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A NEW ADIANTHINE LITOPTERN AND ASSOCIATED MAMMALS FROM A DESEADAN FAUNULE IN MENDOZA, ARGENTINA

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and José Luis Minoprio[1]

ANTECEDENTS

The present paper is devoted to descriptions of a few fossil mammals from the Divisadero Largo formation in the Province of Mendoza, Argentine Republic. These strata had been noted in a cursory way long before, but the occurrence of fossil mammals in them was not known until 1936 when Sr. Adrián Ruiz Leal found a small hegetothere skull, which was later described by one of us (Minoprio, 1947). In 1943 and subsequently Dr. Olivo Chiotti made a geologic map of the area, a section of which was published in the cited work by Minoprio, and he also found other specimens which in 1945 were referred for identification to Dr. Ángel Cabrera, then of the Museo de La Plata. Dr. Cabrera's work has been interrupted, and descriptions of these fossils have not yet been published.

In January, 1946, Dr. Chiotti's study of the area resulted in a thesis entitled "Estratigrafía y Tectónica del Oeste de la Ciudad de Mendoza y Las Heras." This important and detailed stratigraphic study has not been published, but it is deposited in the Facultad de Ciencias Exactas, Físicas y Naturales of the Universidad de Córdoba, Argentina, and is available for consultation or loan. (It has been consulted by us.)

Sr. Carlos Rusconi, of Mendoza, became acquainted with the

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occurrence of fossil mammals in this area through the work of Chiotti and Minoprio and was guided to the fossil localities by Minoprio. With Sr. M. Tellechea he found various other fossils there, and he has published descriptions of some of these (Rusconi, 1946a, 1946b, 1946c). These papers and Minoprio, 1947 (published after Rusconi, 1946, but based on prior work by Chiotti and Minoprio), are the previous published references to this interesting new fauna.

OCCURRENCE

The fossils here in question were found in the Divisadero Largo formation at and near its type locality around and south of the eastern end of the Cerro Divisadero Largo about 8 kilometers west of the city of Mendoza. The regional geology and full stratigraphic sequence are highly complicated, but for present purposes it is sufficient to present a brief summary directly pertinent to the occurrence of the fossil mammals. This summary is based mainly on Chiotti's observations and data.

A thick and complex series of Paleozoic and Mesozoic rocks here terminates upward in a sharply defined erosional unconformity at the top of the "Estratos del Victor."[1] The age of these strata is not absolutely fixed but they are generally considered Rhaetic. Above this disconformity there are approximately 2200 meters of continental Tertiary rocks. These in turn are capped in places with strong angular unconformity by some 800 meters of conglomerate, called "Los Mogotes" and considered Pleistocene by Chiotti, a determination based on their structural and stratigraphic relationships as no fossils have yet been found in them.

The strata between the Estratos del Victor and the Conglomerado de Los Mogotes are also unfossiliferous except for the Divisadero Largo fauna near their base. On lithological grounds and on the basis of two apparent major disconformities, Chiotti has subdivided this series as follows:

METERS	
1550	*Serie del Higueral*
450	*Serie de las areniscas inestratificadas*
160	*Formación de Divisadero Largo*

[1] Beneath the "Estratos del Victor," the "Estratos de Cacheuta" and the "Estratos de Potrerillos" are both fossiliferous. The former contains *Estheria forbesi* and some *Thinnfeldia*, the latter more numerous *Thinnfeldia*.

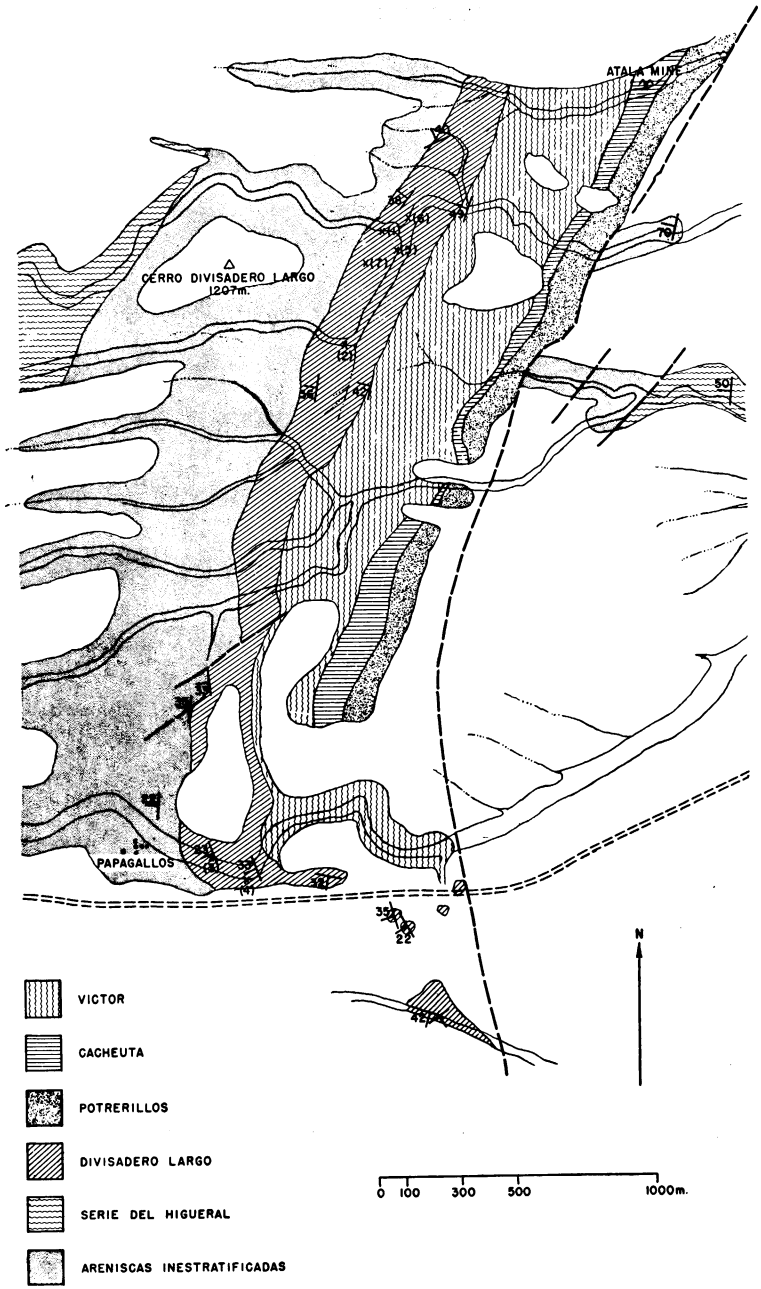

FIG. 1. Sketch map of the mammal-bearing exposures of the Divisadero Largo formation. Data from Chiotti, with some additions by Minoprio; drawn by N. Altshuler.

