THE DESEADAN VERTEBRATE FAUNA OF THE SCARRITT POCKET, PATAGONIA

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INTRODUCTION

DISCOVERY OF THE SCARRITT POCKET

THE DISCOVERY OF THE Scarritt Pocket in central Chubut, Argentina, by Dr. George Gaylord Simpson during the Scarritt expedition of 1933–1934 makes one of the classic stories of vertebrate paleontological field work. An account of the discovery has already been published by Simpson (1941a), but a résumé should be included here as a prelude to the account of the faunules found there.

From a scrap of bone petrified in a peculiar way and seen in the hands of an itinerant sheep herder in 1931, Simpson learned of the existence of a new bone locality. Unfortunately the sheep herder did not know where the bone came from and could only wave his hand vaguely in the direction of the interior. Also the field season was so far advanced that it was impractical to follow up the clue immediately.

However, two years later, in 1933, the search was started. In Trelew, another fragment of the same type came to light. This fragment came from a man named Espinel who lived up river in the interior and who, the story went, had a much larger piece. When finally located, Espinel said that his piece had been given to him by a *pasiandero*, one of the homeless ones. After much prodding, Espinel remembered that the wanderer had mentioned "the Turk" and "Canquel" in connection with the bone.

Further search led deeper into the interior, where trucks had never been before, and where a mountain range loomed up instead of the valley shown on the map. There the "Turco Terrible" lived at his "Casa Canquel" and here the trail seemed to end, for the Turk, a real Ottoman complete with water pipe, knew nothing of the bone.

However, luck, which seemed to guide the search more than once, stepped in. Another *pasiandero*, a hunter, who happened to be there at the time, said that he knew of lots of petrified bones; they came from Viper Canyon on the other side of the mountain range which, incidentally, was the real Canquel.

Since there was no pass across the Mesita Canquel from "Casa Conquel" to Viper Canyon, this meant a long trip around the north end of the range and south along the other side.

There were bones at Viper Canyon but not the right ones. Luck stepped in again. The father-in-law of the Indian sheep herder with whom the party stayed while prospecting in Viper Canyon knew of some bones in a great *rinconada* farther south.

The Rinconada de los Lopez, named from an abandoned ranch near by, was found to be an embayment in the side of the *meseta*. Three sides were formed by steep, lava-capped walls, and it was floored by tilted lava blocks and exposures of tuff and bentonite. Bone was present, but it was disappointing in that there were only a few scraps of Casamayoran forms.

After several days of prospecting the party was again on the verge of abandoning the search. There was, however, one small part of the Rinconada left unprospected. This was a rimmed basin just under the southwestern wall of the *rinconada*. When the searchers looked over the edge of this basin they knew their quest was at an end. The floor was literally paved with bone of the type that had set off the long hunt. The spot was named the Scarritt Pocket in honor of the benefactor of the expedition, and it yielded the material to be dealt with in this paper.

PREVIOUS WORK ON THE FAUNA

Since the return of the expedition the press of other work has kept Simpson from publishing anything more than a short generic and specific description of *Scarrittia* (1934b). The purpose of this present paper is to give an account of the skeletal parts, which were essentially unknown in the family, and the interesting allied faunules that aid in the correlation of the beds. In 1949 Schaeffer described the anuran remains and A. E. Wood (1949) discussed the rodents.

ACKNOWLEDGMENTS

The profound thanks of the author are extended, first, to Dr. G. G. Simpson for

GEOLOGY OF THE SCARRITT POCKET[1]

ROCKS

THE SCARRITT POCKET is a small embayment in the southwestern part of a larger embayment, the Rinconada de los Lopez, cut into the west side of the Sierra Canquel. The Pocket extends along the barranca for approximately one-third of a mile. The sides of the Pocket are formed by an arc of volcanic intrusives that emerges from the main escarpment of the *meseta* and partially encloses the Pocket. Within the Pocket the rocks consist of poorly assorted breccias with lava

The origin of the intrusive walls is not clear, although they were undoubtedly formed in connection with some volcanic action. It is sufficient for the present study to state that at the time of the death of the specimens found in the Pocket (see faunule list below) there was a basin surrounded by the intrusive walls and enclosing a small lake or pond. The material outside the intrusive walls was at a level with the top. Before, during, and subsequent to this time, pyroclastic material from other near-by centers of volcanic activity
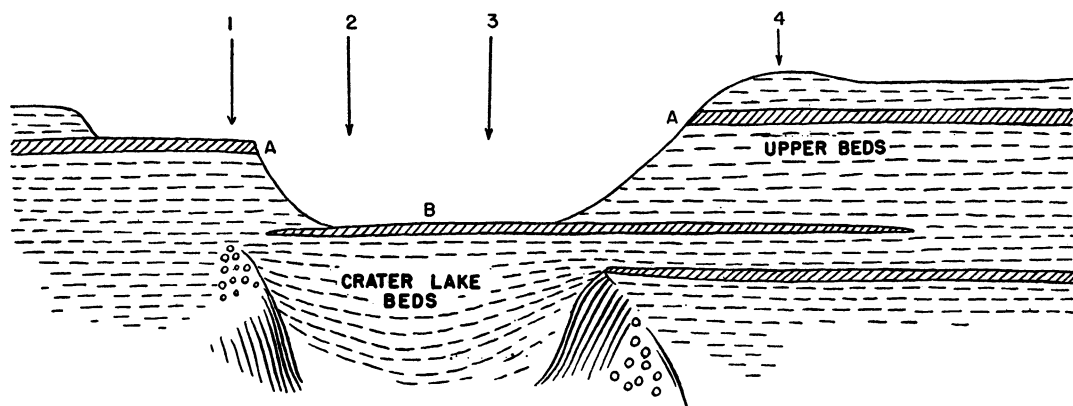
FIG. 1. Sketch of the wall of the Rinconada de los Lopez showing relationship of the Scarritt Pocket to the neighboring beds. A and B are lava flows Alpha and Beta; 1 to 4 indicate position of cross sections in figure 2. (After Simpson, unpublished field notes.) Approximate scale: 1/1300.

blocks, scoria and baked tuffs, thick-bedded tuffs and bentonites, thin beds of coarse sandstone, and finely laminated bentonite. Scattered throughout are erratic pebbles and small boulders of lava. As the beds approach the intrusive walls they grade into coarse breccia. The walls had been cut by dikes that were subsequently eroded out and filled with breccia.

The rocks of the main escarpment, outside the walls of the Pocket, consist of irregularly bedded tuffs and lava flows. In the lower part of the section the beds end abruptly at the intrusive walls, but above the walls they are continuous over the crater. One lava flow, on the west side, seems to terminate at and pass into the west intrusive wall.

slowly filled the cavity of the crater with ash and tuff while erosion brought material down from the intrusive walls to form the breccia near their base. At the same time the surrounding surface was being built up, but the deposition was faster within the crater owing to wind-drifted ash. After the crater was filled, lava flows, such as Beta (see figs. 1, 2) and other ash beds were laid down across the top of the crater.

FAUNULES

The horizon and locality for all the specimens discussed in this paper are as follows: Sarmientan group, Deseadan stage, lower Oligocene, in or near the Scarritt Pocket, southwest portion of Rinconada de los Lopez, west side of Sierra Canquel, central Chubut, Argentina.

[1] Based on Simpson's field notes. A fuller account by Simpson is in preparation.
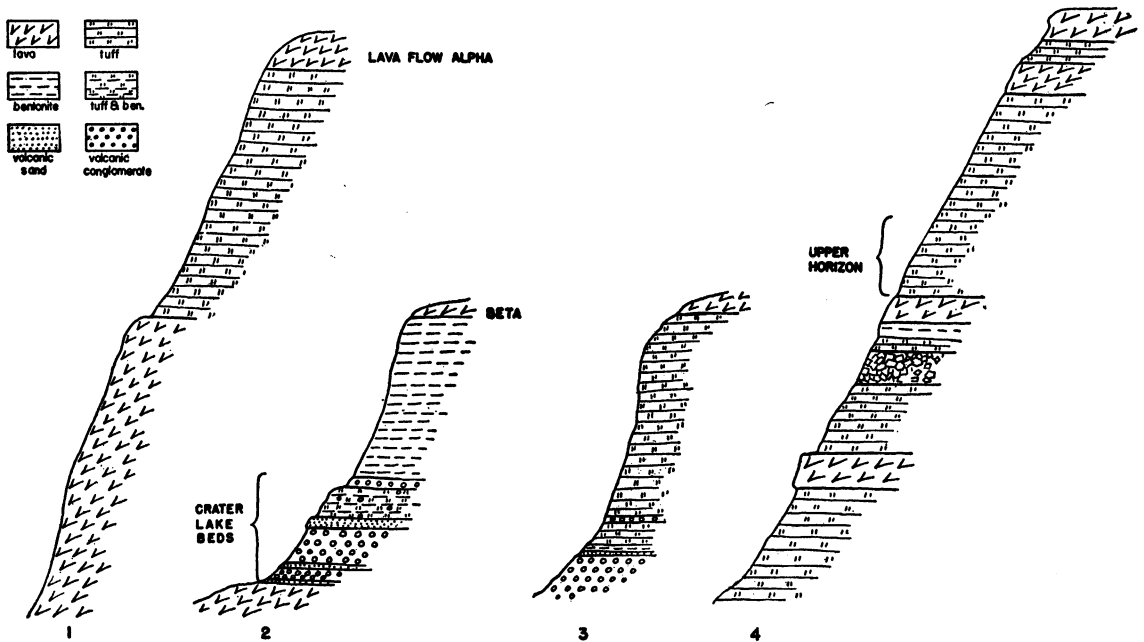
FIG. 2. Cross sections through the wall of Rinconada de los Lopez and Scarritt Pocket. See figure 1 for locations. (After Simpson, unpublished field notes.) Approximate vertical scale: 1/1500.

There are four faunules in the area. The first and most productive faunule in number of specimens is contained in the Crater Lake beds of the Scarritt Pocket proper, enclosed within the intrusive walls. The greatest proportion of the specimens came from this horizon. The faunule list includes:

Amphibia
  Anura
    Calyptocephalella canqueli Schaeffer
    Eupsophus sp.
    Neoprocoela edentatus Schaeffer
Mammalia
  Marsupialia
    Proborhyaena gigantia Ameghino
  Edentata
    Peltephilus sp.
    Palaeopeltis cf. inornatus Ameghino
  Rodentia
    Platypittamys brachyodon Wood
  Notoungulata
    Rhynchippus pumilus Ameghino
    Scarrittia canquelensis Simpson
    Cf. Leontiniidae indet.

Another faunule of one specimen came from a breccia-filled dike near the top of the intrusive walls and is probably contemporaneous with the Crater Lake faunule:

Marsupialia
  Cf. Pharsophorus sp.

To the east and west of the Scarritt Pocket, along the southern escarpment of the Rinconada de los Lopez, the lava flow Beta, which overlies the Crater Lake beds, is, in turn, overlain by a nodular tuff. From these upper beds on the west side of the Pocket came another faunule, as follows:

Notoungulata
  Archaeohyrax cf. propheticus Ameghino
  Cf. Proadinotherium sp.
  Progaleopithecus tournoueri Ameghino
  Plagiarthrus clivus (Ameghino)
  Trachytherus sp.
  Propachyrucos simpsoni Chaffee
  Prosotherium garzoni Ameghino
  Rhynchippus cf. equinus Ameghino
Astrapotheria
  Cf. Parastrapotherium sp.

A fourth faunule of one specimen from the same nodular tuffs as the preceding, but at a higher level and to the east of the Pocket, is as follows:

Notoungulata
  Prohegetotherium sculptum Ameghino

The species in the faunules (except, of

course, those confined to this locality) are found elsewhere in Patagonia only in the Deseadan. The known vertical ranges of the genera include the Deseadan. Half of them have been reported only from this stage as can be seen in the following list[1]:

Proborhyaena	Deseadan, Colhuehuapian
Pharsophorus	Mustersan, Deseadan
Peltephilus	Deseadan, Santacruzian
Paleopeltis	Mustersan, Colhuehuapian
Archaeohyrax	?Mustersan, Deseadan
Rhynchippus	Deseadan
Proadinotherium	Deseadan, Colhuehuapian
Progaleopithecus	Deseadan
Plagiarthrus	Deseadan
Trachytherus	Deseadan
Prohegetotherium	Deseadan

[1] *Scarrittia, Platypittamys,* and the frogs are not included because of the lack of material from other localities. The ranges given are after Simpson, 1945b.

Propachyrucos	Deseadan
Prosotherium	Deseadan
Parastrapotherium	Deseadan, Coluehuapian

The absence of *Pyrotherium* and any of the Litopterna is unfortunate, but the rest of the fauna clearly shows the Deseadan affinities of the beds. Whether the beds are exactly equivalent to the type Deseado or are earlier or later is hard to determine (see discussion of the Deseadan below). Wood (1949) feels that the rodent, *Platypittamys,* is primitive and that the Crater Lake beds, therefore, are earliest Deseadan. Whether *Scarrittia* is contemporaneous with *Leotinia* or not is impossible to determine without more knowledge of their ancestors. More exact correlations of these beds must wait, therefore, until faunal lists of the typical Deseado exposures are published.

THE LOCATIONS of the specimens discussed in this and the following sections are abbreviated as follows:

A.M.N.H., the American Museum of Natural History

U.S.N.M., United States National Museum, Washington, D. C.

C.N.H.M., Chicago Natural History Museum, Chicago, Illinois

Amherst, Department of Geology, Amherst College, Amherst, Massachusetts

In the tables throughout, the measurements are in millimeters and the following abbreviations are used:

AW, width of anterior lobe
D, depth, dorsoventral dimension
L, length, anterior-posterior dimension
PW, width of posterior lobe
W, width, transverse dimension
WD, width, distal
WP, width, proximal

AMPHIBIA

ORDER SALIENTIA LAURENTI[1]

FAMILY LEPTODACTYLIDAE STRAND

CALYPTOCEPHALELLA STRAND

Calyptocephalus DUMÉRIL AND BIBRON, 1841, Erpétologie général, vol. 8, p. 450.

Calyptocephalella STRAND, 1926, Arch. Naturgesch., div. A, vol. 92, no. 8, p. 55 (new name for *Calyptocephalus* Duméril and Bibron, 1841, preoccupied).

GENOTYPE: *Calyptocephalus gayi* Duméril and Bibron.

Calyptocephalella canqueli Schaeffer

Calyptocephalella canqueli SCHAEFFER, 1949, p. 50.

The type specimen (A.M.N.H. No. 3429) came from the quarry level of the Lake beds in the Pocket. It consists of a partial skeleton including a crushed skull, right half of the pectoral girdle, right fore limb, and the first three vertebrae. Also there are isolated vertebrae and limb fragments probably belonging to the same individual. There

[1] The anuran specimens from the Scarritt Pocket have been completely and adequately described by Schaeffer (1949). A résumé of his descriptions and conclusions is included here only for completeness of the faunule list.

are, in addition, two referred specimens from the same locality: A.M.N.H. No. 3400, dissociated lower jaw and limb fragments; A.M.N.H. No. 3427, a partial skeleton showing coccyx, pelvis, and hind limbs.

In discussing the species Schaeffer compares it to the recent species of the same genus, *C. gayi*. He found (1949, p. 54) that "adults of *C. canqueli* retained some subadult skull characters" of *C. gayi*.

EUPSOPHUS FITZINGER

Cystignathus DUMÉRIL AND BIBRON (in part), 1841, Erpétologie général, vol. 8, p. 392.

Borborocoetes BELL, 1843, The zoology of the voyage of H.M.S. Beagle, pt. 5, Reptiles, p. 34.

Eupsophus FITZINGER, 1843, Systema reptilium, p. 31. (For discussion of generic synonymy, see Parker, 1932, Ann. Mag. Nat. Hist., ser. 10, vol. 10, p. 342.)

Eupsophus sp.

Four specimens from the quarry level of the Lake beds in the Scarritt Pocket that Schaeffer (1949) has referred to this genus are:

A.M.N.H. No. 2407, complete skeleton, skull badly crushed

A.M.N.H. No. 3415, pelvis and hind appendages of a small individual

A.M.N.H. No. 3420, skull fragments and hind appendages

A.M.N.H. No. 3422, crushed skull, left forearm and vertebral column

NEOPROCOELA SCHAEFFER

Neoprocoela Schaeffer, 1949, p. 57.

GENOTYPE: *Neoprocoela edentatus* Schaeffer.

Neoprocoela edentatus Schaeffer

Neoprocoela edentatus SCHAEFFER, 1949, p. 57.

The type of this genus and species (A.M.N.H. No. 3428) came from the quarry level of the Lake beds of the Scarritt Pocket. It consists of a partial skeleton including skull, vertebral column, and proximal portions of left forearm. Schaeffer (1949, p. 58) points out that it "is a true but primitive leptodactylid with an edentulous upper jaw as its principal specialized divergence." On the other hand, he suggests (1949, p. 62) that because of its dilated sacral diapophyses and edentulous maxillary it might belong to the Atelopodidae.

MAMMALIA
Order MARSUPIALIA Illiger
Suborder POLYPROTODONTIA Owen
Family BORHYAENIDAE Ameghino
PROBORHYAENA Ameghino

Proborhyaena Ameghino, 1897b, p. 501.

GENOTYPE: *Proborhyaena gigantea* Ameghino.

Proborhyaena gigantea Ameghino

Plate 13

Proborhyaena gigantea Ameghino, 1897b, p. 501.

The specimen (A.M.N.H. No. 29576) consists of the right mandible, with complete dentition except for the incisors, broken immediately anterior to the angle, from the quarry level of the Lake beds in the Pocket. The teeth are broken but not worn. The canine is large. The premolars become increasingly larger from P_1 to P_3 and are all single-cusped, double-rooted teeth. M_1 is smaller than P_3 and is distinctly molariform. The molars increase in size from M_1 to M_4. The talonid is reduced to a single cusp, which is progressively reduced from M_1 to M_4, where it is a low vestige on the side of the protoconid. The protoconid and the paraconid both increase in size from M_1 to M_4 though the paraconid is larger, relative to the protoconid, in M_1 than in M_4. The metaconid is entirely absent, as noted by Riggs and Patterson (1939, p. 149) in a Colhuehuapian representative of the genus.

Unfortunately the type of *P. gigantea* lacks M_{2-4}, and M_1 is so worn that it is impossible to determine the condition of the talonid and metaconid. However, the present specimen can be referred to the species without reservations because of the extreme size of the canine and the robustness of the mandible.

Cabrera (1927, p. 273) attempted to group the borhyaenid genera into subfamilies on the basis of the presence or absence of the metaconid and the size of the talonid. His subfamily Proborhyaeninae is characterized by the presence of a small but distinct metaconid and his Borhyaeninae by the lack of a metaconid and the widening and antero-

posterior compressing of the talonid. According to that classification the present specimen, definitely *Proborhyaena*, would, on the basis of the absent metaconid, be in the subfamily Borhyaeninae.

Riggs and Patterson (1939, p. 149) point out that Cabrera's grouping would not fit a natural classification. Simpson (1948, p. 41) says that this type of classification is horizontal and that "the ancestral Borhyaeninae had surely been successively Proborhyaeninae and Cladosictinae of Cabrera." The present specimen shows that the genus *Proborhyaena*, certainly not ancestral to *Borhyaena*, also went through the later stages of Cladosictinae and Borhyaeninae of Cabrera.

TABLE 1

Proborhyaena gigantea (A.M.N.H. No. 29576)

	L	W
C	27.8	18.9
P_1	20.0	9.8
P_2	17.8	10.8
P_3	22.2	13.3
M_1	19.6	11.0
M_2	22.0	14.3
M_3	27.8	17.0
M_4	39.1	18.2

PHARSOPHORUS Ameghino

Pharsophorus Ameghino, 1897b, p. 502.

GENOTYPE: *Pharsophorus lacerans* Ameghino.

Cf. Pharsophorus sp.

This specimen (A.M.N.H. No. 29591) came from the beds outside the Pocket at a higher topographic level than the Lake beds but was probably contemporaneous with the Lake beds faunule. It consists of a badly crushed skull lacking the basicranial region. The only teeth preserved are the right and left canines, first premolars, and the second left premolar.

The generic identification is difficult owing to the lack of cheek teeth. On the basis of size alone it can be tentatively placed in the genus *Pharsophorus*. However, the specimen does show a few noteworthy points.

The lacrimal foramen is located just inside the anterior border of the orbit. Sinclair (1906) suggests that this foramen shifted

progressively in the carnivorous marsupials from a position well within the orbital border to outside the border.

The canines are of only moderate size and are very little worn. They show no expansion at the base. The anterior and posterior edges of each canine are enclosed in cement coming well down towards the tip and leaving a band of enamel exposed on the labial and lingual sides. Ameghino's figure of the lower jaw of *Pharsophorus* (1906, p. 349, fig. 183) shows quite a large canine. It may be that this specimen is from a young individual and that the canines are just erupting.

The nasals have been faulted apart to expose the depth of the bone. They are extremely thick and heavy, being about 4 to 5 mm. in thickness.

The infraorbital foramen is single, as opposed to the double condition reported by Sinclair (1930) in the Colhuehuapian form, *Borhyaena riggsi*. This specimen also shows a single pit in the palate, questionably placed between M^2 and M^3, as indicated by the alveoli.

TABLE 2

Cf. *Pharsophorus* (A.M.N.H. No. 29591)

		L	W
Nasals			
	R	85.9	31.7
	L	88.0	31.8
C			
	R	13.4	8.8
	L	12.3	7.8
P^1			
	R	7.5	3.7
	L	7.9	4.1
P^2			
	R	—	—
	L	14.2	6.9

ORDER **EDENTATA** CUVIER

SUBORDER **XENARTHRA** COPE

FAMILY **PELTEPHILIDAE** AMEGHINO

PELTEPHILUS AMEGHINO

Peltephilus AMEGHINO, 1887, p. 25.

GENOTYPE: *Peltephilus strepans* Ameghino.

Peltephilus sp.

Two scutes (A.M.N.H. No. 29263) from the Crater Lake beds are identifiable as this genus. One is from the immovable part of the carapace and measures 17.8 mm. long, 24 mm. wide, and 5.9 mm. thick. The external surface has, in addition to many small vascular openings, three large pits near the outer edge. The portion of overlap is small and rough as are the other edges.

The other scute is not so clearly identifiable with the genus. It is about twice the size of the scute described above but is broken and has no definable ornamentation other than rather large vascular openings. It is possibly one of the lateral cephalic scutes.

FAMILY **GLYPTODONTIDAE** BURMEISTER

PALAEOPELTIS AMEGHINO

Palaeopeltis AMEGHINO, 1895, p. 659.

GENOTYPE: *Palaeopeltis inornatus* Ameghino.

Palaeopeltis cf. inornatus Ameghino

Palaeopeltis inornatus AMEGHINO, 1895, p. 659.

One scute and two scute fragments (A.M.N.H. No. 29617) from the Crater Lake beds are referable to this species. They are 14 to 15 mm. thick and the unbroken scute is 46 by 53 mm. in the other dimensions. Other than the vascular perforations on the external surface there is no ornamentation.

ORDER **RODENTIA** BOWDICH[1]

SUBORDER **HYSTRICOMORPHA** BRANDT

FAMILY **ACAREMYIDAE** WOOD

PLATYPITTAMYS WOOD, 1949

Platypittamys WOOD, 1949, p. 6.

GENOTYPE: *Platypittamys brachyodon* Wood.

Platypittamys brachyodon Wood

Platypittamys brachyodon WOOD, 1949, p. 6, figs. 3A, B, D; 4A, B; 5; 6A, B, C.

TYPE: A.M.N.H. No. 29600, a partial skeleton with skull and jaws.

REFERRED SPECIMENS: A.M.N.H. No. 29601, a partial skeleton without skull.

HORIZON: Crater Lake beds.

A condensation of Wood's description of the genus is as follows: a small, ground-

[1] The rodent specimens from the Scarritt Pocket have been most adequately covered by A. E. Wood (1949). A résumé is included here only for completeness of the faunule list.

living, New World hystricomorph, showing cursorial tendencies, with low-crowned cheek teeth of subequal transverse lophs on both upper and lower molars and non-molariform premolars. "The masseter had not yet begun to pass through the infraorbital foramen" (Wood, 1949, p. 6).

The genus, although the most primitive known South American rodent, does not seem to be directly ancestral to the other members of the family because of the structure of the limbs. However, the dentition shows that it is close to the ancestral stock of the later hystricomorphs with cursorial adaptations (Chinchilloidea, Cavioidea, and the South American Octodontoidea).

The absence of the mesoloph and the mesolophid together with the structure of the premolars in *Platypittamys* would suggest that the theridomyids were ancestral to the South American hystricomorphs. It is impossible to derive *Platypittamys* from any known paramyid or sciuravid because of the structure of upper and lower fourth premolar. However, other similarities seem to suggest that the ancestor of *Platypittamys* and the other South American hystricomorphs, when discovered, will be a member of either the Paramyidae or the Sciuravidae.

ORDER **NOTOUNGULATA** ROTH

SUBORDER **TOXODONTA** SCOTT

FAMILY **ARCHAEOHYRACIDAE** AMEGHINO

ARCHAEOHYRAX AMEGHINO

Archaeohyrax AMEGHINO, 1897b, p. 431.

GENOTYPE: *Archaeohyrax patagonicus* Ameghino.

Archaeohyrax cf. propheticus Ameghino

Archaeohyrax propheticus AMEGHINO, 1897b, p. 435.

