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Oligocene-Miocene Vertebrates from the Valley of Lakes (Central Mongolia): Morphology, phylogenetic and stratigraphic implications

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4. Marsupialia, Erinaceomorpha and Soricomorpha (Mammalia)

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(With 29 figures, 3 diagrams, and 15 tables)

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Abstract

The Oligocene and Miocene marsupials and insectivores from 45 profiles and fossiliferous sites in the Valley of Lakes in Mongolia are presented. The samples include more than 4400 specimens, mostly isolated teeth and some jaw fragments. The biozones A, B, C, C1, D, D1/1, D1/2 and E span the entire Oligocene and Miocene. About 2500 specimens are from the Early Oligocene biozones A and B, nearly 1800 from the Late Oligocene – Early Miocene biozones C to D, and only c. 150 specimens from the Early to Late Miocene biozones D1 and E.

The rare finds of two didelphid species from biozones A and B add to the still extremely poor record of fossil marsupials in Asia.

The erinaceids are the most common and the most diverse insectivores in all biozones. The most abundant species is the tupaiodontine *Zaraalestes minutus* (MATTHEW & GRANGER, 1924), which makes c. 90 % of the didelphid-insectivore fauna of biozone A, and still more than 70 % in biozone B. *Zaraalestes minutus* is absent in biozones C and C1 and apparently re-appeared in biozone D.

The brachyericines are represented by one dentary fragment of a probably new *Exallerix* species from biozone D, which appears to be the smallest known thus far, and by two specimens from biozone C of a new species, *Exallerix tuberculatus* nov. spec.

The erinaceines are represented by four species of *Palaeoscaptor*, including the new species *Palaeoscaptor tenuis* nov. spec., by the three new *Amphechinus* species, *A. taatsiingolensis* nov. spec., *A. minutissimus* nov. spec., and *A. major* nov. spec., and by the new *Parvericius* species, *Parvericius buk* nov. spec.

The soricomorphs are very rare in numbers, nevertheless conspicuously diverse in biozone B. The talpids are represented by the new species *Mongolopala tathue* nov. gen. nov. spec. and by nine indeterminable species. The most common soricid is the heterosorcine *Gobisorex kingae* SULIMSKI, 1970.

New crocidosoricine taxa are recorded from biozone B: *Taatsinia hoeckorum* nov. gen. nov. spec., and from biozone C1: *Tavoonyia altaica* nov. gen. nov. spec. The new soricine genus *Builstynia fontana* nov. gen. nov. spec. is recorded from biozone E. The zalambdodont soricomorph cf. *Asiapternodus mackennai*

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LOPATIN, 2003 is represented by a single premolar from biozone A. The Oligocene and Miocene Mongolian didelphids and insectivores are compared with related taxa from selected areas.

Keywords: Didelphidae, Erinaceomorpha, Soricomorpha, Oligocene, Miocene, Mongolia, Systematics, New Taxa

Zusammenfassung

Die oligozänen und miozänen Beuteltiere und Insektenfresser von 45 Profilen und fossilführenden Fundstellen im Tal der Gobiseen in der Mongolei werden vorgestellt. Das Material umfasst mehr als 4400 Stücke, meist isolierte Zähne und einige Kieferbruchstücke. Die Biozonen A, B, C, C1, D, D1/1, D1/2 und E erstrecken sich vom unteren Oligozän bis in das obere Miozän. Ungefähr 2500 Stücke sind allein aus den unteroligozänen Biozonen A und B, fast 1800 aus den oberoligozänen bis untermiozänen Biozonen C bis D. Nur etwa 150 Funde sind aus den unter- bis obermiozänen Biozonen D1/1, D1/2 und E.

Die wenigen Funde von zwei Didelphidenarten aus den Biozonen A und B ergänzen den äußerst spärlichen Fossilbericht fossiler Beuteltiere in Asien.

Die Erinaceiden sind in allen Biozonen die häufigsten Insektenfresser mit der größten Diversität. Am zahlreichsten vertreten ist der Tupaiodontine *Zaraalestes minutus* (MATTHEW & GRANGER, 1924), der allein ca. 90 % der Didelphiden-Insektivoren-Fauna in Biozone A ausmacht, und noch mehr als 70 % in Biozone B. *Zaraalestes minutus* fehlt in den Biozonen C und C1 und erscheint offensichtlich in Biozone D wieder.

Von den Brachyericinen gibt es ein Unterkieferbruchstück einer wahrscheinlich neuen *Exallerix*-Art aus Biozone D und zwei Stücke von der neuen Art *Exallerix tuberculatus* nov. spec. aus der Biozone C.

Die Erinaceinen sind durch vier Arten von *Palaeoscaptor*, darunter *Palaeoscaptor tenuis* nov. spec., vertreten und durch drei neue *Amphechinus*-Arten, *A. taatsiingolensis* nov. spec., *A. minutissimus* nov. spec. und *A. major* nov. spec. sowie durch die neue *Parvericius*-Art *Parvericius buk* nov. spec.

Die Soricomorpha sind zwar nur in geringer Anzahl vertreten, dafür aber in Biozone B erstaunlich divers. Unter den Talpiden gibt es die neue Art *Mongolopala tathue* nov. gen. nov. spec. und neun nicht näher bestimmbare Arten. Die häufigste Soricide ist der Heterosoricine *Gobisorex kingae* SULIMSKI, 1970.

Neue Crocidosoricinen-Taxa wurden nachgewiesen für Biozone B: *Taatsinia hoeckorum* nov. gen. nov. spec. und Biozone C1: *Tavoonyia altaica* nov. gen. nov. spec. Ein neuer Soricine, *Builstynia fontana* nov. gen. nov. spec. , stammt aus Biozone E. Der zalambdodonte Soricomorphe cf. *Asiapternodus mackennai* LOPATIN, 2003 ist durch einen einzigen Prämolaren aus Biozone A belegt.

Die oligozänen und miozänen Didelphiden und Insectivoren der Mongolei werden mit ähnlichen Taxa aus einer Reihe anderer Gebiete verglichen.

Schlüsselwörter: Didelphidae, Erinaceomorpha, Soricomorpha, Oligozän, Miozän, Mongolei, Systematik, neue Taxa.

Content

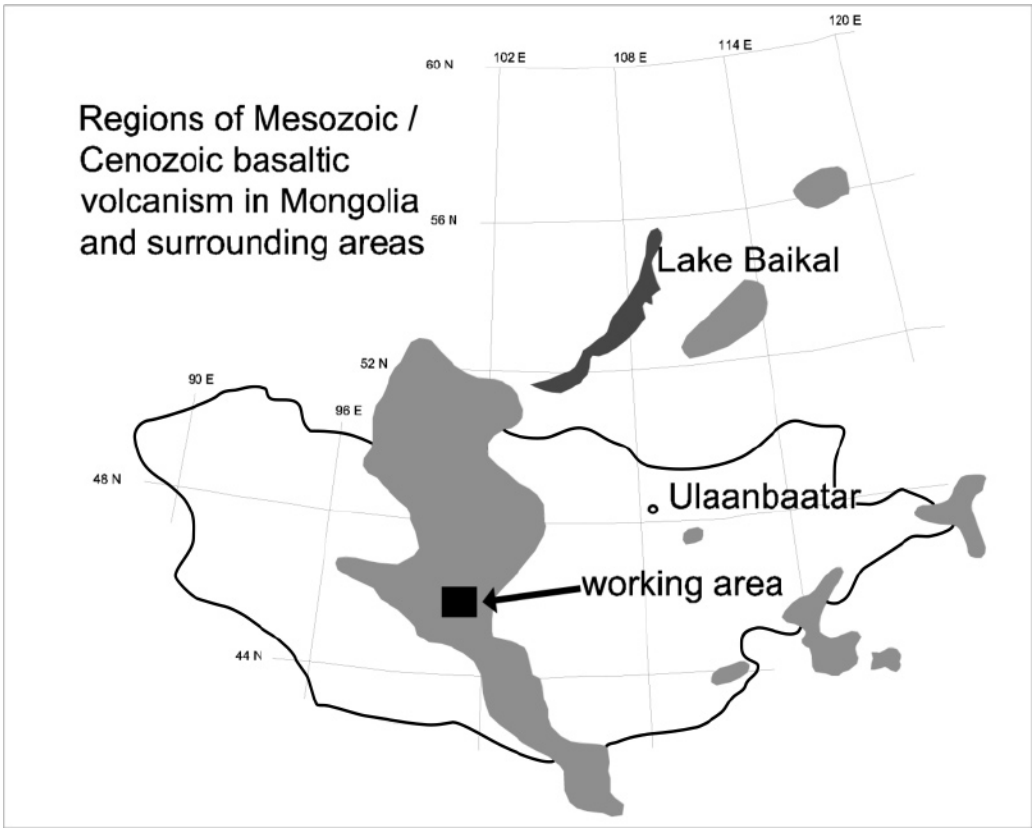


Fig. 1: Geographical outline of Mongolia including Lake Baikal with the distribution of Mesozoic and Cenozoic volcanoes in Mongolia and surroundings and the working area. (from Höck et al. 1999)

1. Introduction

The Valley of Lakes is the northwestern large depression between two mountain ranges, the Altai Mtns. in the W, SW and S and the Khangai Mtns. in the north. It is a continental rift basin and one of the best places, where Cenozoic fossiliferous aeolian, fluvial, and lacustrine sediments are associated with basalts (for details see DAXNER-HÖCK et al. 1997, HÖCK et al. 1999). In the past hundred years or so the area was studied by a number of palaeontological expeditions, the latest being the joint Austrian-Mongolian one. This Austrian-Mongolian project aimed at a detailed field study of the Cenozoic sequence in the Tatsin Gol and the Tatsin-Tsagan Noor area, which are scientifically the most important parts of the Valley of Lakes in Central Mongolia. The fieldwork including

geological mapping, sampling basalts for absolute ages, and sampling micromammals, was carried out in six field seasons from 1995 to 1997, 2001, 2004 and 2006. Mammal faunas were collected from the Tatsin Gol area up to Ikh Argalantu Nuru in the east, from fossil horizons along profiles and from some isolated but stratified fossil sites within the area. In total, about 120 vertebrate faunas with varying fossil content were collected from 45 profiles and fossiliferous sites (see DAXNER-HÖCK & BADAMGARAV 2007: Tab. 1-3). The small mammals were extracted by screen-washing of the sediment. Most of the material consists of isolated teeth of insectivores, rodents, and lagomorphs, while jaws and postcranials are rather rare. The profiles were subdivided into lithologically defined horizons. DAXNER-HÖCK et al. (1997) and HÖCK et al. (1999) established and redefined the biostratigraphy for the Hsanda Gol and Loh Formations on the basis of rodent assemblages. They distinguished from bottom to top eight informal biozones (A, B, C, C1, D, D1/1, D1/2, and E), which are characterised by a well-defined sequence of selected rodent genera and species from all respective fossil horizons. They span the time from the Early Oligocene to the Late Miocene. Three basalt layers within the sequence yielded radiometric ages. An Oligocene-Miocene biochronology of Central Mongolia based on the basalt dates and the biozones, with a tentative correlation with the Chinese and European biochronologies is presented in HÖCK et al. (1999, Fig. 22) and DAXNER-HÖCK & BADAMGARAV (2007: Tab. 4). These rodent-based biozones serve as our stratigraphic frame.

2. Marsupials and insectivores from the Tertiary of Mongolia and adjacent China

Fossil marsupials are extremely rare in Asia. Tertiary marsupials were so far unknown from Mongolia. The Zaysan Basin in Kazakhstan yielded the first Cenozoic herpetotheriine marsupial records. STORCH & QIU (2002) summarized the known Cenozoic marsupial record in Asia.

MATTHEW & GRANGER (1924) were the first to describe insectivores from the Hsanda Gol Formation near Loh. They erected a number of new taxa of erinaceids: *Tupaiodon morrisi* MATTHEW & GRANGER, 1924, ?*Tupaiodon minutus* MATTHEW & GRANGER, 1924, *Palaeoscaptor acridens* MATTHEW & GRANGER, 1924, and *Palaeoscaptor rectus* MATTHEW & GRANGER, 1924.

MCKENNA & HOLTON (1967) identified among the material from the Third Asiatic Expedition to Mongolia of the American Museum of Natural History a jaw of a brachyericine, which they named *Exallerix hsandagolensis* MCKENNA & HOLTON, 1967. The jaw was found in the Hsanda Gol Fm. near Tsagan Nor, Mongolia.

MELLETT (1968) published a revised faunal list of the Oligocene Hsanda Gol Formation including the following insectivores: *Palaeoscaptor acridens*, *Amphechinus rectus*, *Tupaiodon morrisi*, ?*Tupaiodon minutus*, and *Exallerix hsandagolensis*.

The insectivores collected during the Polish-Mongolian Palaeontological Expedition to the Gobi Desert in 1964 were studied by SULIMSKI. The material came from the two already known localities Loh and Tatal Gol (Hsanda Gol Fm.) and in addition from Khatan Khayrkhan and Nareen Bulak. SULIMSKI (1970) reported on the following insectivore species: *Ictopidium tatalgolensis* SULIMSKI, 1970, *Amphechinus* (*Palaeoscaptor*) *acridens*, *A.* (*Palaeoscaptor*) cf. *rectus*, *A.* (*Palaeoerincaeus*) cf. *minimus* (= *Parvericius*

montanus KOERNER, 1940), and the soricid *Gobisorex kingae* SULIMSKI, 1970. This was the first non-erinaceomorphan insectivore so far described from the Oligocene of Mongolia.

RUSSELL & DASHZEVEG (1986) described two new Early Eocene genera and species of Nyctitheriidae, *Bumbanius rarus* and *Oedolius perexiguus*, from the Naran-Bulak Fm. Nemegt Basin, Mongolia.

RUSSELL & ZHAI (1987) published a comprehensive monograph on the mammals of the Paleogene of Asia. The oldest named insectivore mentioned is the soricomorph micropternodontid *Sarcodon pygmaeus* MATTHEW & GRANGER, 1925 from the Late Paleocene locality Gashato, Omono Gobi Prov.

STORCH & DASHZEVEG (1997) described the new tupaiodontine genus and species *Zaraalestes russelli* STORCH & DASHZEVEG, 1997 from the Middle Eocene localities of Tsagan Tsav and Mergen, southeastern Gobi desert. They re-considered the classification of Tupaiodontinae and assigned ?*Tupaiodon minutus* and *Ictopidium tatalgolensis* to *Zaraalestes minutus*.

In a series of papers LOPATIN (2002a, b, 2003a, b, 2004a, 2005) and LOPATIN & ZAZHIGIN (2003) described new erinaceids, talpids, and soricids from the Late Paleocene through the Miocene of Mongolia. The new taxa include the galericines *Oligochenus grandis* LOPATIN, 2005 from Ergilin Dzo, Latest Eocene, and *Eogalericius butleri* LOPATIN, 2004 from the Khaychin–Ula 2 locality, Middle Eocene; the tribe Scymnericini LOPATIN, 2003 with the type species *Scymnerix tartareus* LOPATIN, 2003 from Ulan-Khureh, Early Oligocene, Shand-Gol Fm.; the brachyericines *Exallerix manahan* LOPATIN & ZAZHIGIN, 2003, Tatal Gol, Shand-Gol Fm. and *Postexallerix securis* LOPATIN & ZAZHIGIN, 2003, Ulan Tologoi locality, Loo Fm; the erinaceine *Amphechinus gigas* LOPATIN, 2002, Khunuk locality, Shand-Gol Fm.; the talpid *Mongoloscapter zhegalloi* LOPATIN, 2002, Tatsin Gol, Shand-Gol Fm., and the geolabidid *Gobigeolabis verigranum* LOPATIN, 2004, Naran Bulak Fm., Late Paleocene.

