ZOFIA KIELAN-JAWOROWSKA

PRELIMINARY DATA ON THE UPPER CRETACEOUS EUTHERIAN MAMMALS FROM BAYN DZAK, GOBI DESERT

(WSTĘPNE DANE O GÓRNO-KREDOWYCH SSAKACH ŁOŻYSKOWYCH Z BAJN DZAK NA PUSTYNI GOBI)

(Plates XXII-XXVII)

Abstract, — An account is given of the remains of eutherian mammals, collected by the Polish-Mongolian Palaeontological Expeditions from the Upper Cretaceous sandstone (Djadokhta Formation) of Bayn Dzak in the Gobi Desert. The monotypic genus *Kennalestes* nov., assigned tentatively to the superfamily Leptictoidea, uncertain family, is erected and *Kennalestes gobiensis* n. sp. is described and figured. *Zalambdalestes* GREGORY & SIMPSON, 1926 is re-diagnosed on the base of new material of *Z. grangeri*. The dentition of *Z. grangeri* and a fragmentary lower jaw identified as *Zalambdalestes* sp. are described and figured. The presence of two more eutherian new genera in the collection under investigation is noted.

INTRODUCTION

The discovery of eutherian (placental) mammals in the Cretaceous sandstone of Bayn Dzak (Shabarakh Usu), in the Gobi Desert, by the Central Asiatic Expeditions of the American Museum of Natural History in New York, in 1923 and 1925, caused a sensation in palaeontology. These were the first placental mammals to be recognized in beds older than the Tertiary and they seemed to confirm Professor OSBORN's hypothesis which held Central Asia to be most probably the centre of development of placental mammals before the Tertiary. When the Cretaceous eutherian mammal skulls were found at Bayn Dzak again in 1964 and 1965, by the Polish-Mongolian Palaeontological Expeditions (see KIELAN-JAWOROWSKA & DOVCHIN, 1968), the Cretaceous eutherians were not the rarity they had been some 40 years before. They have recently been found in Upper Cretaceous beds in various places in North America (SIMPSON, 1951; CLEMENS, 1961, 1963*a*; CLEMENS & L. S. RUSSELL, 1965; SLOAN & VAN VALEN, 1965; VAN VALEN & SLOAN, 1965), one single tooth was found in Europe (LEDOUX *et al.*, 1966) and a fragmentary lower jaw with two teeth in South America (GRAMBAST *et al.*, 1967). Moreover, a fragmentary therian lower jaw with M_1-M_3 was found in the Lower Cretaceous referred to as Upper Jurassic (SHIKAMA, 1947) of South Manchuria, therian teeth were discovered in the Lower Cretaceous (Albian) of Texas (PATTERSON, 1956; SLAUGHTER, 1965) and in the Wealden of Great Britain (CLEMENS, 1963*b*).

The Cretaceous mammals from the Gobi, by virtue of their good state of preservation, differ from all those known from other continents. Whereas all the North American materials obtained by washing the sediment and screening the residue consist of isolated teeth or, at

best, fragmentary upper and lower jaws, the Gobi material embraces entire or partial skulls, often with lower jaws in occlusion, well preserved and showing the details of the skull structure. The Central Asiatic Expeditions assembled at Bayn Dzak in the red, poorly cemented sandstone of Djadokhta Formation (SIMPSON, 1928*a*, p. 2) a collection of 11 individuals (partial skulls and fragments of postcranial skeletons), assigned by SIMPSON (1925, 1928*a*) and GREGORY & SIMPSON (1926) to Multituberculata and Insectivora (presently Multituberculata, Insectivora and Deltatheridia). One multituberculate species (*Djadochtatherium matthewi* SIMPSON), and five insectivore species (*Deltatheridium pretrituberculare* GREGORY & SIMPSON, *Deltatheroides cretacicus* GREGORY & SIMPSON, *Hyotheridium dobsoni* GREGORY & SIMPSON, *Zalambdalestes lechei* GREGORY & SIMPSON, and *Zalambdalestes grangeri* SIMPSON) were described.

The Polish-Mongolian Palaeontological Expeditions assembled a collection of 25 individuals of Cretaceous mammals in 1964 and 1965 at the same locality. Five further specimens were later revealed in the laboratory, during the preparation of sandstone nodules collected at Bayn Dzak. In 1967, a five person field party from the Polish Academy of Sciences and the Academy of Sciences of the Mongolian People's Republic spent one week in Bayn Dzak. This group collected 6 further specimens of Cretaceous mammals. As a result, the collection of Cretaceous mammals from Bayn Dzak, housed (see also KIELAN-JAWOROWSKA & DOVCHIN, 1968, p. 12) in the Institute of Palaeozoology in Warsaw, consists of 36 individuals, 9 of which were collected in 1964, 21 in 1965 and 6 in 1967. Thirteen specimens of this collection belong to the eutherian mammals and 23 to the multituberculates.

All the mammals (except one skull), collected at Bayn Dzak by both the American and Polish-Mongolian Palaeontological Expeditions, come from one stratigraphical horizon, designated by GRADZIŃSKI *et al.* (1968, p. 71 and Fig. 30) by the numeral 2. This is a 10 metre thick layer of orange to moderate reddish-brown sand or poorly cemented sandstone with sandstone nodules. One multituberculate skull (Z. Pal. No. MgM-I/17) was found in 1965, some 13 metres higher than the sandstone with nodules, near the top of the Flaming Cliffs, in a horizon designated by the numeral 4.

The poorly cemented sandstone, in which mammal remains were found (horizon No. 2), crops out in Bayn Dzak in three fields. The first, designated as "The Main Mammal Field" (GRADZIŃSKI *et al.*, 1968), lies at the base of the Flaming Cliffs. All the mammal specimens collected by the American Expeditions and by the Polish-Mongolian Palaeontological Expedition in 1964 come from this field. During the 1965 Polish-Mongolian Expedition and in the course of field-work in 1967 mammals remains were collected, in addition to the Main Field, in two other fields, named "The Ruins", situated 2500 metres NW of the Flaming Cliffs and "The Volcano", which lies at the foot of the volcano-shaped hill, 2000 metres NW of the Ruins. The majority of specimens were found in sandstone nodules, the only exception being a fragmentary multituberculate skull (Z. Pal. No. MgM-I/12) found during 1965 in the Main Field *in situ*, in a sandstone yielding *Protoceratops andrewsi*.

The paper of NOVOZHILOV (1954) cast some doubts as to the Cretaceous age of the mammals from Bayn Dzak (see VAN VALEN, 1966; MAC INTYRE, 1966, and others). However, the geological observations carried out during the Polish-Mongolian Palaeontological Expeditions (LEFELD, 1965; GRADZIŃSKI *et al.*, 1968), and in particular the finding of a mammal skull *in situ*, in a sandstone containing *Protoceratops andrewsi*, proves without doubt that the mammals from Bayn Dzak are indeed of Cretaceous age and together with *Protoceratops andrewsi*, *Pinacosaurus grangeri*, dinosaurs eggs and lizards, characterize the sandstone of the Djadokhta Formation.

It is difficult to establish the exact age of the Djadokhta Formation, before all the fauna collected in the sandstone from Bayn Dzak has been elaborated, the more so since all the species of dinosaurs, lizards and mammals described from this formation are endemic species. The Djadokhta Formation is usually referred to as an Upper Cretaceous Formation, without further qualification. Preliminary examination of the eutherian mammals from Bayn Dzak, elaborated by the present writer, and their degree of anatomical differentiation seem to indicate that the fauna from Bayn Dzak is older than that of the Hell Creek Formation of Montana and the Lance Formation of Wyoming, while younger than the fauna of the Forestburg "Trinity Sandstone" (Albian) of Texas. This agrees with the conclusion of Professor R. E. SLOAN who, after examining some photographs of multituberculates from Bayn Dzak collected by the Polish-Mongolian Palaeontological Expeditions, wrote to the present writer (letter of March 14, 1966): "The multituberculates from Bayn Dzak are almost exactly intermediate between those from the Trinity Sandstone of the Albian of Texas and those of the Judith River fauna (same age as Belly River of Alberta) of the Mid-Campanian of Montana". Should this be the case, the Djadokhta Formation would correspond to the lower part of the Upper Cretaceous (Coniacian-Santonian).

In 1966, the present author began elaboration of the eutherian mammals from Bayn Dzak. The collection of multituberculates will be elaborated at a later date. At present, all the eutherian mammals from Bayn Dzak collected in 1964 and 1965 have been prepared, while those from 1967 are in the process of preparation.

The cement of sandstone nodules, yielding the mammal skulls is calcareous, however the skulls could not be prepared by chemical methods, as all the bones found in the sandstone of Djadokhta Formation are calcified and acetic acid affects the bone. The surrounding sandstone has been separated from the skulls by means of the finest entomological steel needles under a binocular microscope.

Preliminary determination of the eutherian mammals from Bayn Dzak gives the following species:

1. *Zalambdalestes grangeri* SIMPSON, represented by two skulls: Z. Pal. No. MgM-I/14 and Z. Pal. No. MgM-I/16, dentition of which is described in the present paper.
2. *Zalambdalestes lechei* GREGORY & SIMPSON, represented by two specimens: Z. Pal. No. MgM-I/13, badly damaged partial skull with lower jaws in occlusion; Z. Pal. No. MgM-I/32, fragment of the right lower jaw with damaged M_1-M_3.
3. *Zalambdalestes* sp., represented by a single individual: Z. Pal. No. MgM-I/4, described in the present paper.
4. *Kennalestes gobiensis* n. gen., n. sp., represented by three specimens: Z. Pal. No. MgM-I/3, type specimen; Z. Pal. No. MgM-I/2 and Z. Pal. No. MgM-I/5, described in the present paper.
5. New genus and species, so far undescribed, represented by a single invidual: Z. Pal. No. MgM-I/1, an almost complete skull of a young individual, with lower jaws in occlusion.
6. New genus and species so far undescribed, represented by a single individual: Z. Pal. No. MgM-I/29, a partial left lower jaw with P_1-M_3.
7. Unidentified specimen Z. Pal. No. MgM-I/30, strongly damaged anterior fragment of a skull, with fragmentary lower jaws in occlusion, which might belong to *Deltatheridium pretrituberculare* GREGORY & SIMPSON.
8. Unidentified specimen Z. Pal. No. MgM-I/31, partial left lower jaw with strongly damaged M_2-M_3.

9. Unidentified specimen Z. Pal. No. MgM-I/15 — partial left lower jaw with strongly damaged M_1-M_3.

The representatives of *Deltatheridium pretrituberculare* GREGORY & SIMPSON (except uncertain Z. Pal. No. MgM-I/30), of *Deltatheroides cretacicus* GREGORY & SIMPSON and of *Hyotheridium dobsoni* GREGORY & SIMPSON, described from the same locality by GREGORY and SIMPSON (1926), have not been found by our expeditions.

Thus the collections of eutherian mammals from Bayn Dzak, found by both the Central Asiatic Expeditions of the American Museum of Natural History and the Polish-Mongolian Palaeontological Expeditions, embraces about 9 species of eutherian mammals belonging to 6 or 7 genera. From the results of the American Expeditions, which found only one species of multituberculates *(Djadochtatherium matthewi)* in Bayn Dzak, one could assume that eutherian mammals were more differentiated in the Djadokhta Formation than multituberculates. The collection at the disposal of the present author, however, shows that this is not the case. Before all the species of multituberculates have been prepared, it is difficult to give even an approximate number of species and genera. However a cursory glance at the prepared collection of multituberculates shows that, in the Djadokhta Formation, this group was differentiated to more or less the same extent as were the eutherian mammals.

