ZOFIA KIELAN-JAWOROWSKA

NEW UPPER CRETACEOUS MULTITUBERCULATE GENERA FROM BAYN DZAK, GOBI DESERT

(Plates X—XVII)

Abstract. — Four new multituberculate genera and species from the Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Gobi Desert, are diagnosed and figured. One of them, *Gobibaatar parvus* n. gen., n. sp., is assigned to Ectypodontidae in Ptilodontoidea, the three remaining to Taeniolabidoidea: *Sloanbaatar mirabilis* n. gen., n. sp. and *Kryptobaatar dashzevegi* n. gen., n. sp. to Eucosmodontidae, and *Kamptobaatar kuczynskii* n. gen., n. sp. to Taeniolabididae. The multituberculate fauna of the Djadokhta Formation is characterized. It is concluded that the degree of anatomical differentiation of Bayn Dzak multituberculates indicates the lower part of the Upper Cretaceous (Coniacian-Santonian) as the presumable age of the Djadokhta Formation.

INTRODUCTION

The Polish-Mongolian Palaeontological Expeditions assembled a collection of 30 specimens of mammals in 1964 and 1965 at Bayn Dzak (Shabarakh Usu) in the Gobi Desert, in the Upper Cretaceous sandstone of the Djadokhta Formation (KIELAN-JAWOROWSKA & DOVCHIN, 1968). In 1967, a five person field party of the Polish Academy of Sciences and the Academy of Sciences of the Mongolian People's Republic spent one week in Bayn Dzak, collecting 6 additional specimens. Of this collection, 12 specimens are eutherian mammals, while 24 are multituberculates. A preliminary report on the eutherian mammals from Bayn Dzak was published earlier (KIELAN-JAWOROWSKA, 1968/69). In that paper the characteristics of 3 places, designated the Main Field, Ruins and Volcano, where mammals were collected at Bayn Dzak, were described (see also GRADZIŃSKI *et al.*, 1968/69).

The Third Central Asiatic Expedition of the American Museum of Natural History in 1923, collected at Bayn Dzak (referred to as Shabarakh Usu) a single multituberculate skull, described by SIMPSON (1925) as *Djadochtatherium matthewi*. Later, a fragment of right maxilla with two premolars was prepared from a Bayn Dzak sandstone nodule in the American Museum of Natural History and assigned by GREGORY and SIMPSON (1926) to the same species. Fragments of the postcranial skeleton, associated with the first skull, were described by SIMPSON (1928*a*). *Djadochtatherium matthewi* has not been found by the Polish-Mongolian Palaeontological Expeditions in Bayn Dzak. Among the specimens collected by our expeditions, there are some new genera, showing that the multituberculates were greatly differentiated at the time of the deposition of the Djadokhta Formation.

As the complete preparation of the investigated material and its study will take some time, the author thought it desirable to publish separately the preliminary data on this fauna, including diagnoses of 4 new genera. It should be stressed that the number of taxonomic

units in the studied collection is greater than might appear from the present paper. As, however, some specimens are still in the process of preparation, it is impossible to give even an approximate number of the new taxonomic units.

The present study contributes new data on the skull structure in Multiberculata. In all the studied genera the palatine fissures are present, the nasals are comparatively extensive, expanded posteriorly, the naso-frontal suture more or less sigmoid. In none of the studied forms has a lacrimal bone been found[1]. The naso-lacrimal duct is absent, which among land mammals is extremely rare, characteristic only of elephants and some pecari.

The braincase, preserved only in *Sloanbaatar mirabilis* n. sp. (Z. Pal. No. MgM-I/20) and in *Kamptobaatar kuczynskii* n. sp. (Z. Pal. No. MgM-I/33) will be described in detail in a later paper. Here the author wishes only to note the presence of extensive tabulars, uknown so far in Multituberculata and very rare in mammals. The existence in mammals of tabulars has been shown only in the ontogenetic development of *Microgale* (PARKER, 1885), *Chrysochloris* (BROOM, 1916; COOPER, 1928) and in seals (de BEER, 1937, p. 444). In the structure of the nuchal surface *Sloanbaatar* and *Kamptobaatar* recall the Tritylodontoidea, in particular *Likhoelia ellenbergeri* GINSBURG, 1961 (see GINSBURG, 1962), The lateral wall of the braincase (preserved in *Kamptobaatar*) does not seem to be entirely ossified. The fan-shaped orbitosphenoid has a large exposure in the orbit, occupying most of the interorbital wall. The alisphenoid is poorly recognized, probably reduced to a comparatively small, ventral element, somewhat larger than in *Ornithorhynchus*. The lower part of the wall of the temporal fossa is occupied by an extensive anterior lamina of the petrosal, as in the monotremes. The basicranial region is roughly of the same pattern as in *Ptilodus* (see SIMPSON, 1937), differing in details. In *Sloanbaatar* as in *Ptilodus* the foramen pseudoovale (see MACINTYRE, 1967) is double, while in *Kamptobaatar* there are five foramina in the region of foramen pseudoovale. In *Kamptobaatar* the choanal region is of unusual structure, as the pterygoids do not form parts of the walls of the choanae, but are situated on either side along the middle of the choanal channel.

Assignment of the studied genera to families proved difficult for the following reasons. The Cretaceous multituberculates, so far described (MARSH, 1889*a*, 1889*b*, 1892; SIMPSON, 1925, 1928*a*, 1928*b*, 1929*a*, 1929*b*; WOOD & ORMSBEE, 1954; CLEMENS, 1963*a*, 1963*b*; SLOAN & VAN VALEN, 1965, and others), are, with the exceptions of *Mesodma thompsoni*, *Catopsalis joyneri*, *Djadochtatherium matthewi* and *Stygimys kuszmauli*, represented by isolated teeth or fragmentary jaws. Similarly, in the majority of known Tertiary genera, complete skulls have so far not been found. Thus, the existing taxonomy of Multituberculata is based mostly on the structure of the dentition. On the other hand, in the collection of multituberculates from Bayn Dzak studied by the present writer, there are numerous, more or less complete skulls. It is very interesting that in skulls of a quite different structure, belonging without doubt to different suborders, the premolars and molars are very similar.

What are the characters of dentition common to all the here described genera?

In all the studied genera, the dental formula is $\frac{2\ 0\ 4\ 2}{1\ 0\ 2\ 2}$. I^1 is provided with a single cusp, I^2 located medial to the line of the molars and premolars, P^1, P^2 and P^3 are double-rooted. There are 2:4 or 2:5 (3:5 or 6 in *Kamptobaatar*) cusps on P^4, while 4:4:ridge, or 4:5:ridge, or 5:5:ridge on M^1 and 1:2:3 on M^2. The incipient inner ridge on M^1 extends along the posterior half of the tooth length in all the genera, except for *Kamptobaatar* n. gen., where it extends for the entire tooth length. In the majority of cases the cusps on the inner ridge of M^1 are not

[1] It should be noted that the only multituberculate species in which the lacrimal bone was found is *Paulchoffatia delgadoi* KÜHNE, the oldest known multituberculate skull, described by KÜHNE (1961) from the Kimmeridgian of Portugal.

developed. In all the genera P_3 is present, the number of serrations on P_3 is 8—9 in all the genera except for *Kamptobaatar*, where it is 6 (or 7?); the cusp formula of M_1 is 4:3, while that of M_2 is 3:2 (2:2 in *Sloanbaatar*).

In spite of the similarities in the pattern of the tooth cusps, the new genera differ considerably from each other in the shape of the skull and mandible and in the structure of the lower incisors, which calls for their assignment to two different suborders: Taeniolabidoidea and Ptilodontoidea.

However, the Bayn Dzak mammals differ from all the previously known Upper Cretaceous and Tertiary Ptilodontoidea and Taeniolabidoidea in having a much smaller number of cusps on the molars and only two rows of cusps (third incipient) on M^1. In this respect they recall the Jurassic and Lower Cretaceous Plagiaulacoidea (see SIMPSON, 1928*b*, 1929*a*), differing considerably from the latter in having a reduced number of lower premolars (two), while there are four in Plagiaulacoidea. The skull structure of Plagiaulacoidea is so far imperfectly known, but, basing on the structure of their dentition and of the lower jaw, one can state that the Bayn Dzak multituberculates are in certain respects intermediate in morphology between the Plagiaulacoidea on the one hand, and the previously known Ptilodontoidea and Taeniolabidoidea on the other.

The Bayn Dzak multituberculates are morphologically much more primitive than the Upper Cretaceous multituberculates from the Lance Formation and Hell Creek Formation of North America and show similarities to the Lower Cretaceous species. According to data sent by Professor SLOAN, they are morphologically intermediate between those from the Trinity Sandstone of the Albian of Texas and those of the Judith River Fauna (Campanian) of Montana, described by SAHNI (MS). This seems to indicate that the Djadokhta Formation corresponds to the lower part of Upper Cretaceous (Coniacian-Santonian), which has been noted already by the writer elsewhere (KIELAN-JAWOROWSKA, 1968/69).

The terminology used in the present paper has been adopted from SIMPSON (1937) and CLEMENS (1963*a*) with some modifications. SIMPSON (1937, p. 756) called large openings, situated in the premaxillo-maxillary suture in *Taeniolabis* and *Ptilodus* — the anterior palatal (or incisive) foramina. These openings occur in all the multituberculate skulls studied by the present writer and are called in the present paper the palatine fissures — as in their shape and position they correspond exactly to these structures in eutherian mammals. In the specimens, in which the palatal region is well preserved (e.g. in *Kamptobaatar kuczynskii* n. sp., see Pl. XVI, Fig. 1*e*) in addition to the palatine fissures there occur true anterior palatine foramina, situated slightly in front of the transverse palatine suture, in the position characteristic for numerous eutherian mammals. No palatine groove has been observed in the studied skulls.

In P_4 of *Kryptobaatar dashzevegi* n. sp. (see Pl. XV, Figs. 1*b*, 1*d*) between the two roots there is a supernumerary root. Supernumerary roots have been found by SIMPSON (1936, Fig. 1) in P_4, M_1 and M_2 of *Meniscoessus* sp., and by JEPSEN (1940, Pl. 2, Fig. 4) in P_4 of *Anconodon gidleyi* (SIMPSON). The supernumerary root in P_4 of *Kryptobaatar dashzevegi* n. sp. is called in the present paper after SIMPSON (1936) — an accessory root.