Northern China: TEILHARD DE CHARDIN (1926) reported on *Palaeoscaptor acridens* (=*Amphechinus rectus*, misidentification noted by BUTLER 1984) from the Middle Oligocene locality Saint-Jacques, Inner Mongolia (Nei Mongol, China).

ZDANSKY (1930) described a small erinaceomorphan, *Ictopidium lechei* ZDANSKY, 1930, from the Late Eocene Heti Fm., Shanxi Prov., China.

BOHLIN (1937) made known two jaws of *Palaeoscaptor* sp. from the Late Oligocene of the Shargaltein Valley in western Gansu. Some years later, BOHLIN (1942) described *Palaeoerinaceus* cf. *rectus* (= *Palaeoscaptor* cf. *rectus*), *Palaeoerinceus kansuensis* BOHLIN, 1942, and *Palaeoerinaceus minimus* BOHLIN, 1942 (= *Parvericius montanus* KOERNER, 1940) from Taben-Buluk, western Gansu. A single m2 from Taben Buluk was referred to Soricidae sp. by BOHLIN (1942); STORCH et al. (1998) agreed with this assignment with slight reservation. Some additional Late Oligocene faunas from Inner Mongolia and Xinjiang Uygur Autonomous region including erinaceines are compiled by RUSSELL & ZHAI (1987).

QIU & STORCH (2005) updated the Neogene insectivore faunas of China and presented a complete list of the insectivores from Neogene localities of China. Among areas

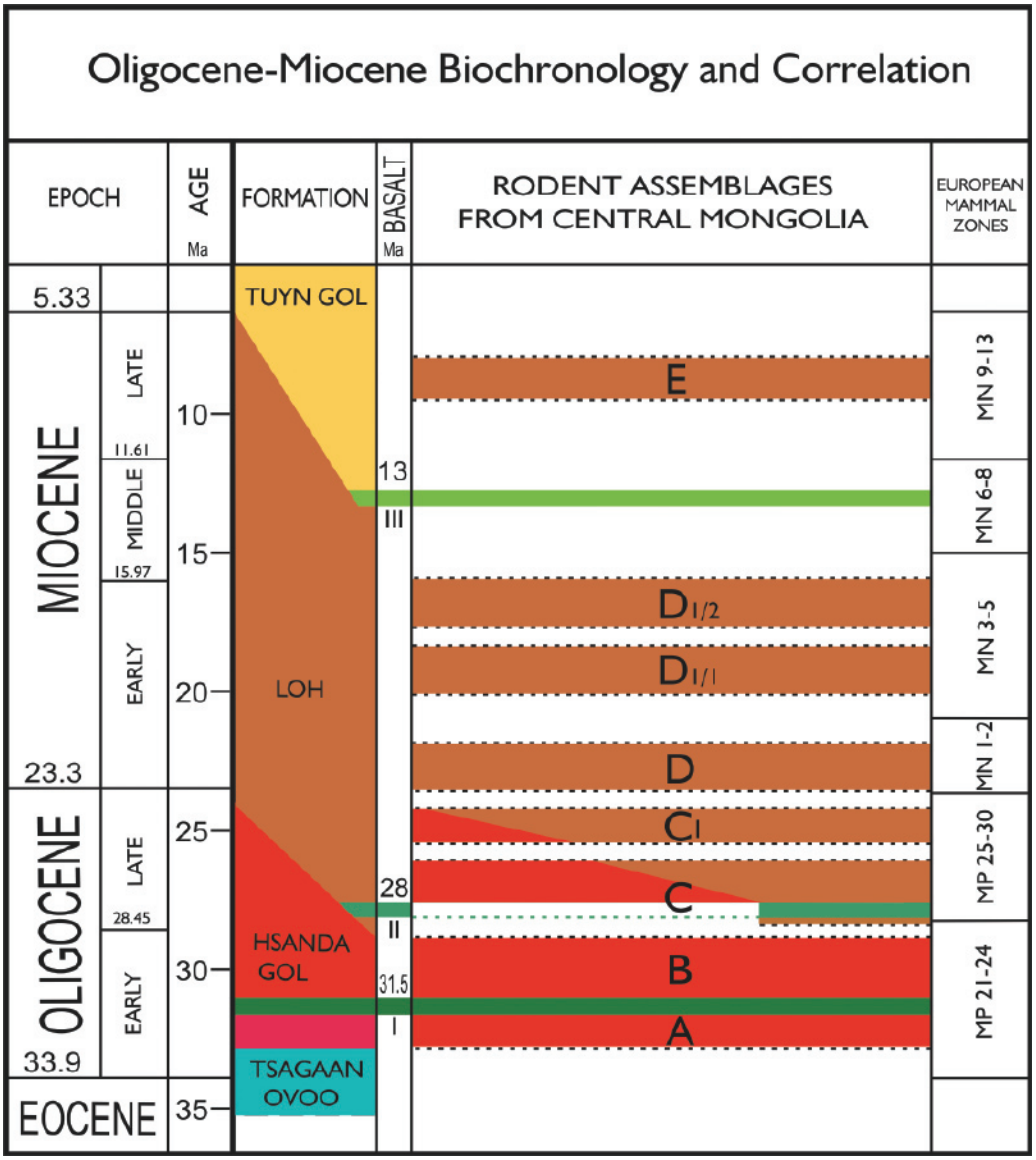


Fig. 2: Oligocene-Miocene biochronology of Central Mongolia based on informal biozones and on basalt datings. Tentative correlation with European biochronologies. The boundary between epochs are drawn according to Gradstein et al. (2004). (From Daxner-Höck & Badamgarav 2007; after Höck et al. 1999)

adjacent to Mongolia, the Inner Mongolian Chinese sites of Tunggur, Middle Miocene, Ertemte, Late Miocene, and Bilike, Early Pliocene, are remarkably rich in insectivores, in particular soricids and talpids. On the other hand, Early and Middle Miocene faunas from the North Junggar Basin, Xinjiang Uygur Autonomous Region of China, yielded erinaceids only.

The insectivores from the Tertiary of Mongolia are far from being well-known. The older faunas – explored up to the 1960ies – consist of scattered finds from surface sampling. Hence the sample-sizes are small and the variability of most species is unknown. In the material under study the most common species are represented by many specimens. Thus it is possible to outline the variability in size and morphology.

3. Material and methods

In all around 60 tons of fossiliferous sediments were washed in the field camps with fine-meshed screens (down to 0.5 mm). The material of every single fauna is kept separately. All measurements are given in mm. The didelphid teeth have been measured according to CROCHET (1980). For the measurements of erinaceids the work of ENGESSER (1980: figs 8–10) is widely followed. Additionally we present the lingual length in the upper molars, which is taken parallel to the lingual margin. For the measurements of the talpid and soricid teeth see HUTCHISON (1974) and REUMER (1984). The lower molars are measured at an exactly perpendicular entoconid in occlusal view, otherwise the width of the molars increases distinctly.

In most tables the usual biometric parameters are given: m = arithmetic mean ± standard error of the mean (95 % probability), s = standard deviation, n = number of measured specimens, R = range, minimum to maximum value; V = coefficient of variation, sx100/m.

All teeth and dentaries of erinaceines, soricids, and talpids are figured as left ones, right specimens were reversed to left ones. Teeth of didelphids, tupaiodontines, and brachyericines are figured as they are.

All investigated material is housed in the Natural History Museum Vienna (NHMW).

Abbreviations – Localities (and GPS-dates)

BUK = Builstyn Khudag (BUK-A = N 45°23'03", E 101°30'44"), **DEL** = Del (DEL-B = N45°27'08", E 101°22'24"), **GRAB** = unknown name (GRAB-II = N 45°16'53", E 101°57'30"), **HL** = Khongil (HL= N 45°27'37", E 101°09'14"), **Hü** = hill (german: Hügel), **IKH** = Ikh Argalatyn Nuruu (IKH-A = N 45°17'52", E 102°05'05"; IKH-B = N 45°17'30", E 102°05'35"), **LOG** = Luugar Khudag (LOG-A = N 45°32'18", E 101°00'48"), **LOH** = Loh (LOH-A = N 45°17'22", E 101°47'04"; LOH-B = N 45°17'20", E 101°47'39"; LOH-C = N 45°15'44", E 101°43'03"), **ODO** = Olon Ovoony Khurem (ODO-A = N 45°32'24", E 101°08'17"), **RHN** = Huch Teg (=Tavan Ovoony Deng in HÖCK et al. 1999, Tab. 1) (RHN-A = N 45°29'37", E 101°12'17"), **SHG** = Hsanda Gol (SHG-A = N 45°16'01", E 101°45'45"; SHG-AB = N 45°16'00", E 101°46'37"; SHG-C = N 45°15'47", E 101°43'03"), **TAR** = Unzing Khurem (=Tarimalyn Khurem in HÖCK et al. 1999, Tab. 1) (TAR-A = N 45°31'06", E 101°18'23"), **TAT** = Tatal Gol (TAT-C = N 45°18'21", E 101°38'01"; TAT-D = N 45°17'37", E 101°37'32"; TAT-Hü same as TAT-D), **TGL** = Taatsin Gol left (TGL-A = N 45°26'57", E 101°16'18"), **TGR** = Taatsiin Gol right (TGR-A = N 45°25'08", E 101°15'44"; TGR-B = N 45°24'53", E 101°15'44"; TGR-AB/21 = N 45°24'42", E 101°15'22"; TGR-AB/22 = 45°24'47", E 101°15'21"; TGR-Bad = C/Bad 5,6 TGR-C = N 45°23'09", E 101°14'36"), **TGW** = Toglorhoi (= Taatsiin Gol west in HÖCK et al 1999) (TGW-A = N 45°22'39", E 101°06'01"), **UNCH** = Unkheltseg (UNCH-A = N 45°27'41", E 101°12'05").

Sections without age-control by one of the basalt layers, i.e. biostratigraphically dated (biozones A-E) and referred to type and reference profiles of the formations Tsagaan Ovoo, Hsanda Gol,

Loh and Tuyn Gol by lithological and biostratigraphical criteria: BUK-A; RHN-A; SHG-A-B; TAT-Hü/1,6; TGR-C; TGW-A; UNCH-A.

Biozones A, B = Early Oligocene; C, C1 = Late Oligocene; D = Oligocene/Miocene transition; D1/1 = mid Early Miocene; D1/2 = late Early Miocene); E = Late Miocene.

Surface finds, partially referred to one of the biozones A-E: BUK, DEL, GRAB-II, HL-A, IKH, LOH, RHN, SHG, TAT, TAT-W, TGL, TGR, TGR-C, TGW and UNCH without further level specification.

Abbreviations – Measurements

A = antemolar (used for soricid teeth between incisor and P4/p4); BdwE = distal breadth without epicondyles; distW = distal width between metastyle and lingual tooth basis, parallel to the mesial margin; DS = diameter of shaft; H = height; L = length; labL = labial length; lingL = lingual length; MandH-m2 = height of mandible below m2; MandW-middle of m3 = width of mandible below the middle of m3; mesW = mesial width between parastyle and lingual basis of protocone, parallel to the mesial margin; midW = width between mesostyle and lingual basis of protocone, parallel to the mesial margin; TaW = talonid width; TrW = trigonid width; W = maximum width perpendicular to length; Mand+/- = mandibular fragment with/without teeth; Max+/- = maxillary fragment with/without teeth.

4. Systematic Palaeontology

4.1. Order Didelphimorphia Gill, 1872

4.1.1. Family Didelphidae Gray, 1821

Subfamily Herpetotheriinae Trouessart, 1879

Genus *Asiadidelphis* Gabunia, Shevyreva & Gabunia, 1990

Type species: *Asiadidelphis zaissanense* Gabunia, Shevyreva & Gabunia, 1990

***Asiadidelphis zaissanense* Gabunia, Shevyreva & Gabunia, 1990**
(Fig. 3.1–3.6)

M a t e r i a l :

Biozone A, samples GRAB-II/2 – 1 M3-ectoloph (NHMW 2006z0114/0000).

Biozone B, samples TGR-B/1, TGR-AB/22, TGR-AB/21, SHG-A/15+20 – 1 dentary fragment with m3-m4, 2 D3, 1 M1, 1 M4, 1 m1, 1 m2/3, 1 m4 (NHMW 2006z0116/0000, 2006z0116/0001, 2006z0116/0002, 2006z0116/0003, 2006z0117/0000, 2006z0117/0001, 2006z0118/0001).

M e a s u r e m e n t s : see Tab. 1.

D e s c r i p t i o n : Our material only has the M1 in common with the type series. If measurements are taken according to fig. 1 of Gabunia et al. (1990), both are of the same size (1.60 x 1.40 mm).

D3 is dilambdodont, its labial margin is much extended and the ectoflexus very shallow. The metacone is distinctly taller and stronger than the paracone. The preparacrista

connects to stylar cusp B and the preprotocrista is continuous with the paracingulum and cusp A. Stylar cusps B and E are most prominent, followed by A and D which are of subequal height. Cusp C is minute. Cusp D is laterally compressed and slightly twinned. Conules are absent.

Tab. 1: Tooth measurements (mm) of *Asiadidelphis zaissanense* and *A. tjutkovae* (upper teeth = length x width, lower teeth = length x trigonid width x talonid width).

		A. zaissanense	*A. tjutkovae*
Biozone A	M3	1.58 x ——	
	m4		1.76 x 0.98 x 0.72
Biozone B	D3	1.32 x 1.12 1.26 x 1.12	
	M1	1.37 x 1.53	
	M4	0.74 x 1.48	
	m1	1.30 x 0.70 x 0.68	
	m2/3	1.31 x 0.70 x 0.73	
	m3	1.33 x 0.74 x 0.72	
	m4	1.32 x 0.66 1.35 x 0.71	

M1 is fully dilambdodont, the stylar shelf is wide, the ectoflexus is shallow, and the distolabial extremity of the tooth is extended. The metacone is taller and stronger than the paracone. Among the stylar cusps, B and D are most prominent. Cusps A, C, and E are of subequal height. Cusp C is elongate anteroposteriorly. The preparacrista connects to stylar cusp B. The preprotocrista is continuous with the metacingulum and cusp A. There is at most a weak suggestion of conules. A valley separates the metacone from the labial termination of the postprotocrista. The metacingulum is faint and short.

M3 shows a more symmetrical ectoloph than M1 and a deeper ectoflexus. Otherwise, it is similar.

M4 is strongly reduced posteriorly. The paracone is distinctly higher than protocone and parastyle. The small metacone forms the distal apex of the tooth. The preparacrista is directed toward the weakly individualized stylar cusp B but turns just before reaching cusp B and continues to cusp A. A well-developed stylar cusp is located in the position of a cusp C opposite to the most labial point of the centrocrista. The postprotocrista meets the metacone. The preprotocrista is continuous with the paracingulum and cusp A (= parastyle). A posterior cingulum is poorly indicated. Conules are absent.

Based on the available scarce material, m1-m4 appear to be subequal in size, getting only slightly longer from m1 through m4. Compared to European taxa, the lower molars are more similar to *Peratherium* than to *Amphiperatherium*.

m1 has sharp cusps and ridges. The protoconid is most prominent and in a more mesial position with regard to the metaconid. m1 shows long and strong pre- and postcingulids. The entoconid is rounded. The large hypoconulid is located distolabially to the entoconid. The crista obliqua meets the posterior wall of the protoconid close to the trigonid notch.