The structure is much complicated by faulting, but that part pertinent to the Divisadero Largo and its mammal localities is a broad syncline trending nearly north and south. The broad center of the syncline is formed by the Higueral beds, with the

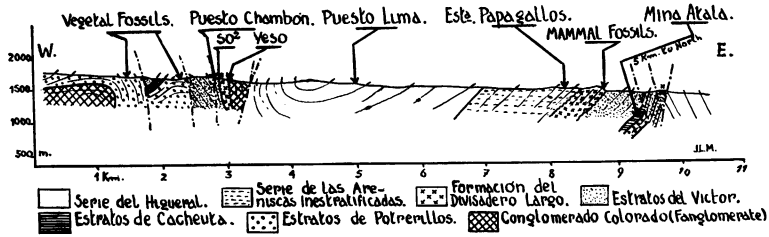

FIG. 2. East-west section through the Divisadero Largo mammal locality and adjacent structures, section A-A′ of Chiotti's manuscript. The eastern part of the section crosses the area shown on a larger scale in figure 1. Data from Chiotti, with some additions by Minoprio; drawn by Minoprio.

"unstratified sandstones" and the Divisadero Largo forming narrower zones in the more steeply folded sides of the syncline. The Divisadero Largo thus outcrops in two north-south bands on the two sides of the structure, between 5 and 6 kilometers distant

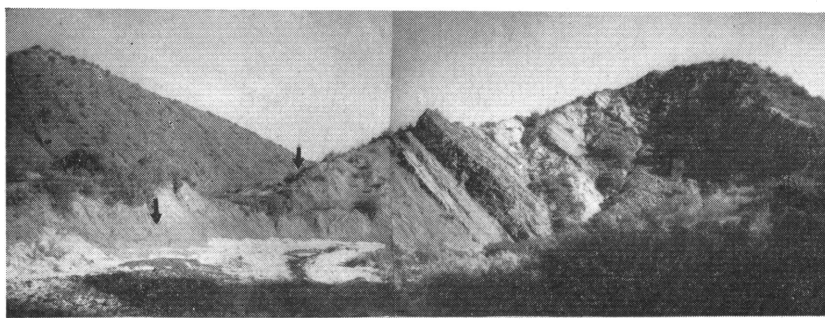

FIG. 3. Exposure of the Divisadero Largo formation at the east end of Cerro Divisadero Largo. Arrows indicate two of the fossil localities. Photograph by Minoprio.

from each other. The fossil localities are all in the eastern band, shown in the accompanying sketch map (fig. 1), section (fig. 2), and photograph (fig. 3). The following generalized section of the Divisadero Largo in this region is abbreviated from Chiotti's thesis:

METERS	
30	Variegated clays, reddish gray and violet, in beds 2–15 cm. thick, terminating above in a 60-cm. bed of pale gray argillaceous tuff
20	Maroon and gray, medium-grained sandstones alternating with thin beds of red and gray clay
60	Maroon and gray sandstones, partly conglomeratic, in beds 30 cm. to several meters in thickness. FOSSIL MAMMALS
45	Drab reddish sandstones, mostly fine to medium grained but with some conglomerate, in part micaceous, well stratified, and laminated
2–5	Compact, resistant, drab red conglomerate with lime and quartz pebbles up to 10 cm. in diameter. This rests with erosional disconformity on the Estratos del Victor and it also forms clastic dikes 2–7 cm. thick extending down into the older beds for distances of 4–5 meters

The age of these beds is probably Deseadan. The evidence for this will be discussed after consideration of the known fossil mammals.

DESCRIPTIONS OF MAMMALIAN FAUNA

ORDER LITOPTERNA

GEN. ET SPP. INDET.

Recently collected material includes a fragment of left lower jaw with roots of dm_4 or P_4 and M_{1-2} and a small part of an unerupted M_3. A fragment of right lower jaw with a broken, unerupted M_3, although not marked as associated, is probably part of the same individual. These pieces represent an animal of about the same size as a jaw fragment with roots of P_3–M_3 previously published (Minoprio, 1947, p. 376, fig. 6d and d′). The genus or species might be the same, but the specimens are too incomplete to warrant any positive conclusion. Minoprio compared the previously published fragment with *Paramacrauchenia* Bordas, but, as he fully recognized, it is so poorly preserved that this does not constitute an identification.

The present fragments are also so imperfect that they cannot be identified. Right M_3, the most significant part preserved, has the usually rather characteristic posterior end broken off. The remaining part could belong to a macraucheniid, although apparently not to *Paramacrauchenia*. It is, however, rather more similar to some of the Santacrucian and Colhuehuapian proterotheres, but not precisely like them. If these are its true affinities it probably represents a different and older genus. Comparison

with the Deseadan *Eoproterotherium* Ameghino and *Deuterotherium* Ameghino is desirable. As described by Ameghino, the unworn lower molars referred to *Deuterotherium* have the cusps more distinct and less fully merged into lophids than in the present M_3, which apparently cannot be congeneric with Ameghino's specimen. Lower molars of *Eoproterotherium* have not been described. In describing that genus, Ameghino said that he had lower as well as upper molars, but no descriptions or figures of lower teeth have been published. The present form must be listed merely as an indeterminate litoptern until better specimens are found and wider comparisons become possible.

FAMILY **MACRAUCHENIIDAE**

SUBFAMILY **ADIANTHINAE**

ADIANTOIDES, NEW GENUS

TYPE: *Adiantoides leali*, new species, *infra.*

KNOWN DISTRIBUTION: Deseadan, Divisadero Largo formation, Mendoza, Argentina.

DIAGNOSIS: A fully brachyodont adianthine litoptern with dentition somewhat similar to that of *Proadiantus* but probably closer to *Adianthus*. P^2 obliquely triangular, smaller and less transverse than P^3. P^{3-4} similar but progressively larger, strongly transverse, with persistent median internal fossette, very large and prominent parastyle, and labial face of protoloph posterior to the parastyle excavated, with basal cingulum. Postero-internal cingulum of P^4 barely larger than antero-internal cingulum and not cuspidate or projecting to form a hypocone. Upper molars relatively transverse, with projecting parastyles and ectolophs probably relatively simple posterior to parastyles. M^{1-2} with median internal and weak postero-internal fossettes, anterior cingulum apparently small and forming no, or only a very transitory, antero-internal fossette. M^3 short anteroposteriorly, obliquely triangular. Lower cheek teeth generally more as in *Proadiantus*, but talonids on M_{1-2} shorter and narrower than trigonids and M_3 strongly distinctive in having the talonid only slightly greater than the trigonid in length and much narrower, with entoconid continuing hypoconulid crest and barely differentiated, not forming a transverse crest.