REFERRED SPECIMENS: A.M.N.H. No. 29609, unassociated upper and lower teeth; A.M.N.H. No. 29610, associated immature dentition; right P^2-M^2, left P^2-M^2, right lower canine (broken), right P_{1-4}, one loose incisor; A.M.N.H. No. 29611, immature dentition, P^2-M^3.

The adult teeth compare favorably in size with those of both *A. patagonicus* and *A. propheticus*. However, the former species lacks the first lower premolar. The present

specimens are referred to the latter species on the basis of the one lower first premolar (A.M.N.H. No. 29610). Future study of these two species may show that the presence of P_1 is due to individual variation or is dependent upon age.

FAMILY **LEONTINIIDAE** AMEGHINO

SCARRITTIA SIMPSON

Scarrittia SIMPSON, 1934b, p. 2.

GENOTYPE: *Scarrittia canquelensis* Simpson.

DIAGNOSIS: Very close to *Leontinia* but with I^1 enlarged, caniniform, and I^2 small. Lower incisors more procumbent than in *Leontinia* and no lingual grooves on the protocones of P^{2-4} as there are in *Leontinia*.

Scarrittia canquelensis Simpson

Plates 6–12; text figures 5–7

Scarritia canquelensis SIMPSON, 1934b, p. 2.

TYPE SPECIMEN: "A specimen not collected and now unidentifiable" (Simpson, 1934b, p. 2).

HYPODIGM: The following specimens:

A.M.N.H. No. 29571, skeleton (pl. 8)
A.M.N.H. No. 29577, skeleton
A.M.N.H. No. 29578, skeleton
A.M.N.H. No. 29580, skeleton
A.M.N.H. No. 29581, skeleton (pl. 10)
U.S.N.M. No. 13879, skeleton (pl. 7)
A.M.N.H. No. 29567, jaw fragments
A.M.N.H. No. 29568, lower M_{2-3}
A.M.N.H. No. 29569, associated M_{2-3}
A.M.N.H. No. 29582, manus
A.M.N.H. No. 29583, skull, jaws, cervical and dorsal vertebrae, and associated fragments
A.M.N.H. No. 29584, skull, jaws, atlas, and axis
A.M.N.H. No. 29585, partial skeleton, lacking skull and jaws (pls. 11, 12)
A.M.N.H. No. 29586, partial lower jaw, RP_3-M_2
A.M.N.H. No 29588, skull fragments
A.M.N.H. No. 29592, lower right P_4-M_3
A.M.N.H. No. 29593, upper dentition, LP^4-M^3
A.M.N.H. No. 29594, upper dentition, RI^1-M^3, LP^{1-4}
A.M.N.H. No. 29595, fragments of auditory region and axis
A.M.N.H. No. 29598, carpus and tarsus, possibly associated
A.M.N.H. No. 29599, associated fragments of upper and lower dentition
A.M.N.H. No. 29612, right lower jaw, symphysis and part of left (pl. 9, figs. 4, 5)

A.M.N.H. No. 29613, palate with complete dentition (pl. 9, fig. 2)

A.M.N.H. No. 29614, palate and auditory region (fig. 6)

A.M.N.H. No. 29615, unassociated upper dentitions (pl. 9, fig. 1)

A.M.N.H. No. 29616, miscellaneous upper and lower teeth, and foot bones (pl. 9, fig. 3)

A.M.N.H. No. 29624, miscellaneous teeth and foot bones

A.M.N.H. No. 29625, upper dentition, P^4–M^3

A.M.N.H. No. 29626, associated tarsus

A.M.N.H. No. 29627, lower P_2–M_2

A.M.N.H. No. 29628, lower P_4–M_3

A.M.N.H. No. 29629, upper dentition, LI^1–M^3

A.M.N.H. No. 29630, miscellaneous teeth

HORIZON: Crater Lake beds.

DIAGNOSIS: Sole known species of the genus as defined above.

The morphology of *Scarrittia* is discussed below.

Cf. LEONTINIIDAE INDET.

A.M.N.H. No. 29607 from the Crater Lake beds consists of a right upper dentition, P^2–M^2; right lower dention, P_2–M_2; and left lower dentition, M_{1-3}. The teeth are low crowned and small, about one-quarter of the size of those of *Scarrittia*. The second upper premolar appears to be single cusped, with a distinct external cingulum curving downward at the anterior and posterior ends. The third premolar is larger, and the

external cingulum is less distinct. The fourth premolar is square in crown shape and has a central fossa, with at least two small cristae. It has a small, slightly crenulated, internal cingulum. There is an indication of a vertical ridge on the lingual side of the protocone.

The first molar is more elongated anteroposteriorly than P^4. The anterior labial corner is broken, so there is no evidence of the presence or absence of a pillar at this point. The ectoloph and the protoloph are large. The metaloph is short and, with the hypoloph, encloses a posterior fossette. The median valley opens internally well back of the center of the lingual face. There is a small internal cingulum on the anterior lingual corner and no external cingulum.

The crown of M^2 is shattered and broken, but enough remains to show that it has the same pattern as M^1 though not so worn. There is an indication of a pillar at the anterior labial corner.

The right P_{2-3} show the lower premolar pattern. The labial face, rising to a single cusp, has two low ridges divided by a groove, deeper on P_3 than on P_2, running from the external cingulum to the crown. The posterior ridge terminates at the cusp and the anterior one on the forward slope of the cusp. The external cingulum is curved as it is in the upper premolars.
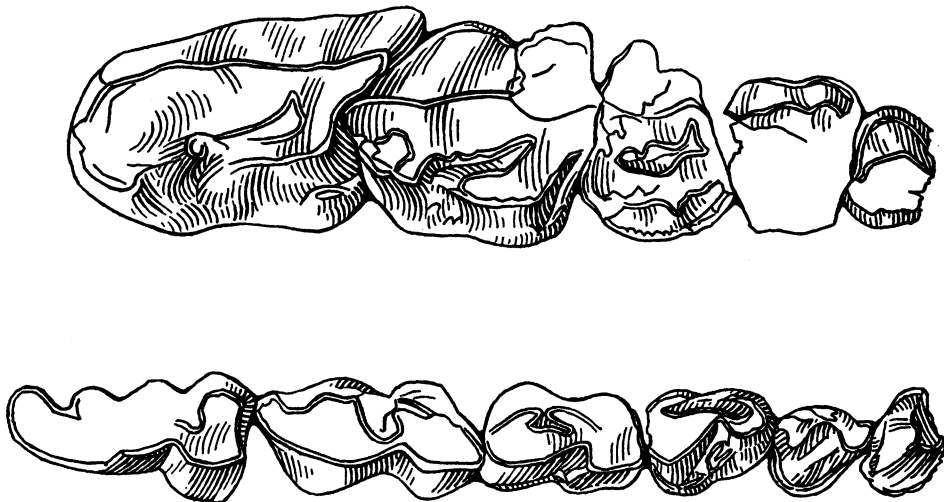

FIG. 3. Cf. Leontiniidae indet., A.M.N.H. No. 29607. Crown view of upper right P^2–M^2 (above) and composite crown view of lower right P_{2-4} and left M_{1-3} as mirror image (below). ×1.5.

TABLE 3

LEONTINIIDAE INDET. (A.M.N.H. No. 29607)

	L	W
Upper dentition		
P^2	—	10.7
P^3	—	—
P^4	—	—
M^1	22.2	18.2
M^2	30.8	18.5
Lower dentition		
RP$_2$	7.3	9.5
LP$_2$	—	—
RP$_3$	8.1	8.4
LP$_3$	—	—
RP$_4$	10.0	9.4
LP$_4$	—	—
RM$_1$	—	9.9
LM$_1$	13.2	9.5
RM$_2$	18.7	—
LM$_2$	19.3	9.8
RM$_3$	—	—
LM$_3$	21.8	9.5

The fourth lower premolar is broken but has indications of the ridges mentioned above, and there is an external cingulum present.

The molars of the right side are fragmental. On the left, M$_{1-2}$ show the basic notoungulate pattern of a small trigonid and a large talonid. However, the hypolophid is less than half of the length of the whole talonid.

The specimen is referred to the Leontiniidae on the basis of the large protoloph, the single posterior fossette, the short hypolophid, and the small internal cingula on the molars. However, without knowledge of whether any of the incisors are enlarged into caniniform teeth or the canine is reduced, it is impossible to eliminate the specimen from the Isotemnidae. Generally the isotemnids have heavier cingula, but the teeth of many of the genera referred to that family by Ameghino are imperfectly known.

The specimen might possibly be referred to the genus *Henricofilolia* which was described by Ameghino (1901, p. 404) on the basis of a single M^1. In all he described six species, five of which were based on isolated upper molars and one on an M^1 and an M$_3$. In general the upper teeth are low crowned and have well-developed internal cingula

that tend to be crenulated. The upper molars of the present specimen are brachydont but the internal cingula are small.

FAMILY **NOTOHIPPIDAE** AMEGHINO

RHYNCHIPPUS AMEGHINO

Rhynchippus AMEGHINO, 1897b, p. 462.

GENOTYPE: *Rhynchippus equinus* Ameghino.

Rhynchippus pumilus Ameghino

Plate 14

Rhynchippus pumilus AMEGHINO, 1897b, p. 464.

One specimen (A.M.N.H. No. 29579) of this genus was found in the Lake beds of Scarritt Pocket in close association with the *Scarrittia* remains. It consists of a badly crushed partial skeleton. The dentition is complete except for the upper right incisors.

The crushing was so complete that little can be done with the various bones, beyond identification, except in the tarsi. Both right and left tarsal elements are preserved virtually uncrushed. Previous descriptions of the *Rhynchippus* tarsus are quite inadequate, so a detailed description of the present specimen is in order.

In general aspect it is comparable to a very primitive artiodactyl. If found dissociated from the teeth it would be difficult to distinguish from the typotheres and hegetotheres (Sinclair, 1909). Described in the terms used for the northern ungulates the tarsus of *Rhynchippus* is serial and the foot is paraxonic.

The astragalus has a distinct head and neck set at a 30-degree angle to the axis of the bone. It has a distinct crest on the shallow trochlea, with the external crest higher than the internal, as in *Hegetotherium* (Sinclair, *op. cit.*). There is no astragalar foramen. The astragalo-calcaneal facet is dumb-bell shaped (as in typotheres and hegetotheres) and faces laterally. The sustentacular facet is separated from the preceding by a small but deep interarticular sulcus. The facet is slightly smaller in area than the astragalo-calcaneal facet, oval in shape, with the long axis parallel to that of the whole bone. There is no distal astragalar facet for further articulation with the calcaneum. There is no articu-

lation with the cuboid. The navicular facet is strongly convex.

The calcaneum is very typothere-like in having a rather large facet for the cuboid and in the medial projection of the sustentacular facet. The fibular facet is well rounded and prominent. The sustentacular facet is rather small and faces dorsally and medially. The astragalo-calcaneal facet is larger and faces medially. The cuboid facet is large and concave and is placed on a long neck. Medially, there is a small facet for the navicular. There is no peroneal tubercle.

The navicular is wider than long, with a pointed plantar projection. The astragalar facet is cup shaped, with a distinct rim. Laterally there are a small facet for the calcaneum and a slightly larger one for the cuboid. Distally the facet for the ectocuneiform occupies two-thirds of the surface and narrows ventrally. The mesocuneiform facet is smaller and saddle shaped. The navicular-ectocuneiform articulation is on a level with the calcaneal-cuboid articulation because of the long neck on the calcaneum.

The cuboid, in this case, lives up to its name in shape. The calcaneal facet is convex transversely and occupies nearly the whole proximal surface. On the proximal end of the medial side is the facet for the navicular. Distally there is a slightly concave facet for the fourth metatarsal. On the plantar surface there is a large tubercle that overhangs a rather transverse peroneal groove.

The ectocuneiform is longer than wide and thins ventrally. Laterally there is no distinct facet for the cuboid, although the two were in contact. Medially there are facets for the mesocuneiform and the second metatarsal. The great proximo-distal dimension offsets the length of the calcaneal neck and brings the articulation of metatarsal III even with the articulation of the cuboid and metatarsal IV.

The mesocuneiform is a small bone, with facets for the navicular, the ectocuneiform, and the second metatarsal.

Only the right third and left fourth metatarsals are represented by proximal ends. Neither one shows any extended plantar projection. The presence of metatarsal II is indicated by the mesocuneiform. On the lateral side of metatarsal IV there is

a small facet that suggests the presence of a small fifth metatarsal.

As can be seen by the dissociation of the astragalus from the cuboid the transverse tarsal joint (Schaeffer, 1947) does not occur between the astragalus and calcaneum on the one side and the navicular and cuboid on the other, as it does in the artiodactyls and perissodactyls. Rather, the distal end of the navicular is opposite to the calcaneal-cuboid articulation. (See below for comparison to other Toxodonta.)

TABLE 4

Rhynchippus pumilus (A.M.N.H. No. 29579)

	L	W
Upper dentition		
P^1	5.3	6.2
P^2	6.8	7.5
P^3	—	—
P^4	9.3	9.8
M^1	12.4	9.5
M^2	14.8	9.5
M^3	14.8	9.0
Lower dentition		
I$_2$	3.9	2.8
I$_3$	4.4	3.5
C	5.6	3.5
P$_1$	5.2	—
P$_2$	5.4	4.5
P$_3$	6.4	5.0
P$_4$	—	4.4
M$_1$	9.8	5.6
M$_2$	12.2	5.4
M$_3$	16.8	5.0

Cf. **Rhynchippus** sp.

One fragment of a right premaxilla containing I$^{1-3}$ (A.M.N.H. No. 29618) from the upper beds to the west of the Pocket is referable to this genus. The teeth are twice the size of those of the *R. pumilus* specimen and may be referable to *R. equinus* Ameghino (1897b, p. 463).

FAMILY **TOXODONTIDAE** GERVAIS

PROADINOTHERIUM AMEGHINO

Proadinotherium AMEGHINO, 1895, p. 625.

GENOTYPE: *Proadinotherium leptognathus* Ameghino.

Cf. **Proadinotherium** sp.

Three teeth (A.M.N.H. No. 29621), upper

right second molar and left first molar and one lower molar, came from the upper beds near the Pocket. The teeth are unassociated and broken. They are possibly referable to the genus *Proadinotherium*.

SUBORDER **TYPOTHERIA** ZITTEL

FAMILY **INTERTHERIIDAE** AMEGHINO

PROGALEOPITHECUS AMEGHINO

Progaleopithecus AMEGHINO, 1904, p. 171.

GENOTYPE: *Progaleopithecus tournoueri* Ameghino.

Progaleopithecus tournoueri Ameghino

Plate 15

Progaleopithecus tournoueri AMEGHINO, 1904, p. 171.

This specimen (A.M.N.H. No. 29603). from the upper beds near the Pocket consists of a poorly preserved skull with right M^{1-3} and left M^{2-3} and a lower jaw consisting of the symphysis and both rami, broken behind M_3. The lower dentition lacks the left P_4 and right I_3–P_2, being thus completely represented on one side or the other.

The interatheriid affinities are unmistakable in the small, closely set incisors. The specimen agrees very closely with Ameghino's description of *P. tournoueri* and with Patterson's redescription of the type (1940). The type[1] consists of the symphysis and a part of the left ramus bearing I_1–P_2.

Patterson (1940, p. 24) believed that these teeth were deciduous because of the close resemblance to the milk dentition of *Protypotherium* sp. figured by Sinclair (1909, pl. 5, figs. 13, 14) and because of the rapidly tapering crowns and roots. The teeth of the present specimen are not deciduous, and Patterson has stated (personal communication) that, on the basis of X-rays taken of the type and obtained subsequent to the publication of his account, he now believes that the type dentition is not deciduous and that the rapidly tapering roots could also be found on permanent teeth.

The teeth of the present specimen are more worn than those of the type but still exhibit comparable characters. The first and second

lower incisors are divided into typical interatheriid double columns.[2] The third incisor, canine, and first two premolars are in continuous series, with no diastema and show like structure with increasing complexity. The third incisor "is convex externally and concave internally" (Patterson, 1940, p. 21). The canine shows an increase in size over the third incisor and has a slight posterior heel. Both teeth have prominent internal grooves which, in I_3, isolate a small cusp but, in the canine, the tooth is worn down below the probable base of the cusp so that only one groove is apparent.

The first premolar is longer than the canine, the increase being mostly in the larger heel. Again it has an internal groove but here it is more recumbent.

The second premolar is double rooted, is longer, and has a larger heel than P_1.

The preceding teeth have been adequately described from the type by Patterson (1940). The remainder of the cheek teeth, lacking in the type, are radically different. Premolar three is distinctly molariform in being bilobed. The anterior lobe is large, in fact larger than the lobes of any tooth following it. It is rounded anteriorly, where it overlaps P_2, and widens posteriorly. It is divided from the posterior lobe, which is small and triangular in shape, by internal and external grooves. It differs distinctly from the third premolar of *Archaeophylus*, which is narrow, with little indication of the double triangle.

The remaining teeth, P_4–M_2, are all bilobed, with the anterior and posterior lobes equal in size. Each lobe is triangular in shape, with the apex pointing anteriorly. M_3 is trilobed, with the third lobe as a smaller rounded addition on an otherwise normal molar.

The upper teeth are represented by M^1–M^3. They have a slight similarity to those of *Cochilius volvens* (Simpson, 1932c). On all three teeth the two lobes are of nearly equal size, though the anterior one may be slightly larger. There is a deep groove on the anterioexternal corner of each tooth. This groove makes an infold of enamel that forms a buttress for the high external cusp of the anterior lobe.

The skull is too badly crushed to reveal

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[1] In the Collection Tournouër of the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris.

[2] This was the basis for Ameghino's unfortunate generic name.

TABLE 5

Progaleopithecus tournoueri
(A.M.N.H. No. 29603)

	L	W
Upper dentition[a]		
RM$^{1-3}$	16.1	
RM^1	5.1	4.2
LM^1	—	—
RM^2	4.8	4.1
LM^2	4.7	4.1
RM^3	3.9	3.4
LM^3	3.8	3.5
Lower dentition[b]		
RI$_1$	1.0	2.2
LI$_1$	1.0	2.2
RI$_2$	1.3	1.9
LI$_2$	1.2	1.7
RI$_3$	—	—
LI$_3$	3.5	2.3
RC	—	—
LC	3.3	2.7
RP$_1$	—	—
LP$_1$	4.7	2.8
RP$_2$	5.9	2.4
LP$_2$	5.5	2.5
RP$_3$	4.6	2.8
LP$_3$	5.0	2.8
RP$_4$	4.9	2.9
LP$_4$	—	—
RM$_1$	4.4	3.2
LM$_1$	—	—
RM$_2$	4.9	3.2
LM$_2$	5.1	3.1

[a] Palatal width at M^2, 20.3 mm.
[b] Depth of right ramus below M$_2$, 12.8 mm.

much of its structure. There is a fairly prominent postorbital process, and the zygomatic arch is stout. Enough remains of the auditory region to show the inflated bullae and epitympanic sinuses. The latter resemble the condition found in *Plagiarthrus* but are so much inflated that the occipital crest is masked by them.

Patterson (1940, p. 24) suggests that *Progaleopithecus* might be synonymous with some other interatheriid genus. However, the present specimen shows the dentition to be adult and distinct from the other typothere genera, and the hope of eliminating the poor generic name must be abandoned. It differs markedly from *Archaeophylus* as noted above for the lower molars. In the upper

molars a comparison with photographs[1] of *Archaeophylus* shows that the Scarritt Pocket specimen differs in the comparative size of the lobes. In *Archaeophylus* the anterior lobe is short, while the posterior one is elongated internally. In *Progaleopithecus*, as stated above, the lobes are of nearly equal size.

The lower teeth differ from Ameghino's description of *Archaeophylus* (1897b, p. 423). In *Archaeophylus* the second and third lower premolars are bilobed on the lingual side and trilobed on the labial side. This condition is reversed in *Progaleopithecus*. Also, in *Archaeophylus*, the anterior lobe on P$_4$ is larger than the posterior while in *Progaleopithecus* this is true on P$_3$ and the lobes on P$_4$ are approximately equal.

Progaleopithecus is easily distinguished from *Cochilius* in that the lower incisors of the former are bilobed both labially and lingually while only lingually on the latter. The anterior lobe of the lower molars is equal to the posterior and on P$_3$ is definitely larger in *Progaleopithecus*, while in *Cochilius* it is decidedly smaller.

PLAGIARTHRUS Ameghino

Clorinda Ameghino, 1895, p. 624 (*nec Clorinda* Barrande, 1879).
Plagiarthrus Ameghino, 1897, p. 436 (to replace *Clorinda*, preoccupied); 1913–1936, vol. 21, pp. 584–585.

Genotype: *Clorinda cliva* Ameghino.

Plagiarthrus clivus (Ameghino)

Plate 16, figure 1

Clorinda cliva Ameghino, 1895, p. 624.
Plagiarthrus clivus, Ameghino, 1897a, p. 7; 1897b, p. 436; 1913–1936, vol. 21, pp. 584–585.

The specimen (A.M.N.H. No. 29606) from the upper beds near the Pocket is a very fragmentary lower dentition containing right M$_{1-3}$, broken P$_4$, and left P$_{2-4}$ broken. The inside of the symphyseal area, as preserved in a natural mold, is narrow and forward sloping and indicates the interatheriid character of the specimen.

Among interatheriids the comparative size of the lobes of P$_4$ is generally diagnostic.

[1] Kindly sent by Dr. Eduardo del Ponte of the Museo Argentino de Ciencias Naturales, Buenos Aires, and presumably of Ameghino's type.

In *Cochilius* the anterior lobe is smaller, with approximately one-half of the crown area of the posterior. *Protypotherium* is at the other extreme, with the anterior lobe the larger of the two. *Plagiarthrus* is intermediate but tending towards *Cochilius*.

The present specimen agrees with the above diagnosis of *Plagiarthrus*. The fourth premolar on each side is broken, but on the left there is enough of the tooth to indicate the comparative size of the lobes. The anterior lobe is only slightly smaller than the posterior.

The specific identification is based on negative rather than on positive evidence. The specimen does not disagree with the type of the species as figured by Simpson (1932c, p. 7, fig. 6). However, the species of *Argyrohyrax*, which Simpson (1932c, p. 6; 1945b, p. 129) made synonymous with *Plagiarthrus*, were described by Ameghino from upper dentitions, and it is entirely possible that the present specimen belongs to one of these.

TABLE 6

Plagiarthrus clivus (A.M.N.H. No. 29606)

	L	W
RP$_4$	—	3.9
RM$_1$	6.4	4.1
RM$_2$	5.9	3.9
RM$_3$	8.0	3.6

FAMILY **MESOTHERIIDAE** ALSTON

TRACHYTHERUS AMEGHINO

Trachytherus AMEGHINO, 1889, p. 918.

GENOTYPE: *Trachytherus spegazzinianus* Ameghino.

Cf. **Trachytherus** sp.

One upper right molar, ?M^2 (A.M.N.H. No. 29622), is referable to this genus. It approaches *T. grandis* Loomis (1914, p. 82) in the small size of the secondary crista and the large size of the mesoloph and protoloph. It differs from *T. grandis* in the greater length of the internal valley and in the presence of a small crista at the anterior end of the valley. In the other species, *T. spegazzinianus* and *T. conturbatus*, the mesoloph and protoloph do not meet on

the internal face, and the secondary crista is large.

SUBORDER **HEGETOTHERIA** SIMPSON

FAMILY **HEGETOTHERIIDAE** AMEGHINO

PROHEGETOTHERIUM AMEGHINO

Prohegetotherium AMEGHINO, 1897b, p. 424.

GENOTYPE: *Prohegetotherium sculptum* Ameghino.

Prohegetotherium sculptum Ameghino

Plate 16, figures 2, 3

Prohegetotherium sculptum AMEGHINO, 1897b, p. 424.

The specimen (A.M.N.H. No. 29605) from the upper beds near the Scarritt Pocket consists of both sides of a lower jaw, with complete dentition. The incisors are smaller than those in other hegetotheres but are broad and spatulate as in the rest of the family. The first incisor, only slightly larger than I$_2$ and I$_3$, is pitched forward, with the crown set obliquely. The canine is again slightly smaller than the preceding tooth and is not so forward slanting. There is no diastema, and P$_1$ is larger than the canine, about the same size as I$_3$, but is not so recumbent. The crown is not set obliquely, but the anterior edge tends to overlap the canine on the inside. The second premolar, having only a very narrow anterior lobe, is not completely molariform. The remaining cheek teeth, except M$_3$, are very much alike in having large, triangular-shaped, posterior lobes with smaller rounded anterior lobes. In M$_3$ the anterior lobe is much like the lobes just described, but the posterior lobe is longer and narrower, and indentations on the lingual and labial surfaces nearly delineate a third lobe.

The genus was described by Ameghino from upper teeth as being similar to *Hegetotherium* but having an external furrow on the anterior margin of the cheek teeth and a canine larger than in *Hegetotherium*. The lower cheek teeth, P$_4$–M$_3$, of *Hegetotherium* as described by Sinclair (1909, p. 18, pl. 1, fig. 5) resemble those of the present specimen very closely. The third premolar is smaller than that of the present specimen, but they both have the two-lobed molariform pattern. The second premolar of the present

specimen has a small anterior lobe, while that of *Hegetotherium* does not. The third incisor, canine, and first premolar of the present specimen are larger than those of *Hegetotherium*, and I_{1-2} are smaller.

