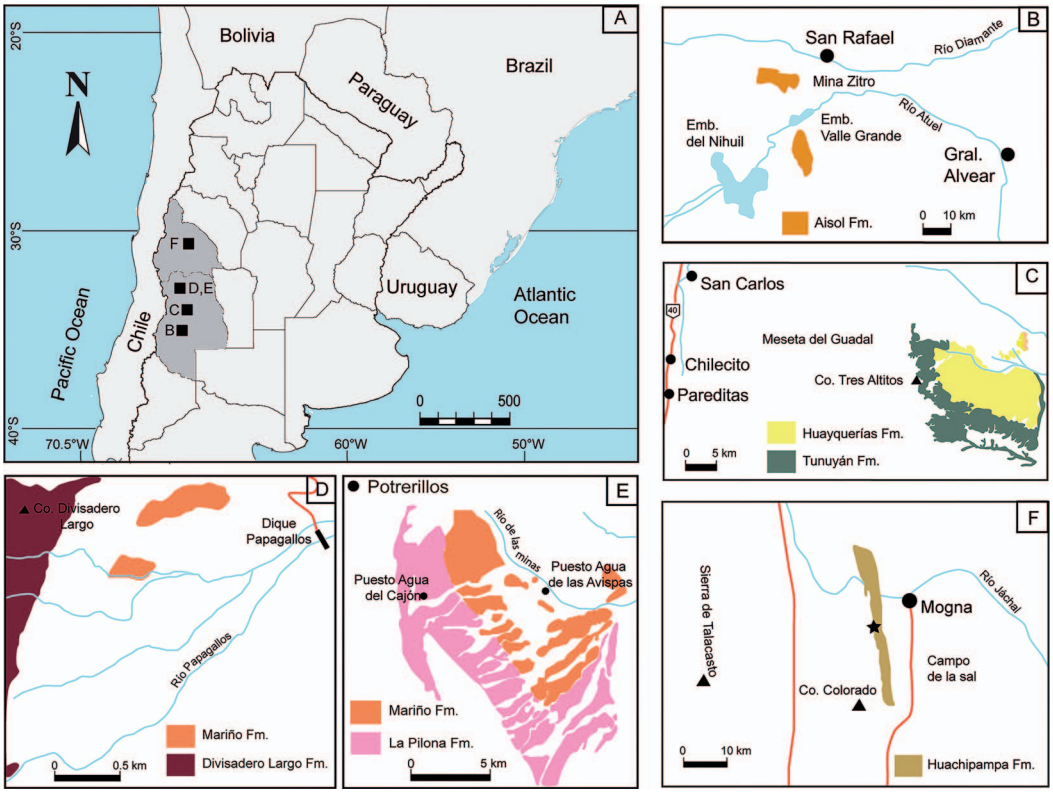

Figure 1. Geographic and stratigraphic provenance of the fossil remains of the Romer collection collected during an expedition to Argentina at the Museum of Comparative Zoology. **A**, map of Argentina and the geographical location of the Cenozoic outcrops of the Mendoza (B–E) and San Juan (F) provinces. **B**, the Aisol Formation and Mina Zitro fossil locality, San Rafael Department, Mendoza Province (modified from Garrido et al., 2014). **C**, the Huayquerías and Tunuyán formations at Huayquerías del Este in Mendoza Province (modified from Garrido et al., 2017, and Vera and Ercoli, 2018). **D**, the Divisadero Largo Formation at its type locality, Divisadero Largo hill, Mendoza Province (modified from Lluch, 1971). **E**, the Mariño and La Pilona formations at the Cacheuta area, Mendoza Province (modified from Irigoyen et al., 2000; Buelow et al., 2018). **F**, the Huachipampa Formation at the Mogna area, San Juan Province (modified from Cuerda et al., 1984).

mation (Camp 6, Sierra Mogna; Fig. 1F). They also explored Agua de la Peña (Camp 5, Ischigualasto Basin) and Marayes area in San Juan Province and the north side of the Campo de Talampaya area in La Rioja Province, but no fossils were reported from there.

The results of this expedition were recorded in a field notebook (Romer, unpublished field notebook, 1958), where the recovered specimens were numbered from 1 to 70, including precisely detailed geographical and geological data. According to this book, 85% of the collection (61 specimens) are identified as mammals, while the remaining 15% are distributed among birds (2 specimens), turtles (3 specimens), gastropods (2 specimens), and indeterminate bones. It should be noted that a part of the material collected by the joint MCZ–MACN expedition was deposited at the MACN (see Simpson et al., 1962; López, 2008), while the other part (here named as the Romer collection) together with the original field notebook, were deposited in the Vertebrate Paleontology collection in the Museum of Comparative

Zoology (VP, MCZ), Harvard University (USA).

Some specimens of the Romer collection were catalogued with MCZ and subsequently published by Simpson et al. (1962) in a relevant work concerning the Divisadero Largo fauna from the Divisadero Largo Formation (Mendoza; see below). On the contrary, other specimens have remained uncatalogued, preserving only the original field numbers, and unpublished until the present contribution. Here, we present this small but peculiar collection, providing an updated taxonomic list of the vertebrate remains collected from west-central Argentina, using as reference the information detailed by Romer's unpublished field notebook (1958). This is relevant not only for the Divisadero Largo fauna (Mendoza), which has already been intensively addressed (Simpson et al., 1962; López, 2008), but also for those faunas that are lesser-known (e.g., Huachipampa Formation, San Juan Province).

MATERIALS AND METHODS

The Romer collection is housed at the Museum of Comparative Zoology (MCZ), Harvard University (Cambridge, USA). The MCZ is also the repository for Romer's unpublished field notebook (1958). This field notebook is relevant because it describes in detail the exact geographic provenance of the fossils, the geological aspects of each fossiliferous locality that the team visited, and a brief description of each fossil that they collected. It should be noted that each fossil was numbered with a field notation, as 1-58M to 70-58M ("M" refers to Mendoza Province, and 58 to the year of unearthing). The team also explored adjacent areas in San Juan and La Rioja Provinces (see above). Most specimens belonging to the Romer collection housed in MCZ were given an MCZ catalog number, such as those published by Simpson et al. (1962; see below), but some of them have been identified according to the original field numbers. This small collection remained unknown and was localized when in 2018 the main author (BV) visited the MCZ and studied it personally.

The systematic study was achieved through direct comparisons with specimens from the institutions detailed below, as well as an extensive literature review. We also include a brief paragraph commenting on the updated information for each geological unit. Linear measurements of teeth and other remains were taken using an electronic digital caliper (0.01-mm precision).

Institutional Abbreviations. AMNH FM, American Museum of Natural History, Fossil Mammals (New York, USA); MACN, Museo Argentino de Ciencias Naturales 'B. Rivadavia,' PV, Paleontology Vertebrate (Buenos Aires, Argentina); MCNAM-PV, Museo de Ciencias Naturales y Antropológicas 'J. C. Moyano,' Paleontology Vertebrate (Mendoza, Argentina); MCZ VP, Museum of Comparative Zoology, Vertebrate Paleontology (Harvard University, Cambridge, USA); MLP, Museo de La Plata (La Plata, Argentina); MMMP, Museo de Ciencias Naturales de Mar del Plata 'Lorenzo Scaglia' (Mar del Plata, Argentina).

Other Abbreviations. AP, anteroposterior; i, lower incisor; L, length; m, lower molars; mf, lower molariform tooth (abbreviation used for Xenarthra dentition); myr, million years; p, lower premolars; SALMA, South American Land Mammal Ages; W, width.

Geologic Context

Mendoza Province (Fig. 1A–E). The Divisadero Largo Formation (Chiotti, 1946) has been informally divided into two members, the lower section ('zone with anhidryte') and the upper section ('areniscas abigarradas'; see Simpson et al., 1962; Kokogián et al., 1988). Fossil content from the lower section includes crocodiles, boas, turtles, and mammals (Minoprio, 1947;

Simpson et al., 1962; Pascual and de la Fuente, 1993; López, 2008 and references cited there), which suggests abundant water and vegetation and a humid depositional environment (Gasparini et al., 1986; López, 2008). Recently, a U–Pb dating of a tuff of the lower level indicates a maximum age of deposition of 55.02 ± 0.82 myr for the Divisadero Largo Formation (Paleocene–Eocene; Mescua et al., 2017).

It should be noted that, besides the MCZ–MACN joint expedition of 1958 (by A. Romer and his team), previous expeditions to Divisadero Largo (Mendoza) were performed by Bryan Patterson in 1952 and George. G. Simpson in 1955, both under the guidance of José L. Minoprio, and also by Federico García Romeu and Osvaldo Reig in 1951 (see Patterson, 1952). These and many other expeditions to Divisadero Largo resulted in numerous specimens that are currently deposited in different institutions in Argentina (MACN, MCNAM, MLP, MMMP) and the United States (AMNH, MCZ). Many of these specimens were first published by Simpson et al. (1962). Both the fauna and geology from Divisadero Largo were extensively studied by several specialists from 1947 through 2014 (e.g., Minoprio, 1947, 1951; Patterson, 1952; Rusconi, 1946a, b, c; Simpson et al., 1962; López, 2008, 2009, 2010, 2015; Cerdeño et al., 2008; Lorente et al., 2014).

The Aisol Formation (González Díaz, 1972), which crops out in southern Mendoza Province (San Rafael Department; Fig. 1A–B), was previously studied geologically and paleontologically (e.g., Sepúlveda et al., 2007; Forasiepi et al., 2011, 2015; Garrido et al., 2014). The absolute age was determined by means of U–Pb zircon isotope dating at the base of the Aisol Formation and established a date ca. 19.480 ± 0.025 myr (Burdigalian, early Miocene; Forasiepi et al., 2015).

The Mariño Formation (Biondi, 1936, nom. subst. Rolleri and Criado Roque, 1970) is classically subdivided in three members, from the base to the top: the 'Conglomerados Violáceos,' the 'Areniscas Entrecruzadas or Areniscas Inestratificadas,' and the 'Estratos de Mariño or Serie del Higueral' (Chiotti, 1946). From the top of the middle member (i.e., Areniscas Entrecruzadas), mesotheriid and rodent remains were reported in the Potrerillo and Divisadero Largo areas (Cerdeño, 2007; Cerdeño and Vucetich, 2007; Cerdeño et al., 2018), and recently, zircon U–Pb dating constrained the middle section between 17.96 ± 0.2 and 17.4 ± 1.3 myr (Burdigalian, early Miocene; Buelow et al., 2018). A few fossil remains have been reported as coming from this unit at Toscal de Mariño, near Agua de las Avispas.

The La Pilona Formation (Truempy and Lehz, 1937) was constrained between 12.03 ± 0.45 myr (Irigoyen et al., 2000) and 8.39 ± 0.42 myr (Buelow et al., 2018), which means a Serravalian–Tortonian age (middle–late Miocene; Cohen et al., 2013; updated).

The Tunuyán Formation (Dessanti, 1946) crops out on the East, South, and West flanks of the Huayquerías del Este area at 50 km E from the town of San Carlos (San Carlos Department) in north–central Mendoza Province (Fig. 1A, C). According to Yrigoyen (1994), the deposition of the Tunuyán Formation, with not yet known radiometric dating, is probably between 5.5 Ma and 3.8 Ma (Zanclean, early Pliocene; Cohen et al., 2013; updated). According to Romer's field notebook, the fossil levels in the Baños de la Salada area are from near the top of the Tunuyán Formation and consist of pinkish and yellowish silt and bands of conglomerate, ranging from fine to coarse.

San Juan Province. Kelly (1962; in Cuerda et al., 1984) recognized several lithostratigraphic units in the around Sierra Mogna (also known as Sierra del Morado, see Contreras et al., 2019): the Huachipampa, Quebrada del Cura, Río Jáchal, and Mogna formations. The Huachipampa Formation was circumscribed by regional correlations in the range of 10–8.4 myr

(Jordan et al., 1990), although in the Sierra de Huaco area, a tuff sand level was dated in 10.3 myr (Johnson et al., 1986; Contreras et al., 2019). These data delimit the Huachipampa Formation to the Tortonian (late Miocene; Cohen et al., 2013; updated).

RESULTS

We describe each specimen using the catalogue number provided. However, we and the MCZ staff are unable to locate some specimens at present. In these cases, we use their original field number (see Table 1).