The following genera have hitherto been referred to the Adianthinae, or the Adianthidae of Ameghino:

Pseudadiantus Ameghino, 1901; Casamayoran, Patagonia
Proadiantus Ameghino, 1897; Deseadan, Patagonia
Tricoelodus Ameghino, 1897; Deseadan, Patagonia
Proheptaconus Bordas, 1936; Colhuehuapian (Trelew formation and local fauna), Patagonia
Adianthus Ameghino, 1891; Colhuehuapian (typical) and Santacrucian, Patagonia

Pseudadiantus proves on restudy of the originals (observations by Simpson, in manuscript) to be an interathere (a synonym of *Notopithecus*) and must be removed from this group. *Tricoelodus* is a poorly known form probably also incorrectly referred to this group and in any case so unlike the other genera named or the present new genus that explicit comparison is unnecessary.[1] The previously established genera definitely of this group are thus *Proadiantus*, *Proheptaconus*, and *Adianthus*.

Adianthus shows some special resemblance to *Adiantoides*. The strong parastylar spur and absence of mesostyle and metastyle on the upper molars are probably similar, although these characters are not certainly established for *Adiantoides*. The transverse rather than anteroposterior extension of the hypocone is more clearly similar. The relatively internal or, at least, not obviously external position of the median fossette is another resemblance. The relatively undifferentiated entoconids of M_{1-2} are also similar. On the other hand, the cheek teeth of *Adianthus* have higher crowns than those of *Adiantoides*, antero- and postero-internal cingula of the upper molars are stronger and form distinct fossettes, and the anterior lower premolars are apparently more progressive and molariform.

Comparison with *Proheptaconus* is limited by the facts that only M^2 and parts of P^4, M^1, and M^3 are known in that genus (see Bordas, 1936, and, especially, 1939) and that the upper molars are poorly known in *Adiantoides*. *Proheptaconus* is, however, markedly different in the anteroposterior elongation of the known teeth, not transverse as in *Adiantoides*, and the development of strong internal cingulum fossettes. The crowns are probably higher than in *Adiantoides*, and the sculpturing of the labial face of the ectoloph is probably different.

Comparison with *Proadiantus* is made somewhat dubious by possible question as to the relationships of the various specimens referred to that genus. The type, *P. excavatus*, was based on a fragment of right lower jaw with P_{3-4} (Ameghino, 1897) and as

[1] Ameghino's general description of *Tricoelodus* mentions the first and second lower premolars (Ameghino, 1897), but he explicitly specified only a lower jaw fragment with three teeth which were said to be probably P_{2-4} in the text but labeled as P_{3-4} and M_1 (third to fifth molars of Ameghino's terminology) in the accompanying figure. It is possible that they are P_4 and M_{1-2}. Their figured structure is baffling as to affinities, and we are not aware that anyone has cast further light on this problem since Ameghino's original publication more than half a century ago.

far as we know no other specimens explicitly referred to that species have been described or figured. The original description of *P. pungidens* mentioned P_3–M_3 (Ameghino, 1901), and later (Ameghino, 1906) two fairly good specimens were figured, one with I_{1-3}, C, and P_2–M_2, and the other with M_{1-3}. Ameghino's description of M_3 in this species could be taken to imply comparison with *P. excavatus* and hence to indicate the existence of an undescribed M_3 referred to the latter species and with a shorter talonid than that of *P. pungidens*. Patterson (1940) took Ameghino's description to imply such a comparison. The point is important here because it is the larger, more complex talonid of M_3 in *P. pungidens* that most sharply distinguishes it from *Adiantoides*. We believe, however, that Ameghino was comparing M_3 of *P. pungidens* not with the same tooth in *P. excavatus* but with M_{1-2} of *P. pungidens*.

There is, in fact, little reason to doubt that *P. excavatus* and *P. pungidens* are congeneric, as Ameghino thought, and that the talonid development of M_3 as in *P. pungidens* characterizes the genus. Indeed Ameghino's descriptions and figures arouse a strong suspicion that *P. excavatus* and *P. pungidens* represent a single species and that the names are synonymous. As for Ameghino's third species, *P. gibbus*, his description (Ameghino, 1901) evidently implies, although, as usual in his diagnoses, it does not flatly state, that the type included only the anterior part of a lower jaw, without teeth, and an upper incisor. It may be doubted whether such remains were surely identifiable as to genus, and in any case they do not assist or enter into generic comparisons.

Upper cheek teeth of *Proadiantus* have been described only by Patterson (1940). Direct comparison with types or previous specimens was impossible because of the absence of homologous parts. Reference to *Proadiantus* was based on general congruence in size and structure with *P. excavatus* and *P. pungidens* and on the fact that no other adianthine genus was then known to occur in the Deseadan. It now appears that there are (at least) two Deseadan genera and also that it is not absolutely certain that *P. pungidens* is congeneric with the type of *Proadiantus*, *P. excavatus*. Patterson's upper dentition of *P.* sp. indet. and Ameghino's lower jaws of *P. pungidens* are certainly quite different from *Adiantoides* and probably are congeneric with each other. On the latter point, it is significant that Patterson's specimen has a markedly elongate M^3 and that an elongate M_3 is characteristic of *P.*

pungidens. That the genus thus represented is really *Proadiantus* is not at present susceptible of complete and rigid proof, but it is highly probable and must be accepted as a working premise if the taxonomy of the group is to be kept practicable.

If this conception of *Proadiantus* be used for comparative purposes, *Adiantoides* is certainly a distinct genus different from *Prodiantus* in many ways, the more important of which are incorporated in the preceding diagnosis. Differences in the upper teeth are in general similar to those between *Proheptaconus* and *Adiantoides*.

Comparative data are limited, especially as regards the later genera, now less well known than the Deseadan forms. It seems likely, however, that *Proadiantus* has special resemblance and relationships to the more advanced genus *Proheptaconus* and that *Adiantoides* has a similar relationship to the more advanced *Adianthus*. Special resemblance between *Proadiantus* and *Adiantoides* seems to be mainly in primitive characters and that between *Proheptaconus* and *Adianthus* in advanced characters. There seem, then, within the subfamily to be two groups or phyla, as follows:

Age	Phyla	
Santacrucian	Adianthus	
	|	
Colhuehuapian	Adianthus	Proheptaconus
	|	|
Deseadan	Adiantoides	Proadiantus

It is not clear and is somewhat improbable that the relationships within each phylum are exactly ancestral and descendent.

As regards the broader affinities of this group, Ameghino considered it as more or less closely related to the macraucheniids, and this view has not been seriously challenged. The only differences of opinion have been on the relatively unimportant point whether the group should rank as a separate family near the Macraucheniidae or should be placed in the Macraucheniidae. Ameghino (e.g., 1906) followed the former course, Scott (e.g., 1910) and most subsequent students the latter. Bordas (1939) proposed that two subfamilies be recognized in the Macraucheniidae, one for the present group and the other for all the other, typical or unquestioned, macraucheniid genera. Patterson (1940) supported this arrangement.

