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THE SUPPOSED OCCURRENCES OF MESOZOIC MAMMALS IN SOUTH AMERICA[1]

By George Gaylord Simpson

It is proposed to discuss here a few isolated supposed occurrences of mammals in the Mesozoic of South America. This is a question quite aside from that of the age of the *Notostylops* and related early mammalian faunas of Patagonia or that of the supposed survival of dinosaurs into the Tertiary there. Those mammalian faunas have been considered to be of Cretaceous age (Ameghino, Roth, and some other students accepting their conclusions) and have also been supposed to include dinosaurs, whatever the age. That problem is to be discussed in another note. Here are considered only occurrences of supposed mammals reported as coming from pre-*Notostylops* beds of undoubted Mesozoic age.

This is the first technical paper of the Scarritt Patagonian Expedition, being based chiefly on studies undertaken for the expedition in the Museo Nacional de Historia Natural Bernardino Rivadavia in Buenos Aires. As further results are published, fuller acknowledgment of indebtedness to many individuals and institutions will be made, but here special thanks must be expressed to Dr. M. Doello Jurado, Director of the Museo Nacional, for his constant and generous coöperation. Sr. Carlos Ameghino gave valuable advice and much unpublished data and Dr. Egidio Feruglio supplied full particulars regarding the discovery reported by him. In beginning publication it is also desired to express appreciation of the generous support of Mr. H. S. Scarritt and others who made this expedition possible.

The important supposed occurrences of South American Mesozoic mammals, under the conditions defined above, are as follows:

1. Hatcher's find in the barrancas of the Río Tarde near Lago Pueyrredon.
2. Ameghino's famous "*Proteodidelphys* fauna," supposedly from the Chubutiano of the Chubut Valley.
3. Supposed cetacean teeth reported by Ameghino from the Salamanqueano Formation.
4. Supposed mammals from Mesozoic strata in Jujuy reported by Feruglio.

The reported horizons are not all of exactly known age, but all are surely Mesozoic. The inquiry, then, is (1) whether the specimens in

[1]Publications of the Scarritt Patagonian Expedition, No. 2.

question are really mammalian, and (2) whether they actually came from the stated horizon.

The conclusions reached are (1) that most or all of the specimens of the *Proteodidelphys* fauna are mammalian, while the others (all of which have been lost) probably were not, and (2) that the *Proteodidelphys* fauna was not really derived from Mesozoic beds, while the others probably or surely were. It therefore appears that all these reports are highly dubious or incorrect and that Mesozoic mammals are not yet surely known from South America. It is not intended to deny that they occurred there or that their remains will eventually be found, which is quite probable. The intention is only to erase from the record several important errors or statements so dubious as to be of no value. The oldest mammals now known from South America are derived from beds belonging to or immediately below the *Notostylops* complex and are of distinctly Tertiary aspect. They will be described and illustrated in a later publication.

HATCHER'S SUPPOSED RÍO TARDE MAMMALS

Hatcher (1900, p. 90) in discussing his Belgrano Beds, Pueyrredon Series, says "A few imperfect plant remains were also found and a very few small, tritubercular teeth were discovered associated in the same rock with remains of Ammonites. These tritubercular teeth may perhaps pertain to mammals." The invertebrates were studied by T. W. Stanton, who placed them as not earlier than about the middle of the Cretaceous. Hatcher continues, "The Cretaceous age of these beds as determined by Stanton from a study of the invertebrate collections is significant, since Dr. Ameghino, after seeing two of the small teeth collected by myself from them, immediately referred this entire series of beds to the Jurassic."

There were repeated references to these beds and to the supposed mammals, but for the most part they are unimportant here. Ameghino's definitive opinions appear in the "Formations Sédimentaires" (1906), as follows (p. 464–465):

"Faune Tardéenne

"Les plus anciens débris de Mammifères connus jusqu'à présent de Patagonie, viennent du crétacé inférieur de la région du lac Pueyrrédon. Ici, dans les hautes falaises du Río Tarde, le regretté naturaliste M. Hatcher trouva, emboîté dans la même roche que les Ammonites, un certain nombre de petites molaires biradiculées . . . avec couronne

à une cuspide centrale plus haute et deux ou trois cuspides latérales et avec l'émail à surface ridée d'une manière très apparente. J'ai référé ces débris à un précurseur probable des Zeuglodontes. . . . Il est regrettable que mon éminent collègue et ami, M. le Prof. W. B. Scott, qui possède ces débris n'en ait pas encore donné une description."

