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CRETACEOUS MAMMAL SKULLS FROM MONGOLIA[1]

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The discovery of Cretaceous mammal skulls in Mongolia by the Central Asiatic Expedition of the American Museum of Natural History is an event of exceptional importance in vertebrate palæontology. The Cretaceous forerunners of the varied placental mammals of the Paleocene and Eocene have hitherto been known only by inference. The studies of Cope, Osborn, Wortman, Matthew and others upon the dentition and skeleton of Eocene mammals led to the view that the earliest insectivores and creodonts, taken collectively, were descendants of the most primitive group of placentals, for which the name Therictoidea was proposed by Gregory in 1910.[2] It was further inferred that the stem placentals of the Cretaceous would be more or less intermediate in character between the Jurassic *Amphitherium* and such early Eocene forms as *Palæoryctes*, *Didelphodus* and the Oxyclænidæ.[3]

In 1924 and 1925, the Third Asiatic Expedition, under the leadership of Roy C. Andrews, explored the Djadokhta formation of Mongolia, which yielded the famous dinosaur eggs and the superb series of *Protoceratops* skulls and skeletons. Here Mr. Walter Granger and his associates after prolonged search finally discovered no fewer than seven skulls or parts of skulls, some with associated lower jaws, of Cretaceous mammals. Of these the first specimen discovered in 1924 proved to be an allotherian or multituberculate and has been described as the type of a new genus and family of allotherians in the American Museum Novitates.[4]

The remaining specimens discovered in 1925 have been very skillfully extricated from the matrix by Mr. Albert Thomson and generously entrusted to us for description by Professor Osborn and Doctor Matthew. Upon examination the new specimens appear to be quite distinct from all of the hitherto described jaws and teeth of Cretaceous mammals, including those in the Marsh collection of the Peabody Museum, Yale University, in the American Museum of Natural History, in the U. S. National Museum and elsewhere.

[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 69.

[2] The Orders of Mammals, Bull. Amer. Mus. Nat. Hist., XXVII, p. 464; see also pp. 304–307, 467, 468.

[3] 1922, The Origin and Evolution of the Human Dentition, Baltimore, pp. 99–107, 512.

[4] Simpson, George Gaylord, 1925, A Mesozoic Mammal Skull from Mongolia, American Museum Novitates, No. 201, Nov. 24.

At least the majority of the known American Cretaceous mammals, except the allotherians, are marsupials, related rather closely to the existing opossums. All the Mongolian Cretaceous mammals, on the contrary, again excepting the allotherians, so far appear to be placentals.

As far back as Morrison (uppermost Jurassic) times the pantotherian mammals were differentiated into several families. We are also not surprised to find that the Mongolian Cretaceous placentals show considerable diversity among themselves, so that even in the half dozen specimens now available there are representatives of not less than four genera and two families, all apparently new to science.

The largest of these animals was somewhat bigger than a large house rat. Its skull and dentition were distinctly carnivorous in type, with enlarged laniary canines and sharp-bladed, narrow triangular molars, approaching in these features the most primitive Eocene creodonts. Three genera are referred to this family, which is named by us the Deltatheridiidæ. The upper molar teeth are in what may be called a pretritubercular stage of evolution, since the para- and metacones are connate or not separated from each other and are median in position, in line with the primitive tips of the premolars, while the so-called "protocones" are internal spurs from the base of the crown. The lower molars are tritubercular, with shearing paraconid-protoconid blades and narrow heels.

In the second family, called Zalambdalestidæ, the very elongate snout suggests that of *Solenodon*, except that the lateral, not the median, incisors are enlarged. The cheek teeth, much worn in the type, strongly suggest those of zalambdodont insectivores, but a referred specimen indicates that the para- and metacones were partly separated and more buccal in position than in modern zalambdodonts, thus supporting Mivart's and Matthew's view[1] that the peculiar zalambdodont molars have been derived from a more normal tritubercular type. The lower molars are tuberculo-sectorial, with fairly broad heels. One pair of the anterior teeth, probably the median incisors, were much enlarged and procumbent, working between the enlarged upper incisors. The canines were small or absent and there were long spaces behind the enlarged front teeth. The skull avoids the specializations of modern zalambdodonts, the nasals being separate, the zygomatic arches complete and the glenoids not displaced medially; orbital region less reduced, with prominent lacrymal rims. Braincase moderately expanded, not tubular. In these and other important details the Zalambdalestidæ agreed with the

[1]Matthew, W. D., 1913, A Zalambdodont Insectivore from the Basal Eocene, Bull. Amer. Mus. Nat. Hist., XXXII, Art. 27, pp. 307-314.

Deltatheridiidæ, and the characters of one of the new genera named *Hyotheridium* may indicate that at that time the two families were still closely related, however much their presumed descendants, the placental carnivores and insectivores, diverged in later times.

Accordingly these specimens afford additional support for the following conclusions, based on much other evidence:

1) The Paleocene and Eocene insectivores and oxyclænid creodonts, taken collectively, represent survivors of an earlier insectivore-creodont stock, examples of which have now been discovered in Mongolia.

2) The discovery of these earliest of definite placentals in Mongolia furnishes some support to the hypothesis that Central Asia was the homeland of the placental radiation.

3) The Mongolian Cretaceous mammals stand between the Jurassic pantotherians and the Paleocene placentals, both in time and in dental structure, but are somewhat nearer to the latter.

4) The Mongolian Cretaceous mammals favor the view of Wortman and others that the para- and metacones collectively of the mammalian tritubercular molar are in line with, and homologous with, the "reptilian" tip of the premolar crowns, and that the so-called protocones represent internal basal spurs, correlated functionally with the differentiation of a heel or talonid, on the lower molars.

The following is a list of the mammalian fauna now known from the Djadokhta formation:

MULTITUBERCULATA
- Ptilodontidæ
  - *Djadochtatherium matthewi* Simpson

INSECTIVORA
- Deltatheridiidæ
  - *Deltatheridium pretrituberculare* G. and S.
  - *Deltatheroides cretacicus* G. and S.
  - *Hyotheridium dobsoni* G. and S.
- Zalambdalestidæ
  - *Zalambdalestes lechei* G. and S.

Of these, all are known from at least part of the skull, including the palate, and all but *Deltatheroides* also from associated lower jaws. *Zalambdalestes* is incomparably the best known of all Mesozoic mammals, every main part of the skull and jaws being known, although some features are still rather obscure.