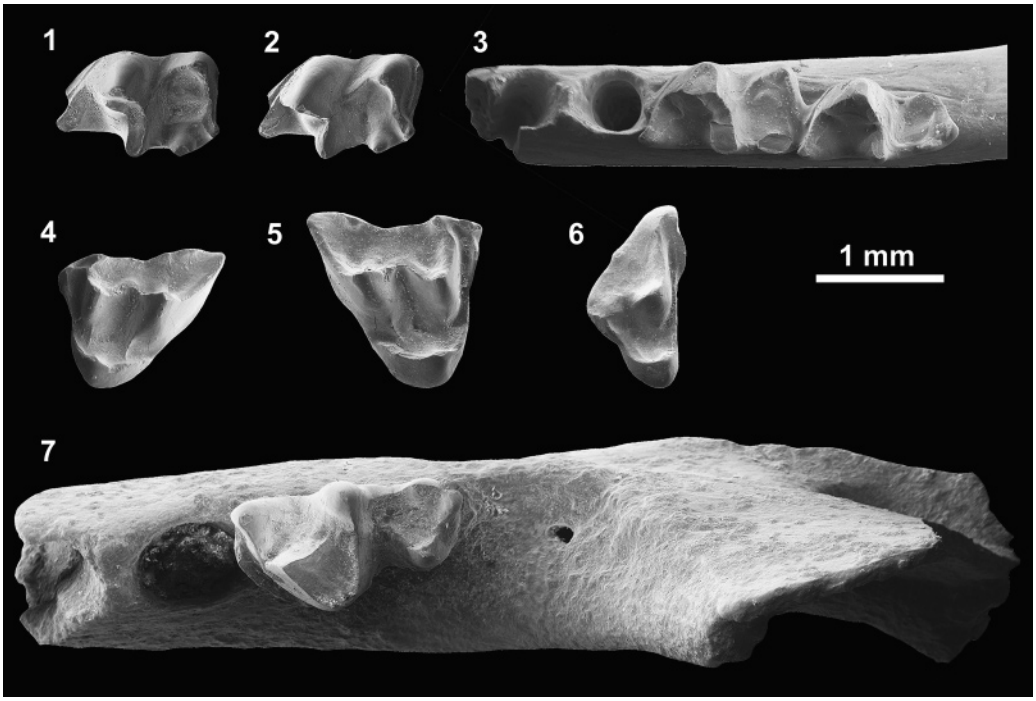


Fig. 3: *Asiadidelphis zaissanense* Gabunia, Shevyreva & Gabunia, 1990. – All teeth in occlusal view: **1:** Right m1, Hsanda Gol (sample SHG-A/15+20, biozone B, NHMW 2006z0118/0001); **2:** Right m2/3, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0116/0003); **3:** Right m3-m4, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0116/0001); **4:** Left D3, Taatsiin Gol right (sample TGR-AB/21, biozone B, NHMW 2006z0115/0001); **5:** Right M1, Taatsiin Gol right, sample TGR-AB/22, biozone B, NHMW 2006z0116/0002)); **6:** Right M4, Taatsiin Gol right (sample TGR-B/1, biozone B, NHMW 2006z0117/0001); **7:** *Asiadidelphis tjutkovae* Emry, Lucas, Szalay & Tleuberdina, 1995; left mandibular fragment with m4, occlusal view, Tatal Gol (sample TAT-HÜ/1, biozone B, NHMW 2006z0119/0001).

m2-3 are essentially similar to m1. They differ in having a weaker postcingulid.

m4 has a strong precingulid and no postcingulid. The large hypoconulid forms the posterolingual extremity of the tooth. The small entoconid is laterally compressed. The crista obliqua terminates anteriorly beneath the trigonid notch.

Asiadidelphis tjutkovae Emry, Lucas, Szalay & Tleuberdina, 1995
(Fig. 3.7)

Material:

Biozone A, samples TAT-D/1/Hü1 – 1 dentary fragment with m4 (NHMW 2006z119/0001).

Measurements: see Tab. 1.

D e s c r i p t i o n : The m4 of *A. tjutkovae* has more robust main cusps than *A. zaissanense*. Its hypoconulid takes a strictly distal position with regard to the entoconid, while it is slightly displaced labially in *A. zaissanense*. Entoconid and hypoconid are somewhat stronger than in the latter species.

We base our specific assignment on the diagnostic character tooth size, being one quarter to one third larger than in *A zaissanense* (EMRY et al., 1995). In our material, the referred m4 is about 30% larger than in *A. zaissanense* and shows no morphological differences that would exclude it from the genus *Asiadidelphis*.

D i s c u s s i o n : The fossil record of marsupials in Asia is still extremely poor. The first fossil, a single M1, was discovered in 1984 from the middle part of Aksyir Svita, Late Eocene of the Zaysan Basin, Kazakhstan (GABUNIA et al. 1984, 1985). Together with an additional M3 from the same locality it was later described as *Asiadidelphis zaissanense* (GABUNIA et al., 1990). EMRY et al. (1995) added a second species, *A. tjutkovae*, on the basis of a maxillary fragment with associated M2-M4 from the Buran Svita, Early Oligocene of the Zaysan Basin. *A. tjutkovae* is essentially like *A. zaissanense* but one quarter to one third larger than the latter. EMRY et al. (1995) referred *Asiadidelphis* to herpetotheriine didelphids. The present sample includes for the first time D3 and lower molars of *Asiadidelphis*. An opossum, similar to *Asiadidelphis*, was listed from the Middle Eocene Shanghuang fauna of Jiangsu Province, China (QI et al. 1991, 1996). Finally, an unnamed herpetotheriine, represented by four partly fragmentary molars, was reported by KAPPELMAN et al. (1996) from the Eocene Kartal Formation near Ankara, Turkey. Peradectine marsupials from Asia, on the other hand, are thus far only known from the Miocene of Thailand (DUCROCQ et al. 1992, MEIN & GINSBURG 1997) and Jiangsu Province, eastern China (STORCH & QIU 2002).

4.2. Order Erinaceomorpha GREGORY, 1910

4.2.1. Family Erinaceidae FISCHER VON WALDHEIM, 1817

4.2.1.1. Subfamily Tupaiodontinae BUTLER, 1988

Genus *Zaraalestes* STORCH & DASHZEVEG, 1997

Type species: *Zaraalestes russelli* STORCH & DASHZEVEG, 1997

Zaraalestes minutus (MATTHEW & GRANGER, 1924)
(Fig. 4)

1924 ?*Tupaiodon minutus* nov. spec.; MATTHEW & GRANGER, p. 2.
1970 *Ictopidium tatalgolensis* nov. spec.; SULIMSKI, p. 55.
1997 *Zaraalestes minutus*; STORCH & DASHZEVEG, p. 438.

M a t e r i a l :

Biozone A, samples SHG-C/1, SHG-C/2, TGL-A/2, HL/1, HL/2, IKH-A/1T, Grab-II/2, SHG-C/2, TAT-C/1, TAT-C/3, TAT-C/1, TAT-C/2, TAT-HÜ1, TGL-A, TGR-A/13, TGR-A/14, SHG-C/1. – 23 mandibular fragments (some without teeth), 2 maxillary fragments, 613 isolated teeth (NHMW 2006z0120/0000, 2006z0121/0000,

2006z0121/0001, 2006z0121/0002, 2006z0121/0003, 2006z0122/0000, 2006z0123/0000, 2006z0123/0001, 2006z0123/0002, 2006z0124/0000, 2006z0167/0000, 2006z0168/0000, 2006z0169/0000, 2006z0171/0000, 2006z0172/0000, 2006z0172/0001, 2006z0176/0000, 2006z0178/0000, 2006z0179/0000)

Biozone B, samples IKH-B/2, SHG-A/6, SHG-AB/12, DEL-B/7, TAT-C/6, TAT-C/7, TGL-A/11c, TGL-A/11a, TGL-A/11b, TGL-A/11, TGR-B/1, TGR-AB/22, TGR-AB/21, TGR-AB/21, SHG-A/15, SHG-A/9, SHG-A/1, SHG-A/15+20, SHG-A/20. – 54 mandibular fragments (some without teeth), 7 maxillary fragments, 1.249 isolated teeth (NHMW 2006z0125/0000, 2006z0166/0000, 2006z0170/0000, 2006z0173/0000, 2006z0174/0000, 2006z0174/0001, 2006z0174/0002, 2006z0174/0003, 2006z0174/0004, 2006z0174/0005, 2006z0174/0006, 2006z0174/0007, 2006z0175/0000, 2006z0175/0001, 2006z0175/0002, 2006z0177/0000, 2006z0177/0000, 2006z0177/0000, 2006z0177/0000, 2006z0180/0000, 2006z0181/0000, 2006z0182/0000, 2006z0183/0000, 2006z0184/0000, 2006z0185/0000, 2006z0186/0000, 2006z0187/0000).

Biozone D, samples UNCH-A/4, UNCH-A/3. – 3 mandibular fragments, 181 isolated teeth (NHMW 2006z0188/0000, 2006z0189/0000).

M e a s u r e m e n t s : for isolated teeth see Tabs. 2–4.

Lm1-m3: 4.45, 4.48.

LM1-M3: 3.69; LP4-M3 5.00.

Height of mandible below m1 (lingually): 2.20-2.60, n = 18, mean = 2.39.

D e s c r i p t i o n : Tooth size (Tabs. 2–4): The present samples compare well with the holotype of *Z. minutus* (Hsanda Gol Formation, Loh) in size. The data do not indicate a major shift of tooth size either between biozones A, B, and D nor among local assemblages within biozones. However, the lengths of p3 and P3 from biozone A appear to average smaller than in specimens from B and D. The samples of B include a few tupaiodontine teeth which appear to be too large for the species *Z. minutus* (see below).

Mandible: The horizontal ramus is slender and only slightly tapered anteriorly. The leading edge of the ascending ramus rises at an open angle to the alveolar line. The mental foramen is located below p3. The symphysis extends beneath p2 posteriorly. The dental formula of the lower dentition is 3-1-3 or 4-3. The p3 and p4 are double-rooted, and the other lower antemolars are single-rooted. The alveoli of the incisors increase in diameter from i3 through i1; the small i3 alveolus is in most cases displaced labially. The incisors become increasingly procumbent anteriorly.

The present assemblages from the sequence of biozones A and B show a strong tendency to loose p1. One specimen from biozone A has preserved a single-rooted p2 and in front of it five alveoli to house single-rooted p1, c, i3, i2, and i1. Of the six specimens from biozone A with a completely preserved anterior row of alveoli, four show six alveoli in front of p3 and thus prove the existence of a p1, while only two specimens have five alveoli and thus have obviously lost the p1. On the other hand, of the 16 specimens of biozone B with completely preserved alveoli, 15 show five alveoli before p3 and only one has six and thus retained a p1. The single available specimen from biozone D exhibits five alveoli.

Tab. 2: Tooth measurements (mm) of *Zaraalestes minutus* from selected localities, Biozones A, B, and D.

	Biozone A/TAT-HÜ1			Biozone B/TGR-AB/21			Biozone D/UNCH-A/3+4		
	n	R	m	n	R	m	n	R	m
Lp3	13	1.03–1.24	1.15	26	1.17–1.38	1.27	16	1.13–1.35	1.26
Wp3		0.67–0.82	0.73		0.66–0.88	0.72		0.64–0.80	0.71
Lp4	23	1.31–1.56	1.43	20	1.34–1.58	1.48	7	1.41–1.55	1.47
Wp4		0.86–1.13	0.97		0.88–1.05	0.95		0.84–0.97	0.93
Lm1	11	1.64–2.00	1.88	26	1.71–2.04	1.82	11	1.64–2.00	1.82
Wam1		1.12–1.38	1.24		1.08–1.30	1.17		1.05–1.21	1.17
Wpm1		1.16–1.40	1.27		1.12–1.38	1.24		1.14–1.29	1.22
Lm2	18	1.53–1.76	1.60	23	1.50–1.78	1.60	11	1.54–1.69	1.60
Wam2		1.07–1.28	1.15		1.04–1.25	1.14		1.03–1.20	1.12
Wpm2		1.08–1.28	1.16		1.05–1.23	1.15		0.99–1.19	1.11
Lm3	6	1.40–1.62	1.48	22	1.36–1.54	1.46	10	1.33–1.62	1.44
Wam3		0.85–1.05	0.93		0.82–1.04	0.90		0.81–1.02	0.91
Wpm3		0.77–0.95	0.85		0.74–0.91	0.80		0.73–0.94	0.82
LP3	14	1.33–1.54	1.45	23	1.41–1.70	1.58	7	1.36–1.64	1.53
WP3		1.14–1.33	1.25		1.09–1.39	1.27		1.16–1.32	1.24
LP4	16	1.44–1.68	1.54	16	1.43–1.72	1.58	9	1.50–1.70	1.57
WP4		1.58–1.76	1.69		1.50–1.85	1.64		1.53–1.71	1.62
LbM1	9	1.52–1.69	1.61	34	1.47–1.75	1.61	8	1.52–1.70	1.56
WaM1		1.78–2.03	1.90		1.81–2.13	1.95		1.83–2.01	1.94
WpM1		1.93–2.14	2.04		1.98–2.31	2.10		1.90–2.23	2.09
LbM2	26	1.31–1.54	1.41	28	1.31–1.50	1.42	6	1.25–1.50	1.42
WaM2		1.72–2.10	1.85		1.80–2.07	1.92		1.77–2.02	1.94
WpM2		1.61–2.02	1.75		1.53–1.92	1.73		1.64–1.88	1.75
LM3	11	0.87–1.02	0.94	37	0.85–1.08	0.95	21	0.81–1.04	0.93
WM3		1.33–1.51	1.42		1.37–1.62	1.47		1.26–1.56	1.47
Ld3	1	1.31	1.31	2	1.29–1.33	1.31			
Wd3		0.76	0.76		0.66–0.71	0.69			
Ld4	3	1.47–1.52	1.50	1	1.55	1.55			
Wd4		0.92–1.01	0.95		0.93	0.93			

Maxillary: The infraorbital foramen is located in a deep depression above P3. The anterior root of the jugal arch arises above M2 and the metastyle of M1. The dental formula of the upper dentition is ?3-1-3-3. Three incisors are most likely, but they are not represented either in situ nor by their alveoli. The canine and P2 are double-rooted. P1 is lost, at least in available specimens from biozone B, which show a small diastema between canine and P2. P3 and P4 are three-rooted.

Antemolars: The third and fourth upper and lower premolars are well represented in the samples and easily to recognize. i1, i2, p2, C and P2 are found in situ, though only represented by a single tooth or very few specimens each. In addition, there are a couple of isolated peg-like, unicuspid, and single-rooted antemolars which can be allocated with reservation only (?i3, ?c). Candidates for p1 and upper incisors are apparently absent.

Tab. 3: Mean values (mm) of lower cheek teeth of *Zaraalestes minutus* from selected localities, Biozones A, B, and D (premolars = n / greatest length x greatest width, molars = n / length x trigonid width x talonid width). Sharp epoxy casts of *holotype of *Z. minutus* (AMNH 19135) and **paratype of *Tupaidon morris* (AMNH 19134).

