ZOFIA KIELAN-JAWOROWSKA

MULTITUBERCULATE SUCCESSION IN THE LATE CRETACEOUS OF THE GOBI DESERT (MONGOLIA)

(Plates V-XXI)

Contents

Abstract. — The Late Cretaceous Gobi Desert localities yielding mammalian fauna are discussed. The fauna found in the Barun Goyot Formation (Lower Nemegt Beds) in 1970 and 1971 in four localities: Nemegt, Khulsan, Khermeen Tsav I, Khermeen Tsav II, is compared with that from the Djadokhta Formation (Coniacian or Santonian) of Bayn Dzak. The degree of anatomical differentiation of multituberculates indicates Campanian as the age of the Barun Goyot Formation. No common multituberculate species is found in the Djadokhta Formation and in the Barun Goyot Formation. Three new multituberculate genera and four new species are diagnosed and figured: *Bulganbaatar nemegtbaataroides* n. gen., n. sp. from the Djadokhta Formation and *Nemegtbaatar gobiensis* n. gen., n. sp., *Chulsanbaatar vulgaris* n. gen. n. sp., and *Djadochtatherium catopsaloides* n. sp. from the Barun Goyot Formation. Two new multituberculate families: Sloanbaataridae and Chulsanbaataridae are established. No single representative of Ptilodontoidea is found in the Barun Goyot Formation. It is shown that the Eucosmodontidae and Taeniolabididae originated at the beginning of the Late Cretaceous in Asia and reached North America in Latest Cretaceous. The lacrimal is found in Cretaceous multituberculates and it is shown that the petrosal has a larger exposure on the lateral wall of the braincase than recognized previously. The triradiate pattern of the choanal structure, previously known only in *Kamptobaatar*, is found in three other taeniolabidoid genera.

INTRODUCTION

Until recently the Upper Cretaceous mammals of Asia were known from the red sandstone of the Djadokhta Formation at the locality of Bayn Dzak (Shabarkh Usu) — (Text-fig. 1). The mammals at Bayn Dzak were discovered by the Central Asiatic Expedition of the American Museum of Natural History (GREGORY & SIMPSON, 1926; SIMPSON, 1925, 1928*a*, 1928*b*). More recently this locality has been explored by the Polish-Mongolian Palaeontological Expeditions and a collection of about 50 mammalian specimens assembled (KIELAN-JAWOROWSKA, 1969*a*, 1969*b*, 1970*a*, 1970*b*, 1971; KIELAN-JAWOROWSKA & DOVCHIN, 1969; KIELAN-JAWOROWSKA & BARSBOLD, 1972). It is difficult to estimate the age of the Djadokhta Formation as all the fossils found in this sandstone belong to new taxa, unknown elsewhere. On the basis of differentation of the multituberculate fauna, found in the Djadokhta Formation, I came to the conclusion (KIELAN-JAWOROWSKA, 1970*a*) that it is of Coniacian or Santonian age.

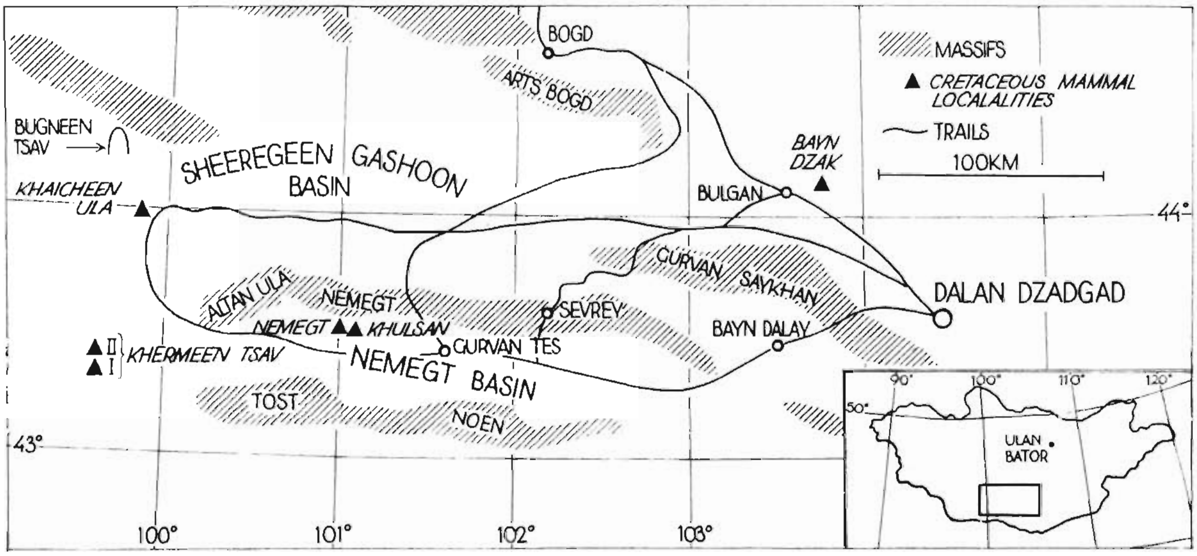


Fig. 1
Diagrammatic map of the Gobi Desert, showing the localities, in which the Late Cretaceous mammals were found.

A single multitberculate specimen was found by the Soviet-Mongolian Geological Expedition in 1968, at the locality of Khaicheen Ula and was described by KIELAN-JAWOROWSKA & SOCHAVA, (1969) as *Buginbaatar transaltaiensis*. The stratigraphic succession of the beds is not very clear at this locality and their assignment to the Uppermost Cretaceous (Maastrichtian) must be regarded as tentative. The possibility cannot be excluded that *B. transaltaiensis* is of early Paleocene age and therefore the Khaichen Ula locality is not further discussed in this paper.

During the Polish-Mongolian Palaeontological Expeditions to the Gobi Desert in 1970 and 1971 (KIELAN-JAWOROWSKA & BARSBOLD, 1972; GRADZIŃSKI & JERZYKIEWICZ, 1972) new localities with Upper Cretaceous mammals younger than those from the Djadokhta Formation, were discovered (Text-fig. 1). In 1970 Upper Cretaceous mammals were found for the first time in the Lower Nemegt Beds (GRADZIŃSKI, 1970) at the localities of Nemegt and Khulsan in the Nemegt Basin. These beds have been designated as the Barun Goyot Formation and are concordantly overlain by the Upper Nemegt Beds, designated as the Nemegt Formation (MAR-

TINSON *et al.*, 1969, GRADZIŃSKI & JERZYKIEWICZ, 1974). Mammals have not been found in the latter. During the 1971 expedition the collecting of mammals in Barun Goyot Formation was continued in the localities of Nemegt and Khulsan, and in two new localities: Khermeen Tsav I and Khermeen Tsav II, situated some 40 km south-westwards from the western end of the Nemegt Basin.

The collection of mammals, assembled in 1970 and 1971 from the Barun Goyot Formation in the four localities mentioned above, embraces about 100 specimens, less than a third of which are insectivores, the remainder are multituberculates.

In the present paper the diagnoses of three new multituberculate genera and four new species are given, one new species derives from the Djadokhta Formation, the other three from the Barun Goyot Formation. It should be mentioned that at this writing only a part of the multituberculate collection from Barun Goyot Formation has been prepared. Nevertheless, I have thought it desirable to publish the diagnoses of the new genera and species from this formation, as my preliminary investigation of this fauna has led to stratigraphic conclusions which may be relevant to other studies of the Late Cretaceous fossils from the Gobi Desert. It is possible that further preparation of the collection from the Barun Goyot Formation will show the occurrence of new species and genera; it may also provide new information on the skull structure of the species described here. The postcranial skeletons associated with the skulls will be described at a later date.

The fossils described in the present paper are housed in the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw, abbreviated as Z. Pal. The American Museum of Natural History, New York, is abbreviated as A.M.N.H.

ACKNOWLEDGMENTS

I wish to express my deep gratitude to Dr. K. HIIEMAE (Anatomy Department, Guy's Hospital, Medical School, London), to Dr. G. Mac INTYRE (Biology Department, Queens College, Flushing, N. Y.), Prof. M. C. McKenna (American Museum of Natural History, New York) and to Prof. R. E. SLOAN (Department of Geology and Geophysics, University of Minnesota, Minneapolis) for reading the manuscript and for most valuable discussion. Thanks are due to the following from the technical staff of the Palaeozoological Institute, Polish Academy of Sciences in Warsaw: Mrs. J. SKARŻYŃSKA, for her skilfull preparation of the described specimens Mrs. K. BUDZYŃSKA, for text drawings, Mr. W. SKARŻYŃSKI, for taking the photographs and Mr. W. SICIŃSKI, for arranging the plates.

STRATIGRAPHY

The two Late Cretaceous formations of the Gobi Desert in which the mammals were found are the Djadokhta Formation and Barun Goyot Formation [1]. Both are similar litholo-

[1] I assign the red sandstones that occur in Khermeen Tsav I and Khermeen Tsav II to the Barun Goyot Formation, as they contain the same assemblage of mammals as this formation (Lower Nemegt Beds) in Nemegt and Khulsan. Almost all species of mammals known from Nemegt and Khulsan were found at Khermeen Tsav II. At Khermeen Tsav I only two specimens of mammals were found, both belonging to *Djadochtatherium catopsaloides* n. sp. (this is the species known otherwise from Khulsan and Khermeen Tsav II). Lizards, very common in the red sandstones of Khulsan, Nemegt and Khermeen Tsav II, are comparatively rare in Khermeen Tsav I. However, the assemblage of dinosaurs and dinosaur eggs in Khermeen Tsav I is the same as in Khermeen Tsav II, Khulsan and Nemegt. These indicate that the red sandstones, cropping out in these four localities are contemporaneous.

gically, developed as vivid red, poorly cemented sandstone, with sandy concretions of variable size. Small, white calcareous concretions occur in both formations.

The sandstones in the four localities containing the Barun Goyot Formation have weathered in strikingly similar way to that of the Djadokhta Formation. The landscape of the Barun Goyot Formation localities reminds one very strongly of that of Bayn Dzak. At first glance, the fauna occurring in the Barun Goyot Formation appears to be similar to that of the Djadokhta Formation, but more thorough investigation shows distinct differences. The dinosaur eggs, characteristic of the Djadokhta Formation, are also numerous in the Barun Goyot Formation. However, in addition to the dinosaur eggs common at Bayn Dzak (Djadokhta Formation), spherical eggs, 10—12 cm in diameter, occur in the Barun Goyot Formation. These have a very thick shell, not like those found at Bayn Dzak. Similar spherical eggs are known from France and Spain and have been regarded as belonging to sauropods. It seems that there is little evidence for such an assumption, but it is interesting that isolated sauropod teeth do occur in the Barun Goyot Formation and not in the Djadokhta Formation. *Velociraptor* OSBORN, characteristic of the Djadokhta Formation was found in the Barun Goyot Formation. *Saurornithoides* OSBORN, known from the Djadokhta Formation, was not found in the Barun Goyot Formation, but as this genus occurs in the Nemegt Formation (BARSBOLD, 1974) it must have lived during the time of deposition of the Barun Goyot Formation. The ankylosaurid and protoceratopsid dinosaurs known from the Djadokhta Formation were found in the Barun Goyot Formation, but are represented there by new taxa (personal communication from Dr. T. MARYAŃSKA). Numerous lizards were found, some belonging to the same species as those from the Djadokhta Formation, but there are in addition some new groups of lizards which are not known from the Djadokhta Formation (personal communication from Dr. A. SULIMSKI). The birds (ELŻANOWSKI, 1974) and diplopod myriapodes, found in the Barun Goyot Formation were not found in the Djadokhta Formation. Tortoises are common in the Barun Goyot Formation (MŁYNARSKI, 1972), but very rare in the Djadokhta Formation. Due to this rarity, it cannot be stated whether they represent the same taxonomic units.

As far as the mammals are concerned it is difficult to compare the samples from both formations before complete preparation of the new collection, but it may be stated that *Deltatheridium* occurs in both Djadokhta and Barun Goyot Formations; in addition in the Barun Goyot Formation at least two new eutherian genera are found.

The multituberculate assemblage from the Djadokhta Formation consists of 6 genera and species: *Djadochtatherium matthewi* SIMPSON, *Gobibaatar parvus* KIELAN-JAWOROWSKA, *Kryptobaatar dashzevegi* KIELAN-JAW., *Sloanbaatar mirabilis* KIELAN-JAW., *Kamptobaatar kuczynskii* KIELAN-JAW., and *Bulganbaatar nemegtbaataroides* n. gen. n. sp. In the collection from Bayn Dzak, there are 2 or 3 monotypic, as yet undescribed multituberculate genera. Of the 9 genera known from Bayn Dzak, only one, *Djadochtatherium* is represented in the fauna from the Barun Goyot Formation [2]. The Barun Goyot multituberculate assemblage consists of 2 new genera, and 3 new species: *Chulsanbaatar vulgaris* n. gen. n. sp., *Nemegtbaatar gobiensis* n. gen. n. sp. and *Djadochtatherium catopsaloides* n. sp., described in the present paper and 3 more, poorly known, as yet undescribed genera.

Among the multituberculates from the Djadokhta Formation, the eucosmodontid *Bulganbaatar nemegtbaataroides* is regarded as an ancestor of *Nemegtbaatar gobiensis* and the taenio-

[2] It is not certain whether *Kamptobaatar* is or is not present in the Barun Goyot Formation. As, the dentition and lower jaw of the possible representative of this genus are not known, and its similarity to *Kamptobaatar* lies only in the general shape of the skull, its assignment to this genus cannot be stated with any certainty.

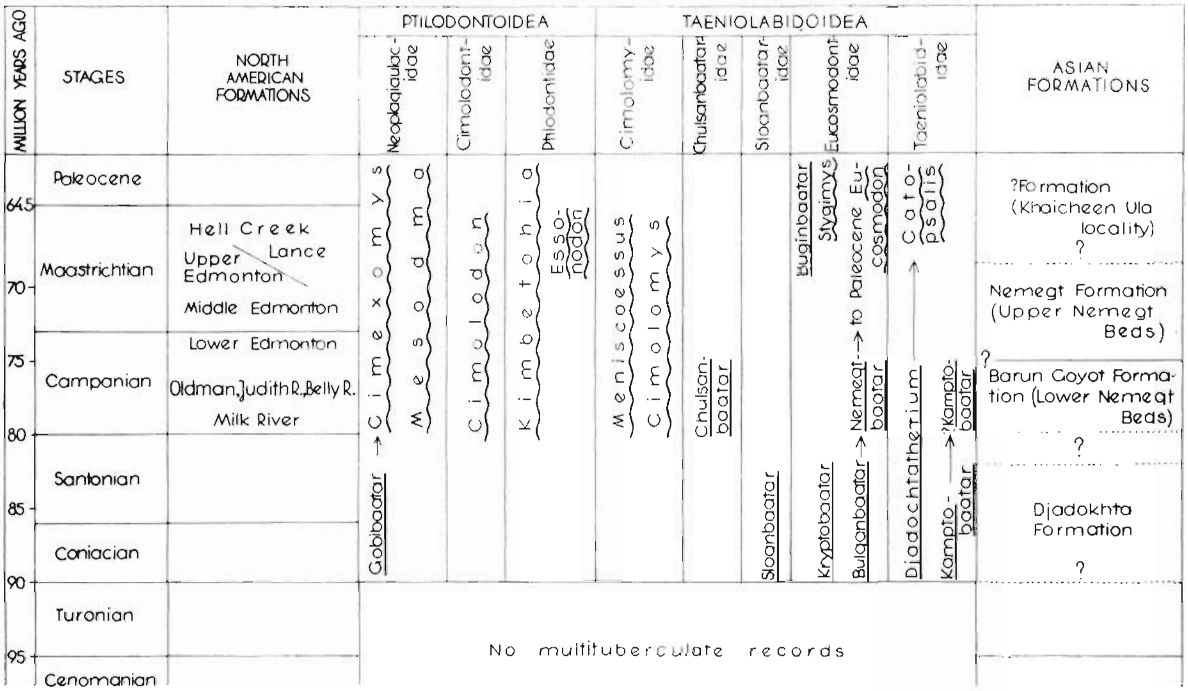


Fig. 2

Distribution of multituberculate genera in the Late Cretaceous. Asian genera are underlined with a straight line, North American genera with wavy line. Genus *Viridomys* Fox of uncertain ordinal and familial assignment is not figured. The Barun Goyot Formation is overlain concordantly by the Nemegt Formation; the question mark at the boundary between these formations indicates the doubt as to the age of the boundary.

labidid *Djadochtatherium matthewi* is regarded as an ancestor of *Djadochtatherium catopsaloides* (see Text-fig. 2). Both ancestral forms from the Djadokhta Formation when compared with their Barun Goyot Formation descendants, are smaller and less advanced in the tooth structure. The ancestor of the most common Barun Goyot multituberculate *Chulsanbaatar vulgaris*, has not been found.

The oldest known Late Cretaceous mammals of North America are those of Early Campanian Upper Milk River Formation; these early mammals include: Symmetrodonta, Triconodonta, Marsupialia, Multituberculata and uncertain Eutheria (Fox, 1969, 1970, 1971, 1972*a*, 1972*b*). In the Middle Campanian Judith River Formation the Triconodonta and Symmetrodonta do not appear anymore (Sahni, 1972). The mammalian fauna from the Upper Milk River Formation is very different from that of the Djadokhta Formation in Asia, where only the Multituberculata and Theria were found. The Djadokhta Formation multituberculates are also very different from those of the Upper Milk River Formation. Among the Upper Milk River multituberculates *Cimexomys*, being similar to *Gobibaatar*, is the only genus of Asiatic affinities; in the tooth structure *Cimexomys* is more advanced than *Gobibaatar*. All other multituberculate genera from the Upper Milk River Formation belong to different lineages than the Asiatic forms.

The Barun Goyot Formation *Djadochtatherium catopsaloides* n. sp. may be regarded with great confidence as an ancestor of the North American *Catopsalis joyneri*, from the Late Maastrichtian Hell Creek Formation (Sloan & Van Valen, 1965). *Catopsalis* which is an Asiatic immigrant, is the oldest representative of the Taeniolabididae in North America. Another taeniolabidoid family, the Eucosmodontidae, makes its appearance in North America in the Late Campanian El Gallo Formation, where it is represented by a single M^2, identified as *?Stygimys* sp. (LILLEGRAVEN, 1972). It is difficult to base phylogenetic and palaeogeographic conclusions on a single M^2, however, the tooth identified as *?Stygimys* sp. appears to be without doubt an eucosmodontid, which may be regarded as originating from the Asian *Nemgtbaatar* (see p 37). In Asia both the Taeniolabididae and Eucosmodontidae are known since Djadokhta Formation. The above comparisons show that the Barun Goyot Formation is older than the Late Campanian. In the localities of Nemegt and Khermeen Tsav the Barun Goyot Formation (Lower Nemegt Beds) conformably underlies the Nemegt Formation (Upper Nemegt Beds), from which a rich and differentiated dinosaur fauna of the Late Campanian or Early Maastrichtian age is known (ROZHDESTVENSKY, 1957, 1965, MALEYEV, 1955*a*, 1955*b*, 1956, OSMÓLSKA & RONIEWICZ, 1970, NOWIŃSKI, 1971, OSMÓLSKA *et al.*, 1972, MARYAŃSKA & OSMÓLSKA, 1974, BARSBOLD, 1974). On the basis of the above data I estimate the age of the Barun Goyot Formation as ?Campanian, possibly Middle Campanian (see Text-fig. 2).

ANATOMY

The anatomy of the forms described here will be mainly restricted to osteological diagnoses, because the present paper is chiefly concerned with stratigraphy. Nevertheless, the better preservation of skulls from the new Campanian localities makes possible some corrections of previous descriptions of multituberculate skull anatomy.