Mendoza Province (Fig. 1A–E)

Divisadero Largo Formation

Locality: Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city (Fig. 1D). From this site, the team collected and numbered the specimens 20-58M to 46-58M (Table 1). The lower levels of the Divisadero Largo Formation (i.e., zone with anhydrite) were dated in 55.02 ± 0.82 myr (Paleocene–Eocene; Mescua et al., 2017), which indicates a maximum age. However, it should be note that the bearing levels of the Divisadero Largo fauna are located higher from the dated level.

Remarks: Testudines are represented by fragmentary remains of the carapace, such as MCZ VP 101618 (edge of carapace; Fig. 2A), MCZ VP 101619 (large part of carapace, much crouched and broken), and MCZ VP 101620 (portion of carapace; Fig. 2B). These specimens add to other testudine records from the Divisadero Largo Formation (Minoprio, 1947; Pascual and de la Fuente, 1993).

NOTOUNGULATA

BRACHYSTEPHANUS POSTREMUS SIMPSON, MINOPRIO AND PATTERSON, 1962

Referred material: MCZ VPM-7406, fragments of mandible; MCZ VPM-7408, parts of both mandibular rami with left p4–m2 (Fig. 2C); MCZ VPM-7409, fragment of maxillary with left P3–M3 (Fig. 2D); MCZ VPM-7410, fragment of maxillary with left M1–2 (Fig. 2E); MCZ VPM-7411, fragment of mandible with left m2–3 (Fig. 2F); MCZ VPM-7413, fragment of mandible with p1–m2; MCZ VPM-7414, incomplete right mandible; MCZ VPM-7417, fragment of maxillary with right P1–4; MCZ VPM-7420, two fragments of maxillary. See more details in Simpson et al. (1962) and López (2008).

XENOSTEPHANUS CHIOTTI SIMPSON, MINOPRIO AND PATTERSON, 1962

Referred material: MCZ VPM-7415, numerous small fragments of upper and lower jaws with identifiable parts of right P4–M1 (Fig. 2G). See more details in Simpson et al. (1962) and López (2008).

ALLALMEIA ATALAENSIS RUSCONI, 1946A

Referred material: MCZ VPM-7412, fragment of maxilla with left M1–3 (the M3 is broken and preserves only the paraloph; Fig. 2H); MCZ VPM-7423, fragments of cranium and postcranium.

Remarks: Specimen MCZ VPM-7412 was included in the referred material of *A. atalaensis* by Simpson et al. (1962: 271) as coming from the type locality (vicinity of Cerro Divisadero Largo). According to the information in Romer's field notebook (1958), this specimen comes from the 'Casamayor' level, Unit 2.

Many years after, in his revision of the fauna from Divisadero Largo, López (2008) maintained MCZ VPM-7412 as *A. atalaensis* but had doubts about the taxon of MCZ VPM-7423.

NOTOUNGULATA INDET.

Referred material: MCZ VPM-7418, incomplete mandible with right p3–m1 and left c, and p1–3 (Fig. 2I); MCZ VPM-7422,

Table 1. Specimen descriptions.

Field Number	Catalog Number	Class/Order/Family/Subfamily	Genus/Species	Description	Locality	Unit
1-58M	MCZ VP 101594	Mammalia/Notoungulata/ Mesotheriidae	cf. *Altytipotherium*	isolated left m3	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
2-58M	MCZ VP 101610	Mammalia/Rodentia	indet.	isolated tooth	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
3-58M	MCZ VP 101596	Mammalia/Notoungulata/ Mesotheriidae	cf. *Altytipotherium*	fragment of mandible with a right m3	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
4-58M	MCZ VP 101597	Mammalia/Xenarthra/ Glyptodontidae	cf. *Propalaehoplophorus*	fragment of right mandible with four teeth; mf1 to mf4	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
5-58M	lost	Gastropoda	indet.		Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
6-58M	MCZ VP 101611	Aves	indet.	proximal end of ulna	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
7-58M	MCZ VP 101606a,b	Mammalia/Xenarthra/ Dasypodidae	*Stenotatus* sp.	two osteoderms	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
8-58M	lost	Mammalia/Astrapotheria/ Astrapotheriidae?	indet.	distal end of humerus	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
9-58M	MCZ VP 101612	Mammalia/Folivora/ Megatheriidae	indet.	phalanx	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
10-58M	MCZ VP 101591	Mammalia/Litopterna/ Macraucheniidae	Cramaucheniinae gen. et sp. indet.	fragmentary cervical vertebrae	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
11-58M	MCZ VP 101592	Mammalia/Litopterna/ Macraucheniidae	Cramaucheniinae gen. et sp. indet.	proximal epiphysis of tibia and a patella	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
12-58M	MCZ VP 101613	Mammalia/Notoungulata/ Toxodontiidae	indet.	axis and six fragments of vertebrae	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
13-58M	MCZ VP 101593	Mammalia/Litopterna/ Macraucheniidae	Cramaucheniinae gen. et sp. indet.	phalanx I and fragments of two distal metapodials	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
14-58M	MCZ VP 101614	Mammalia/Pilosa/Megatheriidae	indet.	distal end of radius	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
15-58M	MCZ VP 101615	Mammalia/Pilosa/Megatheriidae	indet.	partial humerus, ulna, and fragment of undetermined bones	Camp 1, north of Mina Zitro, Mendoza Province	Aisol Fm.
16-58M	MCZ VP 101595	Mammalia/Pilosa/ Megatheriidae/Megatheriinae	*Pyramiodontotherium* sp.	a right mandible with four broken molars	Camp 2, Baños de la Salada area, 15 km East of San Carlos, Mendoza Province	Tunuyán Fm.
17-58M	MCZ VP 100410a–d	Mammalia/Litopterna/ Macraucheniidae/ Macraucheniinae	Macraucheniinae gen. et sp. indet.	occipital region of a skull, articular head of a humerus, proximal of tibia, fragment of proximal radius	Camp 2, Baños de la Salada area, 15 km East of San Carlos, Mendoza Province	Tunuyán Fm.
18-58M	lost	Rodentia/Ctenomyidae	indet.	fragment of molar	Camp 2, Baños de la Salada area, 15 km East of San Carlos, Mendoza Province	Tunuyán Fm.

TABLE 1. CONTINUED.

Field Number	Catalog Number	Class/Order/Family/Subfamily	Genus/Species	Description	Locality	Unit
19-58M	MCZ VP 101617	Mammalia/Pilosa/Megatheriidae	indet.	part of skull with tooth root	Camp 2, Baños de la Salada area, 15 km East of San Carlos, Mendoza Province	Tunuyán Fm.
20-58M	MCZ VPM-7417	Mammalia/Notoungulata	*Brachystephanus postremus*	fragment of maxillary with right P1–4	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
21-58M	MCZ VPM-7418	Mammalia/Notoungulata	Notoungulata indet.	incomplete mandible with right p3–m1 and left c, and p1–3	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
22-58M	MCZ VPM-7408	Mammalia/Notoungulata	*Brachystephanus postremus*	parts of both mandibular rami with left p4–m2	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
23-58M	MCZ VP 101618	Testudines	Testudines indet.	edge of carapace	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
24-58M	lost	Mammalia	*Groeberia*?	part of skull or mandibles	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
25-58M	MCZ VPM-7406	Mammalia/Notoungulata	*Brachystephanus postremus*	fragments of mandible	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
26-58M	MCZ VPM-7416	Mammalia/Litopterna/ Sparnotheriodontidae	*Phoradiadius divortiensis*	fragment of lower jaw with part of p4, and badly preserved m1 and m2	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
27-58M	lost	Mammalia indet.	Mammalia indet.	maxillary fragment with two molars	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
28-58M	MCZ VPM-7420	Mammalia/Notoungulata/ Oldfieldthomasiidae	*Brachystephanus postremus*	two fragments of maxillary	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
29-58M	lost	Mammalia/Notoungulata	Notoungulata indet.	ramus fragment with two molars	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
30-58M	MCZ VPM-7407	Mammalia/Litopterna/ Sparnotheriodontidae	*Phoradiadius divortiensis*	fragment of maxillary with right M2–3	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
31-58M	MCZ VPM-7409	Mammalia/Notoungulata	*Brachystephanus postremus*	fragment of maxillary with left P2–M3	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
32-58M	MCZ VPM-7410	Mammalia/Notoungulata	*Brachystephanus postremus*	fragment of maxillary with left M1–2	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
33-58M	lost	Mammalia/Notoungulata	Notoungulata indet.	ramus fragment with m2–3	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.

Table 1. Continued.

Field Number	Catalog Number	Class/Order/Family/Subfamily	Genus/Species	Description	Locality	Unit
34-58M	MCZ VP 101619	Testudines	Testudines indet.	large part of carapace, much crouched and broken	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
35-58M	MCZ VPM-7411	Mammalia/Notoungulata	*Brachystephanus postremus*	fragment of mandible with left m2–3	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
35-58M	MCZ VPM-7423	Mammalia/Notoungulata	*Allalmeia atalaensis*	fragments of cranium and postcranium	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
35-58M	MCZ VPM-7422	Mammalia/Notoungulata	Notoungulata indet.	fragment of mandible with right p4–m1?, distal of femur, and right astragalus	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
35-58M	MCZ VPM-7421	undetermined	undetermined	miscellaneous	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
36-58M	lost	undetermined	undetermined	ribs and unidentified bones	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
37-58M	MCZ VP 101620	Testudines	Testudines indet.	portion of carapace	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
38-58M	MCZ VPM-7419	undetermined	undetermined	fragments of maxillary and mandible with teeth	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
39-58M	MCZ VPM-7415	Mammalia/Notoungulata	*Xenostephanus chiotti*	fragments of upper and lower jaws with identifiable parts of right P4–M1	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
40-58M	MCZ VPM-7412	Mammalia/Notoungulata	*Allalmeia atalaensis*	fragment of maxilla with left M1–3	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
41-58M	lost	undetermined	undetermined	incomplete ramus with teeth	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
42-58M	lost	undetermined	undetermined	fragment of ramus with teeth.	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
43-58M	lost	undetermined	undetermined	fragment of maxilla with broken teeth	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
44-58M	MCZ VPM-7414	Mammalia/Notoungulata	*Brachystephanus postremus*	incomplete right mandible	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.

TABLE 1. CONTINUED.

Field Number	Catalog Number	Class/Order/Family/Subfamily	Genus/Species	Description	Locality	Unit
45-58M	MCZ VPM-7413	Mammalia/Notoungulata	*Brachystephanus postremus*	fragment of mandible with p1–m2	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
46-58M	MCZ VP 101621	Undetermined	Undetermined	skeletal bones	Camp 3, Mina Atala, vicinity of Cerro Divisadero Largo, ca. 8 km west Mendoza city.	Divisadero Largo Fm.
47-58M	MCZ VP 101622	Xenarthra/Cingulata	Dasypodidae indet.	cranial region of skull	Camp 4, Agua de las Avispas, Cacheuta Basin, Mendoza Province	Mariño Fm.
48-58M	lost	Gastropoda	*Corbicula elchaensis*	various isolated shells and several	Camp 4, Agua de las Avispas, Cacheuta Basin, Mendoza Province	Mariño Fm.
49-58M	MCZ VP 101598	Mammalia/Notoungulata/ Hegetotheriidae/ Hegetotheriinae	*Hemihegetotherium* sp.	right half of a bad preserved skull with P3 in eruption and P4–M2	Camp 5, 1 km north of Puesto Agua del Cajón, Mendoza Province	La Pilona Fm.
50-58M	MCZ VP 101607	Mammalia/Notoungulata/ Hegetotheriidae/ Pachyrukhinae	Pachyrukhinae gen sp. indet.	left mandible with teeth	Camp 5, 1 km north of Puesto Agua del Cajón, Mendoza Province	La Pilona Fm.
51-58M	MCZ VP 101698a–f	Mammalia/Notoungulata/ Hegetotheriidae/ Pachyrukhinae	*Paedotherium* sp.	several fragments of mandible and isolated upper molar	Camp 5, 1 km north of Puesto Agua del Cajón, Mendoza Province	La Pilona Fm.
52-58M	MCZ VP 101623	Mammalia/Rodentia	gen. sp. indet.	isolated tooth	Camp 5, 1 km north of Puesto Agua del Cajón, Mendoza Province	La Pilona Fm.
53-58M	MCZ VP 101624	Mammalia/Notoungulata/ Toxodontiidae	indet.	mandible with teeth	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
54-58M	lost	Mammalia/Rodentia	Rodentia indet.	partial skull	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
55-58M	MCZ VP 101625	Mammalia/Rodentia/ Chinchiliidae	Chinchiliidae indet.	partial mandible	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
56-58M	MCZ VP 101626	Mammalia/Xenarthra/Cingulata	Cingulata indet.	part of carapace	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.