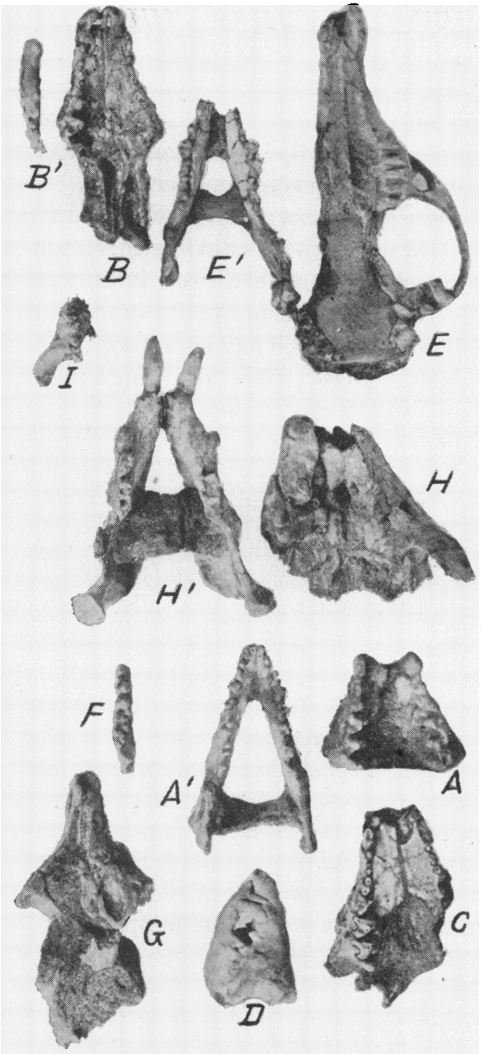

Fig. 1. Cretaceous mammal skulls and jaws. Djadokhta formation, Mongolia. Natural size.

A, A^1, *Deltatheridium pretrituberculare*. Type.
B, B^1, *Deltatheridium pretrituberculare*. Referred specimen, A. M. No. 21706.
C, *Deltatheroides cretacicus*. Type.
D, *Hyotheridium dobsoni*. Type.
E, E^1, *Zalambdalestes lechei*. Type.
F, *Zalambdalestes lechei*. First paratype, A. M. No. 21707.
G, *Zalambdalestes lechei*. Second paratype, A. M. No. 21704.
H, H^1, *Djadochtatherium matthewi*. Type.
I, *Djadochtatherium matthewi*. Referred specimen, A. M. No. 21703.

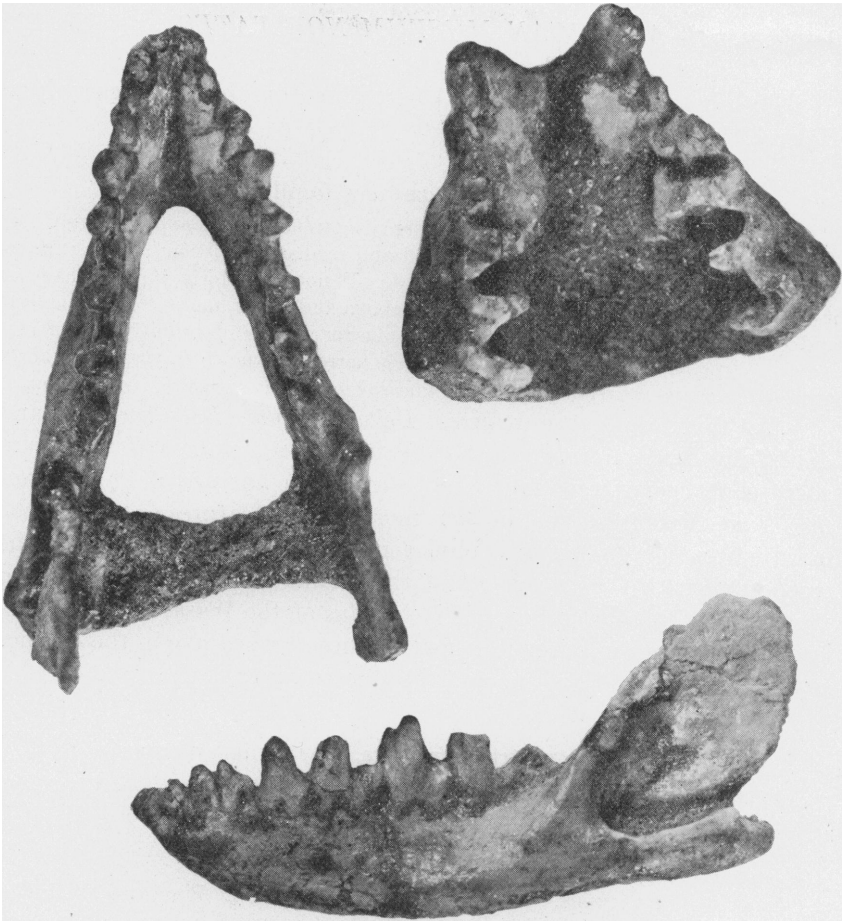

Fig. 2

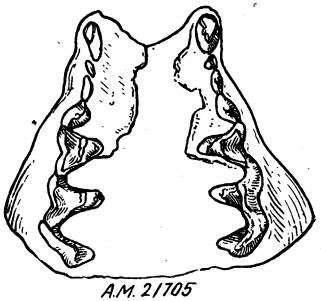

Fig. 3

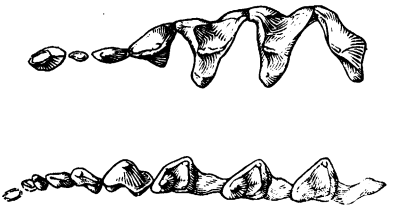

Fig. 4

Fig. 2. *Deltatheridium pretrituberculare.* Type, A. M. No. 21705. × 3/1.
Fig. 3. *Deltatheridium pretrituberculare.* Type palate. × 2/1.
Fig. 4. *Deltatheridium pretrituberculare.* Left upper and right lower teeth of type. × 3/1.

The photographs are by Mr. Albert Thomson, the drawings by Mrs. Helen Ziska.