Bioz/Section	p3	p4	m1	m2	m3
A/TAT-HÜ1	13 / 1.15 x 0.73	23 / 1.43 x 0.97	11 / 1.88 x 1.24 x 1.27	18 / 1.60 x 1.15 x 1.16	6 / 1.48 x 0.93 x 0.85
A/TGL-A/2	4 / 1.10 x 0.72	12 / 1.41 x 0.96	7 / 1.87 x 1.20 x 1.28	8 / 1.55 x 1.13 x 1.16	6 / 1.47 x 0.89 x 0.84
B/TGR-AB/21	26 / 1.27 x 0.72	20 / 1.48 x 0.95	26 / 1.82 x 1.17 x 1.24	23 / 1.60 x 1.14 x 1.15	22 / 1.46 x 0.90 x 0.80
B/TGR-B/1	43 / 1.25 x 0.71	27 / 1.52 x 0.98	20 / 1.86 x 1.19 x 1.25	32 / 1.64 x 1.13 x 1.16	25 / 1.47 x 0.92 x 0.82
B/TGR-AB/22	21 / 1.26 x 0.73	27 / 1.49 x 0.99	26 / 1.85 x 1.18 x 1.23	25 / 1.59 x 1.15 x 1.16	23 / 1.47 x 0.95 x 0.79
D/UNCH-A/3-4	16 / 1.26 x 0.71	7 / 1.47 x 0.93	11 / 1.82 x 1.17 x 1.22	11 / 1.60 x 1.12 x 1.12	10 / 1.44 x 0.91 x 0.82
*Z. minutus**	1.28 x 0.76	1.44 x 0.96	1.86 x 1.18 x 1.24		
*T. morrisi***				2.16 x 1.52 x 1.44	2.00 x 1.28 x 1.12

Tab. 4: Mean values (mm) of upper cheek teeth of *Zaraalestes minutus* from selected localities, Biozones A, B, and D, (premolars = n / greatest length x greatest width, molars = n / labial length x anterior width x posterior width). Sharp epoxy cast of *holotype of *T. morris* (AMNH 19134).

Bioz/Section	P3	P4	M1	M2	M3
A/TAT-HÜ1	14 / 1.45 x 1.25	16 / 1.54 x 1.69	9 / 1.61 x 1.90 x 2.04	26 / 1.41 x 1.85 x 1.75	11 / 0.94 x 1.42
A/TGL-A/2	8 / 1.43 x 1.31	4 / 1.54 x 1.89	7 / 1.65 x 1.94 x 2.07	5 / 1.42 x 1.87 x 1.72	5 / 0.91 x 1.40
B/TGR-AB/21	23 / 1.58 x 1.27	16 / 1.58 x 1.64	34 / 1.61 x 1.95 x 2.10	28 / 1.42 x 1.92 x 1.73	37 / 0.95 x 1.47
B/TGR-B/1	19 / 1.62 x 1.29	20 / 1.58 x 1.62	29 / 1.62 x 1.96 x 2.11	30 / 1.44 x 1.92 x 1.76	31 / 0.94 x 1.46
B/TGR-AB/22	20 / 1.58 x 1.30	18 / 1.58 x 1.62	31 / 1.63 x 1.94 x 2.10	35 / 1.42 x 1.95 x 1.73	32 / 0.95 x 1.45
D/UNCH-A/3-4	7 / 1.53 x 1.24	9 / 1.57 x 1.62	8 / 1.56 x 1.94 x 2.09	6 / 1.42 x 1.94 x 1.75	21 / 0.93 x 1.47
*T. morrisi**	2.08 x 1.64	2.20 x 2.32	2.04 x 2.68 x 3.00	1.68 x 2.60 x 2.40	1.24 x 2.20

Lower antemolars: The tip of the only available i1 is broken; the preserved crown basis appears to indicate a pointed apex. The i2 is laterally compressed and shows a continuous dorsal ridge; the lingual face (Fig. 4,1) is slightly excavated by tooth wear. The ?i3 has an ovate occlusal outline. The low apex is connected by a smooth sloping ridge with the mesial extremity of the tooth. The well-developed posterior heel is slightly concave and there is a faint labial cingulid and a minute distal cuspule. The ?c has a roun-

ded occlusal outline. Its apex is higher than in the adjacent ?i3 and p2. The distal heel is very short. Both ?i3 and ?c show faint suggestions of a cingulid. The p2 is small. It is morphologically similar to ?c, consisting essentially of a blunt main cusp and a reduced posterior heel. The p3 has a high protoconid with a flat or slightly concave posterior face; anteriorly a smooth ridge connects the apex of the protoconid with the anterolabial base of the paraconid. The paraconid is raised and compressed anteroposteriorly (the paraconid is usually stronger in specimens from biozone B than from A). The posterior heel is short mesiodistally and shows a raised distal edge, sometimes equiped with a central cuspule. The metaconid is usually absent; in a couple of specimens, however, there is a ridge-like swelling in the position of a metaconid. The p4 has a rather wide occlusal outline. The trigonid is fully developed; the protoconid is high and acute, the metaconid is weaker and only slightly lower than the protoconid, and the paraconid is raised, protruding anteriorly, and compressed anteroposteriorly. The three trigonid cusps are separated from each other by deep notches. The short talonid usually shows a small entoconid (better developed in specimens from Zone B than from A). The raised posterior edge of the talonid is in an oblique dorsolingual-ventrolabial position. There is a well-eveloped short precingulid along the base of the paracristid.

Upper antemolars: The C is laterally compressed and apically slightly bent posteriorly. A weak crest connects the apex with the distal extremity of the crown. Cingula are absent. The small P2 has a navicular outline and a low and blunt apex. There is a minute basal ledge anteriorly and a slightly stronger one posteriorly as well as a faint distal crest similar to that of C. The P3 is expanded lingually by the protocone lobe. The tooth is dominated by the high paracone and the prominent, bowed metacrista. The protocone lobe is of subrectangular outline and the well-developed protocone is located at its anterolingual corner. The hypocone is absent. There is a well-developed cuspate parastylar projection in front of the paracone and a narrow postcingulum along the posterior crown margin. The P4 differs from P3 by its lingually more expanded lobe which bears a well-developed coniform hypocone. The hypocone is lower than the protocone and located further lingually. It is either isolated (more frequently in samples from biozone A) or connected by a ridge with the posterior wall of the protocone (more frequently in samples from Zone B). The preprotocrista is continuous with the paracingulum. The postprotocrista is usually absent in samples from Zone A, while in samples from Zone B it is usually present and terminates either free or reaches the posterior side of the paracone. The parastyle is strong and cusp-like; its apex is connected by ridges with the base of the paracone and the precingulum. The high paracone and metacrista dominate the crown as in P3. The narrow postcingulum is continuous.

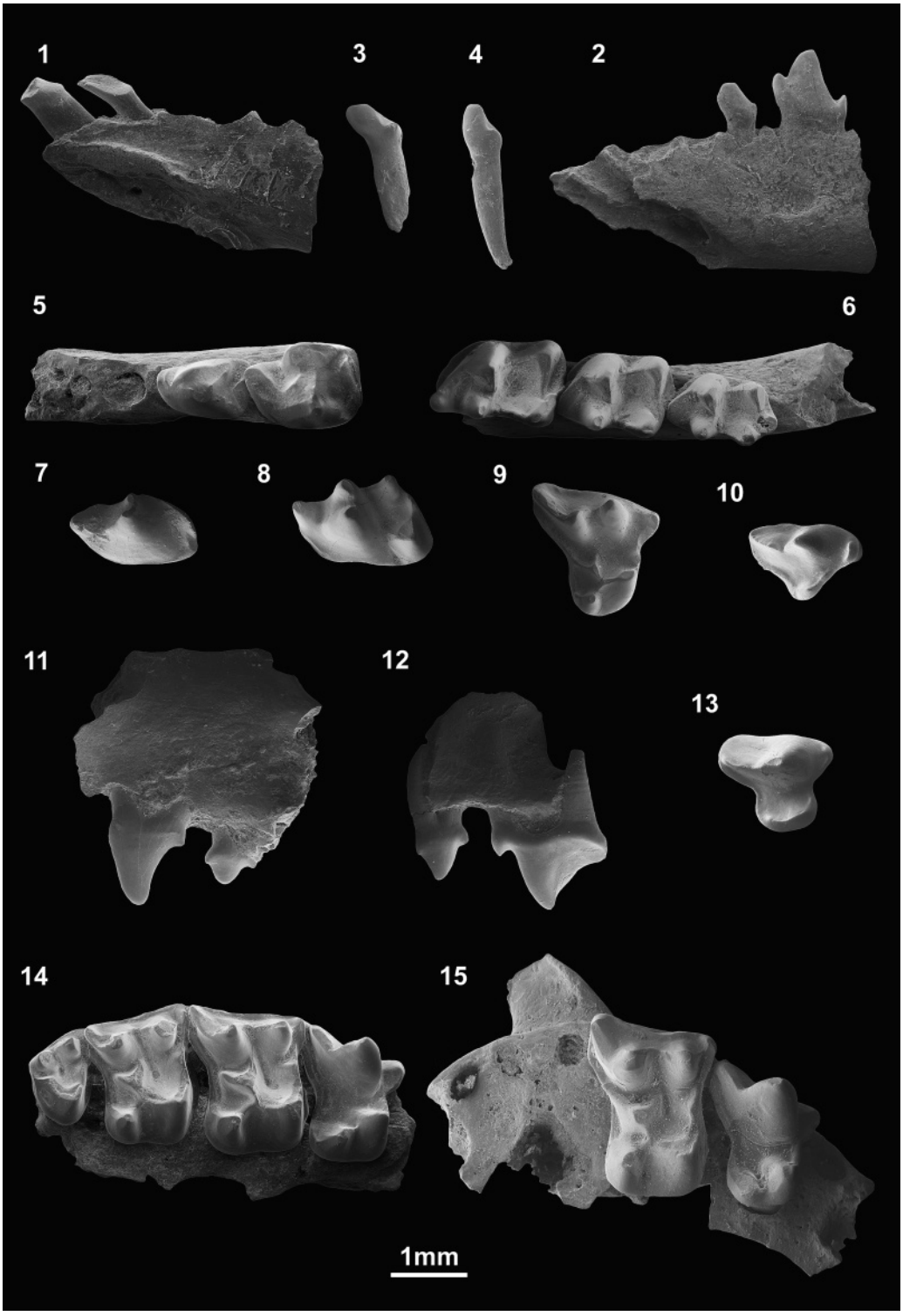
Lower molars: The m1 and m2 have wide subrectangular occlusal outlines. The trigonid is low and compressed anteroposteriorly; the trigonid and talonid are of subequal width (in m1, talonid usually slightly wider than trigonid). The crestiform paraconid and paracristid are in a rather transverse position; they form a raised shearing crest on m1 while they are lower and oriented more vertically on m2. The protoconid and metaconid are of subequal height and separated by a deep trigonid notch. The high entoconid is tranversely slightly compressed; the entocristid closes the talonid basin lingually. The hypoconulid is absent. The low hypoconid is quickly flattening with wear. The cristid obliqua is low and labial in position. The pre- and postcingulids are wide, the well-

developed ectocingulid is discontinuous at the base of the hypoconid. The m3 is marked by a prominent salient hypoconulid (as evidenced from sharp casts, the allegedly absent hypoconulid of the single available m3 of "*Ictopidium tatalgolensis*" (SULIMSKI, 1970: fig. 1A) is actually broken off). The talonid of m3 is slightly reduced in width, otherwise m3 is morphologically similar to m2.

Upper molars: The M1 and M2 are extended transversely and have a subrectangular occlusal outline. The subequal paracone and metacone are well separated. The centrocrista is low, the postmetacrista is high, and the preparacrista is reduced to a faint longitudinal ridge. The paraconule is small to indistinct, in some specimens there is a faint suggestion of the postparaconule crest. The metaconule and the metaconule crests are strong; the premetaconule crest meets the anterior face of the metacone. The protocone is anteroposteriorly compressed and sharp. The smaller and lower hypocone of M1 is usually connected by a narrow ridge with the postprotocrista; in M2, the hypocone is either connected or isolated. The trigone basin is deep. The ecto-, pre-, and postcingula are narrow yet continuous. The small M3 has a subtriangular outline. The hypocone and postmetacrista are absent. The metaconule is usually distinct and very short metaconule crests can be present. The precingulum is continuous, the postcingulum restricted to the base of the postprotocrista.

Deciduous dentition (unicuspids excluded from descriptions): The d3 has a subtrigone structure. The sharp protoconid is twinned with the lower metaconid and the paraconid is low. The unicuspid distal heel slopes labially. The ectocingulid is very weak. The d4 is molariform. The subequal protoconid and metaconid are close together and their apices are separated by a distinct notch. The paraconid is protruding anteriorly and its apex is raised. The entoconid is conical and higher than the hypoconid. There is a faint suggestion of a hypoconulid. The cristid obliqua is short and low. The precingulid is well developed, the ectocingulid is absent.

Fig. 4: *Zaraalestes minutus* (Matthew & Granger, 1924): **1:** Right mandibular fragment with i1-i2, lingual view, Taatsiin Gol right (sample TGR-A/14, biozone B, NHMW 2006z0172/0001); **2:** Left mandibular fragment with p2-p3, labial view, Tatal Gol (sample TAT-HÜ/1, biozone A, NHMW 2006z0121/0001); **3:** Left ?i3, labial view, Tatal Gol (sample TAT-C/2, biozone A, NHMW 2006z0123/0001); **4:** Left ?c, labial view, Tatal Gol (sample TAT-C/2, biozone A, NHMW 2006z0123/0002); **5:** Left dentary fragment with p3-p4, occlusal view, Tatal Gol (sample TAT/D1, biozone A, NHMW 2006z0121/0002); **6:** Right dentary fragment with m1-m3, occlusal view, Tatal Gol (sample TAT/D1, biozone A, NHMW 2006z0121/0003); **7:** Left d3, occlusal view, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0174/0003); **8:** Left d4, occlusal view, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0175/0001); **9:** Right D4, occlusal view, Taatsiin Gol right (sample TGR-B/1, biozone B, NHMW 2006z0174/0001); **10:** Right D3 in occlusal view, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0174/0003); **11:** Left maxilllary fragment with C2-P2, labial view, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0174/0006); **12:** Left maxilllary fragment with P2-P3, labial view, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0174/0002); **13:** Right P3, occlusal view, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0174/0005); **14:** Rigth maxillary fragment with P4-M3, occlusal view, Taatsiin Gol right (sample TGR-B/1, biozone B, NHMW 2006z0175/0002)); **15:** Right-maxillary fragment with P4-M1, occlusal view; hypocone region damaged, Taatsiin Gol right (sample TGR-AB/22, biozone B, NHMW 2006z0174/0007).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1mm

The D3 has a subtriangular occlusal outline. The sharp postparacrista is separated by a notch from the sharp metacrista. The mesial part of the metacrista is raised to form some sort of a crest-like metacone. The protocone lobe is of fairly large size and the protocone itself is rather small. The parastyle is an anteroposteriorly compressed low cusp. The lingual cingula are well developed. The D4 (length x width of a single complete specimen = 1.73 x 1.54) is molariform. The paracone and metacone are in a twinned position and sparated by a V-shaped notch. The centrocrista is well developed, the postmetacrista is high and sharp, and the preparacrista is absent. The small hypocone is connected by a ridge with the postprotocrista. The conules are very small. The high postmetaconule crest is continuous with the postcingulum and the short premetaconule crest meets the base of the metacone. The parastyle is of moderate size and its apex raised.

