MESOZOIC MAMMALIA. VIII. GENERA OF LANCE MAMMALS OTHER THAN MULTITUBERCULATES.

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INTRODUCTION.

The problem of classifying and interpreting the mammals of the Lance, upper Cretaceous, Formation is an extremely intricate and difficult one. It is a problem which can by no means be entirely solved even at the present time, nearly forty years after the original discovery, but some progress is now possible. A redescription and attempted revision of the whole fauna has been completed for future publication and a preliminary abstract of the taxonomic results, as they affect the mammals other than multituberculates, is here presented.

Except for Cope's *Meniscoëssus* and *Thlœodon* and for three genera, *Ectoconodon*, *Protolambda* and *Synconodon*, defined by Osborn somewhat later, all the named Lance mammals were discovered by parties exploring for Professor Marsh and were named by him. With the exception of three anterior parts of lower jaws, his types are all isolated teeth, and nearly all the known specimens are of this nature. Feeling that the still very imperfect knowledge of early mammals did not warrant an attempt to associate these teeth, especially those of the multituberculates, and feeling that the advantages of making them known promptly would compensate any errors involved in interpreting such isolated material, Professor Marsh adopted a classification which was one of *teeth* and not of whole *animals*. In the case of the multituberculates, the result was a system, admittedly artificial, which yet permitted the distinguishing and classifying of each of the tooth types. In the case of the trituberculate teeth, the result was somewhat less successful. Strict application of the principle of separation would have resulted in so many names that, in an attempt to simplify matters, species were in some cases associated with genera and specimens with species on grounds which have not been fully confirmed.

It was inevitable that a classification built up on such inadequate materials would require revision with the advance of

scientific knowledge, that it would be necessary to attempt to reconstitute the various animals, separate teeth of which had received separate names, and that many of the terms used would be later found invalid. Marsh himself planned a thorough revision of the group, but his great activity in other lines prevented his ever returning to the subject, and it fell to Professor Osborn to take the first steps in the direction of this necessary synthesis.

In dealing with material of this sort it is out of the question to distinguish all the species represented. Even the genera which can be established must, if they are to be useful, be very broadly drawn. Unquestionably when more associated material is known several, at least, of the genera here recognized will be subdivided, and it is certain that many more species are present than can be given certainly valid definitions at present.

The fauna as now recognized, except for the multituberculates, is as follows:

MARSUPIALIA.

POLYPROTODONTIA.

Didelphiidæ:

Pediomyinæ, new subfamily.
Pediomys hatcheri (Osborn).
Pediomys elegans Marsh.
Nyssodon punctidens Simpson, new genus and species.

Didelphodontinæ, new subfamily.
Didelphodon vorax Marsh.
Ectoconodon petersoni Osborn.
Thlæodon padanicus Cope.
Alphodon marshi Simpson, new genus and species.

Didelphiidæ, Inc. sed.
Cimolestes incisus Marsh.
Diaphorodon curtus (Marsh), new genus.
Delphodon comptus (Marsh), new genus.
Stagodon spp. div. Marsh.

PLACENTALIA.

INSECTIVORA.

Leptictidæ:

Gypsonictops hypoconus Simpson.

?PLACENTALIA, Inc. sed.

Telacodon lævis Marsh.
Batodon tenuis Marsh.

MARSUPIALIA s. PLACENTALIA, Inc. sed.
Synconodon sexcuspis Osborn.

Brief diagnoses of the various genera and of the new subfamilies follow.

MARSUPIALIA.

POLYPROTODONTIA.

Family Didelphiidæ.

The forms here included were placed by Professor Marsh in his families Stagodontidæ and Cimolestidæ, families which have never been defined and which it now proves impossible to define usefully, the type genus of one including only premolars and that of the other only isolated lower molars of the most doubtful associations. Various bits of material from the Belly River and the Lance reveal to us the entire lower jaw and dentition, the upper premolars and molars, part of the jugal, squamosal and periotic, and practically all of the maxilla and palatine of various late Cretaceous polyprotodonts. This evidence does not, it is true, all pertain to one genus, but all of it is very strikingly similar to the comparable parts of the recent *Didelphis*. In fact it is necessary to recognize that the data now in hand do not permit removing these Mesozoic opossums from the family Didelphiidæ. The evidence of the teeth, especially of the more characteristic upper molars, clearly shows that there are two distinct groups, one with teeth more like those of the modern didelphids, but more primitive than the latter, the other group an extinct side line with heavy crushing teeth, apparently a durophagous adaptation. These two groups are defined as subfamilies.