The present genus tends to bring out differences from, mere

than additional resemblances to, the typical macraucheniids or Macraucheniinae. The fact is that the genera studied by Bordas and by Patterson, *Proheptaconus* and *Proadiantus*, respectively, have the cheek teeth distinctly more similar to those of the Macraucheniinae than do *Adianthus* or *Adiantoides* (the latter, of course, unknown to Bordas or Patterson when they discussed this group). The skull of *Adiantoides*, as described below, seems to lack any definitely macraucheniine specializations. Extraordinarily primitive on the whole, it may also have some divergent specialization of its own, not in a macraucheniine direction.

It may be that the two phyla recognized above are not really closely related but are independent parallel or even convergent groups. In such a case, *Proadiantus* and *Proheptaconus* may represent an early and aberrant macraucheniid offshoot, while *Adiantoides* and *Adianthus* may be better placed in a separate family, a revival and emendation of Ameghino's Adianthidae. It would, however, be premature to jump to this conclusion on the present insufficient evidence. It does still seem more probable that these four genera of pygmy litopterns are related to one another and that they represent an offshoot from the remote macraucheniid ancestry. By Deseadan times, two lines within the group had become rather sharply distinct, and still more sharply distinct from the Macraucheniinae, but while awaiting better knowledge it seems preferable to retain them in a single subfamily, Adianthinae, of Macraucheniidae.

Adiantoides leali,[1] new species

Figures 4, 5

TYPE: Associated skull and jaws, incomplete, as described below.

HYPODIGM: Type only.

HORIZON AND LOCALITY: Deseadan age in the Divisadero Largo formation, 8 kilometers west of the city of Mendoza, Argentina.

DIAGNOSIS: Sole known species of the genus as diagnosed above. Measurements of type as in table 1.

The specimen consists of associated skull and jaws with parts, at least, of all teeth, upper and lower and of both sides. Many of the teeth are, however, severely damaged, particularly the crowns of the upper molars. The lower jaws are nearly complete through

[1] For Adrián Ruiz Leal, who found the first fossils in the Divisadero Largo formation.

M_3, but most of the post-dental part is broken away and lost. The skull is broken through just anterior to the jaw articulation and ear region, and the part posterior to this is lost. The face and anterior part of the cranium are severely crushed and broken, and many bits are lost, but most of the characters of these regions can be made out.

The dental formula is complete, $\frac{3 \cdot 1 \cdot 4 \cdot 3}{3 \cdot 1 \cdot 4 \cdot 3}$, and the tooth series are closed, without distinct diastemata. I $^{2-3}_{3}$, the canines, and P_1 are somewhat openly spaced from their neighbors, but the other teeth are closely crowded.

I^{1-2} are poorly preserved. They are small teeth, and the crown of I^2, at least, is somewhat expanded. I^3 is larger and has a well-developed, expanded crown with a spoon-like anterior flare. The posterior part is worn by contact with the lower canine. The upper canine is larger than I^3 and slightly larger in section and considerably higher than P^1. It is procumbent to about the same extent as I^3, and the crown, poorly preserved, has a similar but less prominent anterior flare.

P^1 is a small, obliquely triangular tooth with length slightly exceeding width. The labial face is rather smoothly rounded, with a weak cingulum. Coronal details cannot be determined. P^2 is similar in outline but with length and width nearly equal and with a prominent postero-internal protocone. The external cingulum is more distinct, and there are small but definite parastyle and metastyle folds. Very weak anterior and posterior cingula are present. P^3 and P^4 are closely similar to each other except for the greater size of the latter. The crowns are irregularly ovoid in plan and are markedly transverse. There is a large, rounded, unusually prominent parastyle fold or pillar on each, and the labial surface of the ectoloph posterior to the parastyle is excavated, with a sharp basal cingulum, terminated by a small metastyle crest. The face above the cingulum is broken and obscure, but no evidence of paracone, mesostyle, or metacone folds is seen. Antero- and postero-internal cingula are present, but they are small, subequal, the posterior cingulum perhaps a trifle larger than the anterior, without hypocone. The only coronal detail visible on the broken teeth is a persistent, median, relatively internal fossette immediately labial to the protocone apex.

M^{1-2}, badly preserved, are apparently similar except for the larger size of M^2. They are obliquely trapezoidal and wider transversely than long anteroposteriorly. There are a prominent

FIG. 4. *Adiantoides leali* Simpson and Minoprio. Type. A. Skull, lacking posterior part of cranium, right lateral view. B. Right lower jaw, lateral view. C. Right lower dentition, crown view. All twice natural size. Drawing by J. C. Germann.

parastyle projection and an external cingulum posterior to this. Other details of the labial wall cannot be determined clearly, but it seems probable that this wall was relatively simple and without pronounced folds other than the parastyle. On the lingual side of M^1 and probably but not surely of M^2 there are a sharp groove, well above the base, and a notch differentiating hypocone and protocone. Immediately labial to this notch is a median fossette. There is a metaloph, and posterior to this, posterolabial to the hypocone, is a cingulum that forms a much shallower fossette. The antero-internal cingulum is very small and forms no fossette or, at most, a shallow and evanescent one. Nothing can clearly be seen as to the pattern of the more labial half of the coronal surface. The crown of M^3 is more triangular and oblique, short anteroposteriorly and strongly transverse. There is a moderate postero-internal cingulum. Other details are lost by breakage.

The lower incisor roots increase slightly in diameter from I_1 to I_3. The crown of I_3 was apparently low and somewhat expanded. The lower canine is larger than I_3 or P_1. The outer face is smoothly rounded, and there is an anterior extension excavated and with basal cingulum on the lingual side.

P_1 is a small, simple, one-rooted tooth with rounded labial face, the anterolingual part slightly excavated, the transversely compressed main cusp followed by a tiny heel. P_2, markedly larger and two-rooted, is incipiently molariform and has well-differentiated trigonid and talonid, separated by a sharp, vertical labial groove. The trigonid is an anteroposterior blade rounded on the outer and excavated on the inner face. The much smaller talonid is feebly excavated lingually. P_3 is intermediate in structure between P_2 and P_4, but with definite molarization and more nearly like P_4. P_4 is fully molariform and differs essentially from M_1 only in having a relatively smaller talonid.