When describing the Djadokhta multituberculates (KIELAN-JAWOROWSKA, 1969*a*, 1969*b* and 1970) I stated that the lacrimal bone and lacrimal foramen are lacking in all Bayn Dzak multituberculates. In the light of the material from new Campanian localities, described in the present paper, this does not seem to be the case. In the best preserved skull of *Nemegtbaatar gobiensis* (Z.Pal.No.MgM-I/81) — (see Pl. VII, Fig. 1*a* and Text-fig. 3*a*), on the right side of the skull roof, an extensive, rectangular lacrimal is seen in the corner between the maxilla, nasal and the frontal. On the left side of the same skull, the trace of the lacrimal is less clearly recognized. In the majority of the specimens so far studied, this part of the skull is either damaged, or the suture between the frontal and the lacrimal is fused. However, careful examination of the skulls shows that there are also traces of a more or less similarly shaped lacrimal in *Gobibaatar parvus*, *Kryptobaatar dashzevegi*, and *Kamptobaatar kuczynskii* from the Djadokhta Formation and in *Chulsanbaatar vulgaris* and perhaps in *Djadochtatherium catopsaloides* from the Barun Goyot Formation. One can conclude therefore that the lacrimal was characteristic of the multituberculates as a whole, and in this respect they seem to differ from the monotremes. The lacrimal foramen was not found in the skulls examined, but it remains possible that more detailed preparation of this region would expose it.

A second anatomical emendation introduced in the present paper involves the shape of the ascending lamina (called also anterior lamina or lamina obturens) of the petrosal. I figured in *Kamptobaatar kuczynskii* (KIELAN-JAWOROWSKA, 1969*b*, Text-fig. 2; 1971, Text-fig. 3 and 14) the junction between the petrosal and the parietal as a horizontal suture, situated in the middle of the height of the lateral wall of the braincase seen in lateral view. In *Nemegtbaatar gobiensis* (Z.Pal.No.MgM-I/81), a specimen in which all the sutures are clearly visible (Pl. VII, Fig. 1*a*; Text-fig. 3*b*) the suture between the parietal and the petrosal is situated much more dorsally and extends as a roughly horizontal line, in the posterior prolongation of the postorbital process, just below the rounded edge between the cranial roof and the lateral wall of the braincase. The parietal contributes very little to the structure of the lateral wall of the braincase, most of which is formed by the ascending lamina. The examination of this region in other species shows that in all the skulls examined (including *Kamptobaatar kuczynskii*) the junction between the parietal and the petrosal is probably situated much more dorsally than previously figured. Further preparation of the orbit and temporal fossa in these skulls will probably allow one to describe the exposure of particular bones and the foramina in the braincase in more detail.

The pterygoids, placed in the middle of choanal channels in *Kamptobaatar kuczynskii*, are found in the same position in *Bulganbaatar nemegtbaataroides*, in *Nemegtbaarar gobiensis* and *Chulsanbaatar vulgaris* and it seems possible that such a position of the pterygoids is characteristic of all the Taeniolabidoidea, or even of all the multituberculates.

SYSTEMATICS

Suborder TAENIOLABIDOIDEA (GRANGER & SIMPSON, 1929) emend. SLOAN & VAN VALEN, 1965

In the present paper I accept for the time being SLOAN & VAN VALEN's (1965) division of the later Multituberculata into the Ptilodontoidea and Taeniolabidoidea. I am not happy with this division as I think that thc taeniolabidoid type of the lower incisor arose independently at least twice in multituberculate evolution. The suborder Taeniolabidoidea is thus of polyphyletic (at least diphyletic) origin. However, I feel that the formal modification of the classification should not be undertaken until a detailed comparative study of Asian and North American multituberculates has been completed.

SLOAN & VAN VALEN (1965) defined the suborder Taeniolabidoidea as (*l. c.*, p. 3): "... including multituberculates in which the enamel of the lower incisor is restricted to the ventrolateral surface of the tooth, producing a self-sharpening tooth, similar to that of rodents. The shearing premolars are reduced in proportion to the molars in all included genera except *Eucosmodon*". The latter statement should be removed from the definition of the Taeniolabidoidea, as in different taeniolabidoid genera the shearing premolars are not reduced in proportion to the molars.

SLOAN & VAN VALEN included 3 families in the Taeniolabidoidea: the Cimolomyidae (MARSH, 1889), the Eucosmodontidae (JEPSEN, 1944) and the Taeniolabididae GRANGER & SIMPSON, 1929. In the present paper I recognize 2 new taeniolabidoid families: the Chulsanbaataridae nov. and Sloanbaataridae nov.

Nothing is known of the skull structure in the Cimolomyidae; four remaining families are well known from several complete skulls and in some cases from postcranial skeletons; they are well defined and differ distinctly from each other. The Sloanbaataridae and Chulsanbaataridae are monotypic families, known only from Central Asia. The Eucosmodontidae and Taeniolabididae are known from Central Asia and North America. The representatives of both families made their appearance first in Asia (in the Coniacian or Santonian Djadokhta Formation), were present in the Campanian on the same continent and migrated to North America, the Eucosmodontidae probably in the Middle or Late Campanian, while the Taeniolabididae in the Late Maastrichtian. Among the Asiatic eucosmodontid and taeniolabidid genera there are the probable ancestors or forms close to the ancestry of the North American representatives of these families.

The only taeniolabidoid family known in North America from beds earlier than the Latest Cretaceous are the Cimolomyidae, the oldest representatives of which occur in the Campanian Upper Milk River and Judith River Formations; nothing is known of the origin of this family.

Of the six genera described from the Djadokhta Formation, only one (*Gobibaatar parvus* KIELAN-JAWOROWSKA) belongs to the Ptilodontoidea and five to Taeniolabidoidea, while all the recognized genera from the Barun Goyot Formation belong to the Taeniolabidoidea. This is different from the conditions in North America, where in the Late Cretaceous (and Early Tertiary) the Ptilodontoidea prevail over the Taeniolabidoidea (Text-fig. 2).

Family EUCOSMODONTIDAE (JEPSEN, 1940)

Revised diagnosis. — Medium sized Taeniolabidoidea, with anterior part of the skull roughly triangular, braincase moderately convex and occipital plate arranged at a right angle with regard to the tooth plane. Zygomatic arches moderately expanded laterally, glenoid fossa roughly rounded or pear-haped. One pair of palatal vacuities. Lower jaw arranged comparatively horizontally, its lower margin forming a small angle with a horizontal plane. Coronoid crest small. Lower incisors strongly compressed, with sharply limited enamel, 3—4 upper premolars, P^4 extending for about 0.7 of M^1 length, P_4 longer than M_1 in all the genera except *Pentacosmodon* and *Microcosmodon*.

Stratigraphical and geographical range. — Late Cretaceous of Central Asia, Latest Cretaceous, Paleocene and Eocene of North America.

Genera assigned:	*Kryptobaatar* KIELAN-JAWOROWSKA, 1970	Cretaceous
	Bulganbaatar nov.	
	Nemegtbaatar nov.	
	Stygimys SLOAN & VAN VALEN, 1965	
	Eucosmodon MATTHEW & GRANGER, 1921	Tertiary
	Neoliotomus JEPSEN, 1930	
	?*Microcosmodon* JEPSEN, 1930	
	?*Pentacosmodon* JEPSEN, 1940	

Discussion. — *Microcosmodon* and *Pentacosmodon* are tentatively assigned to the Eucosmodontidae, as they differ from all other genera in having P_4 reduced in proportion to M_1 and in different proportions of the lower jaw, which is placed strongly obliquely with regard to the horizontal plane, the condyle being situated much higher than in other genera. Skulls and upper dentition of *Pentacosmodon* and *Microcosmodon* are not known.

The oldest known eucosmodontids are two Djadokhta Formation genera: *Kryptobaatar* KIELAN-JAWOROWSKA and *Bulganbaatar* nov. *Kryptobaatar dashzevegi* KIELAN-JAWOROWSKA is the most common multituberculate in the Djadokhta Formation. On the basis of the comparison of *Kryptobaatar dashzevegi* with the Djadokhta Formation ptilodontoid from the family Neoplagiaulacidae (former Ectypodontidae) *Gobibaatar parvus* KIELAN-JAWOROWSKA, I assume that the Eucosmodontidae derive from the Neoplagiaulacidae. *Gobibaatar* and *Kryptobaatar* are extremely similar in the general shape of the snout, in the proportions between the particular bones, in the structure of upper premolars and molars and of the lower molars. The similarities in the molar structure concern the size, shape and even the same number and proportions of cusps on particular teeth. These similarities are so great that in the absence of associated lower jaws it is difficult to classify the rostra with all the premolars and molars to one or to the other genus. *Kryptobaatar* differs from *Gobibaatar* in the quite different proportions of the lower jaw and different structure of the upper and lower incisors and of P_4. These differences justify the assignment of the two genera to different suborders. Unfortunately the palate in *Gobibaatar parvus* is too poorly preserved to show palatal vacuities if present. One can, however, presume that the palatal vacuities were present in *Gobibaatar* as they are characteristic of other Neoplagiaulacidae. It seems very probable that *Kryptobaatar* originated from the forms close to *Gobibaatar*, and that its evolution involved the development of self-sharpening incisors and changes in the proportion of the lower jaw.

Genus **BULGANBAATAR** nov.

Type species: *Bulganbaatar nemegtbaataroides* n. sp.
Derivation of the name: From the village of Bulgan, near Bayn Dzak and from Ulan Baatar.

Diagnosis. — The genus is monotypic, the generic characters are those of the type species.
Stratigraphical and geographical range. — Know only from the Coniacian or Santonian Djadokhta Formation of Bayn Dzak in the Gobi Desert, Mongolia.
Discussion. — See p. 34.

Bulganbaatar nemegtbaataroides n. sp.

(Pl. V, Fig. 4; Pl. VI; Text-fig. 4*a*)

Type specimen: Incomplete badly damaged rostrum, with all the teeth except left M^2 preserved. P^4 on both sides damaged. Z.Pal.No.MgM-I/25.
Type horizon and locality: Coniacian or Santonian, Djadokhta Formation, locality of Bayn Dzak, Gobi Desert, Mongolia.
Derivation of the name: Similar to *Nemegtbaatar* n. gen.

Material. — Only the type specimen is known.
Dimensions: See Tables 1 and 2.
Diagnosis. — Upper dentition formula: 2 0 4 2. Medium sized eucosmodontid, smaller than *Nemegtbaatar*. Zygomatic arch slender, with well defined base, starting in ventral view opposite the end of P_3 and anterior half of P_4. Palatal vacuities long. Infraorbital foramen large, rounded, facing laterally, situated opposite P^2—P^3 embrasure. Zygomatic ridge prominent. Cusps 3 on P^1 and P^2, 4 on P^3, ?2:5 on P^4, 5:5:?3 on M^1, 1:2:2 on M^2. P^4:M^1 length ratio 0.8. Cranium and lower jaws unknown.
Description. — The anterior part of the snout, in front of zygomatic arches is roughly triangular. The zygomatic arch has a slender well defined base, and is directed more laterally than the anterior part of the snout; its anterior margin is situated in ventral view opposite P^3—P^4 embrasure, posterior margin opposite the anterior half of P^4. The infraorbital foramen is comparatively large and rounded, situated opposite P^2—P^3 embrasure, facing anteriorly and laterally and obscured in ventral and dorsal views. The infraorbital canal is very short. The lateral margin of the palatal process of premaxilla is rounded and does not form the prominent and sharp edge as in the majority of the Djadokhta Formation multituberculates, the latter difference, however, may be due to the damage. The sutures between the bones of the face are not recognizable, except for the premaxillo-maxillary suture, along which the skull on both sides is broken and displaced. The palate is strongly concave. As the middle parts of the palatal processes of the maxillae are symmetrically absent on both sides, it is presumed that the missing

Table 1

Dimensions of skulls (in mm)

Species	*Bulganbaatar nemegtbaatar-oides*	*Nemegtbaatar gobiensis*		*Chulsanbaatar vulgaris*			*Djadochtatherium catopsaloides*	
Z.Pal. cat. No.	MgM-I/25	MgM-I/81	MgM-I/76	MgM--I/139	MgM-I/61	MgM--I/108	MgM-I/78	MgM-I/79
Length of skull	—	42.0	ca 40.0	17.7	19.3	ca 16.5	—	61.2
Width of skull	—	30.0	—	14.0	15.5	13.0	57.0	—
Length of premaxilla along alveolar border	4.9	7.5	—	2.8	2.2	2.0	ca 9.0	11.6
Length of premaxilla in sutural contact with nasals	—	9.6	—	4.0	4.5	4.0	16.0	—
Length of palatine process of premaxilla	6.6	7.8	—	4.2	4.5	3.4	ca 11.5	13.6
Length of hard palate between premax.-max. suture and choanal	ca 9.0	6.6	8.5	4.8	7.0	5.5	11.0	12.2
Width of hard palate between P^4	ca 7.0	10.4	10.4	4.5	4.9	4.5	14.0	17.0
Depth of skull above I^2	—	5.1	6.0	2.4	3.0	2.9	9.8	10.8
Depth of skull above M^2	11.7	9.6	12.2	5.3	5.8	5.5	17.5	19.5
Length of nasals	—	17.2	—	ca 9.0	—	?6.0	—	—
Length of frontals	—	15.0	ca 15.8	7.9	—	—	—	—
Length of the lower jaw from the base of the incisor	—	25.8 26.6	—	10.4	11.3 11.4	10.5 10.0	35.3 35.0	—
Depth of the lower jaw below P_3	—	5.8 5.3	—	2.3	2.6	2.5	10.3	—
Depth of the lower jaw below M_1	—	7.1 7.0	—	3.6	4.0	3.6 3.7	12.0 11.2	—

areas correspond to the palatal vacuities, the exact size of which is difficult to discern; they probably extend from opposite P^2 to opposite P^4—M^1 embrasure.

The transverse palatine suture is barely discernible. The horizontal part of the palatine bone is partly damaged and one cannot state whether the postpalatine torus was present. In

Table 2

Dimensions of teeth (in mm)

Species		*Bulganbaatar nemegtbaatar-oides*	*Nemegtbaatar gobiensis*		*Chulsanbaatar vulgaris*			*Djadochtatherium catopsaloides*	
Z.Pal. cat. No.		MgM-I/25	MgM-I/81	MgM-I/76	MgM--I/139	MgM-I/61	MgM--I/108	MgM-I/78	MgM-I/79
P^1	length	1.5	—	1.8	0.6	0.6	0.7	1.4	—
	width	1.0	—	1.5	0.4	0.4	0.4	1.3	—
P^2	length	1.2	0.9	1.4	0.6	0.5	0.5	—	—
	width	1.3	—	1.3	0.5	0.5	0.5	—	—
P^3	length	1.1	0.9	1.1	0.6	0.8	0.7	2.1	—
	width	1.2	—	0.9	0.5	0.55	0.4	1.1	—
P^4	length	2.6	2.5	2.9	1.4	1.65	0.95	3.8	—
	width	1.7	—	1.2	0.5	0.55	0.5	1.1	—
M^1	length	3.1	4.7	5.3	1.8	2.5	2.05	7.9	6.9
	width	2.1	—	2.4	1.1	1.2	1.1	4.4	3.9
M^2	length	1.7	2.1	2.5	0.9	1.1	1.0	5.0	4.3
	width	2.0	—	2.6	1.2	1.3	1.5	4.5	4.5
P_4	length	—	—	—	1.7	1.8	1.6	3.8	—
	width	—	—	—	0.8	0.7	0.6	2.1	—
M_1	length	—	—	—	1.9	1.8	1.6	6.1	—
	width	—	—	—	0.9	0.9	0.8	3.8	—
M_2	length	—	—	—	0.9	0.9	0.9	3.6	—
	width	—	—	—	0.9	0.9	0.85	3.8	—

the choanal region the vomer is recongnizable, and on the right side, the pterygoid is preserved, situated in the middle of choanal channel, as in *Kamptobaatar*. The pterygoid is not as prominent as in *Kamptobaatar*; its free end is damaged. I^1 is poorly preserved. The enamel is very thick on the anterior surface of the tooth, and much thinner on the posterior. I^2 is a peg-like tooth, directed slightly obliquely inwards. P^1, P^2 and P^3 are double rooted, P^1 and P^2 with 3 cusps, 1 buccal and 2 lingual, P^3 is smaller and lower than P^1 and P^2 and has 4 cusps. P^4 is somewhat damaged on both sides; it probably has 2 cusps in the outer row and 5 cusps in the inner row; the third row of cusps is probably not developed. M^1 has 5 cusps in the outer row and 5 in the middle row; the cusps of the outer row are poorly preserved, the last is larger than the remainder those of the middle row are all of equal size. The inner row extends along 3 posterior cusps of the middle row; these cusps are very poorly preserved and their number is uncertain (?3). There is one crescentic cusp on the outer row of M^2, extending along the length of the first cusp in the middle row, two large cusps in the middle row, the posterior one being the largest of all, and 2 cusps in the inner row. In the middle row in front of the first cusp there is a room for an incipient cusp, not developed yet. The cusps in the inner row are smaller than those in the middle row.

Discussion. — *Bulganbaatar nemegtbaataroides* n. sp. differs from the contemporaneous eucosmodontid *Kryptobaatar dashzevegi* KIELAN-JAWOROWSKA in being bigger, and in having the base of the zygomatic arch more slender. In *K. dashzevegi* the zygomatic arch is wide at the base and its anterior margin is entirely confluent with the anterior margin of the snout, while in *B. nemegtbaataroides* the zygomatic arch is directed more laterally than the anterior margin of the snout, and the base of the arch is narrow. The infraorbital foramen is rounded in *B. nemegtbaataroides* and faces laterally, while in *K. dashzevegi* it is smaller, fissure-like and faces ventrally. It is probable that the palatal vacuities of *B. nemegtbaataroides* are longer than in *K. dashzevegi*, but due to the poor state of preservation of the palate in *B. nemegtbaataroides*, this cannot be stated with certainty. Further differences concern the more advanced structure of M^1 in *B. nemegtbaataroides*, the cusp formula of which is 5:5:?4, while in *K. dashzevegi* it is 4:4:ridge. The inner ridge in M^1 in *K. dashzevegi* extends along the 2 posterior cusps of the middle ridge, while in *B. nemegtbaataroides* it extends along 3 cusps.

See also the comparisons with *Nemegtbaatar gobiensis* on p. 37.

Genus **NEMEGTBAATAR** nov.

Type species: Nemegtbaatar gobiensis n. sp.

Derivation of the name: Nemegt — occurring in the Nemegt Valley, Gobi Desert, *baatar*-from 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, Barun Goyot Formation (?Middle Campanian) of Nemegt, Khulsan and Khermeen Tsav II in the Gobi Desert, Mongolia.

Nemegtbaatar gobiensis n. sp.

(Pl. V, Fig. 10; Pls. VII-X; Text-fig. 3 and 4*b-d*)

Type specimen: Almost complete skull crushed dorsoventrally, associated with right and left lower jaws and partial postcranial skeleton. All teeth well preserved. Z.Pal.No.MgM-I/81.

Type horizon and locality: ?Middle Campanian, Barun Goyot Formation, locality Khermeen Tsav II, Gobi Desert, Mongolia.

Material. — In addition to the type specimen, there are 5 specimens from Barun Goyot Formation, localities of Khulsan, Nemegt and Khermeen Tsav II, one of which, almost complete skull without lower jaws (Z.Pal.No.MgM-I/76) is figured in the present paper.

Dimensions: See Tables 1 and 2.