The desired description never was given, and I have been informed by Dr. G. L. Jepsen (personal communication) that the specimens were so poorly preserved as hardly to warrant description and are not now to be found in the Princeton collections. Essentially all we know of them, then, is the brief description given in the above passage by Ameghino, who had himself seen the specimens. The description is far from diagnostic of mammalian teeth. On the contrary, no known Mesozoic mammals agree very closely. It is suggestive of certain sharks, such as the hybodonts, a suggestion the more probable in view of the fully marine nature of the beds. In any event, the serious doubt as to their identification, their poor preservation and their subsequent loss deprive these teeth of right to serious consideration as mammals. The "Faune Tardéenne" must be erased from the squence of Patagonian mammalian faunas at least until further collecting has been done.

THE *PROTEODIDELPHYS* FAUNA

The few remains on which Ameghino established his "*Proteodidelphys* Fauna" are the most important and interesting. Unlike all the other specimens here considered, they are still available for study; they include at least one really identifiable specimen; and they have been almost universally accepted as of Mesozoic age. On them Ameghino erected a fantastically complex structure of theories as to morphology, phylogeny, and stratigraphy. One species, *Proteodidelphys præcursor*, figures as the base of several of his phylogenetic trees and among the bases of his studies in dental morphology. Another, *Archæoplus incipiens*, is supposed to demonstrate the imperfect separation of ungulates and marsupials at that time. The actual material on which these and other equally important conclusions rest is as follows.

1. *Proteodidelphys præcursor*, type an excellent lower jaw.
2. *Archæoplus incipiens*, type an isolated incisor.
3. Another unnamed incisor of different character.
4. A fragmentary dermal plate.
5. A broken edentate tooth.
6. A small hard ball of doubtful nature.

Some further notes on these specimens may preface consideration of their origin.

Proteodidelphys præcursor Ameghino, 1898

P. præcursor, AMEGH., 1898, pp. 117, 187, fig. 52*b*; 1900, pp. 201, figs. 2–5; 1902A, pp. 6–7; 1902B, p. 21, figs. 1–3; 1902C, p. 421, figs. 1–2, 15; 1903, p. 161, figs. 82, 84, 88; 1904, p. 53, figs. 50–51; 1906, p. 288, fig. 69.

P. præcursor, SIMPSON, 1929, p. 130.

TYPE.—Museo Nacional (Buenos Aires) No. 10799, right lower jaw with I_2–M_4.[1]

CHARACTERS.—Dental formula $I_4\,C_1\,P_3\,M_4$. Incisors subequal, spaced, spatulate. Canine erect, root single but grooved, somewhat recurved crown, inner side excavated, very slight rudiment of internal heel. Premolars progressively larger, P_1 to P_3. Molars of generalized didelphid pattern, trigonid little elevated above talonid. Protoconid larger than metaconid, metaconid larger than paraconid. Talonid

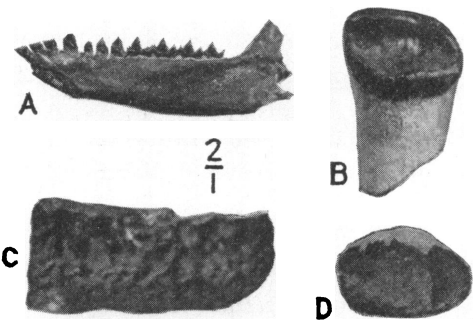

Fig. 1. The "*Proteodidelphys* Fauna."

A. *Proteodidelphys præcursor* Ameghino. Right lower jaw, internal view. Type, M. N. H. N. No. 10799.

B. *Archæoplus incipiens* Ameghino. Incisor, internal view. Type, M. N. H. N. No. 10801.

C. Fragment of dermal scute referred by Ameghino to the Peltephilidæ. External view. M. N. H. N. No. 10800.

D. Edentate tooth. Crown view. M. N. H. N. 10798.

All enlarged two diameters. Photographs from the Museo Nacional de Historia Natural, Buenos Aires.

typically didelphid on $M_{1\text{-}3}$. $M_{1\text{-}2}$ subequal, M_3 somewhat smaller, and M_4 very small and with greatly reduced talonid, shorter and narrower than trigonid and with only one really distinct cusp. Horizontal ramus of moderate proportions, symphysis extending to between canine and P_1, fused, mental foramina under $P_{1\text{-}2}$ and anterior end of M_1.