As the elaboration of the whole collection of eutherian mammals from Bayn Dzak will take some time, it is thought desirable to publish separately preliminary results from the studied material. These contain a diagnosis of *Kennalestes* n. gen., with a description of *Kennalestes gobiensis* n. sp., an emended diagnosis of *Zalambdalestes* GREGORY & SIMPSON, a description of the dentition of *Z. grangeri* SIMPSON and a description of *Zalambdalestes* sp. A more detailed description of the mentioned species, particularly the description of the skull of *Zalambdalestes*, including studies of the ear region, a description of the petrosal of *Kennalestes* and a discussion on the relationship and systematic position of the studied forms, will be published later, together with a description of the remaining eutherian mammals from Bayn Dzak.

Dental nomenclature employed in this paper is adopted in part from VAN VALEN, 1966.

The following abbreviations are used:

Z. Pal. — Palaeozoological Institute of the Polish Academy of Sciences, Warsaw.
A. M. N. H. — American Museum of Natural History, New York.

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Superfamily ?LEPTICTOIDEA

Uncertain Family

Genus KENNALESTES nov.

Type species: *Kennalestes gobiensis* n. sp.

Derivation of the name: Named in honour of Professor MALCOLM C. MCKENNA (American Museum of Natural History in New York); the second part of the name — *lestes* — alludes to the similarities between the new genus and *Zalambdalestes* and *Cimolestes*.

Diagnosis. — Naslas expanded posteriorly, in contact with lacrimals. Infraorbital foramen deep, above P^3, lacrimal foramen large. Postpalatine torus present. Transverse palatine suture opposite P^4-M^1 embrasure, posterior palatine foramina lacking, developed as small notches on the posterior palatine border. Angular process of the lower jaw inflected. Mental foramina beneath P_1 and posterior half of P_4. Upper canine two-rooted, P^4 molariform, but without true metacone (incipient metacone present). Upper molars transverse, with wide embrasures, postcingulum wider than precingulum. Conules small, stylar shelf wide in parastylar area, with prominent parastyle. Lower canine two-rooted. P_4 not molariform. Lower molars with very tall cusps, protoconid the tallest, paraconid the shortest, connate at base with metaconid, talonid cusps poorly developed.

Stratigraphical and geographical range. — Known only from the Upper Cretaceous sandstone of the Djadokhta Formation at Bayn Dzak, Gobi Desert.

Discussion. — The monotypic genus *Kennalestes* nov. cannot be assigned to any known insectivorous or deltatheridian family. It is tentatively assigned to the superfamily Leptictoidea, and a new family will be eventually erected for it later, when all the details of skull structure have been described. *Kennalestes* differs from the representatives of the Leptictidae (see MATTHEW, 1909, 1918, 1937; SCOTT & JEPSEN, 1936; SIMPSON, 1937; BUTLER, 1956, and D. A. RUSSELL, 1964) in having P_4 not molariform and P^4 without the true metacone. Further differences concern the skull structure, in particular the nasals, which in the new genus are expanded posteriorly, in contact with the lacrimals, which is not the case in the Leptictidae. This latter feature seems, however, to be characteristic of all the eutherian mammals from the Djadokhta Formation.

From *Procerberus* (see SLOAN & VAN VALEN, 1965), *Kennalestes* differs in having upper molars much more transverse, with longer embrasures between them, wider stylar shelves and a different structure of P^4_4, which in *Procerberus* are molariform (not in *Kennalestes*).

Of the Leptictoidea families, *Kennalestes* n. gen. recalls also certain features of the Zalambdalestidae. *Zalambdalestes*, which is the only representative of this family, is highly specialized, particularly in the structure of the anterior part of the snout (strongly enlarged I^2, long diastema between I^3 and C, semi-procumbent lower incisors and peg-like, one-rooted lower canine). In the structure of the anterior part of the snout, *Kennalestes* differs strongly from *Zalambdalestes*. The similarities of two genera concern the skull structure, the shape of the nasals, the lacrimals and the maxillary recess. Further similarities concern the structure of the upper canine, P^1, P^2 and P^3, which are similarly shaped, particularly so in lateral view. *Kennalestes* differs, however, from *Zalambdalestes* in having P^3 less elongated transversely and in having upper molars provided with precingulum and postcingulum. The degree of the molarization of P^4 is more or less similar in both genera, the incipient metacone being developed in a similar manner in both cases on the posterior edge of the paracone V. In the structure of the lower

molars *Zalambdalestes* is more similar to the Leptictidae than *Kennalestes* is. In *Zalambdalestes* P_4 is almost completely molariform, with a well developed trigonid, which is not the case in *Kennalestes*.

In the structure of P^4 and in the shape of the upper molars, *Kennalestes* is similar to the Pantolestidae (see MATTHEW, 1909, 1918, 1937; SIMPSON, 1936, 1937). It differs from the representatives of the Pantolestidae in the structure of P_4, which in pantolestids is submolariform, having a distinct paraconid and an incipient talonid, which is not so in the new genus. In the details of skull structure, however, *Kennalestes* differs as considerably from the Pantolestidae as it does from the Leptictidae.

P^4 without more than an incipient metacone, a feature characteristic for *Kennalestes*, *Zalambdalestes* and the Pantolestidae, occurs also in other groups of primitive insectivores, e.g. in the Geolabidinae (see MCKENNA, 1960), in Apternodontidae (see SCHLAIKJER, 1935, and SCOTT & JEPSEN, 1936) and others.

Kennalestes may be compared with the North American Upper Cretaceous genera: *Gypsonictops* SIMPSON and *Cimolestes* MATTHEW. *Gypsonictops* was assigned recently by ROMER (1966) to the Adapisoricidae. A discussion on the systematic position of *Gypsonictops* lies, however, beyond the scope of the present paper. *Kennalestes* resembles *Gypsonictops* (see SIMPSON, 1951) in the general pattern of the upper and lower molars, differing in having the upper molars with wider stylar shelves and a different structure of P^4_4, which in *Gypsonictops* are molarized.

On the other hand, *Kennalestes* shows considerable similarities to the North American Upper Cretaceous genus *Cimolestes* MARSH, assigned (see CLEMENS & L. S. RUSSELL, 1965) to the Palaeoryctidae. M_1 and M_2 of *Kennalestes gobiensis* are very similar to the lower molar being the type of *C. incisus* MARSH (see MARSH, 1889, Pl. 4, figs 12-15, and SLAUGHTER, 1965, fig. 6), differing however in having the trigonid relatively shorter with regard to the talonid, anterior cingulum less conspicuous and no fourth cusp (mesoconid) on the talonid. The lower jaw of *Cimolestes magnus* CLEMENS & RUSSELL figured by these authors (*l. c.*, Fig. 5) shows that P_4 in *Cimolestes magnus* was, as in *Kennalestes gobiensis*, not molariform, however in *C. magnus* P_4 is provided with a small anterior basal cusp and a talonid-like basin, which are lacking in the new species.

The new material of *Gypsonictops* and *Cimolestes* from the Lance Formation of Wyoming, presently under investigation by Dr. CLEMENS, shows that the similarities of *Kennalestes* to the two genera in question concern many other characters of the dentition and skull structure. However, this can be discussed in detail only when the material from the Lance Formation is described by Dr. CLEMENS.

It should be also mentioned that *Kennalestes* shows certain similarities in the structure of the skull and lower jaw to the primitive marsupials, which will be discussed by the present writer in detail when all the eutherian mammals from Bayn Dzak are described.

At the end of this discussion, the author would like to point out that the similarities between the new genus and *Endotherium* SHIKAMA, known from the Lower Cretaceous of South Manchuria (SHIKAMA, 1947), as well as between the new genus and the Lower Cretaceous therians of Texas (PATTERSON, 1956; SLAUGHTER, 1965) are not close enough to warrant a detailed comparison. This also applies to the isolated lower molar, described from the Upper Cretaceous of France (LEDOUX *et al.*, 1966). As regards the two lower molars (M_1-M_2), described from the Upper Cretaceous of South America as *Perutherium altiplanense* THALER (*in* GRAMBAST *et al.*, 1967), they do not seem to the present author to be of the Cretaceous pattern of the tooth structure.

Kennalestes gobiensis n. sp.

(Pls. XXII-XXV; Text-figs. 1-3)

Type specimen: Z. Pal. No. MgM-I/3 — almost complete, somewhat distorted skull, without the posterior portion of the cranium, with right and left lower jaws in occlusion. Right root of I^1, broken off I^2, root of I^3 and C-M^3; left I^3-M^3. Right lower jaw almost complete, the condyle lacking, with I_1-P_3, dP_4, M_1-M_3. In left lower jaw: root of I_1, broken off I_2 and C-M_3 preserved, most anterior portion of the jaw as well as posterior one (coronoid process, condyle and angular process) lacking. One isolated upper incisor (possibly I^1) has been found lying by the palate of the skull.

Type horizon and locality: Upper Cretaceous (Djadokhta Formation), Bayn Dzak (Main Field), Gobi Desert.

Derivation of the name: gobiensis — occurring in the Gobi Desert.

Diagnosis. — As for the genus.

Material. — Three individuals, all found at the Main Field in Bayn Dzak, Gobi Desert. Z. Pal. No. MgM-I/3 — type specimen describe above; Z. Pal. No. MgM-I/2 — partial skull, without lower jaw; most anterior portion of face and posterior portion of cranium lacking. Right side: alveoli for C-P^1 and P^2-M^3; left side: alveoli for C-P^2 and P^3-M^3. All teeth are in an excellent state of preservation. In the same piece of sandstone, about 1 cm behind the skull, was found an incomplete mould of the most posterior portion of the cranium, preserving parietal and interparietal bones and close to it an isolated, well preserved petrosal bone. There is no doubt that all these bones belong to the same individual. Z. Pal. No. MgM-I/5 is an incomplete, somewhat distorted skull, with incomplete right and left lower jaws in occlusion. The anterior portion of the face and posterior portion of the cranium are lacking. P^3-M^3 are preserved on the right side, broken off P^2 and P^3-M^3 on the left. Left mandible with a partial coronoid process, angular process and masseteric fossa, root of P_3, incomplete dP_4, $M_{-1}M_3$, incomplete right mandible with P_3, dP_4, M_1-M_2, and a trigonid of M_3.

Description. — Dental formula:

$$\frac{3\ 1\ 4\ 3}{?2\ 1\ 4\ 3}$$

Measurements — see Table 1.