The essential pattern of P_4–M_2 is bicrescentic, lophiodont, with separate cusp tips not evident after moderate wear, at least. The paraconid wing of the anterior crescent is directly transverse and extends nearly as far lingually as the metaconid wing. The metaconid apex is somewhat expanded or crested posteriorly. The entoconid does not form a separate point or crest but is the lingual terminal of the simple talonid crescent. This end of the crescent is slightly swollen, and the entoconid apex may have been more or less distinct when unworn, but it is otherwise incorporated in the crest. Trigonid and talonid have pronounced

median valleys, open on the lingual side and not forming fossettes. Even on M_{1-2} the talonid is slightly shorter and narrower than the trigonid.

On M_3 the trigonid is badly preserved but was probably similar to that of M_1 or M_2. The talonid is elongated so that it is slightly longer than the trigonid, but the talonid is strikingly narrow, the difference from the trigonid in this dimension being greater than for the preceding teeth. The entoconid is relatively more anterior than on M_{1-2}, medial on the lingual side of the talonid, and it has a slightly differentiated apex, but it is almost completely incorporated in the simple talonid loop (rather than crescent) and shows no tendency to form a second crest or to be transversely elongated.

In general aspect and in many of its details the skull is that of a very primitive, almost generalized ungulate, resembling a small condylarth or some of the least progressive early notoungulates. It is almost, but not completely, devoid of any particular litoptern characters. On the whole, the skull is that of an unusually archaic or unprogressive litoptern which has preserved, as late as the Deseadan, many features of the ancestral condylarths. The large, open orbit is median in the skull, the snout gently tapering and neither reduced nor elongated, the cranium relatively small and pyriform.

In strong contrast with more typical litopterns, there is no regression of the nasals or of the external nares. The nasals are long and slender, moderately expanded posteriorly and slightly anteriorly. They retain sutural contact with the premaxillae, and this is relatively long, about 9 mm. The nasals are broken off at the anterior end of this suture, but this is probably near their ends and their free projection must have been short or lacking. They extend at least as far forward as a vertical from the anterior edge of I^3. The premaxilla has a relatively large, flat, ascending facial plate and does not have a distinct palatal process. The maxilla has a long nasal suture and meets the frontal above the lacrimal. The lacrimal outline is not entirely clear, but this bone seems to have a moderate facial exposure. The lacrimal foramen is within the orbital rim. The infraorbital foramen, not well preserved, seems to have been single and above the posterior end of P^3 or anterior part of P^4.

The base of the zygoma, simple and little expanded laterally, is opposite M^3 and the posterior part of M^2. The large jugal ex-

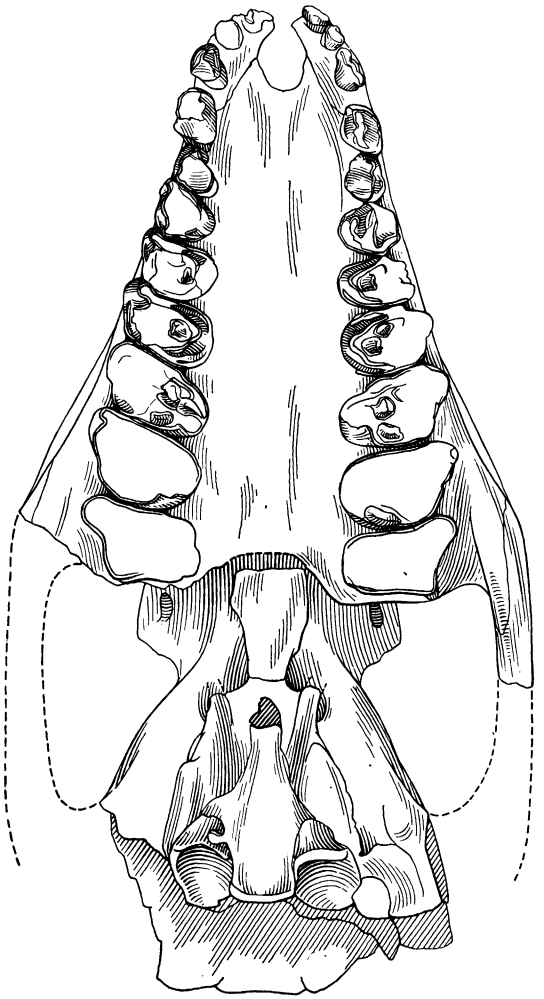

FIG. 5. *Adiantoides leali* Simpson and Minoprio. Type. Skull, lacking posterior part of cranium, ventral view. Twice natural size. Drawing by J. C. Germann.

tends well around the orbital rim and has a small contact with the lacrimal. The zygomatic process of the squamosal is not preserved, but the extent of the preserved parts of the jugal suggest that this process was confined to the posterior part of the zygoma and probably formed no definite postorbital process. The simple, tabular frontal does have a small postorbital process, much less prominent than in *Theosodon*, for example, and without a foramen.

The small cranium is markedly compressed anteriorly. An endocranial cast has not been prepared, but it can be seen that the brain was very unprogressive, with small, pyriform cerebral lobes and relatively large olfactory bulbs serially anterior to the cerebrum.

The choanae are poorly preserved, but apparently the palate was less excavated posteriorly than is usual in litopterns and ended opposite about the middle of M^3. Crests ascending from the pterygoid processes and running laterally towards the ear region are rather more like those of some Santacrucian proterotheres (e.g., *Diadiaphorus*) than macraucheniids (*Theosodon*), doubtless the more primitive litoptern condition.

The specimen as preserved ends posteriorly at the open basisphenoid-basioccipital suture. At each side of the basisphenoid here and mainly above the level of its ventral surface is the hemispherical anterior part of a cavity walled by a bone distinct from the basisphenoid or alisphenoid and perhaps, but not certainly, from the squamosal. This is the most aberrant feature of the known parts of the skull, and it sharpens regret that the ear region is not preserved beyond this puzzling feature. The cavity looks like part of a tympanic bulla, but it is too high and too anteromedial for a normal bulla, and inflated bullae are (otherwise?) unknown in litopterns. Litopterns do have an epitympanic cavity (Simpson, 1933), not homologous with that of the notoungulates, but this lies in the squamosal near the posterior zygomatic base and does not form an exposed swelling or lie next to the basisphenoid as in this specimen. The notoungulate epitympanic cavity is in a totally different position. The cryptic structure of this specimen hints that *Adiantoides* had a peculiar ear region, but speculation as to its precise nature and implications seems futile, and it can only be hoped that further collecting will reveal a complete basicranium of this extraordinary little animal.

The large optic foramen is relatively posteroventral, deep in the orbit. The interorbital wall here, above the basisphenoid

and below the tapering, dorsally situated anterior end of the endocranial cavity, is thin, and the opposite optic foramina are confluent as preserved. This condition could be original but is probably caused by postmortem destruction of a paper-thin bony septum. The foramen lacerum anterius and foramen rotundum are probably confluent (as usual in litopterns). The opening is large and is immediately postero-ventro-lateral to the optic foramen, with the corresponding canals separated by a moderately stout bony wall. A possible, but uncertain, foramen ovale is seen as a rather small, somewhat slit-like opening in the alisphenoid at a point lateral to the anterior end of the sinus mentioned in the last paragraph.