The present specimen is referred to *Prohegetotherium* because of the resemblance to *Hegetotherium* in P_4-M_3 and because the canine is larger than that of *Hegetotherium* as it was described by Ameghino in the upper dentition.

The specimen is referred to *P. sculptum* on the basis of size, since *P. shumwayi* Loomis (1914) is too small. It differs from *P. carettei* Minoprio (1947, p. 371) from the Deseadan of Mendoza in having a closed dental series, a deeper symphysis, a narrower I_1, a wider I_2, and larger I_3-P_4.

TABLE 7

Prohegetotherium sculptum
(A.M.N.H. No. 29605)

	L	W	AW	PW
I_1-M_3	55.1			
P_2-M_3	38.2			
I_1	—	3.6		
I_2	—	3.3		
I_3	—	3.2		
C	—	2.6		
P_1	3.4	2.0		
P_2	6.0		1.9	3.0
P_3	6.8		2.9	3.6
P_4	6.6		3.1	3.9
M_1	6.8		3.1	4.0
M_2	6.6		3.0	4.0
M_3	8.7		3.0	3.3

PROPACHYRUCOS Ameghino

Propachyrucos Ameghino, 1897b, p. 425.

GENOTYPE: *Propachyrucos smithwoodwardi* Ameghino.

Propachyrucos simpsoni, new species[1]

Plate 17, figures 1, 2

TYPE: A.M.N.H. No. 29604, right and left lower jaws, broken behind M_3, with right and left I_{1-2},, P_2-M_3, and alveoli for I_3, C, and P_1.

HORIZON AND TYPE LOCALITY: Sarmientan group, Deseadan stage, lower Oligocene, upper beds, near Scarritt Pocket, southwest

[1] Named for Dr. George Gaylord Simpson.

portion of Rinconada de los Lopez, west side of Sierra Canquel, central Chubut, Argentina.

SPECIFIC DIAGNOSIS: Of the same size as *Propachyrucos ameghinorum* Simpson (1945a) and slightly smaller than *Prosotherium garzoni* Ameghino (1897b, p. 426). Anterior lobes on P_{3-4} larger in crown area than posterior lobes. Anterior lobes on M_{1-2} equal, or barely subequal, in crown area, to the posterior lobes. The third incisor, canine, and first premolar reduced.

DESCRIPTION: *Propachyrucos simpsoni* differs from *P. ameghinorum*, which was found "a few kilometers" from the above locality (Simpson, 1945a, p. 551), in being more robust, in having M_{2-3} straighter on the

TABLE 8

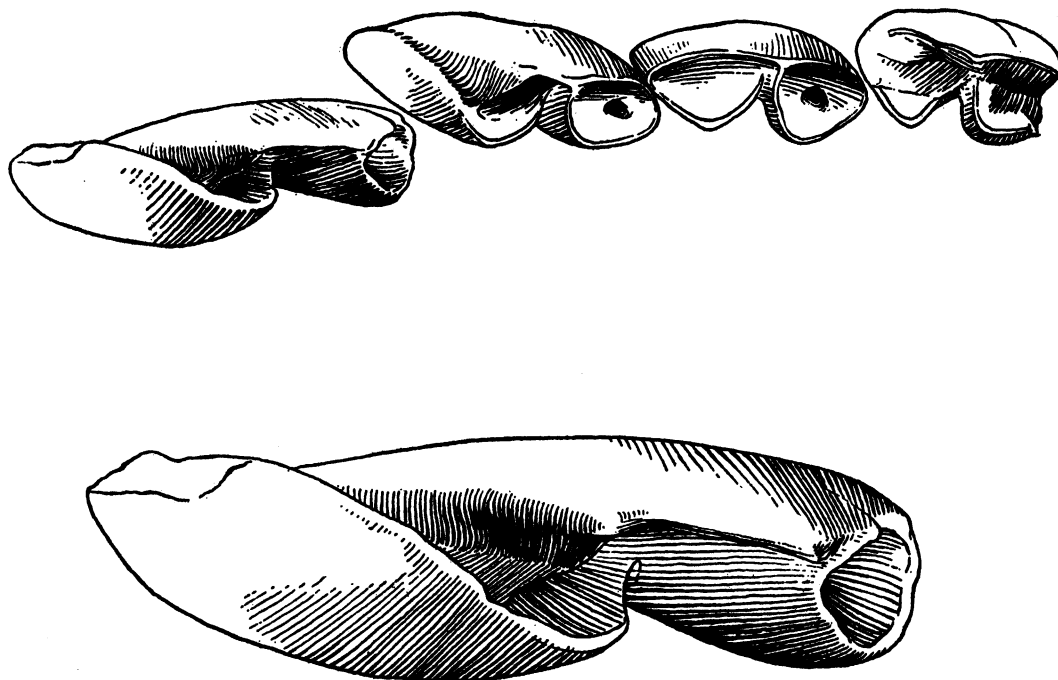|	*Propachyrucos simpsoni* A.M.N.H. No. 29604	*Propachyrucos ameghinorum*[a] A.M.N.H. No. 29574
I_1-M_3	53.0	53.1
P_2-M_3	32.1	30.9
M_1-M_3	18.7	17.8
I_1		
W	5.2	5.1
I_2		
W	2.8	2.7
P_2		
L	4.8	5.0
AW	2.2	2.2
PW	2.5	2.5
P_3		
L	4.9	4.9
AW	2.7	2.5
PW	2.6	2.6
P_4		
L	4.9	4.9
AW	3.1	2.5
PW	3.1	2.6
M_1		
L	5.7	5.4
AW	2.9	2.3
PW	3.3	2.9
M_2		
L	6.0	5.5
AW	2.9	2.4
PW	3.3	2.8
M_3		
L	7.6	7.5
AW	3.0	2.3
PW	2.8	2.5

[a] Measurements after Simpson (1945a, p. 553).

FIG. 4. *Propachyrucos* cf. *simpsoni* Chaffee, A.M.N.H. No. 29620. Immature dentition. Crown view. Right dM₂₋₄ and M₁ (above). ×7. Right M₁ (below). ×14.

lingual side, and in having the anterior lobes of P_{3-4} larger than the posterior lobes. It differs from *P. smithwoodwardi* Ameghino (1897b, p. 425), the type of the genus, in the reduction of the canine and first premolar. The former is also the larger (*P. simpsoni*, I_1–M_3, 53 mm.; and *P. smithwoodwardi*, 41 mm., Ameghino, *loc. cit.*). *P. crassus* Ameghino (1897b, p. 425) is a doubtful species based, apparently, only on P_{2-3} and was described as being quite large. *P. aequilatus* Ameghino (1901, p. 371) was based on an unfigured fragment of lower jaw, with P_4–M_3, and was described as having the anterior and posterior lobes of equal size. The measurement of 24 mm. given by Ameghino for the length of M_{1-3} of that species shows that it is larger than *P. simpsoni* (M_{1-3}, 18.7 mm.).

REFERRED SPECIMEN: An immature jaw (A.M.N.H. No. 29620) from the same locality and beds is referred to this species. It consists of both rami, containing right and left I_{1-2}, P_1, DM_{2-4}, and right M_1. The deciduous teeth have the same basic pattern as M_1, and the anterior and posterior lobes are approximately equal in size. Sinclair (1909, p. 18) says that in *Protypotherium* (A.M.N.H.

No. 9482) from the Santacruzian "the milk-premolars may be readily recognized by the presence of roots." His figure of the upper dentition (*op. cit.*, pl. 5, fig. 12) shows the rooted condition of DM^{2-4}. An inspection of the lower jaw of the same specimen shows that the same condition is true in DM_{2-4}. The deciduous teeth of this specimen (A.M.N.H. No. 29620) are not rooted. They are very deep, going to the full depth of the ramus, with no sign of permanent teeth below them. Since the specimen that Sinclair described is of an older individual (M_3 had just erupted) than the present specimen, it may be that the deciduous teeth formed roots after the buds of the permanent teeth appeared.

The two permanent cheek teeth, P_1 and M_1, have just erupted and show the unworn structure. On M_1 the metaconid, the highest cusp in the crown, and the entoconid form the entolophid. The labial wall of the anterior lobe is formed by the protoconid, only slightly lower than the metaconid, and the paraconid, the lowest of all the cusps. The labial wall of the posterior lobe is formed by the hypoconid and the hypoconulid, the

former slightly larger than the latter. A groove opens between the hypoconulid and the entoconid. The structure of P_1 is the same as that of M_1, but the anterior lobe of the former is shorter than that of the latter.

The effects of wear on this basic pattern are illustrated by the deciduous teeth. The protoconid is very soon worn down to the level of the paraconid. The groove between the entoconid and the hypoconulid disappears next with the hypoconid and the hypoconulid. The metaconid and entoconid persist the longest as distinct cusps.

The first permanent molar differs markedly from the unworn M_3 of the Santacruzian interatheriid genus *Protypotherium* figured by Sinclair (1909, pl. 5, fig. 14a). In this genus there is no entolophid. The trigonid and talonid are distinctly separate, with a vertical internal groove between the lobes.

PROSOTHERIUM AMEGHINO

Prosotherium AMEGHINO, 1897b, p. 426.

GENOTYPE: *Prosotherium garzoni* Ameghino

Prosotherium garzoni Ameghino

Prosotherium garzoni AMEGHINO, 1897b, p. 426.

One specimen (A.M.N.H. No. 29608) from the upper beds near the Pocket consists of a right upper dentition, P^1-M^3, and associated right lower M_{2-3}. The upper teeth are similar to an upper dentition from the Deseadan locality at Cabeza Blanca (A.M.N.H. No. 14154, exchange from the Amherst collection) identified as *Prosotherium garzoni*. The anterior lobe on M_2 of the Scarritt Pocket specimen is larger than the posterior lobe, a character generally used to distinguish the genus.

This genus was described by Ameghino as lacking the lower canine and first premolar and as having the anterior lobes of P_2-M_3 larger than the posterior lobes. It may be that the genus is synonymous with *Propachyrucos*. Loomis (1914, p. 65) states that in the Amherst specimens of *Prosotherium* P_1 is present as a vestige and I_3 is lacking. In the type specimens of *Propachyrucos ameghinorum* and *Propachyrucos simpsoni* I_3, C, and P_1 are reduced and in the former the left P_1 is smaller than the right, suggesting individual variation in this area. Simpson (1945a, p. 560) suggests that the presence or

TABLE 9
Prosotherium garzoni (A.M.N.H. No. 29608)

	L	W	AW	PW
Upper dentition				
P^1	—	3.0		
P^2	4.0	3.3		
P^3	4.4	3.6		
P^4	4.4	4.0		
M^1	5.9	5.0		
M^2	6.0	4.3		
M^3	6.2	3.9		
Lower dentition				
M_2	6.0		3.5	3.9
M_3	7.8		3.0	3.4
M_3, third lobe		1.9		

absence of vestigial teeth might vary, "individually, ontogenetically, or interspecifically."

Propachyrucos aequilatus with the anterior lobes equal in size to the posterior lobes on P_4-M_2, and *Propachyrucos simpsoni*, with the anterior lobes greater than the posterior ones on P_{3-4}, approach the large anterior lobe condition of *Prosotherium*. There is also some evidence, though it is not conclusive, that the relative size of the lobes may change during the continued growth and wear of the teeth.

These more or less intermediate forms suggest that *Propachyrucos* and *Prosotherium* intergrade and that they may eventually be considered synonymous. However, until more material is available for study it is thought best to continue listing them as separate genera.

ORDER **ASTRAPOTHERIA** LYDEKKER

SUBORDER **ASTRAPOTHERIOIDEA** AMEGHINO

FAMILY **ASTRAPOTHERIIDAE** AMEGHINO

PARASTRAPOTHERIUM AMEGHINO

Parastrapotherium AMEGHINO, 1895, p. 636.

GENOTYPE: *Parastrapotherium holmbergi* Ameghino.

Cf. Parastrapotherium sp.

One upper molar (A.M.N.H. No. 29619) from the upper beds near the Pocket is referable to this group and is tentatively identified as *Parastrapotherium*.

DETAILED DESCRIPTION OF *SCARRITTIA*

MORPHOLOGY

AT FIRST GLANCE there would seem to be a wealth of material on which to base a description (see *Scarrittia* hypodigm above). The extreme compaction of the bentonite in which the material was buried, however, resulted in severe crushing of the bones. In some instances there has been a plastic flow of the bone so that, for example, the scapulae of the skeletons are molded over the ribs and vertebrae like wet cardboard. The result is that even such routine procedures as counting the number of vertebrae become major operations, and the majority of measurements are not accurate for restored bones. It is therefore impossible to establish any valid quantitative data on the skeleton, so the comparative descriptions must suffice.

AXIAL SKELETON

DENTITION

Plate 9

The dental formula is the same as that of *Leontinia*,

$$\frac{3.1.4.3}{3.1.4.3}$$

with no diastema.

UPPER INCISORS

The first incisor is greatly enlarged into a caniniform tooth. This enlargement is greater than in I^2 of *Leontinia*. The tooth is recurved, with the surface of wear nearly vertical and facing posteriorly.

The second incisor is distinctly the smallest tooth of the upper series. It is a simple cone, with an external cingulum curved so that the ends are ventral to the middle.

The third incisor and the canine are larger than I^2 but of the same form.

UPPER PREMOLARS[1]

The first premolar differs from the rest in having a distinctly round crown and seems to form a transition between the incisor-like canine and the other cheek teeth. It is very like that of *Leontinia* as described by Patterson (1934a). The external cingulum curves downward at both ends to meet the parastyle and metastyle. The paracone and metacone are joined together and are separated from the small parastyle by a groove on the labial side. The metaloph connects the para-metacone with the protocone and

[1] Nomenclature of parts after Patterson (1934a).

TABLE 10

UPPER INCISORS AND CANINE

	I^1		I^2		I^3		C	
	L	W	L	W	L	W	L	W
Scarrittia canquelensis								
A.M.N.H. No. 29613								
R	16.7	15.2	—	—	—	—	15.4	14.7
L	16.5	15.4	13.5	12.6	15.7	14.2	14.2	14.9
A.M.N.H. No. 29594								
R	21.3	15.2	15.1	13.2	14.6	—	15.1	19.8
A.M.N.H. No. 29581	18.3	—	12.2	—	16.4	—	15.4	—
A.M.N.H. No. 29577	18.1	—	16.5	—	—	—	—	—
A.M.N.H. No. 29580	19.2	—	14.4	—	17.8	—	13.4	—
Leontinia gaudryi								
C.N.H.M. No. P13284								
R	11.3	10.3	14.0	22.1	11.1	13.4	—	—
L	12.2	11.4	15.7	18.2	11.6	12.5	14.2	13.8
Amherst No. 3290[a]	12	—	25	—	11	12	—	—

[a] After Loomis (1914, p. 116).

TABLE 11

UPPER PREMOLARS

	P¹		P²		P³		P⁴	
	L	W	L	W	L	W	L	W
Scarrittia canquelensis								
A.M.N.H. No. 29613								
R	—	—	22.3	28.0	23.3	32.2	25.3	34.7
L	15.8	20.9	23.0	29.0	23.5	31.8	26.1	35.1
A.M.N.H. No. 29615								
R	—	—	23.4	30.3	25.6	33.8	27.0	35.5
A.M.N.H. No. 29629								
L	17.8	20.6	22.3	30.8	25.5	34.6	26.1	36.8
A.M.N.H. No. 29594								
R	16.8	19.2	23.3	29.6	25.1	33.6	26.5	37.5
L	15.2	21.4	22.7	31.1	27.4	37.5	30.7	36.8
A.M.N.H. No. 29581	21.5	—	23.1	—	27.0	—	28.7	—
A.M.N.H. No. 29577	—	—	20.6	—	23.5	—	26.0	—
A.M.N.H. No. 29580	15.5	—	22.5	—	25.7	—	29.6	—
Leontinia gaudryi								
C.N.H.M. No. P13412								
R	—	—	20.0	28.6	23.7	35.7	24.9	38.4
L	—	—	19.0	27.8	22.3	32.9	24.8	36.5
C.N.H.M. No. P13284								
R	16.2	21.6	21.0	32.1	23.4	32.5	27.3	34.8
L	16.0	21.0	20.6	28.6	23.3	32.1	24.4	35.0
C.N.H.M. No. P13285								
R	—	—	20.2	18.1	22.5	23.2	25.0	35.5
L	—	—	—	—	22.8	28.5	24.0	33.7
Amherst No. 3290[a]	12	18	18	28	20	34	22	38
Amherst No. 3291x[a]	—	—	—	—	—	—	20	34
Ancylocoelus sp.								
C.N.H.M. No. P13342								
R	11.9	15.0	15.1	22.9	16.1	23.2	18.6	26.0
L	13.7	12.4	15.8	19.4	17.0	23.2	17.9	26.4

[a] After Loomis (1914, p. 116).

becomes larger with wear.

On P²⁻⁴, as in *Leontinia*, the external cingulum becomes progressively weaker, nearly disappearing on P⁴, and the groove between the parastyle and paracone becomes shallower. A ridge of enamel joins the anterior cingulum to the protocone. The protoloph becomes progressively stronger from P² to P⁴. On unworn teeth the metaconule is nearly as prominent as the protocone and joins it to the ectoloph, forming the metaloph with wear. *Scarrittia* differs from *Leontinia* in having a prominent internal cingulum and in lacking the lingual groove on the protocone.

MOLARS

In the series of specimens at hand the molars are longer than wide. With wear, however, the length-width ratio of M¹ and M² decreases until in very old individuals, of which there are no specimens at present, the width would probably exceed the length. As in *Leontinia*, M¹ is longer at the crown than at the roots, M² is straight sided, and M³ is longer at the roots than at the crown. The parastyle is more distinct than in *Leontinia*. The metaloph is prominent, ending in the "pseudohypocone." The metaloph, the ectoloph, and the posterior cingulum, or hypoloph, enclose a posterior fossette that disappears with wear progressively from M¹ to M³ so that it is present on only one of the series at any one time. As in *Leontinia*, the ectoloph and protoloph are long, and the central fossa opens lingually between the

protocone and the "pseudohypocone." A small secondary crista on the posterolingual side of the ectoloph appears on each molar in turn during wear. It disappears with further wear so that, like the posterior fossette, it rarely is present on more than one tooth at a time. There is no external cingulum, but the internal and anterior cingula are present. Unfortunately, none of the specimens show the median ridge described by Patterson (1934a, p. 93) as being present on the unworn teeth of *Leontinia*. On one specimen (A.M.N.H. No. 29616) the pre-wear presence of a median ridge is indicated by a serrated edge of enamel on the ectoloph bordering the central valley.

Wear changes the appearance of the teeth. The protoloph and metaloph, the former more than the latter, increase in size at the expense of the central fossa, and the lingual opening tends to disappear.

LOWER INCISORS

The first and second incisors are small, high-crowned, nipping teeth. The third incisor is enlarged into a caniniform, as in *Leontinia*, but is more procumbent than in *Leontinia* and tends to overlie the other incisors. This is probably due to the development of I^1 and the odd occlusion of I^1 and I_3.

The canine is small and incisor-like except for a wider, obliquely set crown.

LOWER PREMOLARS

The first premolar is small, only slightly larger than the canine, and is beginning to

TABLE 12

UPPER MOLARS

	M¹		M²		M³	
	L	W	L	W	L	W
Scarrittia canquelensis						
A.M.N.H. No. 29613						
R	33.8	34.9	45.0	42.4	51.8	41.1
L	35.1	35.6	46.0	41.0	52.2	43.0
A.M.N.H. No. 29615						
R	40.2	38.5	47.6	41.8	—	44.1
A.M.N.H. No. 29629						
L	37.8	36.5	49.5	42.7	—	—
A.M.N.H. No. 29594						
R	35.9	38.8	43.8	45.3	56.8	47.7
A.M.N.H. No. 29581	37.5	—	50.0	—	58.5	—
A.M.N.H. No. 29577	30.6	—	44.3	—	55.6	—
A.M.N.H. No. 29580	42.7	—	52.0	—	59.7	—
Leontinia gaudryi						
C.N.H.M. No. P13412						
R	36.5	41.8	48.2	45.5	53.6	40.3
L	37.2	39.4	50.0	42.5	50.5	36.2
C.N.H.M. No. P13284						
R	37.9	36.3	48.2	44.7	54.8	44.4
L	40.2	39.7	47.5	44.8	—	45.6
C.N.H.M. No. P13285						
R	39.0	38.0	49.5	39.2	57.5	35.1
L	40.9	35.5	49.0	38.4	57.0	34.2
Amherst No. 3290[a]	28	40	36	48	46	48
Amherst No. 3291x[a]	24	38	33	45	46	47
Ancylocoelus sp.						
C.N.H.M. No. P13342						
R	24.5	28.0	34.0	34.5	42.4	34.0
L	24.8	27.7	30.4	31.1	42.4	30.5

[a] After Loomis (1914, p. 116).

TABLE 13

LOWER INCISORS AND CANINE

	I_1		I_2		I_3		C	
	L	W	L	W	L	W	L	W
Scarrittia canquelensis								
A.M.N.H. No. 29612								
R	11.2	6.2	13.0	7.9	14.5	20.7	—	—
L	9.7	6.5	—	—	15.7	15.3	—	—
A.M.N.H. No. 29578	7.2	—	8.2	—	15.9	—	—	—
A.M.N.H. No. 29581	7.4	—	8.1	—	14.0	—	12.3	—
A.M.N.H. No. 29580	7.4	—	7.8	—	14.5	—	—	—
Leontinia gaudryi								
C.N.H.M. No. P13419	—	—	—	—	17.6	17.2	10.5	11.1
Amherst No. 3290[a]	8	—	10	—	23	—	8	—
Amherst No. 3291x[a]	8	—	10	—	13	—	9	—
Leontinia garzoni								
C.N.H.M. No. P13501	—	—	8.6	8.7	11.2	12.1	7.4	9.4
Ancylocoelus sp.								
C.N.H.M. No. P13348	12.5	12.2	9.8	13.5	17.8	22.5	—	—

[a] After Loomis (1914, p. 116).

TABLE 14

LOWER PREMOLARS

|	P_1		P_2		P_3		P_4	
	L	W	L	W	L	W	L	W
Scarrittia canquelensis								
A.M.N.H. No. 29612								
R	—	—	19.8	18.9	23.5	19.8	26.0	21.7
L	—	—	18.5	18.8	23.0	20.0	—	—
A.M.N.H. No. 29628								
R	—	—	—	—	—	—	26.3	20.1
A.M.N.H. No. 29627	—	—	17.5	17.7	19.6	19.3	23.9	21.9
A.M.N.H. No. 29592	—	—	—	—	—	—	25.7	21.2
A.M.N.H. No. 29578	16.0	—	20.2	—	25.0	—	32.4	—
A.M.N.H. No. 29581	8.6	—	18.7	—	23.4	—	29.4	—
A.M.N.H. No. 29580	—	—	18.9	—	22.5	—	33.0	—
A.M.N.H. No. 29583	—	—	16.9	—	22.9	—	25.6	—
Leontinia gaudryi								
C.N.H.M. No. P13463	—	—	15.7	14.2.	19.5	17.6	22.6	18.6
C.N.H.M. No. P13419	—	—	16.7	15.9	19.1	16.5	21.4	19.0
Amherst No. 3290[a]	13	12	18	17	21	19	24	19
Amherst No. 3291x[a]	8	12	16	15	18	16	21	18
Leontinia garzoni								
C.N.H.M. No. P13501	11.7	10.6	14.5	12.4	17.1	13.8	20.5	16.4
Ancylocoelus sp.								
C.N.H.M. No. P13348	—	—	12.1	12.7	14.3	14.7	17.6	15.5

[a] After Loomis (1914, pp. 116–117).
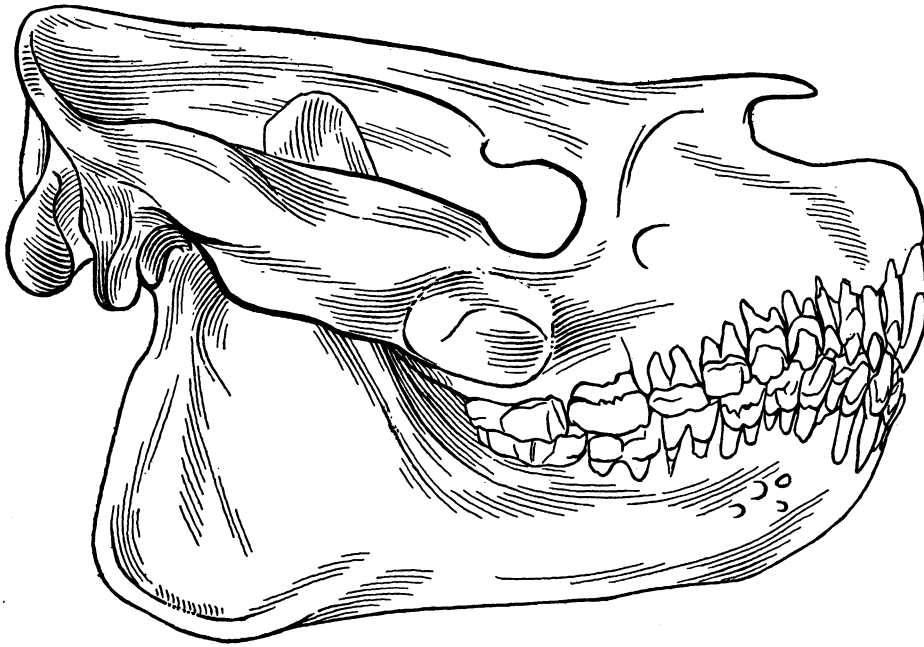
FIG. 5. *Scarrittia canquelensis* Simpson. Reconstruction of skull. $\times\frac{1}{4}$ (approximate).

show the premolar pattern. The second premolar has nearly four times the crown area of P_1. The premolars increase in size and in length-width ratio from the second to the fourth, owing to the enlargement of the talonid. In crown view, compared to the molars, the premolars give the appearance of being square because their length-width ratio is smaller. External and internal cingula are present on all three teeth. On unworn or slightly worn teeth there is an increase in the relative sizes of the talonid from P_2 to P_4. The paraconid and protoconid are of equal size on each tooth and increase in size very little from P_2 to P_4. The metaconid is the most prominent cusp. The entoconid is the largest cusp on the talonid though much smaller than the metaconid. The hypoconid cannot be definitely located on the material at hand. On all three teeth the trigonid and talonid are distinctly separated by a deep groove on the lingual side.