Upper dentition. Incomplete upper incisors are preserved only in Z. Pal. No. MgM-I/3. On the right side of the specimen there are traces of three incisors. Incisor row antero-posterior rather than transverse. The root of I^1 is well seen on the right side of Z. Pal. No. MgM-I/3, both in lateral and occlusal views. It is broken off at the level of the palatal part of premaxilla. It shows a suboval (almost rounded) section perforated in the middle by a canal. The isolated, broken off tooth, found lying at the palatal part of maxilla of the same specimen, is regarded tentatively as I^1. It is a simple tooth, which was directed downwards, somewhat bent posteriorly in the distal part. There is a short diastema between I^1 and I^2. I^2, preserved on the right side of the same specimen, has its most distal part broken off. It is a peg-like tooth, directed downwards, somewhat posteriorly. On the right side of the same specimen, only a part of the root of I^3 is preserved, poorly seen in lateral view. This tooth is well preserved on the left side of the same specimen, but, because the anterior part of the skull is distorted, the left I^3 is situated more anteriorly than the right I^3, opposite right I^1. Left I^3 is a peg-like tooth, directed downwards, somewhat anteriorly. A reconstruction of the anterior part of the skull (Text-fig. 3), based on left and right sides of Z. Pal. No. MgM-I/3, shows that there is a very short diastema between the roots of I^2 and I^3, however, as I^2 is directed slightly posteriorly and I^3 anteriorly, they converge distally somewhat. As all the described incisors are somewhat distorted or broken off, and the same concerns the

Table 1

Kennalestes gobiensis n. sp.
(measurements in mm)

Z. Pal. Mus. cat. No.	MgM-I/3	MgM-I/2	MgM-I/5
C-P^3 ant.-post., ext.	6.37	—	—
M^1-M^3 ant.-post., ext.	4.77	5.0	4.9
M^1 tr.	2.2	2.5	ca. 2.2
M^1 ant.-post., ext.	3.2	1.8	3.18
M^3 tr.	2.4	2.67	1.99
M^3 ant.-post., ext.	1.43	1.78	1.4
C-P_3 ant.-post., ext.	5.7	—	—
M_1-M_3 ant.-post., ext.	5 09	—	4.96
M_1 tr.	1.05	—	—
M_1 ant.-post., ext.	1.65	—	1.57
M_3 tr.	1.17	—	—
M_3 ant.-post., ext.	1.9	—	1.78
Depth of anterior opening of infraorbital canal.	ca. 1.59	ca. 1.4	—
Length of infraorbital canal	ca. 4.01	ca. 3.2	—
Depth of lower jaw below P_4	2.02	—	ca. 2.5
The same below M_3	2.15	—	ca. 2.29

premaxilla, it is possible that the presented reconstruction is not entirely correct, and that in fact the incisors were arranged in somewhat different directions.

The upper canine is situated after the short diastema behind the premaxillo-maxillary suture. It is a two-rooted, very strong tooth, directed downwards.

P^1 is a compressed, very small tooth with one main cusp, and uncertain posterior basal cusp, two-rooted, subtriangular, situated after a short diastema behind C. It is preserved only on both sides of Z. Pal. No. MgM-I/3. P^2 is very slightly larger than P^1 and differs from P^1 in being provided, in addition to the main cusp, with two basal cusps, the posterior larger than the anterior one. The shape of this tooth is very well seen on the right side of Z. Pal. No. MgM-I/2 (Plate XXIV, fig. 1 *a*). A very short diastema is present between P^2 and P^3, which is a three-rooted tooth, subtriangular in lateral view. P^3 is the highest of all the cheek teeth and only slightly lower than the canine. There is no cingulum or stylar shelf. The lingual root is arranged somewhat asymmetrically, in the posterior part of the tooth. In addition to the main cusp, which is very high, there are two additional basal cusps, the anterior low and the posterior more prominent and higher, well seen on the right side of Z. Pal. No. MgM-I/2, though in lateral view the posterior cusp is obscured by P^4. P^4 (possibly dP^4) is similar in structure to the molars, however without a well-developed metacone. It is a comparatively small tooth, shorter (both *long.* and *tr.*) than M^1. In lateral view, its height is a little more than a half that of P^3. The stylar shelf is comparatively wide laterally, narrowing in the middle. There is a very prominent parastyle and behind it an incipient, almost unrecognizable stylocone seen easily only in lateral view. In the posterior part of the stylar shelf which is narrow, an almost undiscernible style (?metastyle) may be recognized. The paracone is situated in the middle of the labial part of the tooth. In lateral view, on the posterior crest of the paracone V there is a basal cusp which, judging from its position and size, can be recognized as an incipient metacone. In lateral view, the incipient metacone appears poorly separated from the stylar shelf and might be mistakenly regarded as one of the styles. The protocone is much lower than the paracone,

but prominent and lingually situated, the conules hardly discernible. The protofossa is hollowed out by wear, directed obliquely downwards towards the posterior, postprotocrista being situated lower than the preprotocrista. The precingulum is very indistinct, the postcingulum more prominent.

M^1 and M^2 are similarly developed and are described here together. M^2 is wider and more robust than M^1. The ectoflexus is very deep, particularly so in M^2. The stylar shelf is

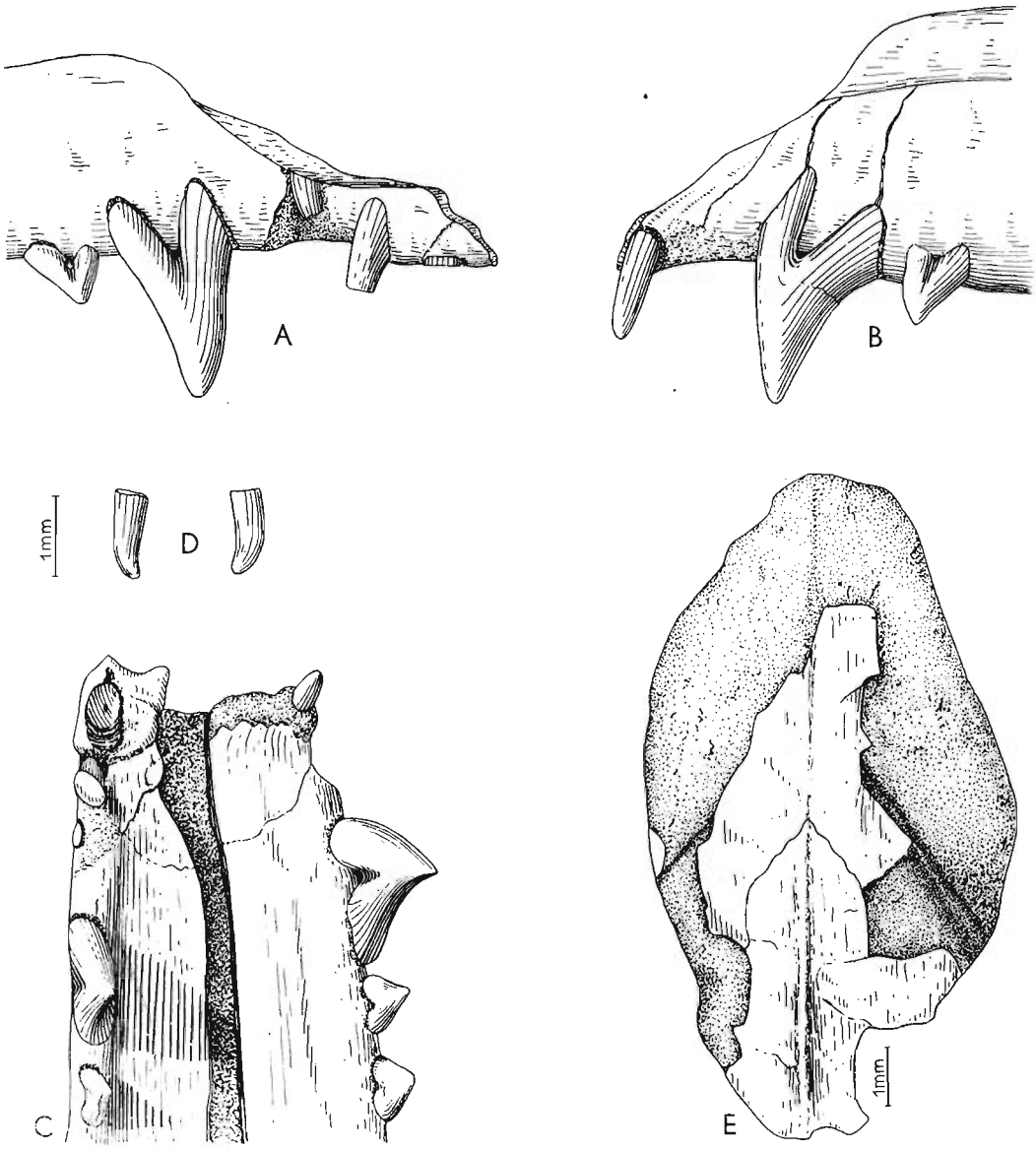

Fig. 1

Kennalestes gobiensis n. sp. *A-C* Anterior part of the skull of Z. Pal. No. MgM-I/3 in lateral and occlusal views, showing a root of I^1, broken off I^2, fragmentary root of I^3, C and P^1 on the right side, and I^3, C, P^1 and P^2 (the latter only in occlusal view), on the left side. *D* Upper incisor, possibly I^1, found lying by the palate of the same specimen. (Figs. *A-D* in the same scale). *E* Fragment of the posterior part of the skull of Z. Pal. No. MgM-I/2, somewhat compressed laterally, found in the same piece of rock as the skull, figured on Plate XXIV, lying 1 cm behind the anterior part of the skull.

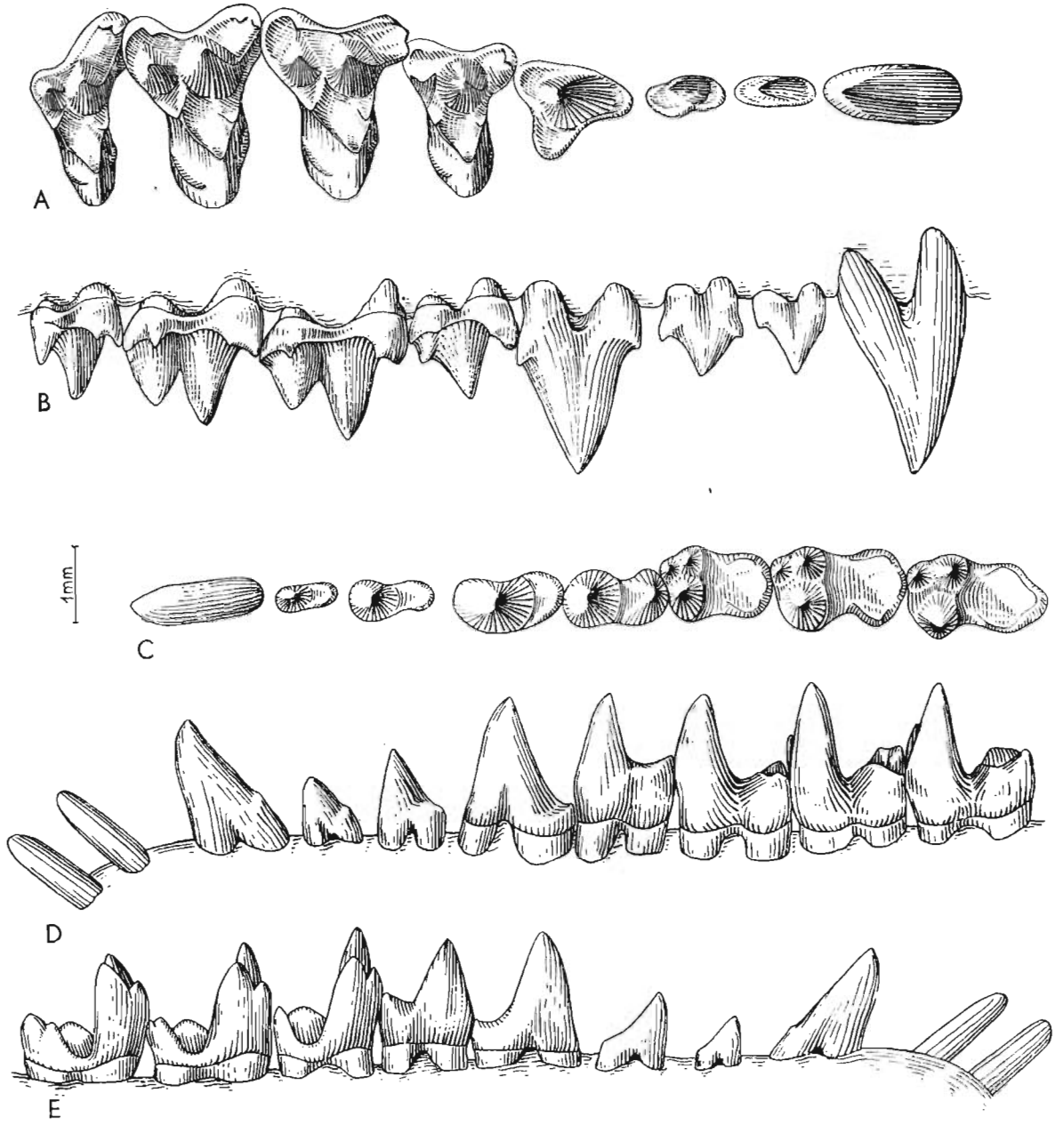

Fig. 2

Kennalestes gobiensis n. sp. *A-B* Upper canine and cheek dentition in occlusal and labial views. *C* Lower canine and cheek dentition in occlusal view. *D-E* Lower dentition in labial and lingual views.