Deltatheridiidæ, new family

DEFINITION.—Upper molars pretritubercular, trenchant, pa and me barely if at all separated or very closely approximated and medial in position; no hy.; interdental embrasures widely open on lingual side. P^4 not molariform, but may have an internal basal expansion. Last premolars, above and below, more or less trenchant and elevated. Canines enlarged, laniary. Lower molars of primitive tuberculosectorial type, the paraconids high, the heels narrow. Known features of skull of primitive insectivore-creodont type. Braincase moderately expanded, not tubular.

To this family are referred *Deltatheridium*, *Deltatheroides*, and doubtfully *Hyotheridium*. Although the known members of the group show slight generic specializations, such as the absence of $P\frac{1}{1}$ in *Deltatheridium*, there is nothing in their more general features to exclude the family from a very central phylogenetic position, ancestral to the creodonts and to many or all of the dilambdodont insectivores and possibly also to other orders. *Didelphodus* of the Wasatch may be related to this family, but it is somewhat more progressive in the further separation of the pa and me and the greater width of the talonids.

Deltatheridium pretrituberculare, new genus and species

TYPE.—Amer. Mus. No. 21705. Palate with C-M^3 and associated lower jaws (Figs. 1–3).

HORIZON.—Djadokhta formation, Upper Cretaceous.

LOCALITY.—Shabarakh Usu, Mongolia.

GENERIC CHARACTERS.—Dental formula $I\frac{?}{?}$ $C\frac{1}{1}$ $P\frac{3}{3}$ $M\frac{3}{3}$. P^1 missing, P^2 simple, one-rooted, P^3 shorter than P^4. P^4 transversely compressed but with small lower posterointernal heel. M^3 transversely widened. No diastemata back of the canine. Lower molars with pr'd higher than pa'd and latter higher than me'd. Talonid comparable in length to trigonid but narrower and more on internal side of tooth. M_3 not reduced, talonid elongated. Snout robust, postorbital constriction slight.

DENTITION.—The dental characters are quite clearly shown on the type specimen. M^3 is a short transverse tooth, strongly oblique anteroexternally. The metastyle and its spur are reduced; the parastylar spur is enlarged and extends strongly anteroexternally. The pa and me do not seem to be separated. On M^2 the pa and me are as yet unseparated or closely approximated, and have a single undivided base. They are quite precisely median on the tooth. Ps and ms are distinct, the former distinctly larger. The pr is heel-like, much lower than pa-me, and lower than the parastyle. This is the widest of the three molars, in contour lambdoid, with the ps hooked forward and with a deep median notch in the external border.

The basal section is acutely triangular, the rounded apex internal and supporting the protocone, the posterior, or metastyle side being a little longer than the anterior, or parastyle side. Apparently there were three roots at the angles of the triangle.

M^1 is comparable in structure, but narrower (transversely), with mts large, relative to ps, and the connate pa and me relatively nearer the external border. P^4 has a high compressed external cusp, apparently with a lower posterior accessory cusp. The tooth is not molariform, but the beginning of such a tendency is seen in the presence of a low posterointernal basal swelling. The main cusp is much higher than that of the succeeding teeth. P^3 is a smaller, single, two-rooted, transversely compressed

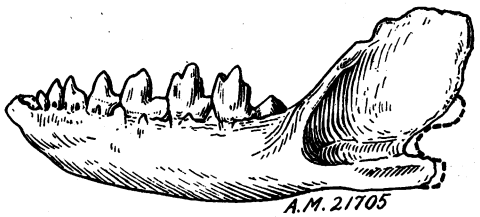

Fig. 5. *Deltatheridium pretrituberculare.* Lower jaw of type. × ⅔.

tooth, while P^2 is still smaller, one-rooted, and P^1 is lacking. The upper canine is a very large, one-rooted, strongly compressed tooth, and, as is seen in No. 21706 (see below), is preceded by a diastema in which is developed a deep pit for the reception of the similarly enlarged lower canine.

In the associated lower jaw (Fig. 5) M_3 is not reduced, its trigonid wider than that of M_2 but not so long relatively. The talonid is much elongated and very narrow.

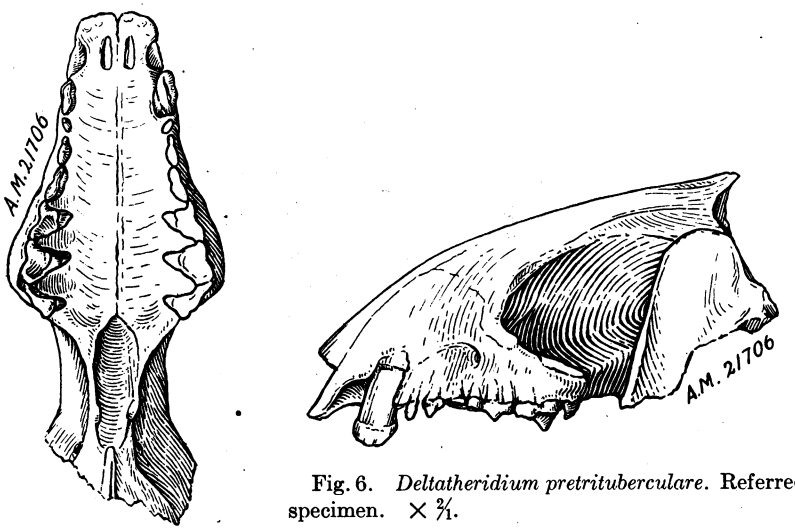

Fig. 6. *Deltatheridium pretrituberculare.* Referred specimen. × ⅔.