LOWER MOLARS

The molars are long, narrow teeth, like the premolars in pattern but with the addition of a posterior extension of the hypolophid. The trilophid is divided from the talonid by

lingual and labial grooves and is smaller than the latter. There is a lingual groove on both the trigonid and the talonid. The one on the former is between the protoconid and metaconid and the paraconid. It disappears on extremely worn teeth. The groove on the talonid is between the entoconid and the hypolophid and is persistent during wear. There is a valley or large fossette in the center of the talonid anterior to the lingual groove. It becomes reduced and disappears with wear.

SKULL

Plate 10; text figure 5

The skull differs only slightly from that of *Leontinia*, being brachycephalic, with a shortened facial region. The nasals are broad and thick, with no sign of a boss, as reported for *Leontinia* (Loomis, 1914, p. 111). The premaxillae extend well forward and are heavy at the symphysis. The zygomatic arches are heavy and, as in *Leontinia*, are continuous with the lambdoidal crests. In general the *Scarrittia canquelensis* skulls tend to be larger than those of *Leontinia gaudryi*, although this may be only an appearance due to crushing. A comparison of the

ear regions (see below) seems to show that the trend towards a broader skull has been carried farther in *S. canquelensis* than in *L. gaudryi*. In the latter the postglenoid process as the post-tympanic process is quite distinct from the tympanic, and the ventral extension of the postglenoid canal is only a notch between the tympanic and the squamosal.

AUDITORY REGION

Text figure 6

One specimen of the left auditory region (A.M.N.H. No. 29614) alone escaped the compaction in such a way as to enable inspection of this interesting area. Unfortunately, the section was broken away from the main portion of the skull, leaving only the structure lateral to the bulla intact. Enough remains, however, to show that there is no major deviation from the general notoungulate pattern.

The specimen is bounded ventrally by the glenoid fossa and the crista meati of the tympanic, posteriorly by the para-occipital process, medially by the sulcus tympanicus and a portion of the lateral wall of the bulla, and anteriorly by the squamosal-jugal suture.

TABLE 16

SKULL

	Total Length
Scarrittia canquelensis	
A.M.N.H. No. 29581	533
A.M.N.H. No. 29578	431
U.S.N.M. No. 13879	507
Leontinia guadryi[a]	
Amherst No. 3335	420
Amherst No. 3291x	392

[a] After Loomis (1914, p. 118).

BONE ELEMENTS: The tympanic is the central bone of the complex. It is laterally and ventrally expanded, as is usual in the notoungulates, to form a process, the crista meati, between the postglenoid process of the squamosal and the post-tympanic process. Ventrally it extends well below the postglenoid process to form part of the posterior wall of the glenoid fossa, with a suture between it and the postglenoid process of the squamosal running nearly horizontally. Posteriorly it is fused with the posterior adventitious bone of Patterson (1936a; Simpson,

TABLE 15

LOWER MOLARS

|	M₁ L	M₁ W	M₂ L	M₂ W	M₃ L	M₃ W
Scarrittia canquelensis						
A.M.N.H. No. 29612						
R	36.0	19.0	41.3	19.5	52.0	15.9
A.M.N.H. No. 29628	33.7	19.8	41.5	23.0	59.0	23.3
A.M.N.H. No. 29627	29.0	20.2	—	—	—	—
A.M.N.H. No. 29592	33.0	19.8	39.5	20.3	54.5	17.9
A.M.N.H. No. 29578	39.5	—	—	—	—	—
A.M.N.H. No. 29581	31.9	—	46.6	—	63.5	—
A.M.N.H. No. 29580	32.4	—	44.1	—	61.9	—
A.M.N.H. No. 29583	36.4	—	43.5	—	55.7	—
Leontinia gaudryi						
C.N.H.M. No. P13463	30.9	16.8	37.4	19.0	48.5	17.6
C.N.H.M. No. P13419	31.2	18.4	36.3	18.6	49.4	17.0
Amherst No. 3290[a]	33	20	40	20	57	20
Amherst No. 3291x[a]	27	20	37	20	57	20
Leontinia garzoni						
C.N.H.M. No. P13501	26.8	14.3	32.2	16.2	40.8	15.1
Ancylocoelus sp.						
C.N.H.M. No. P13348	21.6	14.0	29.5	14.9	44.5	14.7

[a] After Loomis (1914, pp. 116–117).
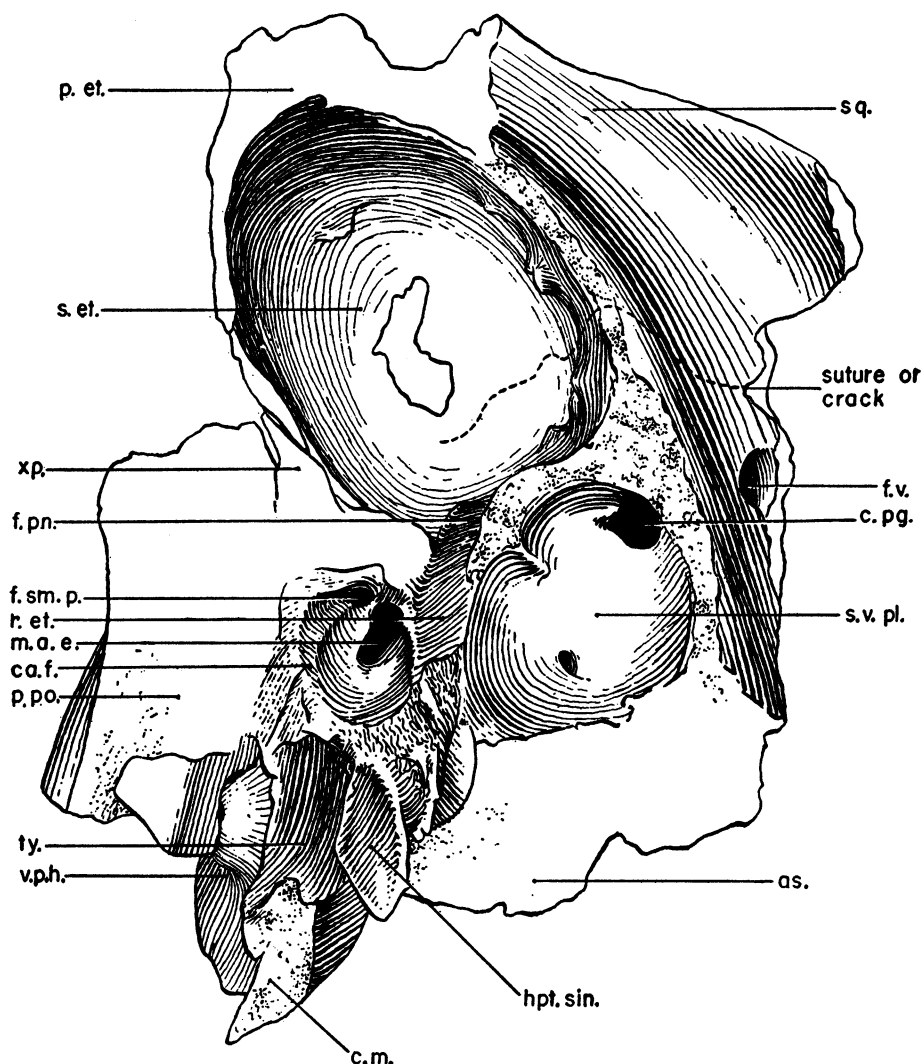
FIG. 6. *Scarrittia canquelensis* Simpson, A.M.N.H. No. 29614. Auditory region, internal view. *Abbreviations;* as., alisphenoid; c. m., crista meati; c. pg., postglenoid canal; c. ty., tympanic cavity; ca. f., canalis facialis; f. a., foramen auricular; f. g., fissura Glaseri; f. pg., postglenoid foramen; f. pn., foramen pneumaticum (of epitympanic sinus); f. sm., stylomastoid foramen; f. sm. p., foramen stylomastoideum primitivum; f. v., venous foramina and canals; hpt. sin., hypotympanic sinus; m. a. e., external auditory meatus; p. a. e., porus acusticus externus; p. et., pars epitympanic; p. pg., postglenoid process; p. po., paroccipital process; p. pt., post-tympanic process; r. et., epitympanic recess; s. et., epitympanic sinus; s. g., glenoid surface; s. v. pl., posterolateral venous sinus; sq., squamosal; ty., tympanic (including entotympanic); v. p. h., vagina processus hyoidei; xp., posterior adventitious element. ×1.5.

1936a), with only a trace of a sutural contact running between the cleft of the stylomastoid foramen and the vagina process hyoidei. The tubular auditory meatus is in the dorsal part of the tympanic which forms the floor, sides, and, questionably (see below), the roof of the meatus. Externally, it sends a projection dorso-anteriorly into the pars epitympanica of the squamosal (Simpson, 1936a).

Ventrally, there is a crista meati running from the posterior side of the tympanic medially. Unfortunately this crest is broken, leaving no indication of its probable junction with the bulla. Medially, the sutures between the tympanic and the adjoining elements are obscured. The sulcus tympanicus is exposed, together with a small portion of the internal face of the lateral wall of the hypotympanic sinus.

The squamosal, lying dorsal and anterior to the tympanic, is broken medially, exposing the epitympanic sinus in the pars epitympanica. There is a possible suture between the pars epitympanica and the pars glenoidea running dorso-anteriorly from the above-mentioned wing of the tympanic on the lateral surface. On the dorsal surface this possible suture has the appearance of a crack, while on the dorso-anterior wall of the epitympanic sinus it again has the appearance of a suture.

The posterior adventitious bone forms the post-tympanic process as a thin plate between the tympanic and the paroccipital process. It has a suture with the latter and another with the pars epitympanica, at least on the medial portion of their contact. Anteriorly, it is closely fused with the tympanic, with only the stylomastoid cleft and auricular canal (see below) between. Ventrally, there is a suture between it and the crista meati of the tympanic. Medially, it is partially broken, but enough remains to show that it lies against the posteroventral wall of the epitympanic sinus and also against the unknown element in the floor of that sinus (see below) without suture.

The periotic is probably present but cannot be identified in the mass of bone lying anterior to the known portion of the tympanic and dorsoposteriorly from the glenoid surface. It may be present in the postero-ventral wall of the venous sinus.

The anterior adventitious bone of Simpson (1936a, p. 10) cannot be identified with certainty. There is a seemingly separate element lying between the tympanic and the pars glenoidea of the squamosal on the glenoid surface. However, the sutural connection with the tympanic is doubtful on the glenoid surface and entirely absent on the broken interior surface of the crista meati. The position of this possible element is much lower than that of the anterior adventitious bone of Simpson in *Oldfieldthomasia* and certainly does not connect with the posterior adventitious bone lateral to the sulcus tympanicus.

There is an element in the floor of the epitympanic sinus and above the meatus that is distinct, at least posteriorly, from the pars epitympanica. Whether this element is exposed on the lateral surface just above the porus acusticus or not cannot be determined because of the cracks in this area. It is partially separated from the posterior adventitious bone by the posterior part of the pars epitympanica. It forms a very thin division, thin enough to transmit light, between the epitympanic sinus and the meatus. Since its relationship with the tympanic is obscure, it may be part of that bone. Simpson (1936a, p. 11) observed a similar element in *Oldfieldthomasia*.

The alisphenoid is represented by a small portion broken anteriorly. It is kept from entire contact with the tympanic (the lateral wall of the hypotympanic sinus) by the fissura Glaseri. Laterally it meets the pars glenoidea of the squamosal.

FORAMINA: The porus acusticus is nearly circular and is on the same level as the glenoid surface between the larger postglenoid foramen and the much smaller auricular foramen (see below). From it the meatus runs directly inward and slightly upward, becoming more oval, with the long dimension vertical, and smaller. About midway from the porus acusticus to the sulcus tympanicus the meatus is restricted to approximately one-third of the cross-sectional area of the porus by a rise in the floor. Internally from this rise the floor drops away to a point, so that the opening at the sulcus has the shape of an inverted teardrop.

The stylomastoid foramen opens in a cleft between the tympanic and the posterior

adventitious bone about 10 mm. postero-ventrally from the porus acusticus. This is the same position as described by Patterson (1932, p. 15; 1936a, p. 215) for *Ancylocoelus*. From there the canalis facialis runs internally and dorsally to emerge on the posterodorsal edge of the sulcus tympanicus in the foramen stylomastoidium primitivum, with an opening of about 1 mm.

Opening into the same cleft as the stylomastoid foramen and hidden by the overhang is another foramen with a canal running directly dorsad for about 12 mm. to a foramen posterior to the porus acusticus. The canal is enclosed by a fusion of the tympanic with the posterior adventitious bone and is the result of the lateral growth of the whole auditory area. It may have contained either, or both, of the internal and posterior auricular nerves which, in the modern horse (Sisson, 1914, p. 802), branch off the seventh cranial (facial) nerve immediately after its emergence from the stylomastoid foramen. The canal and its opening might be termed the auricular foramen in reference to the nerves.

The postglenoid foramen is oval shaped, larger than the porus acusticus, and opens in a fossa immediately anterior and slightly ventral to the porus. The postglenoid canal runs from this foramen dorsally to a point very near the dorsal surface of the squamosal and then turns internally to open into the posterolateral venous sinus. Opening at the bend and running dorsally is a short canal with a foramen on the surface of the squamosal at the parietal suture. The same condition is mentioned by Patterson (1936a, p. 215) for *Ancylocoelus*. A third canal opens in the fossa of the postglenoid foramen and follows the suture between the postglenoid process and the tympanic to emerge in the glenoid surface. This canal would seem to have carried the superficial temporal vein (Sisson, 1914, p. 684), enclosed by the lateral growth of the bones, to the fossa where it turns dorso-internally to emerge through the short canal at the surface of the squamosal. The dorsal cerebral vein joined the superficial vein at the bend and ran internally to the postero-lateral venous sinus.

From this it would seem that the true postglenoid foramen, homologous with that of other ungulates, is internal to the lateral

surface of the skull and is located medial to the short, dorsally directed canal mentioned above.

The foramen lacerum medium may be present in a broken condition adjacent to the external wall of the bulla, but it cannot be determined with certainty.

The fissura Glaseri is present between the alisphenoid and the wall of the hypotympanic sinus. It is in the form of a small cleft, with the canal of Huguier running dorsally from it.

A groove indicating the position of the foramen pneumaticum is present just dorsal to the sulcus tympanicus and runs laterally into the epitympanic sinus.

The vagina processus hyoidei is in its expected position in the projected line from the porus acusticus through the stylomastoid cleft. It is bounded by the tympanic anteriorly, and laterally by the posterior adventitious bone and the paroccipital process. The tympanic forms at least part of the medial wall, and the paroccipital process part of the posterior wall. The rest is broken away. This differs from the condition in *Ancylocoelus* (Patterson, 1932, p. 17, "*Colpodon*") in that the posterior adventitious bone takes part in the lateral wall.[1]

SINUSES: The epitympanic sinus is ovoid in dorsoventral cross section, with the small end pointing dorsoposteriorly. The interior surface is smooth except for a few small, cusp-like bumps. As is discussed above, the walls of the sinus are formed by the pars epitympanicus of the squamosal which may be suturally separate from the main portion of the latter. The floor may be formed by a separate element or by the tympanic (see above). The sinus connects with the tympanic cavity by means of the foramen pneumaticum.

The posterolateral venous sinus lies anteromedially from the epitympanic sinus and is formed in the squamosal. It opens to the exterior by means of the venous canal leading to the postglenoid foramen and by one leading to the dorsum of the skull (see

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[1] Patterson: "There may well have been, and probably was, a posterior adventitious bone in *Ancylocoelus*, although no suture is apparent" (personal communication).

above). Part of the posterior wall of the sinus may be formed by the periotic.

COMPARISON OF AUDITORY REGIONS: In the *Pleurostylodon* specimen (A.M.N.H. No. 28878) examined (see also Simpson, 1936a, p. 28, figs. 10, 11), the porus acusticus is much larger, both comparatively and actually, and opens more medially than in *Scarrittia*. The tympanic is not present in the lateral part of the postglenoid process as it is in *Scarrittia*, where it forms the major portion of the process. The post-tympanic process of *Pleurostylodon* is extremely small and indefinite, while in *Scarrittia* it is distinct. The vagina processus hyoidei is situated more anteriorly than in *Scarrittia*. The crista meati is comparatively as long in both genera. The lateral position of the porus acusticus in *Scarrittia* seems to have been caused by a widening of the basicranial region rather than by extension of the tympanic.

In *Ancylocoelus* (C.N.H.M. No. P14715; Patterson, 1932, p. 15, fig. 4b, "*Colpodon*"; 1936a, p. 215, fig. 51) the crista meati is narrower ventrally and wider dorsally than in *Scarrittia*. The stylomastoid process is larger, and the porus acusticus is much larger. Otherwise the auditory regions of the two genera are very similar.

Homalodotherium (Patterson, 1932, p. 6, fig. 1; 1936a, p. 216, figs. 52, 53) differs considerably from *Scarrittia* in the auditory region. In the over-all aspect the region is not so laterally extended as in *Scarrittia*. The crista meati is not so long or so massive. The tympanic takes no part in the postglenoid process. The stylomastoid foramen is not in a cleft surrounded by the crista meati and the post-tympanic process. The porus acusticus externus is only partially surrounded by the tympanic, while in *Scarrittia* the tympanic forms a solid lateral face of bone in which the porus appears much like a venous foramen.

The auditory region of *Nesodon* (Scott, 1912a, pp. 135–137; Patterson, 1932, p. 17; 1936a, p. 209, fig. 49) differs from *Scarrittia* only in the comparative sizes and positions of the various parts. In *Nesodon* the crista meati is long and narrow from the lateral aspect, extending far below the postglenoid process of the squamosal. The porus acusticus has a much more dorsal position, being

close to the junction of the zygomatic arch with the lambdoidal crest. It is also much larger than the postglenoid foramen which is situated anteroventrally from it. The post-tympanic process is larger and more prominent in *Nesodon* and is not situated between the paroccipital process and the crista meati, but forms the posterolateral angle of the skull. The stylomastoid foramen opens in the cleft between the crista meati and the post-tympanic process, as it does in *Scarrittia*, but there is no canal or foramen dorsal to it as are the auricular canal and foramen in *Scarrittia*.

MANDIBLE

The lower jaws of *Scarrittia* differ from those of *Leontinia* only slightly. The latter are stouter and shorter than the former. This is probably due to the occlusion of lower I_3 and upper I^1 in *Scarrittia*, which would tend to lengthen the symphysis and force the anterior incisors into a more procumbent position.

TABLE 17

LOWER JAW

	Length	Height at Condyle	Depth at M_1
A.M.N.H. No. 29578	322	159	61
A.M.N.H. No. 29581	451	224	—
A.M.N.H. No. 29580	—	167	75.5
U.S.N.M. No. 13879	407	—	59.8

HYOID

On specimen A.M.N.H. No. 29583 two elements are present that are tentatively identified as the stylohyals. They are approximately 100 mm. long but are broken at the epihyal end.

VERTEBRAE

CERVICAL

The seven cervical vertebrae are exceptionally long, the neck being longer than the skull, while in *Nesodon*, *Adinotherium*, and *Homalodotherium* it is shorter. However, in the length of the neural spines and the length of the centra the cervicals of *Scarrittia* more nearly resemble those of *Homalodotherium* than they do those of the other two genera.

The individual vertebrae are the largest in the whole column. The centra are nearly twice the diameter and length of those of the thoracic vertebrae. An interesting feature of all the *Scarrittia* skeletons is the death pose, in which, as is frequent among articulated fossil skeletons, the head and neck were posthumously arched back over the shoulders. However, in *Scarrittia* the neck is straight, and the bending is in an acute-angled flexure between the seventh cervical and the first thoracic.

None of the *Scarrittia* specimens at hand show the atlas clearly. The crushing has so deformed the skulls and jaws that they cover and nearly mask this first vertebra. On one specimen (A.M.N.H. No. 29581) enough can be seen to show that it is not unlike the atlas ascribed to *Leontinia* by Loomis (1914, p. 119, fig. 74). His figure shows that it is a stouter element than in *Nesodon*, with the transverse processes broader and with larger atlanto-diapophysial foramina.

The axis is larger than the rest of the cervicals, with a high, hatchet-shaped neural spine and a prominent odontoid process. It is very similar to that of *Homalodotherium* except that the spine in that genus does not angle posteriorly to such a degree as in *Scarrittia*. It differs markedly from that of *Nesodon* in the greater length of the centrum which is even dimensional in its entire length. The anterior cotyles are broad and convex, and the neural canal is nearly triangular in cross section.

The third cervical is only a little shorter than the axis. The opisthocoelous centrum is heavy, and the transverse processes are prominent and, as nearly as can be determined, depressed. The neural spine is lower than that of the axis and not so long.

The succeeding cervicals follow this pattern with little change. The centra become progressively shorter, and there is an indication of inferior lamellae on the fifth, though their presence on the sixth and seventh cannot be demonstrated. The neural spines remain low and diminish towards the seventh, on which the spine has the size and shape of that of the first thoracic.

THORACIC

There are 14 to 15 thoracic vertebrae. The anterior centra are small in diameter and short in length, increasing in both dimensions posteriorly. The first neural spine is short and has little backward inclination. The second neural spine is longer and slightly inclined, and the third is the longest of any of the vertebrae. From the third to the seventh the spines decrease in length but increase in backward inclination. Behind the seventh the spines become broader and the inclination decreases, until those of the last three thoracic vertebrae are vertical.

The spines are much shorter and weaker than those of *Nesodon* and do not have as much backward inclination as do those of either *Nesodon* or *Adinotherium*. They have a strong resemblance to those of *Homalodotherium* in their length, breadth, and position.

LUMBAR

There are five lumbar vertebrae. The centra are larger than those of the thoracic vertebrae and increase in size posteriorly as do the transverse processes. The latter are not so long as those of *Nesodon* but are broader. The zygapophyses are flat, and the articular surfaces are at only a slight angle to the axis of the column.

The transverse processes of the last lumbar are broader than those on the preceding vertebra. They curve posteriorly and form articulations with the forward-curving processes of the first sacral. This condition differs from that in *Nesodon* and *Adinotherium* (Scott, 1912a, pp. 149, 208, pl. 26, fig. 1) in that there is no articulation with the transverse processes of the penultimate lumbar nor any connection with the ilium.

SACRAL

There are seven sacral vertebrae fused together and diminishing in size posteriorly. The transverse processes of the first sacral, as noted above, articulate with those of the last lumbar.

CAUDAL

There are at least eight caudal vertebrae. There were probably a few more but the tail was distinctly short.

RIBS

The ribs are simple and like those of any medium-sized ungulate. The sixth to the

tenth are double headed. The condition in the first to the fifth cannot be determined. The eleventh to the thirteenth or fourteenth are single headed.

STERNUM

The presence of a sternum is indicated on several specimens, but little can be seen of the form or number of the elements.

FORE LIMB

SCAPULA

The scapula is well rounded in outline, with the inferior angle smooth and the axillary border convex. It is broader than the scapulae of either *Thomashuxleya* or *Homalodotherium*. The spine is high, with a posteriorly recurved free border. The metacromion is situated about midway on the spine and is not prominent. The acromion is small and short. The scapula of *Nesodon* has an acromion and two long metacromia.

HUMERUS

The humerus is a massive bone only slightly shorter than the femur or the radius. The head is comparatively small and flat, with an unexplained articular surface on its external side. The greater tuberosity is nearly as large as the head, with the deltoid ridge extending from it. The latter is not so prominent as in *Homalodotherium* and is not hooked on the distal end.

The supinator ridge is not prominent. The entepicondyle is large and imperforate. The trochlear surface for the radius is convex both anteroposteriorly and transversely. The surface for the ulna is convex anteroposteriorly but concave transversely. A continuation of the deltoid ridge limits the trochlea internally. The anconeal fossa is imperforate and is not wide or deep.

RADIUS AND ULNA

The radius and ulna are separate bones, with the radius the stouter of the two. They are longer, in comparison to the humerus, than in *Thomashuxleya* but not so long as in *Homalodotherium*. The ulna is straight, with a strong olecranon. The sigmoid notch carries only the facet for the inner humeral trochlea. The lesser sigmoid cavity is well rounded. Distally there is the usual oblique facet for the cunieform but none for the pisiform. It compares closely with the ulna ascribed to *Leontinia* by Loomis (1914, p. 120, fig. 77).