comparatively wide at the corners of the tooth, strongly narrowing in the middle. The parastylar area is developed (in occlusal view) as a large, rounded lobe, with a prominent parastyle. In labial view behind the parastyle, there is a stylocone, closely adhering to the parastyle and lower than it. On the metastylar area, there is a small, sharp stylar cusp, situated in front of the metastyle, very well seen in lateral view. The paracone is larger and higher than the metacone. The conules are distinct, the metaconule situated more labially than the paraconule. The

protocone is prominent, placed asymmetrically at the anterior part of the tooth opposite the paracone. Preprotocrista and postprotocrista are developed as distinct edges, protofossa hollowed out by wear, directed obliquely, but less so than in P^4. The anterior face of protocone is more vertical than the posterior one; the precingulum is distinct but small, and much less prominent than the long and wide postcingulum.

M^3 is smaller than M^2, asymmetrical, with very large parastylar area, small ectoflexus, the metastylar area not developed. In occlusal view, the outer edge of the tooth is directed strongly obliquely, the parastylar area developed as a large, suboval lobe, stretching somewhat out behind the outer margin of M^2. On the parastylar area there are two styles, adhering to each other, parastyle and stylocone, well seen in lateral view. The protocone is larger and higher than the metacone, which is situated at the postero-labial corner of the tooth. The metaconule is placed somewhat more labially than the paraconule. The protocone tip is situated asymmetri-

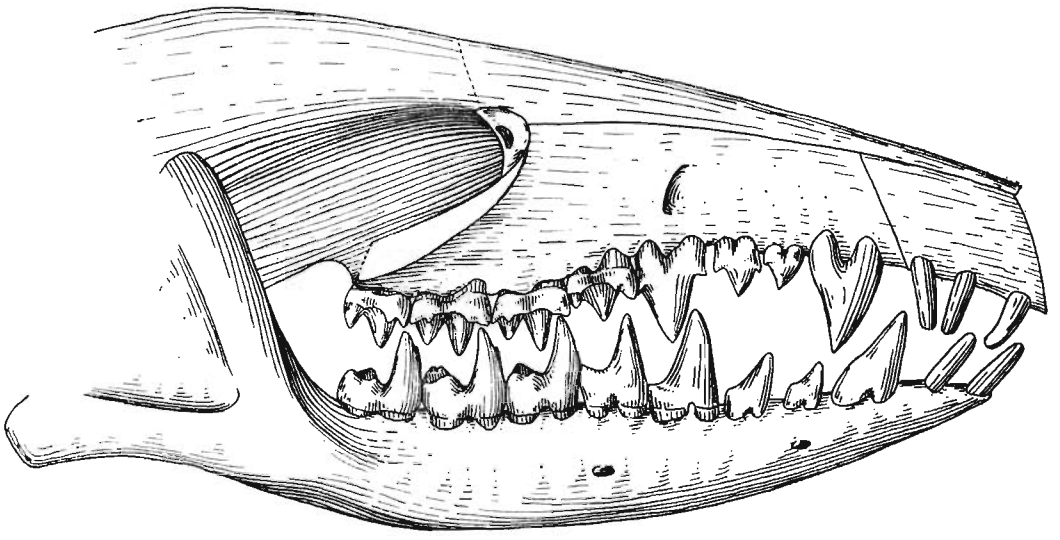

Fig. 3
Kennalestes gobiensis n. sp., schematic reconstruction of the anterior part of the skull in lateral view; ×6.

cally in the anterior part of the tooth; the postprotocrista placed lower than the preprotocrista. The postcingulum is larger than the precingulum.

Lower dentition. The lower incisors are preserved only in Z. Pal. No. MgM-I/3, partially broken I_1 and I_2 in the right lower jaw, and the root of I_1 and broken off I_2 in the left. The structure of the anterior part of the lower jaws of Z. Pal. No. MgM-I/3 shows that there is no room in front of the preserved incisors for one tooth more. I_1 is situated in the prolongation of the lower edge of the jaw, being strongly procumbent. I_2 is somewhat less procumbent. There is a short diastema between I_2 and the canine. There are no traces of I_3 or its alveolus; since, however, both lower jaws with lower incisors are strongly damaged, the presence of three incisors cannot be excluded.

All lower teeth behind I_2 including the canine are two-rooted. The canine is high, subtriangular, trenchant, slightly procumbent.

There is a very short diastema between the canine and P_1, which is subtriangular, compressed, with a main cusp and very small, posterior basal cusp. There is also a short diastema between P_1 and P_2. P_2 is similar in shape to P_1, but distinctly larger and somewhat less procum-

bent, provided with a main anterior cusp and a prominent posterior basal cusp. The distema between P_2 and P_3 is very short. P_3 is somewhat higher than the canine, directed upwards, provided with an anterior main cusp and a low posterior basal cusp. P_4 is preserved only on the right side of Z. Pal. No. MgM-I/3. On the left side of the same specimen, and in the right and left lower jaws of Z. Pal. MgM-I/5, dP_4 is present. DP_4 is a strongly compressed tooth, slightly lower than P_3, with a centrally disposed main cusp, very low anterior basal cusp, and comparatively high posterior cusp, placed somewhat lingually with regard to the longitudinal axis of the tooth. P_4 is somewhat higher than dP_4. It is not molariform and consists of a main cusp in the anterior part of the tooth, and an unbasined heel with a single cusp.

Three lower molars are similarly shaped and will be described together. The trigonid is compressed anteroposteriorly, being in M_1 slightly less than one half of the total length of tooth. The talonid increases in length towards the posterior, and in M_3, the trigonid is equal to 0.40 of the total tooth length, M_3 being the longest of the molars. The protoconid is the largest cusp. The metaconid is larger than the paraconid, which is situated more centrally on the anterior face of the tooth. Since in the studied collection there are no isolated teeth, the anterior face of the molars is difficult to examine. However, in the left lower jaw of Z. Pal. No. MgM-I/3, which bears the best preserved molars, one can recognize on the anterior face of the trigonid of M_2 and M_3 a very weak anterior cingulum, originating near the base of the crown at the buccal edge and projecting diagonally upwards. The talonid is very low in comparison with the high trigonid. Of the three talonid cusps on M_3, the hypoconulid is the highest, entoconid lower, hypoconid the lowest. There is a very steep ridge, connecting the entoconid to the base of the trigonid on the lingual side, running steeply downwards, due to which the large part of the postfossid is seen in lingual view. The crista obliqua connects the hypoconid to the posterior face of the trigonid, almost opposite (slightly labial) the notch between the paraconid and the metaconid. In all the examined M_1 and M_2, the talonid cusps are somewhat worn; it appears, however, that they were developed in a similar manner as in M_3. The talonid basin (postfossid) is comparatively large, rounded, hollowed out somewhat obliquely by wear in all the molars, forming a sort of furrow which originates at the lingual side of the trigonid and runs diagonally upwards towards the hypoconid, the entoconid and hypoconulid forming the high edge of this furrow. In M_3, the crown behind the hypoconulid is somewhat swollen posteriorly, which causes the talonid of M_3 to be longer than that of M_2 and M_1.

Skull. The snout is elongate and tubular, strongly narrowing anteriorly, more sharply so in front of the anterior opening of the infraorbital foramen. The bones of the cranium are broken and incompletely preserved. The anterior part of frontals is preserved in all the three skulls. Since the bones of the cranial roof are in all the specimens broken, one cannot recognize with certainty the suture between the nasal and the frontal. Evaluation of its course — opposite the anterior margin of the orbit and directed subtransversely (Text-fig. 3), must be regarded as tentative.

The antero-lateral corners of the frontals contact the lacrimals. The suture between the frontal and maxilla (or palatinum) in the pterygo-palatine fossa is indeterminate. The postorbital process is lacking. In all the specimens, the frontals are either flat, or directed somewhat obliquely downwards towards the median suture. The latter position, however, seems to be caused by the state of preservation. The preserved part of the brain-case (covered by the frontals) is very narrow, tubular. The contact of the frontals with parietals is not preserved.

The fragmentary parietals are preserved only in a fragment of the posterior part of the brain case of Z. Pal. No. MgM-I/2 (see Text-fig. 1*e*, and Plate XXIV, figs. 1*f*, 1*g*), preserved in the same piece of sandstone as the anterior part of the skull, 1 cm behind it. This specimen

is somewhat compressed laterally; in the anterior part, the bones of the cranial roof are not preserved, showing the part of the endocranial mould. In the middle of the posterior part of the brain case, fragmentary parietals are preserved.

A large part of the interparietal bone, separated from the parietals by a discernible suture, is preserved in the same specimen. The interparietal is comparatively extensive, wedged between the parietals. The sagittal crest is very low at the posterior part, becomes more prominent in the middle and disappears again in the anterior one third of the interparietal. The posterior edge of interparietal is not preserved.

In the piece of rock yielding the skull designated as Z. Pal. No. MgM-I/2, an isolated, well-preserved petrosal, regarded as belonging to the same specimen, was found lying between the two fragments of the skull. The petrosal will be described in a later paper, together with the description of the ear region of other eutherian mammals from Bayn Dzak.

The bones of the face are much more completely preserved than those of the cranium. The fragmentary premaxilla is preserved only in Z. Pal. No. MgM-I/3, its body and nasal process being almost entirely damaged. The palatine process of the premaxilla is somewhat concave. The posterior extremity of the palatine process is convex posteriorly, the suture between it and palatine process of maxilla being directed from the middle antero-laterally.

The maxilla is elongate and comparatively low in a vertical sense. It is highest at the margin of the orbits, and thence its height diminishes slightly anteriorly and strongly posteriorly. The premaxillo-maxillary suture is not preserved, it has been placed (in Z. Pal. No. MgM-I/3) about 1 mm in front of the canine, which lies entirely within the maxilla. The anterior extremity of the maxilla, in front of the infraorbital foramen is somewhat concave. The alveolar border is slightly sigmoid. The infraorbital foramen is deep, directed somewhat diagonally, having a thickened posterior edge, situated above the middle of P^3. It appears from the preserved parts of the maxilla that the premaxillo-maxillary suture was directed more or less vertically (not very diagonally), the nasal process of the premaxilla not being very well developed.