Diagnosis. — Dental formula: $\frac{2\ 0\ 4\ 2}{1\ 0\ 2\ 2}$. Medium-sized eucomodontid, length of the skull 40—45 mm. Snout in front of zygomatic arches roughly triangular, bluntly pointed. Zygomatic arch directed more laterally than the anterior margin of the snout. In ventral view the anterior margin of zygomatic arch situated opposite P^3, the posterior opposite the anterior part of P^4. Zygomatic ridge prominent. Infraorbital foramen rounded, large, facing anteriorly and laterally, situated opposite P^2. Naso-frontal suture, angulate rather than rounded, each

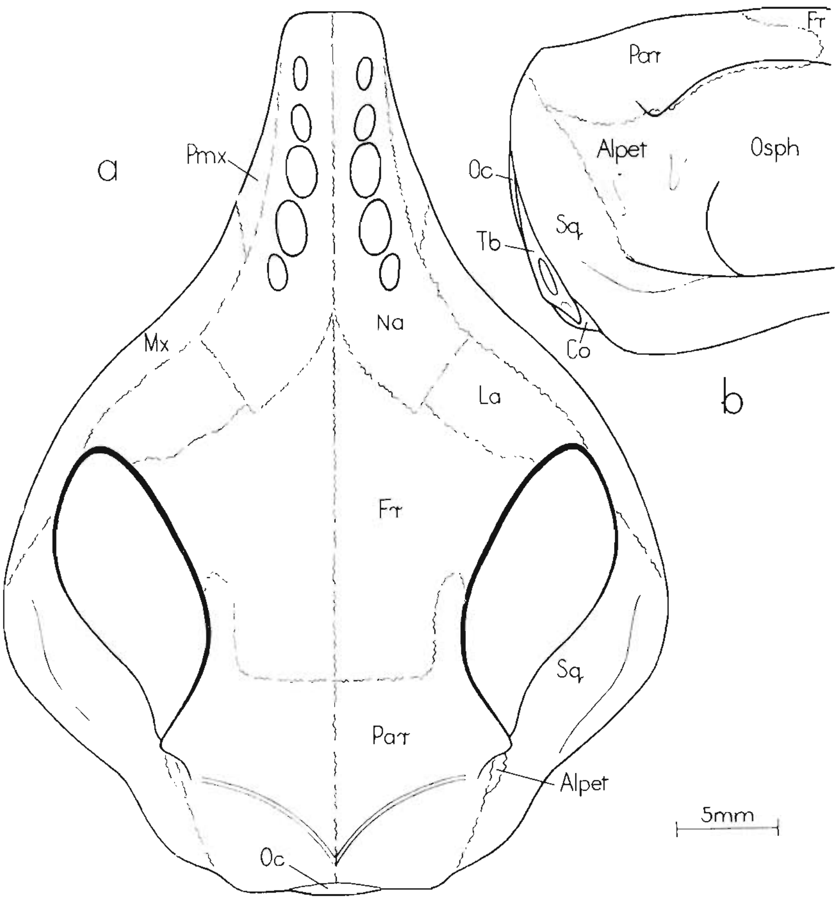


Fig. 3

Nemegtbaatar gobiensis n. sp., *a* — reconstruction of the skull in dorsal view, *b* — reconstruction of the braincase in lateral view, (the sutures between the orbitosphenoid, alisphenoid and the anterior lamina of the petrosal are not visible). *Alpet* — anterior lamina of the petrosal, *Co* — occipital condyle, *Fr* — frontal, *La* — lacrimal, *Mx* — maxilla, *Na* — nasal, *Oc* — occipital, *Osph* — orbitosphenoid, *Par* — parietal, *Pmx* — premaxilla, *Sq* — squamosal, *Tb* — tabular.

nasal pointed posteriorly, frontals tapering together anteriorly into a pointed end along the median suture. Lacrimal as seen in dorsal view very large, roughly rectangular, slightly narrowing towards the margin of the orbit. Palatal vacuities markedly elongated extending from opposite P^2 to ?opposite anterior half of M^1. Choanal region of triradiate structure, as in *Kamptobaatar*. Zygomatic arch slender, glenoid fossa flat, with raised posterior margin, pear-shaped, narrowing anteromedially. Fronto-parietal suture consists of two branches directed posteriorly and transversely, meeting at a slightly rounded right angle; the frontals have a wide, transverse posterior end. Postorbital process moderately prominent. The parietals form the whole cranial roof posteriorly, but barely extend onto the lateral wall of the braincase, which is formed by the ascending lamina of the petrosal. This lamina tapers posterodorsally into a pointed end inserted between the parietal and squamosal. The suture between the parietal and occipital extends along the prominent lambdoidal crest. The occiput is roughly semicircular, the suture between the tabular and occipital is convex inwards, the post-temporal fossa is situated very low, just above the paroccipital process. The basicranial region is more or less of ***Sloanbaatar*** type.

The lower jaw is massive, with a prominent masseteric crest and small coronoid crest. The angle between the margin of the lower jaw and horizontal line amounts 10—12°). The condyle is at the same level as the teeth surface; it is roughly oval in dorsal view. Mental foramen is comparatively large, situated in the middle of the length of the diastema, not much above the middle of the depth of the jaw. Both lower and upper incisors have a sharply limited enamel, the lower incisors are strongly compressed. Upper premolars are double rooted, dP^1 has 6 cusps, P^2 3 cusps, dP^3 3 cusps, P^3 3-2 cusps. There are 3:6-7:0-1 cusps on P^4, 6-7:7:4-5 on M^1, 1:3:2 on M^2. The inner ridge on M^1 extends along 0.6 of the tooth length. P^4:M^1 length ratio 0.7. P_3 is very small, peg-like, P_4 very large, arcuate, with 6-7 serrations provided with ridges and basal cuspule. Cusps 5-4 on M^1, 3:2 on M_2. P_4:M_1 length ratio is 1.7.

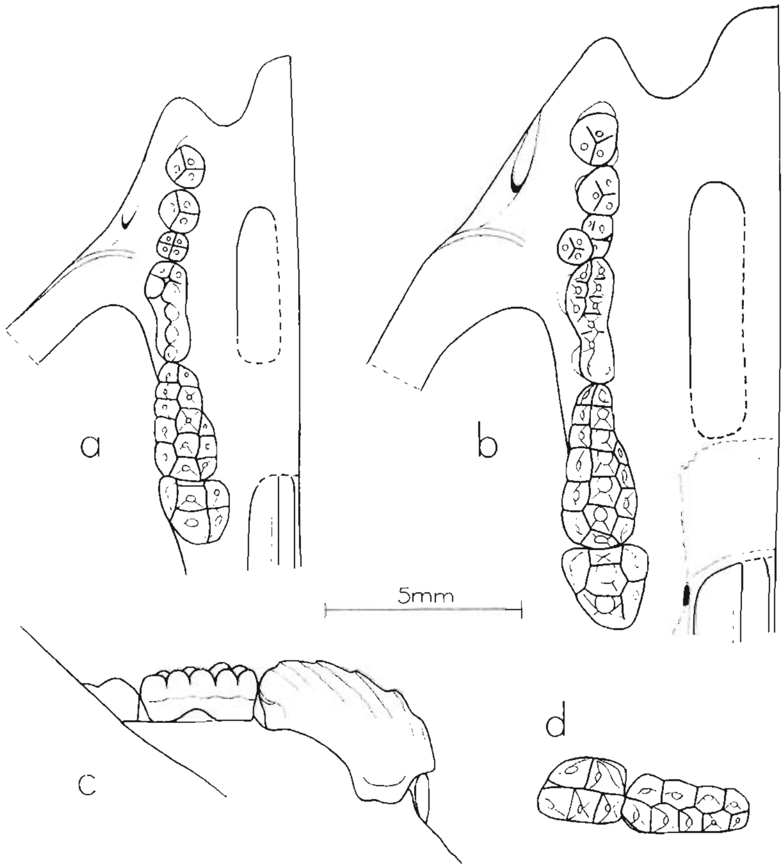


Fig. 4

a- Bulganbaatar nemegtbaataroides n. sp., reconstruction of the palate with P^1, P^2, P^3, P^4, M^1 and M^2, *b-d* — *Nemegtbaatar gobiensis* n. sp., *b* — reconstruction of the palate with P^1, P^2, dP^3, P^3, P^4, M^1 and M^2, *c* — reconstruction of the right lower premolars and molars in outer view, *d* — right M_1 and M_2 in occlusal view.

Discussion. — *Nemegtabaatar gobiensis* is similar to *Bulganbaatar nemegtbaataroides* from the Djadokhta Formation, but is larger and has a more advanced upper dentition. The similarities lie in the shape and position of the infraorbital foramen which in both cases is large, rounded and situated opposite P^2. The shape of the anterior part of the zygomatic arch is similar in both species; it is not confluent with the anterior part of the snout in ventral view, but has a narrow, well defined base and starts more or less in the same place, opposite P^3 and anterior part of P^4. The zygomatic ridge is more prominent in *N. gobiensis* than in *B. nemegtbaataroides*. The presence of large palatal vacuities in *B. nemegtbaataroides* constitutes a further similarity. The differences lie in the structure of the upper cheek teeth, which are larger and have a greater number of cusps in *N. gobiensis*, e.g. cusp formula in *B. nemegtbaataroides* is in P^4 2:5 and in M^1 5:5: ?3, while in *N. gobiensis* P^4 has 3:6-7:0-1; *B. nemegtbaataroides*is very incompletely known and further comparisons of both species cannot be made; however, the preserved rostrum of this species shows that it probably lies very close to the ancestral forms of *N. gobiensis*.

From the North American Late Campanian El Gallo Formation of Baja California del Norte, Mexico, LILLEGRAVEN (1972) described the single M^2, identified as *?Stygimys* sp. This tooth is very similar to that in *N. gobiensis*, from which it differs in having three cusps in the inner row, whereas there are two in *Nemegtbaatar*. LILLEGRAVEN has shown that M^2 of *?Stygimys* sp. resembles that of *Stygimys kuszmauli* from the Hell Creek Formation (SLOAN & VAN VALEN, 1965). *N. gobiensis* differs from *S. kuszmauli* in having a single cusped upper incisor, double-rooted upper premolars, a different shape of the upper tooth row, bigger palatal vacuities and differently shaped P^4. The lower jaw has a different shape in two genera; it is much more elongated in *Nemegtbaatar* than in *Stygimys*. It is impossible to decide on the basis of available material whether *?Stygimys* sp. may be regarded as an intermediate form between *Nemegtbaatar* and the true *Stygimys*. On the other hand the lower jaw of *N. gobiensis* closely resembles the Paleocene eucosmodontid *Eucosmodon gratus* JEPSEN (see JEPSEN, 1930, Pl. 1, Figs 1—4) from which it differs in being insignificantly smaller and in having a proportionally bigger P_4, in presence of P_3 and in less robust lower incisor. The upper dentition of *Eucosmodon* is known only in *E. americanus* (COPE), described by WILSON (1956). *N. gobiensis* differs from *E. americanus* in being much smaller, in having double rooted P^2, smaller number of cusps in M^2 and possibly also in M^1 and P^4. However, the general pattern of the upper premolars and molars is in *N. gobiensis* and *E. americanus* very similar. It is probable that *Nemegtbaatar* is an ancestor or stays close to the ancestors of *Eucosmodon* MATTHEW & GRANGER and that *?Stygimys* sp. described by LILLEGRAVEN (1972) is an intermediate form between these two genera.

Family SLOANBAATARIDAE nov.

Diagnosis. — Small Taeniolabidoidea; anterior part of the skull in front of the zygomatic arches developed as a rectangular snout. Zygomatic arches strongly divergent, maximum width of the skull in front of glenoid fossa, which is roughly triangular. Braincase strongly vaulted, occipital plate low, arranged obliquely, at an angle of about 115° with regard to the tooth plane. Palate concave, with 2 pairs of palatal vacuities. Enamel on lower incisor not sharply limited. Lower jaw arranged strongly obliquely at an angle of 30° with respect to the horizontal plane, the condyle placed very high. Four upper premolars, P_4 not reduced in proportion to M_1.

Stratigraphical and geographical range. — Coniacian or Santonian Djadokhta Formation, Bayn Dzak, Gobi Desert, Mongolia.

Discussion. — The new family is monotypic, erected to include *Sloanbaatar mirabilis* KIELAN-JAWOROWSKA, 1970. The Sloanbaataridae differ from the Eucosmodontidae in having quite different proportions of the skull and lower jaw. The braincase in the Sloanbaataridae is much higher than in the Eucosmodontidae, with the occipital plate arranged obliquely against the tooth plane, whilst in the Eucosmodontidae it is arranged at a right angle. There are two pairs of palatal vacuities in the Sloanbaataridae and one in the Eucosmodontidae. The lower jaw is differently saped in two families: in the Sloanbaataridae it is arranged obliquely, with a very highly placed condyle, while in the Eucosmodontidae it is arranged much more horizontally, with a lower condyle.

The anterior part of the snout is rectangular in the Chulsanbaataridae and Sloanbaataridae; in the genral proportions of the skull the Sloanbaataridae more closely resemble the Chulsanbaatarisae, than the other Taeniolabidoidea. They differ, hower, in having palatal vacuities absent in Chulsanbaataridae, in having more divergent zygomatic arches, a more convex braincase and in the more obliquely arranged lower jaw. From the Taeniolabididae, the Sloanbaataridae differ distinctly in having palatal vauities, differently arranged zygomatic arches, the maximum width of the skull in front of the glenoid fossa, in a much more convex braincase, a more obliquely arranged lower jaw and no tendency towards the reduction of shearing premolars and development of large molars, characteristic of the Taeniolabididae.

Family CHULSANBAATARIDAE nov.

Diagnosis. — Small Taeniolabidoidea; anterior part of the snout in front of zygomatic arches rectangular. Zygomatic arches moderately divergent, maximum width of the skull in front of the glenoid fossa. Naso-frontal suture on each side convex posteriorly. Infraorbital foramen small. Occipital surface arranged at right angle against tooth plane. Lower jaw strongly oblique with respect to the tooth plane, condyle placed much higher than the tooth. P_4 not reduced in proportion to M_1.

Stratigraphical and geographical range. — Campanian, Barun Goyot Formation of the Gobi Desert Mongolia.

Discussion. — The new family is monotypic, erected to include *Chulsanbaatar vulgaris* n. gen., n. sp. Chulsanbaataridae differ from the Eucosmodontidae in the lack of palatal vacuities, rectangular anterior part of the snout and more obliquely arranged lower jaw. They share with the Taeniolabididae the lack of palatal vacuities, but differ from them in showing no tendency towards the reduction of the shearing premolars and an increase of the number of the cusps on the molars. From the Cimolomyidae, which are poorly known, they differ in the structure of P_4 and of the upper molars.

Genus **CHULSANBAATAR** nov.

Derivation of the name: gobiensis — from the Gobi Desert.
Type species: Chulsanbaatar vulgaris n. sp.
Derivation of the name: From the locality of Khulsan and from Ulan Baatar.

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

Stratigraphical and geographical range. — Known only from the ?Middle Campanian Barun Goyot Formation of the Gobi Desert, Mongolia.

Chulsanbaatar vulgaris n. sp.

(Pl. V, Fig. 8; Pls. XI-XVI; Pl. XVII, Fig. 1; Text-fig. 5)

Type specimen: Skull, associated with left and incomplete right lower jaws; all teeth well preserved, zygomatic arch and part of the bacicranial region lacking. Z.Pal.No.MgM-I/139.

Type horizon and locality: ?Middle Campanian, Barun Goyot Formation, locality of Khulsan, Gobi Desert Mongolia.

Derivation of the name: Lat. *vulgaris* = common.

Material. — Most common mammal in the Campanian of the Gobi Desert, represented in the present collection by 36 specimens, most of which are complete or nearly complete skulls, associated with lower jaws, in a few cases with partial postcranial skeletons. The specimens were found in Nemegt, Khulsan and Khermeen Tsav II. In spite of the large number of specimens, some anatomical features are difficult to recognize, as the bone of the skulls is not only very thin but often damaged or missing. The sutures are as a rule very indistinct. In addition to the type specimen, 2 skulls: MgM-I/108 from Khermeen Tsav II and MgM-I/61 from Khulsan are figured here.

Dimensions: See Tables 1 and 2.

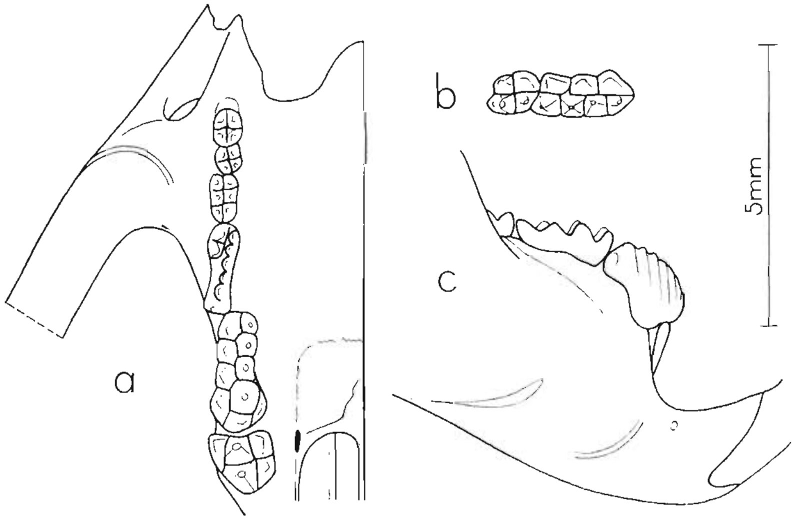


Fig. 5

Chulsanbaatar vulgaris n. sp., *a* — reconstruction of the palate with dP^1, dP^2, dP^3, P^4, M^1 and M^2, *b* — right M_1 and M_2 in occlusal view, *c* — part of the right lower jaw, with P_3, P_4, M_1 and part of M_2 in outer view.

Diagnosis. — Dental formula: $\frac{2\,0\,4\,2}{1\,0\,2\,2}$; length of the skull varies between 17 and 24 mm. Anterior part of the snout roughly rectangular, then the snout extends laterally; the zygomatic arches are confluent with this part of the snout. The greatest width of the skull is in front of glenoid fossa. In ventral view the anterior margin of the zygomatic arch is poorly defined, the posterior originates opposite the anterior half of P^4. Infraorbital foramen small, situated opposite P^2, clearly visible in ventral view. Glenoid fossa roughly oval, a prominent ridge extends along the dorsal wall of the glenoid fossa. Frontals deeply inserted between the nasals along the median suture, lacrimal roughly rectangular, poorly recognized; frontals gently rounded posteriorly. Postorbital process small. Post-temporal fossa comparatively large situated high above the paroccipital process. Transverse palatine suture extends opposite the second cusp of M^1. Postpalatine torus hardly developed, the horizontal part of the palatine bone raised towards the median suture. Pterygoids situated in the middle of choanal channels as in *Kamptobaatar*.

The lower jaw margin forms an angle of 20° with the horizontal plane. Below P_4 there is a deep depression, surrounded anteriorly by a rounded ridge, which is convex anteriorly. Masseteric crest is very prominent, starting behind this depression. Just below the crowns of P_4 and M_1 there is a characteristic, crescentic area. Coronoid crest comparatively small. Mental foramen comparatively large, situated close to the upper margin of the jaw, in the posterior half of the diastema.

Enamel on I_1 thin, but distinctly limited to the antero-ventral part. Upper premolars double rooted. Cusps 4 on dP^1 and dP^2, 6 on dP^3, 3 on P^1 and P^2, 4 on P^3, 2-3:5-6 on P^4 4:5:1 on M^1, 1:2:2 on M^2. P^4:M^1 length ratio 0.75. P_4 arcuate, with 6 serrations provided with ridges and basal cuspule, cusps 4:3 on M_1 and 2-3:2 on M^2. P_4:M_1 length ratio is 1.0.

Family TAENIOLABIDIDAE GRANGER & SIMPSON, 1929

Genus DJADOCHTATHERIUM SIMPSON, 1925

Species: Djadochtatherium matthewi SIMPSON, 1925 — *type species*
Djadochtatherium catopsaloides n. sp.

Revised diagnosis. — Dental formula: $\frac{2\ 0\ 3\text{-}4\ 2}{1\ 0\ \ 2\ 2}$. Medium-sized taeniolabidid; snout triangular, bluntly pointed; zygomatic arches confluent with lateral margins of the snout. Lacrimal uncertain, probably very large, roughly rectangular. Premaxilla short, with long nasal process, maxilla very long, orbit in dorsal view comparatively small, situated far posteriorly. In ventral view the anterior margin of zygomatic arch poorly defined, the posterior situated opposite P^4. Infraorbital foramen small, situated opposite P^3. Postorbital process very long, peg-like, fronto-parietal suture from the margin of the orbit extends about 4 mm transversely, then turns posteriorly, forming a semicircular arch; glenoid fossa more square than oval (the 3 above characters are not preserved in specimens of *D. matthewi*). Lower jaw strongly elongated, arranged comparatively horizontally, forming an angle of about 20° with the horizontal plane. Coronoid crest prominent, masseteric crest weak. Mental foramen placed in the middle of diastema, close to the upper margin of the jaw. Enamel on lower and upper incisors very sharply limited. Upper premolars double-rooted; 4 upper premolars in *D. matthewi*, 3 in *D. catopsaloides*. P^4, M^1 and M^2 known only in *D. catopsaloides*. P^4 without outer row of cusps, middle row concave buccally. P_3 peg-like, situated much lower than P_4. P_4 cone-like, with 3-4 cusps in the main row and one postero-external cusp.