The specimens described in the present paper are housed in the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw (see KIELAN-JAWOROWSKA & DOVCHIN, 1968/69, p. 12).

Abbreviations used:

Z. Pal. — Palaeozoological Institute of the Polish Academy of Sciences, Warsaw.
A. M. N. H. — American Museum of Natural History, New York.
U. C. M. P. — University of California, Museum of Paleontology, Berkeley.

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The specimens described in the present paper were collected by numerous persons who were members of the Polish-Mongolian Palaeontological Expeditions in 1964 and 1965 and by members of the 1967 field party of the Polish Academy of Sciences and the Academy of Sciences of the Mongolian People's Republic. The preparation of the specimens was performed in the Palaeozoological Institute of the Polish Academy of Sciences by Mr. M. KUCZYŃSKI B. Eng. The photographs were taken by Miss M. CZARNOCKA, the drawings made by Mrs. D. SŁAWIK, Mr. W. SICIŃSKI helped the author in preparing the plates. To all these persons the writer wishes to express her thanks and indebtedness.

DESCRIPTIONS

Suborder PTILODONTOIDEA SLOAN & VAN VALEN, 1965
Family ECTYPODONTIDAE SLOAN & VAN VALEN, 1965
Genus **GOBIBAATAR** nov.

Type species: *Gobibaatar parvus* n. sp.

Derivation of the name: *Gobi* — occurring in the Gobi Desert, Mong. *baatar* = a hero, alludes to the name of the capital of Mongolia, Ulan Baatar.

Diagnosis. — The genus is monotypic, the generic characters are those of the type species.

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

Discussion. — See p. 40.

Gobibaatar parvus n. sp.

(Pl. X, Fig. 1; Pl. XI; Pl. XII, Fig. 1)

Type specimen: Incomplete skull, lacking most of the braincase, associated with incomplete right and left lower jaws. The skull is somewhat depressed, particularly on the left side, palatal region heavily damaged. Root of left I^1, right I^1, broken right and left dI^2, incipient right and left I^2, right and left badly damaged P^1—P^3, damaged left P^4, right P^4, right and left M^1 and M^2. Left dental ramus of the maxilla is bent due to distortion. Lower teeth well preserved, except for left P_4 which is damaged. Z. Pal. No. MgM-I/10.

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

Derivation of the name: Lat. *parvus* = small.

Diagnosis. — Dental formula: $\frac{2\ 0\ 4\ 2}{1\ 0\ 2\ 2}$. Snout blunt, subtriangular, with zygomae strongly divergent posteriorly. No constriction in front of zygomatic arches, which are entirely

confluent with lateral margins of snout; insignificant constriction of lateral margins opposite I^2. In lateral view snout deepens uniformly posteriorly, its depth above M^1 is about twice that above I^1. Interorbital constriction prominent. Nasals convex upwards, expanded posteriorly. Naso-frontal suture strongly convex posteriorly, frontals tapering in the middle into a pointed end, deeply inserted between the nasals. Antero-lateral corners of frontals contact maxillae. Fronto-parietal suture imperfectly known. Premaxilla comparatively short, with long, slender

Table 1

Measurements of skulls in Bayn Dzak multituberculates (in mm)

Species	*Gobibaatar parvus*	*Sloanbaatar mirabilis*	*Kryptobaatar dashzevegi*	*Kamptobaatar kuczynskii*	
Z. Pal. Mus. cat. No.	MgM-I/10	MgM-I/20	MgM-I/21	MgM-I/33	MgM-I/39
Length of skull	—	22.3	—	19.0	—
Estimated width of skull	ca. 20.0	ca. 19.0	ca. 20.0	ca. 15.0	—
Length of premaxilla along alveolar border	3.5	—	3.5	2.7	2.7
Length of premaxilla in suture with nasals	ca. 7.5	—	ca. 7.0	ca. 5.2	—
Length of maxilla opposite the middle of the orbit	ca. 10.0	—	ca. 10.7	ca. 3.8	—
Length of palatine process of premaxilla	ca. 6.5	ca. 4.8	ca. 6.8	4.0	5.1
Length of hard palate between premax.-max. suture and choanae	—	ca. 7.0	ca. 8.5	6.1	ca. 6.0
Width of hard palate between P^4	ca. 6.0	ca. 5.2	6.0	4.8	5.4
Depth of skull above I^1	ca. 4.0	4.2	4.8	2.2	—
Depth of skull above M^3	ca. 8.0	8.3	9.5	5.6	—
Length of nasals	ca. 12.0	—	ca. 13.0	8.5	ca. 10.0
Length of frontals	—	—	—	8.4	—
Length of the lower jaw from the base of incisor	—	ca. 15.0	—	—	—
Depth of the lower jaw below P_3	3.99	ca. 3.3	3.25	—	2.8
Depth of the lower jaw below M_1	5.27	ca. 4.3	5.1	—	3.5

nasal process. Palatal process of premaxilla extensive. Ventral wall of maxilla outside the row of premolars subtriangular. Infraorbital foramen small, situated on the ventral wall of maxilla opposite P^2, partly obscured in lateral view. The orbit has no floor and the zygomatic arches are more anterior in occlusal than in dorsal view. Posterior edge of zygomatic arch originates in occlusal view opposite P^4. Palatine fissures present, poorly known, palatal vacuities unknown. Upper tooth-row convex outwards in horizontal plane, moderately concave downwards in vertical plane. Lower jaw comparatively short and deep, with very strong coronoid and masseteric crests. One mental foramen situated opposite the middle of the base of permanent incisor, which is just erupting. Lower incisor entirely covered with enamel. First

upper incisor with a single cusp, second incisor located medial to the line of molars and premolars. Cusps 3:2 on P^1, 1:2 on P^2, 2:2 on P^3, 2:4 on P^4; 4:4:ridge on M^1; 1:2:3 on M^2. Eight serrations on P_4, all provided with ridges. The highest point of P_4 on the line of cusps of M_1 and M_2. Cusps 4:3 on M_1 and 3:2 on M_2. Ratio length of P_4 to length of M_1 approximately 1.3.

Measurements — see Tables 1 and 2.

Table 2

Measurements of teeth in Bayn Dzak multituberculates (in mm)

Species	*Gobibaatar parvus*	*Sloanbaatar mirabilis*	*Kryptobaatar dashzevegi*	*Kamptobaatar kuczynskii*	
Z. Pal. Mus. cat. No.	MgM-I/10	MgM-I/20	MgM-I/21	MgM-I/33	MgM-I/39
P^1 length	ca. 1.3	0.98	1.6	0.8	0.7
width	0.8	0.72	1.0	0.7	0.7
P^2 length	0.85	0.8	1.0	0.5	0.7
width	0.8	0.7	0.9	0.5	0.6
P^3 length	0.9	0.9	0.75	0.5	0.5
width	—	0.6	0.75	0.4	0.4
P^4 length	2.2	1.7	2.1	1.7	1.8
width	ca. 1.5	0.8	0.9	0.6	0.8
M^1 length	2.6	1.9	2.5	1.9	—
width	1.6	1.1	1.5	1.2	—
M^2 length	2.0	1.2	2.1	1.2	—
width	1.7	1.2	1.9	1.15	—
P_4 length	3.1	2.7	2.7	—	2.4
width	1.1	0.9	1.1	—	0.75
M_1 length	2.3	1.7	2.1	—	1.8
width	1.9	1.0	1.2	—	1.1
M_2 length	1.6	—	1.6	—	—
width	1.4	1.0	1.4	—	—

Discussion. — *Gobibaatar* n. gen. seems to be close to the forms which gave rise to both the Ectypodontidae and Cimolodontidae. The small size of the new genus and its resemblance to *Cimexomys* calls for its assignment rather to the Ectypodontidae than to the Cimolodontidae. *Gobibaatar* differs from the known members of the Ectypodontidae (see MATTHEW & GRANGER, 1921; GRANGER & SIMPSON, 1929; JEPSEN, 1930, 1940; RUSSELL, 1964; CLEMENS, 1963*a*; SLOAN & VAN VALEN, 1965) in having a distinctively shaped P_4 in lateral profile, with the highest point on the line of cusps of M_1 and M_2 (not above it) and in having a smaller number of cusps on the molars. The smallest number of cusps in the described Ectypodontidae has been found in *Cimexomys judithi* SAHNI (MS), from the Judith River Formation of North America. In

Cimexomys judithi P_4 has 9 serrations (while *Gobibaatar parvus* has 8), and the lateral profile is more arched than in the new species. The number of cusps in P^4 (2:4) and in M^1 (4:4:ridge) in *Gobibaatar parvus* is smaller than in *Cimexomys judithi* which has 3:5:2 cusps in P^4 and 5:5:1 in M^1.

Cimexomys minor SLOAN & VAN VALEN from the Hell Creek Formation of Montana and Lance Formation of Wyoming (see SLOAN & VAN VALEN, 1965, Text-fig. 2) has P_4 with 8 serrations, but differs from *Gobibaatar parvus* in having a somewhat greater number of cusps in M_1^1 and the lower jaw less deep with a less prominent masseteric crest. The presence of multituberculates with few-cusped molars in both Hell Creek Formation and Lance Formation of North America shows that this primitive fauna, typical of the Djadokhta Formation, survived until the latest Cretaceous (and early Paleocene) in North America, being there, however, rare.

Gobibaatar parvus resembles *Mesodma thompsoni* CLEMENS from the Hell Creek Formation and Lance Formation in the structure of the lower jaw, which in both species is comparatively deep, with strong masseteric and coronoid crests. The new species differs from *Mesodma thompsoni* in having a much smaller number of cusps on the molars, P_4 much lower in lateral profile, with only 8 serrations (12—14 in *M. thompsoni*). With regard to the Cimolodontidae, *Gobibaatar* resembles *Cimolodon nitidus* MARSH (see CLEMENS, 1963*a*) in the structure of the upper premolars and similarly shaped lower jaw; the differences concern differently shaped P_4 and a lower number of cusps on the molars in *Gobibaatar*. It should also be noted that among the Bayn Dzak genera the shape of the skull of *Gobibaatar* (zygomae divergent posteriorly, confluent with lateral margins of the snout) resembles two taeniolabidoid genera: *Kryptobaatar* n. gen. and *Djadochtatherium* SIMPSON.