The mandible is rather shallow and stout, the lateral surfaces rounded. The stout, procumbent, fully fused symphysis ends beneath about the middle of P_2. There are a mental foramen beneath P_1 and another, smaller, beneath P_4. On the right side, but not the left, there is another, still smaller foramen beneath the posterior end of P_3.

Measurements of the teeth of the type are given in table 1.

TABLE 1

MEASUREMENTS, IN MILLIMETERS, OF THE TYPE OF *Adiantoides leali*

(All measurements of upper teeth are approximations only)

	I^1–M^3	I_1–M_3	P^{1-4}	M^{1-3}	P^1–M^3	P_{1-4}	M_{1-3}	P_1–M_3
Length	37	39	14	14	27	15.6	16.5	32.3
	P^1	P^2	P^3	P^4	M^1	M^2	M^3	
Length	3	4	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$	$4\frac{1}{2}$	
Width	$2\frac{1}{2}$	4	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	8	$7\frac{1}{2}$	
	P_1	P_2	P_3	P_4	M_1	M_2	M_3	
Length	3.1	4.0	4.4	4.4	5.2	5.4	6.8	
Width	1.9	2.4	2.9	3.7	4.0	4.3	3.8	

Skull measurements of the distorted specimen would be too inaccurate to have much value and are sufficiently suggested by the accompanying figures.

ORDER NOTOUNGULATA

FAMILY **INTERATHERIIDAE**

GEN. ET SP. INDET.

One of us has previously figured a fragmentary lower jaw tentatively identified as *Interatherium* sp. (Minoprio, 1947, fig. 6c and c′). Further study shows that this specimen must be excluded from the genus *Interatherium*, although it probably does belong to the same family. The tooth pattern is so unusual that a new form may be represented, but the material seems to us insufficient for useful definition, and its description is deferred with the hope of finding more adequate specimens.

FAMILY **MESOTHERIIDAE**

Trachytherus mendocensis,[1] new species

Figure 6

TYPE: Four associated upper cheek teeth and fragments of at least three others, as specified below.

HYPODIGM: Type only.

HORIZON AND LOCALITY: Deseadan age, Divisadero Largo formation, about 8 kilometers west of the city of Mendoza, Argentina.

DIAGNOSIS: Much smaller than other known species of this genus. P^{2-3} strongly transverse, obliquely triangular in section, without grooves or ridges on rounded outer face. M^1 trapezoidal in section, almost as wide as long in middle wear stages, outer face smoothly curved, as on premolars, without grooves or ridges. M^2 more angulate at antero-external corner, outer face more as in Patagonian species.

The teeth that represent this species are all loose and in part broken, but they seem to be associated, and they are character-

FIG. 6. *Trachytherus mendocensis* Simpson and Minoprio. Type. Right P^{2-3} and M^{1-2}, crown views. Twice natural size. Drawing by J. C. Germann.

istic. Three teeth of the right side have their extra-alveolar parts complete, although the basal parts are broken. These are

[1] From the locality in the Province of Mendoza and near the city of that name.

identified as P^{2-3} and M^1. These identifications are almost certainly correct, unless the species should prove when better known to represent an allied but distinct genus, and even in that case the placing may be the same. There are also a left P^2 with the extra-alveolar portion complete and two fragments of left M^1. M^2 is represented by the broken inner part from the right side and a smaller fragment of this part as well as an antero-external fragment from the left side.

The wear stage is near that of Ameghino's figured specimen of *T. spegazzinianus* (Ameghino, 1889, pl. 79, fig. 1, and fig. 7 of the present paper), with coronal pattern obliterated from P^{1-2}, M^1 with the characteristic Y-shaped infolding of the inner wall, and M^2 with the median lobe reaching the inner side and openly exposed there. The general characters are those of *Trachytherus*, and there can be little doubt that a close relationship exists. It is, of course, impossible to discount the chance that complete dentitions or skulls might reveal more important differences.

The Patagonian species is, or are, so variable that the apparent, rather slight morphological differences noted in the diagnosis or

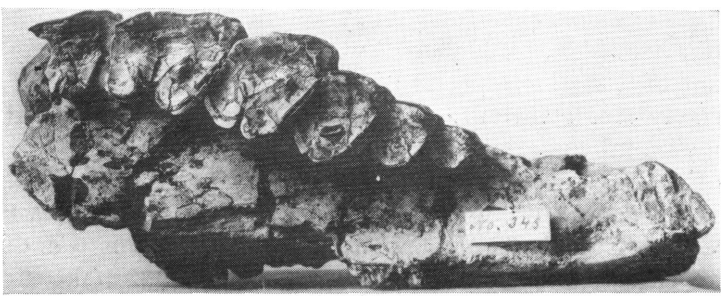

FIG. 7. *Trachytherus spegazzinianus* Ameghino. Right P^2–M^3, crown view. For comparison with *T. mendocensis*, figure 6. About two-thirds natural size. Photograph by W. B. Scott.

visible in the figure are of doubtful taxonomic value. The difference in size is, however, sufficient in itself to validate the species, pending better establishment of the other diagnostic differences that doubtless do exist.

Ameghino defined two species from the Deseadan of Patagonia (probably both from Cabeza Blanca): *Trachytherus spegazzinianus* Ameghino, 1889, and *T. conturbatus* Ameghino, 1891.

Loomis proposed another from Cabeza Blanca: "*Eutrachytherus*"[1] *grandis* Loomis, 1914. Characteristic measurements of M^1 in these three species, given by their authors, and the same measurements for *T. mendocensis*, type, are as follows:

	LENGTH	WIDTH
T. grandis	29 mm.	21 mm.
T. spegazzinianus	19	23
	20	21
T. conturbatus	17	9[2]
T. mendocensis	9.1	8.3

Patterson (1934) has pointed out that the dimensions and other characters of the teeth in this genus are highly variable, both among different individuals and in different wear stages of teeth of the same individual. He concluded that the three proposed Patagonian species are probably synonymous. If this is correct (and there is no serious reason to doubt it), the size difference of *T. mendocensis* is even more surely of specific value. If the described Patagonian specimens are all of one species, "*T. conturbatus*" is an extremely small variant of that species, and the Mendoza fossil, so much smaller still, cannot belong in the same group. The only possibility of synonymy for the Mendoza fossil would arise if "*T. conturbatus*" were based on an extremely large variant of a distinct species of which the Mendoza animal is an extremely small variant. That possibility is so remote that it cannot be taken seriously.