Stratigraphical and geographical range. — Coniacian or Santonian Djadokhta Formation through ?Middle Campanian Barun Goyot Formation, Gobi Desert, Mongolia.

Djadochtatherium catopsaloides n. sp.

(Pl. V, Fig. 9; Pl. XVII, Fig. 2; Pls. XVIII-XXI; Text-fig. 6)

Type specimen: Almost complete skull of a young individual, associated with right and left lower jaws; all teeth preserved; basicranial, choanal and occipital regions damaged. Z.Pal.No.MgM-I/78.

Type horizon and locality: ?Middle Campanian, Barun Goyot Formation, Khermeen Tsav I, Gobi Desert, Mongolia.

Derivation of the name: catopsaloides — showing similarities to *Catopsalis* COPE.

Material. — In addition to the type specimen, there is a left M_2 with a fragment of lower jaw from Khulsan, a skull with partial lower jaws from Khermeen Tsav II and a damaged skull without lower jaws from Khermeen Tsav I (Z.Pal.No.MgM-I/79), the latter figured in the present paper.

Dimensions: See Tables 1 and 2.

Diagnosis. — Dental formula: $\frac{2\,0\,3\,2}{1\,0\,2\,2}$. Skull length varies between 60—65 mm. Naso-frontal suture unknown. Postorbital process in Z.Pal.No.MgM-I/78 measuring 8 mm. On the lower jaw a distinct swelling beneath the anterior root of P_4. A diastema between P^1 and P^3 increasing in length with growth of animal. Number of cusps on P^1 and P^3 unknown. Cusps

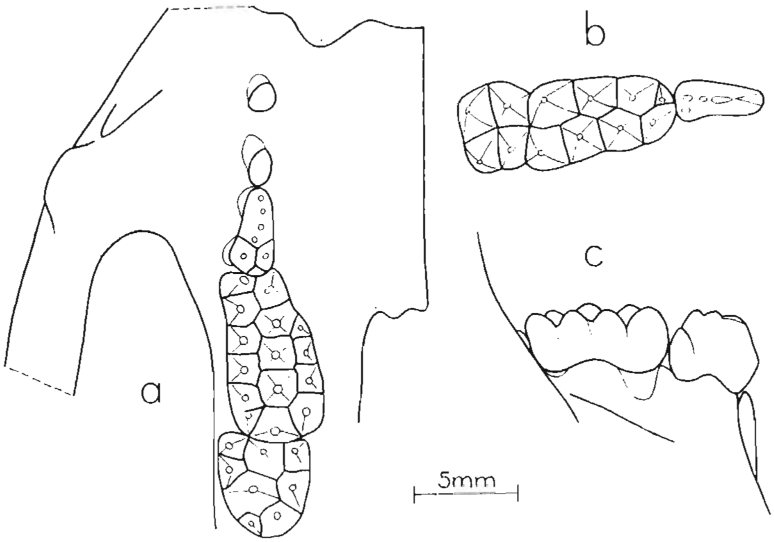


Fig. 6

Djadochtatherium catopsaloides n. sp., *a* — reconstruction of the palate with P^1, P^3, P^4, M^1 and M^2. In P^1 and P^3 the cusps are worn out, *b* — right P_4, M_1 and M_2 in occlusal view, *c* — right P_3, P_4 and M_1 in outer view.

5:1 on P^4, 5-6:5-6:4 on M^1, 2:2-3:2-3 on M^2. Inner ridge in M^1 extending for 0.75 of the tooth length. P^4:M^1 length ratio 0.45. P_3 very small; entire posterior side of P_3 adhering to dentary in posterior part of diastema. P_4 with 3 cusps in the main row and prominent postero-external cusp. Cusp 4:4 on M_1 and 2:2 on M_2. P_4:M_1 length ratio is 0.5.

Discussion. — *Djadochtatherium catopsaloides* closely resembles the Djadokhta Formation representative of the same species, *D. matthewi*, differing from it chiefly in having 3 upper premolars (P^2 is lost) while there are 4 upper premolars in *D. matthewi*. Two specimens of *D. matthewi*, are known, both housed in the American Museum of Natural History in New York. The type specimen A.M.N.H.No.20440, consists of a rostrum associated with right and left lower jaws. The upper and lower molars are not known. *D. matthewi* is a little smaller than *D. catopsaloides*, the estimated length of the skull of the former species is 50 mm, while it is 60—65 mm in *D. catopsaloides*. The shape of the anterior part of the snout is very similar in both species, as is the shape and size of infraorbital foramen. The lower jaw of *D. catopsaloides* is more robust than that of *D. matthewi*, it is proportionally deeper with respect to length than in *D. matthewi*, but otherwise the muscle scars on both jaws seem to be of the same pattern. The lower incisors are very similar in both species, with the same pattern of wear; it should, however, be stated that the published drawings and photographs of *D. matthewi* lower jaw, may led to the false idea on the position of the lower incisors. In both lower jaws of A.M.N.H.No.20440, these teeth were broken off and have been glued in a more horizontal position than they were originally. The radius of curvature of the lower incisor in *D. matthewi* is about 13 mm and is constant throughout the length of the incisor. The height and width of the incisor are 3.4 and 2.3 mm respectively. The enamel of the incisor was scraped off in preparation, but the section and the wear facet shows that it was similar to that of the later Taeniolabidoidea. In the original photographs of *D. matthewi* (SIMPSON, 1925, Fig. 7) the front 3/4 of the broken M_1 was cemented back into the left lower jaw one alveolus too far anteriorly. The P_4 is not preserved in this jaw, but is in the right jaw. In SIMPSON'S figure 7*B*, the two lower jaws were carefully aligned, so that the right P_4 could be seen just in front of the displaced M_1, which gives an entirely wrong impression of the position of this tooth. P_4 in *D. matthewi* is 3.2 mm long and has 4 cusps, in addition to the prominent postero-external cusp. P_3 is present in both jaws, rather than absent as SIMPSON maintained. The restored left M_1 is 4.7 mm in length and 2.1 mm wide, with a cusp formula 4:4. The cusps at least the second cusp in both external and internal rows, have the types of buttresses facing the central valley, similar to those in *Catopsalis* and *Taeniolabis*. The muscle scars for the superficial masseter muscle on the zygoma of both specimens of *D. matthewi* is very similar to that in *D. catopsaloides*. On the basis of the second specimen of *D. matthewi* (A.M.N.H.No.21703; GREGORY & SIMPSON, 1926, p. 30) one can state that P^1 and P^2 have three cusps each and the measurement of these teeth are: P^1 2.1 × 1.9 mm; P^2 1.6 × 1.6 mm.

The above comparisons show that *D. matthewi* could be regarded as an ancestor of *D. catopsaloides*, and that *Djadochtatherium* SIMPSON should be placed in the Taeniolabididae rather than in the Eucosmodontidae. Another species which seems to be also very close to *D. catopsaloides*, is *Catopsalis joyneri* SLOAN & VAN VALEN, 1965, from the Late Cretaceous Hell Creek Formation (Bug Creek Anthills locality) of Montana. *C. joyneri* is more massive and about 10% larger than *D. catopsaloides*. It is also more advanced in the structure of the lower blade and of the molars. The structure of P^4 is very similar in both species, there is no outer row of cusps, 5 cusps in the main row in both species and extra cusp in the postero-internal corner of the tooth. The P^4:M^1 length ratio is almost the same in both species, 0.42 in *C. joyneris* and 0.45 in *D. catopsaloides*. The cusp formula of M^1 is 5-6:5-6:4 in *D. catopsaloides* and 7:8:8 in *C. joyneri*, that of M^2 2:2-3:2-3 and 2:3:3 respectively. The P_4 is comparatively shorter and more triangular in *C. joyneri* than it is in *D. catopsaloides*, and it has 3 cusps as is the case in *D. catopsaloides*. The number of cusps in M_1 and M_2 is greater in *C. joyneri* than in *D. catopsaloides*, being 5:4 and 4:4 respectively for M_1, and 3:2 and 2:2 respectively for M_2. We do not know the entire skull of *C. joyneri*, but the fragments of the skulls preserved show that the infraorbital foramen is of similar shape and size, 1.4 mm in diameter in *D. catopsaloides* and 1.7 in *C. joyneri*. The position of the infraorbital foramen is somewhat more ventral in *D. catopsaloides* than it is in *C. joyneri*. The structure of the palate and of the glenoid fossa is also very similar in both species.

The above comparisons show that it is very probable that *D. catopsaloides* is an ancestor of *C. joyneri*, or it is very close to the form that gave rise to *Catopsalis*. The Paleocene taeniolabid from Mongolia *Prionessus lucifer* MATTHEW & GRANGER does not seem to be closely related to *D. catopsaloides* (see MATTHEW *et al.*, 1928). It is smaller and has a cusp formula for the upper and lower molars, that cannot be regarded as originating from *D. catopsaloides*. *Prionessus* appears to belong to a different evolutionary line in the Taeniolabididae, perhaps derivable from *Kamptobaatar*.

The largest representative of the Taeniolabididae, *Taeniolabis taoensis* (COPE) does not invite a close comparison with *Djadochtatherium* (see SIMPSON, 1937). It is about 3 times larger, has a much more advanced dentition and shows great changes in skull structure and in the shape of certain bones, evidently correlated with an increase of size and development of musculature.

It should be stressed that the frontals of *Taeniolabis* are shaped differently from those in other multituberculates; they taper posteriorly to a pointed end and do not contribute to the margin of the orbit. In *Djadochtatherium catopsaloides* a tendency towards the reduction of the size of frontals characteristic of *Taeniolabis* can be observed. The frontals in *D. catopsaloides* have a rounded posterior margin and are narrower posteriorly, than in other Taeniolabidoidea, e.g. in the Eucosmodontidae and Sloanbaataridae, where the frontals have a wide transverse posterior margin.

Palaeozoological Institute
of the Polish Academy of Sciences

02-089 Warszawa, Al. Żwirki i Wigury 93
April 1972

REFERENCES

BARSBOLD, R. 1974. Saurornithoididae, a new family of small theropod dinosaurs from Central Asia and North America. Results Polish-Mongol. Palaeont. Exped. V. — *Palaeont. Pol.*, **30**, 5-22, Warszawa.

CLEMENS, W. A. JR. 1963. Fossil mammals of the type Lance Formation, Wyoming. Part I. Introduction and Multituberculata. — *Univ. Calif. Publ. Geol. Sci.*, **48**, 1-105, Berkeley.

ELŻANOWSKI, A. 1974. Preliminary note on the Palaeagnathous bird from the Upper Cretaceous of Mongolia. Results..., V. — *Palaeont. Pol.*, **30**, 103-109, Warszawa.

FOX, R. C. 1969. Studies of Late Cretaceous vertebrates. III. A trincodont mammal from Alberta. — *Canad. Journ. Zool.* **47**, 6, 1253-1256.

— 1970. Eutherian mammal from the Early Campanian (Late Cretaceous) of Alberta, Canada. — *Nature*, **227**, 5258, 630-631.

— 1971. Early Campanian multituberculates (Mammalia: Allotheria) from the Upper Milk River Formation, Alberta. — *Canad. Journ. Earth Sci.*, **8**, 8, 916-938.

— 1972*a*. A primitive therian mammal from the Upper Cretaceous of Alberta. — *Ibid.* **9**, 11, 1479-1494.

— 1972*b*. An Upper Cretaceous symmetrodont from Alberta, Canada. — *Nature*, **239**, 5368, 170-171.

GRADZIŃSKI, R. 1970. Sedimentation of dinosaur-bearing Upper Cretaceous deposits of the Nemegt Basin, Gobi Desert. Results..., II. — *Palaeont. Pol.*, **21**, 147-229.

GRADZIŃSKI, R. & JERZYKIEWICZ, T. 1972. Additional geographical and geological data from the Polish-Mongolian Palaeontological Expeditions. Results..., IV. — *Ibidem*, **27**, 17-32.

— 1974. Sedimentation of the Cretaceous Barun Goyot Formation (Lower Nemegt Beds). Results..., V. — *Ibidem*, **30**, 111-146.

GRADZIŃSKI, R., KAŹMIERCZAK, J. & LEFELD, J. 1969. Geographical and geological data from the Polish-Mongolian Palaeontological Expeditions. Results..., I. — *Ibidem*, **19**, 33-84.

GREGORY, W. K. & SIMPSON, G. G. 1926. Cretaceous mammal skulls from Mongolia. — *Amer. Mus. Novit.*, **225**, 1-20, New York.

JEPSEN, G. L. 1930. Stratigraphy and palaeontology of the Paleocene of northeastern Park County, Wyoming. — *Proc. Amer. Phil. Soc.*, **69**, 463-528, Philadelphia.

KIELAN-JAWOROWSKA, Z. 1969*a*. Preliminary data on the Upper Cretaceous eutherian mammals from Bayn Dzak, Gobi Desert. — Results..., I. — *Palaeont. Pol.*, **19**, 171-197, Warszawa.

— 1969*b*. Discovery of a multituberculate marsupial bone. — *Nature*, **222**, 5198, 1091-1092, London.

— 1970*a*. New Upper Cretaceous multituberculate genera from Bayn Dzak, Gobi Desert. Results..., II. — *Ibidem*, **21**, 35-49.

— 1970*b*. Unknown structures in multituberculate skull. — *Nature*, **226**, 5249, 974-976, London.

— 1971. Skull structure and affinities of the Multituberculata. Results..., III. — *Palaeont. Pol.* **25**, 5-41, Warszawa.

KIELAN-JAWOROWSKA, Z. & BARSBOLD, R. 1972. Narrative of the Polish-Mongolian Palaeontological Expeditions 1967-1972. Results..., IV. — *Ibidem*, **27**, 5-13.

KIELAN-JAWOROWSKA, Z. & DOVCHIN, N. 1969. Narrative of the Polish-Mongolian Palaeontological Expeditions 1963-1965. Results..., I. — *Ibidem*, **19**, 7-32.

KIELAN-JAWOROWSKA, Z. & SOCHAVA, A. 1969. The first multituberculate from the uppermost Cretaceous of the Gobi Desert (Mongolia). — *Acta Palaeont. Pol.*, **14**, 3. 355-371, Warszawa.

LILLEGRAVEN, J. A. 1969. Latest Cretaceous mammals of upper part of Edmonton Formation of Alberta, Canada, and review of marsupial-placental dichotomy in mammalian evolution. — *Univ. Kansas Paleont. Contrib.*, **59**, 1-122, Lawrence.

— 1972. Preliminary report on Late Cretaceous mammals from the El Gallo Formation, Baja California del Norte, Mexico. — *Contrib. in Science, Nat. Hist. Mus.*, Los Angeles County, **232**, 1—11.

MALEYEV, E. A. — see МАЛЕЕВ, Е. А.

MARTINSON, G. G., SOCHAVA, A. V. & BARSBOLD, R. — see МАРТИНСОН, Г. Г., СОЧАВА, А. В. & БАРСБОЛД, Р.

MARYAŃSKA, T. 1970. Remains of armoured dinosaurs from the uppermost Cretaceous in Nemegt Basin, Gobi Desert. Results..., II. *Palaeont. Pol.*, **21**, 23-34, Warszawa.

MARYAŃSKA, T. & OSMÓLSKA, H. 1974. Pachycephalosauria, a new order of ornithischian dinosaurs. Results..., V. — *Ibidem*, **30**, 45-102.

MŁYNARSKI, M. 1972. Zangerlia testudinimorpha n. gen., n. sp., a primitive land tortoise from the Upper Cretaceous of Mongolia. Results..., IV. — *Ibidem*, **27**,

NOWIŃSKI, A. 1971. Nemegtosaurus mongoliensis n. gen., n. sp. (Sauropoda) from the Uppermost Cretaceous of Mongolia. Results..., III. — *Ibidem*, **25**, 57-84.

OSMÓLSKA, H. & RONIEWICZ, E. 1970. Deinocheiridae, a new family of theropod dinosaurs. Results..., II. — *Ibidem*, **21**, 5-22.

OSMÓLSKA, H., RONIEWICZ, E. & BARSBOLD, R. 1972. A new dinosaur, Gallimimus bullatus n. gen., n. sp. (Ornithomimidae) from the Uppermost Cretaceous of Mongolia. Results..., IV. — *Ibidem*,

ROZHDESTVENSKY, B. K. — see Рождественский, А. К.

SAHNI, A. 1972. The vertebrate fauna of the Judith River Formation, Montana. — *Bull. Amer. Mus. Nat. Hist.*, **147**, 6, 323-412, New York.

SIMPSON, G. G. 1925. A Mesozoic mammal skull from Mongolia. — *Amer. Mus. Novit.*, **201**, 1-11, New York.

— 1928*a*. Further notes on Mongolian Cretaceous mammals. — *Ibidem*, **329**, 1-9.

— 1928*b*. Affinities of the Mongolian Cretaceous insectivores. — *Ibidem*, **330**, 1-11.

— 1937. Skull structure of the Multituberculata. — *Bull. Amer. Mus. Nat. Hist.*, **73**, 727-763, New York.

SLOAN, R. E. & VAN VALEN, L. 1965. Cretaceous mammals from Montana. — *Science*, **148**, 3667, 220-227, Washington.

WILSON, R. W. 1956, Additional remains of the multituberculate genus Eucosmodon. — Univ Kansas Publ., Mus. Not. Hist., **9**, 117-123

МАЛЕЕВ, Е. А. 1955*а*. Гигантские хищные динозавры Монголии. — *Докл. АН СССР*, 10А, 4, 634-637, Москва.

— 1955*б*. Новые хищные динозавры из верхнего мела Монголии. — *Ibidem*, **10А**, 5, 779-782.

— 1956. Панцырные динозавры верхнего мела Монголии. Ч. II. — *Тр. Палеонт. Инст. АН СССР*, **62**, 51-91, Москва.

МАРТИНСОН, Г. Г., СОЧАВА, А. В., БАРСБОЛД, Р. 1969. О стратиграфическом расчленении верхнемеловых отложений Монголии. — *Докл. АН СССР*, **189**, 5, 1081-1084, Москва.

Рождественский, А. К. 1957. Утконосый динозавр — зауролоф из верхнего мела Монголии. — *Vertebr. Palasiatica* , **1**, 2, 129-148, Peking.