SZALAY (1965) was the first to describe the deciduous teeth in Multituberculata. Among others, he figured the anterior portion of the left lower mandible of *Ptilodus* sp. (A. M. N. H. No. 83003), with both deciduous and permanent lower incisors retained. In the collection studied by the present writer there is an undescribed multituberculate specimen (Z. Pal. No. MgM-I/8), in which, in right and left lower jaws, both deciduous and permanent incisors, are present. In the lower jaws of *Gobibaatar parvus* n. sp., figured in the present paper (Pl. XI, Figs. 1*a*, 1*b*, and Pl. XII, Fig. 1), there are permanent lower incisors, retaining their initial position and being in the state of moving downwards into the adult position, occupied previously by deciduous incisor. In the skull of the same specimen (Pl. XI, Fig. 1*c*) both permanent and deciduous I^2 are preserved. The incipient permanent I^2 (right better preserved) are situated labially with regard to dI^2, which are badly damaged. It is also not excluded but that part of the premolars preserved in the same skull is deciduous. This indicates that the skull of the type specimen of *Gobibaatar parvus* n. sp., figured in the present paper, belongs to a comparatively young individual.

Suborder TAENIOLABIDOIDEA SLOAN & VAN VALEN, 1965

Discussion. — SLOAN and VAN VALEN (1965, p. 3) defined the Taeniolabidoidea as: "... including multituberculates in which the enamel of the lower incisor is restricted to the ventro-lateral surface of the tooth, producing a self-sharpening tooth similar to that of rodents". This means that in taeniolabidoids the enamel is *ex definitione* absent from the dorso-medial surface of the lower incisor.

Three of the here described Bayn Dzak genera: *Sloanbaatar* n. gen., *Kryptobaatar* n. gen. and *Kamptobaatar* n. gen., are assigned to Taeniolabidoidea, basing on the structure of the

lower jaw, the shape of the lower incisor, the structure of the palate and the skull proportions. Among these genera, only in *Kryptobaatar* n. gen. is the enamel sharply limited, restricted to the ventro-lateral surface of the lower incisor. In *Kamptobaatar* n. gen. the enamel is thick on the ventro-lateral surface of the incisor, disappearing gradually from the dorso-medial surface, while in *Sloanbaatar* n. gen. the lower incisor seems to be entirely covered with enamel. In the latter case, the enamel is thick on the ventro-lateral surface and very thin on the dorso-medial surface.

The structure of the lower incisor in the above genera indicates that at the time of the deposition of the Djadokhta Formation, the thin layer of the enamel was in certain taeniolabidoids still retained on the dorso-medial surface of the lower incisor, showing however a tendency to disappear.

Family ?EUCOSMODONTIDAE Jepsen, 1940

Genus **SLOANBAATAR** nov.

Type species: *Sloanbaatar mirabilis* n. sp.

Derivation of the name: named in honour of Professor Robert E. Sloan (Department of Geology and Geophysics, University of Minnesota, Minneapolis); Mong. *baatar* = a hero, alludes to the name of the capital of Mongolia, Ulan Baatar.

Diagnosis. — The genus is monotypic, the generic characters are those of the type species.

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

Discussion. — See p. 43.

Sloanbaatar mirabilis n. sp.

(Pl. X, Fig. 2; Pl. XII, Fig. 2; Pl. XIII; Text-fig. 1)

Type specimen: Complete skull, little distorted, considerably cracked, associated with complete right and left lower jaws. All teeth preserved, except for right and left I^2 (alveoli present) and right and left P_3 (alveoli present). Left P_4, M_1 and M_2 badly damaged. Z. Pal. No. MgM-I/20.

Type horizon and locality: Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Ruins, Gobi Desert.

Derivation of the name: Lat. *mirabilis* = wonderful, alludes to unusual state of preservation of the type specimen.

Diagnosis. — Dental formula $\frac{2\ 0\ 4\ 2}{1\ 0\ 2\ 2}$. Anterior part of the snout subrectangular, then outer margin bends outwards. Zygomatic arches in occlusal view start opposite P^3 and anterior part of P^4, strongly expanded laterally, with anterior part slender, posterior more robust, wide in occlusal view. Naso-frontal suture poorly known, convex posteriorly, both frontals tapering anteriorly in the middle to a (?)rounded end, inserted between the nasals. Antero-lateral corners of frontals contact maxillae. Fronto-parietal suture in the shape of a wide bow convex posteriorly, at the margins of the cranial roof bent anteriorly. Orbit very large, without floor. Postorbital process conspicuous, situated far posteriorly. Parietal crests very faint, running from postorbital process postero-medially, meeting each other close to the lambdoid crests. Sagittal crest lacking, cranial roof rounded posteriorly. Lambdoid crests very prominent, crescent-shaped.

Ventral wall of maxilla, outside the row of premolars small. Infraorbital foramen small, rounded, situated opposite P^2, visible in ventral and lateral views. Palatine fissures small. Two palatal vacuities (poorly known), anterior extending from opposite P^2 to opposite the middle of P^4, posterior (wider), opposite M^1. Upper tooth row curved outwards in a horizontal plane, concave ventrally in vertical plane. Lower jaw comparatively slender, with shallow masseteric fossa, which extends forwards opposite anterior root of P_4 and a very deep pterygoid fossa. Coronoid process comparatively small. Mental foramina undiscernible. Lower incisor robust, covered with enamel, which is very thin (?or absent) on the dorso-medial surface. First upper incisor small, single-cusped, second located medial to the line of the molars and premolars (only alveoli present), P^1, P^2, P^3 double-rooted, P^1 and P^2 with 3 cusps, P^3 with 4 cusps, P^4

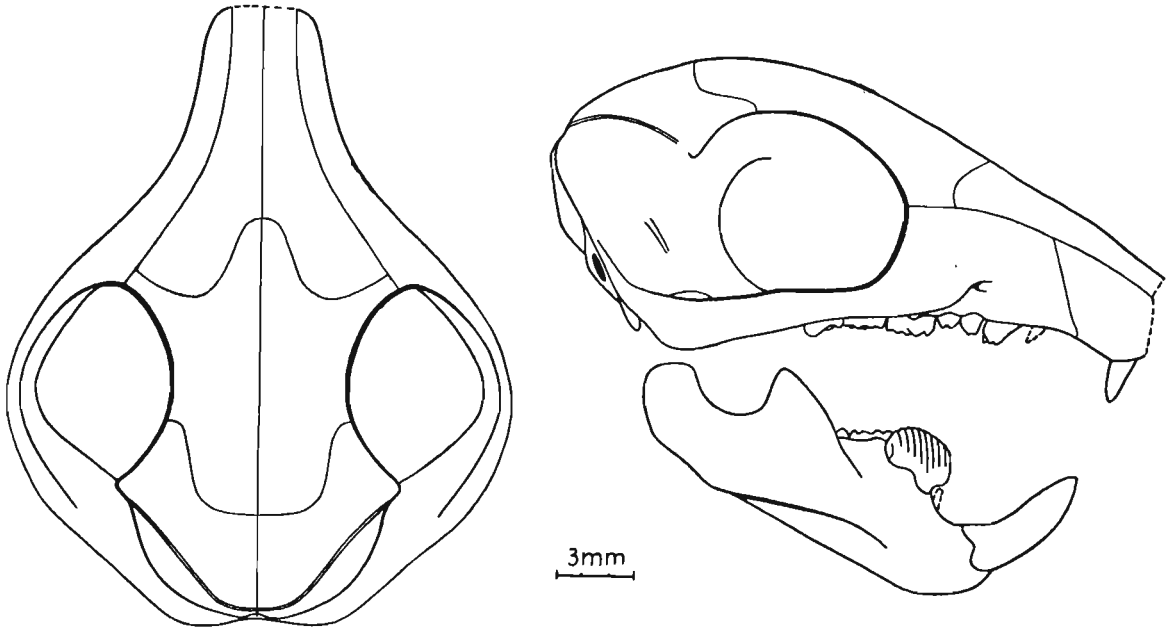

Fig. 1
Sloanbaatar mirabilis n. sp.
Reconstruction of the skull, in dorsal and lateral views.

with 2:5 cusps. Cusps 4:4:ridge on M^1 and 1:2:3 on M^2. P_3 not preserved, alveolus present, P_4 arcuate, with 8 serrations, not higher than the level of the molar cusps, M_1 with 4:3 cusps, M_2 with 2:2. Ratio length of P_4 to length of M_1 approximately 1.6.

Measurements — see Tables 1 and 2.

Discussion. — *Sloanbaatar* n. gen. is tentatively assigned to the Eucosmodontidae for the following reasons. The structure of the upper tooth row, which is curved outwards in a horizontal plane and concave ventrally in vertical plane, is of a ptilodontoid character. *Sloanbaatar* cannot be, however, assigned to Ptilodontoidea on account of the structure of the lower jaw and lower incisor. The enamel on the lower incisor of *Sloanbaatar* is very thin on the dorso-medial surface and the tooth has an eucosmodontid wear facet. The structure of the lower jaw shows the presence of a comparatively small temporal muscle and comparatively

large masseter, characteristic of Taeniolabidoidea. Similarly the pattern of palatal vacuities in *Sloanbaatar* is of the taeniolabidoid type.

Eucosmodontidae was originally defined (as a subfamily) by JEPSEN (1940) as having limited enamel on the lower incisor, upper incisor bifid, three upper premolars and P^2—P^3 single-rooted. These features, which are not primitive, are characteristic of Paleocene-Eocene Eucosmodontidae. In the uppermost Cretaceous eucosmodontid *Stygimys* SLOAN & VAN VALEN there are four upper premolars. Professor SLOAN is of the opinion (personal communication) that *Neolitomus* JEPSEN could also have double-rooted upper premolars. It may be presumed that at the early part of the late Cretaceous, the ancestral members of the Eucosmodontidae could have double-rooted P^1—P^3, single-cusped upper incisors and in some cases still retained the thin layer of the enamel on the dorso-medial surface of the upper incisor.

In addition to the characters cited above, *Sloanbaatar* n. gen. differs from the previously known members of the Eucosmodontidae in having a lower number of cusps on the molars. In this respect it recalls two other Bayn Dzak eucosmodontids (*Djadochtatherium* SIMPSON and *Kryptobaatar* n. gen.), from which it differs in having a very different shape of skull, upper tooth row convex outwards in a horizontal plane, lower incisor entirely covered with enamel and in being smaller. It is not excluded but that the differences between *Sloanbaatar* n. gen. and the other members of the Eucosmodontidae are higher than of generic rank, and that a new subfamily will eventually be erected for it in the forthcoming more detailed elaboration, when all the details of its skull structure have been described.