Table 1. Continued.

Field Number	Catalog Number	Class/Order/Family/Subfamily	Genus/Species	Description	Locality	Unit
57-58M	MCZ VP 101599	Mammalia/Notoungulata/ Mesotheriidae	*Pseudotypotherium* sp.	mandible with left p4–m2 and right p4–m3 and an associated left humerus	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
58-58M	MCZ VP 101600	Mammalia/Notoungulata/ Hegetotheriidae/ Pachyrukhinae	*Tremacyllus* sp.	symphysis with right i1–2 and left i1, right p3–m1, and left p3–m1 and isolated m3	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
59-58M	MCZ VP 101627	aves?	indet.	median phalanx of hind foot	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
60-58M	MCZ VP 101628	Mammalia/Rodentia/ Hydrochoeridae	Hydrochoeridae indet.	fragment of skull and mandible	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
61-58M	MCZ VP 101601	Mammalia/Notoungulata/ Mesotheriidae	*Pseudotypotherium* sp.	fragment of right mandible with a broken p4 and the trigonid of the m1	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
62-58M	lost	Mammalia/Notoungulata/ Toxodontiidae	indet	portion of right ramus with broken m2–3	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
63-58M	MCZ VP 101602	Mammalia/Notoungulata/ Mesotheriidae	*Pseudotypotherium* sp.	left humerus, proximal fragment of ulna, and proximal fragment of radius	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
64-58M	MCZ VP 101603	Mammalia/Notoungulata/ Mesotheriidae	*Pseudotypotherium* sp.	fragment of maxillary with very bad preserved right P3–M2?	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
65-58M	MCZ VP 101604	Mammalia/Notoungulata/ Mesotheriidae	*Pseudotypotherium* sp.	fragment of maxilla with left P3–M2 and a fragment of mandible with unidentifiable teeth	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.

TABLE 1. CONTINUED.

Field Number	Catalog Number	Class/Order/Family/Subfamily	Genus/Species	Description	Locality	Unit
66-58M	MCZ VP 101629	Mammalia/Xenarthra/Cingulata	Cingulata indet.	osteoderms, posteranial bones	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
67-58M	lost	Mammalia/Rodentia	Rodentia indet.	skull	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
68-58M	MCZ VP 101605	Mammalia/Notoungulata/ Mesotheriidae	*Pseudotypotherium* sp.	left humerus without proximal epiphysis	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
69-58M	MCZ 100411	Mammalia/Tardigrada/ Megatheriidae	Megatheriidae indet	left ramus	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.
70-58M	MCZ VPM-4739	Mammalia/Rodentia	Rodentia indet.	jaw	Camp 6, YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province	Huachipampa Fm.

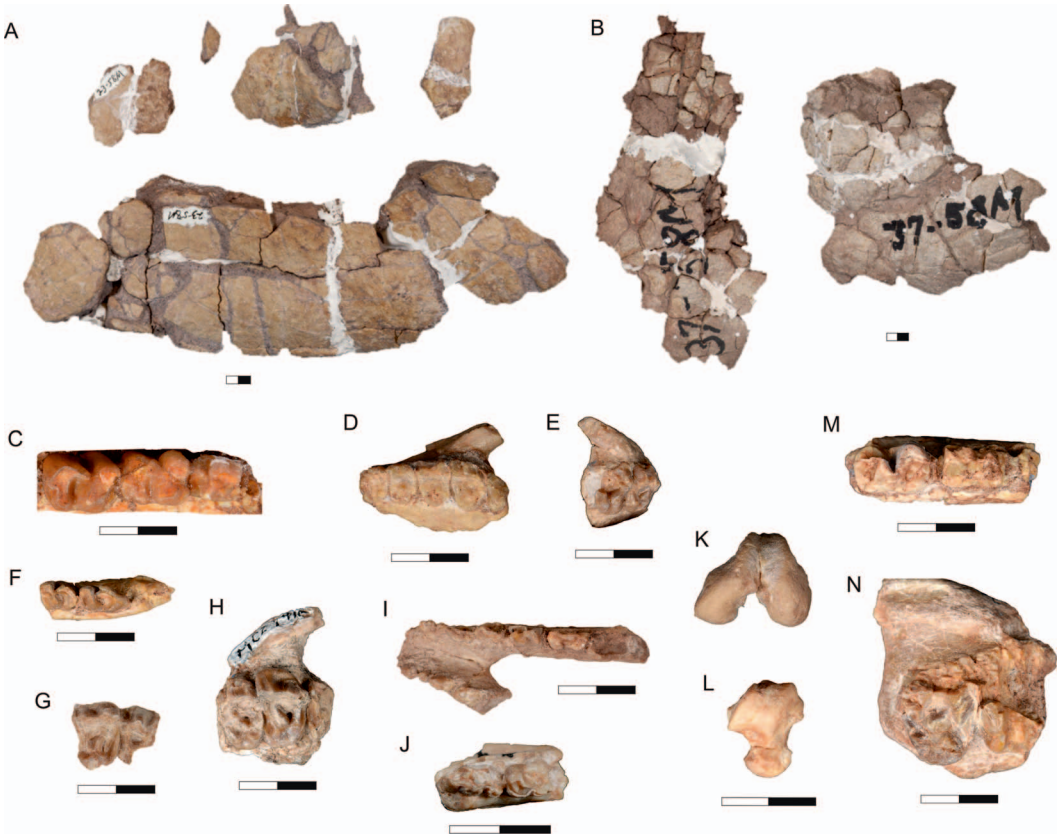

Figure 2. **A–N**, fossil specimens from the Divisadero Largo Formation (Mendoza Province): **A–B**, Testudines indet. (A), MCZ VP 101618, edge of carapace; (B), MCZ VP 101619, large part of carapace; **C–F**, *Brachystephanus postremus*, MCZ VPM-7408, left p4–m2 (C); MCZ VPM-7409, left P3–M3 (D); MCZ VPM-7410, left M1–2 (E); MCZ VPM-7411, mandible with left m2–3 (F); **G**, *Xenostephanus chiotti*, MCZ VPM-7415, right P4–M1; **H**, *Allalmeia atalaensis* MCZ VPM-7412, fragment of maxilla with left M1–3; **I–L**, Notoungulata indet., MCZ VPM-7418, mandible with right p3–m1 and left c, and p1–3 (I); MCZ VPM-7422, mandible with right p3–p4? (J), distal of femur (K), and right astragalus (L); **M–N**, *Phoradiadius divortiensis*, MCZ VPM-7416, fragment of lower jaw (M), and MCZ VPM-7407, right M2–3 (N). Scale equals 10 mm.

fragment of mandible with right p3–p4?, distal end of femur, and right astragalus (Fig. 2J–L).

Remarks: These specimens were not published by Simpson et al. (1962), while MCZ VPM-7422 was referred with doubts to *Xenostephanus chiotti* by López (2008).

Lower teeth MCZ VPM-7422 have considerably eroded occlusal surfaces, but some features resemble *Oldfieldthomasia*, like how the p3 is longer than the p4, and the metaconid lingually curves and directs distally. The astragalus MCZ VPM-7422 is characterized by having a symmetrical and high trochlea with parallel but inclined lateral and medial sides (~36° from the vertical axis), a short neck relative to the trochlea, and a well-developed dorsal crest. In proximal view, a foramen seems to be present into a long sulcus, but sediment does not permit detailed observation. In posterior view, a wide and deep inarticular sulcus separates the ectal facet from the sustentacular facet. The ectal facet is a rectangular and concave surface inclined at ~50° from the vertical axis. The sustentac-

ular facet is wide, convex, and well-delimited from the head by a deep sulcus. It is a bit larger (L = 9.9 mm) than that of *Notopithecus* (Vera, 2012) and differs from it and *Allalmeia atalaensis* (Lorente et al., 2014) in having a symmetrical and more inclined trochlea, and a shorter and wider neck (Fig. 2L). In turn, its features resemble *Colbertia* (Bergqvist et al., 2007), excepting a well-protruding tibial protuberance among other differences in the latter species. The morphologies indicated for this material do not allow us to conclude a taxonomic assignment, so we prefer to consider that it corresponds to a Notoungulata indet.

LITOPTERNA
SPARNOTHERIODONTIDAE SORIA, 1980
PHORADIADIUS DIVORTIENSIS SIMPSON, MINOPRIO AND PATTERSON, 1962

Referred material: MCZ VPM-7416, fragment of lower jaw with part of p4, and badly preserved m1 and m2 (Fig. 2M); MCZ VPM-7407, maxillary fragment with right M2–3 (Fig. 2N), the M2 preserves only the lingual half and the M3 lacks the ectoloph; Table 1.

Remarks: both specimens were included in the referred material of *Phoradiadius divortiensis* by Simpson et al. (1962), who also figured the M3 of MCZ VPM-7407, and López (2008). According to the field notebook, these specimens, including 20-58M to 25-58M (not figured), come from the lower Buff Layer, Minoprio's 'Musters,' Unit 3.

Other Fossils of the Romer Collection from the Divisadero Largo Formation

Other reports from the Divisadero Largo Formation correspond to the following: specimens 29-58M (ramus fragment with two molars) and 33-58M (ramus fragment with m2–3) attributed to 'Notoungulata indet.'; and specimen 24-58M (part of skull or mandibles) listed as '*Groeberia*?'. However, these specimens could not be located in the collection, as well as in the cases of 27-58M (maxillary fragment with two molars), 36-58M (ribs and unidentified bones), 41-58M (incomplete ramus with teeth), 42-58M (fragment of ramus with teeth), and 43-58M (fragment of maxilla with broken teeth; Table 1). Additionally, MCZ VPM-7421 (miscellaneous), MCZ VPM-7419 (fragments of maxillary and mandible), and MCZ VP 101621 (skeletal bones) are too fragmentary to be identified.

Aisol Formation

Locality: Camp 1, north of Mina Zitro (Fig. 1B).

Remarks: according to Romer's unpublished field notebook (1958), 15 specimens were collected in this locality, numbered as 1-58M to 15-58M. The fossils of this locality pertained to the Aisol Formation (Burdigalian, early Miocene; Garrido et al., 2014).

XENARTHRA COPE 1889
CINGULATA ILLIGER, 1811
GLYPTODONTIDAE GRAY, 1869
PROPALAEHOPLOPHORINAE AMEGHINO, 1891
CF. *PROPALAEHOPLOPHORUS* AMEGHINO, 1887B

Referred material: MCZ VP 101597, fragment of right mandible with four teeth (mf1 to mf4; Fig. 3A–B); Table 1.