The radius is slightly bowed but not so much so as in either *Thomashuxleya* or *Homalodotherium*. The proximal articulation is narrow and somewhat discoidal, indicating some power of rotation. On the internal side of the shaft, about one-fourth of the length from the proximal end, is a rugose crest 20 mm. in length. Scott (1930) mentions a similar crest on *Homalodotherium* but on the external side of the shaft.

TABLE 18

FORE LIMB

| | Scapula | | Humerus | | Ulna | Radius |
	L	W	L	W (Head)	L	L
Scarrittia canquelensis						
A.M.N.H. No. 29581						
R	—	—	485	189.6	—	472
L	—	363	482	185.2	255	500
A.M.N.H. No. 29580						
R	—	—	—	—	—	434
L	—	—	—	—	—	471
U.S.N.M. No. 13879						
R	372	—	435	—	—	419
Leontinia cf. *gaudryi*						
Amherst No. 3328[a]	—	—	314	77	430	310

[a] After Loomis (1914, pp. 119–120).

MANUS

Plate 11, figure 1

The manus of *Scarrittia* is mesaxonic, with digit III the largest, digits II and IV equal in size, and digit V the smallest, and semifunctional. It is very like the manus of the palaeosyopine titanotheres and is of the same mediportal type.

CARPUS

The carpals are alternating, with the lunar resting equally on the unciform and the magnum. The first and second rows are of equal length. In *Nesodon* the first row tends to be longer, while in *Homalodotherium* it is the second row that is dominant.

SCAPHOID: This element is about equidimensional when viewed from the anterior. The dorsoventral dimension is twice as large as either the transverse or the proximodistal dimensions. The palmar half is a rugose knob, with no articular surfaces. The articular surface for the magnum is saddle shaped, convex transversely and concave palmodorsally. Ventrally from it is the articular facet for the trapezoid, which is larger and also saddle shaped. The facet of articulation with the lunar is confined to the upper third of the bone, leaving a gap below. The articular surface for the radius is continuous with that on the lunar, convex palmodorsally and nearly flat transversely. There is no articulation with the trapezium.

LUNAR: The lunar is the largest element in the first row and the second largest in the carpus. It has about the same dimensions proximodistally as transversely and is slightly larger palmodorsally. The articular surface for the radius is strongly convex, coming well down on the dorsal side and with the transverse dimension nearly twice that of the palmodorsal. The facet for the scaphoid is small and does not project markedly. There seems to be no articulation with the cuboid, although there is a small, smooth area proximally on the ulnar side. The articular surface for the magnum is small and rather flat dorsally, but ventrally it is larger and concave, almost a socket. The surface for the unciform is approximately equal to that for the magnum and is convex dorsally, becoming smaller and concave ventrally.

TABLE 19

CARPUS

	A.M.N.H. No. 29585		A.M.N.H. No. 29581	
	R	L	R	L
Cuboid				
L	26.7	24.8	—	22.5
W	45.0	42.7	—	46.0
D	37.1	37.0	—	—
Lunar				
L	42.4	42.2	43.4	—
W	43.7	43.0	43.7	—
D	46.7	—	—	—
Scaphoid				
L	—	32.7	—	—
W	—	27.0	—	—
D	—	57.1	—	—
Unciform				
L	45.1	46.0	55.4	51.1
W	64.5	63.4	63.5	65.0
D	33.9	33.8	—	—
Magnum				
L	39.1	33.0	37.6	38.1
W	39.3	41.3	35.0	35.2
D	49.2	49.1	—	—
Trapezoid				
L	—	26.2	—	—
W	—	25.7	—	—
D	—	33.7	—	—
Trapezium				
L	40.1	—	—	—
W	14.5	14.0	—	—
D	29.7	29.8	—	—

CUBOID: The cuboid has its longest dimension transversely, the next palmodorsally, and the least proximodistally. The ulnar articulation occupies all the proximal surface and is long and flat transversely, short and concave palmodorsally. The facet for the pisiform is smaller than the preceding and divided from it by a ridge. The articular surface for the unciform occupies all the distal area. It is concave on the radial side and convex on the ulnar side, allowing for a twisting movement between the two elements.

UNCIFORM: The unciform is the largest element in the carpus, with its largest dimension transversely, the next proximodistally, and the least palmodorsally. It articulates with metacarpals IV and V distally and with III by means of a facet on the radial side, set obliquely. The facet for the magnum is larger

than that for metacarpal and lies in the same plane as that articulation.

MAGNUM: The magnum is a larger element than the trapezoid, with its greatest dimension palmodorsally, the next proximodistally, and the least transversely. On the proximal surface there is an articulation for the scaphoid dorsally, and one for the trapezoid ventrally which lies obliquely across the axis of the former. On the palmar surface there is a rugose knob, much like that on the scaphoid but smaller. On the distal part of the ulnar face there are two facets for the unciform. The larger is dorsal and the smaller is separated from it. Above the former and at a slight angle to it is a facet for the lunar. Ventrally there is an articular "head" that fits the concave articular surface of the lunar. Distally the magnum articulates only with metacarpal III, but it does have an articulation with metacarpal II laterally.

TRAPEZOID: The trapezoid is smaller than any of the above-mentioned elements. It has its greatest dimension palmodorsally, with the transverse and proximodistal dimensions smaller and equal. It lies obliquely to the larger scaphoid and articulates with the latter by a saddle-shaped facet occupying the whole proximal surface. There are two separate facets for the articulation with the magnum, one on the proximodorsal part of the ulnar face and the other, much smaller, palmodistally from it. Distally the trapezoid articulates with metacarpal II. There is also a small facet for the trapezium.

TRAPEZIUM: The trapezium is a small, flattened element with the shape of an inverted pear. There is a rough indentation on the radial surface but no indication of articulation with a metacarpal I, though that element may have been represented as a vestigial remnant.

PISIFORM: The pisiform is a long, relatively narrow element articulating dorsally with the unciform and distally with a small facet on a proximal elongation of metacarpal V.

METACARPUS

There are four metacarpals. Three of these, II, III, and IV, were functional and the last, V, was semi-functional, touching the ground only in soft underfooting. The four metacarpals are strongly divergent, with V more than the others, articulating with one another only at the proximal ends.

Metacarpal II is shorter and stouter than metacarpal IV. The proximal end is only slightly expanded and articulates mainly with

TABLE 20

METACARPALS

| | A.M.N.H. No. 29585 | A.M.N.H. No. 29581 | | A.M.N.H. No. 29578 | | A.M.N.H. No. 29582 | |
	L	R	L	R	L	R	L
II							
L	179.9	—	—	—	133.0	151.4	157.0
WP	32.0	—	—	—	31.7	36.1	—
WD	45.3	—	—	—	29.6	32.4	—
III							
L	200.4	195.8	206.0	143.0	153.0	165.6	173.0
WP	40.7	42.2	44.9	35.5	37.8	34.4	—
WD	49.8	47.5	51.0	—	—	42.8	—
IV							
L	188.5	183.1	177.0	133.0	—	147.1	141.5
WP	34.9	35.6	37.2	29.8	—	28.2	—
WD	41.6	44.1	42.9	34.8	—	38.0	—
V							
L	116.6	—	109.7	82.1	—	95.8	94.5
WP	24.0	—	—	15.9	—	19.5	—
WD	31.9	—	33.5	20.8	—	25.1	—

the trapezoid, though on the ulnar side there is a projection which overlaps the proximal end of metacarpal III and articulates with the magnum. The upper end of the shaft is triangular in cross section, becoming more flattened palmodorsally in the central part. The distal end is expanded more than the proximal end, and the trochlea is grooved much like that of the second phalanges.

Metacarpal III is the longest and stoutest element. The proximal end is slightly expanded and articulates mainly with the magnum but with an ulnar projection overlapping metacarpal IV and articulating with the unciform. The shaft is oval in cross section and is much stouter than that of either metacarpal II or IV. The distal end is slightly expanded, and the trochlea, which is not grooved as in metacarpal II, occupies all the width.

Metacarpal IV is longer than metacarpal II but not so long as metacarpal III and is much slighter than either. The proximal end is expanded and articulates mainly with the unciform but with side facets for metacarpals III and V. The shaft is triangular in cross section and is about two-thirds of the width of the shaft of metacarpal III. The distal end is greatly expanded, and the trochlea is like that of metacarpal III.

Metacarpal V is the smallest of the metacarpals and probably was not functional in normal locomotion. It is little more than half of the length of metacarpal III and about two-thirds of the length of metacarpal IV. The proximal end is slightly expanded, articulating with the unciform, with metacarpal IV radially, the proximoventrally with the pisiform. The shaft is oval in cross section, and the distal end is narrower than the proximal. The trochlea is well rounded and occupies most of the width of the distal end.

PHALANGES

The phalanges are broad and rather flattened but otherwise normal. The ungual phalanges are characterized by deep median clefts, suggestive of the presence of claws, although the distal ends are spatulate in shape.

COMPARISON OF THE MANUS

The carpus is exceedingly like that of *Nesodon* (Scott, 1912a, pp. 156–163) except

for comparative sizes of the elements and slightly different emphasis on some articulations. The unciform of *Scarrittia* is comparatively much larger than that of *Nesodon*, and in *Nesodon* the articulation of the unciform with metacarpal III is much larger then in *Scarrittia*.

The metacarpals in *Nesodon* are shorter and stouter than they are in *Scarrittia*. Also metacarpal IV of *Nesodon* is described by Scott (*loc. cit.*) as being shorter and heavier than metacarpal II, while in *Scarrittia* the opposite is true.

The manus of *Adinotherium* (Scott, 1912a, pp. 211–214) is like that of *Nesodon* and *Scarrittia* except that the pisiform has a wider proximal articulation with the cuboid. In both *Nesodon* and *Adinotherium* metacarpal V is vestigial.

The manus of *Rhynchippus* (Loomis, 1914, p. 99) is more compact than in *Scarrittia*, and the metacarpals are not divergent. The cuboid is large, being nearly equal to the unciform in size, while in *Scarrittia* it is smaller than the unciform. The scaphoid and lunar are equal in size and the trapezoid is larger in comparison to the magnum than in *Scarrittia*. The metacarpals have no overlapping ulnar projections on the proximal ends, and the shafts of metacarpals II and IV are definitely curved. Metacarpal V is vestigial.

The manus of *Scarrittia* agrees very well with that of *Thomashuxleya* as described by Simpson (1936b, p. 6) except for the reduction of digits in the former. The major differences seem to be due to the increased size of *Scarrittia* rather than to any radical change, such as is found in *Homalodotherium*. The lunar, magnum, and trapezoid in *Scarrittia* are larger, comparatively, then in *Thomashuxleya* but not so large as in *Homalodotherium*. The cuboid is much smaller than in either *Thomashuxleya* or *Homalodotherium*. The scaphoid in *Scarrittia* and *Thomashuxleya* articulates with the magnum, but in *Homalodotherium* it does not. The lunar-magnum and the lunar-unciform articulations in *Scarrittia* and *Thomashuxleya* are of equal size, while in *Homalodotherium* the former is larger. However, the pisiform in *Scarrittia* agrees with that of *Homalodotherium* in having no articulation with the ulna.

HIND LIMB

PELVIS

The pelvis of *Scarrittia* is similar to that of *Thomashuxleya* and *Homalodotherium* and differs from that of *Nesodon* in having the ilium expanded into a flat, broad, almost wing-like plate. The anterior edge is rounded and the anterior spine is recurved to point posteriorly. The ischium and pubis differ from those of *Nesodon* in being shorter anteroposteriorly and larger dorsoventrally The obturator foramen is nearly round. The ischium has a short, heavy, proximal portion expanding laterally into a thin, broad plate.

FEMUR

The femur of *Scarrittia* is longer than the humerus, in about the same ratio as in *Thomashuxleya* but not so much so as in *Homalodotherium*. The head is prominent, with a well-defined neck and a pit for the round ligament, a feature which is lacking in *Homalodotherium*. The greater trochanter is high, with a deep digital fossa. The lesser trochanter is small and the third trochanter is large but not prominent. The latter is confined to the upper one-third of the shaft and is not so long as in *Homalodotherium*. In *Nesodon* the third trochanter is located about midway of the shaft.

PATELLA

The patella is quite normal for a mammal of this size, being oval in the anterior view and flattened in the lateral view.

TIBIA AND FIBULA

The tibia is only slightly shorter than the femur, about the same length as the humerus. It is massive and resembles that of *Thomashuxleya*. The fibula is a slender bone and may have been ankylosed at the proximal end with the tibia as in *Nesodon*. However, this seeming fusion may have been due to crushing and bone flow after burial.

PES

Plate 11, figure 2; plate 12

The pes is five toed, but only three of the toes were functional. One specimen (A.M.N.H. No. 29585) of the right foot is sufficiently uncrushed to give a clear picture of the tarsus. On this specimen the fifth digit is represented, but the first has been restored from another specimen.

The pes is shorter and broader than that of *Nesodon* but not so much so as in *Homalodotherium*. The position was in all probability semiplantigrade, approaching *Homalodotherium* in this respect.

TARSUS

CALCANEUM: The calcaneum is short and heavy. The tuberosity is slightly expanded laterally and is deep dorsoventrally. The fibular facet is small and does not project laterally as it does in *Homalodotherium*. On the tibial side of the fibular facet, the facet for the astragalus is convex and set obliquely. The sustentaculum forms a projection on the side of the calcaneum and carries a slightly

TABLE 21

HIND LIMBS

	L	Pelvis PW[a]	DW[b]	L	Femur PW	DW	Tibia L	Fibula L
A.M.N.H. No. 29577	577	705	216	502	—	—	—	—
A.M.N.H. No. 29578	—	—	—	353	—	—	323	310
A.M.N.H. No. 29581								
R	—	—	—	545	131.8	210	491	—
L	—	—	—	534	—	201	505	493
A.M.N.H. No. 29585	—	—	—	—	—	—	516	506
U.S.N.M. No. 13879								
R	—	—	—	516	—	—	455	—
L	527	—	—	482	—	—	447	—

[a] Width at illial wings.
[b] Width at pubis.

concave articular surface for the astragalus. The distal end of the calcaneum is deeper than broad and has a concave articulation for the cuboid which covers the whole width and a little more than half of the depth of the distal end. On the plantar side there is a shallow tendinal sulcus. The bone agrees very closely with Gaudry's description (1906, p. 243, "*Colpodon*") of the calcaneum of *Leontinia*.

ASTRAGALUS: The astragalus also agrees with that of *Leontinia*, according to Gaudry's description (*loc. cit.*). The trochlea is shallow, as in *Nesodon*, the neck short, and the head is only moderately convex. As in *Thomashuxleya* and *Nesodon*, there is no contact with the cuboid. In *Homalodotherium* there is a small contact with the cuboid. As in *Nesodon* there is a rugose tuberosity on the proximal tibial side at the end of the internal side of the trochlea.

NAVICULAR: From the anterior aspect the navicular is nearly trapezoidal in shape. The upper two faces articulate with the astragalus and the lower two with the ectocuneiform and mesocuneiform. The most remarkable feature of the element is a plantar extension which extends posteriorly with a greater length than the anteroposterior dimension of the main part of the bone and to a point well behind the calcaneum. It seems to articulate with a like extension on the ectocuneiform without movement, though this is uncertain because of the crushing and secondary mineralization in the area on this specimen. Scott (1912a, p. 171) mentions a "low tuberosity" in this same position on *Nesodon* and says that it "appears to be the remnant of the usual navicular hook." However, since there is a small hook on the navicular of *Scarrittia* in addition to the plantar extension, it would seem that, in *Scarrittia*, it was not such a remnant.

ECTOCUNEIFORM: The ectocuneiform is a smaller element than the navicular, with articulations for the latter, the mesocuneiform, the cuboid, and metatarsals III and IV. It also has a plantar extension similar to that of the navicular.

MESOCUNEIFORM: The mesocuneiform is the smallest bone present in the tarsus. It does not seem to be fused with the endocuneiform as it is in *Nesodon* (Scott, *loc. cit.*), and

TABLE 22

TARSALS (A.M.N.H. No. 29585)

	L	W	D
Calcaneum			
R	116.3	64.0	65.0
Astragalus			
R	62.1	64.9	44.8
Cuboid			
R	26.3	51.0	63.3
L	27.1	50.4	60.7
Navicular			
R	20.0	44.2	81.1
L	21.1	44.8	77.8
Ectocuneiform			
R	21.8	34.0	86.0
L	21.0	33.8	75.1
Mesocuneiform			
R	16.4	24.0	34.0

it has a small articular facet on the medial side, presumably for articulation with that element.

ENDOCUNEIFORM: The endocuneiform has not been located on the specimens of *Scarrittia* at hand. However, it was probably present, articulating with the navicular, the mesocuneiform, and metatarsal I.

CUBOID: The cuboid is flatter proximodistally than the navicular. From the anterior aspect it is rectangular in shape, with a proximomedial extension towards, but not meeting, the astragalus. Proximally it articulates with the calcaneum on a slightly lower level than the astragalo-navicular articulation but higher than the navicular-ectocuneiform articulation. It also has a plantar extension, but it is not so large as the extensions of the navicular and ectocuneiform. A tuberosity, in the same position but smaller than this extension, is present on the cuboid of *Nesodon* (Scott, 1912a, p. 172).

METATARSUS

There are five metatarsals, only three of which are functional, metatarsals I and V being vestigial. They are divergent and much shorter than the metacarpals. Metatarsal I is represented on only one specimen (A.M.N.H. No. 29580), but it is so crushed and distorted that little can be said of it beyond the fact that it is present. Metatarsal II is the shortest of the functional elements.

TABLE 23
METATARSALS[a]

| | A.M.N.H. No. 29585 | | A.M.N.H. No. 29580 | | A.M.N.H. No. 29581 | A.M.N.H. No. 29578 | |
	R	L	R	L	L	R	L
II							
L	88.3	86.7	—	86.4	—	69.6	—
WP	23.7	24.0	—	26.3	—	—	—
WD	32.8	33.6	—	—	—	—	—
III							
L	110.4	102.6	106.7	103.7	107.5	86.9	85.7
WP	37.0	34.4	37.7	40.7	40.0	—	30.7
WD	38.2	42.0	43.1	46.3	35.9	28.9	
IV							
L	97.8	93.9	96.7	97.1	89.3	—	90.0
WP	41.2	—	39.4	—	—	—	36.9
WD	33.4	—	36.1	—	—	—	—
V							
L	62.0	—	58.8	—	—	—	—
WP	27.8	—	34.9	—	—	—	—
WD	15.5	—	19.9	—	—	—	—

[a] Metatarsal I is not included, since the only specimen is badly crushed.

The proximal end is narrower than the shaft which is straight and nearly round in cross section. The distal end is slightly expanded, and the trochlea extends over nearly the whole width. The trochlea surfaces on the three functional metatarsals do not extend so far up on the dorsal side as they do on the metacarpals. Metatarsal III is the stoutest and longest of the three. The proximal end is only slightly expanded where it articulates with metatarsals II and IV. The shaft is straight and slightly flattened dorsoventrally. The distal end is like that of metatarsal II but larger. Metatarsal IV is longer than metatarsal II, but the shaft is smaller and curved. The proximal end is greatly expanded, taking up all of the distal surface of the cuboid. The shaft is narrow and curves laterally away from an axis normal to the cuboid articular surface. The distal end is expanded but is not so wide as that of metatarsal IV. Metatarsal V is vestigial, but still recognizable, with an expanded proximal end articulating with the cuboid. It is about half of the length of metatarsal III. The distal end is badly mutilated, so the presence or absence of a trochlea and phalanges cannot be determined.

PHALANGES

The phalanges of the functional toes are short and heavy. The ungual phalanges are flattened, with a deep medial cleft, as they are in the manus.

COMPARISON OF THE PES

The pes of *Scarrittia* is more like that of *Nesodon* (Scott, 1912a, pp. 170–175) than that of *Homalodotherium*. It only approaches the latter, in which the astragalus and cuboid meet (as they do not in *Nesodon*) in the proximomedial extension of the cuboid towards the astragalus and in the proximal position of the calcaneal-cuboid articulation. In *Nesodon* this articulation is on a level with the articulation between the navicular and the ectocuneiform. *Scarrittia* also differs from *Nesodon* in the plantar extensions on the navicular, ectocuneiform, and cuboid which are represented by tuberosities in *Nesodon*. In *Nesodon* metatarsal IV is as stout in the shaft as metatarsal II and in *Scarrittia* it is not.

In *Adinotherium* (Scott, 1912a, pp. 215–217) metatarsal IV is stouter and heavier than metatarsal II, while in *Scarrittia* the opposite is true.

TABLE 24

LIMB INDICES

	Humero-radial	Humero-metacarpal	Humero-femoral	Femoro-tibial	Tibio-metatarsal
Scarrittia					
A.M.N.H. No. 29578	102	43	93	91	26
A.M.N.H. No. 29581 (R)	97	40	89	90	—
A.M.N.H. No. 29581 (L)	103	43	90	94	21
A.M.N.H. No. 29585	93	45	84	—	—
Thomashuxleya[a]	75.3[b]	31[b]	90[b]	88	35
Homalodotherium[a]	112	47	76	60	26
Nesodon[a]	78	38	97	87	25

[a] After Simpson (1936b, p. 9).
[b] Average of three indices given by Simpson.

The tarsus of *Rhynchippus* (see above) differs from that of *Scarrittia* in being more compact. The metatarsals are not divergent. The cuboid is far removed from the astragalus, in fact the calcaneal-cuboid articulation is on a level with the navicular-ectocuneiform articulation as it is in *Nesodon*. The calcaneum is longer and narrower than in *Scarrittia*, and the neck is much longer. The trochlea of the astragalus is shallower and rather narrower and the neck is more distinct.

The indices as given for *Scarrittia* in table 24 are only approximate since, as mentioned above, the crushed condition of the bone precludes any exact measurements. However, they do show general trends in that the fore legs are longer than in *Thomashuxleya* or *Nesodon* but not so long as in *Homalodotherium*. Also there has been no great lengthening of the femur as in *Homalodotherium*, but the tibia is longer than in *Nesodon* and *Thomashuxleya*.

POSSIBLE SKIN

On one specimen (A.M.N.H. No. 29581) a difference in matrix color and texture in the belly region might possibly indicate the remains of skin. However, there is nothing definite in the indication. A thin section taken from the area shows no recognizable skin structures such as hair follicles. It is possible, though, that such structures were destroyed either by the dehydration of the animal before burial or by the extreme compaction of the bentonite after burial. Petrographically the specimen is composed of 70 to 80 per cent limonite, and the rest is chalcedony and opal.

RELATIONSHIPS

GENERIC

Ameghino described and included in his family Leontiniidae, at various times, 11 genera with 28 species (see table 25). Of these only three genera, *Leontinia*, *Colpodon*, and *Ancylocoelus*, were generally recognized as valid previous to the discovery of *Scarrittia*. In addition to *Scarrittia* the list should include, at least for the present, *Scaphops* and *Henricofilholia*.

Scaphops was made synonymous with *Leontinia* by Loomis (1914, p. 108) because

"*Scaphops* is based on a mandibular symphysis, which is wider than usual for *Leontinia*" and, in his opinion, would come within the range of individual variation of *Leontinia*. However, the genus was based on a premaxilla ("intermaxillary," Ameghino, 1895, p. 629).[1] Later, in what amounts to a redefinition of the genus, Ameghino (1897b, p. 475) states that the first lower premolar is missing and it is, therefore, distinct from

[1] Actually, if *Scaphops* and *Leontinia* were synonymous, the former genus would have page priority.

Leontinia. It is distinct from *Ancylocoelus* in having both the upper and lower canines present.

Henricofilholia was included in the Leontiniidae by Ameghino. Loomis (1914, p. 132) placed the genus in the Isotemnidae. However, the cheek teeth have more of a leontiniid aspect in the small internal cingula, the well-developed protoloph and smaller metaloph, and the pillar at the external anterior corner which makes the crown triangular in shape. The lack of knowledge of the incisors and canines is unfortunate and, at present, the genus can be placed only provisionally in the family Leontiniidae.

The other genera and species referred to the family by Ameghino are much too poorly known for even a provisional classification. *Leontinia tertiaria* was described by Ameghino (1902b, p. 105) on the basis of two "deciduous" molars from the Colhuehuapian. The species is too problematical for confidence in its validity. *Pyralophodon* and both species of *Loxocoelus* were based on upper cheek teeth and are not well enough known to be established definitely.

Scarrittia, because of its closeness to *Leontinia*, is certainly a member of the family. As is said above, it might possibly be found to be a subgenus of *Leontinia* when more adequate skeletal material of the latter genus is discovered. The question of how the two genera are related makes interesting speculation. It would also have a bearing on the stratigraphical relationship between the Scarritt Pocket beds and the typical Deseadan.

It is reasonable to assume, without direct evidence, that all the leontiniids arose from the same stock, probably isotemnid. It is also reasonable to assume that in this ancestral stock none of the incisors had become enlarged towards the caniniform condition of the leontiniids.

By definition of the family, the early leontiniid stock, as yet unknown or unrecognized, began the caniniform enlargement of the incisors. Since in leontiniids, other than *Scarrittia*, in which the premaxillary teeth are known, it is the second upper incisor that is enlarged into a caniniform, it would again be a reasonable assumption that this was the primitive leontiniid condition. There-fore, the development of the leontiniids was a matter of the forward shift of the growth gradient from the canine to I^2 and I_3. There may have been an intermediate with the high of the growth gradient at I^3.