Its cusp structure is obscure, while that of the trigonid seems to be as in M_2. The latter is of primitive tuberculo-sectorial type, the three trigonid cusps distinct, sharply pointed, and erect. The pr'd is higher than the pa'd and the latter is higher than the me'd. The talonid is a little shorter than the trigonid and is narrow and does not extend so far externally as the trigonid. Its cusps have been worn off. M_1 is similar to M_2, save that the trigonid is a little narrower. P_4 is not at all molariform, but is a

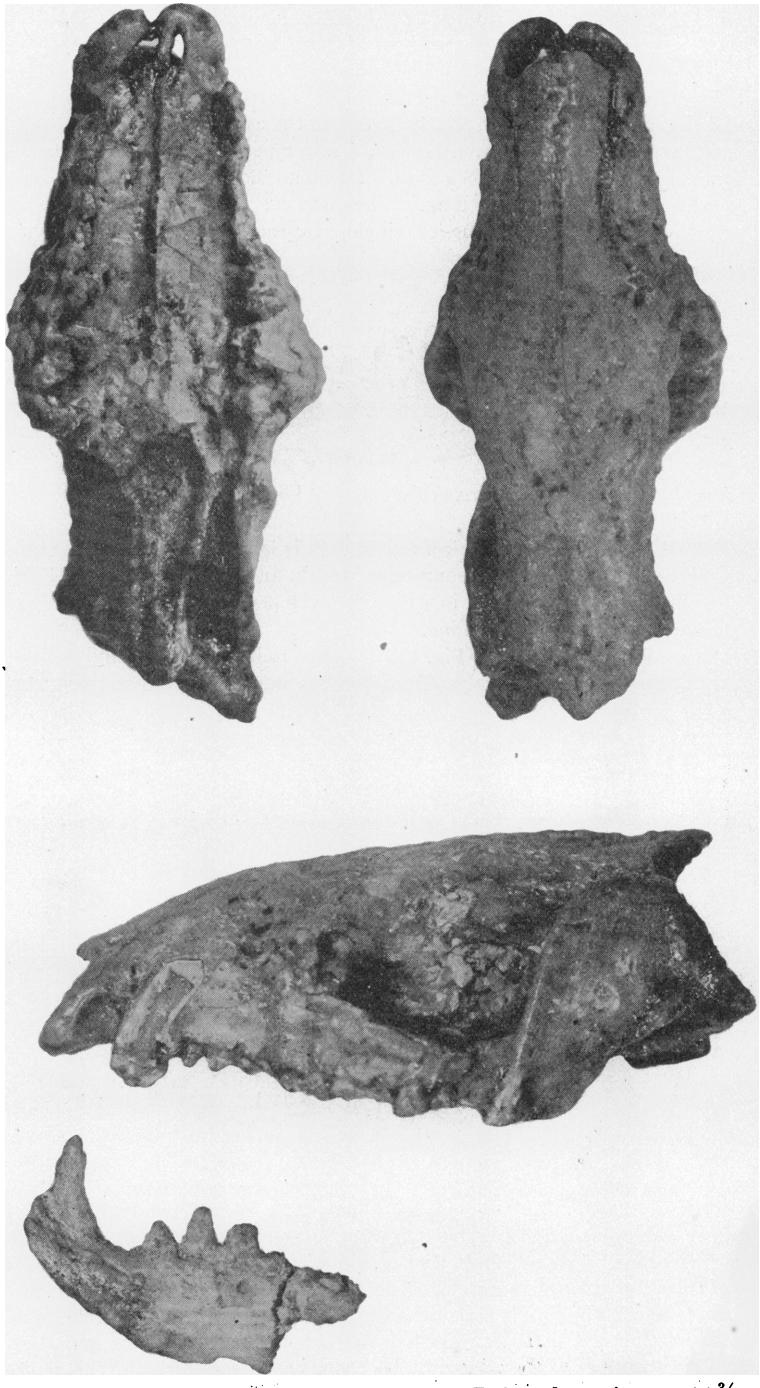

Fig. 7. *Deltatheridium pretrituberculare*. Referred specimen. $\times \frac{3}{1}$.

high, two-rooted, compressed tooth with a single main cusp and a small median posterior heel cusp. P_3 is similar but much smaller, lower, and pointed rather more forward, while P_2 is still smaller but also two-rooted. P_1 is absent. The canine is large, semiprocumbent, and there are no pre- or post-canine diastemata. The number of incisors is questionable, but they were arranged in a transverse arc.

SKULL AND JAWS.—The skull of the type is not preserved, but another specimen, Amer. Mus. No. 21706, agreeing very closely in dental character with the type and referred to the same genus and species, consists of a well-preserved anterior half of the skull, with an associated fragment of the lower jaw. The skull was apparently quite stout, with a robust and not greatly produced snout. The interorbital expansion and postorbital constriction are not marked. The orbit is of primitive character and moderate size, with a somewhat projecting lacrymal rim, the lacrymal foramen marginal. The nasals are separate, long, widening posteriorly and slightly constricted in the middle. The premaxillæ are essentially as in *Didelphis*, save that the postero-ascending process does not extend so far posteriorly. Also as in *Didelphis*, a thin plate from the maxilla covers the precanine pit externally so that the suture is anterior

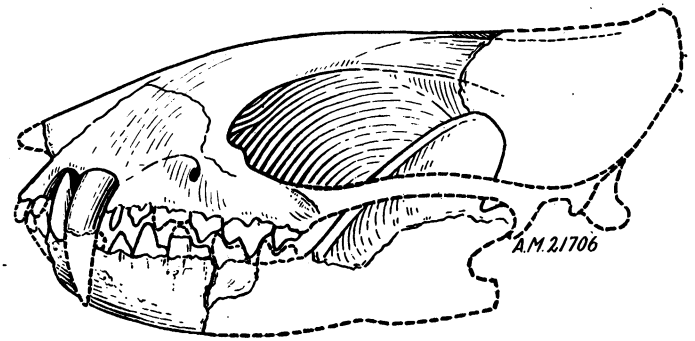

Fig. 8. *Deltatheridium pretrituberculare*. Restoration based on referred skull. ×½.

to the latter, as seen from the side. The sagittal crest is, so far as may be inferred from its anterior portion, of slight development. The palate is of comparable width, internal to the alveoli throughout, and is without fenestræ. The interpterygoid channel is long and narrow.

For the characters of the mandible we turn again to the type (Figs. 2, 5). The jaw in general is quite heavy and relatively short. The lower border is broadly curved, turning up rather markedly anteriorly. The symphysis is short, ending beneath P_3. The coronoid was broad and stout. The posterior ends of both rami are broken off so that the nature of the condyle and angle cannot be inferred, but there is no evidence that the latter was inflected.

MEASUREMENTS

A. Type

Upper cheek teeth (ant. face canine to post. face M^3)	15	mm.
P^{2-4} ant. post.	4.8	
M^{1-3} ant. post. (along median cusps)	6.3	
Lower cheek teeth (c to m_3)	17	
P_{2-4} a.p.	5.3	
M_{1-3} a.p.	10.2	

Fig. 9

Fig. 10

Fig. 9. *Deltatheroides cretacicus.* Type, A. M. No. 21700. × ¾.
Fig. 10. *Deltatheroides cretacicus.* Upper teeth of type, much worn and broken. × ¾.