D i s c u s s i o n : The description focuses on the general morphological design and disregards a very detailed consideration of morphological variation. The samples of *Zaraalestes minutus* from biozones A and B represent certainly a phylogenetic lineage which is marked by a couple of evolutionary changes. Apomorphic characters by which specimens from Zone B differ from Zone A samples, include: Relative size increase of p3/P3, a strong tendency to loose p1, the stronger development of the p3 paraconid and p4 entoconid, the development of a hypocone-protocone connection on P4, and the development of a postprotocrista on P4. The latter derived features contribute to the molarisation of the posterior antemolar dentition. These differences within the *Z. inutes* lineage in our opinion do not require, however, taxonomic distinction.

On the other hand, there are some *Zaraalestes* specimens from biozone B which appear to lie above the size range of a single species, *Z. minutus*. They are listed below as *Zaraalestes* sp. and this sample may actually include a few additional specimens now allocated to *Z. minutus*. Apart from size, we can substantiate no differences from *Z. minutus* and leave at the moment the specific status of the large specimens undecided.

A second tupaiodontine species known from the Hsand Gol Formation, *Tupaiodon morrisi* MATTEW & GRANGER, 1924, is still larger than *Zaraalestes* sp. and differs also morphologically in having no ectocingulids on m2 and m3, a large crescentic hypocone on P4, an a small but distinct hypocone on P3.

***Zaraalestes* sp.**

(Fig. 5)

M a t e r i a l :

Biozone B, samples DEL-B/7, TGR-AB/22, TGR-AB/21. – 1 dentary fragment with p2-p3, one dentary fragment with p4, 1 m2, 1 m3, 1 P3, 1 P4 (NHMW 2006z0190/0001, 2006z0190/0002, 2006z0190/0003, 2006z0191/0001).

M e a s u r e m e n t s (length x width or length x trigonid width x talonid width):

p4 1.86 x 1.25; m2 1.96 x 1.33 x 1.28; m3 1.76 x 0.99 x 0.94; P3 1.78 x 1.48, P4 1.88 x 1.85.

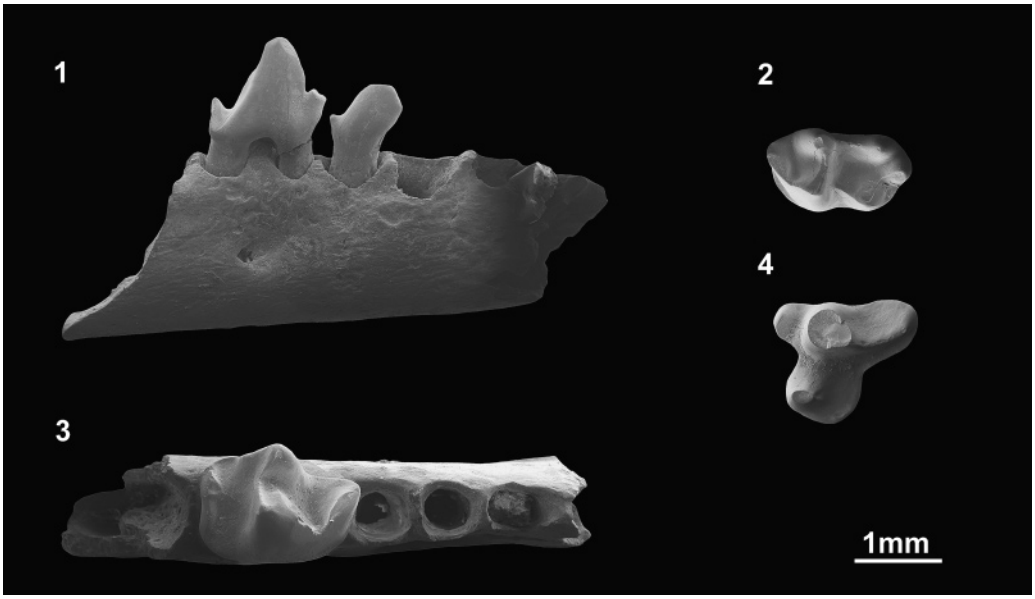


Fig. 5: *Zaraalestes* sp.: **1:** Right mandibular fragment with p2-p3, labial view, Taatsiin Gol right (sample TGR-AB/21, biozone B, NHMW 2006z0190/0001); **2:** Left m3, occlusal view, Taatsiin Gol right (sample TGR-AB/21, biozone B, NHMW 2006z0190/0003); **3:** Right mandibular fragment with p4, occlusal view, Del (sample DEL-B/7, biozone B, NHMW 2006z0191/0001); **4:** Left P3, occlusal view, Taatsiin Gol right (sample TGR-AB/21, biozone B, NHMW 2006z0190/0002).

4.2.1.2. Subfamily Brachyericinae BUTLER, 1948

Genus *Exallerix* MCKENNA & HOLTON, 1967

Type species: *Exallerix hsandagolensis* MCKENNA & HOLTON, 1967

***Exallerix pustulatus* nov. spec.**
(Fig. 6.1–6.2)

E t y m o l o g y : *pustulatus*, Latin = covered with tubercles, in allusion to the richly ornamented teeth.

H o l o t y p e : Right dentary fragment with m1-m2, and alveoli of i1-p4 (mesial extremety of m1 slightly damaged; NHMW 2006z0192/0001, Fig. 6.1a-b).

M e a s u r e m e n t s of holotype: m1 >4.20 x 2.47 x 2.55; m2 3.48 x 2.19 x 2.07; m1 Ltal 1.60; m2 Ltrig 1.92; Ltal 1.56; H of ramus below m1 (lingually) 5.2.

T y p e l o c a l i t y : Taatsiin Gol right, Valley of Lakes, Central Mongolia, Section TGR-C/1 (HÖCK et al. 1999).

T y p e s t r a t u m : Hsanda Gol Formation.

A g e : Late Oligocene, biozone C sensu HÖCK et al. (1999).

O c c u r r e n c e : Sample TGR-C/1, Hsanda Gol Formation, biozone C.

P a r a t y p e : One left p4; NHMW 2006z192/0002 (Fig. 6.2a-b), Strato- and topotypic, sample TGR-C/1.

M e a s u r e m e n t s of paratype: p4 2,51 x 1,59

D i a g n o s i s : Small-sized; p4 with three-cusped trigonid; p3 present; p4-m2 with extreme enamel ornamentation on labial sides; crowns of p4-m2 strongly exoedaenodont; "masseteric ridge" on mandibular ramus prominent and strong.

D i f f e r e n t i a l d i a g n o s i s : *Exallerix pustulatus* nov. spec. is distinguished from all brachyericine taxa except *Exallerix hsandagolensis, E. efialtes* LOPATIN, 1996, and apparently, *E. manahan* LOPATIN & ZAZHIGIN, 2003 by the presence of p3 (lower dental formula 2-1-2-2). Differs from all nominal brachyericine taxa by the presence of a metaconid on p4, differs from all taxa except *Metexallerix junggarensis* BI, 1999 (BI 1999, 2000), *Brachyerix* MATTHEW, 1933 and *Metechinus* MATTHEW, 1929 by the presence of a paraconid on p4. Distinguished from all brachyericine taxa by the extreme development of the embossed sculpturing on the labial sides of p4-m2 (in *E. hsandagolensis*, only two rows of enamel knobs; in *E. efialtes*, one row; in *E. manahan* and *Synexallerix otus* LOPATIN & ZAZHIGIN, 2003, the tubercles are fused to form an ectocingulid; in *Metexallerix gaolanshanensis* QIU & GU, 1988, *M. junggarensis*, and *Postexallerix* LOPATIN & ZAZHIGIN, 2003, the tubercles are largely or completely reduced). The North American taxa lack an ornamentation. Moreover, the trigonid of m1 of *E. tuberculatus* nov. spec. is clearly less extended anteroposteriorly and relatively wider transversely than in other brachyericines (cf. LOPATIN & ZAZHIGIN 2003, RICH 1981). However, precise quantitative data such as length:width ratios are not available because of the incompleteness of the anterior extremity of the tooth.

Scymnerix tartareus LOPATIN, 2003 also shows an ornamentation of rows of enamel knobs on p4-m2. It is, however, clearly distinct from brachyericines by erinaceine features of the skull, mandible, and dentition and was assigned to a new erinaceine tribe, Scymnericini, by LOPATIN (2003a).

D e s c r i p t i o n : Lower jaw: The horizontal ramus is shortened, heavy, and deep. The mental foramen is funnel-shaped and located below the anterior extremity of m1. A prominent strong ridge ("masseteric ridge" of MCKENNA & HOLTON 1967) starts below the anterior root of p4 and passes above the mental foramen down to the ventro-labial edge of the ramus to follow it posteriorly. Dorsally to this ridge there is a broad concavity. A rugose muscle scar extends along the ventral edge of the ramus from below the mental foramen anteriorly. A longitudinal groove occupies the ventral edge posteriorly to this ridge.

There are six alveoli in front of m1. The first, the i1 alveolus, is hypertrophied. The tooth homologies for Brachyericinae follow MCKENNA & HOLTON (1967). The second alveolus, presumably of i2, is very small and displaced labially. The third to sixth alveoli are subequal in diameter and likely house single-rooted c and p3 and a double-rooted p4. The p4 alveoli are compressed anteroposteriorly. All alveoli, including those of m1 and m2, are strongly inclined labially, resulting in a distinctly more ventral position of their labial margins relative to the lingual ones.

Dentition: The dental formula is 2-1-2-2. The teeth are strongly exoedaenodont (i. e., the enamel of the labial crown base overhangs the mandible conspicuously), the crowns

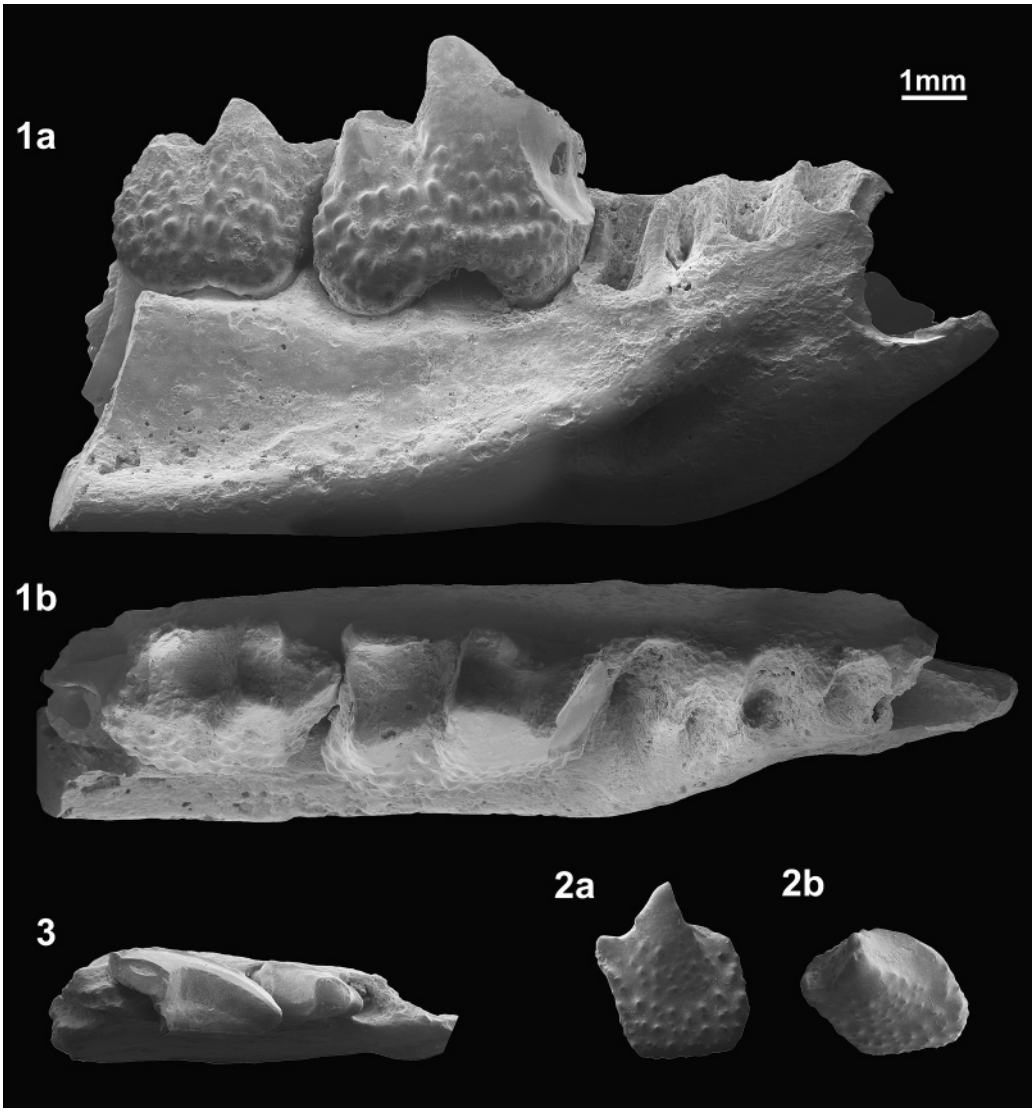


Fig. 6: *Exallerix tuberculatus* nov. spec.: **1:** Right dentary fragment with m1-m2 (holotype), a. labial view; b. occlusal view; Taatsiin Gol right (sample TGR/C1, biozone B, NHMW 2006z0192/0001); **2:** Left p4 (paratype), a. labial view; b. occlusal view, Taatsiin Gol right (sample TGR/C1, biozone B, biozone B, NHMW 2006z0192/0002); **3:** *Exallerix* sp., left dentary fragment with p4-m1-trigonid, occlusal view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0193/0001).

are thus labially considerably higher than lingually, and the labial base of m1 and m2 appears slightly swollen. The teeth show an extremely rich ornamentation. Circular enamel knobs on the labial and postero-labial side provide a raspberry-like appearance of m1 and m2.

m1 and m2: There are three to four longitudinal rows of enamel knobs which are nearly parallel and slightly undulating. The lines are complemented by various irregular knobs. Free of the embossed sculpturing are only the apices of the proto- and hypoconid. Postcingulids are absent. m1: The trigonid is lingually open. The talonid is slightly wider than the trigonid. The mesial wall of the trigonid is partly damaged and the exact length cannot be taken. From its preserved enamel base it is obvious, however, that the paralophid was slightly bent mesio-lingually, similar to *E. hsandagolensis* (McKenna & Holton 1967: Fig. 2). The protoconid is the highest and most voluminous cusp. The metaconid is very close to the protoconid and its apex is slightly farther forward than the apex of the protoconid. Both apices are separated by a shallow depression. The entoconid is higher than the hypoconid; it is laterally compressed and meets anteriorly the well-developed metastylid. The talonid lacks a hypoconulid. m2: The trigonid is relatively shorter and the talonid more reduced. The apices of the proto- and metaconid are better separated than on m1. The embossed posterior wall of the hypoconid is protruding distally. The talonid is closed lingually by the laterally compressed entoconid and the entocristid. The hypoconid region is low and flat. The hypoconulid is absent.

p4: The laterally compressed tooth is reduced in size as compared to the molars. It differs from other brachyericine taxa in having a three-cusped trigonid. The dominating main cusp, the protoconid, is centered over the anterior root. The small bud-like metaconid is closely attached to the lingual wall of the protoconid; both apices are separated by a shallow depression. The low paraconid is slightly compressed anteroposteriorly and forms the mesio-lingual extremity of the crown. It is distally separated from the protoconid by a shallow transverse valley. Labially, the crown dips sharply down to give rise to an extremely deep labial side which is almost completely covered by the embossed sculptering. A cingular ridge starts with a minute cuspule below the metaconid and passes down disto-labially to the posterior edge of the crown. The distal heel is strongly inclined labially and without cusps. There is a faint suggestion of an entocingulid.