Dimensions: mf1 (L = 9.0 mm, W = 5.8 mm), mf2 (L = 12.6 mm, W = 6.9 mm), mf3 (L = 16.8 mm, W = 8.7 mm), mf4 (L = 18.8 mm, W = 7.8 mm), molariform series length (mf1–mf4, 59.5 mm), and maximum mandibular depth at the last tooth level (46.7 mm). There is a miniscule and shallow alveolus in front of the mf1 (Fig. 3A), which probably belongs to the cavity for a vestigial incisor (Scott, 1903; González Ruiz et al., 2020 and its respective references). The posteroventral margin of the symphysis extends to the widest part of the first lobe of the mf4. The mf1 is obliquely oriented (anterolingual–posterolabial) with respect to the mf2–mf4, which are anteroposteriorly

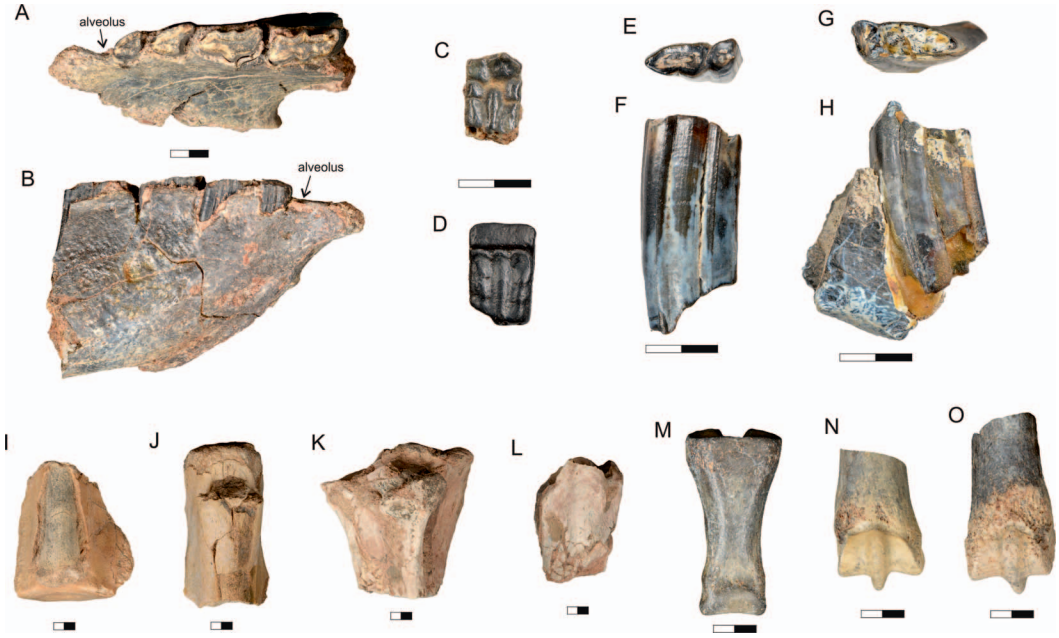

Figure 3. **A–O**, fossil specimens from the Aisol Formation (Mendoza Province): **A–B**, cf. *Propalaehoplophorus* MCZ VP 101597, fragment of right mandible with four teeth, mf1 to mf4, in occlusal and labial views; **C–D**, *Stenotatus* sp. MCZ VP 101606a–b, fixed (C) and moveable (D) osteoderms; **E–H**, cf. *Altitypotherium*, MCZ VP 101594, left m3 (E–F) and MCZ VP 101596, fragment of mandible with a right m3 (G–H), in occlusal and lingual views; **I–O**, Cramaucheniinae gen. et sp. indet.: MCZ VP 101591, two vertebrae (I–J); MCZ VP 101592, proximal epiphysis of tibia and patella (K–L); MCZ VP 101593, phalanx I (M) and fragments of two distal metapodials (N–O). Scale equals 10 mm.

aligned. It has a subtriangular occlusal outline, whose longer side coincides with the labial face; the labial and linguodistal faces are convex, while the mesiolingual face is concave. The mf2 presents a subtriangular outline. This molariform differs in occlusal shape with the mf1 by having a distolabial end conspicuously extended and a concave distal face. This peculiar extension confers to the mf2 an asymmetrical shape (Fig. 3A). The mf3 clearly differs from the mf2 in having trilobed labial and lingual faces; that is, the anterior, middle, and posterior lobes limited by two labial and two lingual slight grooves. The mf4 is a trilobed tooth as mf3 but differs from it in having deeper labial and lingual grooves, a better-developed labial half-middle lobe, and larger anterior and posterior lobes.

Remarks: The features observed in MCZ VP 101597 here described (e.g., mf1 and mf2 are subcircular or subelliptic in transversal section, and mf3 with slight indication of lobation) characterize to the propalaehoplophorine glyptodonts (Carlini et al., 2008). Propalaehoplophorinae represents one of the early-divergent Glyptodontidae groups (late Oligocene–middle Miocene), whose genera were initially recognized in Argentinian Patagonia (Carlini et al., 2008). During the Santacrucian SALMA (late early Miocene), the Propalaehoplophorinae showed great diversification, evidenced in the recognition of five genera and eight species: *Propalaehoplophorus* Ameghino, 1887b (*P. australis* and *P. minor*), *Cochlops* Ameghino, 1889 (*C. muricatus* and *C. debilis*), *Eucinepeltus* Ameghino, 1891 (*E. complicatus* and *E. petestatus*), *Metopotoxus* Ameghino, 1898 (*M. anceps*), and *Asterostemma* Ameghino,

1889 (*A. depressa*; see Scott, 1903). From these five genera, confidently assigned mandibular fragments correspond to *Propalaehoplophorus* and *Eucinepeltus*, while references to mandibular specimens of *Cochlops*, *Eucinepeltus*, and *Metopotoxus* were not clearly assessed, published, lost, or even more their validity questioned (see González Ruiz et al., 2020). Other early Miocene Glyptodontidae records correspond to *Parapropalaehoplophorus septentrionalis* from the Chucal Formation (northern Chile; Croft et al. 2007).

Comparing with glyptodonts of similar age to that considered for Aisol Formation, tooth dimensions of specimen MCZ VP 101597 are larger than in *Propalaehoplophorus australis*, *P. minus*, *Eucinepeltus petesatus* from the Santa Cruz Formation (González Ruiz, 2010; González Ruiz et al., 2020), and *Parapropalaehoplophorus septentrionalis* from the Chucal Formation (northern Chile, early Miocene; Croft et al., 2007). Its horizontal ramus height and the morphology of the mf2 are comparable to that of *Pa. septentrionalis* (Croft et al., 2007: fig. 6). However, MCZ VP 101597 distinguishes from *Pa. septentrionalis* in having the first three molariforms different in occlusal shape between them (mf1 trapezoidal, mf2 subtriangular, and mf3 is labially and lingually trilobed), while *Pa. septentrionalis* has quite similar subtriangular mf1–mf3 as *Eucinepeltus* (González Ruiz et al., 2020: fig. 9). In turn, the trilobed configuration of mf3 in MCZ VP 101597 (Fig. 3A) is comparable to the same tooth of *Propalaehoplophorus*.

In sum, features that closely relate MCZ VP 101597 to *Propalaehoplophorus* are a mandibular predental zone markedly everted, the horizontal ramus with a convex ventral margin (Fig. 3B), mf1 different from mf2, and a trilobed mf3. However, the trapezoidal morphology of the mf1 and the distolabially extended mf2 of MCZ VP 101597 also resembles *Parapropalaehoplophorus*. This suggests that MCZ VP 101597 could represent a new species of *Propalaehoplophorus* or even a different taxon. However, considering the lack of clearly assessed and published references to mandibular specimens of other Propalaeohoplophorinae genera (e.g., *Cochlops*, *Eucinepeltus*, and *Metopotoxus*) the taxonomic attribution of MCZ VP 101597 is cf. *Propalaehoplophorus*.

Following a previous report in the Aisol Formation by Soria (1983), Forasiepi et al. (2011) indicated the presence of three glyptodontids: Propalaeohoplophorinae gen. et sp. indet. (isolated osteoderms from different individuals, MACN–PV 18608, MACN–PV 18612) and Hoplophorinae gen. et sp. indet (a small fragment of caudal tube, MACN–PV 15074; probably belonging to Lomaphorini). Unfortunately, on account of the fragmentation of the remains we cannot refine the taxonomic identification.

DASYPODIDAE GRAY, 1821
EUPHRACTINAE WINGE, 1923
EUTATINI BORDAS, 1933
STENOTATUS AMEGHINO, 1891
STENOTATUS SP.

Referred material: MCZ VP 101606 comprises two osteoderms—MCZ VP 101606a, fixed osteoderm (Fig. 3C); and MCZ VP 101606b, moveable osteoderm (Fig. 3D; see Table 1).

Remarks: following the standard terminology for describing cingulate osteoderms, the figures are raised areas of the osteoderm; sulci are the grooves that delineate figures; and piliferous pits are round indentations on the surface of the osteoderm that have been interpreted as being associated with hairs (see Croft et al., 2007 and references therein).

MCZ VP 101606a (L = 12.65 mm; W = 7.92 mm; Fig. 3C) has six peripheral figures surrounding the principal figure, which is elongated and convex. The two anterior figures are pentagonal in contour with a plane to slightly convex surface, while the lateral figures (two in each side) are

rectangular and externally convex. Piliferous pits are observed in the posterior side. MCZ VP 101606b (L = 14.18 mm; W = 9.28 mm; Fig. 3D) displays three longitudinal figures similar-sized and convex: two lateral figures, each with two faint transverse grooves, and a principal figure separated from the lateral figures from shallow grooves. Piliferous pits are placed in these grooves between the lateral and principal figures, and in the posterior side. The features described in both specimens are characteristic of the osteoderms of the pelvic shield and moveable band of *Stenotatus*.

Stenotatus is a genus typical from Patagonia (Argentina), including five species (*S. patagonicus*, *S. hesternus*, *S. ornatus*, *S. centralis*, *S. planus*) from the late Oligocene to middle Miocene (Scillato and Carlini, 1998). Outside of Patagonia, *Stenotatus* sp. nov. was recorded in the early Miocene Chucal fauna in northern Chile (Croft et al., 2007). *Stenotatus* sp. was also recorded in the Chinches bearing level, oldest fauna of the Chinches Formation (San Juan Province, Argentina; Santacrucian SALMA; see López et al., 2011; fig. 4b). López et al. (2011) related the specimen from San Juan to *Stenotatus* sp. nov. described by Croft et al. (2007) and with *Stenotatus* cf. *S. patagonicus* described by Kramarz et al. (2010) for the early Miocene of Gran Barranca (Chubut, Argentina).

Comparatively, osteoderms of MCZ VP 101606 from the Aisol Formation seem to be larger than the osteoderms from the Chucal (Croft et al., 2007) and Chinches faunas (López et al., 2011). They also differ from *S. planus* (Cerro Boleadoras Formation, Santa Cruz Province; Scillato and Carlini, 1998; fig. 1d) in having a more stylized principal figure and a wider groove separating it from the peripheral figures in MCZ VP 101606a, and a plane and narrower anterior side in MCZ VP 101606b.

With the available evidence (only two osteoderms), we opt to identify both specimens as *Stenotatus* sp. This report constitutes the first mention of a Dasypodidae Eutatini *Stenotatus* for the Aisol Formation, increasing the diversity of the Cingulata previously recorded for this outcrop (Forasiepi et al., 2011; Garrido et al., 2014).

Notoungulata Roth, 1903
Mesotheriidae Alston, 1876
cf. *Altitypotherium* Croft, Flynn, and Wyss, 2004

Referred material: MCZ VP 101594, left m3 (Fig. 3E–F); MCZ VP 101596, fragment of mandible with a right m3 (Fig. 3G–H); Table 1.

Remarks: The m3 of MCZ VP 101594 (Fig. 3E–F) is characterized by having a vertical groove in the center of the lingual face of the talonid, which extends over the entire length of the crown. This groove confers a bilobed shape to the lingual border of the talonid (Fig. 3F). The m3 MCZ VP 101596 (Fig. 3G–H) has broken the lingual face of the trigonid and there is a fracture in the middle of the talonid. This specimen is probably associated with the m3 MCZ VP 101594 because of the similar size of both teeth (Table 2) and the shared morphology, such as a continuous layer of enamel and the presence of a lingual sulcus on the talonid, although it is less evident in the molar MCZ VP 101596 because of a fracture in this area (Fig. 3H).

Among Mesotheriidae from the Aisol Formation, *Eutrachytherus modestus* Roth, 1899, was reported based on specimen MNHSR-PV 1152 (Garrido et al., 2014). These authors also reported that the specimen MNHSR-PV 154 from the overlying La Huertita Formation could correspond to *Pseudotypotherium exiguum* (Ameghino, 1887a) or *P. subinsigne* (Rovereto, 1914). The La Huertita Formation lacks absolute dating but was referred to Montehermosan–Chapadmalalan SALMA (Zanclean–Piacenzian; Garrido et al., 2014). All previous mentions correspond to the upper dentition, which cannot be compared with the

TABLE 2. MEASUREMENTS (MM) OF LOWER DENTITION OF NOTOUNGULATA SPECIMENS DESCRIBED IN THE TEXT.

	i1		p3		p4		m1		m2		m3		
			L	W	L	W	L	W	L	W	L	W	H md m1
Pachyrukhinae													
MCZ VP 101698a			3.2	2.3	3.9	2.8	4.9	3.0	(4.8)	2.9			
MCZ VP 101698b							4.6	2.9	4.5	2.9	-	2.1	13.1
MCZ VP 101698d											(6.1)	-	
MCZ VP 101600a			2.6	1.8	2.9	2.2	3.7	2.3			5.0	2.2	
MCZ VP 101600b	3.0	1.2											
MCZ VP 101600c			2.4	1.9	2.8	2.1	3.5	2.5			5.1	2.1	
Mesotheriidae													
MCZ VP 101594											13.6	5.3	
MCZ VP 101596											14.6	5.3	
MCZ VP 101599					16.2	8.9	22.0	10.2	20.3	9.2	25.8	8.0	42.01
MCZ VP 101601					18.1	10.0							

specimens here described from the Romer collection (lower teeth of MCZ VP 101594 and MCZ VP 101596). It should be noted that *Eutrachytherus* Ameghino, 1897 is a nomen illegit pro *Trachytherus* Ameghino, 1889 (Mones, 1986) and no other mention concerning the species *E. modestus* was performed, although it was also described on the basis of the upper dentition (Roth, 1899).