B. Referred specimen (No. 21706)

Upper cheek teeth (ant. face C to post. face M^3)	14.5
P^{2-4} a.p.	4.9
M^{1-3} a.p.	6.1
Tip pmx. to glenoid fossa	30.2
Tip pmx. to lacr. tubercle	14.2
Width across upper canines	7.1
Width across M^3 (outside)	12
Length of palate, tip pmx. to post. nares	20
Width of skull across lacr. tubercles	12.5
Width across incipient post. orb. processes	8

Deltatheroides cretacicus, new genus and species

TYPE.—Amer. Mus. No. 21700, anterior part of skull with C-M^3, badly worn and broken (Fig. 5).

HORIZON.—Djadokhta formation.

LOCALITY.—Shabarakh Usu, Mongolia.

GENERIC CHARACTERS.—Apparently closely similar to *Deltatheridium* in the comparable features, but slightly more robust, with four upper premolars, the first one-rooted, P^2 two-rooted, P^3 about as long as P^4, and the latter with a more marked internal expansion (submolariform).

This imperfectly known genus, the molars of which are so badly worn as to make their structure somewhat doubtful, must be closely related to *Deltatheridium*, with which it agrees closely in general form, tooth arrangement, and molar pattern so far as can be told. The total length of the upper molars is also the same. The differences in the premolars, however, appear to be such as could not be ascribed to age or to individual or specific differences, and probably the other features will be found to furnish valuable distinctions also when they are better known.

MEASUREMENTS

Upper cheek teeth (ant. face canine to post. face M^3)	18.1 mm.
P^{1-4} a.p.	8.2
M^{1-3} a.p.	6.3

Hyotheridium dobsoni,[1] new genus and species

TYPE.—Amer. Mus. No. 21702, complete anterior portion of interlocked skull and jaws, broken off just back of $M\frac{3}{3}$.

HORIZON.—Djadokhta formation.

LOCALITY.—Shabarakh Usu, Mongolia.

GENERIC CHARACTERS.—Dental formula $I\frac{?}{?}$ $C\frac{1}{1}$ $P\frac{3}{3}$ $M\frac{3}{3}$. Diastemata between C and $P\frac{2}{2}$ and beneath $P\frac{2}{2}$ and $P\frac{3}{3}$. Canines large, first premolars wanting. Antorbital constriction of skull pronounced, snout slender and moderately elongated.

[1] In honor of the author of "A Monograph on the Insectivora."

Due to the fact that it has not been possible to separate the interlocked jaws and that the teeth are worn and obscure, their structure is very doubtful. It seems probable that it was comparable to that of *Deltatheridium*. There is a small transverse M^3, larger M^{2-1}, perhaps a submolariform P^4, and two-rooted, compressed P^3, both higher than the molars. In the middle of the post-canine diastema is the smaller

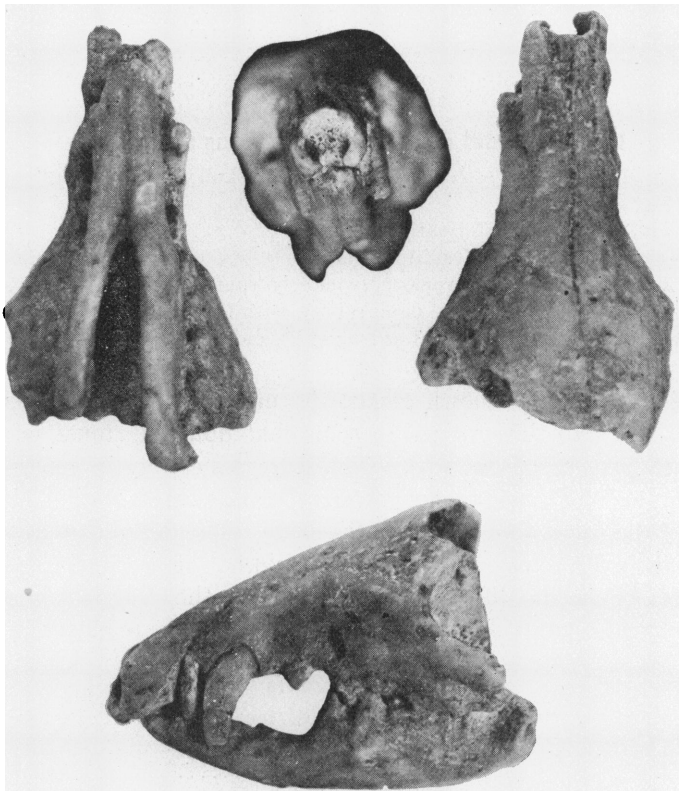

Fig. 11. *Hyotheridium dobsoni*. Type, A. M. No. 21702. $\times \frac{3}{1}$.

two-rooted, compressed P^2. Anterior to the large upper canine is a diastema and notch for the lower one. The lower dentition was of the same arrangement: three molars, two higher but undoubtedly simple premolars, one premolar a little anterior to the middle of the long post-canine diastema.

The slender elongated snout is very distinctive in comparison with *Deltatheridium*. There appears to be a good naso-lacrymal contact, excluding a fronto-maxillary one.

The molar structure is very dubious but it seems more reasonable that it was more similar to that of *Deltatheridium* than to that of *Zalambdalestes*. In general aspect, elongation of face, development of diastemata, etc., No. 21702 is certainly intermediate between the two but it is not safe to assume that it forms an actual structural link, since its more significant structural details are too obscure for final judgment.