D i s c u s s i o n : We make no attempts to determine the affinities of the Asian brachyericine genera and to re-consider their taxonomic rank because their fossil record is quite often very poor. Thus, we cite the taxa (see the above differential diagnosis) as originally described.

***Exallerix* sp.,** probably new
(Fig. 6.3)

M a t e r i a l :

Biozone D, sample UNCH-A/3 – 1 mandibular fragment with p4, trigonid of m1, alveolus of i1, and 3 alveoli between i1 and p4 (NHMW 2006z0193/0001).

M e a s u r e m e n t s :

p4	1.56 x 1.02	
m1	TrW	1.45

D e s c r i p t i o n : The horizontal ramus is short and deep. A groove extends on the labial side from below p4 posteriorly. The alveolus of i1 is greatly enlarged and terminates posteriorly below the protoconid of m1. There are three alveoli between i1 and p4 (presumably of i2, c, and p3), the anterior one being small and short, the second small

and displaced labially, and the third large in diameter. p4 is double-rooted, and the anterior root of m1 is very strong.

p4 is reduced but not as much as in other *Exallerix* species. The protoconid is rounded and somewhat inflated. The precingulid is slightly raised in the position of a paraconid. There is a minute swelling in the position of a metaconid. The well-developed posterior heel of the tooth lacks cusps. The pre-, ecto- and postcingulid are continuous, the entocingulid is discontinuous at the base of the protoconid.

The trigonid of m1 is extended anteroposteriorly, the paralophid being directed nearly anteriorly. The trigonid basin is open lingually and deeply excavated by wear. The sculptured ectocingulid reaches almost the anterior extremity of the crown and resembles a string of pearls. The ectocingulid is more irregular and not fully complete.

D i s c u s s i o n : The present specimen appears to represent the smallest *Exallerix* taxon described thus far. *Exallerix hsandagolensis* (Tsagan Nor, Hsanda Gol Formation) and *E. efialtes* LOPATIN, 1996 (Early Miocene, Aral Formation of Kazakhstan) differ in having no suggestion of a paraconid and metaconid on p4 and being distinctly larger (in both species, trigonid width of m1 = 2.6 and width of p4 = 2.0; MCKENNA & HOLTON 1967, LOPATIN 1996, LOPATIN 2004c). *Exallerix efialtes* appears to us very similar to the type species in size and morphology. *Exallerix manahan* LOPATIN & ZAZHIGIN, 2003 (Tatal Gol, Hsanda Gol Formation) is substantially larger than *E. hsandagolensis* and *efialtes* (trigonid width of m1 = 3.6; LOPATIN & ZAZHIGIN 2003).

4.2.1.3. Subfamily Erinaceinae FISCHER VON WALDHEIM, 1817

Genus *Palaeoscaptor* MATTHEW & GRANGER, 1924

Type species: *Palaeoscaptor acridens* MATTHEW & GRANGER, 1924

Palaeoscaptor acridens MATTHEW & GRANGER, 1924
(Fig. 7)

1924 *Palaeoscaptor acridens*, new genus and species; MATTHEW & GRANGER, p. 2, fig 2.
1970 *Amphechinus* (*Palaeoscaptor*) *acridens* (MATTHEW & GANGER, 1924); SULIMSKI, p. 61-63; pl. XVIII, figs 7-8; pl XIX, figs 1-3, text-figs 1 G-J, 2 B.
1984 *Palaeoscaptor acridens* MATTHEW & GRANGER, 1924; HUANG, p. 305-306, pl. 1, fig. 1-3

M a t e r i a l :

Biozone A, samples HL-A/1, SHG-C/2, TAT-C1, TAT, C/2, TAT-C/3, TAT-D/1, TGL-A/2, TGR-A/13. – 10 dentary fragments with teeth, 22 isolated teeth (NHMW 2005z0094/0001,2005z0098/0000,2005z0099/0000,2005z0102/0000,2005z0104/0000-0001, 2005z0106/0000, 2005z0107/0000, 2005z0113/0000).

Biozone B, samples IKH-A/1, IKH-B/2, SHG-AB/17-20, SHG-AB/12, DEL-B/7, SHG, TAT-C/6, TAT-C/7, TGL-A/11c, TGL-A/11, TGL-A11b, TGL-A11, TGR-B/1, TGR-AB/22, TGR-AB/22/1c, TGR-AB/22/2, TGR-AB/21, SHG-A/15, SHG-15+20. – 37 dentary fragments with and without teeth, 7 maxillary fragments with teeth, 199 isolated teeth (NHMW 2005z0096/0000, 2005z0108/0000, 2005z0110/0000, 2005z0219/0000, 2005z0117/0000-0001, 2005z0118/0000, 2005z0119/0000, 2005z0120/0000,

Tab. 5: *Palaeoscaptor acridens*, sample statistics of the teeth

loc., Biozone	meas.	n	R	m	s	V
A	Hum1	8	2.20–3.85	2.90±0.41	0.462	15.9
B	Hum1	11	2.50–3.75	3.14±0.27	0.380	12.1
C	Hum1	9	2.52–3.05	2.83±0.14	0.172	6.07
C1	Hum1	1		2.68		
D	Hum1	2	2.70–3.30	3.00		
A	Lm1-m3	2	6.00–6.00	6.00		
B	Lm1-m3	6	5.48–6.12	5.75±0.29	0.256	4.45
C	Lm1-m3	1		5.70		
B	Li3	2	0.89–0.98	0.94		
	Wi3	2	0.66–0.71	0.69		
B	Li3/p2	25	0.78–1.09	0.95±0.03	0.082	8.61
	Wi3/p2	25	0.53–0.76	0.65±0.02	0.057	8.85
C	Li3/p2	1		1.29		
	Wi3/p2	1		0.83		
A	Lcinf.	1		1.32		
	Winf.	1		0.59		
B	Lcinf.	14	1.31–1.48	1.38±0.03	0.052	3.75
	Winf.	14	0.61–0.77	0.68±0.03	0.054	8.01
C	Lcinf.	4	1.33–1.52	1.40		
	Winf.	5	0.58–0.74	0.68±0.08	0.061	8.93
D	Lcinf.	1		1.35		
	Winf.	1		0.71		
A	Ld2	1		1.00		
	Wd2	1		0.81		
A	Ld4	2	1.73–1.76	1.75		
	Wd4	2	0.99–1.00	1.00		
B	Ld4	1		1.74		
	Wd4	1		1.04		
B	Lp2	2	0.83–0.93	0.88		
	Wp2	2	0.49–0.62	0.56		
C	Lp2	1		0.99		
	Wp2	1		0.73		
A	Lp4	9	1.51–1.92	1.69±0.11	0.140	8.29
	Wp4	9	0.94–1.21	1.08±0.07	0.087	8.09
B	Lp4	18	1.51–1.85	1.72±0.04	0.085	4.97
	Wp4	26	0.97–1.31	1.09±0.03	0.085	7.76
C	Lp4	5	1.65–1.95	1.82±0.17	0.124	6.80
	Wp4	10	0.97–1.21	1.10±0.05	0.073	6.62
D	Lp4	2	1.74–1.81	1.78		
	Wp4	3	1.09–1.13	1.11		

loc., Biozone	meas.	n	R	m	s	V
A	Lm1	7	2.38–2.78	2.63±0.12	0.123	4.88
	Wam1	10	1.28–1.62	1.50±0.08	0.102	6.83
	Wpm1	11	1.36–1.71	1.56±0.07	0.100	6.42
B	Lam1	17	2.31–2.92	2.73±0.09	0.163	5.95
	Wpm1	30	1.35–1.60	1.48±0.02	0.065	4.43
	Wpm1	32	1.37–1.68	1.52±0.03	0.070	4.56
C	Lam1	3	2.57–2.93	2.77		
	Wpm1	5	1.47–1.63	1.53		
	Wpm1	4	1.53–1.64	1.57		
D	Lam1	1		2.88		
	Wpm1	1		1.50		
	Wpm1	1		1.46		
A	Lm2	9	1.89–2.16	2.06±0.07	0.080	3.89
	Wam2	10	1.23–1.46	1.33±0.05	0.071	5.36
	Wpm2	10	1.09–1.31	1.25±0.05	0.067	5.30
B	Lm2	17	1.87–2.14	1.99±0.04	0.080	4.04
	Wam2	25	1.18–1.47	1.29±0.03	0.074	5.76
	Wpm2	23	1.07–1.43	1.24±0.04	0.083	6.67
C	Lm2	7	1.82–2.13	1.93±0.11	0.113	5.85
	Wam2	10	1.14–1.38	1.26±0.06	0.083	6.55
	Wpm2	8	1.16–1.32	1.25±0.05	0.059	4.75
D	Lm2	1		2.16		
	Wam2	2	1.23–1.50	1.37		
	Wpm2	3	1.20–1.45	1.34		
A	Lm3	3	1.26–1.37	1.31		
	Wam3	3	0.76–0.87	0.80		
B	Lm3	21	0.94–1.20	1.02±0.03	0.064	6.33
	Wam3	25	0.58–0.82	0.68±0.01	0.049	7.30
C	Lm3	2	0.97–1.27	1.12		
	Wam3	3	0.70–0.92	0.84		
B	LCsup	2	0.71–0.79	0.75		
	Wcsup	2	0.45–0.47	0.46		
B	LP2	6	0.73–0.97	0.85±0.14	0.099	11.7
	WP2	6	0.42–0.63	0.51±0.12	0.083	16.4
B	LP3	12	1.28–1.47	1.38±0.04	0.067	4.88
	WP3	11	0.92–1.21	1.07±0.08	0.107	10.0
C	LP3	2	1.37–1.38	1.38		
	WP3	1		1.30		
D	LP3	6	1.15–1.27	1.21±0.06	0.049	4.06
	WP3	3	0.95–1.10	1.04		

loc., Biozone	meas.	n	R	m	s	V
A	LP4	2	2.17–2.41	2.29		
	WP4	2	1.91–2.16	2.04		
B	LP4	5	2.30–2.54	2.40±0.12	0.088	3.68
	WP4	8	2.00–2.30	2.13±0.10	0.115	5.39
C	LP4	3	2.05–2.49	2.23		
	WP4	3	1.86–2.19	2.04		
D	LP4	2	2.35–2.51	2.42		
	WP4	2	2.03–2.05	2.04		
A	LbM1	2	2.16–2.19	2.18		
	LliM1	1		1.70		
	WaM1	1		2.54		
	WpM1	1		2.61		
	Wp/Lb	1		120.8		
B	LbM1	10	2.08–2.33	2.18±0.07	0.093	4.24
	LliM1	23	1.69–2.08	1.86±0.04	0.085	4.56
	WaM1	10	2.43–2.80	2.61±0.10	0.135	5.16
	WpM1	10	2.34–2.90	2.66±0.12	0.164	6.15
	Wp/Lb	8	106.4–131.0	119.2±6.9	7.77	6.52
C	LbM1	4	2.05–2.23	2.15		
	LliM1	8	182–1.96	1.88±0.04	0.050	2.66
	WaM1	3	2.33–2.67	2.45		
	WpM1	3	2.42–2.83	2.61		
	Wp/Lb	3	113.1–126.9	121.8		
D	LbM1	2	2.19–2.31	2.25		
	LliM1	8	1.71–1.98	1.86±0.07	0.083	4.43
	WaM1	2	2.34–2.58	2.46		
	WpM1	2	2.53–2.76	2.66		
	Wp/Lb	2	119.5–122.4	120.9		

loc., Biozone	meas.	n	R	m	s	V
A	LbM2	2	1.62–1.69	1.66		
	LliM2	2	1.29–1.33	1.31		
	WaM2	2	2.20–2.23	2.22		
	WpM2	1		1.71		
	Wa/La	2	132.0–135.8	133.9		
B	LbM2	17	1.42–1.82	1.62±0.06	0.113	6.99
	LliM2	21	1.16–1.60	1.32±0.06	0.108	8.18
	WaM2	18	1.95–2.50	2.21±0.08	0.150	6.78
	WpM2	18	1.46–1.89	1.65±0.07	0.129	7.83
	Wa/La	16	128.2–145.3	137.5±2.77	5.036	3.66
C	LbM2	7	1.55–1.71	1.63±0.06	0.060	3.67
	LliM2	10	1.21–1.56	1.39±0.08	0.105	7.54
	WaM2	9	2.09–2.32	2.24±0.06	0.070	3.12
C	LbM2	7	1.55–1.71	1.63±0.06	0.060	3.67
	LliM2	10	1.21–1.56	1.39±0.08	0.105	7.54
	WaM2	9	2.09–2.32	2.24±0.06	0.070	3.12
	WpM2	8	1.57–1.93	1.75±0.11	0.129	7.36
	Wa/La	7	125.9–144.0	136.9±5.9	5.857	4.28
D	LbM2	3	1.46–1.66	1.54		
	LliM2	4	1.14–1.37	1.26		
	WaM2	2	1.95–2.22	2.09		
	WpM2	3	1.50–1.64	1.55		
	Wa/La	2	130.9–133.7	132.3		
B	LM3	9	0.35–0.54	0.46±0.05	0.062	13.6
	WaM3	9	0.95–1.21	1.04±0.07	0.086	8.27
C	LM3	1	1	0.54		
	WaM3	1	1	1.14		

2005z0122/0000, 2005z0124/0000, 2005z0125/0000, 2005z0131/0000, 2005z0133/0000-0006, 2005z0133/0000-0002, 2005z0136/0000, 2005z0138/0000, 2005z0139/0000).

Biozone C, samples TGR-C/1, TAR-A/2, TGW-A (surface), TGW-A/2a, TGW-A/2b, TGR-C/1b, TGR-C/1, TGR-C/2, TGR-Bad 5. – 7 edentulous dentary fragments, 4 dentary fragment with teeth, left maxillary fragment with P4-M1, 60 isolated teeth (NHMW 2005z0143/0000, 2005z0147/0000, 2005z0149/0000 (surface sampling), 2005z0153/0000, 2005z0155/0000, 2005z0159/0000, 2005z0220/0000, 2005z0164/0000, 2005z0168/0000, 2005z0169/0000, 2005z0171/0000, 2005z0178/0000, 2005z0130/0000).

Biozone C1, sample DEL-B/12. – left dentary fragment with broken i2 and two alveoli for p2 (NHMW 2005z0200/0000)

Biozone D, sample UNCH-A/3 (represents a mixed fauna B+D). – left dentary with p4, right dentary with m2, left maxillary fragment with P3-P4, 29 isolated teeth (partly fragments) (NHMW 2005z0206/0000).

M e a s u r e m e n t s : see Tab. 5, Diagr. 1.

D e s c r i p t i o n : In the homologisation of the antemolars we follow LECHE (1902). Consequently, the large incisor is the i2, followed by i3, the canine, p2 and p4, given that only two lower premolars are present.