Subfamily Pediomyinæ, nov.

Differing from the Didelphodontiinæ in the didelphine premolars and molar contour. Differing from the later didelpids (Didelphiinæ) in the subequal paracone and metacone, the direct communication of the anterior style and the paraconule, the absence or slight development of the second stylar cusp, and the fact that the fourth stylar cusp is uniformly more developed than the third (median) one.

Genus *Pediomys* Marsh.

Genotype: *Pediomys elegans* Marsh.

Diagnosis: Based on a single upper molar. Molar cusps relatively low. Pa and me well separate. No cingula on base of pr.

Remarks: Molars referable to this genus are very numerous and show considerable variation, especially (a) in size, (b) in ratio of breadth to length, (c) in obliquity, (d) in having a nearly straight or an angulate outer contour, and (e) in the variation of the stylar cusps from slight and ridge-like to larger and conical. (A) and (e) are no doubt in part of systematic value and will permit the description of distinct species, or possibly even genera, when associated material is available. (D) is of doubtful significance. (B) and (c) are largely or wholly due to position in the molar series and not to systematic differences. In spite of this very considerable variation the collections of molars show no discontinuities which could be seized upon as the limits of taxonomic units, and all are best referred simply to *Pediomys* sp. at present.

Osborn's *Protolambda* proves to have been erroneously oriented, the anterior side being mistaken for the posterior, and in fact it falls within the *Pediomys* series, although not conspecific with the genotype.

Genus *Nyssodon,* nov.

Genotype: *Nyssodon punctidens,* nov.

Holotype: Cat. No. 13654 Yale Peabody Museum, a single upper molar.

Diagnosis: Primary cusps all slender and high, pa and me closely approximated, with confluent bases. Narrow anterior and posterior cingula on base of pr. No median stylar cusps.

Subfamily Didelphodontinæ, nov.

External cingulum of upper molars more symmetrical, without marked parastylar or metastylar spur, distinctly bilobed. Premolars bulbous, crushing.

Genus *Didelphodon* Marsh.

Genotype: *D. vorax* Marsh.

Diagnosis: Based on a single upper molar. Second anterior stylar cusp well developed, larger than the paracone. No median outer cusp. First posterior stylar cusp very small, last (most posterior) large and ridge-like.

Remarks: It is proposed to use the name *Didelphodon* only for upper molars, as the lower molars here referred cannot be shown to be correctly associated with the uppers. *D. ferox*, based on a lower molar in poor condition, is synonymous with *Cimolestes curtus*, although neither is correctly referred to *Cimolestes* (see below). *D. comptus*, also based on a lower molar, is certainly not congeneric with either of these.

Genus *Ectoconodon* Osborn.

Genotype: *E. petersoni* Osborn.

Diagnosis: Like *Didelphodon*, but first of the two posterior stylar cusps considerably larger, and with a very small median cusp somewhat internal to the edge of the stylar shelf.

Remarks: *Didelphodon* and *Ectoconodon* are in fact much more closely alike than one would judge from the published figures and they may even be synonymous, as the differences are such as could be due to position in the dental series or to variation of not more than specific value.

Genus *Alphadon*, nov.

Genotype: *A. marshi*, nov.

Holotype: Cat. No. 13659 Yale Peabody Museum, a single upper molar.

Diagnosis: Stylar cusps homologous with those seen in *Didelphodon* considerably less prominent, but with a very strong median external cusp.

Remarks: This genus, the species of which is, or are, considerably smaller in size than those of the two foregoing genera, is represented by a number of molars of very individual aspect and showing no true transition to the *Didelphodon* type, proper.

Genus *Thlæodon* Cope.

Genotype: *T. padanicus* Cope.