There is a very long maxillo-nasal contact. It appears from the structure of Z. Pal. No. MgM-I/5 (Plate XXV, fig. 1 *a*), that the nasal is bevelled for articulation with maxilla, which covers it dorsally. At the anterior edge of the orbital cavity placed opposite M^1, the maxilla contacts the lacrimal. The zygomatic process of the maxilla is comparatively long, strongly narrowing posteriorly, being over a large area covered dorsally and laterally by the malar bone, which however is preserved only on the right side of Z. Pal. No. MgM-I/5 (see Plate XXV, fig. 1 *b*). On the left side of the same specimen and in all other specimens, the malar bone is lacking and the wide contact of the zygomatic process with the malar is well exposed. The recessus maxillaris is very large, almost flat, subtriangular, occupying the whole base of the orbit. It is perforated by numerous foramina alveolaria posteriora, in which the tips of the molar roots are visible. In the anterior corner of the recess, the maxillary foramen, leading to the infaorbital canal, is clearly visible. The opening of the posterior palatine foramen is not discernible. Also the maxillo-palatine suture in this part is not possible to trace, and one cannot be certain whether maxillo-frontal contact existed. Between the horizontal part of the maxillary recess and the vertical (proximal) wall of the orbits, there is a longitudinal groove, with an uncertain opening at its end, opposite M^3, which might correspond to the sphenopalatine foramen. On the left side of Z. Pal. No. MgM-I/5, in the upper part of the vertical wall of the orbit, there is a longitudinal line, which could be interpreted as a suture between the expanded maxilla and the frontal. In such a case, the perpendicular wall of the palatine would be crowded out from the orbit by the expanded maxilla. As, however, all these elements are poorly preserved,

the above consideration concerning the structure of the orbit must be regarded as entirely tentative.

The transverse palatine suture is preserved only in Z. Pal. No. MgM-I/2. As however, this part of the palatine is somewhat cracked, the evaluation of its course must be regarded as tentative. It is situated opposite P_4-M_1 embrasure, directed from the middle somewhat postero-medially. The anterior palatine foramina are large, suboval, placed entirely within the palate. The palatine groove is shallow and distinct, well seen only on the left side of Z. Pal. No. MgM-I/2, proceeding anteriorly from the palatine foramen to a point opposite posterior root of P^2.

The palatine bones are not well preserved except for the hard palate. The posterior palatine foramina are apparently lacking, judging from Z. Pal. No. MgM-I/2 (right side), it may be presumed that there was a notch in the lateral part of palatine bone, at the rear of palate, for the minor palatine artery. The palatines form a transversely directed torus, at the rear of palate, best preserved on Z. Pal. No. MgM-I/2.

The nasals are strongly elongate, very narrow anteriorly, expanded posteriorly in contact with the lacrimals. Anterior margin of nasals is not preserved.

The lacrimal is in contact with maxilla, nasal, frontal and malar. Its facial wing is large, crescent-like, while the orbital wing seems to be smaller; its boundaries are, however, not well recognized. The lacrimal foramen is large, situated in the margin of the orbit. The lacrimal foramen is best seen on the left side of Z. Pal. No. MgM-I/2 (see Plate XXIV, fig. 1*c*), on this specimen, however, the lacrimal bone is incomplete, its dorsal part lacking. It appears that an almost complete lacrimal bone is preserved on the right side of Z. Pal. No. MgM-I/3, where the lacrimal foramen is somewhat compressed, but the superior part of the lacrimal bone is more completely preserved (Plate XXIII, fig. 1*a*).

The malar bone is partially preserved on the right side of Z. Pal. No. MgM-I/5, covering the maxilla both dorsally and laterally, the orbital part of the malar very narrow. The preserved part narrows anteriorly, towards the lacrimal. The posterior extremity is broken off, suggesting the presence of a well developed zygomatic arch. On the right side of Z. Pal. No. MgM-I/3 the most anterior part of the malar (contacting with lacrimal) is preserved, while posteriorly one can recognize on the maxilla a furrow, indicating the lower edge of the malar (see Plate XXIII, fig. 1*a*).

The *lower jaw* is almost completely preserved on the right side of Z. Pal. No. MgM-I/3, and only the condyle and posterior part of coronoid process are lacking. On the left side of the same specimen it is less complete, while in Z. Pal. No. MgM-I/5 only small fragments of the lower jaws are preserved. In Z. Pal. No. MgM-I/3 right and left lower jaws were preserved separately due to distortion (see Plate XXII, fig. 1*a*).

The lower jaw is slender, tapering strongly anteriorly, with lower margin sigmoid, convex opposite the alveolar border and concave opposite the masseteric fossa. The foramina mentalia are situated beneath P_1 and the posterior root of P_4. The coronoid process ascends steeply upwards, the masseteric fossa is sharply limited by the masseteric crest, but not limited by a ridge below. The angular process in outer view is subquadrangular, directed slightly downwards, in occlusal view it may be seen (Plate XXIII, fig. 1*c*) to be inflected inwards. On the inner side, a longitudinal ridge may be recognized, which runs subparallel to the alveolar border, beneath the second incisor and canine. The symphyseal surface is limited to the area below this ridge and reaches back as far as P_1. The mandibular foramen is well discernible in right Z. Pal. MgM-I/3, situated far backwards, opposite the posterior broken edge of the coronoid process (Plate XXIII, fig. 1*f*). There is a distinct, comparatively deep furrow, running

from the mandibular foramen posteriorly. A more detailed description of this region and its interpretation will be given in the forthcoming paper.

Discussion. — See p. 175.

Superfamily **LEPTICTOIDEA**

Family ZALAMBDALESTIDAE GREGORY & SIMPSON, 1926

Genus **ZALAMBDALESTES** GREGORY & SIMPSON, 1926

Revised diagnosis. — Comparatively large insectivores; skull varying about 5 cm in length, strongly constricted in front of P^1; snout long, tubular, bent downwards; brain-case small; zygomata strongly expanded; postorbital constriction present. Nasals expanded posteriorly, in contact with lacrimals. Sagittal and lambdoid crests moderately developed. Infraorbital foramen above P^3-P^4 embrasure. Anterior palatine foramen very small, opposite P^3. Choanae very narrow, opposite M^3, posterior palatine foramina very large, suboval, with anterior border situated in one line with choanae. I^1 unknown (?lacking), I^2 enlarged, caniniform, I^3 small. Long diastema between I^3 and C, which is two-rooted. Short diastema between C and P^1. P^1 very small, P^2 somewhat larger, both compressed, two-rooted. P^3 in lateral view the largest of all the teeth, with prominent paracone and spur-like protocone. P^4 similar to P^3, without true metacone, but with protocone developed as in molars. Molars strongly elongated transversely, with well developed stylar shelf, paracone larger than metacone, conules incipient, precingulum and postcingulum lacking. M^3 reduced. I_1 procumbent, enlarged. I_2, I_3 and C with decreasing procumbency, styliform, C one-rooted. P_1 and P_2 trenchant, procumbent, P_1 larger than P_2. P_3 with large main cusp and small unbasined heel, P_4 semi-molariform with three-cusped trigonid and unbasined talonid. M_1 and M_2 with trigonids narrower than talonids, paraconid and metaconid connate at bases, paraconid very small, protoconid the highest, talonids strongly basined. M_3 narrower than M_2 with strongly basined talonid, provided with three cusps.

Dental formula: $\frac{?2\ 1\ 4\ 3}{3\ 1\ 4\ 3}$.

Stratigraphical and geographical range. — Upper Cretaceous (Djadokhta Formation), Bayn Dzak, Gobi Desert.

Discussion. — *Zalambdalestes* was erected by GREGORY and SIMPSON in 1926 to include *Z. lechei*, a species based on three specimens (two skulls associated with lower jaws and one lower jaw). SIMPSON (1928*a*) described *Zalambdalestes grangeri*, based on a partial skull, fragmentary pelvis and femur. The lower jaw of *Z. grangeri* was not known up to now.

It cannot be excluded but that the differences between *Z. lechei*, *Z. grangeri* and *Z.* sp. (here described) are connected with individual and age variations and are not of specific rank. Should this be the case, *Z. grangeri* and *Z.* sp. would be younger synonyms of *Z. lechei*. This question could be decided only after examination of all the specimens of *Zalambdalestes*, housed both in the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw and in the American Museum of Natural History in New York. Until this is possible, the present author accepts, for the time being, the validity of *Zalambdalestes* species erected by GREGORY and SIMPSON (1926), and SIMPSON (1928*a*).

In the collection of Cretaceous mammals from Bayn Dzak, collected by the Polish-

Mongolian Palaeontological Expeditions, there are five specimens of *Zalambdalestes*, two of which are assigned provisionally to *Z. grangeri*, two to *Z. lechei* and one (incomplete lower jaw) is described here as *Zalambdalestes* sp. The new details of the skull structure, including the interpretation of the ear region and description of the endocranial mould of *Zalambdalestes*, and a discussion on its affinities will be given later. In the present paper, the author gives only a description of the dentition of *Z. grangeri*, which so far has been poorly known, and a description of *Zalambdalestes* sp.

Zalambdalestes grangeri SIMPSON, 1928

(Pls. XXVI-XXVII; Text-fig. 4)

1928. *Zalambdalestes grangeri* n. sp.: G. G. SIMPSON, Further notes..., p. 2, Figs 1-2, 4-6.
1928*a*. *Zalambdalestes grangeri* SIMPSON; G. G. SIMPSON, Affinities..., Fig. 1*A*.
1961. *Zalambdalestes grangeri* SIMPSON; G. VANDERBROEK, The evolution..., Pl. 10*A*.
1964. *Zalambdalestes grangeri* SIMPSON; L. VAN VALEN, A possible origin..., Fig. 2 (partim).

Diagnosis. — P^1 asymmetrical, shaped as a scalene triangle, directed downwards; upper molars moderately elongated transversely, M^1 width/length ratio varying around 1.66. Depth of the lower jaw along P_1-M_3 not increasing posteriorly; diastema between P_1-C wider than the base of C, P_1 subtriangular with a wide base, slightly procumbent; diastema between P_1-P_2 lacking; P_3 directed upwards, provided with a prominent anterior basal cusp; lower molars comparatively wide; C-P_3/P_4-M_1 ratio (ext. length) about 1·4.

Material. — Two individuals from the Upper Cretaceous sandstone (Djadokhta Formation) of Volcano, Bayn Dzak (Gobi Desert). Z. Pal. No. MgM-I/14 — well preserved partial skull with right and left mandibles in occlusion. Posterior portion of cranium and anterior portion of face (in front of the upper canine) lacking. Lower and upper canines and cheek teeth very well preserved. Z. Pal. No. MgM-I/16 — nearly complete, well preserved skull (without mandibles), showing a somewhat damaged endocranial mould. The bones of the cranial roof and of the anterior portion of face lacking.

Description. — Measurements are given in Table 2.

Dentition: I^1 unknown, I^2 enlarged, caniniform, directed downwards, I^3 small, situated after a short diastema behind I^2. Long diastema between I^3 and C, equal to ext. P^3-P^4 length. Canine two-rooted, diastema between C and P^1 short, somewhat longer than the exterior length of P^1.