DISCUSSION.—The tremendous morphological importance given this specimen by Ameghino seems to me wholly unjustified. Except for the characteristic specialization of M_4, it is, indeed, a primitive and

[1] I_1 and part of the posterior end of the jaw have been lost since the specimen was first figured.

generalized type of marsupial, but there are species just as primitive in every respect, at least as late as the Santa Cruz. There is no way in which *Proteodidelphys* can be distinguished generically from the common *Eodidelphys*. Certain specimens from the Santa Cruz formation referred by Ameghino to *Eodidelphys famula* cannot surely be distinguished specifically: size, structure, and position of each tooth, depth and form of mandible, position and size of mental foramina, even the non-essential characters of color and mode of preservation, are all nearly identical. Given the static nature of the didelphids as a whole, this perhaps does not mean that the present specimen is not older than the Santa Cruz, but it certainly makes it highly improbable that it is greatly older and robs the specimen of any particular morphological interest.

Technically it would perhaps be necessary to reduce the names of this genus and species to synonymy, as they cannot be defined in a diagnostic way, but in view of their history and the doubt that still clouds their true significance, it seems to me practical and permissible to retain them tentatively.

Archæoplus incipiens Ameghino, 1898

A. incipiens, AMEGH., 1898, pp. 117, 174; 1900, p. 200, fig. 1.
A. incipiens, SIMPSON, 1929, p. 130.
TYPE.—Museo Nacional (Buenos Aires) No. 10801, isolated incisor.

DISCUSSION.—The tooth has been fully described and adequately figured by Ameghino. He pointed out its noteworthy resemblance to the incisors of *Isotemnus* and *Trimerostephanos* (primitive homalodontotheres of the *Notostylops* and *Pyrotherium* faunas, respectively), yet largely on this single tooth based a theory of derivation of ungulates from marsupials and repeatedly stated categorically that it shows the beginnings of this differentiation. There is considerable resemblance to isotemnid incisors, although I find no identical tooth in the available material. Closest comparison seems rather to be with upper incisors of the Archæohyracidæ. The specimen is inadequate for generic or specific determination, but there is no reason to suppose it anything but a normal notoungulate of Lower Tertiary type, perhaps of the family Archæohyracidæ.

UNNAMED SPECIMENS

Museo Nacional No. 10798 is a broken edentate tooth. The section is oval, measuring 8 by 5.5 mm., the vertical axis slightly curved. There is a thin ring of harder dentine, vitreous as fossilized. Cement is thin or absent, although perhaps corroded away. This could be either a dasy-

pod or a gravigrade, and there are genera from the *Notostylops* beds to the Pleistocene to which it could belong. With it is a small, hard, yellow nodule, perhaps placed here by Ameghino as a possible dermal ossicle, but more probably a concretion or a coprolite.

Museo Nacional No. 10800 is a fragmentary dermal scute. It is unusually thin, smooth on one side, pitted on the other. So little is preserved, and that little is so nondescript, that it might about equally well be dasypod, reptilian, or even piscine. Ameghino referred it to the Peltephilidæ.

Preserved with the types of *Archæoplus incipiens* is another very different tooth. It has a single long conical root, smooth neck, and slightly asymmetrical crown, one side convex, the other excavated along two sides. It is indeterminate, but is probably a litoptern incisor, of no particular stratigraphic or morphologic interest.

Origin of the "Fauna"

In his frequent references to these specimens, Ameghino said only that they came from the "areniscas abigarradas," that is, from what is now called the Chubutiano or "Lower beds with dinosaurs" of the lower Chubut Valley. He gave no data in support of this statement. From his phrasing, such as "en un tercer yacimiento se encontraron también algunos restos de mamíferos" (1900, p. 198), it is fairly clear that no associated fossils were found, and he would hardly have omitted so important an association if it occurred.

Since I have encountered almost no instances of Carlos Ameghino's being mistaken as to the relative levels of the fossils found by him, when positively affirmed, there would be a strong presumption of accuracy if he had collected these specimens. It has generally been assumed that he did so, no contrary statement being published, but such is not the case. He himself states (personal communication) that they were collected by Nicolás Illin, an employee of the Museo de La Plata, and that it is Carlos Ameghino's opinion that they probably were not from the Chubutiano. Don Carlos states that he never found any trace of mammals in the Chubutiano, and this is the experience of all other collectors except Illin.

In the absence of associated fossils or any other concrete data, it is to be presumed that the horizon was determined by inference from lithology or similar criteria. In this case lithology is of no value, since in this region (as suggested by the work of Roth, who, however, drew quite different conclusions, and as fully proven by the work of our expedi-

tion) there are beds nearly or quite identical in appearance with the Chubutiano, but of much later, Tertiary age.

The preservation of the several specimens is very different, not of great importance but suggesting that they were not found together and still further reducing the chances that they really characterize any one known horizon or that they were in place.