Family EUCOSMODONTIDAE JEPSEN, 1940

Genus **KRYPTOBAATAR** nov.

Type species: *Kryptobaatar dashzevegi* n. sp.

Derivation of the name: Gr. *kryptos* = hidden, alludes to the ventral position of infraorbital foramen; Mong. *baatar* = a hero, alludes to the name of the capital of Mongolia, Ulan Baatar.

Diagnosis. — The genus is monotypic, the generic characters are those of the type species.

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

Kryptobaatar dashzevegi n. sp.

(Pls. XIV and XV)

Type specimen: Incomplete skull, associated with incomplete right lower jaw and a fragment of the left lower jaw; all teeth, except for left P^4 and left P_3, present. Z. Pal. No. MgM-I/21.

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

Derivation of the name: Named in honour of Mongolian palaeontologist DEMBERELYIN DASHZEVEG.

Diagnosis. — Dental formula: $\frac{2\ 0\ 4\ 2}{1\ 0\ 2\ 2}$. Snout triangular, bluntly pointed, no constriction in front of zygomatic arches, which are a direct prolongation of lateral margins. In lateral view length of premaxilla (in the line of orbit) equal to about half that of maxilla. Snout deepens uniformly posteriorly, its depth above M^2 twice that above I^1. Nasals moderately expanded posteriorly, naso-frontal suture gently sigmoid, directed subtransversely in the

middle. Frontals in antero-lateral corners contacting maxillae, posteriorly tapering to a pointed end. Interorbital constriction conspicuous, postorbital process unknown, if present, situated on parietals. Palatal process of premaxilla extensive, ventral wall of maxilla, outside the row of premolars large, subtriangular. Infraorbital foramen elongated longitudinally, situated on ventral wall of maxilla, opposite P^1—P^2 embrasure. Zygomatic arch (posterior edge) originating in occlusal view opposite posterior half of P^4. Orbit without a floor. Palatine fissures present, palatal vacuity slender, situated opposite P^4. Upper tooth row straight in horizontal plane, insignificantly curved in vertical plane.

Masseteric fossa shallow, mental foramen small, situated in front of P_3, close to the upper edge of the jaw, pterygoid fossa very deep. First upper incisor with a single cusp, I^2 located medial to the line of molars and premolars. P^1, P^2 and P^3 double-rooted, P^1 and P^2 with 3 cusps, P^3 with 4 cusps. Cusps 2:5 on P^4, 4:4:ridge on M^1, 1:2:3 on M^2. Lower incisor robust, strongly arched, with limited enamel, P_3 peg-like. Accessory root in P_4 present. P_4 with arcuate profile and 8 (or 9) serrations. Cusps 4:3 on M_1 and 3:2 on M_2. Ratio length of P_4 to length of M_1 approximately 1.2.

Measurements — see Tables 1 and 2.

Discussion. — The assignment of *Kryptobaatar* n. gen. to the Eucosmodontidae is based on the skull proportions, on the structure of the lower jaw and of the lower incisor, which shows the type of wear, characteristic of this family. *Kryptobaatar* n. gen. is more primitive than the majority of Eucosmodontidae, in having double-rooted upper premolars and a lower number of cusps in the molars. In the first respect, it resembles *Djadochtatherium* SIMPSON, allocated recently by SLOAN and VAN VALEN (1965) to the Eucosmodontidae. Further similarities between *Kryptobaatar* and *Djadochtatherium* concern the shape of the snout, which in both cases is comparatively flat, subtriangular, with lateral margins confluent with zygomatic arches. The subtriangular snout, without a constriction in front of zygomatic arches, is characteristic also of *Gobibaatar* n. gen. which, however, is a ptilodontoid.

The comparison of *Kryptobaatar* with *Djadochtatherium* is based on the type specimen of *D. matthewi* (A. M. N. H. No. 20440). It seems doubtful to the present writer, whether the fragmentary right maxilla (A. M. N. H. No. 21703), allocated by GREGORY and SIMPSON (1926) to *D. matthewi*, is in fact conspecific with the type specimen, as it differs from the latter in having a well defined base of zygomatic arch, with a constriction of the lateral margin in front of it, which is not the case in the type specimen.

Kryptobaatar n. gen. differs from *Djadochtatherium* in being smaller and in having different proportions of skull and lower jaw. Basing on SIMPSON's drawings (1925) of *D. matthewi*, one could find more differences between the two genera in question, however, a careful examination of the cast of *D. matthewi* and of its new photograph sent by Prof. SLOAN, shows that it is doubtful, whether the course of the naso-frontal suture and the shape of the frontals were estimated by SIMPSON correctly. Neither can one be sure whether there was no fronto-maxillary contact in *Djadochtatherium* (characteristic of all the other Bayn Dzak multituberculate mammals). *Kryptobaatar* n. gen. resembles also *Djadochtatherium* SIMPSON and *Stygimys* SLOAN & VAN VALEN in having a similar pattern of palatal vacuities, this, however, must be regarded as tentative, as in *Djadochtatherium* and *Stygimys* the most posterior part of palate is unknown. *Kryptobaatar* differs from *Stygimys* in a different shape of skull, the presence of P_3, distinctively shaped P_4, which in *Stygimys* is pothook-shaped, while it is arcuate in *Kryptobaatar*, and in the lower number of cusps on the molars. A comparison of *Kryptobaatar* n. gen. with *Sloanbaatar* n. gen. is given on p. 44.

Family TAENIOLABIDIDAE Granger & Simpson, 1929
Genus **KAMPTOBAATAR** nov.

Type species: *Kamptobaatar kuczynskii* n. sp.

Derivation of the name: Gt. *kamptos* = bent, alludes to the shape of zygomatic arches, directed at first subtransversely and then bent posteriorly; Mong. *baatar* = a hero, alludes to the name of the capital of Mongolia, Ulan Baatar.

Diagnosis. — The genus is monotypic, the generic characters are those of the type species.

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

Discussion. — See p. 47.

Kamptobaatar kuczynskii n. sp.

(Pls. XVI and XVII; Text-fig. 2)

Type specimen: Almost complete skull, unusually well preserved, without lower jaws. Part of zygomatic arches lacking. Z. Pal. No. MgM-I/33.

Referred specimen: Partial skull, strongly damaged, associated with right and left incomplete lower jaws; Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Ruins. Z. Pal. No. MgM-I/39.

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

Derivation of the name: Named in honour of Mr. Maciej Kuczyński, who found the type specimen.

Diagnosis. — Dental formula: $\frac{2\ 0\ 4\ 2}{1\ 0\ 2\ 2}$. Snout bluntly pointed, anterior margins directed at first subposteriorly, then bent outwards. Zygomatic arch originates in occlusal view opposite P^3 and anterior part of P^4, extends at first subtransversely, then postero-laterally, giving the skull a more rectangular than triangular aspect. Skull comparatively low above I^1, its depth increasing 2.5 times to a point above M^2. In lateral view a part of dentition obscured by the zygomatic arch. Infraorbital foramen situated on the vertical wall of the maxilla, opposite P^2. Nasals wide, expanded posteriorly. Naso-frontal suture strongly convex posteriorly, both frontals tapering anteriorly in the middle to a pointed end, inserted deeply between the nasals. Antero-lateral corners of frontals contact maxillae. Fronto-parietal suture forming a wide bow, convex posteriorly, at the margins of the cranial roof bent anteriorly.

Orbit very large, without a floor, interorbital constriction present, postorbital process situated far posteriorly on the parietals. Very faint parietal crests run from postorbital processes postero-medially, continuing in the middle as a short, faint sagittal crest. Lambdoid crests very prominent, crescent-shaped. Palatine process of premaxilla extensive, ventral wall of maxilla outside the row of premolars very narrow. Palatine fissures small, palatal vacuities lacking. Transverse palatine suture opposite anterior part of M^1, anterior palatine foramen small, situated close the transverse suture opposite P^4—M^1 embrasure. Numerous accessory palatine foramina. Postpalatine torus present. Upper tooth row slightly convex outwards in horizontal plane and concave downwards in vertical plane. I^1 with a single cusp, worn as in *Taeniolabis*, I^2 located medial to the line of molars and premolars. P^1, P^2 and P^3 double-rooted, P^1 and P^2 with 3 cusps, P^3 with 4 cusps. Cusps 3:5 or 6 on P^4, 5:5:ridge on M^1, 1:2:3 on M^2. Inner ridge on M^1 extends for the whole tooth length. Four(?) incipient cusps on this ridge in Z. Pal. MgM-I/38 (not figured in this paper) discernible, not discernible in type specimen. Basicranial region not yet prepared.

Lower jaw comparatively short, with shallow masseteric fossa, which extends forwards opposite P_3. One mental foramen in the region of diastema, situated opposite upper one third

of the base of the incisor. Enamel on the lower incisor limited to the ventro-lateral surface, absent (or very thin?) on the dorso-medial surface. Six (or 7?) serrations on P_4, all provided with ridges, P_4 arcuate, 4:3 cusps on M_1, M_2 unknown. Ratio to length of P_4 to length of M_1 approximately 1.3.

Measurements — see Tables 1 and 2.

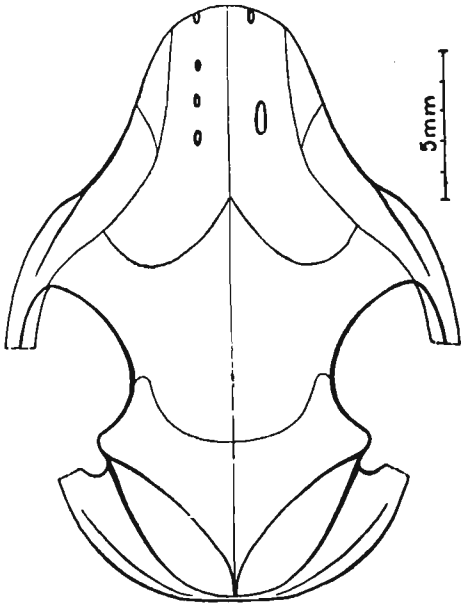

Fig. 2
Kamptobaatar kuczynskii n. sp.
Reconstruction of the skull, in dorsal view.