P^1 small, two-rooted, slightly compressed, asymmetrical, with a single cusp situated in the prolongation of anterior root. No cingulum. In lateral view, the tooth (excluding roots), has an appearance of a scalene triangle, with anterior crest directed downwards, posterior crest longer, directed diagonally. A very short diastema between P^1 and P^2. P^2 is well preserved only on right side of Z. Pal. No. MgM-I/14; on right side of Z. Pal. No. MgM-I/16 it is also preserved, but has the tip of the cusp broken off. It is somewhat larger than P^1, two-rooted, compressed laterally, with a prominent main cusp and a minute anterior basal cusp. A lingual cingulum extends from the anterior cusp to a point opposite the middle of the main cusp, and is absent from the posterior half of the tooth. P^3 is subtriangular in occlusal view, with a large main cusp (paracone) situated close the external border and a spur-like protocone. On the posterior crest of the paracone V (in lateral view), there is a very small cuspule, which is identified here as an incipient metacone. At the posterior end of this crest, in the prolongation of the paracone and metacone cusps, there is a large, prominent metastyle. The stylar shelf

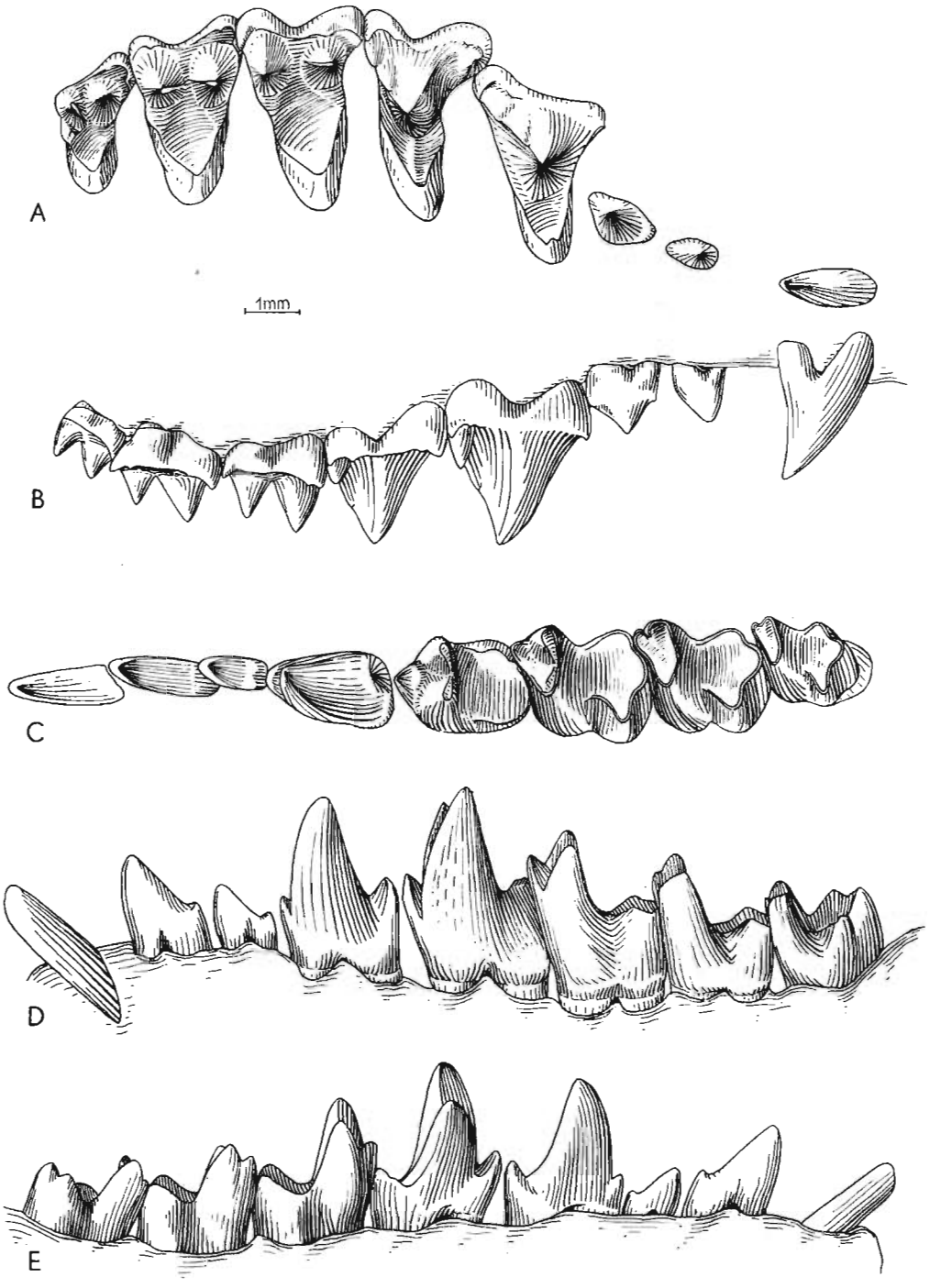

Fig. 4
Zalambdalestes grangeri SIMPSON. *A-B* Upper canine and cheek dentition in occlusal and labial views. *C-E* Lower canine and cheek dentition in occlusal, labial and lingual views.

is not actually developed, however one can recognize in the posterior part of the tooth, in addition to the metastyle, two minute styles hardly discernible. In front of these minute styles, the outer part of the tooth is smooth; in the most anterior part a parastyle is present. The

Table 2

Measurements (in mm) of *Zalambdalestes* species *

Species	*Z. lechei* Gregory & Simpson		*Z. grangeri* Simpson			*Z.* sp.
Mus. cat. No.	Z. Pal. MgM-I/13	A.M.N.H. 21708	Z. Pal. MgM-I/14	Z. Pal. MgM-I/16	A.M.N.H. 21709	Z. Pal. MgM-I/4
I^3-C ant. post., ext.	—	—	—	ca.10.6	—	—
Diastema I^3-C ext.	—	—	—	ca. 4.5	—	—
Diastema C-P^1 ext.	—	—	9.7	ca. 1.2	—	—
P^1-P^3 ant.-post., ext.	—	—	2.85	2.55	—	—
P^3-P^4 ant.-post., ext.	4.5	5.3	4.9	4.9	5.3	—
M^1—M^3 ant.-post., int.	4.6	4.5	4.6	4.7	5.3	—
M^1—M^3 ant.-post., ext.	5 1	5.4	5.1	5.3	6.3	—
P^3-M^3 ant.-post., ext.	9.4	ca. 9.9	9.9	10.0	10.8	—
M^1 ant.-post., ext.	1.8	2.1	2.0	2.1	2.5	—
M^1 tr.	3.4	4.0	3.3	3.4	4.1	—
M^3 ant.-post., ext..	—	ca. 1.4	1.1	1.1	1.7	—
M^3 tr.	—	ca. 2.6	2.4	2.3	2.7	—
C-P_3 ant.-post., ext.	7.93	—	6.95	—	—	5.09
P_4-M_1 ant.post., ext.	4.56	—	4.78	—	—	4.65
M_1-M_3 ant.-post., ext.	6.5	—	6.44	—	—	—
M_1 tr.	—	—	1.91	—	—	1.91
M_1 ant.-post., ext.	2.17	—	2.31	—	—	2.33
M_3 tr.	1.4	—	1.59	—	—	—
M_3 ant.-post., ext..	2.1	—	1.99	—	—	—
Depth of lower jaw (ext.) below P_4	3.44	—	3.72	—	—	2.82
The same below M_3	4.34	—	3.48	—	—	—

* Measurements of A. M. N. H. specimens — after Simpson, 1928*a*.

spur-like protocone is asymmetrical, directed obliquely antero-medially, much lower than the paracone.

P^4 is similar in structure to P^3, but has a protocone developed as in true molars. In lateral view, it is smaller than P^3. On the posterior crest of paracone V, there is a small cuspule identified as an incipient metacone, similar to that in P^3, a prominent metastyle being situated in its posterior prolongation. The stylar shelf is developed though narrower in the middle than in the molars. In addition to the prominent parastyle and metastyle, there are three hardly discernible, minute styles, two posterior ones situated close to the metastyle, anterior — close to the parastyle. The protocone is situated lower than the paracone, directed nearly transversely, with a slight anterior deviation. The precingulum and postcingulum are lacking. The surface between the protocone and paracone is hollowed out by wear, retaining a very characteristic transverse ridge in the middle, absent from other teeth.

M^1 and M^2 are similarly developed and are described here together, M^1 being somewhat wider transversely than M^2. The external margin is strongly incurved in the middle. The paracone and metacone are situated strongly labially, the paracone higher than the metacone. The parastyle and metastyle are prominent, the stylar shelf well developed (particularly at the ends). On the stylar shelf, in addition to the parastyle and metastyle, there are two or

three minute accessory styles, hardly discernible, the mesostyle not being developed. The protocone is situated lower than the paracone and metacone. Incipient conules are very indistinct. Precingulum and postcingulum are lacking. The surface between the protocone and paracone-metacone W is strongly concave, hollowed out by wear. M^3 is a small tooth. The metacone is distinctly lower than the paracone. The parastyle is distinct, the stylar shelf is present only in the anterior half of the tooth, while the metastyle is lacking. The protocone is situated lower than the paracone-metacone. On the postprotocrista, near the metacone base, is a curvature, convex outwards. The surface of the crown is hollowed out by wear, the conules not discernible.

Lower teeth. Lower incisors are unknown. The canine, preserved only on the left side of Z. Pal. No. MgM-I/14 is styliform, one-rooted, semiprocumbent. Between C and P_1 there is a short diastema. All the lower teeth posterior to canine are two-rooted. P_1 is trenchant, very slightly procumbent, with a prominent main cusp and a minute accessory cusp situated posteriorly. P_2 is situated after a very short diastema behind P_1. It is very small, insignificantly procumbent, with anterior main cusp and a minute posterior one. P_3 is larger than P_1 and P_2, consisting of a main cusp, with a minute accessory cusp in front of it, and small, unbasined heel with one low cusp (entoconid). The entoconid is situated lingually, the labial part of the heel sloping steeply downwards. P_4 is submolariform, highest of all the teeth, with three-cusped trigonid and an unbasined talonid. The protoconid is highest, somewhat connate (in posterior view) at the base with the lower metaconid. The paraconid is much lower and smaller than the protoconid and metaconid, situated at the anterior edge of the tooth. The talonid is much shorter than that of M_1, with a single cusp situated lingually and the labial part steeply sloping downwards.

M_1 and M_2 are similarly shaped. M_2 is lower and smaller than M_1. The trigonid in M_1 is smaller than in P_4, the talonid larger. The paraconid and metaconid are connate at their bases, the former being distinctly smaller and lower than the latter. The protoconid is somewhat higher than the metaconid. The talonid is strongly basined, with poorly defined cusps. One can recognize the higher entoconid and lower hypoconid which slightly projects laterally. M_3 is the smallest of the molars, narrower and shorter than M_2, with very small trigonid. The paraconid is vestigial, strongly connate with the metaconid, the protoconid is lower than the metaconid. The talonid is comparatively large, strongly basined, with three cusps. The entoconid is the highest, the hypoconulid situated close to it and insignificantly lower, the hypoconid the lowest.

Zalambdalestes sp.

(Pl. XXVI, fig. 2)

Material. — Incomplete right lower jaw, with alveoli of I_1-C, broken off P_1 and P_2-M_1 (Z. Pal. No. MgM-I/4), from the Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Main Field), Gobi Desert.