If these assumptions are true, then the development of *Scarrittia* might have followed any one of three or more lines as follows: (1) the forward shift of the growth gradient may have been progressive from the high at the upper canine (ancestral), through a high at I^3 (hypothetical), to a high at I^2 (*Leontinia*) and, finally, to a high at I^1 (*Scarrittia*); (2) the growth gradient may have shifted from the canine to a slight high at both the canine and I^2 (pre-*Leontinia*) and then branched to a high at I^1 (*Scarrittia*) and a high at I^2 (*Leontinia*); or (3) the gradient may have shifted directly and independently from the ancestral condition to the high at I^2 (*Leontinia*) and the high at I^1 (*Scarrittia*).

If proposition one were true and *Scarrittia* were a descendant of *Leontinia* then there should be some other evidence of advancement of *Scarrittia* over *Leontinia*. One dubious bit of evidence, the seeming greater width of the *Scarrittia* skull as shown by the auditory region described above, would corroborate the advancement of *Scarrittia* over *Leontinia* and, consequently, the slightly younger age of the Scarritt Pocket beds over the typical Deseadan. This evidence, however, is based on one specimen of *Scarrittia* and may well be a size or an age characteristic.

If proposition three were true and *Scarrittia* and *Leontinia* were parallel descendants of a pre-*Leontinia* then there should be, even in closely parallel lines, some significant differences other than in the upper caniniforms. So far as is known there are none.

Proposition two, in the light of present knowledge, is the most reasonable and gives the best explanation of the similarity of the two genera.

On the basis of the dentition the family can be divided into two "subgroups" (not subfamilies) for convenience only. *Scarrittia* and *Leontinia*, with their complete dental formulas, form one of these. *Ancylocoelus* and *Scaphops* of the Deseadan and *Colpodon* of the Colhuehuapian would form the second

TABLE 25

List of Species of Ameghino's Leontiniids

Name	Age	Present Status
Leontinia gaudryi	Deseadan	Valid
Leontinia garzoni	Deseadan	Valid
Leontinia (Senodon) lapidosa	Deseadan	= *L. gaudryi*[a]
Leontinia oxyrhyncha	Deseadan	= *L. gaudryi*[a]
Leontinia stenognatha	Deseadan	= *L. gaudryi*[a]
Leontinia fissicolis	Deseadan	= *L. gaudryi*[a]
Leontinia tertiaria	Colhuehuapian	?
Colpodon propinquus	Colhuehuapian	Valid
Colpodon plicatus	Colhuehuapian	?
Colpodon distinctus	Colhuehuapian	?
(*Colpodon divisus*)	Colhuehuapian	*Nomen nudum*
Ancylocoelus frequens	Deseadan	Valid
Ancylocoelus lentus	Deseadan	Valid?
Ancylocoelus minor	Deseadan	Valid?
Scaphops grypus	Deseadan	Valid?
Stenogenium sclerops	Deseadan	= *L. gaudryi*[a]
Stenogenius aenigmaticum	Mustersan	?
Rodiotherium armatum	Deseadan	= *Ancylocoelus armatum*[a]
Loxocoelus carinatus	Deseadan	?
Loxocoelus obturus	Deseadan	?
Pyralophodon pyriformis	Deseadan	?
Hedralophus bicostatus	Casamayoran	Isotemnidae
Carlodarwinia pyramidentata	Mustersan	Isotemnidae
Henricofilholia cingulata	Deseadan	Valid
Henricofilholia circumdata	Deseadan	Valid
Henricofilholia inaequilatera	Deseadan	= *H. cingulata?*
Henricofilholia intercincta	Deseadan	= *Parastrapotherium ephebicum*[a]
Henricofilholia lemoinei	Deseadan	= *Parastrapotherium ephebicum*[a]
Henricofilholia lustrata	Deseadan	Valid?

[a] Loomis (1914).

"subgroup" because in these forms one or more teeth are lacking from the series.

Where *Henricofilholia* fits, if, indeed, it does at all in this family, is problematical and must remain so until the anterior teeth of this genus are described.

FAMILIAL

The family Leontiniidae was proposed by Ameghino (1895, p. 646) to include ungulates with upper and lower third incisors enlarged into caniniform teeth. He also noted that the upper cheek teeth resembled those of *Homalodotherium*, while the lower teeth resembled those of *Nesodon*. Later (1897, p. 469), with more material at hand, he found that it was the second upper incisor, rather than the third, that was enlarged.

With the inclusion of *Scarrittia* in the family a redefinition is needed.

REVISED DEFINITION: Toxodonta, with either the first or second upper incisor and the third lower incisor enlarged, caniniform. Protoloph much larger than metaloph. Median valley of the molars with simple cristae. Metaloph and hypoloph enclose a single posterior fossette. Talonid wide and hypolophid less than half of the length of the whole talonid.

When Ameghino redescribed the family he emphasized the supposed intermediate position of the family between the Homalodotheridae and the Nesodontidae. However, he grouped the family with the former in Cope's Ancylopoda, ignoring his previously proposed Suborder Entelonychia (1893). Subsequent authors, not accepting Ameghino's concept of the ancestral position of

the South American forms, revived the term Entelonychia.

Scott (1912b, p. 243) excluded the Leontiniidae from the Entelonychia on the basis of Gaudry's statement (1906, p. 29) that *Leontinia* (*Colpodon* of Gaudry) had three toes on the pes, which was an inference based on the few tarsal elements referred to the genus. Scott also considered the general character of the skull and enlargement of the incisors to be typically toxodont features. Later Patterson (1936a) pointed out that the ear structure of the leontiniids is fundamentally that of the toxodonts.

At the same time Patterson found that *Homalodotherium* also had a toxodont ear region, though more advanced in having (*op. cit.*, p. 225) "a larger, more laterally extended hypotympanic sinus" and that the strange specializations of the group merely overlay the toxodont characters.

Simpson (1945b, p. 238) emphasized the close relationship of the Leontiniidae and Homalodotheriidae by saying that "some infraordinal or superfamilial distinction may yet be acceptable." While it is not the purpose of this paper to propose such a group, the close relationship of the two families to each other and to the isotemnids should be emphasized further than it has been since Ameghino. As Simpson has pointed out (*loc. cit.*), the peculiar limb structure of *Homalodotherium* was the character for the group Entelonychia and these peculiarities are merely superficial.

It must be pointed out that *Scarrittia* and, presumably, *Leontinia* had five toes on the pes, which, even though only three were functional, should remove Scott's objection (see above) to the close relationship between the two families.

The skeleton of *Scarrittia* shows to some degree the position of the Leontiniidae in relation to the Homalodotheriidae, the Toxodontidae, and the Notohippidae. It would seem that it is intermediate between the Homalodotheriidae and the Toxodontidae, though closer to the former, and much farther removed from the Notohippidae. It is unfortunate that the earliest skeletal material of the Toxodontidae (*Nesodon* and *Adinotherium*) and of the Homalodotheriidae comes from the Santacruzian (lower middle Mio-

cene) and is, therefore, presumably more advanced than that of *Scarrittia*. There are, however, some differences that seem to be due to more than advancement.

As Patterson (1932, 1936a) pointed out, the basic structure of the auditory regions of all four families is much the same. There are minor differences such as the relative positions of the porus acusticus externus, the stylomastoid foramen, and the postglenoid foramen, the size and shape of the crista meati, and its relation to the post-tympanic process and the postglenoid process. In *Rhynchippus* the porus acusticus externus is large, just posterior to the postglenoid foramen and dorsal to the stylomastoid foramen, which opens rather ventrally. The crista meati is distinct and projects well below the post-tympanic and postglenoid processes. In *Homalodotherium* the porus is slightly higher than the postglenoid foramen and the crista meati is distinct but does not project much beyond the postglenoid process. In *Nesodon* and *Adinotherium* the porus is very high, the crista meati is distinct from the postglenoid and the post-tympanic processes and extends far below the former. In *Scarrittia* the porus is on a level with the postglenoid foramen and far above the stylomastoid foramen. The crista meati is not distinct from the postglenoid and post-tympanic processes and forms a part of the former.

These differences of size and relationship are probably not basic family characters and may vary considerably within each family. However, they do show that, on the basis of the auditory region, the Leontiniidae are no more closely related to one family than to another.

The teeth of the four families differ only in the details and not in the basic pattern. *Nesodon* and *Adinotherium* have hypsodont teeth as does *Proadinotherium* (Deseadan) to a lesser degree. The teeth of *Scarrittia* are mesodont and those of *Homalodotherium* are the lowest of all. One upper and one lower incisor on each side of the dentition of the toxodonts and the leontiniids are enlarged. In the former they are broad and rather flat teeth resembling those of large rodents, while in the latter they are caniniform.

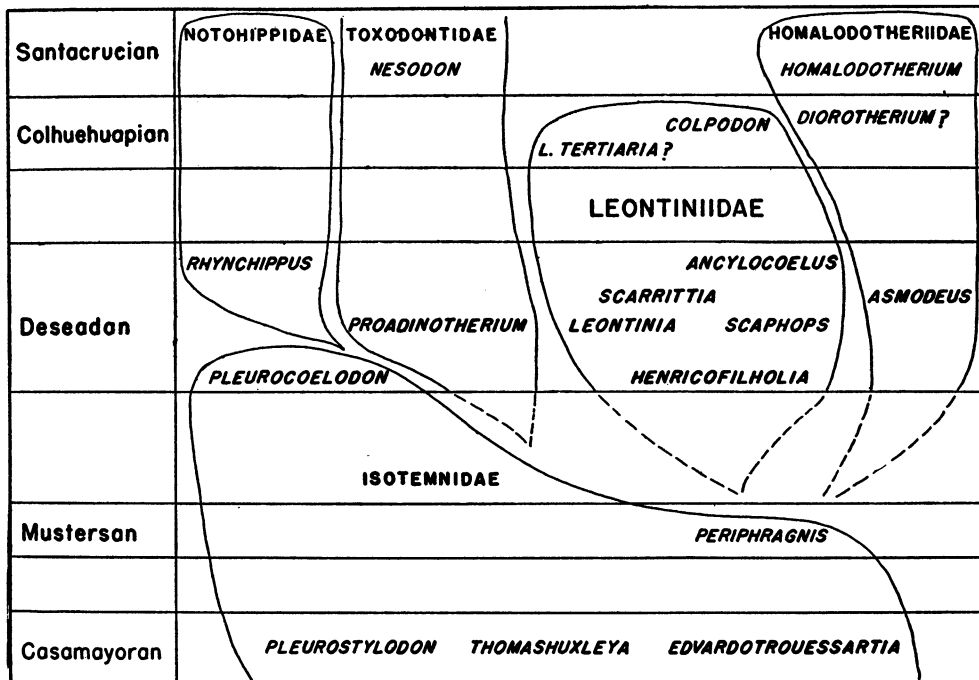The upper molars have the same basic design of protoloph, ectoloph, and metaloph.

Santacrucian	NOTOHIPPIDAE	TOXODONTIDAE NESODON		HOMALODOTHERIIDAE HOMALODOTHERIUM
Colhuehuapian			COLPODON L. TERTIARIA?	DIOROTHERIUM?
			LEONTINIIDAE	
Deseadon	RHYNCHIPPUS	PROADINOTHERIUM	ANCYLOCOELUS SCARRITTIA LEONTINIA SCAPHOPS HENRICOFILHOLIA	ASMODEUS
	PLEUROCOELODON			
		ISOTEMNIDAE		
Musteran			PERIPHRAGNIS	
Casamayoran		PLEUROSTYLODON THOMASHUXLEYA EDVARDOTROUESSARTIA		

FIG. 7. Tentative relationships of the Leontiniidae.

Homalodotherium has nearly square teeth of the simplest type, with the lophs uncomplicated by any cristae or crochets or by the posterior cingulum taking part in the crown structure. The leontiniid molars are slightly longer than wide and are complicated, with a small crista appearing temporarily on the ectoloph and the posterior cingulum joining with the metaloph to enclose a fossette. The notohippid teeth are longer than wide, with a crown pattern more complicated by cristae, crochets, the fossettes enclosed by them, and by the posterior cingulum. The toxodonts of the subfamily Neosdontinae have long, rather narrow teeth. The crown patterns are the most complicated of the four groups, with long secondary cristae and large posterior cingula.

The lower teeth show fewer differences between the families than do the upper. Because of the posterior extension of the hypolophid in *Nesodon* and *Rhynchippus* the width-length ratios of the lower molars of these genera are lower than the same ratios in *Homalodotherium* and *Scarrittia*. In *Homalodotherium* the trigonid is larger in comparison to the talonid than it is in *Scarrittia*, in

which it is, in turn, larger than in *Nesodon* or *Rhynchippus*.

The skeletal features of *Scarrittia* place the leontiniids in an intermediate position between the homalodotheres and the toxodonts but rather closer to the former than the latter. The vertebrae are more like those of the former (see description above). The scapula, though broader and more rounded than in either *Nesodon* or *Homalodotherium*, has a single metacromium as in the latter. The other elements of the fore limbs resemble those of *Nesodon* more than of *Homalodotherium*, but the latter is extremely specialized in these members and resemblances to *Scarrittia*, if any, have been well masked. In the hind limbs the femur differs from that of *Nesodon* in its greater comparative length and by the more proximal position of the third trochanter, both of which features approach the condition in *Homalodotherium*. The tibia and fibula are, as in *Nesodon*, nearly as long as the femur. The pes tends more towards that of *Homalodotherium*, in spite of the high specialization in the latter, in that the cuboid has a tendency towards articulation with the astragalus.

The evidence above is certainly not conclusive and many, if not all, of the features used for comparison may well turn out to be due to parallelism or generic differences alone. Without further evidence, however, of definite ancestral forms, it suggests that the Leontiniidae are a trifle closer to the Homalodotheriidae than to the Toxodontidae and even farther removed from the Notohippidae.

All four families probably arose from the Isotemnidae but not from the same member of that family. Except for the skeleton of *Thomashuxleya* (Simpson, 1936b), the feet of *Periphragnis*, and a few skulls, only the teeth of the genera of this family are well known. *Thomashuxleya*, except for the peculiar zygapophysis of the lumbars (Simpson, 1936b, p. 3), could be ancestral to any one of the families.

The Casamayoran isotemnids can be arranged according to the degree of molar complication that they show from *Pleurostylodon* and *Thomashuxleya* on one hand, with molars showing a tendency towards the development of cristae and fossettes, to the simpler type of *Edvardotrouessartia* on the other. Such an arrangement may not have any validity in the light of additional skeletal material, but for the present it suffices to indicate the possibility that the Toxodontidae and Notohippidae, on the one hand, and the Leontiniidae and Homalodotheridae, on the other, may have come from the two extremes of such an arrangement.

Although the Mustersan isotemnid *Periphragnis* is not on the direct line of ascent to the Deseadan homalodotheres, *Asmodeus*[1] and possibly *Lophocoelus*, it is near to the ancestral form of that group and possibly to that of the Leontiniidae. The small, partially flattened, ungual phalanges of *Periphragnis*, even though cleft, would not seem to have given rise to the heavy claws that characterize the homalodothere line. The teeth show none of the lengthening of the molars or reduction of the canines that characterize the leontiniid ancestor.

[1] It would be interesting to know why Ameghino named this genus after the "king of demons" of Jewish tradition. (Encyclopaedia Britannica, 11th edition.)

ORDINAL AND SUBORDINAL

The Order Notoungulata was established by Roth (1903, p. 33) on the basis of the structure of the auditory region: an inflated osseous bulla and hypotympanic sinus, and a well-developed epitympanic sinus in the squamosal. The history of the order and the suborders that have been assigned to it at various times has been adequately covered by Simpson (1945b, pp. 236–238; 1948, pp. 142–145). It suffices to say that the order is now well established and includes the Suborders Notioprogonia, Toxodonta, Typotheria, and Hegetotheria. The first of these was confined to the Paleocene and Eocene and is not pertinent here except as an ancestral group. The last two are represented in the associated faunules, but a discussion of the subordinal characters is beyond the scope of this paper.

The term Toxodontia was first used by Owen in 1858 to include the few South American ungulate genera then known. In subsequent years various authors (Lydekker, Zittel, etc.) added to and subtracted from the group as additional material was described. When Roth (1903) made clear the fundamental similarities of some of these groups, the toxodonts proper were included in the Notoungulata. Scott (1940b) retained the term Toxodontia under the Notoungulata equal in rank to "Litoptema" [Litopterna] and ?Astrapotheria. At the same time he placed under Toxodontia what may be considered as three suborders, Toxodonta, Typotheria, and Homalodotheria. Simpson (1934c, p. 9) pointed out that Scott's later (1913) use of the term Toxodontia was exactly synonymous with Roth's Notoungulata and that, to avoid confusion of similar names of different rank, it would be better to retain Roth's name and use Scott's (1904) Toxodonta in a subordinal rank under it.

Patterson (1936a, p. 224) described the distinctive ear region of the Toxodonta as follows: hypotympanic sinus equal to or larger than tympanic cavity and ventral to it; a small horizontal septum between tympanic cavity and hypotympanic sinus; projecting, laterally compressed styliform process usually present; internal carotid artery traversing bulla.
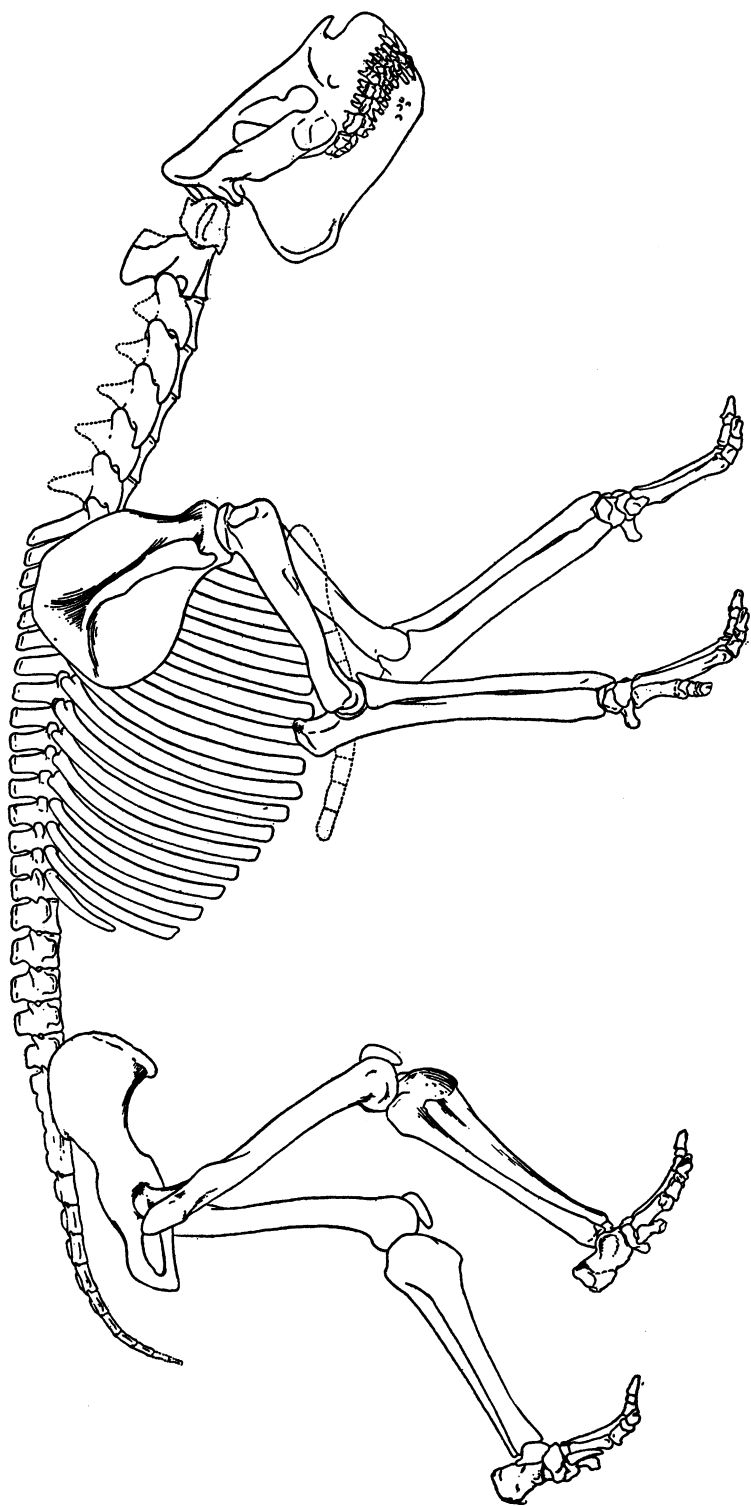
FIG. 8. *Scarrittia canquelensis* Simpson. Reconstruction of the skeleton. ×1/15 (approximate).

RECONSTRUCTION AND RESTORATION

The preparation of a paper reconstruction of a *Scarrittia* skeleton was a considerable problem because of the crushing so often deplored above. John Germann, who did the major portion of the drawing, and John Le Grand, who filled in many of the details, both staff artists at the American Museum of Natural History, are largely responsible for the excellence of figure 8. Each major element of the skeleton was drawn separately, with the effects of crushing eliminated as far as possible. These paper elements were then posed and drawn as the reconstruction. There are unavoidable inaccuracies in the drawing. For example, it was impossible to say what proportion of the length, width, and height of the specimen to be drawn was due to crushing.

The main problems of the pose of the skeleton centered around the following points: the heavy skull and neck; the short neural spines of the thoracic vertebrae; the comparative lengths of the fore and hind limbs; and the digitigrade manus and semi-plantigrade pes.

Because of the first two points it was believed that the head was carried in a very low position with the neck straight. It was felt that the short neural spines did not give sufficient attachment for large splenius muscles that would be necessary to raise the weight of the head, especially with the increased leverage caused by the long neck.

The second two points resolved themselves rather easily. It was found that the digitigrade manus made up the extra length needed in the fore limbs, and the semi-plantigrade pes reduced the extra length of the hind limbs so that the axial skeleton could be maintained at a reasonable level.

The life restoration of *Scarrittia* (pl. 6) was done by John Germann. The animals are depicted as coming to the water-hole in the Scarritt Pocket crater and being killed by the poison gas emitted by a still active fumerole. Another hypothesis of their reason for being in the crater and their death is discussed below.

The beast is shown with a square muzzle. The retraction of the nasal bones and their stoutness indicate the presence of a rather mobile upper lip or a slight proboscis. The mobile upper lip was preferred because of the narrowness of the premaxillae, though this does not rule out the possibility of a protruding snout.

The feet are shown as graviportal, with large pads. It may be that in the manus the digits were freer and more distinct from one another as they are in the modern tapir. The nails covering the ungual phalanges in the restoration may very possibly be entirely wrong. They are depicted as like a modern graviportal animal such as the rhinoceros. No modern mammal of this type, however, has clefts in the ungual phalanges as in *Scarrittia*. This condition is found in other fossil groups such as the isotemnids (*Periphragnis*), the amblypods (*Titanoides*, Patterson, 1935b), and the palaeosyopine titanotheres. It is probably a primitive character, but it seems reasonable to suppose that its presence was adaptive. The cleft in the unguals of clawed mammals is for the origin of ligamentous attachment for the claw. It is probable that the cleft in *Scarrittia* would serve the same purpose and that the nail or hoof was more claw-like than can be imagined from the flattened shape of the unguals.

PALEOECOLOGY

Scarrittia was a moderately heavy animal, larger than a modern tapir but smaller than a rhinoceros. Although long legged, it was probably a slow, ponderous beast, relying on concealment, rather than speed, or active defense, to escape the contemporary carnivorous borhyaenids. The caniniform incisors might have been used for defense, but the heavy neck and weak back seem to preclude any effective use in a method of attack that requires speed and mobility of the head. The

large, low-crowned cheek teeth suggest a browsing habit of eating on some tough, perhaps fibrous, vegetation. The broad feet suggest locomotion on soft ground.

This would indicate a forest habitat with plenty of vegetation for concealment and food. A modern counterpart is the South and Central American tropical forest.

The rest of the faunule of the Crater Lake beds adds little to the picture. Frogs, except that they must have water, and

rodents are quite universal in their choice of habitats in temperate and tropical climates. The borhyaenids probably secured part of their food by preying on the *Scarrittia* herds. The rhynchippid gives the impression of having inhabited more open country. Its incisors are cropping teeth, and the compact feet seem better suited to hard ground. However, the relative proportions of *Scarrittia* specimens to the one *Rhynchippus* found in the Crater Lake beds gives more weight to the theory of a jungle habitat.

The faunule of the upper beds is quite different and has little bearing on the living conditions of *Scarrittia*. The faunule inhabited the area some time after the disappearance of the Crater Lake and after volcanic activity had changed the conditions.

An interesting, although not conclusive, side light on this study has been the parallelism between the leontiniids and the North American titanotheres, especially those of the Eocene. Skeletally the palaeosyopine titanotheres are very similar to *Scarrittia*. The teeth have large grinding surfaces, and the canines are placed far forward by the reduction of the incisors so that they would have functioned in much the same way as the caniniforms of the leontiniids.

To carry the parallelism a bit further, both groups had clawed ungulate relatives, the homalodotheres in South America and the chalicotheres in North America. In both continents the clawed relatives lived to a later epoch than did the leontiniids or the titanotheres.