As nearly as one can judge there was a short ("transverse") M^3, two large and typical molars in front of this (M^{1-2}), a probably submolariform P^4, and a compressed,

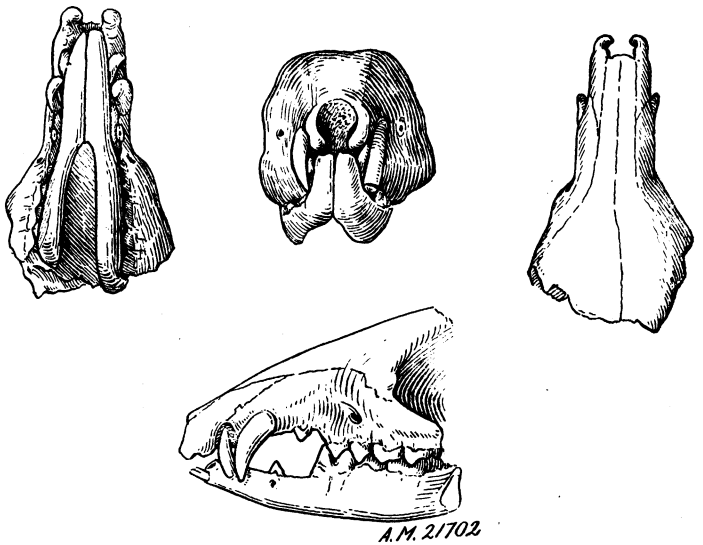

Fig. 12. *Hyotheridium dobsoni*. Type. $\times \frac{2}{1}$.

two-rooted P^3. Then is developed a short diastema, then a smaller, compressed, two-rooted P^2. P^1 is lacking, in its place there being another very slightly larger diastema. The large trenchant tooth in front of this is very clearly the C, not an I as in *Zalambdalestes*. It is preceded by a notch for the similarly enlarged lower canine.

MEASUREMENTS

Upper cheek teeth (ant. face canine to post. face M^3)	14	mm.
M^{1-3} a.p.	4.3	
Tip pmx. to lacr. tubercle	13.3	
Width across upper canines	4.5	
Width across M^3 (outside)	7.3	
Width of skull across lacr. tubercles	9.8	

Zalambdalestidæ, new family

DEFINITION.—Upper molars with distinct but closely approximated paracone and metacone, sublateral in position. Protocone low but well developed. No hypocone. Molars crowded antero-posteriorly, the interdental embrasures reduced to narrow fissures. P^4 more or less molariform. Lower molars with three distinct trigonid cusps but with the pa'd lower than the me'd. Talonids still large, basined, with distinct entoconids and hypoconids, occluding with the protocone only. Orbit and antorbital region of primitive type. Nasals separate. Zygomata complete. Glenoid little displaced internally.

Although a great morphological gap lies between the family thus defined and those to which the recent zalambdodonts are referred, the characters mentioned in the definition are believed without exception to be such as would be seen in the common ancestor of the latter. The Zalambdalestidæ are regarded as representing the stem group of the zalambdodont stock possibly at a time before it separated from the leptictid branch. There are many resemblances with the leptictids in the skull and cheek teeth.

Zalambdalestes lechei,[1] new genus and species

TYPE.—Amer. Mus. No. 21708 (Fig. 7).

PARATYPES.—Amer. Mus. Nos. 21707 and 21704.

GENERIC CHARACTERS.—Dental formula $I\frac{?}{?}$ $C\frac{0}{1}$ or[1] $P\frac{3}{3}$ or [2]. Apparent second upper incisors much enlarged, long post-canine diastema with two-rooted tooth in center of it. M^3 reduced. Anterior lower incisor procumbent, enlarged. Lower canine incisiform. Molars with trigonids narrower than talonids, with pr'd about equal to me'd and both markedly larger than the reduced pa'd. Talonid of M_3 with three distinct cusps, hy'd slightly lower than the approximated en'd and hl'd. Talonid of M_3 not elongated. Snout long, tubular, bent somewhat downward. Sagittal and lambdoid crests moderately developed. Zygomata expanded.

DENTITION.—The upper molars are seen in crown view only in the holotype. They are three in number, the last reduced and with anteroexternal extension, and are unusually short and broad. The outer contour of each is slightly concave in the middle. The cusp structure is obscure, save that there is a marked protocone heel. No. 21704 appears to be a younger individual than the very old type. It apparently retains the deciduous anterior teeth and its snout is much shorter than that of the senile type. It has all its permanent molars in place, and although they cannot be seen in crown view it is possible to affirm that on at least M^{1-2} the pa and me are distinct, although closely approximated and with connate bases, sublateral or nearly so. Returning to the type, P^4 is molariform but with the pa and me nearer the external border. M^1 is the widest of the series. P^3 is not molariform although displaying all the homologous cusps. It is triangular with a high external cusp, a smaller posteroexternal accessory cusp, and a lower internal protocone spur. Apparently

[1] In honor of Professor Wilhelm Leche, author of valued memoirs on the zalambdodonts and other insectivores.

Fig. 13. *Zalambdalestes lechei*. Type. $\times \frac{2}{1}$.

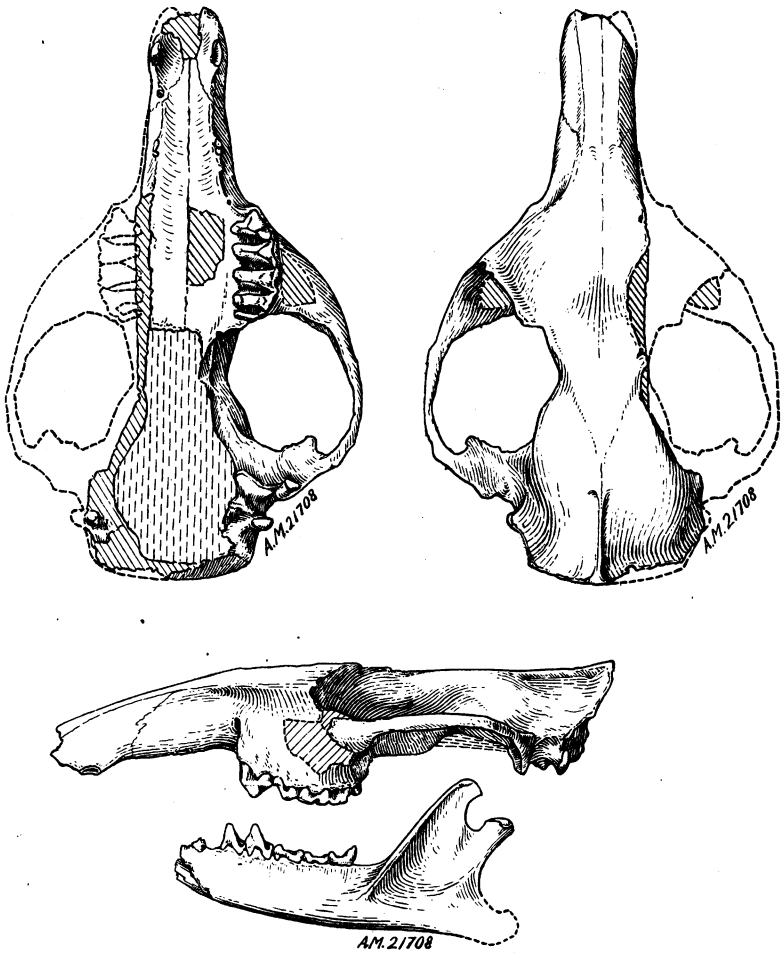

Fig. 14. *Zalambdalestes lechei*. Type. $\times$ 2/1.