Dentary – Only the horizontal rami are preserved. Some yield information on the position of the mental foramen and/or the number of teeth anterior to p4. In the specimens from biozone A the mental foramen is under p2 (3 specimens), under p2/4 (3) and under p4 (0). The corresponding shares for biozone B are: p2 (4), p2/p4 (12), p4 (2); for biozone C: p2/p4 (3), p4 (1). In biozone D there is only one dentary fragment with the mental foramen below p2/p4. There is also some variability concerning the number of premolars (Tab. 6). In biozone A all four relevant specimens have p2 and p3. Two out of three p2 have two closely spaced roots, one is single-rooted. In biozone B 5 dentaries only have a single-rooted p2, three specimens additionally have p3. In one of them either p3 or p2 is double-rooted. Two dentaries from biozone C have no p3, but a double-rooted p2. In biozone D there are one dentary without p3 but a double-rooted p2 and four single-rooted p2. There may be a short diastema either between p4 and p2 or between p2 and canine. But in most dentaries the teeth are closely spaced. In biozone C1 there is only one edentulous dentary fragment with two closely spaced alveoles between p4 and canine, obviously for a double-rooted p2. The mental foramen is situated under p2/p4. The specimen is only slightly smaller than the other dentaries referred to this species.

Tab. 6: Tooth formula, root number of p2, and position of the mental foramen in various samples of *Palaeoscaptor acridens*.

Biozone	tooth formula		p2		mental for. below		
	2133	2123	2-rooted	1-rooted	p2	p2/4	p4
A	4	0	3	1	3	3	0
B	3	10	1	5	4	12	2
C	0	2	2	0	0	3	1
D	0	1	1	0	0	1	

Lower teeth – The caniniform i2 is laterally compressed with a convex buccal face and an even lingual side. Only some fragments are available. The single-rooted i3, the canine and the p2 differ mainly in size. They are implanted increasingly procumbent, this means that the root is only slightly directed posteriorly in the p2, more in the canine and even more in the i3. The size relation is p2<i3<c. The canine is almond-shaped in occlusal outline, i3 and p2 are rather rounded. There are no cingulids. The p3 are only known by their alveoli and expected to be similar to the p2. Not all of these anterior teeth can be differentiated from one another and from those of smaller and larger *Palaeoscaptor* species.

In the p4 the conical paraconid is somewhat lower than the protoconid. The metaconid is quite variable in size. In most p4 it is a slight swelling on the lingual border of the protoconid, in some it is a cuspule attached lingually. There is a marked postcingulid

and faint ectocingulid. In the m1 and m2 the paralophid is notched. The marked precingulid merges into the equally developed ectocingulid. The postcingulid fades into the entoconid. All m3 are clearly double-rooted, with more or less spaced roots. The heel is quite variable in size, but consistently better developed than in *P. rectus*, where it is reduced to a mere postcingulid.

Maxillary – Some fragments preserve the origin of the zygomatic arch above M1 and a large infraorbital foramen above P3. These fragments yield no further information.

Upper teeth – The upper teeth have been associated with the lower teeth on grounds of matching size and quantities. Though being without reasonable alternative, the association remains tentative. P2-M3 are preserved and identifiable. The P2 is double-rooted and has a distal crest, and a mesial and distal basal cuspule each. The P3 has a lingual heel with a protocone and a more or less projecting parastyle. In the P4 there are two lingual cusps and a long shearing postparacrista. The posterior side is emarginated. In most M1 the metaconule is no cup, but is fully merged in the prolongation of the postprotocrista. There is not postmetaconule-crista. There is a narrow groove between preproto-crista and paracone. With respect to the course of the preproto-crista, the morphology of the metaconule, and in the absence of a postmetaconule-crista the M2 is quite similar to the M1. Its hypocone is more conical. Nearly all M3 have no vestige of a metacone. There is only protocone, paracone and parastyle. Only one specimen (biozone B 4426 I6) has a triangular occlusal outline and a distal cusp, the metacone.

D i s c u s s i o n : *Palaeoscaptor acridens* was described by MATTHEW & GRANGER (1924: 2) on the basis of a dentary fragment with p4-m3 from the Hsanda Gol formation east of Loh in Mongolia. The type clearly shows the well-developed heel of the m3 and the antero-posteriorly not compressed trigonid of m1. RICH & RASMUSSEN (1973, fig. 5, 6, tab. 2) figure *P. acridens* from the same period and area as the type and also present some measurements of the teeth. Their figure also shows the heel of m3, the well-developed ectocingulid of the lower molars and a double-rooted p2. BOHLIN (1942) referred *Palaeoscaptor* to the genus *Palaeoerinaceus* FILHOL, 1879. BUTLER (1948) placed *Palaeoerinaceus* and *Palaeoscaptor* in *Amphechinus* AYMARD, 1849. SULIMSKI (1970) published material from the Tatal Gol and Loh area, which was collected by a Polish-Mongolian Palaeontological Expedition. He downgraded *Palaeoscaptor* to a subgenus of *Amphechinus*. RICH & RASMUSSEN (1973) retained the nomen *Palaeoscaptor* as a genus. We also think that a generic separation between *Amphechinus* and *Palaeoscaptor* is warranted. The apomorphic character of *Amphechinus* is the single-rooted m3, whereas the m3 *Palaeoscaptor* retaines two roots.

There is no clear-cut size trend in the succession of the samples. The lower teeth from biozone C are on an average larger than in biozone A or B. But this size relationship is not reflected in the upper teeth. The differences in tooth size are merely accidental. But the dentaries of biozone A are weaker than most others. One dentary with p4-m2 from biozone A (no 3815 A1) is only tentatively included here. In its low mandibular height (2.20 mm) it fits better *P. minutus*, but in the molar size it agrees well with the remainder of the sample. This specimen is intermediate in size. The strongest specimens come from biozone B. The number of lower premolars and the root number of p3 also do not underlie a clear trend. The occurrence of a p2 seems to be restricted to the older samples of biozones A and B. The majority of single-rooted, thus more reduced p3 in biozone B is conspicuous.

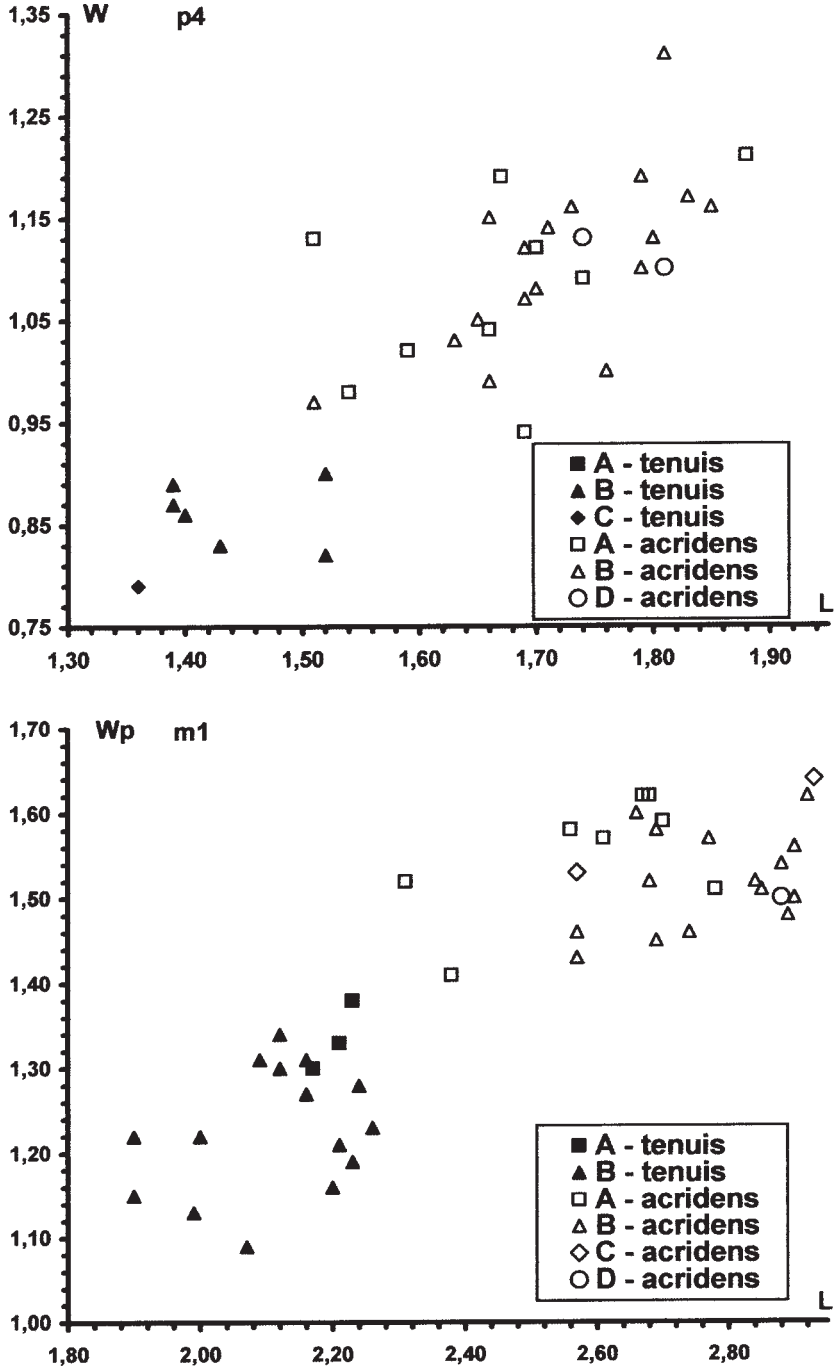


Diagram 1a: *Palaeoscaptor* species from biozones A, C, C1 and D, scatter diagram of the length and width of p4 and m1.

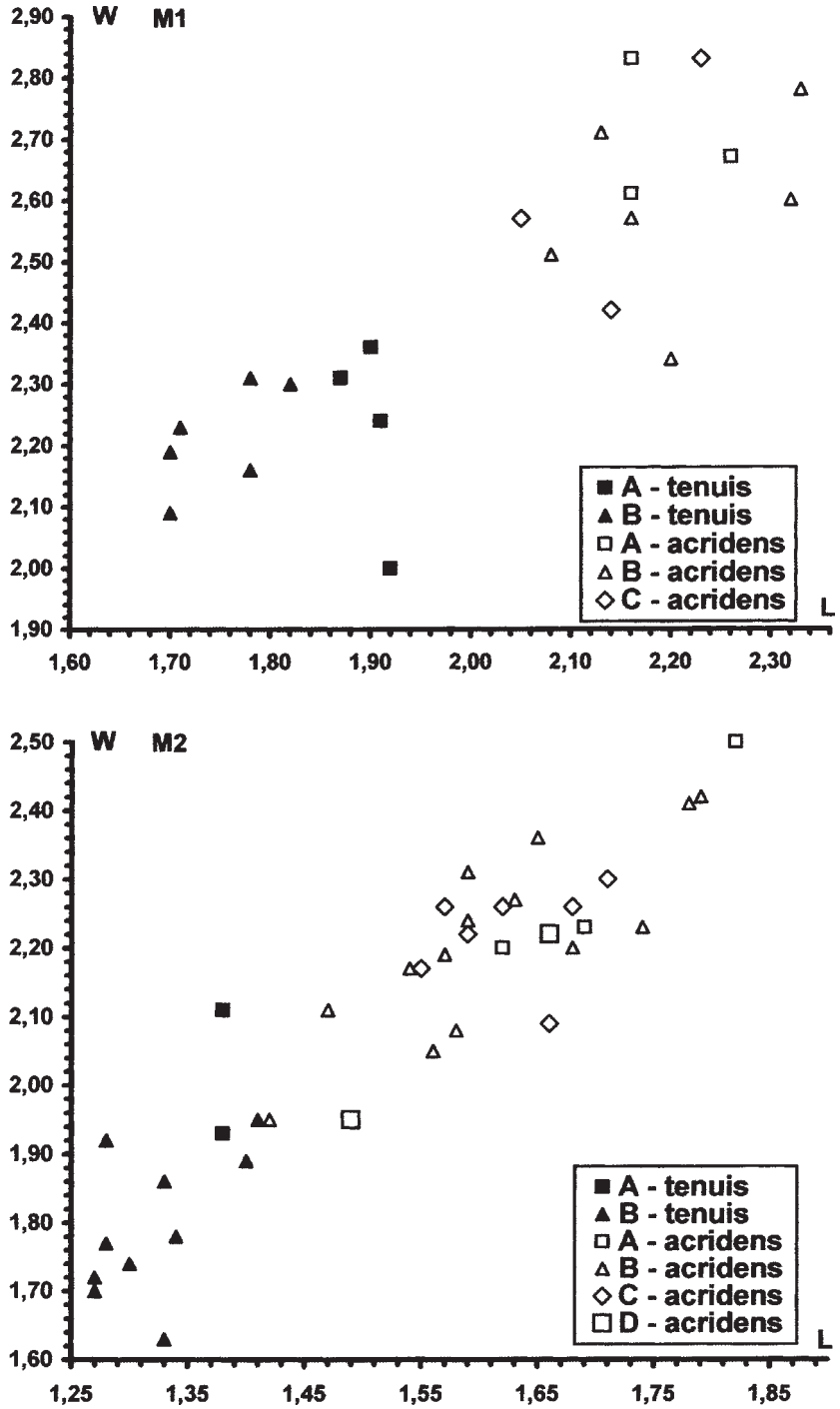
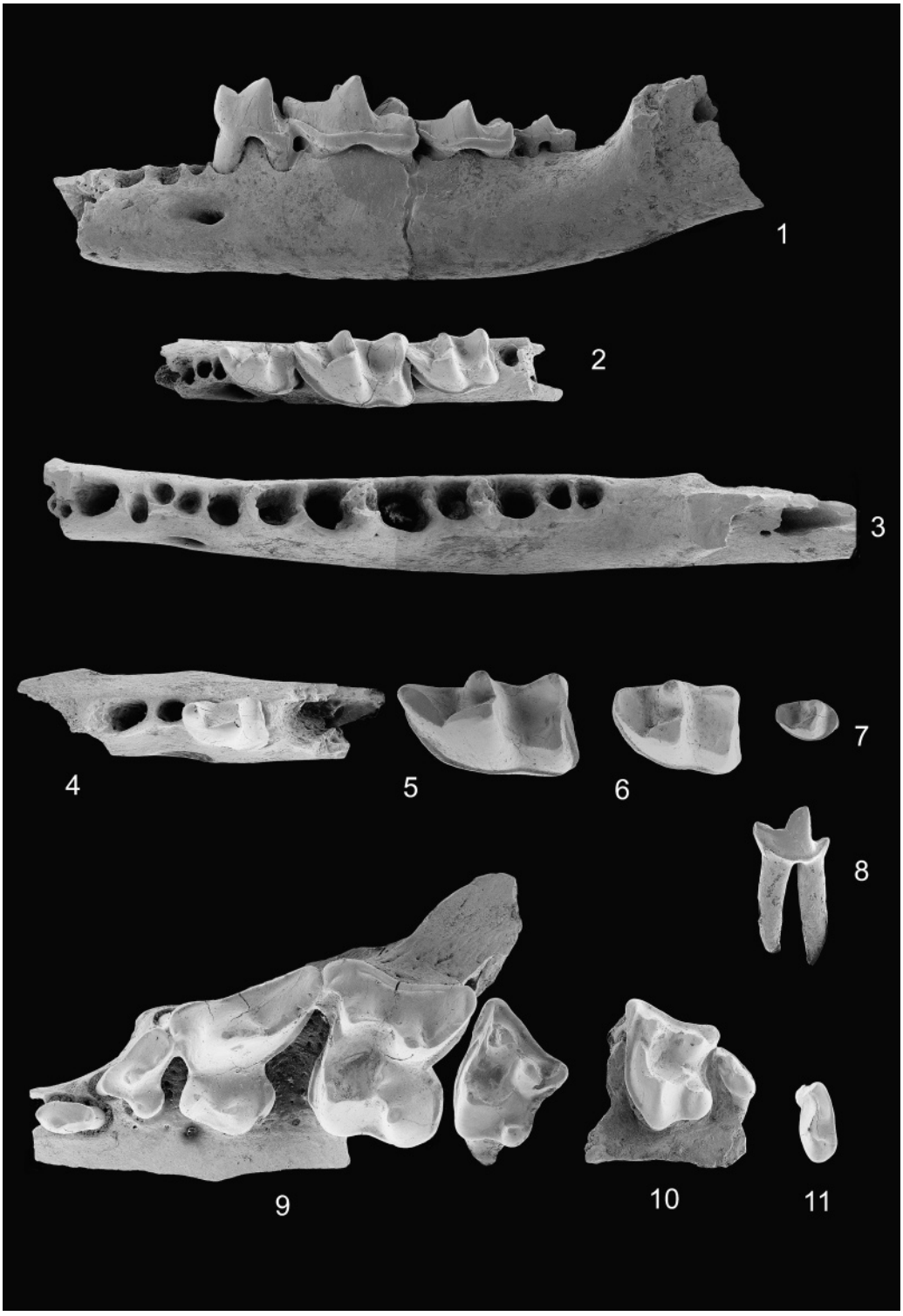