More recently, a new taxon of Mesotheriinae, *Rusconitherium mendocense* Cerdeño, Vera, and Combina, 2018, was described from the fauna of the Mariño Formation (Santacrucian SALMA; Mendoza Province). These authors established general similarities between the specimen from the Aisol Formation (MNHSR-PV 1152) and *R. mendocense*, inferring that the former probably belongs to the same species, although they emphasized that comparison with lower teeth of mesotherines from the Aisol Formation is necessary to check their hypothesis. Specimens MCZ VP 101594 and MCZ VP 101596 share with *R. mendocense* a lingual sulcus on the talonid of the m3, but they differ from it in having larger dimensions and a continuous layer of enamel. On the contrary, in *R. mendocense* there is a posterolingual interruption of the enamel in the m3, which is shared with specimen Ar-96-49 attributed to a Mesotheriinae gen. et sp. nov. from Las Hornillas level of the Chinches Formation, San Juan Province (López et al., 2011).

In turn, the shape of the m3 of MCZ VP 101594 and MCZ VP 101596, with an elongated talonid, a pointed posterior end, the continuous layer of enamel, and a pronounced lingual sulcus in the talonid are shared with both species of *Altitypotherium* (*A. paucidens* and *A. chucalensis*) and *Eotypotherium chico* from the Chucal Formation (Chile; Croft et al., 2004). However, dimensions of the m3 MCZ VP 101594 and MCZ VP 101596 (Table 2) are larger than *E. chico*, smaller than *A. paucidens*, and comparable to those of *A. chucalensis* (Croft et al., 2004; tabs. 2, 4, 5), which also shares similarities with MHNSR-PV 1152 (Garrido et al., 2014).

Considering the scarce material available, we cannot be certain about its taxonomic identity below subfamily level. However, the morphology and dimensions of MCZ VP 101594 and MCZ VP 101596 allows establishing affinities with *Altitypotherium* sp. from the Chucal Formation (Chile), supporting the early Miocene age (Santacrucian SALMA) attributed to the fossil-bearing bed of the Aisol Formation (Forasiepi et al., 2015).

Specimens MCZ VP 101594 and MCZ VP 101596 constitute the first record of mesotheriids from the Mina Zitro locality

and the first lower dentition reported to this group from the Aisol Formation.

Litopterna Ameghino 1889
Macraucheniidae Gervais, 1855
Cramaucheniinae Ameghino, 1902
Cramaucheniinae gen. et sp. Indet.

Referred material: MCZ VP 101591, two fragmentary cervical vertebrae (Fig. 3I–J); MCZ VP 101592, proximal epiphysis of tibia (Fig. 3K) and a patella (Fig. 3L); MCZ VP 101593, phalanx I (Fig. 3M) and fragments of two distal metapodials (Fig. 3N–O).

Remarks: It should be noted that an inconsistency was detected regarding the provenance and identification of the skeletal elements that compose MCZ VP 101593. According to the field notebook, it was listed as a 'Macraucheniid?' coming from the Aisol Formation, but there is a label with the bones indicating that it is a Litoptern from the 'Huayquerías de San Carlos' (>200 km further north from the Aisol Formation; Fig. 1A, C). We consider that this label was incorrectly associated with MCZ VP 101593, and it probably belongs instead to the specimen MCZ VP 100410 listed as a litoptern from the Huayquerías Formation (see below).

Vertebrae of MCZ VP 101591 (Fig. 3I–J) do not preserve processes, but they have a long centrum, which is typical of litoptern macraucheniids. The fragment of tibia and patella MCZ VP 101592 (Fig. 3K, L) are poorly preserved, but they resemble those figured for *Theosodon* (Scott, 1910; pl. XX, figs. 4, 5).

The phalanx of MCZ VP 101593 (L = 41.67 mm; Fig. 3M) is symmetrical with a funnel profile. The proximal epiphysis is wider lateromedially (W = 21.6 mm) than the distal epiphysis (W = 18.36 mm). Based on its dimensions and ratios, it could belong to the digit III; it is slightly larger than the same bone of *Theosodon* (Scott, 1910). The articular surface of the distal epiphysis is antero–posteriorly extended, but more expanded over the posterior face. Both metapodials MCZ VP 101593 (Fig. 3N–O) have a dorsoventrally, well-developed median keel on the distal trochlea. The great extent of the keel is characteristic of noncentral metapodials (Mp II and IV) in many macraucheniids (Shockey, 1999).

Postcranial bones of Macraucheniidae for the Aisol Formation were already reported by Soria (1983) and Forasiepi et al. (2011), who suggested these probably correspond to *Theosodon*, the most common genus of Macraucheniidae Cramaucheniinae for the early Miocene. However, the bones here described are not enough to perform a confident generic determination.

Other Fossil Remains of the Romer Collection from the Aisol Formation

Other groups reported from the Aisol Formation at the MCZ collection correspond to: Aves, MCZ VP 101611 (proximal end of ulna); mammal megatheres, MCZ VP 101612 (two phalanges), MCZ VP 101614 (distal end of radius), and MCZ VP 101615 (partial humerus, ulna, and fragment of undetermined bones); a rodent indet., MCZ VP 101610 (isolated tooth; Table 1); and a toxodontid, MCZ VP 101613 (axis and six fragments of vertebrae), but its fragmentary condition does not allow the authors to identify it properly. Finally, an 'astrapothere?' (a distal end of humerus) and an invertebrate gastropod (field number 5-58M) were also reported in Romer' unpublished field notebook (1958), but unfortunately, they could not be found in the collection (Table 1).

Mariño Formation

Locality: Camp 4, Agua de las Avispas, Cacheuta Basin (Fig. 1E).

Remarks: According to Romer's unpublished field notebook (1958), only two specimens were collected from the Mariño Formation (17.96 ± 0.2 and 17.4 ± 1.3 myr, Burdigalian; Buelow et al., 2018) at this locality, 47-58M and 48-58M (Table 1).

XENARTHRA
CINGULATA
DASYPODIDAE INDET.

Referred material: MCZ VP 101622, part of a skull (posterior braincase; Fig. 3A). It was found approximately 20 m above cliff formed by 'Areniscas Entrecruzadas,' near end of NE spur of Cuchilla del Toscal, not far SW of division between Río Seco de Cacheuta and Arroyo Seco de las Minas (Fig. 1E).

Remarks: Concerning specimen 48-58M, it was not found at the MCZ collection. According to the field notebook, this set of fossils includes various isolated gastropod shells referred to *Corbicula elchaensis* Rusconi, 1949. This material was discovered in a white lens 1 m thick, on top of cliff formed by 'Areniscas Entrecruzadas,' approximately 800 m SW from specimen MCZ VP 101622.

Tunuyán Formation

Locality: Baños de la Salada area, 15 km East of San Carlos, Mendoza (Fig. 1C).

Remarks: This area is situated at the Huayquerías de San Carlos, West from the Meseta Sinclinal del Guadal (Synclinal Plateau; Fig. 1C). In this site, the team collected four specimens, 16-58M to 19-58M (Table 1) from the Tunuyán Formation ($\leq$5.84 Ma for the lower levels; latest late Miocene–early Pliocene; Garrido et al., 2017). It is important to note that the explorers indicated that their specimens were exhumed from the same area where the procyonid *Chapalmalania altaefrontis* Kraglievich and de Olázabal 1959 was found; that is, in the upper section of the unit (Chiesa et al., 2019 and its respective references).

XENARTHRA
PILOSA FLOWER, 1883
MEGATHERIIDAE GRAY, 1821
MEGATHERIINAE GRAY, 1821
PYRAMIODONTOTHERIUM ROVERETO, 1914
PYRAMIODONTOTHERIUM SP.

Referred material: MCZ VP 101595, a right mandible with four broken molars (Fig. 4B–C); Table 1.

Remarks: The specimen MCZ VP 101595 (Fig. 4B–C) is at least 190 mm in length, although it is an incomplete and restored mandible. Height of the mandibular bone at the level of the last tooth is approximately 69.4 mm. The length of the third molariform is approximately 9.45 mm and the length of the first molariform is 9.0 mm. This specimen was catalogued as belonging to *Pronothrotherium* Ameghino, 1907, a genus of Nothrotheriinae (Megatheriidae). This reference could be related to the mention of a nothrotheriine sloth similar to *Pronothrotherium*, but from a more primitive aspect, in the Cacheuta Basin at 30 km to the southwest from Divisadero Largo (Simpson et al., 1962: 281). However, the size of MCZ VP 101595 clearly surpasses those reported for *P. typicum* Ameghino, 1907, *P. subtypicum* Rovereto, 1914, *P. mirabilis* (Kraglievich, 1925), and *P. figueirasi* Perea, 1988 (but see Gaudin et al., 2020, and Discussion). On the contrary, the size and features of MCZ VP 101595 (e.g., squared molariforms aligned in a continuous series and separated by equidistant spaces and the oblique orientation of the transverse crests) correspond to megatheriines (Fig. 4B). Furthermore, the mesiodistal compression observed in the molariforms, inclination of the molariform ridges with respect to the sagittal plane, and relatively shallow dentary (Fig. 4C) are known in *Megathericulus* Ameghino, 1904, and *Pyramiodontotherium* Rovereto, 1914 (De Iuliis et al., 2004). The former genus, *Megathericulus*, was recorded from middle Miocene faunas (see Brandoni et al., 2020), while *Pyramiodontotherium* is a Megatheriinae known in the late Miocene to early Pliocene faunas (De Iuliis et al., 2008). These authors recognized three species of *Pyramiodontotherium*—*P. bergi* (Moreno and Mercerat, 1891) and *P. brevirostrum* Carlini, Brandoni, Scillato-Yané and Pujos, 2002, both from Bajo de Andalhuala (Catamarca Province), and *P. scillatoyanei* De Iuliis, Ré and Vizcaíno, 2004, which comes from the lower member of the Toro Negro