Discussion. — *Kamptobaatar* n. gen. is assigned to the Taeniolabididae on the base of its similarities to *Taeniolabis* COPE in the shape of the skull, structure of the palatal region, dentition and structure of the lower jaw. The structure of the palate without palatal vacuities, characteristic of *Taeniolabis* and *Kamptobaatar* occurs also in *Prionessus* MATTHEW, GRANGER & SIMPSON (see MATTHEW, GRANGER & SIMPSON, 1928) and in *Catopsalis* COPE (personal communication of Prof. SLOAN). Thus it may be recognized as characteristic of the Taeniolabididae.

The number of serrations of P_4 is lower in *Kamptobaatar* than in other Bayn Dzak multituberculates, which shows the beginning of trends characteristic of advanced Taeniolabididae.

The upper tooth row in *Kamptobaatar* which is slightly convex outwards in a horizontal plane and concave downwards in vertical plane, recalls the Ptilodontoidea, it should be, however, mentioned that some differences, which separate later Ptilodontoidea and Taeniolabidoidea, were not as yet pronounced in the representatives of both suborders at the time of the deposition of the Djadokhta Formation.

Kamptobaatar n. gen. resembles *Taeniolabis* COPE (see BROOM, 1914; GRANGER & SIMPSON, 1929) more closely than it does any other multituberculate in the shape of the anterior part of the snout, particularly in the square-like zygomata, unknown in other multituberculates. The premolars and molars of *Kamptobaatar* n. gen. are of the same general pattern as in other Bayn Dzak multituberculates, however, the number of cusps in P^4 and M^1 is somewhat greater.

Only in *Kamptobaatar* among the Bayn Dzak genera does the inner ridge (incipient row of cusps) on M^1 extend the whole length of the tooth, as characteristic of *Taeniolabis* and some species of *Cimolomys* and *Meniscoessus* (see CLEMENS, 1963*a*). *Kamptobaatar* differs from *Taeniolabis* in having a quite different course of fronto-parietal suture and consequently in the shape of the frontals, which in *Taeniolabis* are excluded from contact with maxillae and the orbits, while in *Kamptobaatar* the frontals are extensive, as in all other Bayn Dzak multituberculates.

Further differences between *Kamptobaatar* and *Taeniolabis*, such as reduced upper premolars, greater number of cusps on the molars, relatively shorter skull, reduced P_3, differently shaped P_4 and greater size in *Taeniolabis*, may be regarded as features of higher specialization of the latter genus. Some of these features have already been acquired in the uppermost Cretaceous taeniolabidid *Catopsalis joyneri* SLOAN & VAN VALEN, in which P^4 is reduced in proportion to M^1, and P_4 has the shape characteristic of the advanced Taeniolabididae.

Kamptobaatar kuczynskii n. sp., which is the oldest known species of the Taeniolabididae, is morphologically ancestral to the later species of this family.

It seems likely that *Kamptobaatar* n. gen. is close to the forms which gave rise to the Cimolomyidae SLOAN & VAN VALEN, as it shows similarities (see above) in the structure of M^1 to e.g. *Meniscoessus robustus* (MARSH) and *Cimolomys gracilis* MARSH, differing from the latter species in the much smaller number of cusps in the molars. As the skulls of cimolomyid genera have so far not been found, a more detailed comparison cannot be made.

The cranium of *Kamptobaatar*, in particular the structure of the basicranial region, cannot be described in the present paper, as this requires further preparation and study.

Palaeozoological Institute
of the Polish Academy of Sciences
Warszawa, April 1968

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PLATES

PLATE X

Page

Gobibaatar parvus n. sp. 38

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

(see also Plates XI and XII)

Fig. 1*a*. Partial skull associated with lower jaws, before the final preparation, lateral view, type specimen (Z. Pal. No. MgM-I/10); × 5.

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

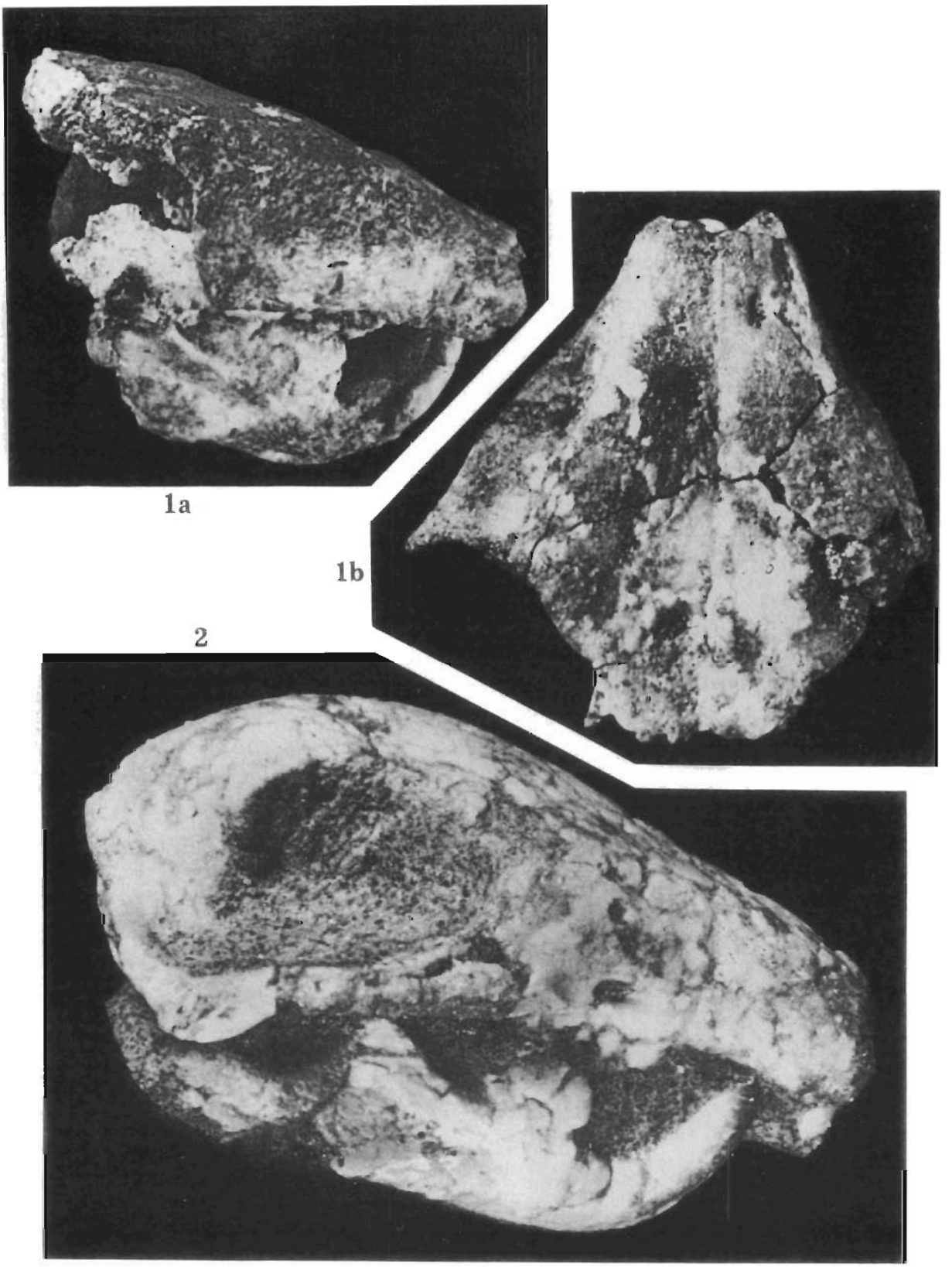
Sloanbaatar mirabilis n. sp. 42

Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Ruins, Gobi Desert

(see also Plates XII and XIII)

Fig. 2. Skull associated with lower jaws, before the final preparation, lateral view, type specimen (Z. Pal. No. MgM-I/20); × 6.

Photo: M. Czarnocka



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Z. KIELAN-JAWOROWSKA: NEW UPPER CRETACEOUS MULTITUBERCULATES

PLATE XI

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

(see also Plates X and XII)

Fig. 1*a*. Partial right lower jaw, labial and lingual views. Type specimen (Z. Pal. No. MgM-I/10); × 5.

Fig. 1*b*. Partial left lower jaw of the same specimen, P_4 strongly damaged. Lingual and labial view; × 5.

Fig. 1*c*. Stereo-photograph of the partial skull of the same specimen, right I^1, left I^1 broken off, right and left dI^2 broken off, incipient right and left I^2, premolars damaged, part of left P^4 lacking, right and left M^1 and M^2 preserved, hard palate strongly damaged. Occlusal view; × 3.5.