there was also a small anteroexternal stylar cusp. Anterior to this tooth is a long diastema, in the middle of which are the two roots of a moderate-sized, compressed, trenchant tooth. The homologies of this tooth are uncertain. It corresponds closely to P^2 of recent zalambdodonts but occludes anterior to the apparent second lower premolar. In front of the premaxillo-maxillary suture is a large transversely compressed, apparently caniniform second incisor. These incisors are not terminal and are separated by the width of the narrow palate. Apparently they were preceded by diastemata, but the tip of the palate is broken.

The lower molars are too worn on the type to be of great value, but are quite clearly seen on No. 21707, referred to the same species. M_3 is reduced, shorter and

narrower than M_2, with the heel not elongated. There are three heel cusps, a rather small hy'd and the closely approximated and somewhat higher en'd and hl'd. The heel is slightly broader than the trigonid and is basined. M_{1-2} are large but closely similar. The protoconid is little if any higher than the metaconid, while the paraconid is reduced. The low hypoconids project laterally; the entoconids are high. P_4 is molariform, similar to M_1 but higher and with a much shorter talonid and relatively elongated trigonid. The pr'd definitely but slightly overtops the me'd, while the pa'd, as before, is small. P_3 is trenchant, two-rooted, consisting of a single cusp with a small unbasined heel; it is nearly as high as P^4.

Neither No. 21707 nor the type shows the anterior region of the lower jaw, but it is well seen in lateral view in the younger skull No. 21704.

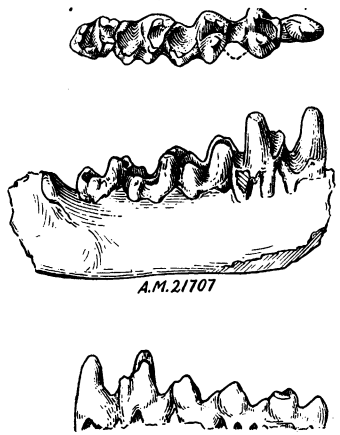

Fig. 15. *Zalambdalestes lechei*. Lower teeth, occlusal, outer and inner views. × 3/1.

P_2 is much smaller than P_3 and more procumbent. In front of it are three one-rooted teeth of increasing procumbency, all simply styliform. The posterior of these must be the canine, the other two I_{2-3}. I_1 is much enlarged, procumbent, and occludes between the enlarged upper incisors.

SKULL.—The palate is a featureless, greatly crushed plate of bone without fenestræ and apparently with no postpalatal ridge. It is somewhat widened in the molar region, but narrower anteriorly and of nearly equal width for the entire length of the snout. The choanæ are narrower than the molar region of the palate. The sutures of the palate are open, although the individual is certainly an old one.

The internasal suture is also open, a remarkable feature for a zalambdodont, but the naso-frontal suture seems to be closed or unrecognizable (the region is somewhat crushed). The premaxilla is much elongated, its posterosuperior point being above P^2. The zygoma arises opposite P^4-M^2. The large opening in its base seen in the photographs is entirely post-mortem in origin and occupies the place of a broad, flat, thin plate of bone for the attachment of the powerful snout muscles. The true infra-orbital foramen is small, near the alveolar border, at the anterior constriction of the

skull just in front of P^3. The lacrymal rim is much elevated and sharp, the lacrymal foramen inside the rim.

The glenoid region is quite centetoid in aspect. The so-called fossa itself is a broad flat horizontal plate, passing externally into the zygoma, and internally having a thin, long, horizontal root on the squamous portion of the squamosal. There is a very distinct, abrupt, vertical, styliform entoglenoid process, posterointernal to the articular surface for the mandibular condyle. The glenoid is external to a line continuing the molar axis, as in a few modern zalambdodonts, but is distinctly more external relative to the occiput than in the latter, in which it has been displaced inward. There is a crest curving inward and forward from the entoglenoid, and, although the alisphenoid region is broken on the type, it can be seen on No. 21704 to be continuous with the pterygoid plate. The lower end of the lambdoid crest forms a

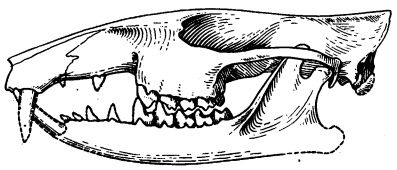

Fig. 16

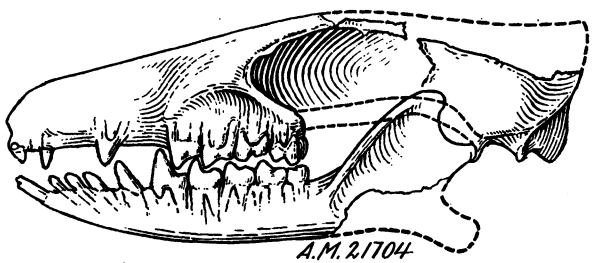

Fig. 17

Fig. 16. *Zalambdalestes lechei*. Restoration based chiefly on type. × ½.
Fig. 17. *Zalambdalestes lechei*. Paratype, slightly restored. × ⅔.

small prominence just above the post-tympanic process and separated from the latter by a notch. Between these two processes posteriorly and the entoglenoid process anteriorly is a rather large open semicircular groove for the auditory meatus. From its course it appears that the middle ear was internal to the entoglenoid rather than posterior as in recent zalambdodonts.