— 1965. Возрастная изменчивость и некоторые вопросы систематики динозавров Азии. — *Палеонт. Журнал*, **3**, 95-109,

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

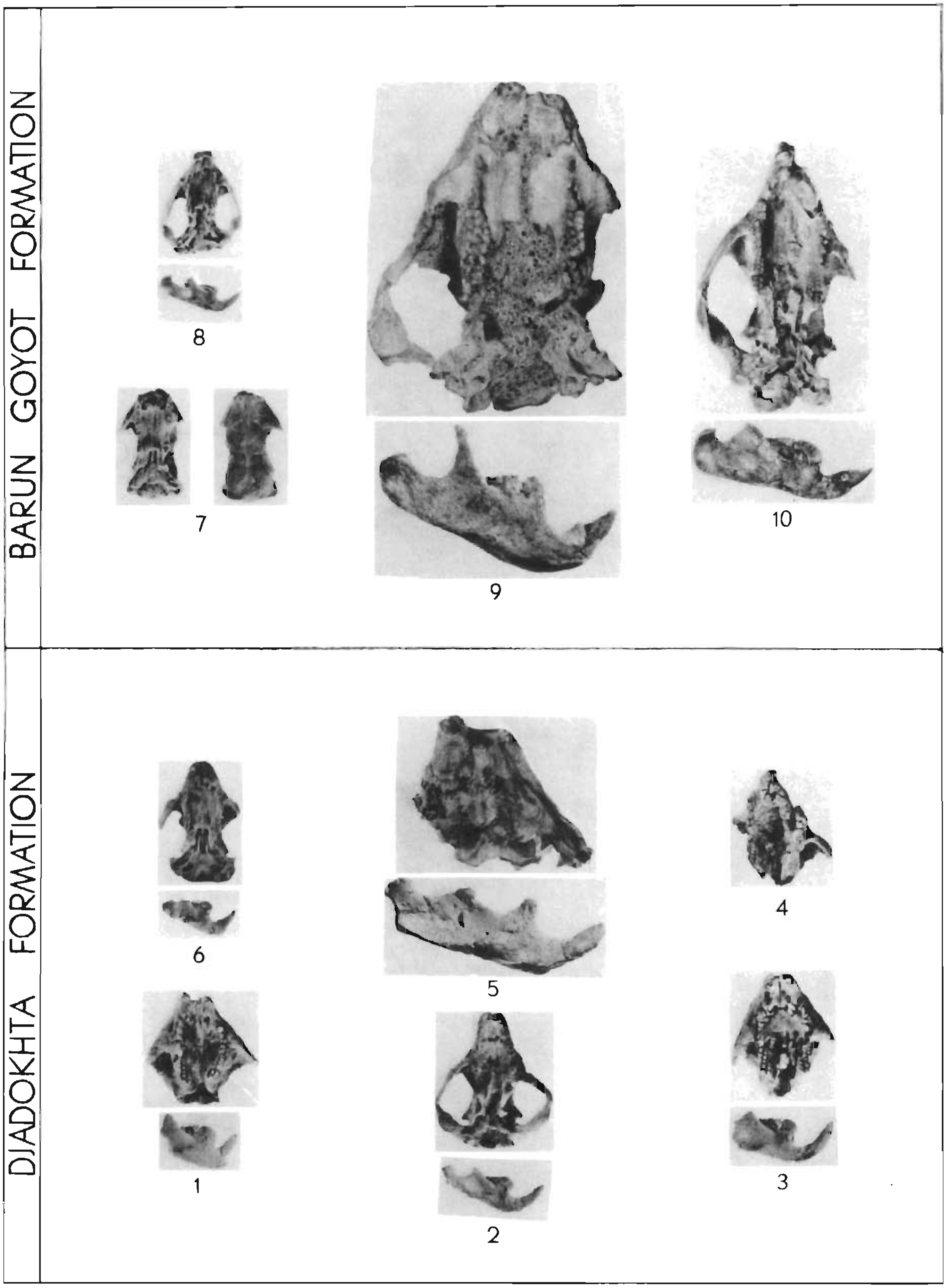
PLATE V

Page

Comparison of the described multituberculates from the Djadokhta Formation and Barun Goyot Formation

All ×1

Photo: W. Skarżyński


BARUN GOYOT FORMATION
8
7
9
10
DJADOKHTA FORMATION
6
5
4
1
2
3

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE VI

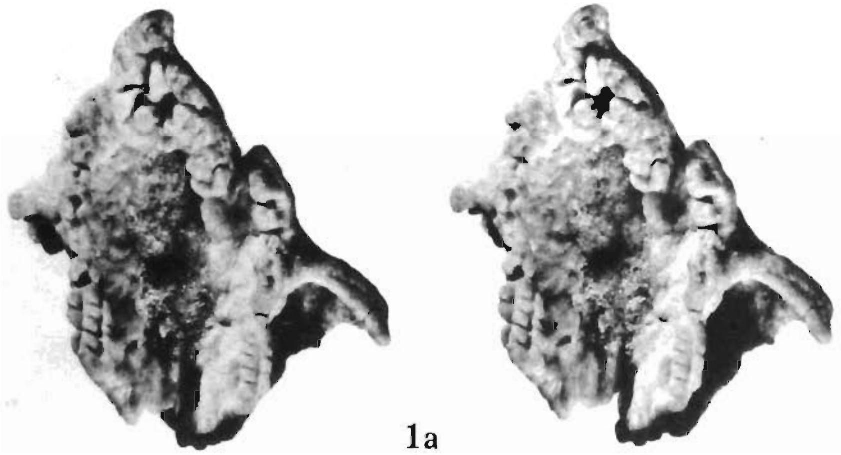
(see also Pl. V)

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

Fig. 1*a*. Stereo-photograph of the rostral part of the skull in ventral view. Left M^2 lacking, right and left P^4 and right M^1 somewhat damaged. Type specimen Z.Pal.No.MgM-I/25.
Fig. 1*b*. Stereo-photograph of the same specimen in anterior view.
Fig. 1*c*. The same specimen in left lateral view.
Fig. 1*d*. Stereo-photograph of the same specimen in right lateral view.
Fig. 1*e*. The same specimen in dorsal view.

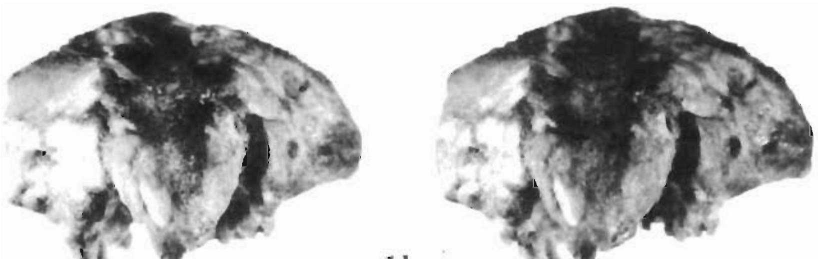
All ×3

Photo: W. Skarżyński

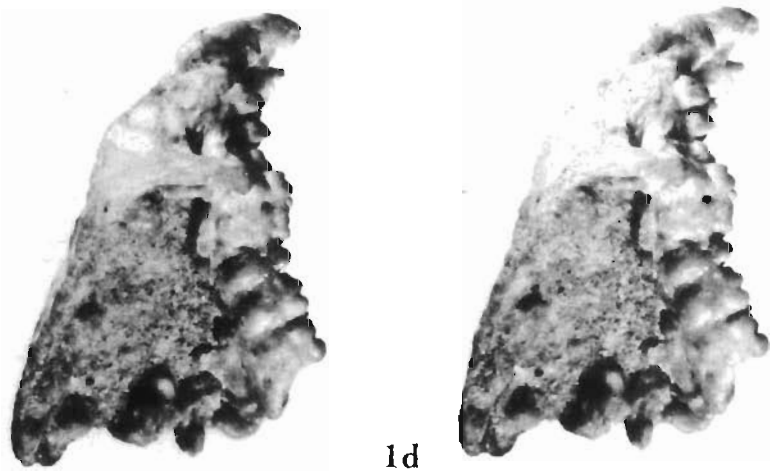


1a

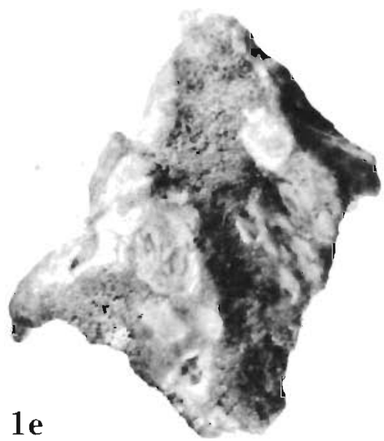
1c



1b



1d



1e

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE VII

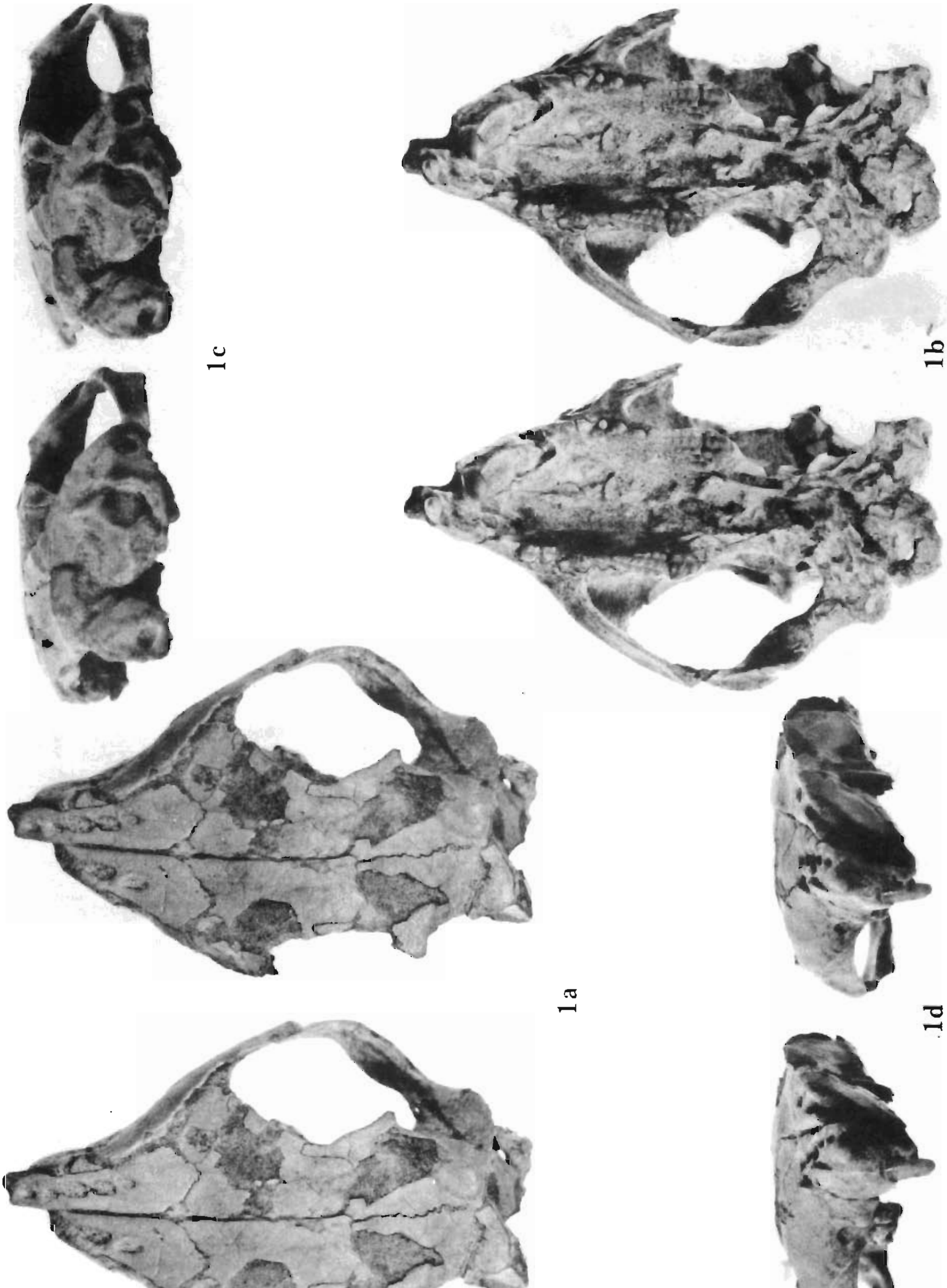
(see also Pls. V and VIII-X)

Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav II, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull in dorsal view. Type specimen Z.Pal.No.MgM-I/81.
Fig. 1*b*. Stereo-photograph of the same specimen in ventral view. Note the presence of DP^3 and P^3 on both sides of the skull.
Fig. 1*c*. Stereo-photograph of the same specimen in occipital view.
Fig. 1*d*. Stereo-photograph of the same specimen in anterior view.

All $\times 2$

Photo: W. Skarżyński


1c
1b
1a
1d

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

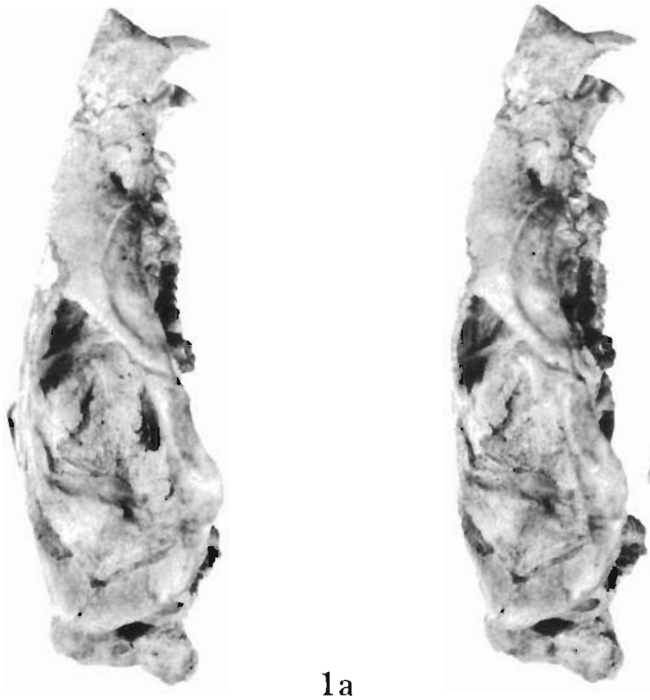
PLATE VIII

(see also Pls. V, VII, IX and X)

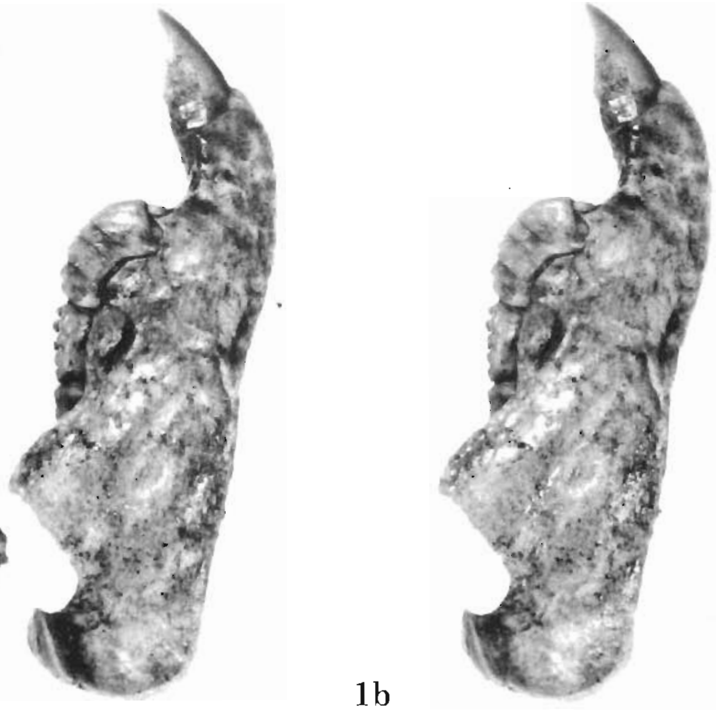
Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav II, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the almost complete, somewhat distorted and flattened skull in lateral view. Type specimen Z. Pal. No. MgM-I/81; ×2.
Fig. 1*b*. Stereo-photograph of the right lower jaw of the same specimen, in outer view; ×3.
Fig. 1*c*. Stereo-photograph of the same jaw in inner view; ×3.
Fig. 1*d*. Left lower jaw of the same specimen in outer and inner views; ×3.

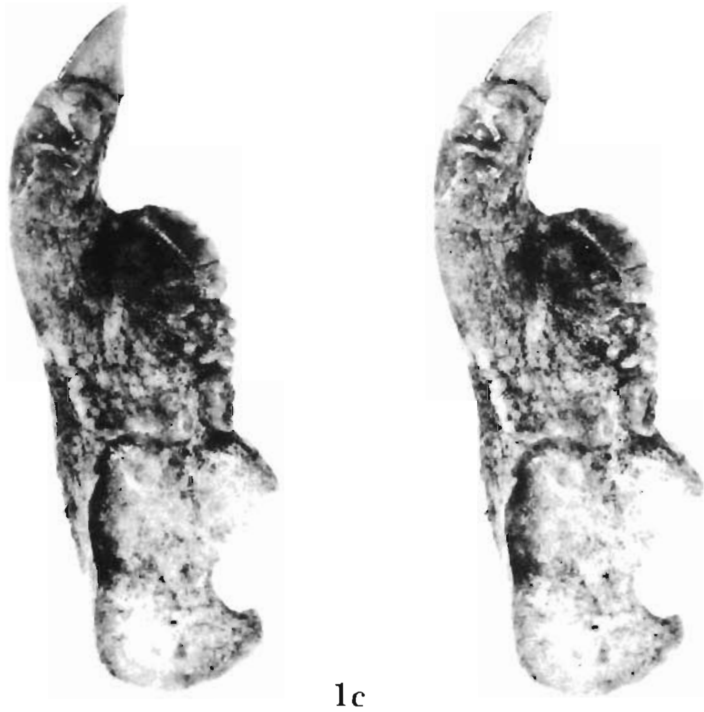
Photo: W. Skarżyński



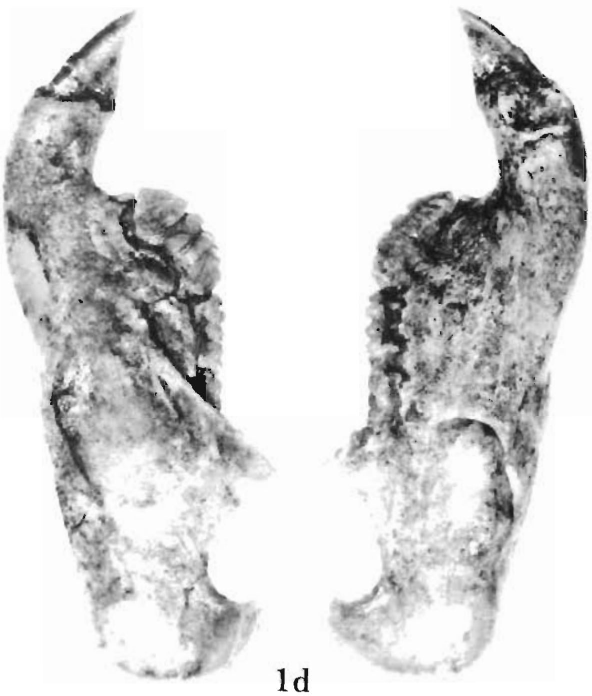
1a



1b



1c



1d

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE IX

(see also Pls. V, VII, VIII and X)

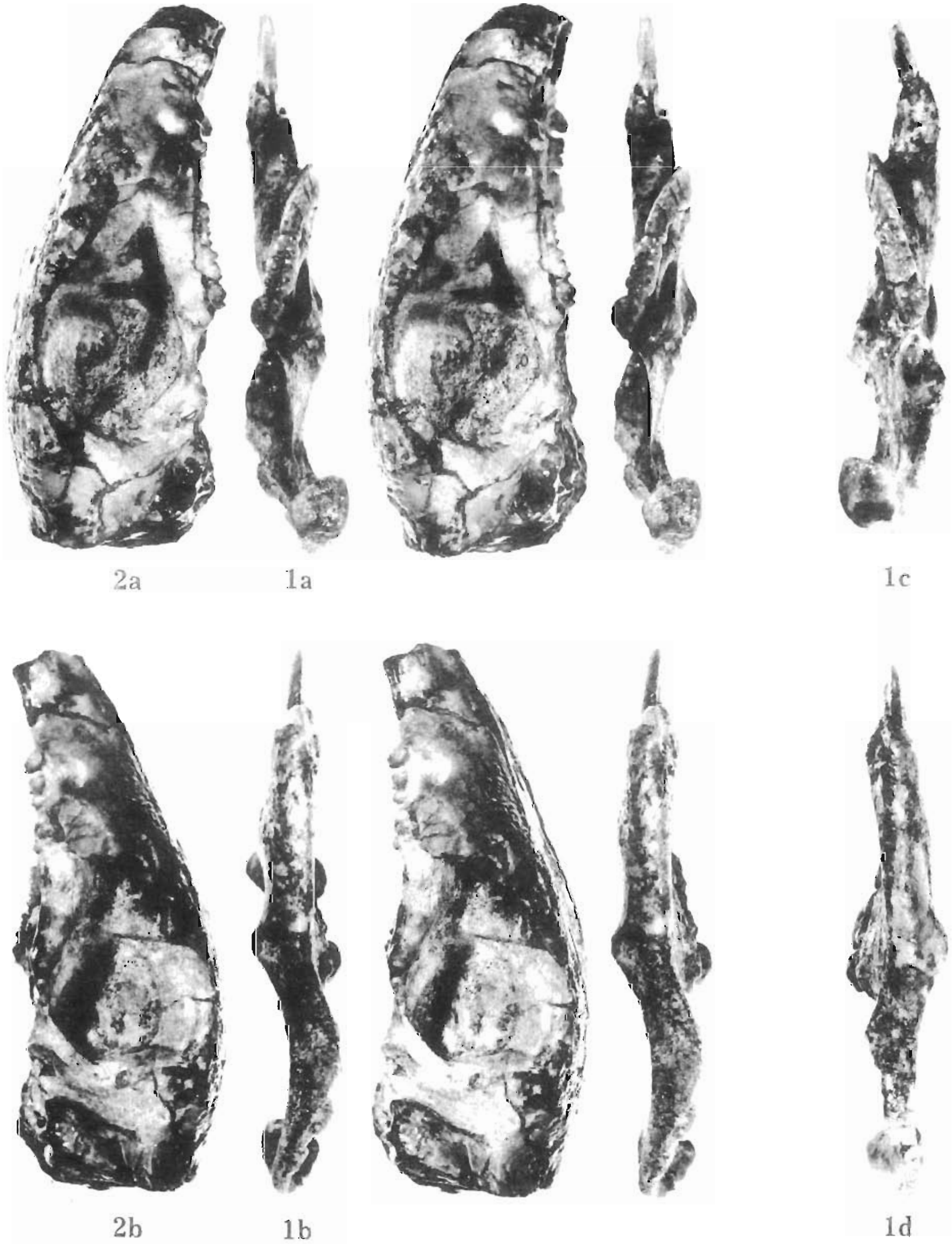
Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav II, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the right lower jaw in occlusal view. Type specimen Z.Pal.No.MgM-I/81; ×3.
Fig. 1*b*. Stereo-photograph of the same jaw in ventral view; ×3.
Fig. 1*c*. Left lower jaw of the same specimen in occlusal view; ×3.
Fig. 1*d*. Left lower jaw of the same specimen in ventral view; ×3.