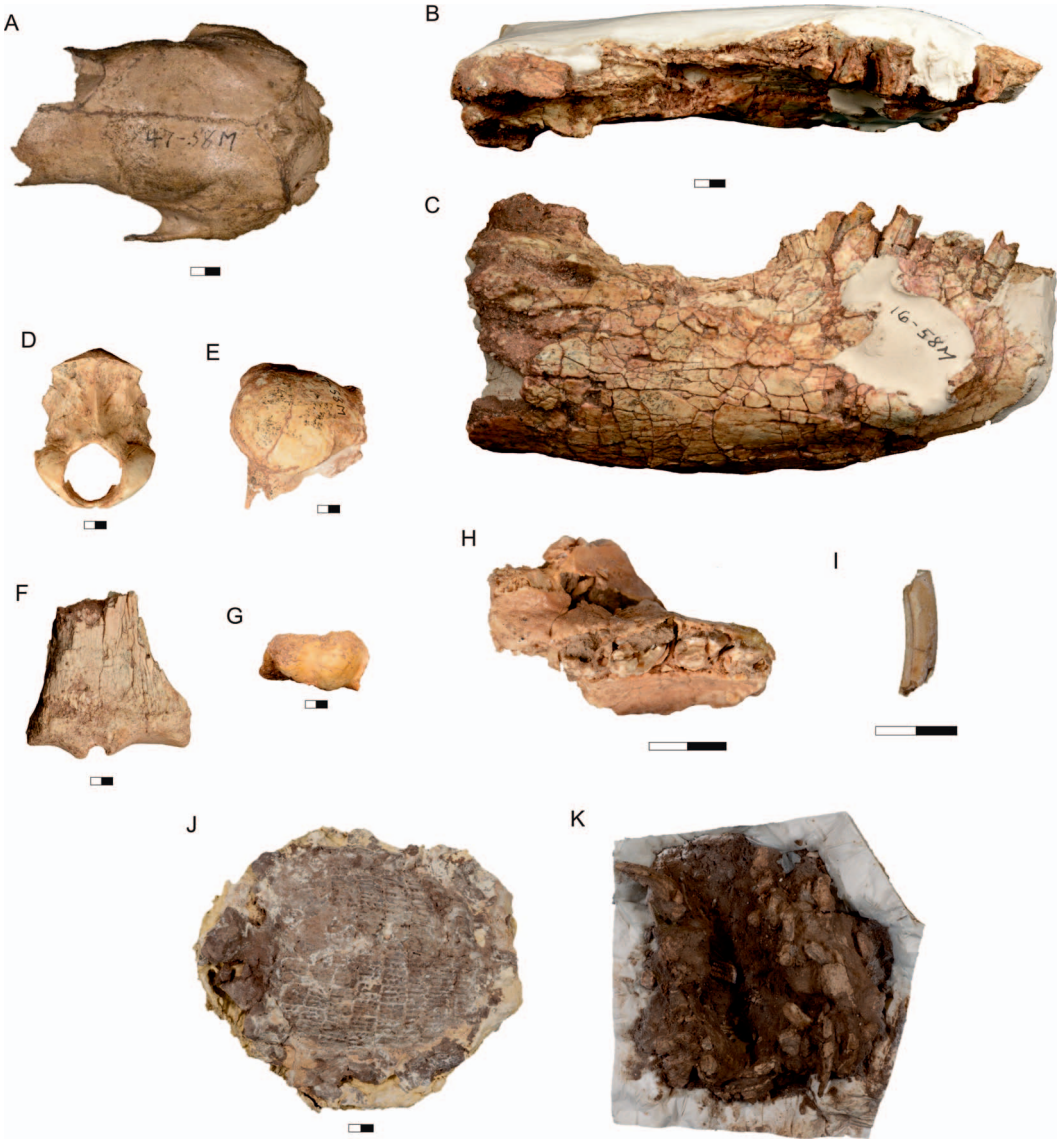

Figure 4. **A**, fossil specimen from the Mariño Formation (Mendoza Province): Dasypodidae indet., MCZ VP 101622, part of a skull. B–G, fossil specimens from the Tunuyán Formation (Mendoza Province): **B–G**, *Pyramiodontotherium* sp. MCZ VP 101595, right mandible with four broken molars, in occlusal and labial views; **D–G**, Macraucheniinae gen. et sp. indet., MCZ VP 100410a–d, occipital region of a skull (D), articular head of a humerus (E), proximal of tibia (F), and fragment of proximal radius (G). **H–I**, fossil specimens from the La Pilona Formation (Mendoza Province): **H**, *Hemihegetotherium* sp., MCZ VP 101598, right half of a bad preserved skull with P3 in eruption and P4–M2; **I**, Rodentia indet., MCZ VP 101623, isolated tooth. **J–K**, fossil specimens from the Huachipampa Formation (San Juan Province): Cingulata indet., MCZ VP 101626, part of carapace (J) and MCZ VP 101629 (K), osteoderms and postcranial bones. Scale equals 10 mm.

Formation (La Rioja Province, dated 6.87–4.95, late Miocene–early Pliocene; Amidón et al., 2016). Other reports refer to *Pyramiodontotherium* sp. from the Ituzaingó Formation (Entre Ríos Province, Brandoni and Carlini, 2009, and references therein).

Before this report, megatheriids were not known in the Tunuyán Formation. Thus, the mandible MCZ VP 101595 here identified as *Pyramiodontotherium* sp. constitutes the first report of a Megatheriinae, which increases the list of xenarthran taxa previously identified in the Tunuyán Formation (see Pascual and de la Fuente, 1993; Chiesa et al., 2019).

LITOPTERNA
MACRAUCHENIIDAE
MACRAUCHENIINAE GERVAIS, 1855
MACRAUCHENIINAE GEN. ET SP. INDET.

Referred material: MCZ VP 100410. At present, it is a set with four bone fragments with the same number, here referred as MCZ VP 100410a–d (Fig. 4D–G); Table 1.

Remarks: MCZ VP 100410a (Fig. 4D) is the occipital region of a skull. It is tall and displays the general features described for *Huayqueriana* cf. *H. cristata* Rovereto, 1914 from the Huayquerías Formation (Forasiepi et al., 2016: 34; fig. 18) in having a vertical ridge (i.e., external occipital crest) descending from the nuchal crest, separating two lateral depressions that are laterally bordered by occipital protuberances, and a circular foramen magnum. However, in *Huayqueriana* cf. *H. cristata* the occipital condyles are dorsoventrally compressed, differing from the longer and convex condyles in MCZ VP 100410a.

The other fragments of bones correspond to the following: MCZ VP 100410b, articular head of a humerus (Fig. 4E); MCZ VP 100410c, proximal end of a tibia (Fig. 4F); and MCZ VP 100410d, a fragment of proximal radius (Fig. 4G). They are probably associated with the occipital MCZ VP 100410a. Unfortunately, the fragmentary condition of these remains does not allow us to assert on their taxonomy beyond subfamily level.

Other Fossils of the Romer Collection from the Tunuyán Formation

Other groups reported for the Tunuyán Formation correspond to the following: a megathere, MCZ VP 101617 (several fragments of skull?) and a rodent catalogued as Ctenomyidae (field number 18-58M, fragment of molar). This latter specimen, however, was not found in the collection (Table 1).

La Pilona Formation

Locality: 1 km approximately north of Puesto Agua del Cajón, Mendoza Province (Fig. 1E). From this unit (Serravalian–Tortonian age, middle-late Miocene), the expedition collected specimens with the field numbers 49-58M to 52-58M (Table 1).

NOTOUNGULATA
FAMILY HEGETOTHERIIDAE AMEGHINO, 1894
SUBFAMILY HEGETOTHERIINAE AMEGHINO, 1894
HEMIHEGETOTHERIUM ROVERETO, 1914
HEMIHEGETOTHERIUM SP.

Referred material: MCZ VP 101598, right half of a badly preserved skull with P3 in eruption and P4–M2 (Fig. 4H); Table 1.

Remarks: according to the field notebook, this specimen was referred to a Pachyrukhinae. However, the features of the teeth correspond to the Hegetotheriinae morphotype (see below).

Specimen MCZ VP 101598 is a juvenile individual evidenced by the incompletely erupted P3 and P4. Although the teeth are severely fractured (Fig. 4H), approximate measurements of the P4 are L = 6.9 mm and W = 3.9 mm. There is a large antorbital foramen above the P4–M1 level (diameter = 4.6 mm). The most anterior border of the zygomatic arch starts just behind the antorbital foramen. Size and morphology

of MCZ VP 101598 resembles that of the *Hemihegetotherium* morphotype because of several features, such as imbricated upper check teeth with mesiolabially elongated parastyle and convex lingual face, trapezoidal-outlined M1 and M2, and the M2 wider and shorter than M1.

Hemihegetotherium comprises four widely distributed species in the middle to late Miocene faunas of Argentina and Bolivia: *H. achataleptum* Rovereto, 1914; *H. torresi* (Cabrera and Kraglievich, 1931); *H. tantillum* Vera, 2019; and *H. trilobus* Croft and Anaya, 2006 (more details see Vera, 2019 and its respective references). Specifically, in the Mendoza Province, the species *H. achataleptum* was described from the Huayquerías Formation based on a skull and a fragment of mandible (MACN PV 8491; Rovereto, 1914). Remains of *Hemihegetotherium* were also reported from the Río de los Pozos Formation (late Miocene–Pliocene; Yrigoyen, 1993) in the Tupungato area, approximately 100 km south from Cacheuta Basin (Cabrera, 1937; Yrigoyen, 1993). However, no collection numbers were provided, and subsequent studies did not refer to these specimens or provide descriptions or illustrations.

Considering that MCZ VP 101598 is a juvenile individual, and its teeth are severely damaged, we can establish comparisons with some of the *Hemihegetotherium* species. MCZ VP 101598 differs from *H. achataleptum* (MACN-PV 8491: L P4 = 8.4 mm; L M1 = 15 mm) and *H. trilobus* (Croft and Anaya, 2006) in its smaller size and having stylized P4 and M1 (subtriangular shaped), with shorter lingual faces and convex distal faces. In turn, MCZ VP 101598 is morphologically similar and closer in size to *H. torresi* (MLP 76-VI-12-25; see Vera, 2019; tab. 1) from the Arroyo Chasicó Formation (Buenos Aires Province), with which it shares subtriangular P3–4 with developed parastyle and paracone folds, a P4 more like P3 than M1, and a M2 quite differentiable from the M1.

Before this work, fossil vertebrate reports were unknown from the Pilona Formation in the Cacheuta area. The identification of the Hegetotheriidae *Hemihegetotherium* is consistent with the middle to late Miocene biochron of this genus. Moreover, we consider that MCZ VP 101598 has more affinities with *H. torresi* from the Chasicó Formation (Buenos Aires Province; 9.43–8.7 myr; Zárate et al., 2007) than to *H. achataleptum* from the Huayquerías Formation (5.84 ± 0.41 myr; Garrido et al., 2017). This is in concordance with the Serravalian–Tortonian dating provided for the Pilona Formation (12 to 8.4 myr; Irigoyen et al., 2000; Buelow et al., 2018).

Subfamily Pachyrukhinae Kraglievich, 1934
Pachyrukhinae gen sp. Indet.

Referred material: MCZ VP 101607, a left mandible with all teeth covered with sediment.

Remarks: According to the field notebook, it belongs to Pachyrukhinae. Despite being covered, we agree with the determination, but this specimen cannot be identified with certainty because of its condition.

Paedotherium Burmeister, 1888
Paedotherium sp.

Referred material: The set MCZ VP 101698 is composed of several specimens probably associated with the same individual. To describe all the specimens in this set, we use letters to differentiate each one.

Specimen MCZ VP 101698a is a fragment of the mandible with left p3–m2 (m2 is broken). A thick layer of cement covers all the teeth. The enamel is absent in the mesial face of p3 and the distolingual end of p3–m1. The p4 is more like the molars than the premolars (i.e., molariform); that is, the talonid is larger than the trigonid and like that of m1. This latter feature differentiates this specimen from *Tremacyllus* from the Huayquerías Formation (Vera and Ercoli, 2018). According to its size (Table 2), it

corresponds to the genus *Paedotherium*. It is larger than *P. typicum* and the specimen MLP 66-IV-23-8 (= MCZ 19313, a specimen from the Las Vertientes, Mar del Plata), although MCZ VP 101698a has a smaller p3 than MCZ 19313. Specimen MCZ VP 101698b is a fragment of mandible with right m1–3 (the talonid of m3 is broken), which may be related to the fragment MCZ VP 101698a (Table 2).

Specimen MCZ VP 101698c is a fragment of the mandible with right i1–2 and p2–3, and left i1 and p2. The i2 is a reduced tooth in comparison to the i1, having a tear-shaped outline. The p2 is labially trilobed, differing from *P. typicum* (Ameghino, 1887a) and resembling *P. minor* Cabrera, 1937 (Cerdeño and Bond, 1998; Vera and Ercoli, 2018).

Specimen MCZ VP 101698d is a left m3, lingually broken and probably related to the specimen MCZ VP 101698a (Table 2). The MCZ VP 101698e is a right I1 (L = 8.2 mm; W = 1.4 mm). The MCZ VP 101698f is a left M1 or M2 (L = 4.7 mm; W = 3.0 mm) with cement on the lingual face.

Other Fossils of the Romer Collection from the La Pilona Formation

Rodentia indet.: Specimen MCZ VP 101623 is an isolated tooth, which was attributed to Pachyrukhinae, but its morphology is typical of a rodent (Fig. 4I).

San Juan Province (Fig. 1A, F)

Huachipampa Formation

Locality: Camp 6 at the YPF encampment, Sierra de Mogna, Huachipampa Basin, East from Tucunuco, Jáchal Department, San Juan Province (Fig. 1F). In this site, the team collected and numbered the specimens 53-58M to 70-58M.