Diagnosis: Based on a badly worn lower jaw, with P_3 and M_3 and a fragment of the upper jaw with P^3 and M^1. Premolars of heavy, bulbous crushing type. Details of lower molars obscure, but apparently like *Diaphorodon* (below). Upper molar also poorly known, but clearly a heavy transverse tooth with blunt crushing primary cusps and strong stylar cusps.

Remarks: The value of this type lies less in its detailed morphology, which is very badly displayed, than in the fact that it is the only Lance specimen in which premolars and molars, upper and lower, are associated naturally. Its premolars are close to or identical with those of *Stagodon* Marsh; its lower molars are inseparable from those of *Diaphorodon* and are also very close to those of *Eodelphis* Matthew from the Belly River; and its upper molars are like those referred to *Didelphodon* Marsh and *Ectoconodon* Osborn. It clearly shows that all these genera are very closely related, and that some of them are probably synonymous, although the material is not clear enough to permit a definite statement of synonymy. *Didelphodon* and *Stagodon* were defined in 1889, *Thlæodon* in 1892, *Ectoconodon* in 1898, *Eodelphis* in 1916, and *Diaphorodon* in the present paper. Marsh's names have priority over all others.

Didelphiidæ, Inc. sed.

Under this head are included the abundant lower molars of definitely didelphid type. Some pertain to the Pediomyinæ, some to the Didelphodontinæ, but it is not now possible to do more than hazard a guess as to the proper allocation of most. Following Osborn's conservative lead, the present classification is based on upper molars and only such of the lower molars are named as had already received names from Marsh. There are thus at least five distinct but closely related types of lower molars in the Yale Collection to which names are not applied at this time.

Genus *Cimolestes* Marsh.

Genotype: *C. incisus* Marsh.

Diagnosis: Based on a single lower molar. Trigonid markedly higher than talonid. Pr^d larger than me^d and latter larger than pa^d. Pa^d considerably reduced. Three talonid cusps.

Remarks: Marsh also referred to this genus another species, *C. curtus,* but the latter is so very unlike the genotype that it is necessarily removed to a new genus.

Genus *Diaphorodon,* nov.

Genotype: *D. (Cimolestes) curtus* (Marsh).

Diagnosis: Based on a single lower molar. Trigonid somewhat higher than talonid, compressed anteroposteriorly. Pr^d and pa^d nearly equal, me^d much lower and reduced. Anterior cingulum broad, almost basin-like. Two poorly defined talonid cusps in the type, but three of normal didelphid aspect in some referred specimens otherwise identical.

Remarks: This tooth is so different from *Cimolestes* (as the new generic name is meant to imply) that it is difficult to see why they were included in one genus. To mention only the most striking point, in one the pa^d is reduced and the me^d large, in the other the reverse is the case. *Didelphodon ferox,* based on a badly weathered and broken lower molar, is clearly conspecific with the present tooth, but the association of either with the upper molars properly called *Didelphodon* is quite uncertain. Osborn suggests the correlation of a similar tooth (his A1) with the *Pediomys* upper molars, but this also lacks confirmation.

Genus *Delphodon,* nov.

Genotype: *Delphodon (Didelphodon) comptus* (Marsh).

Diagnosis: Based on a single lower molar. Trigonid little higher than talonid. Pa^d and me^d equal, pr^d equal or slightly higher. Talonid with three prominent cusps. Anterior cingulum not prominent, not basined.

Remarks: This type of lower molar may be taken to represent the normal didelphid Cretaceous prototype. It includes

a great number of molars in the collection and probably contains more than one genus, not now separable save arbitrarily. This fact, as well as its general character, suggest correlation with the *Pediomys* upper molars, but this association cannot be demonstrated. It seems highly probable that it could not have belonged to *Didelphodon*, and at least there is no evidence for this association, and it certainly is not congeneric with *"Didelphodon" vorax*.

Genus *Stagodon* Marsh.

Genotype: *S. nitor* Marsh.

Diagnosis: Heavy, blunt, conical premolars, usually with a small posterior cusp.

Remarks: This genus certainly is an unnatural one, including premolars of most of the Lance didelphids. Three species have been proposed, but these premolars vary so with position in the series and with the natural genus to which they belong that a detailed taxonomy of them, in themselves, is neither possible nor desirable.