Description. — The teeth of the lower jaw tightly adhere to each other, without any diastemas. The partial root of I_1, preserved in the broken alveolus, shows that I_1 was entirely procumbent, lying in the prolongation of the lower edge of the jaw. Well preserved alveoli of I_2, I_3 and C show that these teeth were probably styliform, with decreasing procumbency. All the teeth posterior to C are two-rooted. The base of P_1, which is preserved, shows that P_1 was slightly procumbent. P_2 is an extremely small tooth, with tiny roots directed almost upwards, asymmetrical, with prominent anterior cusp and a trace of the posterior one. P_3

(partly broken off) is a large, subtriangular tooth, directed upwards, without an anterior basal cusp. It is provided with short, unbasined heel, with a single cusp (entoconid), situated lingually. The labial part of the heel slopes steeply downwards. P_4 is submolariform, with a comparatively large trigonid and shorter talonid. The metaconid is higher than the protoconid. The paraconid is the lowest, overhanging somewhat above the heel of P_3. The unbasined talonid is provided with a single cusp (entoconid), situated lingually, the labial part of the talonid sloping downwards. M_1 consists of a comparatively short trigonid and a large, strongly basined talonid. The metaconid is somewhat higher than the protoconid. The paraconid, placed very close to the metaconid, is very small. On the talonid, the entoconid and hypoconid may be recognized, the latter slightly projecting laterally. The hypoconulid is hardly discernible.

The lower jaw is comparatively slender, its depth does not change below M_1-P_3, tapering anteriorly below P_3-I_2. The lower edge (in labial view) is somewhat incurved below P_3. Small mental foramina are situated below P_1 and anterior part of P_3. On the lingual side there is a longitudinal arch-like ridge, convex upwards, extending below I_2-P_2. The symphyseal area extends below this ridge, reaching back to P_2.

Discussion. — The lower jaw described here as *Zalambdalestes* sp. is more slender than those of *Z. grangeri* and *Z. lechei*. It differs from the previously described species in having no diastemas between the lower teeth, and consequently the anterior part of the jaw is shorter in proportion to the posterior one than in *Z. grangeri* and *Z. lechei*. The exterior length C-P_3/P_4-M_1 ratio is in *Z. minor* 1.08, while in *Z. grangeri* and *Z. lechei*, which are provided with diastemas between C-P_1, and a short diastema between P_1-P_2, this ratio is 1.4 and 1.6 respectively. Further differences concern the shape of P_2, which in *Z. minor* is styliform, while in *Z. grangeri* and *Z. lechei* it is subtriangular. From *Z. grangeri*, it differs also in the shape of P_3, which in *Z. grangeri* is provided with anterior cusp, while in *Z. minor* and *Z. lechei* the anterior cusps are absent.

It may be presumed that the above differences are not of specific rank, but are connected with the young age of the individual.

Palaeozoological Institute
of the Polish Academy of Sciences
Warszawa, November 1967

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PLATES

PLATE XXII

Page

Kennalestes gobiensis n. sp. 177

(see also Plates XIII-XXV)

Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Main Field), Gobi Desert (Z. Pal. No. MgM-I/3)

Fig. 1*a*. Type specimen, partial skull with lower jaw in occlusion, slightly prepared, in right lateral view. Posterior portion of the right lower jaw preserved in the counterpart, not seen in the photograph; × 4.

Fig. 1*b*. The same in left lateral view; × 6.

Fig. 1*c*. The same in dorsal view; × 4.

Fig. 1*d*. Stereo-photograph of the same specimen, after the separation of the lower jaws, in occlusal view, left I^3-M^3, right root of I^1, broken off I^2, fragmentary root of I^3, C-M^3; × 4.

Photo: M. Czarnocka

1a

1b

1d

1c

Z. KIELAN-JAWOROWSKA: UPPER CRETACEOUS EUTHERIAN MAMMALS

PLATE XXIII

Page

Kennalestes gobiensis n. sp. 177

(see also Plates XXII and XXV)

Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Main Field), Gobi Desert

Fig. 1*a*. Type specimen (Z. Pal. No. MgM-I/3), stereo-photograph of the skull after the separation of the lower jaws, in the right lateral view, showing right root of I^1, broken off I^2, fragmentary root of I^3 and C-M^3.

Fig. 1*b*. Anterior portion of the skull of the same specimen with left I^3-M^3, in left lateral view.

Fig. 1*c*. Stereo-photograph of the separated lower jaws of the same specimen, in occlusal view, with I_2-M_3 in the left jaw.

Figs. 1*d*, e. Left lower jaw of the same specimen in labial and lingual views.

Figs. 1*f*, *g*. Right lower jaw of the same specimen in lingual and labial views.

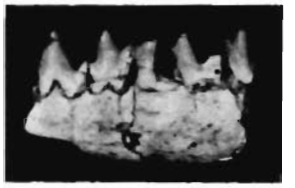
Figs. 2*a*, *b*. Isolated left lower jaw of the specimen Z. Pal. No. MgM-I/5, with P_3, dP_4, M_1, M_2 and trigonid of M_3, in labial and lingual views.

Figs. 2*c*, *d*. Isolated fragmentary right lower jaw of the same specimen, with fragments of P_3, dP_4, M_1-M_3, in lingual and labial views.

All the specimens ×4

Photo: M. Czarnocka

1c 1a

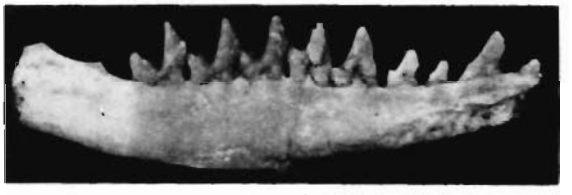


2a

2b

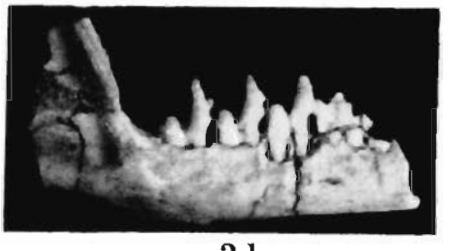
2c

1d



1e

1f



2d

1g

1b

PLATE XXIV

Page

Kennalestes gobiensis n. sp. 177

(see also Plates XXII, XXIII, XXV)

Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Main Field), Gobi Desert (Z. Pal. No. MgM-I/2)

Fig. 1*a*. Partial skull, slightly prepared, with right P^2-M^3 and alveoli for C and P^1, in right lateral view; × 6.

Fig. 1*b*. Stereo-photograph of the same specimen, finally prepared, in occlusal view. Right P^2-M^3 and alveoli for C-P^1, left P^3-M^3 and alveoli for C-P^2; × 4.

Fig. 1*c*. Stereo-photograph of the same, in left lateral view; × 4.

Fig. 1*d*. Stereo-photograph of the same, in right lateral view; × 4.

Fig. 1*e*. Stereo-photograph of the same, in dorsal view; × 4.

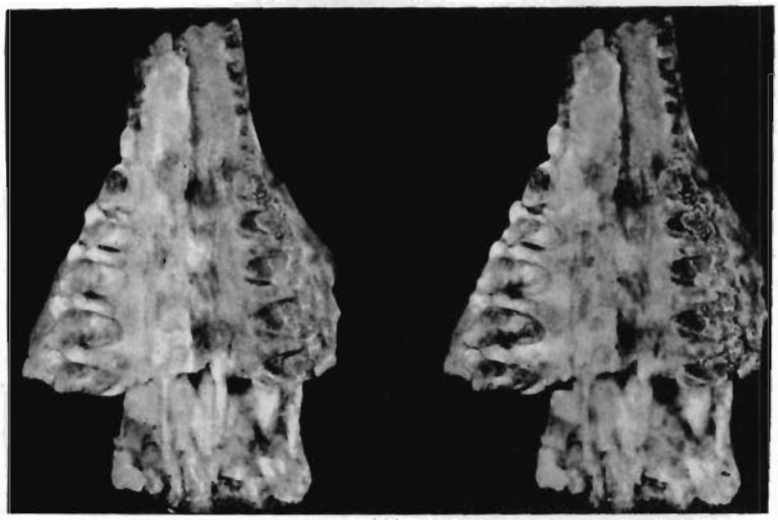
Fig. 1*f*. Montage-photograph of two parts of the same specimen, put together, originally preserved in a distance of 1 cm, one behind the other, in the same piece of rock; × 4.

Fig. 1*g*. Posterior part of the same specimen, in right lateral view; × 4.

Photo: M. Czarnocka

Remark: The tips of the right and left P^3 were broken and lost during preparation. Right P^3 is originally preserved only in Fig. 1*a*. In Figs 1*b*, 1*c* and 1*d*, the tips of the right and left P^3 are reconstructed out of plastic.

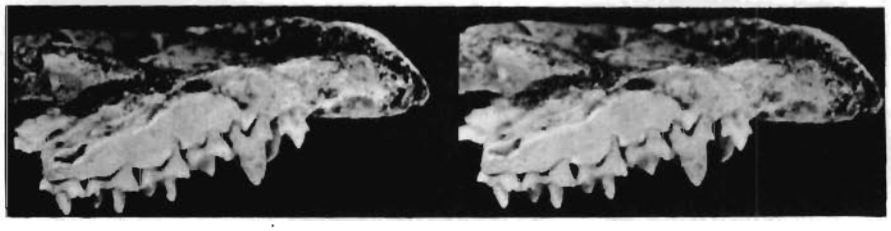
1a



1b

1f

1c



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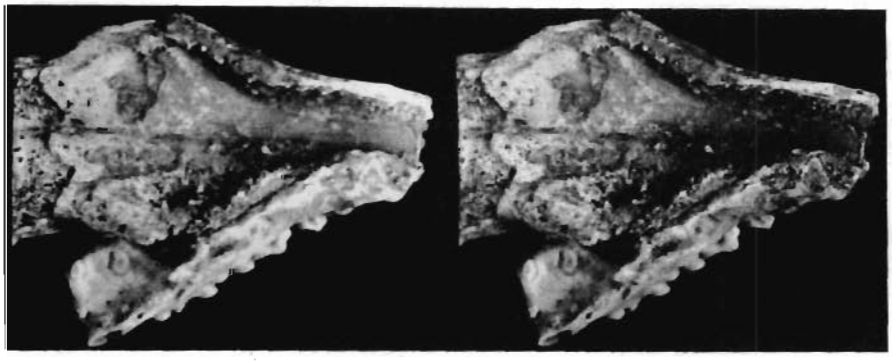


1e

1g

Z. KIELAN-JAWOROWSKA: UPPER CRETACEOUS EUTHERIAN MAMMALS

PLATE XXV

Page

Kennalestes gobiensis n. sp. 177

(see also Plates XXII-XXIV)

Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Main Field), Gobi Desert (Z. Pal. No. MgM-I/5)

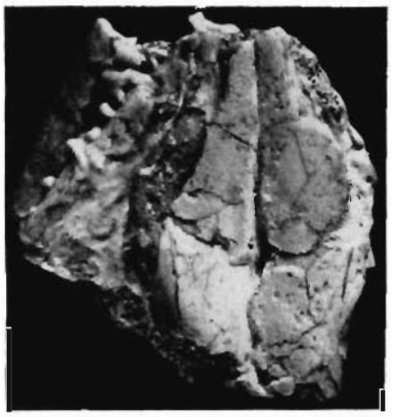
Figs. 1*a*, *b*, *c*. Fragmentary skull with lower jaws in occlusion, in dorsal, right lateral and left lateral views. Fig. 1*a* — ×4; Figs. 1*b*, 1*c* — ×6.

Fig. 1*d*. Stereo-photograph of isolated right and left lower jaws of the same specimen, in occlusal view, with P_3-M_2 and a trigonid of M_3 in the left jaw and P_3-M_3 in the right jaw; ×4.

Fig. 1*e*. Stereo-photograph of the same specimen, after the separation of the lower jaws, in occlusal view, with right P^2-M^3 and left P^2-M^3; ×4.