Remarks: a few years after the MCZ–MACN Expedition in the area of Sierra de Mogna, one of the expedition members, Rosendo Pascual, published a new genus of Rodentia Cardiatheriinae *Xenocardia diversidens* Pascual and Bondesio (1963) from the Huachipampa Formation (Tortonian, late Miocene). This species was based on a specimen (MLP 57-XII-23-5) collected by Dr. H. de la Mota (YPF) and deposited at the MLP. In this work, Pascual and Bondesio (1963: 44) pointed out that the fossils from the Huachipampa Formation were originally determined by Dr. Bryan Patterson (MCZ) and R. Pascual (MLP), who established a correlation with the Arroyo Chasicó Formation and the Estratos de los Llanos (San Luis Province) and assigned a Chasicoan age to the fauna of the Huachipampa Formation. This agrees with the information detailed in the field notebook.

CINGULATA ILLIGER, 1811
CINGULATA INDET.

Referred material: MCZ VP 101626 (part of carapace, Fig. 4J) and MCZ VP 101629 (osteoderms, postcranial bones; Fig. 4K).

NOTOUNGULATA
MESOTHERIIDAE ALSTON, 1876
PSEUDOTYPOTHERIUM AMEGHINO, 1904
PSEUDOTYPOTHERIUM SP.

Referred material: MCZ VP 101599, a nearly complete mandible preserving left p4–m2 and right p4–m3 (Fig. 5A–B) and associated left humerus (Fig. 5C–E); MCZ VP 101603, fragment of maxilla with badly preserved right P3–M2? (Fig. 5F); MCZ VP 101604, fragment of maxilla with left P3–M2 and a fragment of mandible with unidentifiable teeth (Fig. 5G–H); MCZ VP 101601, fragment of right mandible with a broken p4 and the trigonid of the m1 (Fig. 5I); MCZ VP 101605, a left humerus without proximal epiphysis (according to the field notebook, this set also includes a facial region of skull and other bones, but these elements are presently lost); MCZ VP

Figure 5. Mesotheriidae *Pseudotypotherium* sp. from the Huachipampa Formation (San Juan Province): **A–E**, MCZ VP 101599, mandible with left p4–m2 and right p4–m3, in occlusal and labial views (A–B), left humerus, in anterior, posterior and lateral views (C–E); **F**, MCZ VP 101603, right P3–M2?; **G–H**, MCZ VP 101604, left P3–M2 in occlusal and labial views (G) and mandible with unidentifiable teeth in occlusal and lingual views (H); **I**, MCZ VP 101601, fragment of mandible with right p4–m1, in occlusal and lingual views; **J–O**, MCZ VP 101602, left humerus in anterior and lateral views (J–K), proximal fragment of right ulna in lateral and anterior views (L–M), and proximal fragment of right radius in proximal and anterior views (N–O). Scale equals 10 mm.

101602, a left humerus (Fig. 5J–K), proximal fragment of right ulna (Fig. 5L–M), and proximal fragment of right radius (Fig. 5N–O).

Dentition: Among the tooth remains of mesotheres from the Huachipampa Formation, mandible MCZ VP 101599 is the best-preserved specimen (Fig. 5A–D). The morphology and size of its lower teeth, especially the occlusal shape of p4 have a mesially and labially pointed trigonid, resemble specimen MLP 12-1678 of *Pseudotypotherium insigne* (Ameghino, 1887a) from the Monte Hermoso Formation. The specimen MCZ VP 101601 (Fig. 5I) is a bit larger than MCZ VP 101599 (Table 2), although both could be related to the same taxon.

The upper teeth are represented by several fragments of multiple maxillae (Fig. 5F–G), but, unfortunately, the damaged teeth limit our comparisons. Despite that, the general morphology and dimensions are comparable to MACN Pv 8469, the type specimen of *Pseudotypotherium subinsigne* (Rovereto, 1914) from the Tunuyán Formation (Mendoza). Furthermore, MCZ VP 101604 and MCZ VP 101603 were collected at the same place and present the same state of preservation, which means both fragments may represent the opposite sides of the same palate.

Postcranial bones: The left humerus MCZ VP 101599 (Fig. 5C–D) is almost complete, lacking only its proximal epiphysis. It is a gracile bone, with a slender diaphysis and a minimally developed deltoid crest. Its distal end (W = 55.4 mm; AP = 33.0 mm; W trochlea = 43.7 mm) is wide and high relative to the narrow epiphysis, having a convex anterior aspect and a conspicuously concave posterior aspect. The trochlea is a wide and low articular surface, which is not as concave as that of *Plesiotypotherium* (Cerdeño et al., 2012: fig. 4). MCZ VP 101599 is characterized by a shallowly projected medial epicondyle and the epicondylar crest, which is well-developed forward of the bone rather than laterally, forming the pronounced concavity on the posterior aspect of the epiphysis. The humerus MCZ VP 101602 preserves the proximal epiphysis, which is mostly broken, but a posteriorly well-projected head is observed (Fig. 5K). The humerus of MCZ VP 101605 has a partially broken diaphysis and a large and well-marked medial trochlear crest, but it is similar to the humeri of MCZ VP 101599 and MCZ VP 101602.

The features observed in these humeri from the Huachipampa Formation (MCZ VP 101599, MCZ VP 101602, MCZ VP 101605) contrast with a more projected medial epicondyle and a laterally well-extended crest in other mesotheres, such as *Plesiotypotherium* (Cerdeño et al., 2012: fig. 4). Published data of mesotheres are available only for *Trachytherus*, *Plesiotypotherium* and *Mesotherium*, in which the humeri are robust, with a sigmoid shaft, massive and laterally extended deltopectoral crest, a more projected medial epicondyle and entepicondyle, and a laterally well-extended crest (Fernández-Monescillo et al., 2017). These features are clearly different from the humeri here attributed to *Pseudotypotherium* based on the associated dentition. In some respects, humeri of *Pseudotypotherium* sp. from the Huachipampa Formation are similar to *Plesiotypotherium achirense* Villarroel, 1974, sharing a large supratrochlear foramen and slender shaft.

Among the ulnae of mesotheres figured by Fernández-Monescillo et al. (2017; fig. 7), that of MCZ VP 101602 (Fig. 5L–M) is comparable to specimen MACN 7972 attributed to *Pseudotypotherium* sp. These specimens share a similar olecranon profile, both in medial and anterior aspects; in medial view, the distal part of the trochlear notch is anteriorly more projected than the proximal part; and a similar curvature of the posterior side of the olecranon. In this sense, this simili-

tude between the ulnae confirms our attribution of MCZ VP 101602 to *Pseudotypotherium*.

The radius of MCZ VP 101602 (Fig. 5N–O) only preserves its proximal part. The epiphysis is anteroposteriorly flattened, having a lateromedial maximum diameter and a kidney-shaped contour. In proximal view, the articular facets form a sigmoidal and barely concave–convex surface. Published radii of *Pseudotypotherium* are unknown. Comparatively, MCZ VP 101602 shows a similar aspect to the radius of *Plesiotypotherium* (Fernández-Monescillo et al., 2017; fig. 8).

Based on our comparisons, the mesothere here described is certainly attributed to the genus *Pseudotypotherium*. The upper teeth (MCZ VP 101604 and MCZ VP 101603) are comparable in overall morphology to *P. subinsigne* from the Tunuyán Formation (Mendoza). This could mean the mesothere from San Juan represents the same species, a hypothesis also supported by the geographic proximity. However, the state of preservation of the upper teeth of the mesothere from Huachipampa Formation does not allow a suitable comparison with the holotype of *P. subinsigne* (MACN Pv 8469). Additionally, the lower dentition of this latter species is unknown until the present, impeding comparisons with MCZ VP 101599.

Previous reports of Mesotheriidae from San Juan Province correspond to *Typotheriopsis chasicoensis* Cabrera and Kraglievich, 1931, and *T.* ?*silveyrai* Cabrera, 1937, from the Lomas de las Tapias Formation (late Miocene; Contreras and Baraldo, 2011; Contreras et al. 2019). The former species, *T. chasicoensis*, was originally described in the Arroyo Chasicó Formation, Buenos Aires Province (Chasicoan SALMA), while *T. silveyrai* is known in the Huayquerian SALMA (Late Miocene, but extending to early Pliocene), coexisting in some localities with the genus *Pseudotypotherium* (Cerdeño, 2018 and bibliography cited there). *Pseudotypotherium*, in turn, was reported from the Pliocene (Montehermosan and Chapadmalalan faunas) from Buenos Aires (*P. maendrum*) and Mendoza (*P. subinsigne*) provinces (Cerdeño, 2018); in San Luis Province, Río Quinto Formation (*P. subinsigne*, *P. maendrum*, and *Pseudotypotherium* sp.; Chiesa et al., 2019 and its respective references), La Rioja Province, Salicas Formation (*Pseudotypotherium* sp.; Tauber, 2005), and La Pampa Province, Cerro Azul Formation (*P. subinsigne*; Sostillo et al., 2021).

Hegetotheriidae
Pachyrukhinae
Tremacyllus Ameghino, 1891
Tremacyllus sp.

Referred material: MCZ VP 101600, several fragments that allow us to reconstruct the right and left series of the same mandible: the symphysis with right i1–2 and left i1, right p3–m1, and left p3–m1 and isolated m3 (Fig. 6A–D); Table 1.

Remarks: The m1 of MCZ VP 101600 has a well-worn occlusal surface. A thick layer of cement covers the labial face of the teeth. Dimensions of MCZ VP 101600 are smaller than MCZ VP 101698 (Table 2), which was referred to *Paedotherium*. On the contrary, the size and morphology are like *Tremacyllus impressus*, which was identified in the Huayquerías and Tunuyán formations from Mendoza Province (Vera and Ercoli, 2018). However, the material is not enough to identify it at the species level, which is why we opt to identify it as *Tremacyllus* sp.

Rodentia Bowdich, 1821
Hydrochoeridae Gill, 1872
Hydrochoeridae Indet.

Reffered material: MCZ VP 101628, fragment of skull and mandible (Fig. 6E-F)

Comparatively, teeth of specimen MCZ VP 101628 look similar to those of *Xenocardia diversidens* (Hydrochoeridae, Cardiatheriinae), also from the Huachipampa Formation (Pascual and Bondesio, 1963),

Figure 6. **A–H**, fossil specimens from the Huachipampa Formation (San Juan Province): **A–D**, *Tremacyllus* sp., MCZ VP 101600, right p3–m1 (A), symphysis with right i1–2 and left i1 (B), left lower molar (C), and isolated m3 (D); **E–F**, Hydrochoeridae indet., MCZ VP 101628, fragment of skull and mandible; **G**, Chinchiliidae indet., MCZ VP 101625, partial mandible; **H**, bird?, MCZ VP 101627. Scale equals 10 mm.

but more comparisons are needed for a taxonomic identification.

CHINCHILIIDAE BENNETT, 1833
CHINCHILIIDAE INDET.: MCZ VP 101625,
PARTIAL MANDIBLE (FIG. 6G).
RODENTIA INDET.

Reffered material: 54-58M (a partial skull; lost); 67-58M (cranium; lost), and MCZ VPM-4739 (jaw; Table 1).

Other Fossils of the Romer Collection from the Huachipampa Formation

Other groups correspond to the following: bird? MCZ VP 101627 (Fig. 6H); mammal megathere MCZ 100411 (left ramus), and toxodontids MCZ VP 101624 and field number 62-58M (portion of right ramus with broken m2–3). However, these specimens are too fragmentary to be identified or are not found in the collection.

DISCUSSION

Mendoza Province

Divisadero Largo Formation (Table 3). Two specimens of Testudines add to those previously reported for the Divisadero Largo Formation (Minoprio, 1947; Pascual and de la Fuente, 1993). The rest of the fossils from this unit correspond to Notoungulata and Litopterna mammals. Most of them are identifiable specimens of *Allalmeia atalaensis*, *Brachystephanus postremus*, *Xenostephanus chiotti*, and *Phoradiadius divortiensis* (Rusconi, 1946a; Simpson et al., 1962; López, 2008). However, there are many other specimens whose state of preservation impedes a proper identification, according to which we consider it as Notoungulata indet.

Aisol Formation (Table 3). MCZ VP 101597 is the first specimen bearing lower dentition of a Glyptodontidae Propalaehoplophorinae reported for both the Mina Zitro locality and the Aisol Formation. This fragment of mandible shows a combination of features present in both *Propalaehoplophorus* from the Santa Cruz Formation (Patagonia, Argentina, late early Miocene) and *Parapropalaehoplophorus* from the Chucal Formation (northern Chile, Croft et al., 2007). This finding MCZ VP 101597 is not common among the vertebrates registered for the Aisol Formation. Its fossil

Table 3. Fossil specimens identified in the Romer collection at the MCZ.