Photo: M. Czarnocka

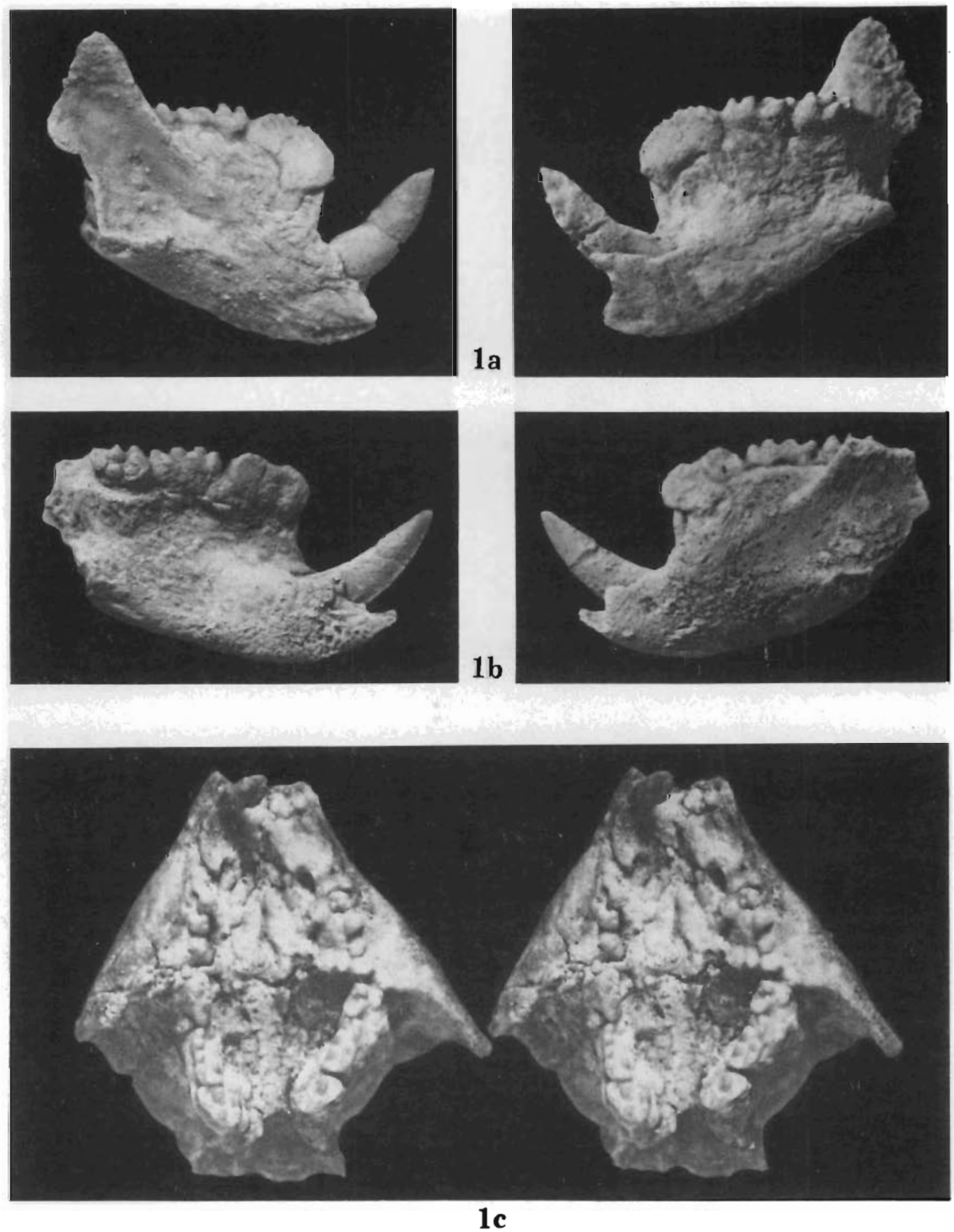

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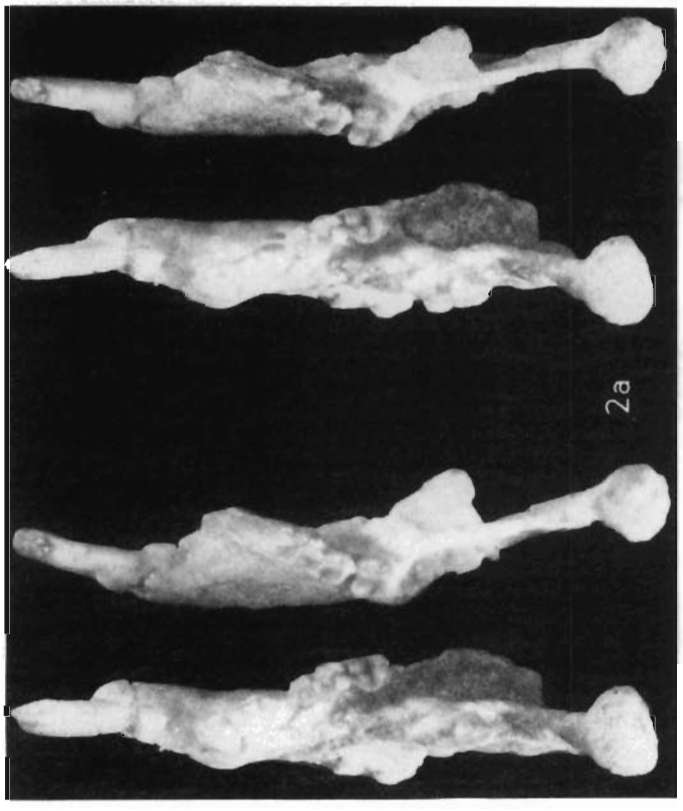
PLATE XII

Fig. 1. Stereo-photograph of the partial lower jaws of the type specimen (left P_4 strongly damaged), occlusal view. Type specimen (Z. Pal. No. MgM-I/10); × 5.

Fig. 2*a*. Stereo-photograph of the lower jaws, in occlusal view. Type specimen (Z. Pal. No. MgM-I/20); × 5.
Fig. 2*b*. Stereo-photograph of the skull of the same specimen (I^2 lacking), occlusal view; × 3.
Fig. 2*c*. Stereo-photograph of the same skull, in lateral view; × 3.

Photo: M.Czarnocka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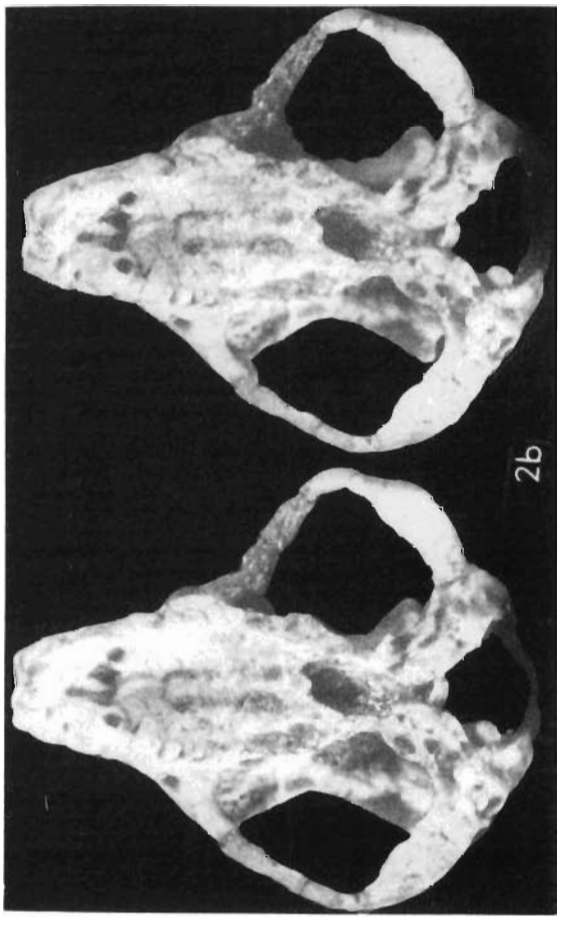
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PLATE XIII

Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Ruins, Gobi Desert

(see also Plates X and XII)

Fig. 1*a*. Stereo-photograph of the skull, associated with lower jaws, before the final preparation, anterior view. Type specimen (Z. Pal. No. MgM-I/20); × 3.

Fig. 1*b*. Stereo-photograph of the same specimen, dorsal view; × 3.

Fig. 1*c*. Right lower jaw of the same specimen (P_3 lacking, alveolus present), labial and lingual views; × 5.

Fig. 1*d*. Left lower jaw of the same specimen, lingual and labial views; × 5.

Photo: M. Czarnocka

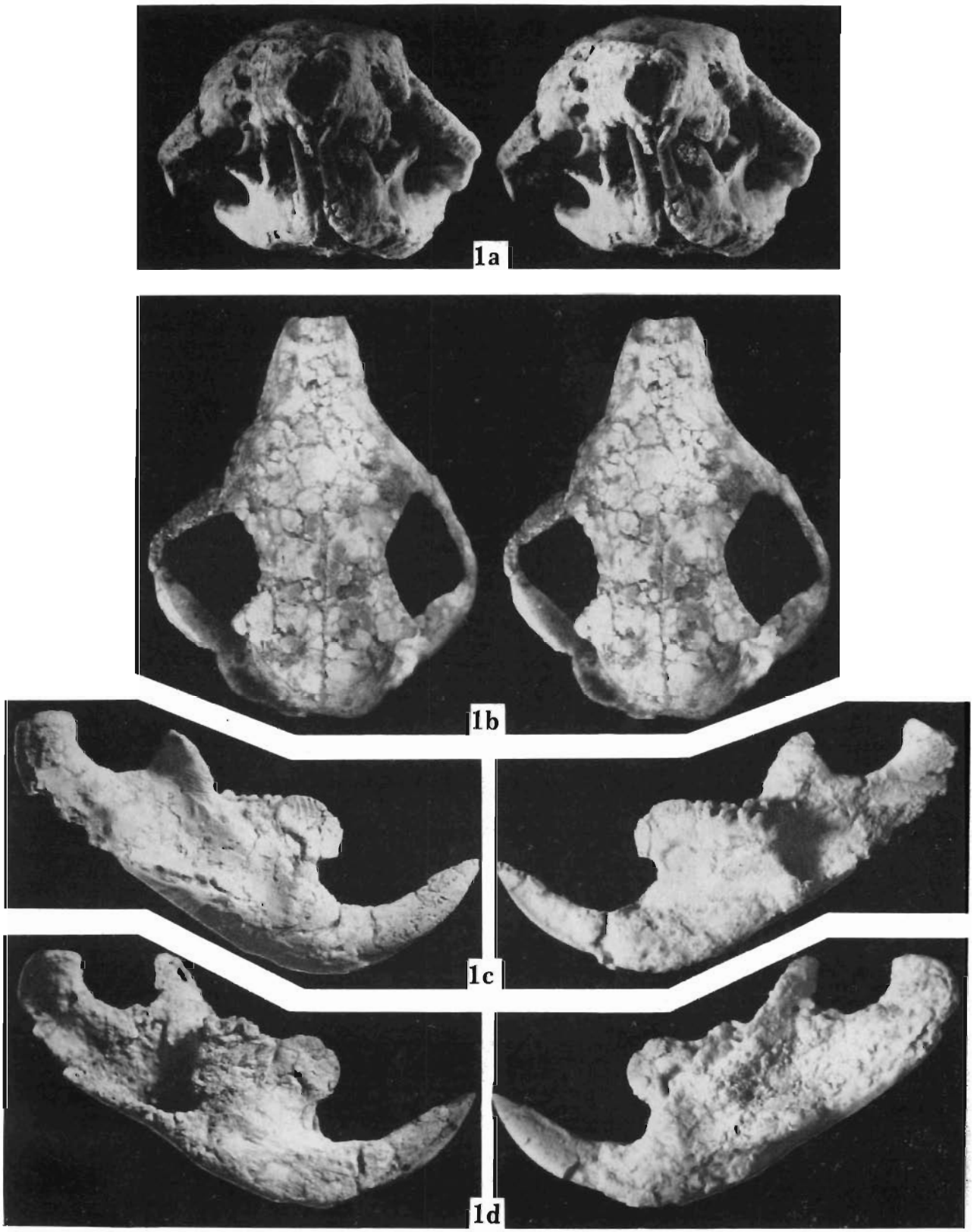
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PLATE XIV