The fossils themselves do not at all suggest Cretaceous age. On the contrary, all are of Tertiary aspect, and the only one that is identifiable is inseparable from a Santa Cruz species. It is improbable that they are from the Santa Cruz, as that formation is not known to occur in this area and as it is improbable that even a careless collector would fail to realize that he was above the characteristic marine Patagoniano, but they could well be of *Notostylops*, *Astraponotus*, *Pyrotherium*, or *Colpodon* age, all of which occur in or near the Chubut Valley and all of which may or do contain similar mammals.

To sum up, there is no real evidence that these mammals are of Cretaceous age and there is much opposing evidence. Until or unless further evidence becomes available, it seems established with great probability that the "*Proteodidelphys* fauna" is from the Tertiary and has no unusual faunal or stratigraphic significance.

SUPPOSED CETACEANS FROM THE SALAMANQUEANO

Ameghino thought the Salamanqueano and the *Notostylops* beds to be contemporaneous in part and even reported land mammals of the *Notostylops* fauna in the Salamanqueano. This is certainly erroneous, and need not be discussed further here. The Salamanqueano is a marine formation of Cretaceous, probably late Senonian age. Whatever their exact correlation, the *Notostylops* beds are unequivocally of considerably later age. The supposed mingling of the two faunas is an error, and was not based on the work of the Ameghinos themselves.

The occurrence of supposed cetaceans in the Salamanqueano is on a different basis. They were found by Carlos Ameghino. As his field data are almost invariably correct and as the Salamanqueano is very easily recognized, this may be accepted as their true horizon. The specimens themselves were not found in the Ameghino collection during an exhaustive search in 1931. The only published data are as follows (Ameghino, 1906, p. 466):

"Dans les couches marines correspondant à la partie la plus inférieure (étage Salamanquéen) fait son apparition le plus ancien des Cétacés connus, le *Proterocetus*, de taille excessivement réduite."

Ameghino apparently never applied a specific name and never gave any description. This formation happens to contain numerous fish teeth, some of which do have somewhat the appearance of minute cetacean teeth, although surely selachians or other fishes. These facts, the reported extremely small size, the only character given by Ameghino, and the general very great *a priori* improbability of cetaceans here make the report unworthy of credence. Furthermore Carlos Ameghino (in conversation) states that he remembers the specimens and believes them to have been teeth of some fish.

SUPPOSED MAMMALS FROM MESOZOIC BEDS IN JUJUY

Feruglio (1927) reported the occurrence of a small, incomplete mandibular ramus, a fragment of another mandible, and a small scapula collected by him in beds either Jurassic or Lower Cretaceous at the railroad station Quemado near the town San Pedro de Jujuy, Province of Jujuy, Argentina.[1] The preliminary note gives no descriptions, only suggesting affinities with the Dromatheriidæ, Triconodontidæ, and "Pantotheriidæ," suggestions which give no conception of the real characters of the material, as the first mentioned group is not mammalian at all and the latter two are very different from each other. As detailed study was intended at a later date, no notes, drawings, photographs, or measurements were taken, and the fossils themselves subsequently disappeared under circumstances which make their rediscovery extremely improbable, having been stolen with some personal effects.

Feruglio (1931) later referred to the specimens in these words: "A estos hallazgos [of fishes and reptiles by Brackenbusch and Steinmann] debe agregarse el por mí efectuado (Feruglio, 1927) en la cantera de asfalto de Garrapatal (San Pedro de Jujuy). Los fósiles aquí recolectados consistían de una rama mandibular algo incompleta y de un fragmento de otra, los que, en base a un primer examen, he apreciado pertenecer al grupo de los mamíferos primitivos. Por una desgraciada circunstancia, estos fósiles se perdieron antes de que tuviera la oportunidad de estudiarlos más detenidamente y figurarlos gráficamente; siendome impossible, en consecuencia, proporcionar una descripción de los mismos."

As Doctor Feruglio remembers them (personal communication), the fossils do not seem to me to have presented unequivocal mammalian characters.

[1] I am indebted to Dr. L. S. Russell for first calling my attention to this occurrence, sending a translation of Doctor Feruglio's paper, and to Dr. Feruglio himself for much unpublished data.

The only further fact of possible bearing on the situation is the recent description by Von Huene (1931, p. 183) of a small jaw from the same formation although from a somewhat higher horizon. This jaw, *Carlesia incognita* v. Huene, 1931, has somewhat the general aspect of a Mesozoic mammal, but on closer study proved to be a reptile, apparently a lacertilian. It is at least possible that Feruglio's discovery was of similar nature, and judgment must be suspended for the present. Further discoveries at this locality would be of great interest.

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