Roth (1898) proposed a species "*Eutrachytherus modestus*" (cited by Ameghino, 1899, as "*E. modicus*," by a *lapsus*) from the Collon Curá beds of northern Patagonia. This was defined as half the size of *T. spegazzinianus*, which would make it about the size of *T. mendocensis*. As far as we know, Roth's specimen has never been figured, and his description is not detailed or entirely clear. It is, however, practically certain that his species does not belong in *Trachytherus*. The Collon Curá beds are at least as late as the Santacrucian and may be even a little later.

[1] *Eutrachytherus* was proposed by Ameghino in substitution for *Trachytherus*, supposedly preoccupied. Under the present Rules of Nomenclature the original name is valid.

[2] This figure is so extraordinarily small in comparison with the length that it may be a misprint. On the other hand, the type may be a very young tooth and the measurements those of the tapering top of the crown. Ameghino did comment that this dimension might increase with age. The tooth has not been figured.

The occurrence in them of a typically Deseadan mesothere is incredible. Roth's description could apply equally well to some later genus of Mesotheriidae ("Typotheriidae" of authors), or perhaps even to a member of some other family. There is no reasonable possibility that the Mendoza fossil belongs in his species, in spite of the similarity in size.

FAMILY **HEGETOTHERIIDAE**

Prohegetotherium carettei Minoprio, 1947

This species was based on an excellent skull and lower jaws previously described and figured (Minoprio, 1947, pp. 371–374, figs. 3–5). Drawings and photographs are here reproduced from the earlier publication (figs. 8–9). The much less well-

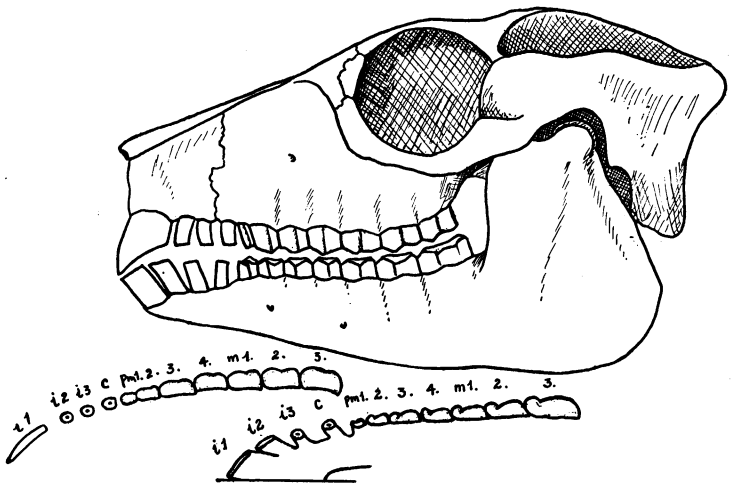

FIG. 8. *Prohegetotherium carettei* Minoprio. Type. Reconstruction of skull and jaws, left lateral view, and of upper and lower dentitions, crown views. Natural size. Drawing by Minoprio.

known genotype, *Prohegetotherium sculptum* Ameghino, differs most obviously in having the external sulcus of the upper molars distinctly more anterior in position. *P. shumwayi* Loomis is still more distinct in this respect and also has the antero-external angle of these teeth decidedly more acute and produced than in either *P. sculptum* or *P. carettei*.

Prohegetotherium carettei reveals a number of generic distinctions from *Hegetotherium* not known in *P. sculptum* or *P. shumwayi*.

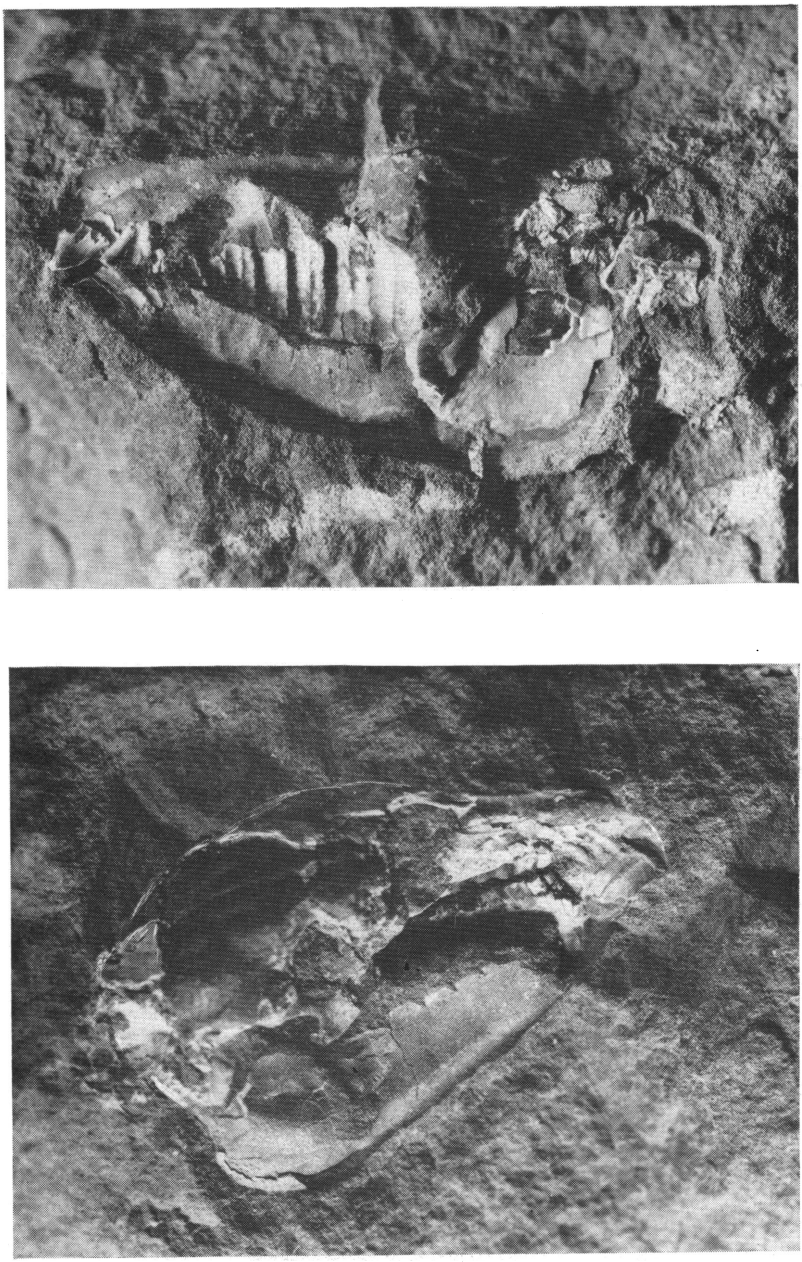

FIG. 9. *Prohegetotherium carettei* Minoprio. Type. Split slabs containing skull and jaws. Natural size. Photograph by Minoprio.