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 2*a*. Stereo-photograph of the nearly complete skull, with anterior part broken off, zygomatic arches lacking, in right lateral view. Z.Pal.No.MgM-I/76; ×2.5.
Fig. 2*b*. Stereo-photograph of the same specimen in left lateral view, ×2.5.

Photo: W. Skarżyński


2a
1a
1c
2b
1b
1d

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE X

(see also Pls. V and VII-IX)

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull in dorsal view. Anterior part of snout and zygomatic arches broken off. Z.Pal.No.MgM-I/76.

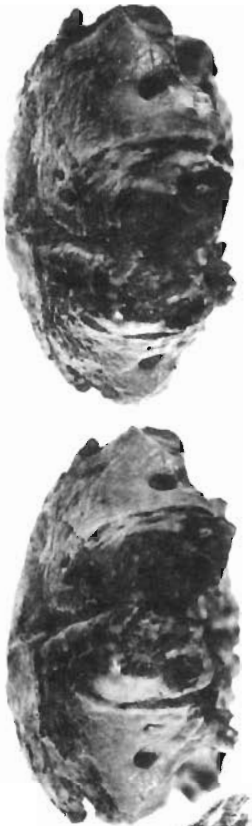
Fig. 1*b*. Stereo-photograph of the same skull in ventral view. Right premolars, except P^3 strongly damaged, parts of right molars lacking. Left P^4 with broken off crown left M^1 and M^2 lacking.

Fig. 1*c*. Stereo-photograph of the same skull in anterior view.

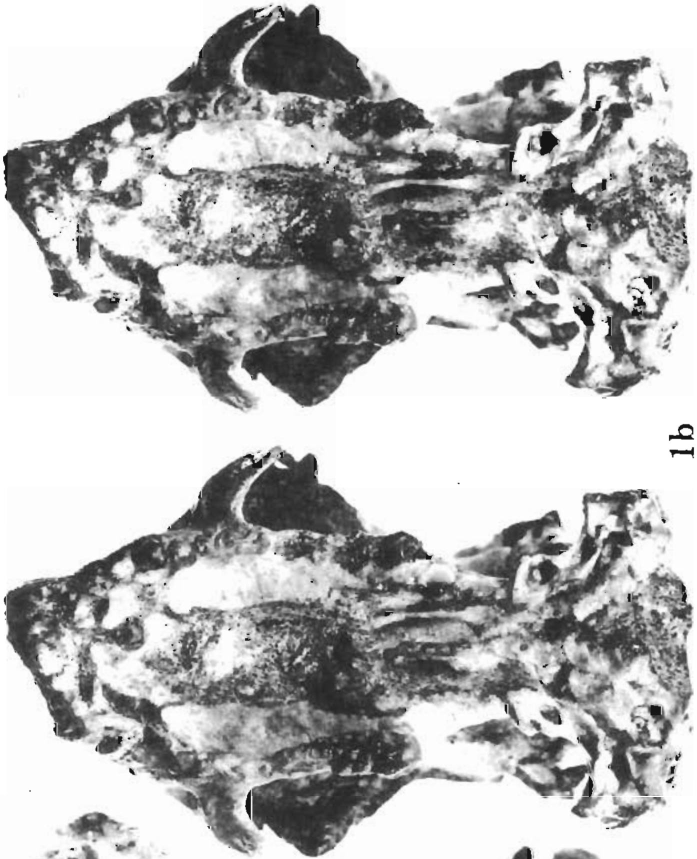
Fig. 1*d*. Stereo-photograph of the same skull in occipital view.

All ×2.5

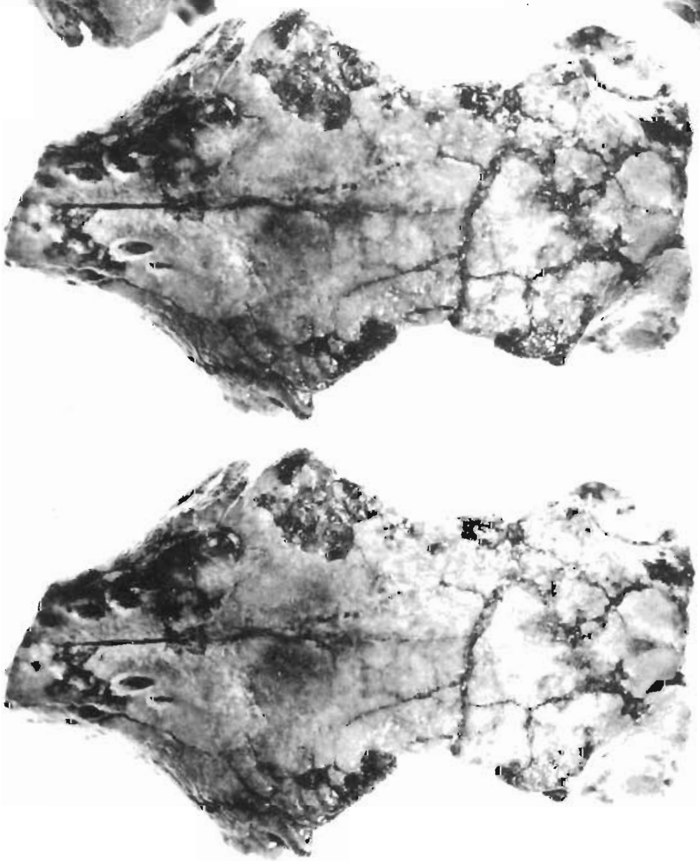
Photo: W. Skarżyński



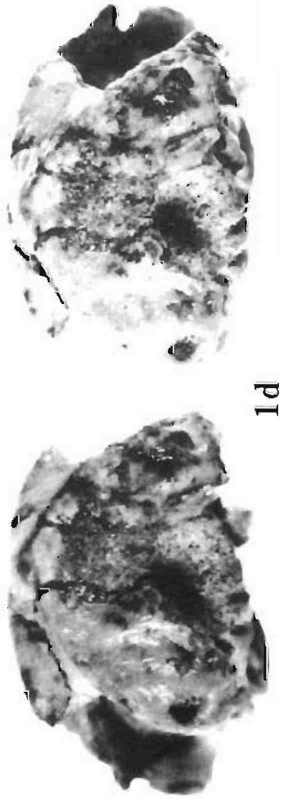
1c



1b



1a



1d

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

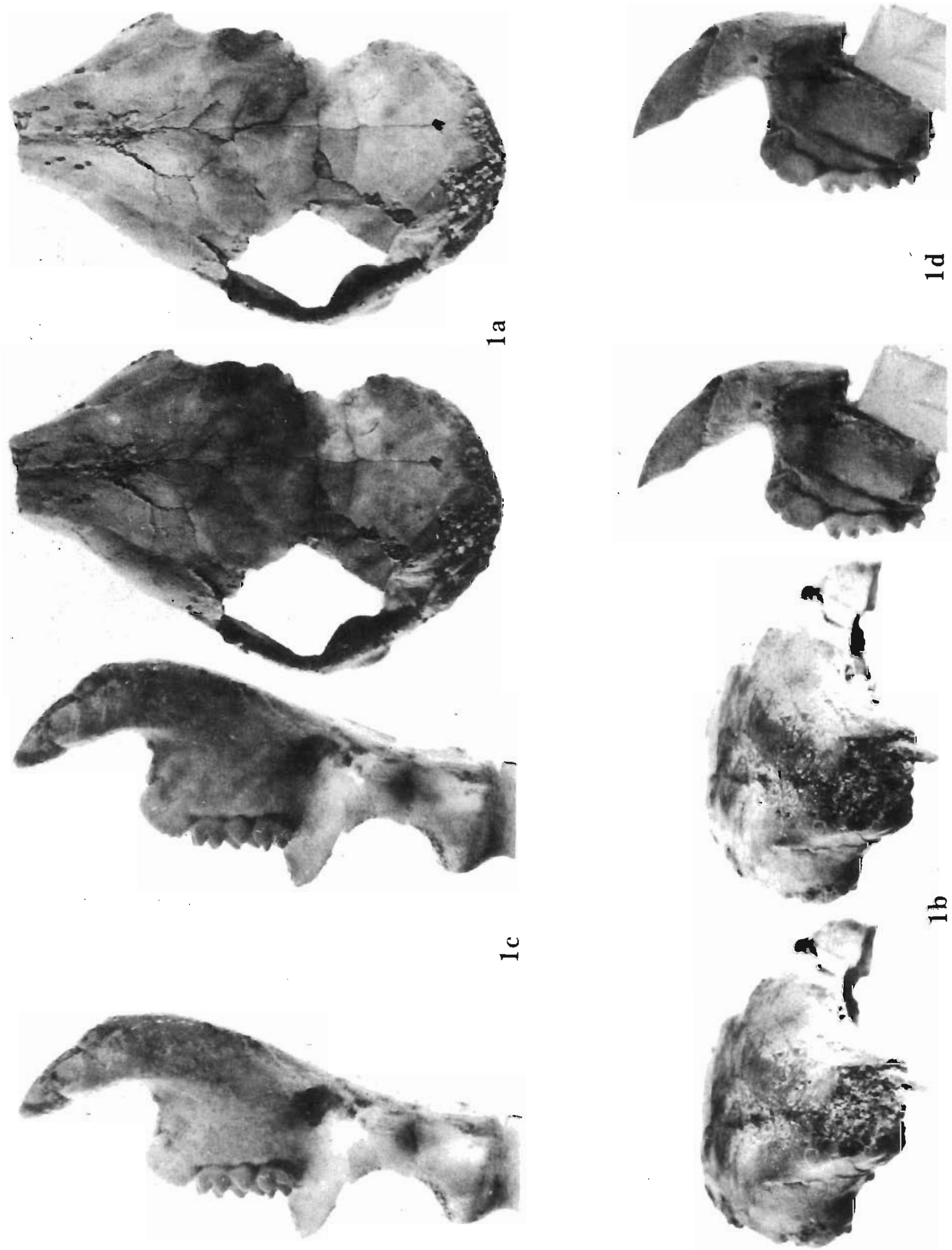
PLATE XI

(see also Pls. V, XII-XVI and XVII, Fig. 1)

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull in dorsal view, type specimen, Z.Pal.No.MgM-I/139; ×5.
Fig. 1*b*. Stereo-photograph of the same skull in anterior view; ×5.
Fig. 1*c*. Stereo-photograph of the left lower jaw of the same specimen in inner view; ×7.
Fig. 1*d*. Stereo-photograph of the incomplete right lower jaw of the same specimen in outer view; ×7.

Photo: W. Skarżyński



1a 1d 1c 1b

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XII

Page

Chulsanbaatar vulgaris n. sp. 39

(see also Pls. V, XI, XIII-XVI and XVII, Fig. 1)

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull in ventral view. Type specimen, Z.Pal.No.MgM-I/139; ×5.
Fig. 1*b*. Stereo-photograph of the same skull in left lateral view, ×5.
Fig. 1*c*. Stereo-photograph of the incomplete right lower jaw of the same specimen in occlusal view; ×7.
Fig. 1*d*. Stereo-photograph of the same jaw in inner view; ×7.

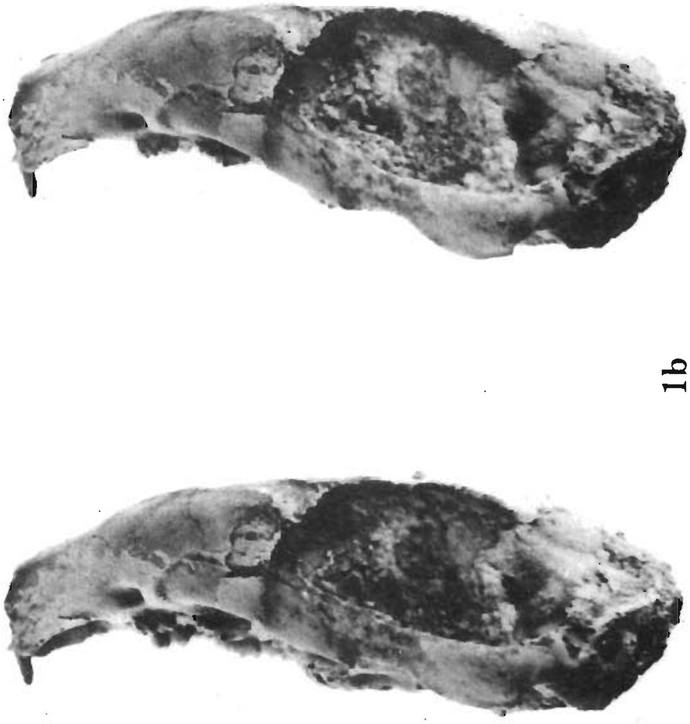
All specimens covered with ammonium chloride

Photo: W. Skarżyński

1a

1d

1c



1b

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XIII

(see also Pls. V, XI-XII, XIV-XVI and XVII, Fig. 1)

Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav II, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull, associated with lower jaws, before the final preparation, in dorsal view. The zygomatic arches on both sides are broken off and are partly replaced by a nylon thread, Z.Pal. No.MgM-I/108.

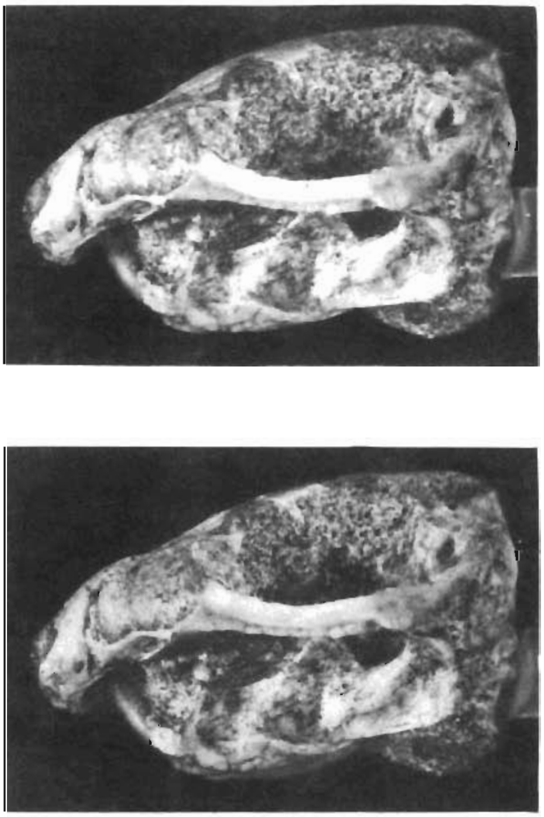
Fig. 1*b*. Stereo-photograph of the same specimen in left lateral view.

Fig. 1*c*. Stereo-photograph of the same specimen in right lateral view.

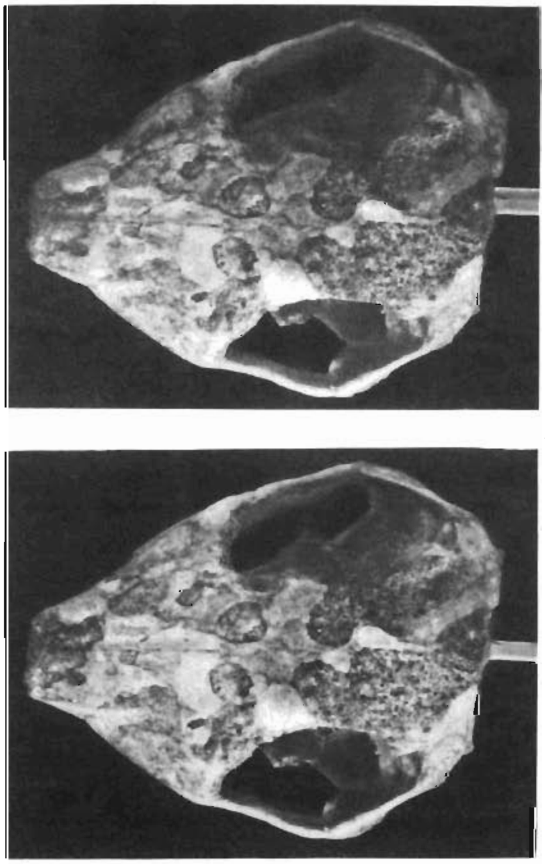
Fig. 1*d*. Stereo-photograph of the same specimen in ventral view.