Insectivora.

Family Leptictidæ.

Genus *Gypsonictops* Simpson.

Genotype: *G. hypoconus* Simpson.

Diagnosis: Upper molar short, transverse, with compressed crescentic pr. Low but well-defined hypocone, and also a slight anterior cingulum on the base of the pr. Me as high as pr and pa a little higher. External cingulum narrow but sharp, with only one stylar cusp, anteroexternal to the pa.

Remarks: This form is an exception to the generalization of Osborn that the hypocone had not yet appeared in the Lance. It also furnishes seemingly positive proof, for the first time, of the presence of a small placental element in the predominately multituberculate and marsupial Lance mammalian fauna. The last premolar and each of the upper molars are known from isolated teeth.

?PLACENTALIA, Inc. sed.

The following two genera seem to be placentals, although this has been denied and cannot be considered as proven beyond doubt. It seems very improbable that either represents the lower dentition of *Gypsonictops*.

Genus *Telacodon* Marsh.

Genotype: *T. lævis* Marsh.

Diagnosis and Discussion: This fragment of lower jaw contains three premolars and three alveoli anterior to them. Marsh believed the alveoli to be for two more premolars (making five in all) and a canine. The present writer feels confident that they are for a large procumbent incisor, its root extending back beneath the canine, a canine of moderate size, and a small first premolar. In any event it seems quite certain that four premolars were present and hence that the jaw probably pertains to the placentals, as the marsupial formula P_3M_4 was already well established even earlier than the Lance. The lower molars known as *Telacodon præstans* may possibly belong in this genus, but this is very uncertain.

Genus *Batodon* Marsh.

Genotype: *B. tenuis* Marsh.

Diagnosis and Discussion: This genus is closely similar to but not identical with *Telacodon*. Three premolars, each with small anterior and posterior accessory cusps, are preserved. Anterior to them is a small alveolus which either lodged the much reduced canine or a small anterior premolar, and anterior to this is a large alveolus which either lodged the canine or a procumbent incisor.

MARSUPIALIA s. PLACENTALIA, Inc. sed.

Genus *Synconodon* Osborn.

Genotype: *S. sexcuspis* Osborn.

Diagnosis: Based on isolated upper and lower molars characterized by strong transverse compression, the upper molar with only one conule and without an external cingulum.

Remarks: Lower molars of this general aspect are not rare in the collections, but most of them appear to be mere position variants of the didelphid types. The upper molar figured by Osborn is, however, unique among Lance forms in the apparent lack of an external cingulum. Unfortunately the original has been mislaid, and the tooth now preserved under the label "*Synconodon* type" is a very ordinary first upper molar of a small *Pediomys*. Osborn's figure sufficiently validates this very peculiar genus, however.

Résumé.

The status of our knowledge of the Lance mammalian fauna, except for multituberculates, may be tabulated as follows:

I. Known from much of lower jaw and a fragment of upper:
   Thlæodon padanicus Cope.

II. Known from isolated upper and lower molars:
   Synconodon sexcuspis Osborn.

III. Known from isolated upper molars:
   Pediomys elegans Marsh.
   P. hatcheri (Osborn).
   Nyssodon punctidens Simpson.
   Didelphodon vorax Marsh.
   Ectoconodon petersoni Osborn.
   Alphadon marshi Simpson.
   Gypsonictops hypoconus Simpson.

IV. Known from isolated lower molars:
   Cimolestes incisus Marsh.
   Diaphorodon curtus (Marsh).
   Delphodon comptus (Marsh).
   At least five other unnamed morphologic types.

V. Known from premolars:
   Stagodon, several species of doubtful status.
   Telacodon lævis Marsh.
   Batodon tenuis Marsh.

The only reported Lance genus which has not been mentioned is *Dryolestes,* a Morrison (upper Jurassic) genus to which was referred the Lance (upper Cretaceous) species *D. tenax,* based on a lower jaw, broken and without teeth. Close comparison permits the positive statement that reference to this genus is incorrect, but the specimen is otherwise indeterminate and the species a nomen nudum.

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