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

(see also Plate XV)

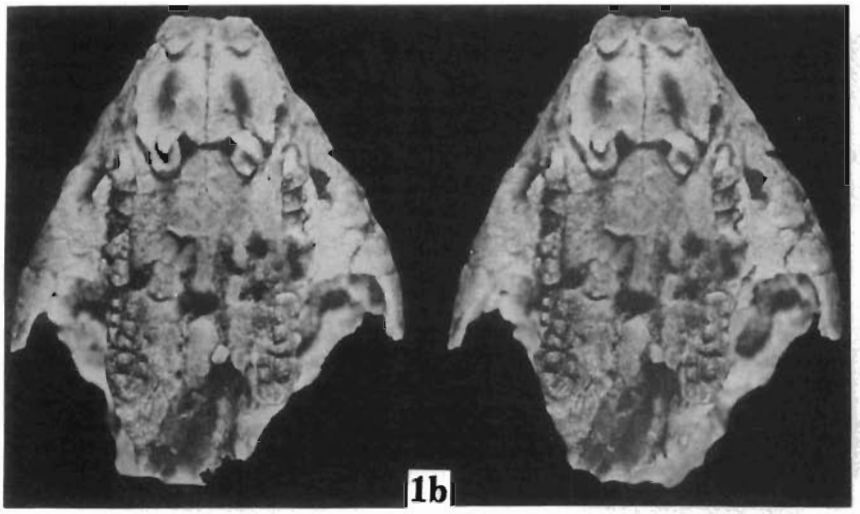
Fig. 1*a*. Partial skull associated with lower jaws, before the final preparation, lateral view. Type specimen (Z. Pal. No. MgM-I/21); × 6.

Fig. 1*b*. Stereo-photograph of the same specimen, after the separation of the lower jaws (left P^4 missing), occlusal view; × 3.

Fig. 1*c*. The same specimen, in dorsal view; × 3.

Fig. 1*d*. Stereo-photograph of the same specimen, anterior view; × 3

Photo: M. Czarnocka



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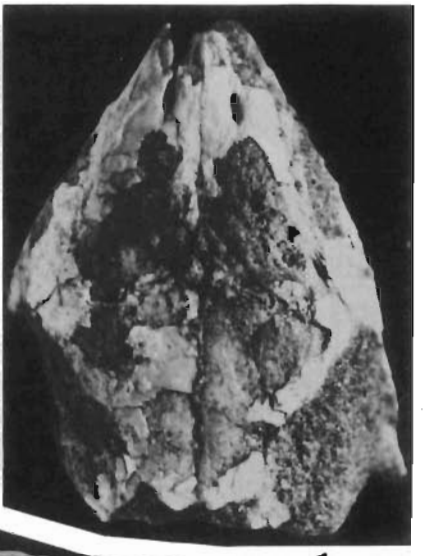

1c

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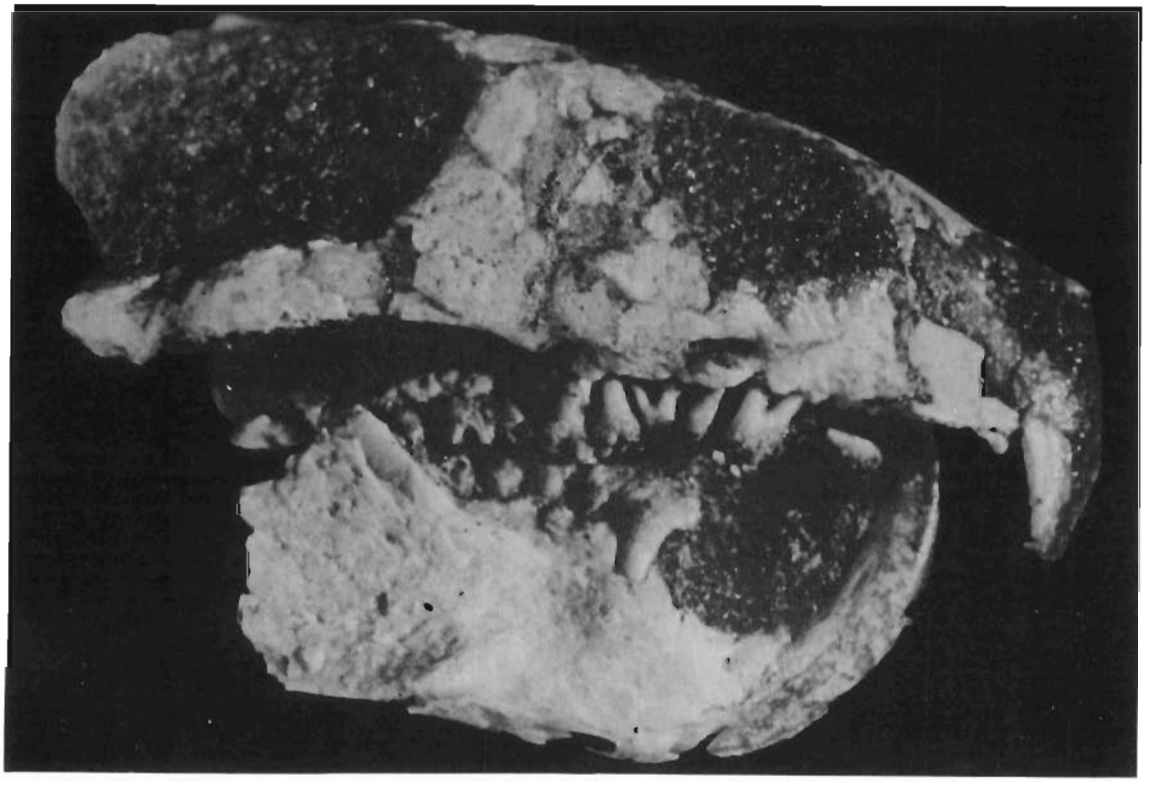


1a

PLATE XV

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

(see also Plate XIV)

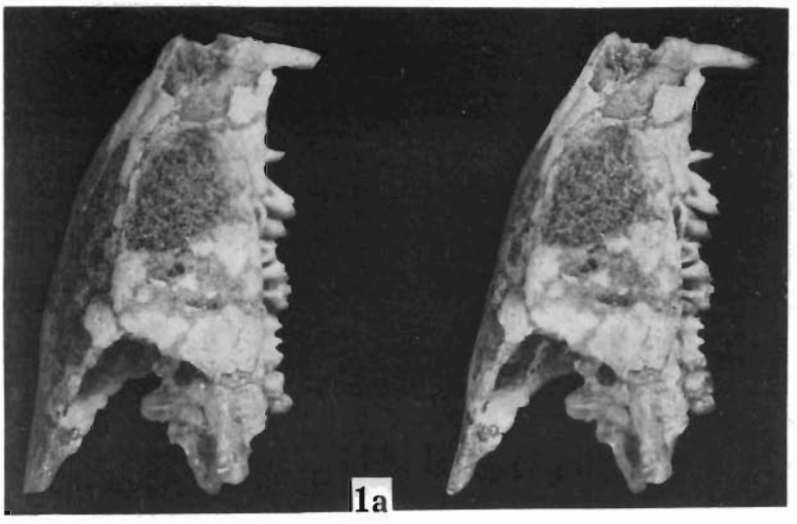
Fig. 1*a*. Stereo-photograph of the skull (type specimen), after the separation of the lower jaws, lateral view (Z. Pal. No. MgM-I/21); × 3.

Fig. 1*b*. Fragmentary left lower jaw of the same specimen, in labial and lingual views, × 5.

Fig. 1*c*. Stereo-photograph of the lower jaws of the same specimens, occlusal view; × 5.

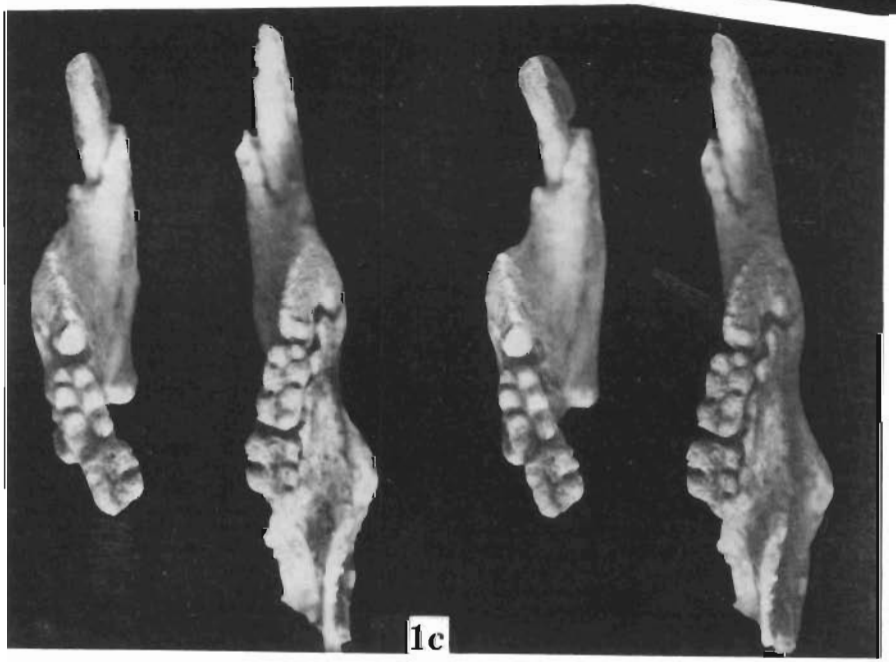
Fig. 1*d*. Incomplete right lower jaw of the same specimen, in labial and lingual views; × 5.