Photo: M. Czarnocka

1d



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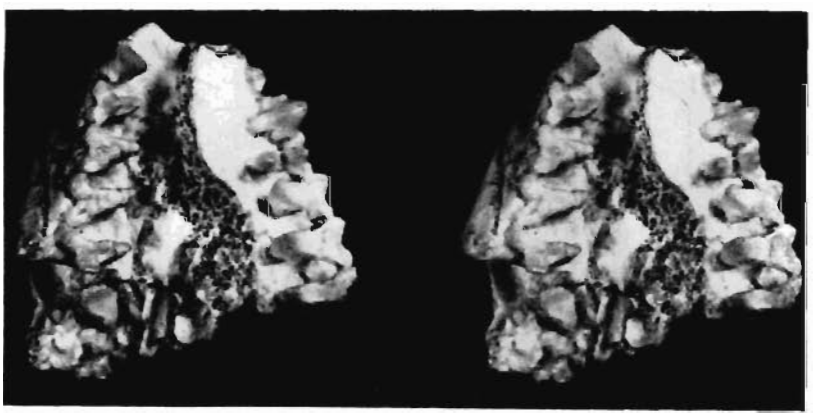

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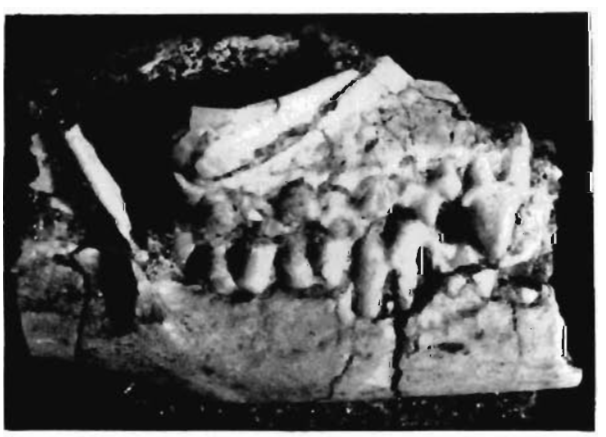
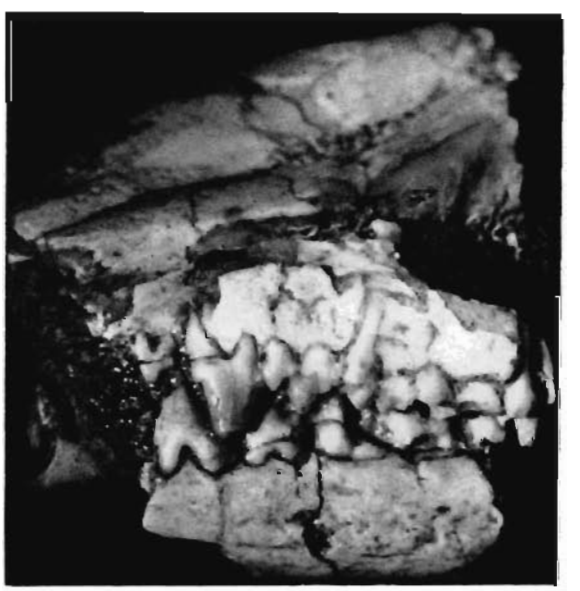


1b



1c

Z. KIELAN-JAWOROWSKA: UPPER CRETACEOUS EUTHERIAN MAMMALS

PLATE XXVI

Page

Zalambdalestes grangeri SIMPSON 186

(see also Plate XXVII)

Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Volcano), Gobi Desert

Figs. 1*a*, *b*, *c*. Partial skull with lower jaws in occlusion, slightly prepared, in right lateral, ventral and left lateral views (Z. Pal. No. MgM-I/14). Figs. 1*a*, 1*b* — ×4; Fig. 1*c* — ×6.

Fig. 1*d*. Stereo-photograph of separated lower jaws of the same specimen, in occlusal view, with C, P_1, alveolus for P_2, P_3-M_3 in left jaw and P_1-M_3 in right jaw; ×4.

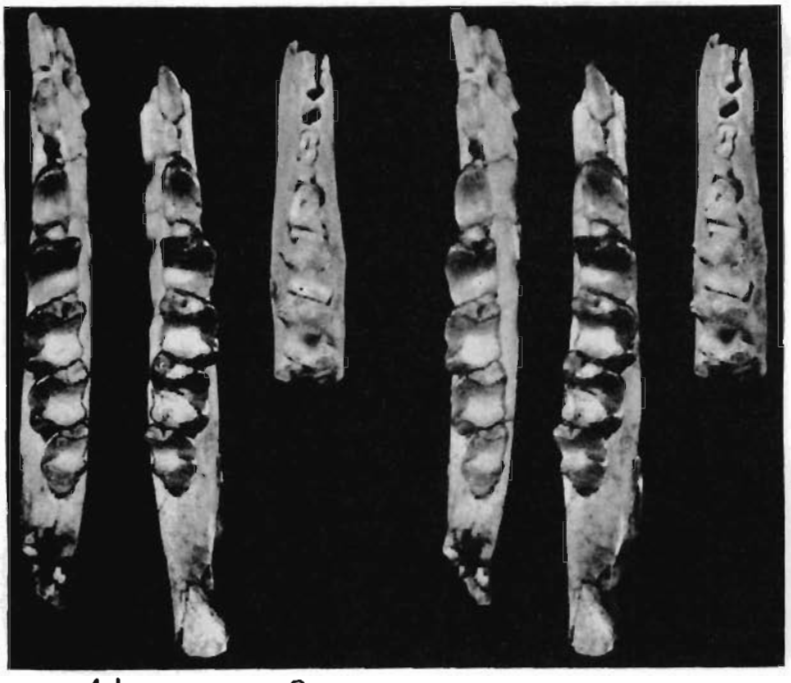
Zalambdalestes sp. 189

Upper Cretaceous, Djadokhta Formation, Bayn Dzak (Main Field), Gobi Desert

Figs. 2*a*, *b*. Fragmentary right lower jaw with alveoli for I_1-C, broken off P_1, P_2, P_3, P_4 and M_1, in labial and lingual views (Z. Pal. No. MgM-I/4); ×4.

Fig. 2*c*. Stereo-photograph of the same specimen, in occlusal view; ×4.

Photo: M. Czarnocka



1d 2c

2a

2b

1a

1b

1c

Z. KIELAN-JAWOROWSKA: UPPER CRETACEOUS EUTHERIAN MAMMALS

PLATE XXVII

Page

Zalambdalestes grangeri SIMPSON 186

(see also Plate XXVI)

Fig. 1*a*. Stereo-photograph of the skull of Z. Pal. No. MgM-I/14, in occlusal view, after the separation of the lower jaws, with C-M^3 on the right side, and C, alveoli for P^1-P^2, and partially damaged P^3-M^3 on the left side; ×4.

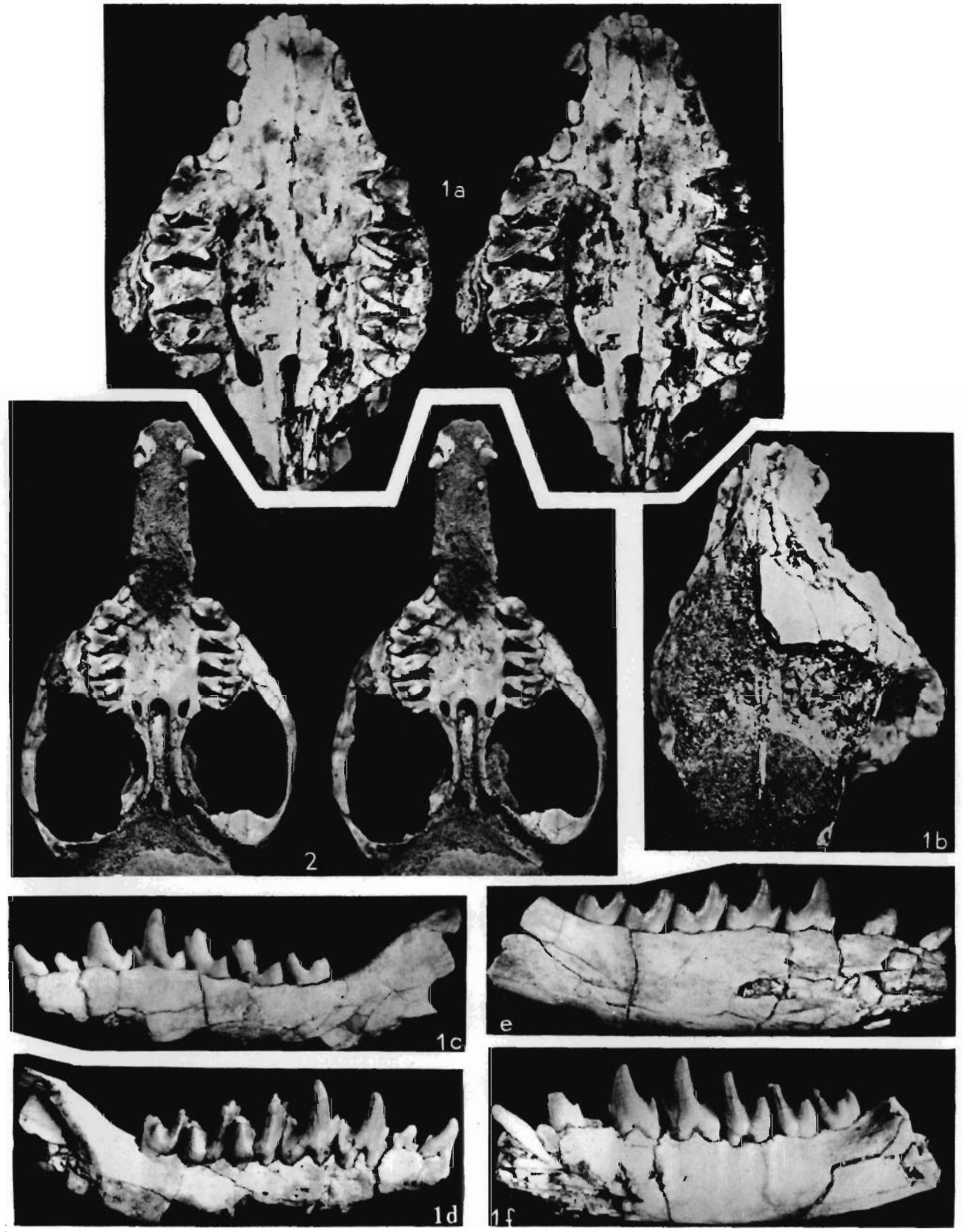
Fig. 1*b*. The same specimen, in dorsal view; ×3.5.

Figs. 1*c*, *d*. Separated right lower jaw of the same specimen with P_1-M_3, in lingual and labial views; ×4.

Figs. 1*e*, *f*. Separated left lower jaw of the same specimen with C, P_1, alveolus for P_2 and P_3-M_3, in lingual and labial views; ×4.

Fig. 2. Stereo-photograph of nearly complete skull (Z. Pal. No. MgM-I/16), in occlusal view. In the anterior part of the snout, the bones were lacking, right and left I^2 and left I^3 have been preserved on their places in sandstone, as well as the partial moulds of right I^3 and right and left canines. Plastic casts have been made from them and plastic roof connecting the incisors with the middle part of the snout. On the right side: I^1, plastic I^3, plastic C and P^1-M^3, on the left I^2-I^3, plastic C and P^2-M^3; ×2.

Photo: M. Czarnocka


1a
2
1b
1c
e
1d
1f