All ×4

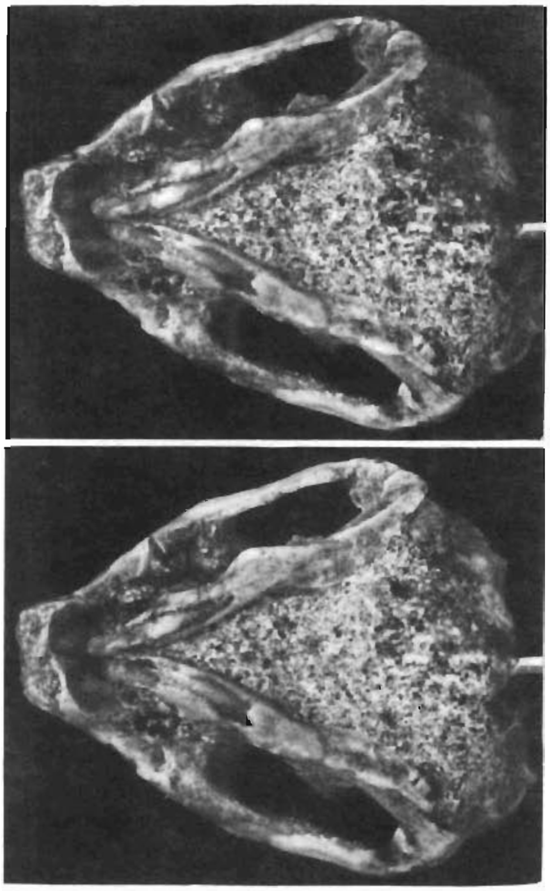
Photo: W. Skarżyński



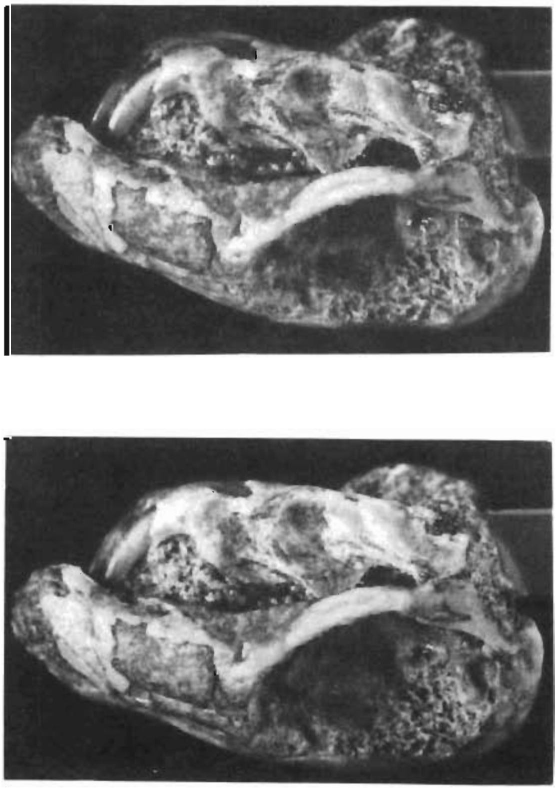
1b



1a



1d



1c

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XIV

(see also Pls. V, XI-XIII, XV-XVI and XVII, Fig. 1)

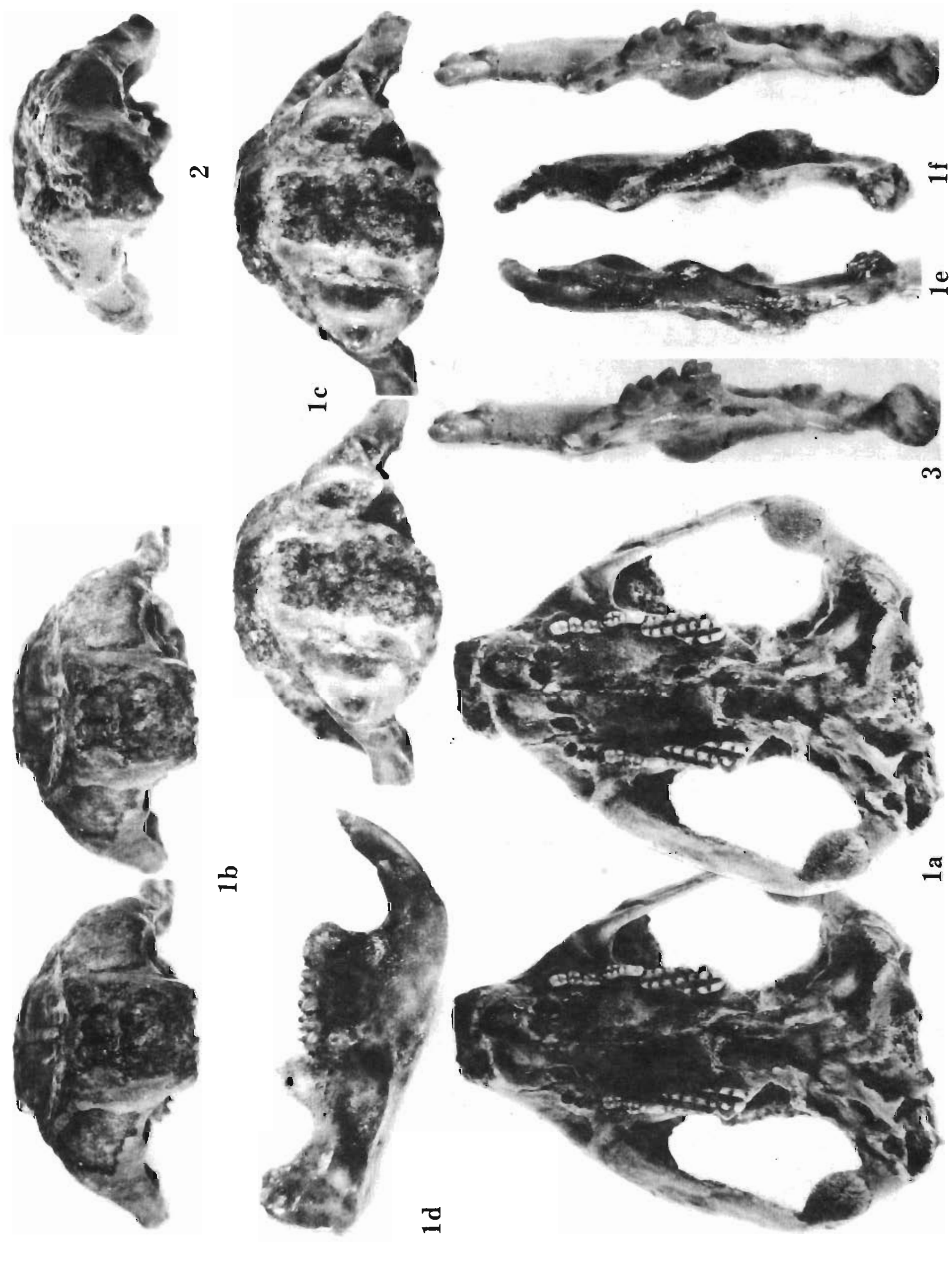
Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav II, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull in ventral view, covered with ammonium chloride, Z.Pal.No.MgM-I/108; ×5.
Fig. 1*b*. Stereo-photograph of the same skull in anterior view; ×5.
Fig. 1*c*. Stereo-photograph of the same skull in occipital view; ×5.
Fig. 1*d*. Left lower jaw of the same specimen in inner view; ×6.
Fig. 1*e*. The same jaw in ventral view; ×6.
Fig. 1*f*. The same jaw in occlusal view; ×6.

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 2. The skull in anterior view, Z.Pal.No.MgM-I/61; ×4.
Fig. 3. Stereo-photograph of the left lower jaw in occlusal view. Type specimen, Z.Pal.No.MgM-I/139; ×7

Photo: W. Skarżyński


2
1b
1c
1d
1a
3
1e
1f

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XV

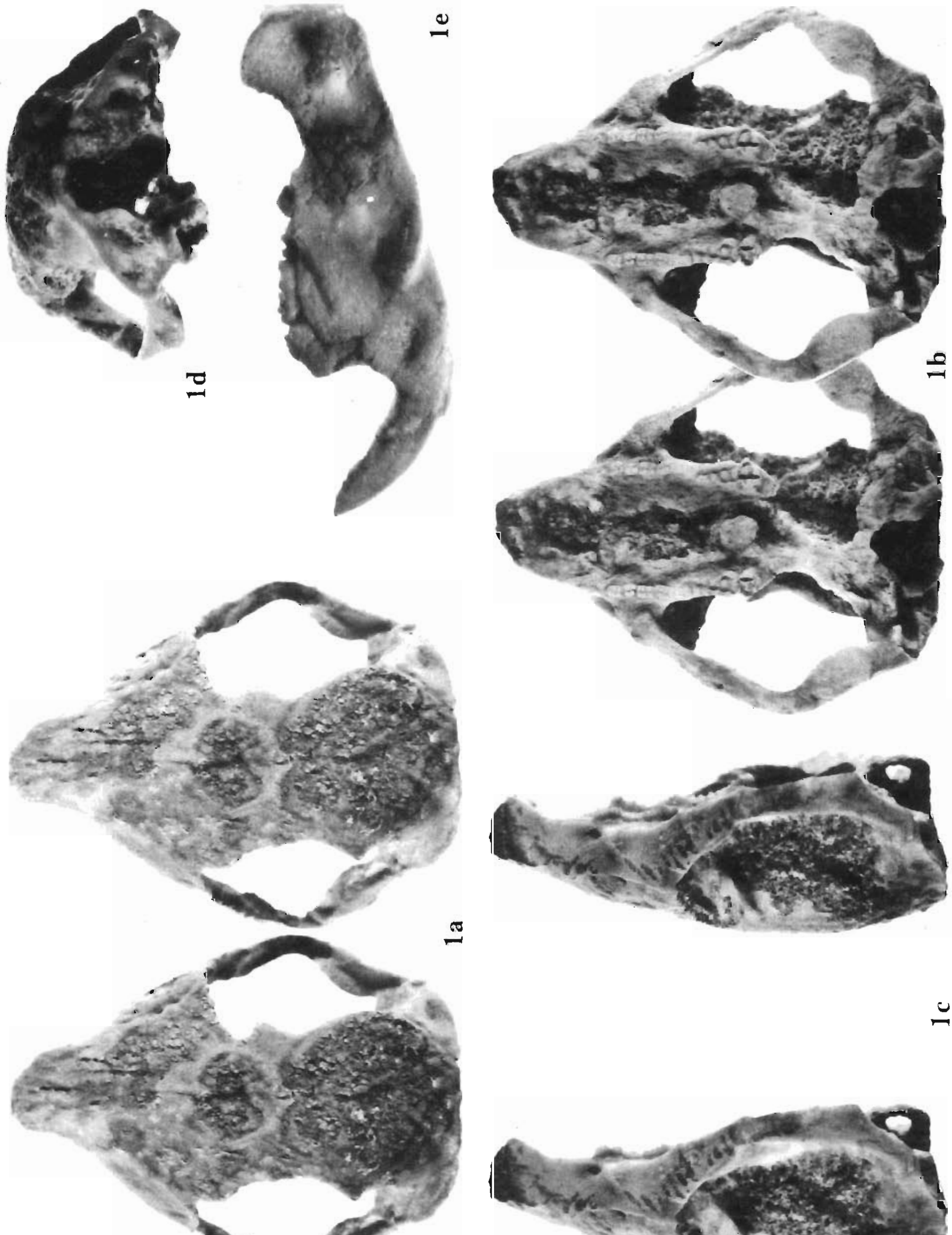
(see also Pls. V, XI-XVI, XVI and XVII, Fig. 1)

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull in dorsal view, Z.Pal.No.MgM-I/61; ×4.
Fig. 1*b*. Stereo-photograph of the same skull in ventral view; ×4.
Fig. 1*c*. Stereo-photograph of the same skull in right lateral view; ×4.
Fig. 1*d*. The same skull in occipital view; ×4.
Fig. 1*e*. Left lower jaw of the same specimen in outer view; ×6.

All specimens except Fig. 1*d* covered with ammonium chloride

Photo: W. Skarżyński


1d
1e
1b
1a
1c

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XVI

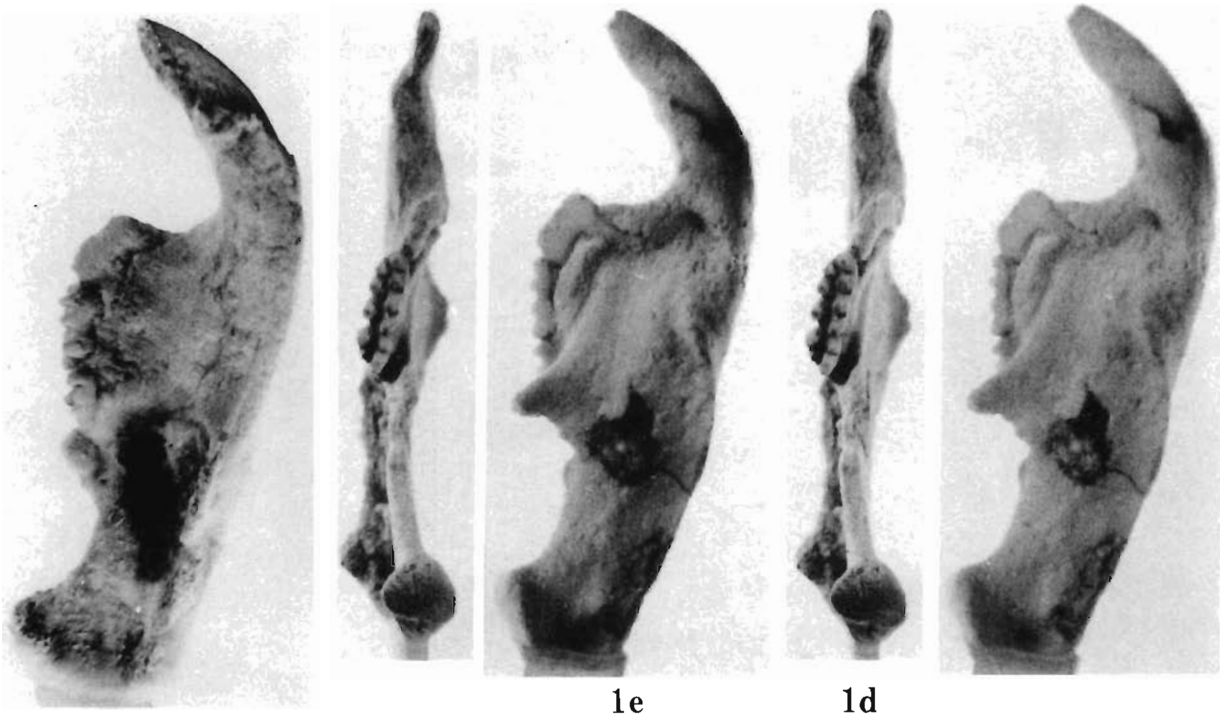
(see also Pls. V, XI-XV and XVII, Fig. 1)

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

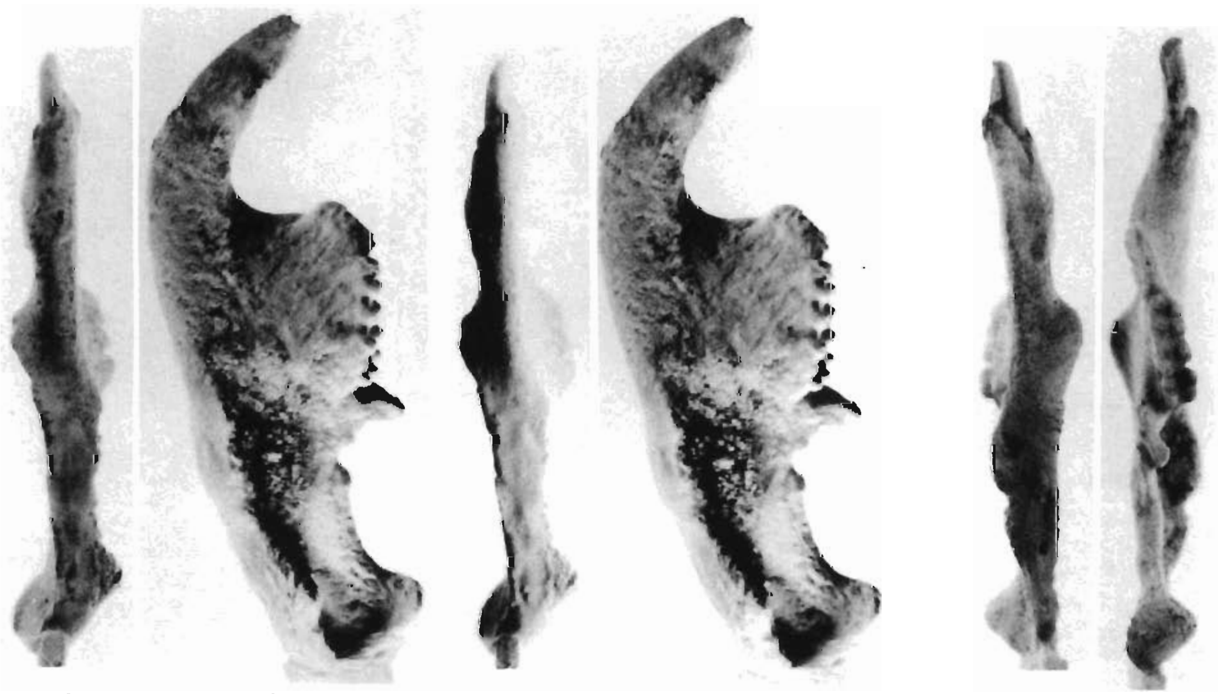
Fig. 1*a*. Left lower jaw in inner view, Z.Pal.No.MgM-I/61.
Fig. 1*b*. The same jaw in ventral view.
Fig. 1*c*. The same jaw in occlusal view.
Fig. 1*d*. Stereo-photograph of the right lower jaw of the same specimen in occlusal view.
Fig. 1*e*. Stereo-photograph of the same jaw in outer view.
Fig. 1*f*. Stereo-photograph of the same jaw in ventral view.
Fig. 1*g*. Stereo-photograph of the same jaw in inner view.

All ×6
All specimens covered with ammonium chloride,

Photo: W. Skarżyński



1a 1e 1d



1f 1g 1b 1c

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XVII

Page

Chulsanbaatar vulgaris n. sp. 39

(see also Pls. V and XI-XVI)

Upper Cretaceous, Barun Goyot Formation, Khulsan, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the left lower jaw in outer view, covered with ammonium chloride, Z.Pal. No.MgM-I/139; ×7.
Fig. 1*b*. The same jaw in ventral view, covered with ammonium chloride; ×7.

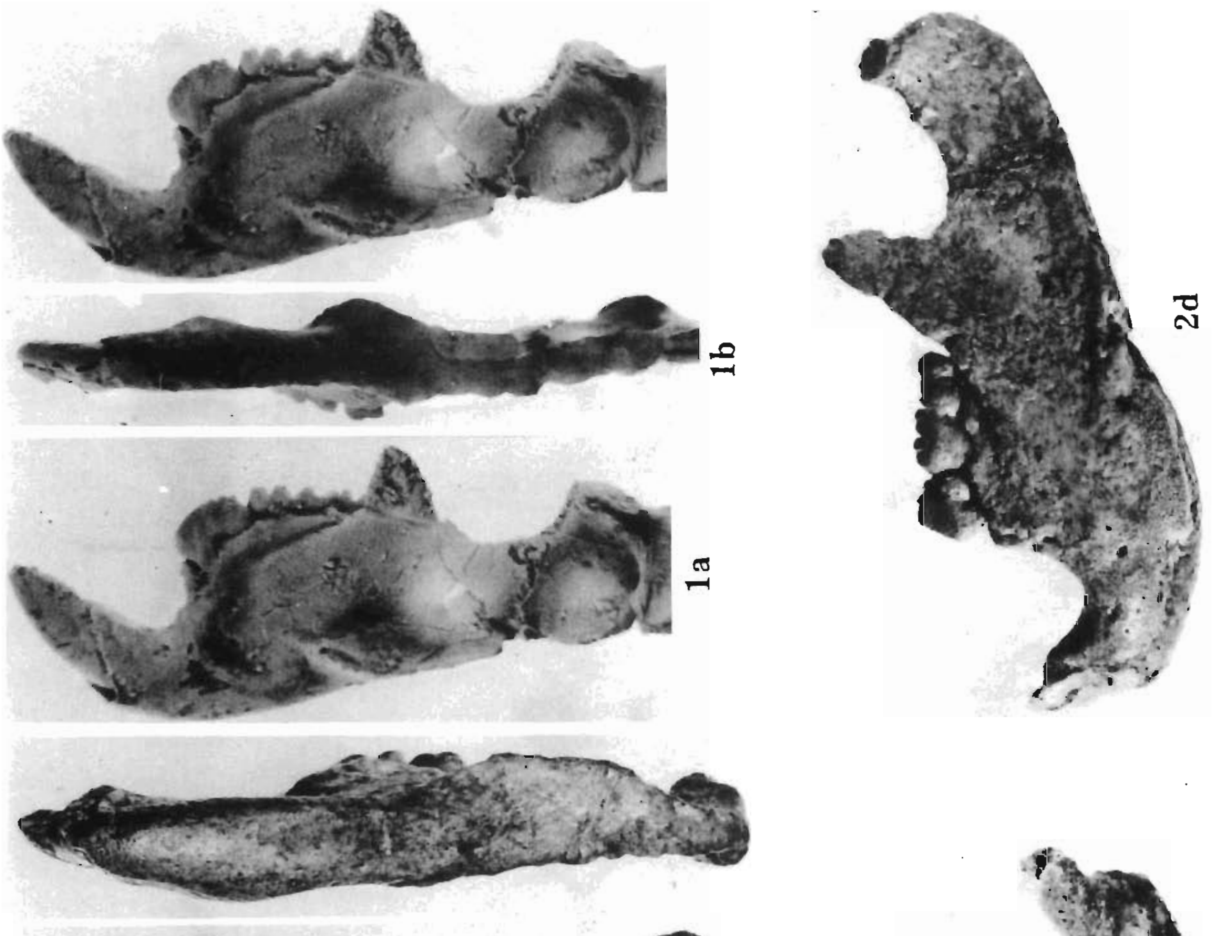
Djadochtatherium catopsaloides n. sp. 40

(see also Pls. V and XVIII-XXI)

Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav I, Gobi Desert, Mongolia

Fig. 2*a*. Stereo-photograph of the right lower jaw of the type specimen in occlusal view, Z.Pal.No.MgM-I/78; ×2.5.
Fig. 2*b*. Stereo-photograph of the same jaw in ventral view; ×2.5.
Fig. 2*c*. Left lower jaw of the same specimen in inner view; ×2.5.
Fig. 2*d*. The same jaw in outer view; ×2.5.