The most striking of these is the fact that *P. carettei* has P_1^1–P_2^2 in a closed and morphologically evenly progressive series, whereas *Hegetotherium* has P_1^1 and P_2^2 separated from each other and from the following teeth by small diastemata and sharply smaller in size and simpler in cross section than P_3^3.

? NOTOUNGULATA

GEN. ET SP. INDET.

Among hitherto undescribed materials there is a symphysis with all the incisors, both canines and first premolars and right P_2, most of these teeth somewhat broken. The specimen merits some mention, even though it is not identified at present. At first sight it resembles *Adiantoides*, but close comparison reveals differences that may accompany widely different systematic positions. The symphysis in the present specimen is more robust and extends as far as the posterior part of P_3. The lower canine is nearly like that of *Adiantoides*. The first premolar is relatively smaller than in *Adiantoides*. The second premolar shows a similar degree of molarization, but the crown is higher, and the tooth is more procumbent. The external groove differentiating trigonid and talonid slopes more distinctly forward as it rises. Such a tooth is somewhat more suggestive of a primitive notoungulate than of an adianthine, but the evidence is too slight for a positive conclusion. The animal was slightly larger than *Adiantoides leali*. The specimen is clearly distinct from *Allalmeia*, in which, as shown in Rusconi's sketch, P_2 is a tiny and completely simple tooth with no molarization whatever (see Rusconi, 1946). P_3 of *Allalmeia* may more nearly resemble P_2 of this specimen.

ORDER UNCERTAIN

GEN. ET SP. INDET.

Last among the hitherto unpublished specimens to be mentioned here are fragments of one individual of what seems to be a new and very strange animal. We consider these scraps insufficient basis for definition, but their occurrence is worthy of mention if only to stimulate further search for specimens of this fauna, which evidently contains many novelties.

A lower incisor is small and simple, not bilobed as in usual astrapotheres. The lower canine is enlarged, but less so than in astrapotheres, and it has a closed root and a crown of moderate

height, somewhat recurved, convex on the outer face and excavated on the edges of the inner face, rather like an enlarged notoungulate canine. No lower cheek tooth is completely preserved, but the better of two fragmentary teeth from this region seems to consist of a simple anteroposterior blade, laterally compressed, rising to a single median apex, followed by a low heel. This seemed to be in the position of a molar, but no animal with a molar like this is known to us. Interpretation as a premolar is morphologically less extraordinary, but still provides no close comparison among previously known forms.

An upper molar, probably M^3, preserves the apical pattern (fig. 10B). This at once excludes reference to the Borhyaenidae,

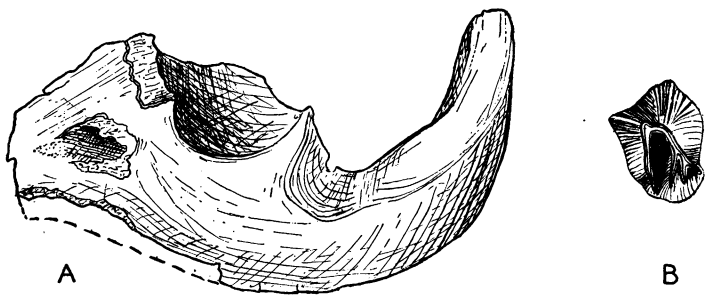

FIG. 10. Gen. et sp. indet. A. Fragment of skull with lower rim of orbit and part of zygoma, left lateral view. One-half natural size. B. Left M^3, crown view. Natural size. Drawing by Minoprio.

which might seem remotely possible on the basis of the very imperfect knowledge of the lower teeth. Reference to a small astrapothere of new and unusual type would be a possibility, and we were at first inclined to this view, but it is also possible that the pattern might be a modification of that seen in M^3 of some of the primitive toxodonts. (Cf. *Proadinotherium*, although reference to that genus cannot be supported.)

The only other characteristic fragment includes the lower border of the orbit and part of the zygoma (fig. 10A) which curves upward strongly and suggests a short, high cranium. This, too, is not well matched in comparative materials available to us, but is in some respects suggestive of both the astrapotheres and the toxodonts.

AGE OF THE DIVISADERO LARGO FORMATION

Before the discovery of fossils in these beds, they were sometimes confused with the older (probably Rhaetic) underlying beds, sometimes considered as belonging later in the Mesozoic and sometimes placed in various parts of the Tertiary. Chiotti's (unpublished) thesis definitely established their age as Tertiary and suggested that they belong rather in the Eogene than the Neogene. His fossils were submitted to Cabrera, and Chiotti cites Cabrera (personal communication) as stating that these fossils are early Eocene. This may indicate that Cabrera tentatively identified some of these fossils as Casamayoran. In view of our findings (below) this would almost certainly indicate the presence of two distinct faunal horizons and would raise serious difficulties because Chiotti's fossils were not apparently lower in the sequence than ours. Cabrera has not, however, made explicit identifications or published this material, and reference to the early Eocene, in indirect quotation from him, may therefore be taken as subject to correction.

Rusconi (1946a, 1946b, 1946c) called the beds "Atalaense." Although this was the first published separate designation for the mammal-bearing horizon, it was subsequent to Chiotti's better-documented designation of them in his unpublished but publicly available thesis as the Divisadero Largo formation. The term "Atalaense" is also unacceptable because it necessarily implies as type locality the Atala Mine, which is not on or in this Tertiary formation but a half kilometer from it at the nearest point and in the Cacheuta strata of late Triassic age. Rusconi gave the age as Oligocene, perhaps Deseadan. *Allalmeia*, the only mammal involved in Rusconi's notes, was compared mainly with long pre-Deseadan Casamayoran fossils.

In a previous paper on this fauna, one of us (Minoprio, 1947), with better fossil evidence than was directly available to previous students, concluded that the Divisadero Largo may provisionally be placed in the Deseadan. Our present study confirms this and seems to put it beyond serious doubt as an approximate correlation at least. An age slightly earlier or later than the typical Deseadan of Patagonia cannot, of course, be excluded when dealing with a few elements of what is clearly a faunal facies distinct from those previously known for this part of the column. All the positively identified species are new. The positively identified genera are as follows:

Adiantoides; genus unknown elsewhere, but more primitive than Colhuehuapian *Adianthus* or *Proheptaconus* and analogous in evolutionary advance to its Deseadan ally *Proadiantus*
Trachytherus; genus confined to the Deseadan as far as known
Prohegetotherium; genus confined to the Deseadan as far as known

Scanty as they are, these data warrant reference to the Deseadan and prohibit the establishment of a new provincial age or stage on the basis of present knowledge.

Rusconi has named a mammal, *Allalmeia atalaensis*, a bird, *Cunampia simplex*, and a reptile, *Ilchunia parca*, from these beds. These do not at present add to the evidence as to age.

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