The fact that the parallelism was in two related groups led to interesting, but possibly far-fetched, speculation. The existence of clawed ungulates has been an enigma in the study of paleoecology since their discovery. But here are two such groups, living at approximately the same time and having relatives, also parallel, that died out earlier.

It has been suggested that the chalicotheres had a diet of tubers and that they used the large claws for digging. Cleft unguals were present in *Scarrittia* and the early titanotheres, as they were, to be sure, in several other primitive groups in both North and South America. The clefts might have been present to strengthen the attachment of a covering for the unguals that would permit some sort of limited digging.

Could it be that during the Eocene and Oligocene there was in both North and South America some food source of important quantity that has entirely disappeared, or is drastically reduced, in modern times? It is known that during the Oligocene the grasses were becoming an important food supply. What had filled the niche before the grasses began to occupy it? Was there some fleshy rooted plant that was driven out, perhaps lasting in limited quantities into the Miocene?

There is no paleobotanical evidence to support this speculation and, because of the very nature of fleshy roots, there is little likelihood of there ever being any. The hypothesis, though it should not be dignified by that name, is included here in the hope that the idea of a possible type of feeding, other than browsing and grazing, may stimulate thinking in that direction.

The question of why the *Scarrittia* remains were concentrated in such large numbers in one spot is interesting. It was pointed out above that the crater of Scarritt Pocket contained a small lake or pond which may have been a water-hole for the *Scarrittia* herd of the area. There was vegetation growing in the water or on the slopes of the crater, because plant remains, so far unclassified, were found in the Crater Lake beds.

The theory has been advanced that the animals were overcome by gases from a still active fumarole. The gases, perhaps normally cleared from the crater by wind, might have collected in lethal quantities on still days and have killed the beasts as they came to drink.

Another theory is that the crater formed a refuge for the *Scarrittia* herd, driven from their normal haunts by increasing volcanic activity in the area and that either starvation or suffocation from a volcanic ash fall was the cause of death.

The fact upholding the gas theory is that the accumulation of the *Scarrittia* remains took place over a period of some time, perhaps years, since the specimens were found at different levels in the Lake beds, and that there was no evidence of predation (predators would also have been gassed). However, quick burial of the remains would be necessary to keep predators off after the gas concentration had lessened. The second theory provides for burial by the ash fall during death.

SUMMARY OF THE DESEADAN STAGE

HISTORY

FLORENTINO AMEGHINO DESCRIBED the genus *Pyrotherium* in 1888 on the basis of a molar sent to him a few years before by Capt. Antonio Romero from the territory of Neuquén. In the same year his brother Carlos discovered *Pyrotherium* remains in Chubut, as well as bones of other animals. In subsequent trips to Patagonia during the years 1889 to 1894 Carlos collected a considerable fauna from these beds. In 1895 Florentino published his "Première contribution a la connaissance de la faune mammalogique des couches a *Pyrotherium*," and in 1897 his second contribution appeared.

The name Deseado formation was first applied to these beds by Gaudry (1906) on the basis of collections made by Tournouër near the Rio Deseado. This locality name replaced Ameghino's faunal name of *Pyrotherium* beds. However, the term Deseado formation should not be used at present for all of Ameghino's *Pyrotherium* localities, since it is doubtful that they are all lithologically similar or would form a mappable unit. Therefore, in this present discussion, the beds are referred to as of the Deseadan stage with no intent to group them in the Deseado formation.

LOCALITIES

There are 11 definite localities of Deseadan faunules. These are located on the accompanying map (fig. 9) and are explained below:

1. Scarritt Pocket, southwest portion of Rinconada de los Lopez, west side of Sierra Canquel, central Chubut. The beds are tuffs, breccias, and bentonites of pyroclastic and pyroclastic-lacustrine origin containing an essentially Deseadan faunule.

2. Cerro del Humo, north of Lago Musters, Chubut. A major Mustersan locality but with some Deseadan present.

3. Cerro Blanco (see 5 below).

4. Kilometer 170 (of the railroad from Comodoro Rivadavia to Sarmiento; see 5 below).

5. Barranca south of Lago Colhué-Huapí, Chubut. Localities 3, 4, and 5 are all similar and essentially a continuation of the same section. Casamayoran, Mustersan, Deseadan, and Colhuehuapian are present, with good faunules from each.

6. Cabeza Blanca, east of the Rio Chico del

Chubut and west of Puerto Visser, Chubut. From this locality have come most of the Deseadan specimens in the Ameghino collection and all of the Loomis collection at Amherst College.

7. Pico Truncado, north bank of the Rio Deseado, Santa Cruz. There is some Deseadan in the vicinity with a small faunule. The Chicago Natural History Museum has a collection from here.

8. Mazaredo (see 9 below).

9. Punta Nava, on the coast of Gulfo San Jorge, Santa Cruz. Deseadan beds reported by both Ameghino and Tournouër but may be only lithologic correlation.

10. Rio Deseado, Santa Cruz. Tournouër collected at a locality on the south bank of the river a few miles from the mouth. This may be taken as the type locality of the Deseado formation.

11. La Flecha, Santa Cruz. The Chicago Natural History Museum has a collection from here.

There are also several possible Deseadan localities and a few highly questionable localities that are not located on the map. These are as follows:

12. Near Neuquén, at the junction of the Rio Neuquén and the Rio Limay to form the Rio Negro, Neuquén Territory. This is the locality given by Ameghino on his sketch map of *Pyrotherium* exposures (1906, p. 99) as the source of his type of *Pyrotherium romeroi* supposedly collected with dinosaur bones. This place has never been relocated and may not have existed. The *Pyrotherium* material may very well have come from farther south.

13. Misiones Territory. In 1906 Ameghino made the statement that the *Pyrotherium* beds (Deseadan) extended from "le territoire de Misiones au N. E. de la République Argentine jusqu'à San Julian dans la Patagonie australe." He mentions finding *Pyrotherium* material here with *Ostrea guaranitica*.

14. Rio Chubut. On his map of the *Pyrotherium* beds (*loc. cit.*) Ameghino shows an exposure near the Rio Chubut at approximately latitude 43° 30′ S., longitude 69° 20′ W.

15. Laguna del Maté (Laguna Pelado, Simpson, 1936c, p. 65), northwest of Lago Palacios, Chubut. Mentioned as a *Pyrotherium* locality by C. Ameghino (1890, p. 45).

16. Near Gran Bajo, south of the Rio Deseado, Santa Cruz. Locality shown on Ameghino's map (*loc. cit.*) at approximately latitude 47° 40′ S., longitude 67° 28′ W.
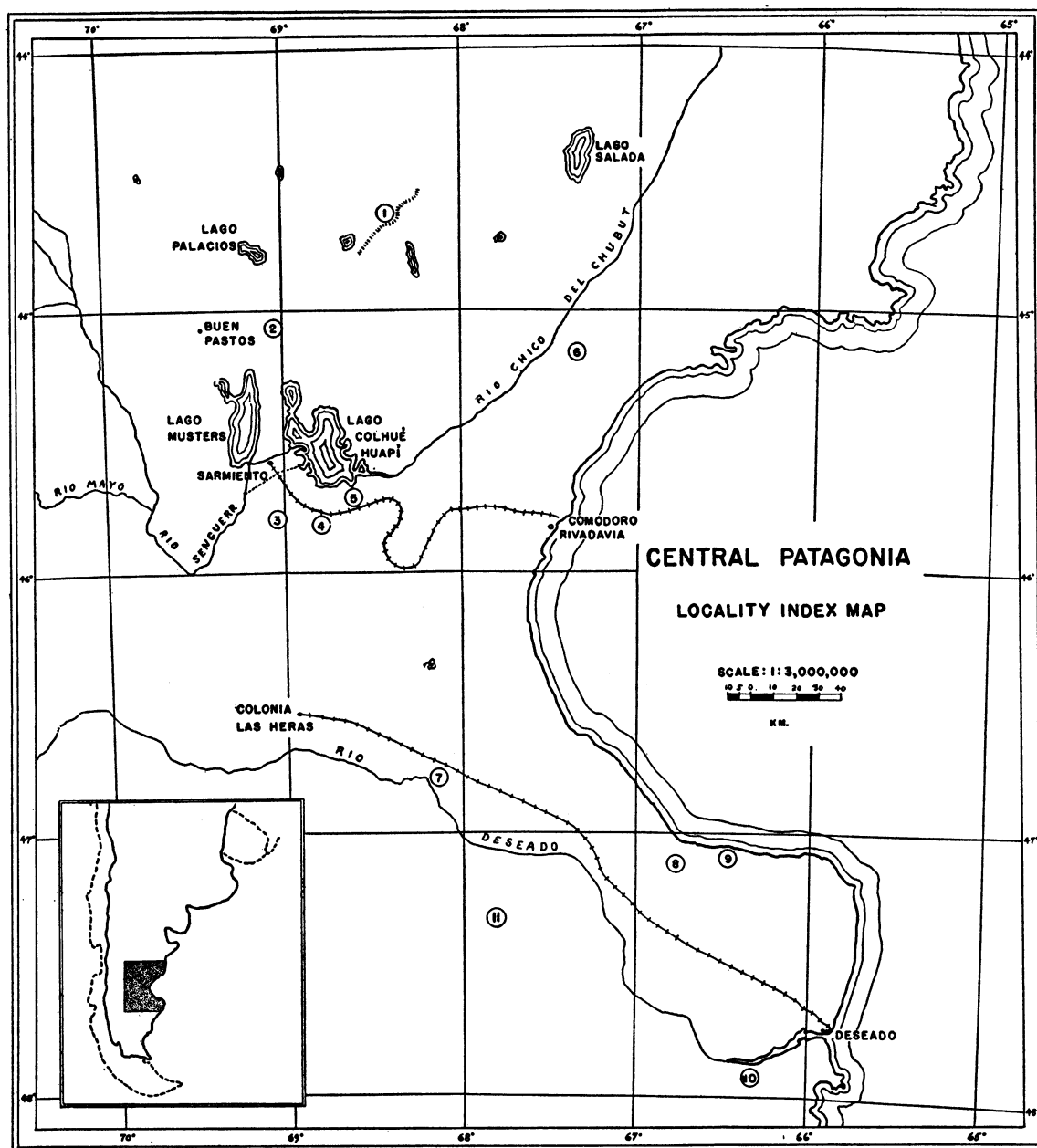
17. Capo Guardian (Capo Watchman of C.

FIG. 9. Map of Deseadan localities. Explanation in accompanying text.

Ameghino), Santa Cruz. Shown by C. Ameghino as having Deseadan beds on large cross section of the coastal exposures (F. Ameghino, 1906).

18. Monte Espejo, Santa Cruz. Probably near the mouth of the Rio Seco. (F. Ameghino, 1906; see 17 above.)

19. Near the source of the Rio Deseado, Santa Cruz. On his third trip to Patagonia C. Ameghino reported a *Pyrotherium* fauna from this area, but,

because of the hardships of travel and transportation, he did not collect any specimens (F. Ameghino, 1895).

20. Lago Viedma and Lago Argentina, Santa Cruz. On his fourth and fifth trips C. Ameghino found the *Pyrotherium* fauna at these localities (F. Ameghino, 1895). These two lakes are near San Julian, giving the southern limit of Ameghino's extent of the beds (see 13 above).

In none of his publications does Ameghino give faunule lists by localities. It is quite improbable that all the genera listed by him (1906) as being from the *Pyrotherium* beds came from each locality or even that all the specimens came from just one. He did seem to recognize some difference between the fauna from the northern localities and that from the southern areas but only in two genera. He states (1895) that *Pyrotherium romeroi* is characteristic of the beds of Neuquén and Chubut ("de la Patagonié septentrionale"), while *P. sorondoi* is characteristic of the beds in Santa Cruz ("de la Patagonié austral"). He also says that *Trachytherus spegazzinianus* is rare in the south but common in the north and that *T. conturbatus* is found only in the north.

SOUTH AMERICAN EQUIVALENTS

The Divisadero Largo formation in the Province of Mendoza, Argentina, is probably of Deseadan age (Minoprio, 1947; Simpson and Minoprio, 1949). The known faunule consists of four mammals, one bird, and one reptile. Two of the mammalian genera, *Trachytherus* and *Prohegetotherium*, are found elsewhere in the Deseadan and only in the Deseadan, unless the Tecan is a true stage (see below). Another genus, *Adiantoides* Simpson and Minoprio (1949, p. 6), is "analogous in evolutionary advance to its Deseadan ally *Proadiantus*" (p. 26).

There are a few other localities, with very limited faunules, which may or may not be of Deseadan age. The Tecan (Teckan, Tequéen, Tequense) beds were named by Ameghino (1906, p. 222) as a stage which he placed above the Deseadan and below the Colhuehuapian. The only genera that he mentions are *Trachytherus* and *Propachyrucos*, and he gives two localities on a map (1906, p. 227, from a verbal communication from Roth), one called "Pecararo" on the Rio Teca, a branch of the Rio Chubut, and another, "Piramides" near the Rio Chubut at approximately latitude 43° 50' S., longitude 69° 05' W. There is some doubt as to whether these localities are actually on the Rio Chubut and its tributaries or on the Rio Negro. Roth mentions (1898b) collecting what he identifies as *Trachytherus* and *Propachyrucos* along the Rio **Negro** and its tributaries. Since the two rivers are similar in appearance on the maps of Argentina, it is possible that Roth made a mistake in pointing out his localities to Ameghino.

As far as can be determined, the only basis Ameghino had for placing these beds higher than the Deseadan is the large size of the *Trachytherus* material. Loomis (1914, p. 82) described a large *Trachytherus* (*Eutrachytherus grandis*) from Cabeza Blanca that was 50 per cent larger than *T. spegazzinianus*. If the Tecan material is actually *Trachytherus*, then it would seem, though hardly proved, that the Tecan beds, if present at all, are of Deseadan age.

Another stage, the Castillense, was named by Kraglievich (1934) and also placed between the Deseadan and the Colhuehuapian. He based it on one typothere specimen found at Curuzucuatia, in Corrientes, northeastern Argentina, by Podestá and named by its discoverer *Ameghinotherium*. Ameghino (1899, p. 5) summarized the description of the form. This may be the basis for Ameghino's long northward extension of the *Pyrotherium* beds (see locality 13 above). The stage is extremely doubtful, and the beds may be either Deseadan or Colhuehuapian, or between the two.

The one and only specimen from the Santa Lucia formation in the Department of Canelones, Uruguay, was described by Kraglievich (1932) as ?*Propachyrucos schiaffinoi*. If this generic identification were correct then the Santa Lucia might possibly be Deseadan in age, although one specimen is hardly a safe basis for correlation. Then too, Kraglievich's specimen was of an upper jaw and was not easily comparable to Ameghino's *Propachyrucos* material which consisted of lower jaws. Simpson (1945a, p. 559), with upper and lower jaw material available of *Propachyrucos ameghinotherium*, says that "*P.*" *schiaffinoi* "almost surely does not belong to *Propachyrucos*." The Santa Lucia formation may, therefore, be anywhere in the Eogene.

In southwestern Loreta, Peru,[1] thick beds of early Tertiary age have yielded one mammalian lower jaw, described as *Griphodon peruvianus* Anthony (1924). Patterson

[1] Patterson (1942) and Simpson (1943) give the exact description of this locality.

TABLE 26

SUMMARY OF AGE CORRELATION[a]

Epochs		Groups	South America Stages	North American Stages
Oligocene	L		Colhuehuapian	Whitneyan
	M		– – – – – – – – – –	Orellan
	E		Deseadan	Chadronian
	L	Sarmientan	– – – – – – – – – –	Duchesnean
				Uintan
Eocene	M		– – – – – – – – – – Mustersan – – – – – – – – – –	Bridgerian
	E		Casamayoran	Wasatchian
Paleocene	L	Riochican	Riochican	Clarkforkian
				Tiffanian

[a] After Simpson (1947b), slightly modified.

(1942) identified the specimen as a pyrothere, suggesting an age between the Mustersan and the Deseadan. Since the beds are some 8000 feet thick (Singewald, 1937) and since the exact location of *Griphodon* within the series is unknown, it is possible that beds of Deseadan age are present.

AGE CORRELATION

Ameghino maintained and vigorously defended from all attack his position that the *Pyrotherium* beds (Deseadan) were Cretaceous. He believed implicitly that the mammals of the *Pyrotherium* fauna had lived contemporaneously with dinosaurs, in spite of the fact that his brother Carlos had never found the two together. On this idea he erected his hypothesis of the ancestral position of the South American Tertiary mammals to the rest of the mammalian orders from other parts of the world.

His ideas have been repeatedly challenged and proved in error (Hatcher, Loomis, Simpson, and others) and it would be of little value to review this well-settled point. The mammal-bearing beds of Patagonia are certainly Tertiary.

The exact age of the Deseadan stage is, however, in doubt. It is the fourth of five stages of mammalian faunas from two stratigraphic groups, the Riochican and the Sarmientan, lying above the marine Salamanca formation of probably early Paleocene age (Simpson, 1945b). The Rio Chico formation, from which come the oldest South American mammals, is alone in the Riochican group. The Casamayor, Musters, Deseado, and Colhué-Huapí formations are in the Sarmientan group. Above the Sarmientan is the marine Patagonian which is "about transitional Oligocene-Miocene" (Simpson, 1940, p. 693). This would sandwich the Riochican and the Sarmientan groups between the Salamancan of possible late Cretaceous or probable early Paleocene and the Patagonian of late Oligocene to early Miocene.

Since South America was isolated from the rest of the world from Paleocene into Pliocene times, comparison of the mammalian faunas of these early Tertiary beds is virtually impossible. A few of the Casamayoran mammals are of "roughly Wasatchian type (lower Eocene of North America)" (Simpson,

1940, p. 694). This would place the Casamayoran as roughly Eocene and the Colhuehuapian as probably upper Oligocene, about equivalent to the early Patagonian.

The oldest South American rodents are Deseadan and, according to Wood (1949, p. 2), "the Paleocene or lower Eocene paramyids or sciuravids were most probably ancestral" to them. This would place the Deseadan as later than lower Eocene and probably Oligocene to allow time for the necessary island hopping and evolution of the ancestors of the Deseadan forms.

Since there are erosional unconformities between each two of the four stages, allowance must be made for each hiatus. Since the Mustersan fauna has a greater affinity for that of the Casamayoran than to that of the Deseadan, a larger hiatus belongs between the Mustersan and the Deseadan. Therefore, with the Casamayoran as lower Eocene and the Colhuehuapian as middle to upper Oligocene the Mustersan would be somewhere in the middle to late Eocene and the Deseadan somewhere in the early to middle Oligocene.

CONCLUSIONS

1. THE SCARRITT POCKET beds are composed of pyroclastics deposited in an extinct, or nearly extinct, crater. The four faunules found in the area are Deseadan in age, although the two upper faunules are slightly younger than the Crater Lake faunule. Wood (1949), because of the primitive rodent material, feels that the Crater Lake beds are lower Deseadan in age.

2. The majority of the forms found in this locality were notoungulates, but representatives of Amphibia, Marsupialia, Edentata, Rodentia, and Astrapotheria were also present. The fauna differs from that of other Deseadan localities in that *Scarrittia* replaces *Leontinia* and no *Pyrotherium* or litoptern material was found.

3. *Scarrittia* is very closely related to *Leontinia*, possibly as a subgenus. The skeleton shows that the family Leontiniidae is intermediate between the Toxodontidae and the Homalodotheriidae and slightly closer to the latter.