Photo: W. Skarżyński


1a
1b
2a
2b
2c
2d

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XVIII

Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav I, Gobi Desert, Mongolia

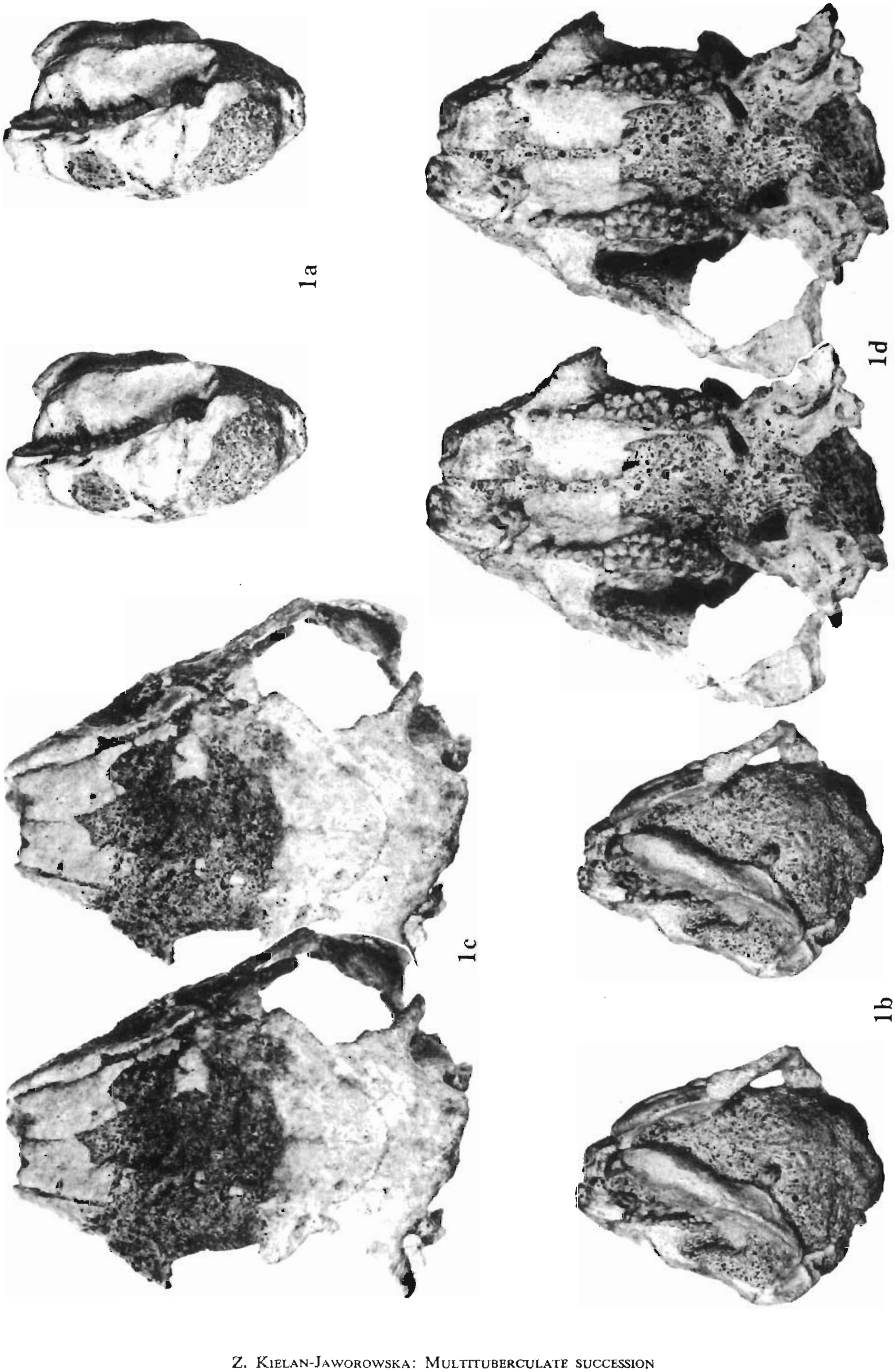
Fig. 1*a*. Stereo-photograph of the skull, associated with lower jaws, before the final preparation, in right lateral view. Type specimen, Z.Pal.No.MgM-I/78; ×1.

Fig. 1*b*. Stereo-photograph of the same specimen in ventral view; ×1.

Fig. 1*c*. Stereo-photograph of the skull of the same specimen, after the preparation, in dorsal view; ×1.5.

Fig. 1*d*. Stereo-photograph of the skull of the same specimen, after the preparation, in occlusal view; ×1.5.

Photo: W. Skarżyński



1a 1b 1c 1d

Z. Kielan-Jaworowska: Multituberculate succession

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XIX

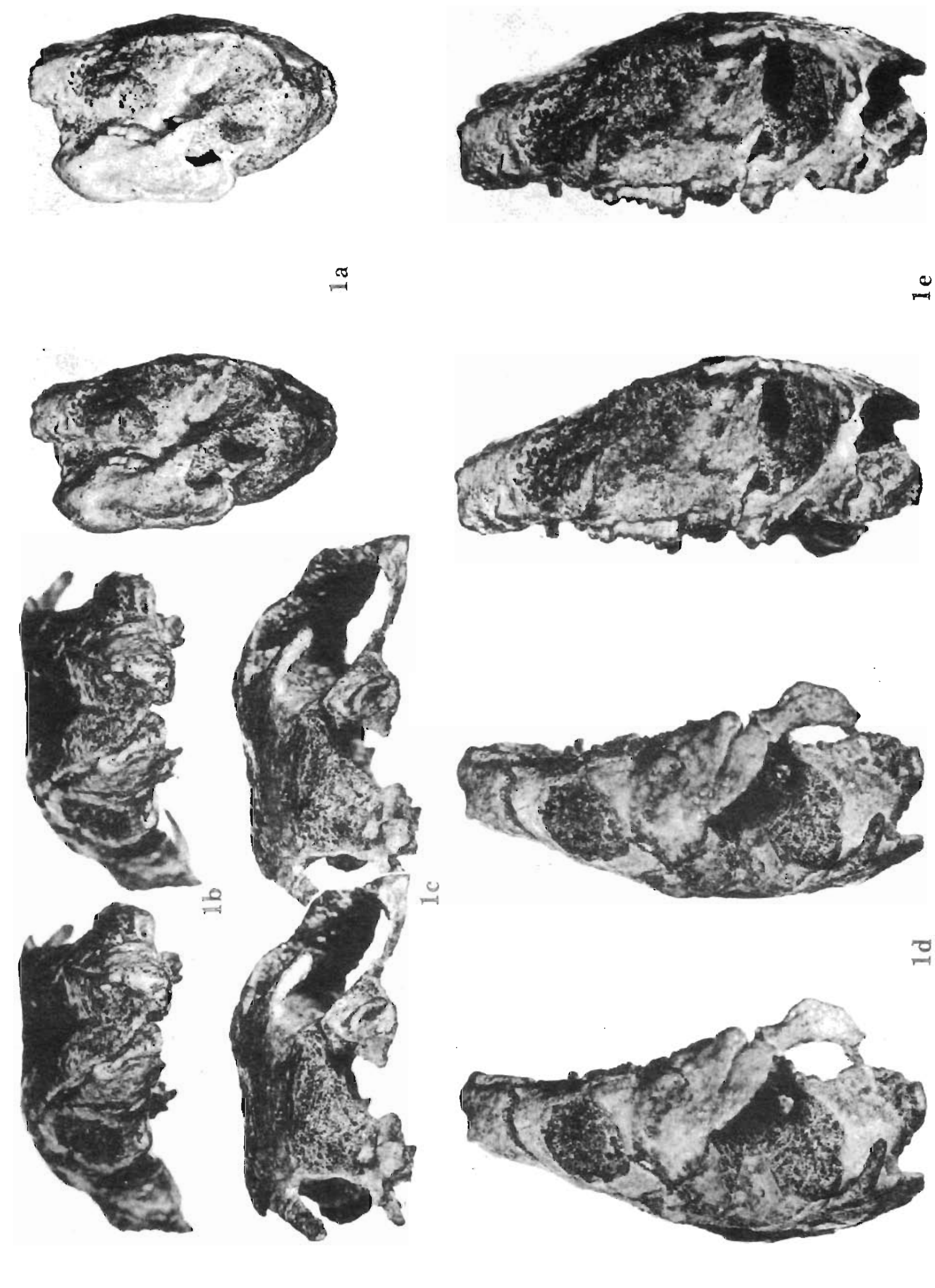
	Page
Djadochtatherium catopsaloides n. . sp	40

(see also Pls. V, XVII, Fig. 2; XVIII, XX and XXI)

Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav I, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the skull associated with lower jaws, before the final preparation, in left lateral view. Type specimen, Z.Pal.No.MgM-I/78; ×1.
Fig. 1*b*. Stereo-photograph of the skull of the same specimen, after the preparation, in anterior view; ×1.5.
Fig. 1*c*. Stereo-photograph of the same skull in posterior view; ×1.5.
Fig. 1*d*. Stereo-photograph of the same skull in right lateral view; ×1.5.
Fig. 1*e*. Stereo-photograph of the same skull in left lateral view; ×1.5.

Photo: W. Skarżyński


1a
1e
1b
1c
1d

Palaeontologia Polonica, No. 30, 1974

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XX

Page

Djadochtatherium catopsaloides n. sp. 40

(see also Pls. V, XVII, Fig. 2; XVIII, XIX and XXI)

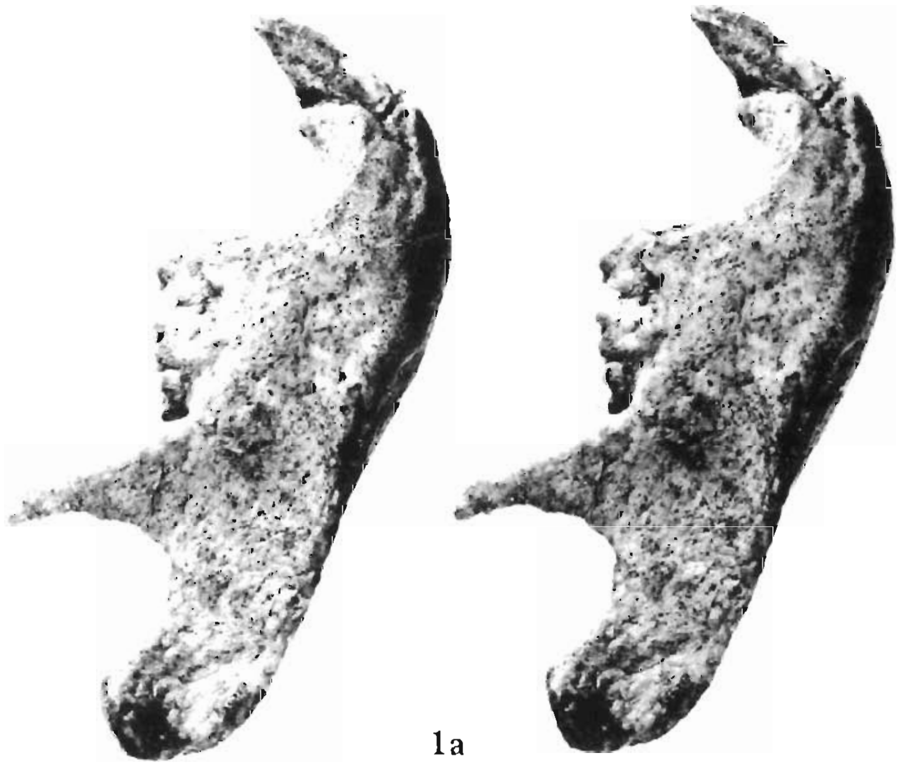
Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav I, Gobi Desert, Mongolia

Fig. 1*a*. Stereo-photograph of the right lower jaw of the type specimen in outer view. Z.Pal.No.MgM-I/78.
Fig. 1*b*. Stereo-photograph of the same jaw in inner view.
Fig. 1*c*. Left lower jaw of the same specimen in occlusal view.
Fig. 1*d*. Left lower jaw of the same specimen in ventral view.

All ×2.5.

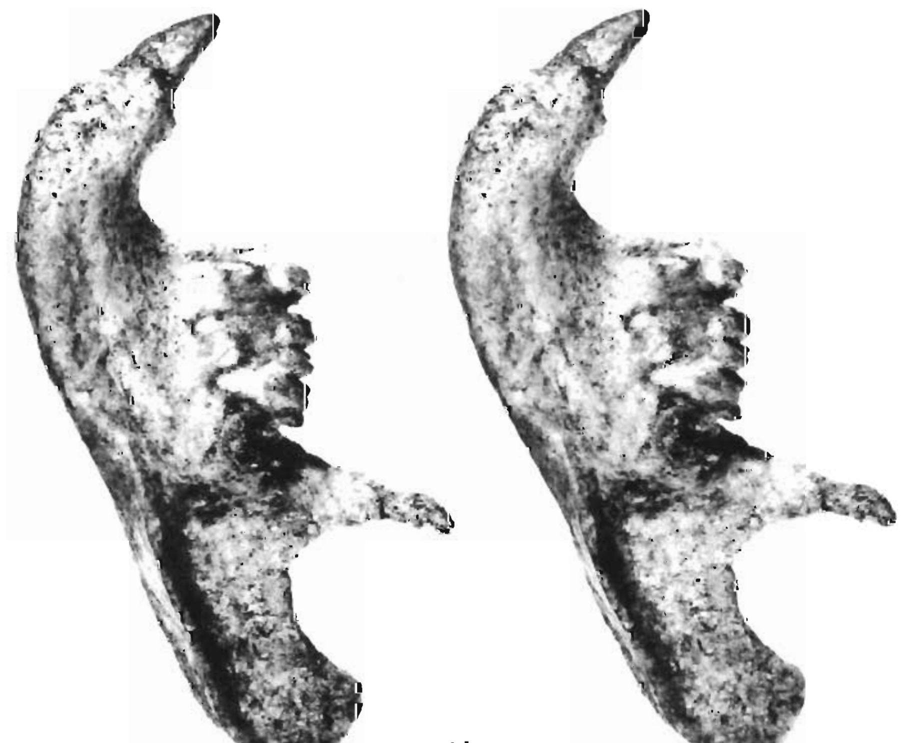
Photo: W. Skarżyński

1c



1a

1d



1b

Palaeontologia Polonica, No. 30, 1974

Z. KIELAN-JAWOROWSKA: MULTITUBERCULATE SUCCESSION

PLATE XXI

Page

Djadochtatherium catopsaloides n. sp. 40

(see also Pls. V, XVII, Fig. 2; and XVIII-XX)

Upper Cretaceous, Barun Goyot Formation, Khermeen Tsav I, Gobi Desert, Mongolia

Fig. 1*a*. Strongly damaged skull in dorsal view. Z.Pal.No.MgM-I/79.

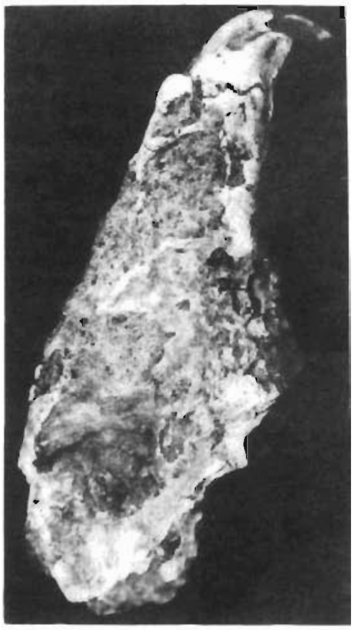
Fig. 1*b*. Stereo-photograph of the same skull in ventral view. Only the roots of premolars preserved, the molars strongly worn out.

Fig. 1*c*. The same skull in right lateral view.

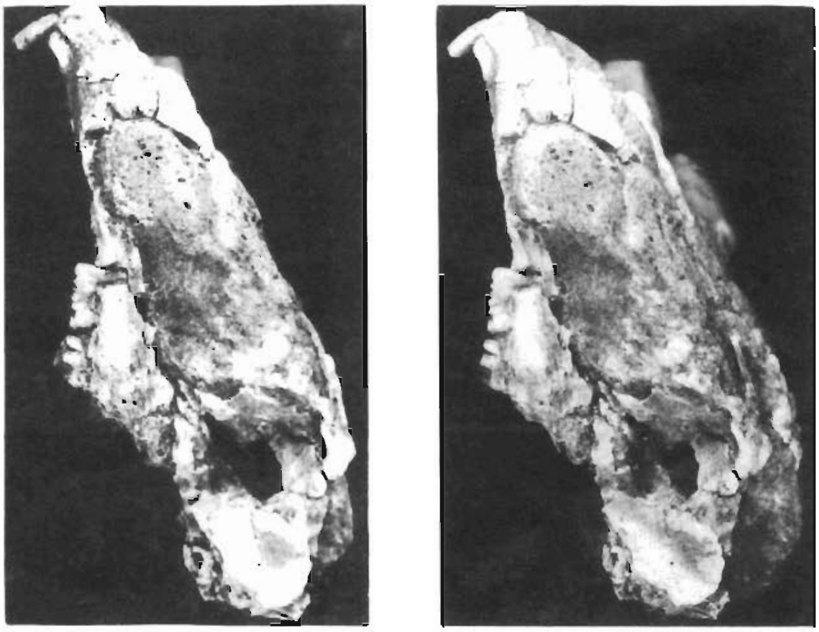
Fig. 1*d*. Stereo-photograph of the same skull in left lateral view.

All ×1.5.

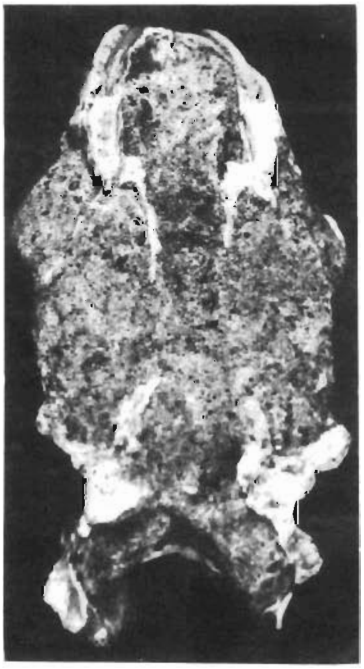
Photo: W. Skarżyński



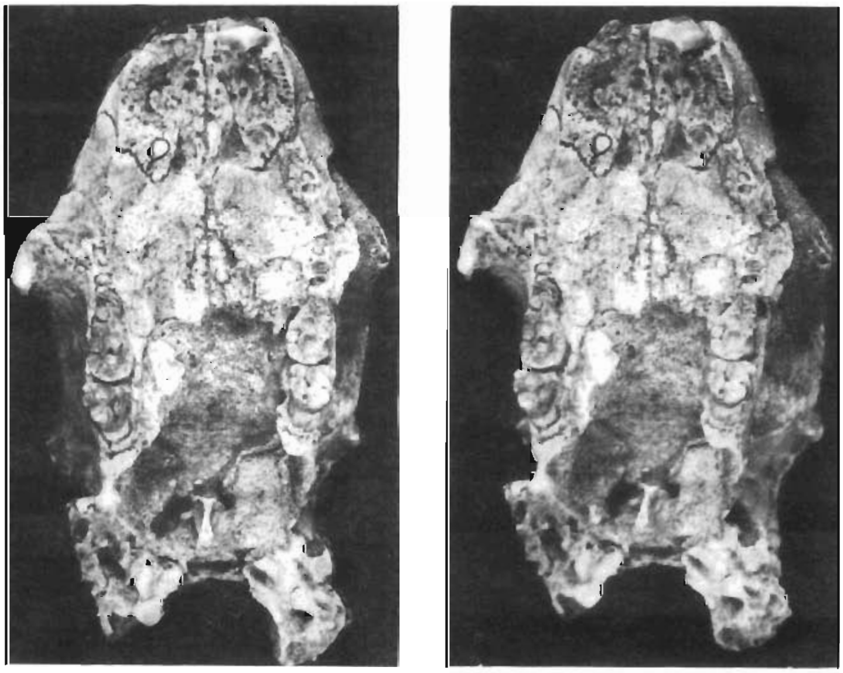
1c



1d



1a



1b