Lower Jaw.—The coronoid ascends at a little distance back of M_3 at ca. 45° to the alveolar border. Its apex is high but rather small and recurved. The condyle is markedly above the alveolar level, the articular surface relatively large and superior in position. The angle is not preserved. There is no masseteric crest, but the fossa is delimited anteriorly by a rounded swelling, which rises, becoming sharper, and borders the coronoid anteroexternally. The internal posterior surface of the mandible is almost featureless, save for the faint oblique swelling running posteriorly to support the condyle and the shallow concavities above and below this.

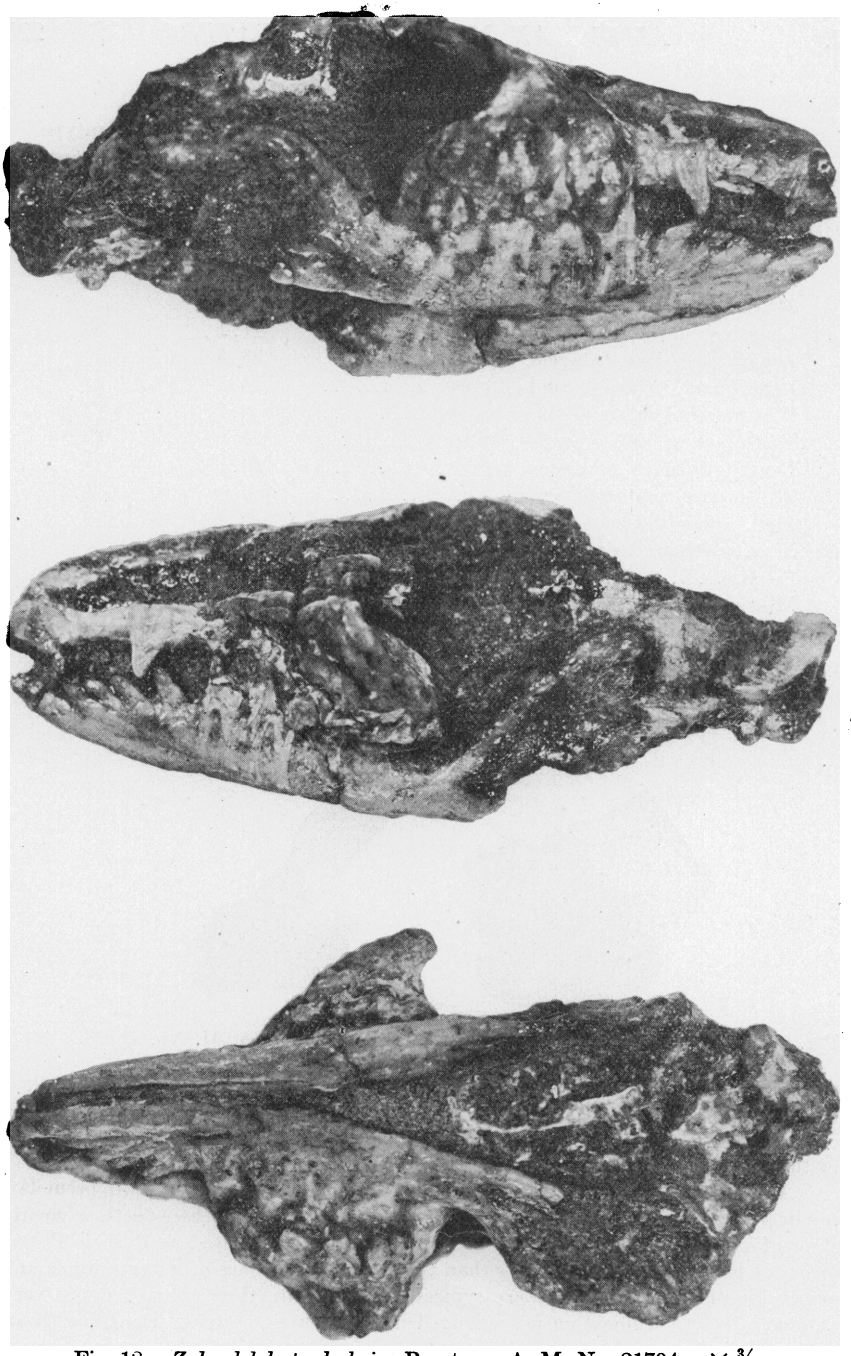

Fig. 18. *Zalambdalestes lechei.* Paratype, A. M. No. 21704. × 3/1.

Measurements

	Type A. M. 21708	Paratype A. M. 21704
Length pmx.-mx. suture to post. border M^3	19.7	19.8
P^{3-4} a.p. (ectoloph)	5	4.8
M^{1-3} (median)	4.3	
M^1 a.p. (ectoloph)	1.2	1.3
M^1 (transverse)	3.1	
Length skull pmx.-cond. (estim.)	41.2	36
Length pmx.-lacr. tubercle	23.5	
Length lacr. tuberc.-lambdoid crest	24.5	21.2
Width across enlarged upper incisors	6.1	3.8
Width across lacr. tubercles. (estim.)	21	17.5
Length of palate, pmx.-post. nares	26.7	18
Width post. orb. constriction	6.8	5.5
Max. width braincase (parietal eminence)	13.2	12.3
Max. width across post. tymp. processes	16	
P_{3-4} a.p.	4.2	
M_{1-3} a.p.	6.1	
Length p_2 to condyle	25	24

Djadochtatherium matthewi Simpson

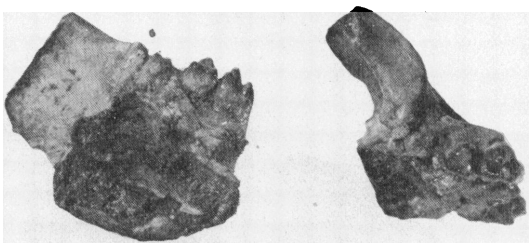

Fig. 19 *Djadochtatherium matthewi.* Referred specimen, A. M. No. 21703. × ¾.

The new discoveries permit a slight addition to our knowledge of the first-known of the Mongolian Mesozoic mammals.

Amer. Mus. No. 21703 is part of a right maxilla with the first two premolars preserved. Its interest lies in the fact that the structure of these teeth is clearly shown for the first time. The first one, which may be designated as P^2 since P^1 was probably lacking, is slightly larger than the second. Both are of a very simple and nearly identical structure and are typically allotherian: three sharp but not very slender, prefectly conical cusps, arranged in a nearly equilateral triangle with an angle external and a side internal.