Province	Mendoza					San Juan
Formation	Aisol	Tunuyán	Divisadero Largo	Mariño	La Pilona	Huachipampa
Taxonomic group						
Testudines			Testudines indet.			
Xenarthra	Megatheriidae indet. Glyptodontidae Propalaehoplophorinae cf. *Propalaehoplophorus* Dasypodidae Eutatini *Stenotatus* sp.	Megatheriidae Megatheriinae *Pyramiodontotherium* sp.		Dasypodidae indet.		Cingulata indet.
Notoungulate	Mesotheriidae Mesotheriinae cf. *Altitypotherium*		Oldfieldthomasidae *Brachystephanus postremus* *Xenostephanus chiotti* *Allalmeia atalaensis* Oldfieldthomasiidae indet. Notoungulata indet.		Hegetotheriidae Hegetotheriinae *Hemihegetotherium* sp. Pachyrukhinae Pachyrukhinae gen sp. indet. *Paedotherium* sp.	Mesotheriidae Mesotheriinae *Pseudotypotherium* sp. Hegetotheriidae Pachyrukhinae *Tremacyllus* sp.
Litopterna	Macraucheniidae Cramaucheniinae Cramaucheniinae gen. et sp. indet.	Macraucheniidae Macraucheniinae Macraucheniinae gen. et sp. indet.	Sparnotheriodontidae *Phoradiadius divortiensis*			
Rodentia	Rodentia indet.				Rodentia indet.	Chinchiliidae indet. Hydrochoeridae indet.

record is scarce and fragmentary (but see the exceptional specimen of a new notoungulate toxodontid; Forasiepi et al., 2015) and the knowledge, in general, of xenarthrans and native ungulates from early Miocene assemblages of Mendoza Province (e.g., Aisol and Mariño formations) is still incipient.

Specimens MCZ VP 101606a–b are here identified as Dasypodidae Eutatini *Stenotatus* sp. This taxon is larger than *Stenotatus* sp. nov. from the Chucal fauna (early Miocene, Chile; Croft et al., 2007) and *Stenotatus* sp. from the Chinches fauna (López et al., 2011), being closer in size to *S. planus* from the Cerro Boleadoras Formation (Scillato and Carlini, 1998). It could represent a new species of *Stenotatus*, but the material does not allow an adequate diagnosis and as previously commented, the xenarthrans of the Aisol Formation and other early Miocene faunas of Mendoza are still poorly known. The presence of *Stenotatus* sp. increases the diversity of Pilosa for the Aisol Formation (i.e., Hoplophorinae and Propalaeohoplophorinae; Forasiepi et al., 2011; Garrido et al., 2014).

In the same way, specimens MCZ VP 101594 and MCZ VP 101596 constitute the first record of a Notoungulata Mesotheriidae for Mina Zitro locality and the first specimens with lower dentition assigned to mesotheres for the early Miocene Aisol Formation. These specimens show a closer affinity to *Altitypotherium* sp. from the Chucal fauna (Chucal Formation; Croft et al., 2004) than to *Rusconitherium mendocense* from the Mariño Formation (northern Mendoza; Cerdeño et al., 2018) or the Mesotheriinae gen. et sp. nov. from Chinches Formation (San Juan Province; López et al., 2011). Thus, early Miocene mesotheriids are present in the faunas of the Aisol, Mariño, Chucal, and Chinches formations, but they have not been recorded in the Santa Cruz Formation (Cerdeño, 2018 and its respective references).

According to our comparisons, both the notoungulate (Mesotheriidae) and the Xenarthra (Glyptodontidae) records of the fauna from the Aisol Formation establish affinities between it and the Chucal fauna from northern Chile.

Other mammal fossils from the Aisol Formation housed at the MCZ correspond to fragmentary bones of Litoptern Macraucheniidae, here identified as Cramaucheniinae gen. et sp. indet., which has similarities with *Theosodon*. However, these specimens are not enough to perform a confident generic determination beyond the subfamily level.

Mariño Formation (Table 3). The most peculiar is the portion of a skull (MCZ VP 101622) of a Cingulata Dasypodidae indet. This specimen adds to the diversity of mammals previously reported for the Mariño Formation, which was composed of Notoungulata mesotheriids *Rusconitherium mendocense* (Cerdeño et al., 2018), the rodent *Scleromys* sp. (Cerdeño and Vucetich, 2007) and the Litopterna Protherotheriidae *Thoatheriopsis mendocensis* Soria, 2001 (but see Villafañe et al., 2012).

La Pilona Formation (Table 3). Before this work, reports of fossil vertebrates were unknown for the Pilona Formation in the Cacheuta area (Mendoza Province). Based on the Romer collection from this unit of Argentina, we identify several specimens that belong to the two subfamilies of Hegetotheriidae, Hegetotheriinae and Pachyrukhinae. Firstly, we recognize the Hegetotheriinae *Hemihegetotherium* sp., which has more affinities with *H. torresi* from the Chasicó Formation (Buenos Aires Province) than to *H. achataleptum* described in the Huayquerías Formation (Mendoza Province). Secondly, among Pachyrukhinae, we identify a Pachyrukhinae indet. and *Paedotherium* sp., which have similitudes with *P. minor*, the species originally described from the Chasicó Formation. The genus *Paedotherium* was also reported in the Salicas Formation, La Rioja

Province (*Paedotherium* sp.), Río Quinto Formation, San Luis Province (*P. insigne* and *P. typicum*), Tunuyán Formation, Mendoza (*P. typicum*), and Cerro Azul Formation, La Pampa Province (Vera and Ercoli, 2018; Chiesa et al., 2019; Sostillo et al., 2021, and its respective references). Thus, based on the Hegetotheriidae record of the La Pilona Formation, affinities could be established between its fauna and that from the Chasicó Formation, which is also in concordance with the comparable ages obtained for both units (Irigoyen et al., 2000; Zárate et al., 2007; Buelow et al., 2018).

Tunuyán Formation (Table 3). The most singular specimen found by Romer's team in the Tunuyán Formation is a fragment of mandible with teeth, here identified as a Megatheriidae Megatheriinae *Pyramiodontotherium* sp. It constitutes the first report of both the Megatheriinae group and the genus *Pyramiodontotherium* in the early Pliocene Tunuyán Formation and increases the list of xenarthran taxa previously reported for this unit. The presence of this genus establishes affinities between the fauna of Tunuyán Formation with those of the Ituzaingó, Andalhuala, and Toro Negro formations

Other specimens from this unit correspond to fragments of the occipital region of a skull, a humerus, a radius, and an ulna, all of them apparently associated, and identify as Macraucheniidae Macraucheniinae gen. et sp. indet.

San Juan Province

Huachipampa Formation (Table 3). Excepting a few intensively studied geological units, such as the Chinches, Puchuzum, and Loma de las Tapias formations, the paleontological Neogene record of the San Juan Province is poorly known (Chiesa et al., 2019 and its respective references). In this work, we reported unpublished fossil mammal specimens from the Huachipampa Formation (Sierra de Mogna area), which corresponds to Cingulata indet., and the first record of notoungulate remains for this unit. Among them, we identify the Mesotheriidae *Pseudotypotherium* sp., which is closely related to *P. insigne* from the Monte Hermoso Formation, and the Hegetotheriidae Pachyrukhinae *Tremacyllus* sp. The *Tremacyllus* record is restricted to the late Miocene–late Pliocene faunas from Argentina. It was reported in Buenos Aires, San Luis, Córdoba, La Pampa, Catamarca, La Rioja, and Mendoza provinces (see Vera and Ercoli, 2018; Chiesa et al., 2019; Sostillo et al., 2021, and its respective references).

Considering this background, the notoungulates from the Huachipampa Formation here reported are significant for several reasons. First, the mesothere specimens correspond to upper and lower dentition and limb bones in association, which is not common in the fossil record and, in the case of the forearm bones (humerus, radius, and ulna), they are the first known for *Pseudotypotherium*. Second, the presence of *Pseudotypotherium* and *Tremacyllus* not only increases the diversity of mammals of the Huachipampa Formation, which was previously known only by the rodent Cardiatheriinae *Xenocardia diversidens* (Pascual and Bondesio, 1963), but also the diversity of mesotheres and hegetotheres previously reported for the Neogene of San Juan Province extending their geographic distribution. Finally, the identification of *Pseudotypotherium* could also mean extending the biochron of this Pliocene taxon to the late Miocene age established for the Huachipampa Formation (Johnson et al., 1986; Contreras et al., 2019).

Regarding the reports of rodents, the presence of a Chinchiliidae indet. (MCZ VP 101625) and a Hydrochoeridae indet. (MCZ VP 101628) increases the diversity of cavioids previously reported for the Huachipampa Formation (Pascual and Bondesio, 1963). Other specimens of rodents were

also listed from this unit, but they were not found in the collection (Table 1).

Among the vertebrate fossils recovered from the Huachipampa Formation, Romer's unpublished field notebook (1958) also listed specimens attributed to birds (field number 59-58M) and mammals, such as xenarthran Megatheriidae (MCZ 100411) and a notoungulate toxodontid (field numbers 53-58M and 62-58M; Table 1). Unfortunately, these specimens could not be found in the collection.

CONCLUSIONS

The MCZ–MACN joint expedition led by Alfred S. Romer visited several fossiliferous localities that encompass Paleogene (early? Eocene) and Neogene (early Miocene to Pliocene) outcrops from central-west area of Argentina. The team collected an interesting sample of fossil remains, including invertebrate gastropods, birds, testudines, and mammal specimens, from Mendoza and San Juan Provinces. The specimens collected as a product of this expedition were distributed at several institutions in the USA (AMNH, MCZ) and in Argentina (MACN, MCNAM, MLP, MMMP). A large part of this collection was published as well.

In this contribution, we present a part of the collection from the MCZ–MACN expedition, which consists of many specimens that remained unpublished and uncatalogued since the 1950s. This small collection is interesting for several reasons. Firstly, it includes assemblages from lesser-known faunas from Mendoza Province, such as those of the Divisadero Largo, Mariño, Aisol, Tunuyán, and La Pilona formations, and the practically unknown Huachipampa Formation in San Juan Province. Second, it encompasses a temporal range from the early? Eocene to early Pliocene, where the early? Eocene is represented by the Divisadero Largo Formation (ca. 50 myr; Mescua et al., 2017), the Burdigalian (early Miocene) is represented by the Aisol (19.48 myr., Forasiepi et al., 2015) and Mariño (19–17.4 myr; Buelow et al., 2018) formations, the Serravalian–Tortonian (late Miocene) is represented by the La Pilona (12–8.4 myr; Buelow et al., 2018) and the Huachipampa formations (10–8.4 myr; Jordan et al., 1990); and the Zanclean (early Pliocene) is represented by the Tunuyán Formation (5.5–3.8 myr; Yrigoyen, 1994).

Among the singular specimens, we reported several first mentions (Table 3): 1) lower dentition attributed to cf. *Altitypotherium* sp. (Mesotheriidae) and cf. *Propalaehoplophorus* (Glyptodontidae), and the presence of *Stenotatus* sp. (Dasypodidae) for the Aisol Formation (Mendoza Province); 2) both the Megatheriinae group and the genus *Pyramiodontotherium* (Megatheriidae) in the Tunuyán Formation (Mendoza Province); 3) a Dasypodidae indet. in the Mariño Formation; 4) mammal ungulate fossils attributed to Hegetotheriidae Hegetotheriinae *Hemihegetotherium* sp. and Pachyrukhinae *Paedotherium* sp. for the Pilona Formation (Cacheuta area, Mendoza Province); and 5) notoungulate remains of Mesotheriidae *Pseudotypotherium* sp. (teeth in association with humeri, radius, and ulna) and Hegetotheriidae Pachyrukhinae *Tremacyllus* for the Huachipampa Formation (San Juan Province).

This work highlights the need to focus and reinforce paleontological explorations in little-known outcrops and localities that have been shown to be fossiliferous. Finally, and most importantly, based on some of these reports, correlations could be established between the faunas represented by the Romer collection and classical faunas from Argentina. For instance, *Pyramiodontotherium* in the Tunuyán Formation establishes affinities with faunas of the Ituzaingó, Andalhuala, and Toro Negro formations (Entre Ríos, Catamarca, and La Rioja provinces, respectively), while the Hegetotheriidae record of the La Pilona Formation correlates its fauna with that of the Chasicó Formation (Buenos Aires Province).

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