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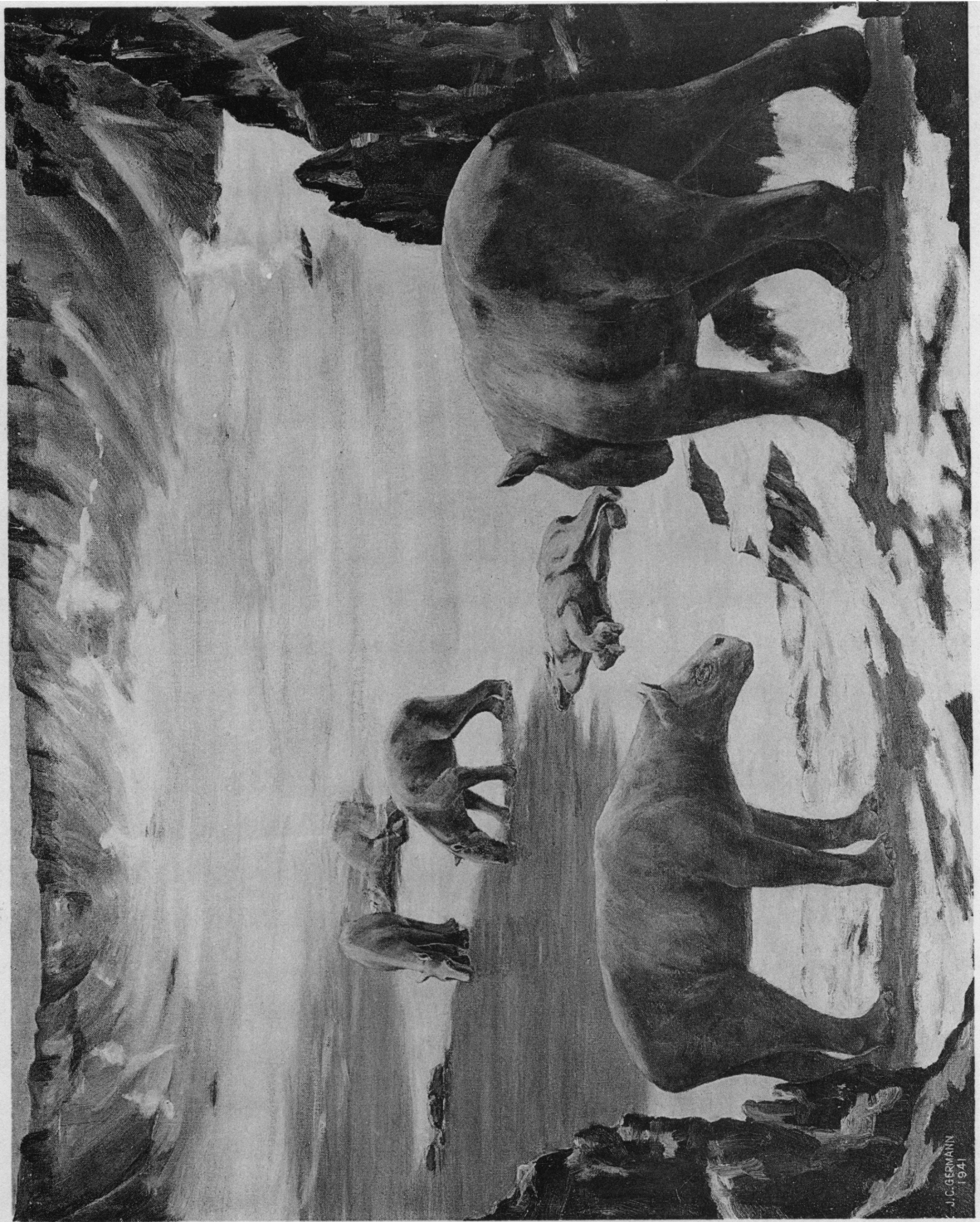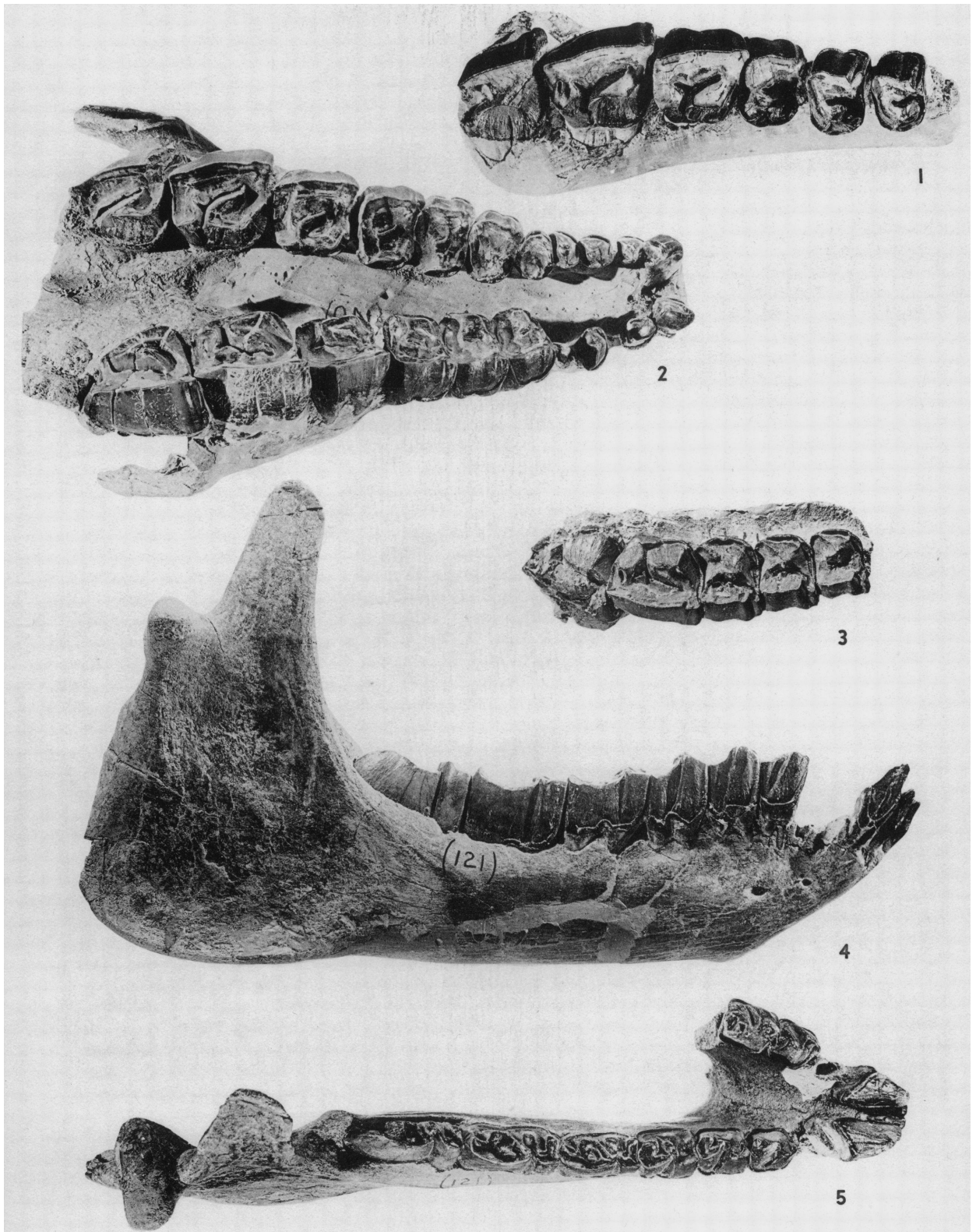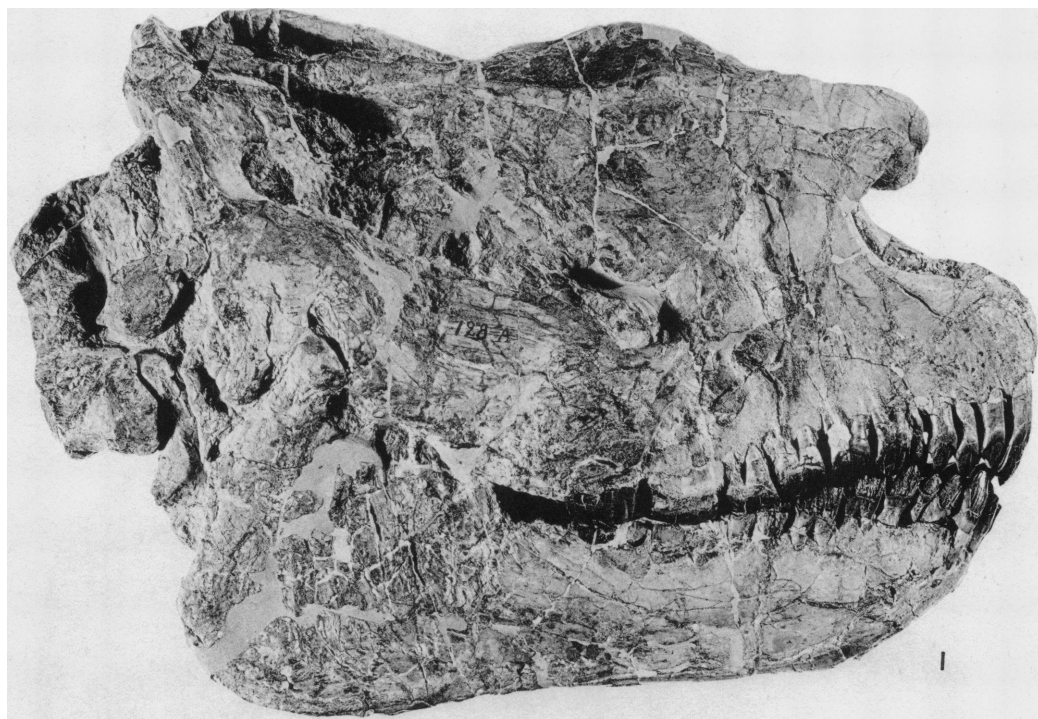
Scarritia canquelensis Simpson. Life restoration
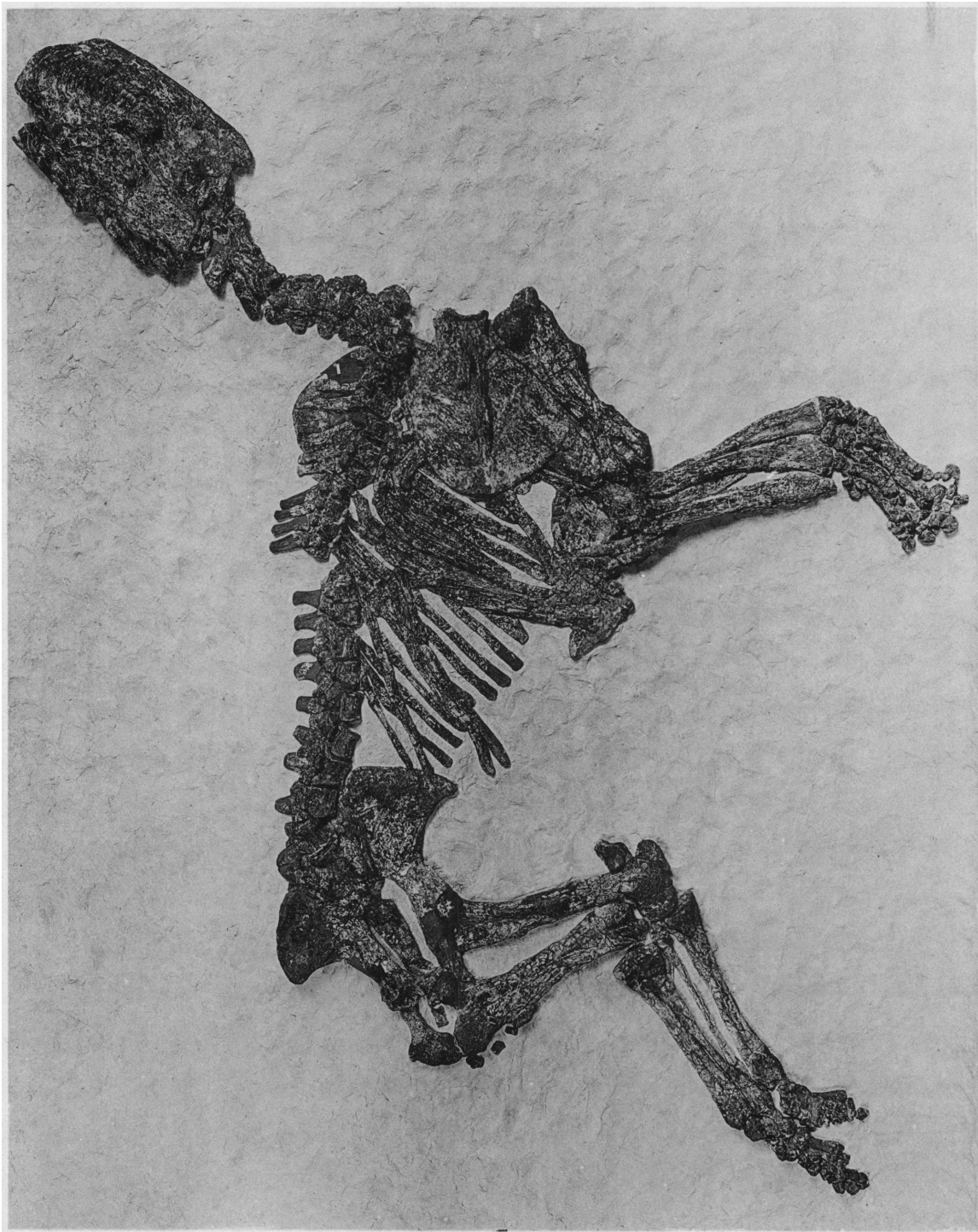
Scarrittia canquelensis Simpson. U.S.N.M. No. 13879. Skeleton. × ¹⁄₁₂

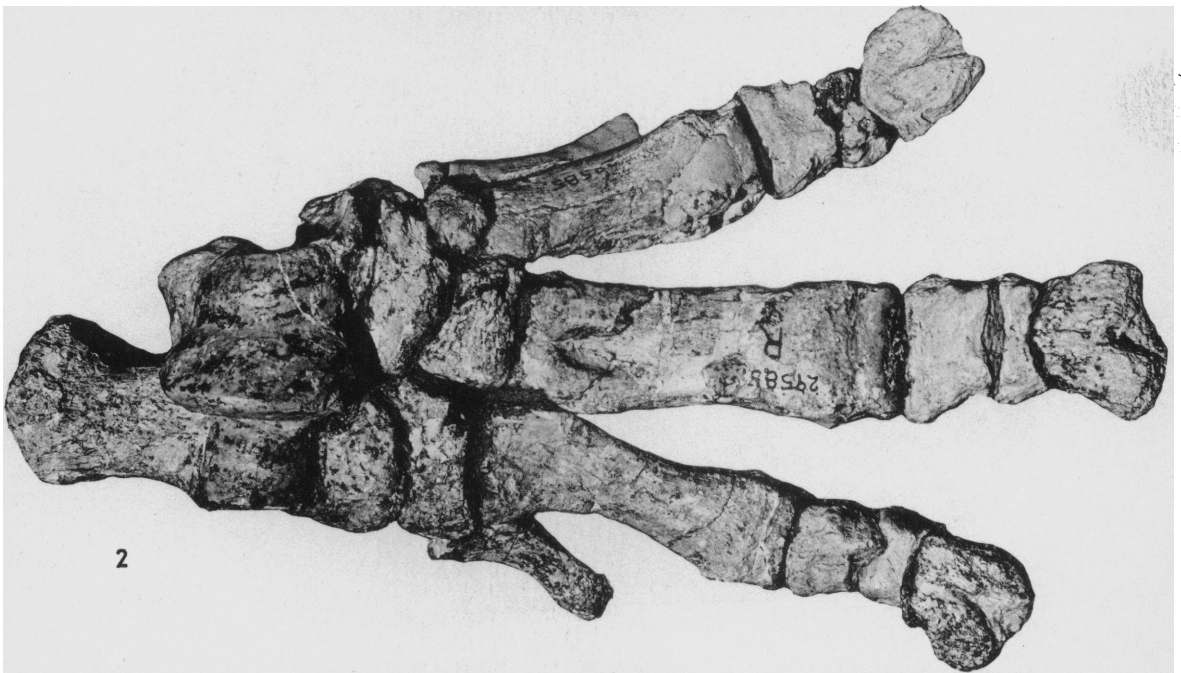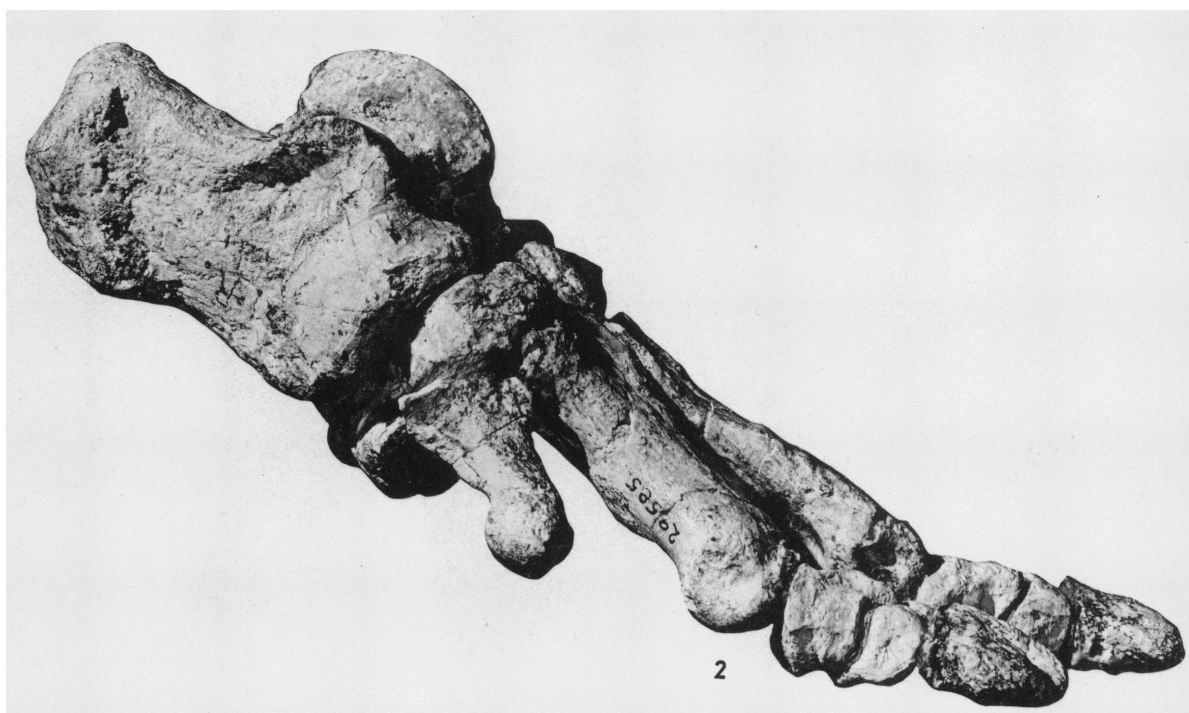*Scarrittia canquelensis* Simpson. All × ⅖. 1. A.M.N.H. No. 29615. Right upper dentition, P²–M³, crown view. 2. A.M.N.H. No. 29613. Upper dentition, crown view. 3. A.M.N.H. No. 29616. Left upper dentition, P²–M², crown view. 4. A.M.N.H. No. 29612. Right lower jaw, P₁ missing, external view. 5. A.M.N.H. No. 29612. Right lower dentition, crown view
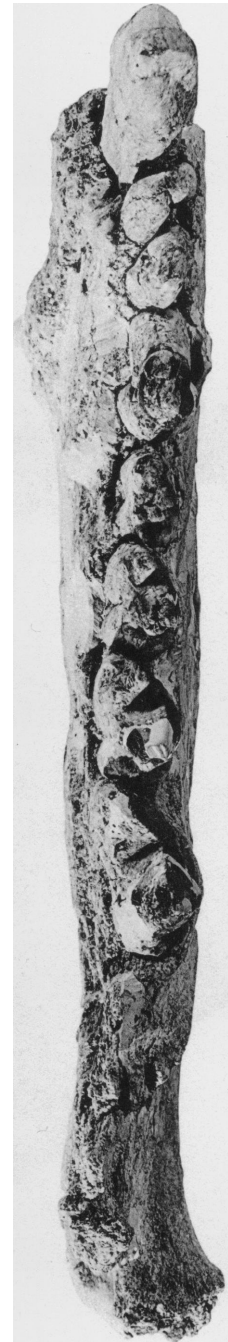
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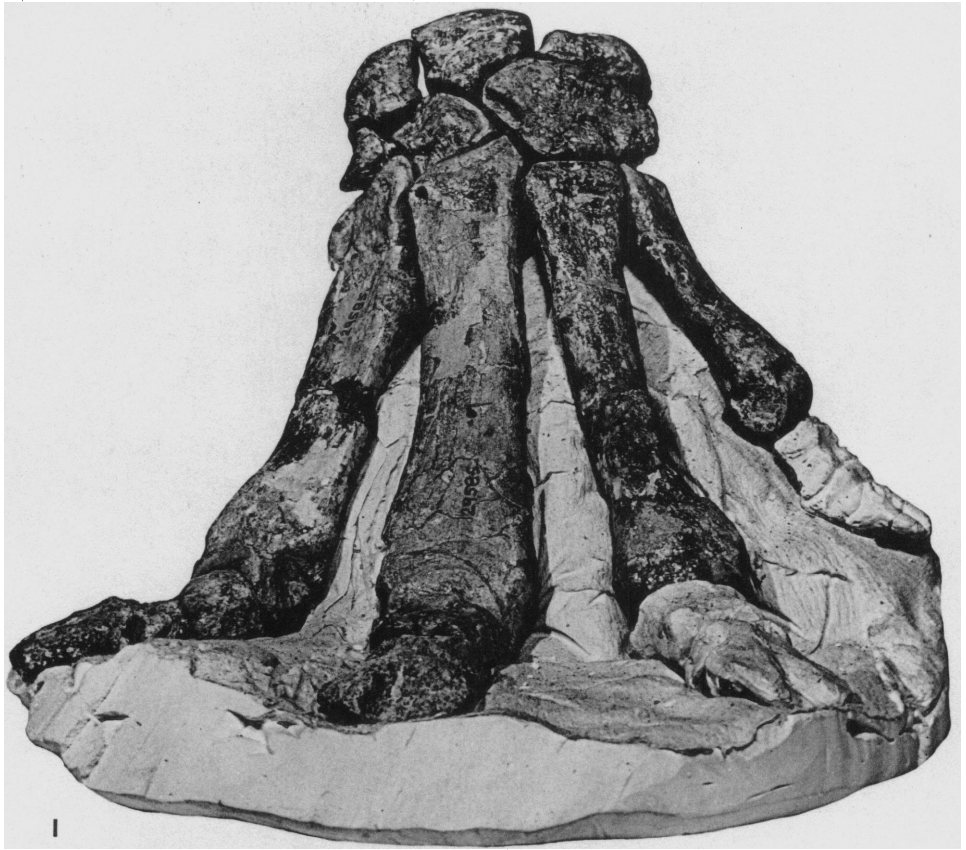
Scarrittia canquelensis Simpson. A.M.N.H. No. 29585. × ½. 1. Left manus, front view. 2. Right pes, front view

*Scarrittia canquelensis* Simpson. A.M.N.H. No. 29585. Right pes. × ½. 1. Internal view. 2. External view

*Proborhyaena gigantea* Ameghino. A.M.N.H. No. 29576. Right lower jaw. × ⅗. 1. External view. 2. Crown view
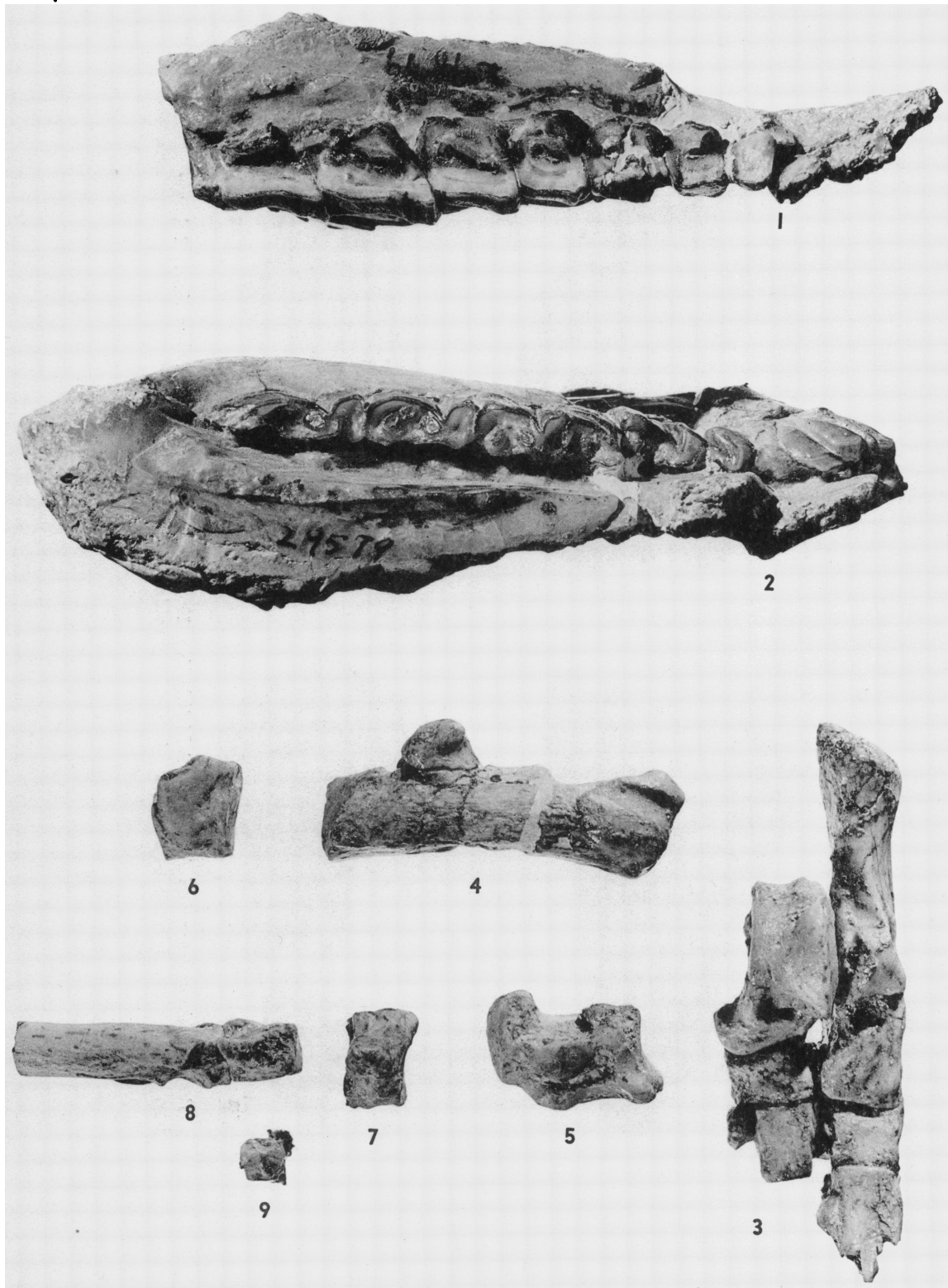
Rhynchippus pumilus Ameghino. A.M.N.H. No. 29579. × 1½. 1. Left upper dentition, crown view. 2. Left lower dentition, crown view. 3. Articulated left tarsus. 4. Right calcaneum. 5. Right astragulus. 6. Right cuboid. 7. Right navicular. 8. Right ectocuneiform and proximal end of metatarsal III. 9. Right mesocuneiform
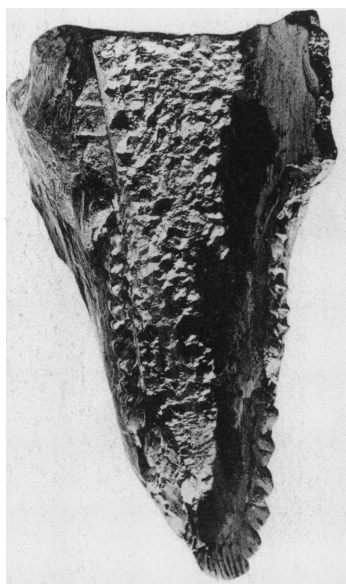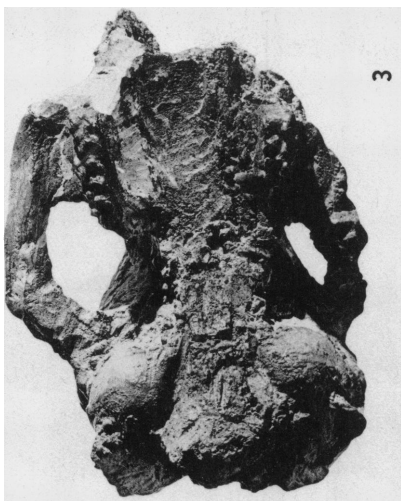
Progaleopithecus tournoueri Ameghino. A.M.N.H. No. 29603. × 1. 1. Lower jaw, crown view. 2. Lower jaw, left side view. 3. Skull, palatal view. 4. Skull, right side view

1. *Plagiarthrus clivus* (Ameghino). A.M.N.H. No. 29606. Incomplete lower jaw, crown view. × 2
2, 3. *Prohegetotherium sculptum* Ameghino. A.M.N.H. No. 29605. Lower jaw. 2. Crown view.
3. Left side view. × 2
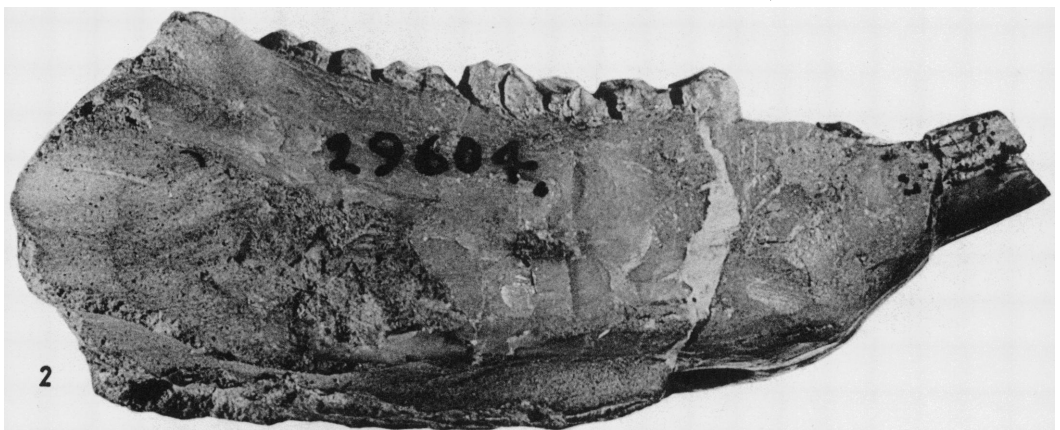
1, 2. *Propachyrucos simpsoni* Chaffee. A.M.N.H. No. 29604, type. Lower jaw. 1. Crown view. 2. Right side view. × 2

3. *Prosotherium garzoni* Ameghino. A.M.N.H. No. 29608. Right upper dentition, P^1–M^3, crown view. × 2