Photo: M. Czarnocka



1a

1b



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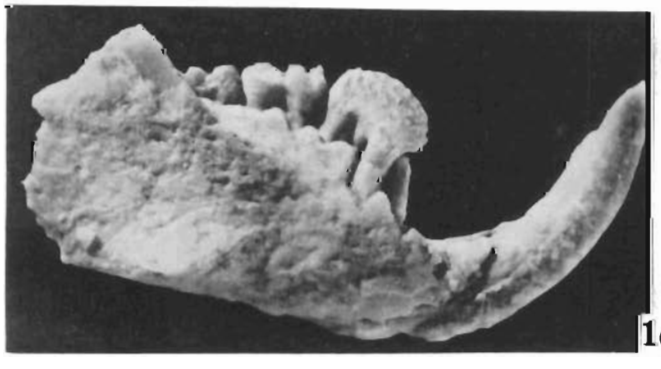

1d

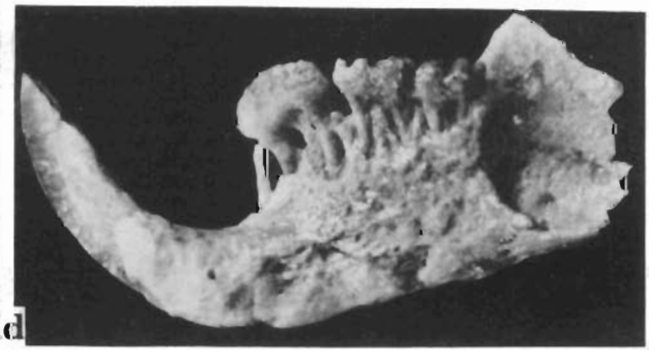

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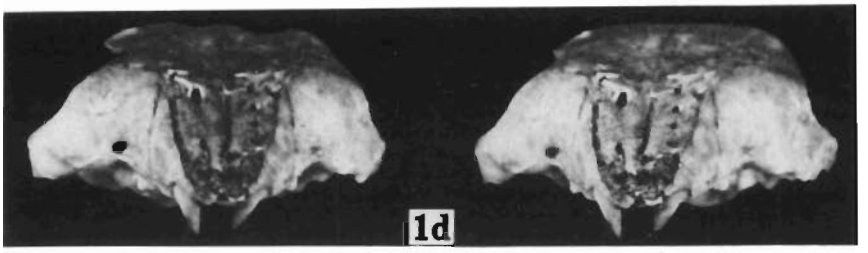
PLATE XVI

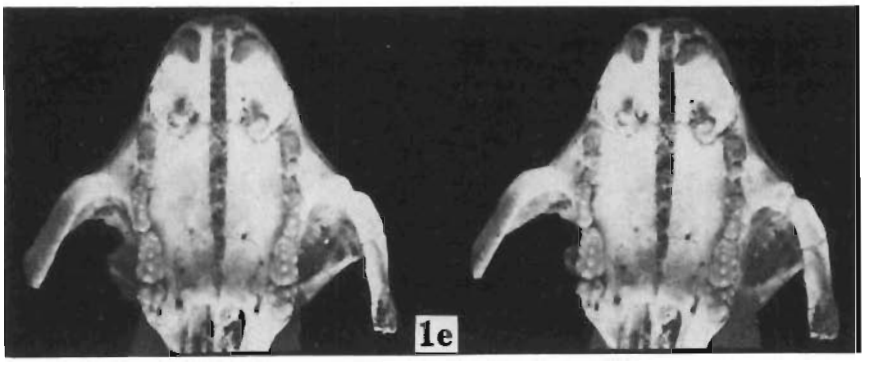
Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Main Field, Gobi Desert

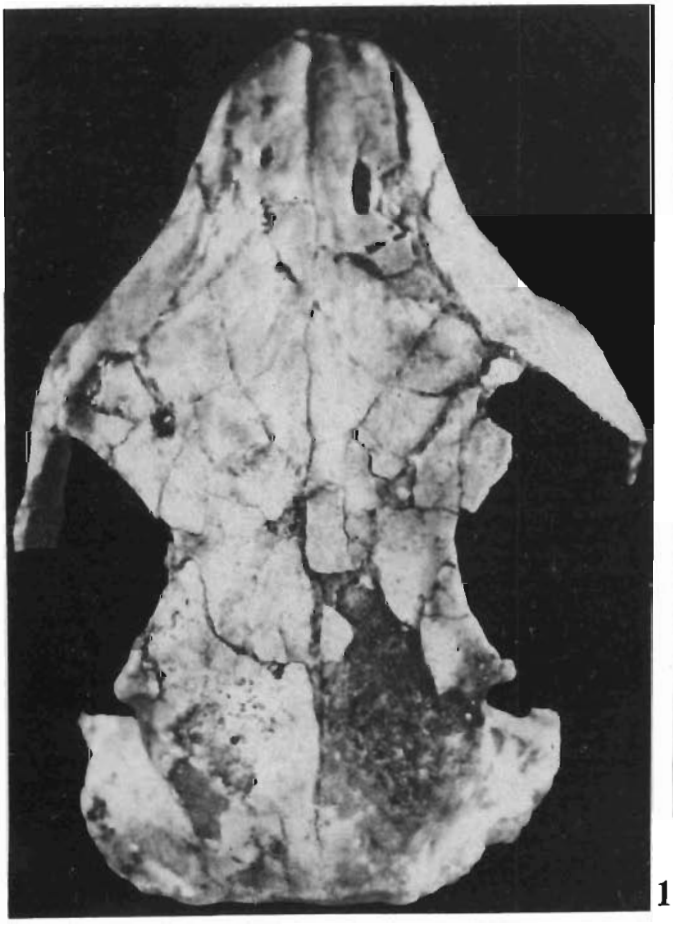
(see also Plate XVII)

Fig. 1*a*. Complete skull (without lower jaws), in dorsal view. Type specimen (Z. Pal. No. MgM-I/33); × 6.
Fig. 1*b*. The same specimen, in lateral view; × 6.
Fig. 1*c*. Left cheek teeth and I^2 of the same specimen, in lateral (somewhat ventral) view; × 12.
Fig. 1*d*. Stereo-photograph of the same specimen, anterior view; × 3.5.
Fig. 1*e*. Stereo-photograph of the anterior part of the same skull, occlusal view; × 3.5.

Photo: M. Czarnocka


1d


1e


1a


1c


1b

Z. KIELAN-JAWOROWSKA: NEW UPPER CRETACEOUS MULTITUBERCULATES

PLATE XVII

Upper Cretaceous, Djadokhta Formation, Bayn Dzak, Ruins, Gobi Desert

(see also Plate XVI)

Fig. 1*a*. Stereo-photograph of partial skull, in occlusal view. Right and left I^1 broken off, I^2, M^1 and M^2 lacking (Z. Pal. No. MgM-I/39); × 4.

Fig. 1*b*. The same specimen, in dorsal view; × 4.

Fig. 1*c*. The same specimen, in right lateral and left lateral views; × 4.

Fig. 1*d*. Stereo-photograph of the incomplete lower jaws of the same specimen, in occlusal view, left M_2 and right M_1 and M_2 lacking, × 5.

Fig. 1*e*. Left lower jaw of the same specimen, in lingual and labial views; × 5.

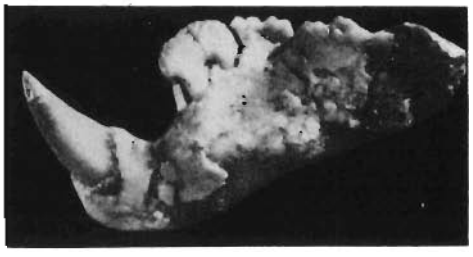
Fig. 1*f*. Fragmentary right lower jaw of the same specimen, in lingual view; × 5.

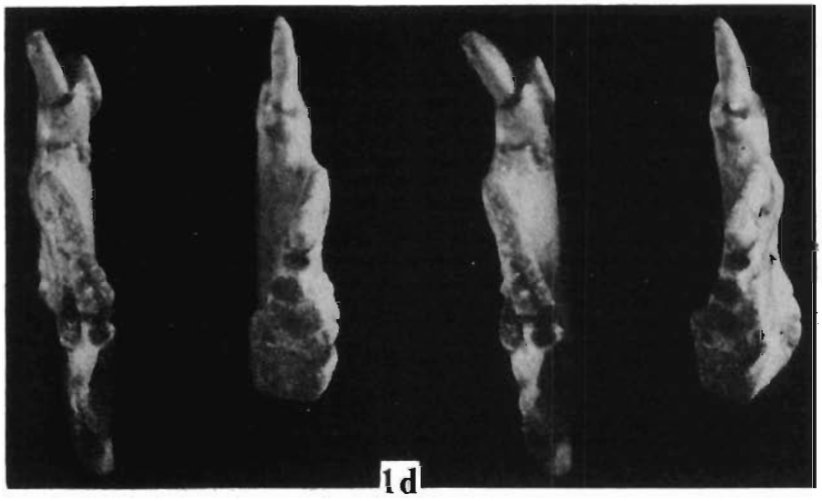
Fig. 1*g*. The same, in labial view; × 5.

Photo: M. Czarnocka

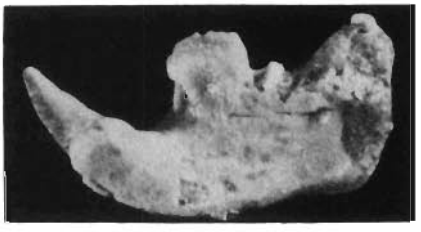
1c

1e

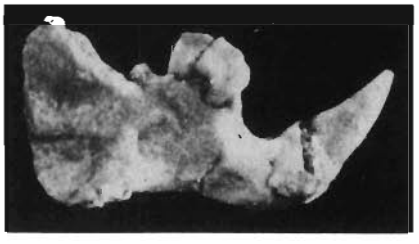




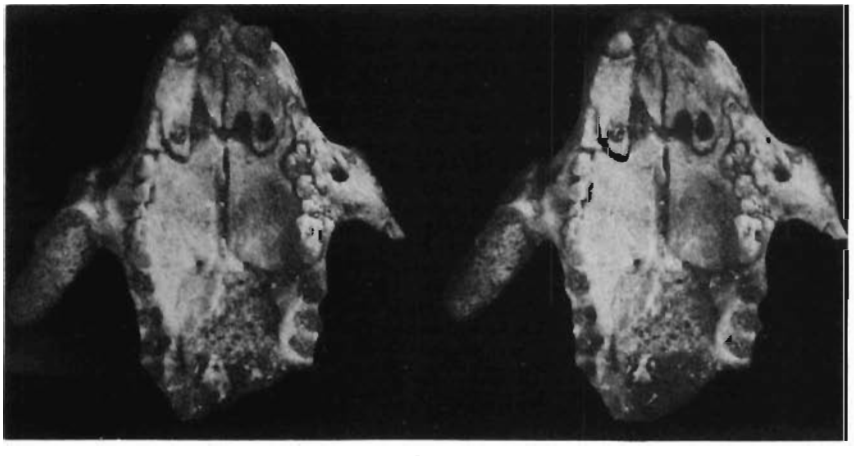
1d



1f



1g



1a

1b