Diagram 1b: *Palaeoscaptor* species, scatter diagram of the length and width of M1 and M2.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There are only few comparative measurements available, hardly any for the upper dentition. The upper M1 and M2 match in size well *P. acridens* from the Tsagan Nor Basin. (AMNH 22080, see RICH & RASMUSSEN 1973, tab. 1, tab. 2, fig. 6) These authors also figure an upper jaw with P3-M3. The M3 has a metacone and is triangular in occlusal outline. This unreduced type of M3 is the absolute exception in the present samples (1 out 25 in biozone B). The present p4 seem to be slightly smaller. But m1 and m2 of AMNH 22080 lie within the range of the samples under study. The eight dentaries with their teeth of *P. acridens* from Tatal Gol and Loh, collected by the Polish-Mongolish expedition, do not differ significantly in size from the specimens under study (SULIMSKI 1970, tab. 4). A dentary with m1-m3 from the Middle Oligocene of Ulantatal, Alxa Zouqi, Nei Mongol lies in the size of m1 and m2 in the lower part of the range of our specimens, but its m3 is larger (HUANG 1984, tab. 1).

Summarising the evidence, all samples under study can be referred to *Palaeoscaptor acridens* without restriction. In all samples *P. acridens* is by far the most common *Palaeoscaptor* species.

Palaeoscaptor cf. *rectus* MATTHEW & GRANGER, 1924
(Fig. 8)

1924 *Palaeoscaptor rectus*, new species; MATTHEW & GRANGER, p. 3
1926 *Palaeoscaptor* (*Erinaceus*?) *acridens* MATTHEW; TEILHARD DE CHARDIN, P, p. 7-8, fig. 3, pl. 1/1.
non 1942 *Palaeoerinaceus* cf. *rectus* MATTHEW & GRANGER; BOHLIN, p. 19
1970 *Amphechinus (Palaeoscaptor)* cf. *rectus* (MATTHEW & GRANGER, 1924); SULIMSKI; p. 63, pl. XIX, fig. 4; text-fig. 1A, C
1984 *Amphechinus rectus* MATTHEW & GRANGER, 1924; HUANG; p. 306-308, pl. l, fig. 4-11.
1984 *Amphechinus* cf. *rectus* MATTHEW & GRANGER, 1924; HUANG; p 308, pl. 1, fig. 12

M a t e r i a l :

Biozone A, sample TAT/D1. – right dentary with p4 (NHMW 2005z0112/0000).

⇦ Fig. 7: *Palaeoscaptor acridens*: **1:** Right dentary fragment with p4-m3, buccal view, Tatal Gol Hügel (sample TAT-D/1, biozone A, NHMW 2005z0104/0001), ca. 7.5x; **2:** Left dentary fragment with p4-m2, occlusal view, Khongil (sample HL 1, biozone A, NHMW 2005z0094/0001), ca. 7.5x; **3:** Left edentulous dentary fragment showing the three alveoles of p2 and p3, occlusal view, Hsanda Gol (sample SHG AB/12, biozone B, NHMW 2005z0117/0001), ca. 7.5x; **4:** Right dentary fragment with p4, occlusal view, Taatsin Gol Right (sample TGR-AB/22, biozone B, NHMW 2005z0133/0001), ca. 7.5x; **5:** Left m1, occlusal view, Taatsin Gol Right (sample TGR-AB/22, biozone B, NHMW 2005z0133/0002), ca. 10x; **6:** Left m2, occlusal view, Taatsin Gol Right (sample TGR-AB/22, biozone B, NHMW 2005z0133/0003), ca. 10x; **7:** Left m3, occlusal view, Taatsin Gol Right (sample TGR-AB/22, biozone B, NHMW 2005z0133/0004), ca. 10x; **8:** Left m3, buccal view, Taatsin Gol Right (sample TGR-AB/21, biozone B, NHMW 2005z0136/0001), ca. 10x; **9:** Right maxillary fragment with P2-M2, occlusal view, Taatsin Gol Right (sample TGR-AB/22, biozone B, NHMW 2005z0133/0005), ca. 10x; **10:** Left maxillary fragment with M2-M3, occlusal view, Taatsin Gol Right (sample TGR-AB/22, biozone B, NHMW 2005z0133/0006), ca. 10x; **11:** Left M3, occlusal view, Taatsin Gol Right (sample TGR-AB/21, biozone B, NHMW 2005z0136/0002), ca. 10x.

Tab. 7: *Palaeoscaptor* cf. *rectus*, (C1 *P.* aff. *rectus*) sample statistics of the teeth.

loc.	meas.	n	R	m	s	V
Biozone B	Hum1	3	3.43–4.30	3.94		
Biozone C	Hum1	7	3.05–4.80	3.84±0.65	0.652	17.00
Biozone C1	Hum1	1		4.50		
Biozone C	Lp4-m3	1		8.60		
Biozone C	Lm1-m3	2	6.80–6.92	6.86		
Biozone B	Li3/p2	9	0.93–1.13	1.05±0.06	0.075	7.12
	Wi3/p2	9	0.66–0.80	0.71±0.04	0.046	6.46
Biozone B	Lcinf.	4	1.58–1.63	1.60		
	Winf.	4	0.74–0.76	0.75		
Biozone C	Lcinf.	3	1.71–2.01	1.84		
	Winf.	3	0.90–1.00	0.95		
Biozone C	Lp2	2	1.21–1.27	1.24		
1-rooted	Wp2	2	0.75–0.77	0.76		
Biozone C1	Lp2	4	1.00–1.24	1.12		
2-rooted	Wp2	4	0.54–0.67	0.60		
Biozone A	Lp4	1		2.20		
	Wp4	1		1.37		
Biozone B	Lp4	1		2.13		
	Wp4	1		1.50		
Biozone C	Lp4	3	1.74–2.07	1.90		
	Wp4	3	1.12–1.41	1.22		
Biozone C1	Lp4	2	2.64–2.64	2.64		
	Wp4	2	1.45–1.58	1.52		
Biozone B	Lam1	2	3.15–3.28	3.22		
	Wpm1	5	1.64–1.85	1.73	0.089	5.12
	Wpm1	4	1.79–2.03	1.87		
Biozone C	Lam1	6	3.02–3.64	3.32±0.24	0.209	6.30
	Wpm1	7	1.53–2.01	1.75±0.18	0.180	10.30
	Wpm1	7	1.54–2.16	1.79±0.23	0.229	12.81
Biozone C1	Lam1	1		3.83		
	Wpm1	2	1.90–2.07	1.99		
	Wpm1	2	1.97–2.14	2.06		
Biozone B	Lm2	6	2.18–2.48	2.29±0.14	0.121	5.29
	Wam2	9	1.40–1.76	1.51±0.11	0.131	8.67
	Wpm2	8	1.38–1.75	1.51±0.12	0.138	9.14
Biozone C	Lm2	6	2.05–2.61	2.35±0.22	0.190	8.06
	Wam2	6	1.32–1.74	1.51±0,16	0.138	9.11
	Wpm2	7	1.27–1.66	1.41±0,13	0.134	9.53
Biozone C1	Lm2	1		2.93		
	Wam2	2	1.73–1.92	1.83		
	Wpm2	2	1.55–1.90	1.73		
Biozone B	Lm3	2	1.21–1.41	1.34		
	Wam3	4	0.81–1.00	0.92		
Biozone C	Lm3	3	1.27–1.48	1.35		
	Wam3	3	0.84–0.92	0.88		

loc.	meas.	n	R	m	s	V
Biozone B	LP2	1		1.29		
	WP2	1		0.70		
Biozone B	LP3	2	1.50–1.59	1.55		
	WP3	1		1.10		
Biozone C	LP3	1		1.50		
	WP3	1		1.28		
Biozone C1	WaP4	1		2.83		
Biozone B	LbM1	1		2.56		
	LliM1	1		2.09		
	WaM1	1		2.96		
	WpM1	1		3.09		
	Wp/Lb	1		120.7		
Biozone C	LiM1	2	2.07–2.15	2.11		
	WaM1	2	2.95–3.32	3.14		
Biozone B	LbM2	3	1.95–2.28	2.10		
	LliM2	3	1.63–1.78	1.70		
	WaM2	3	2.56–2.91	2.74		
	WpM2	3	2.09–2.24	2.15		
	Wa/La	3	127.6–133.3	130.7		
Biozone C	LbM2	2	1.96–1.97	1.97		
	LliM2	1		1.49		
	WaM2	1		2.58		
	WpM2	1		1.90		
	Wa/Lb	1		131.6		
Biozone C1	LbM2	1		1.96		
	LliM2	1		1.73		
	WaM2	1		2.54		
	WpM2	1		2.01		
	Wa/Lb	1		129.6		
Biozone B	LM3	4	0.62–0.72	0.68		
	WaM3	4	1.32–1.48	1.37		
Biozone C	LM3	1		0.52		
	WaM3	1		1.14		

Biozone B, samples IKH-A/1, IKH-B/a, SHG-AB/17-20, TAT-C/7, SHG-A/20. – 5 dentary fragments with teeth, 38 isolated teeth (NHMW 2005z0097/0000, 2005z0109/0000, 2005z0115/0000-0003, 2005z0123/0000-0002, 2005z0141/0000).

Biozone C, samples TGW-A-surface, TGW-A/2a, TGW-A/2b, TGR-C/2, TGR-C/1, TGR-C/Bad 5. – 7 dentary with teeth, right edentulous dentary fragment, 16 isolated teeth (NHMW 2005z0148/0000 (surface sampling**),** 2005z0154/0000-0001, 2005z0160/0000-0001, 2005z0165/0000-0001, 2005z0172/0000, 2005z0129/0001).

Palaeoscaptor aff. r*ectus*

Biozone C1, samples IKH-A/5, RHN-A/7, LOH-C/1, IKH-B/5, DEL-B/12 – left dentary fragment with p4-m2, 6 isolated teeth + 4 double-rooted p2 (NHMW 2005z0173/0000, 2005z0182/0000, 2005z0188/0000, 2005z0189/0000, 2005z0195/0001, 2005z0197/0000).

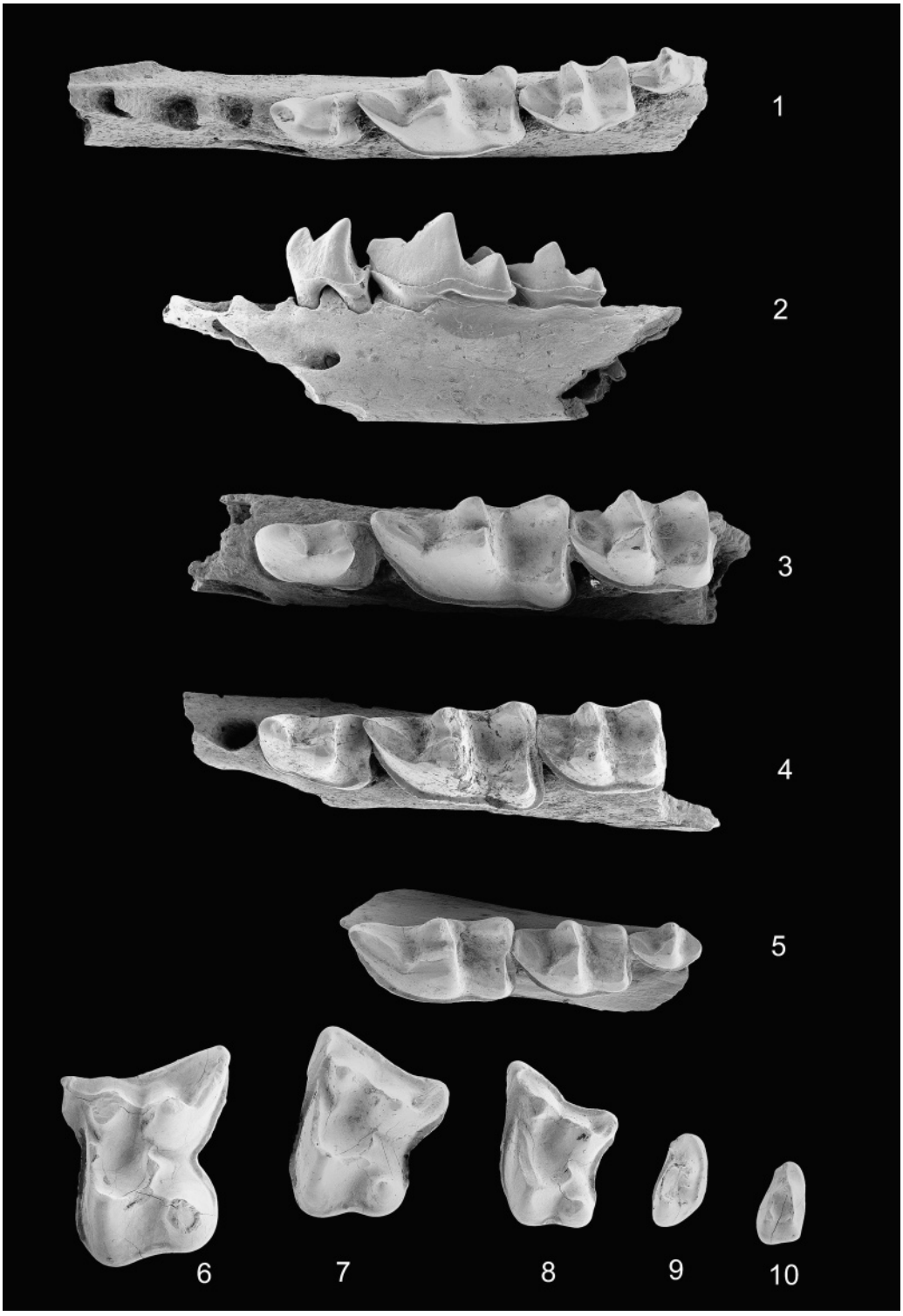
M e a s u r e m e n t s : see Tab. 7.

D e s c r i p t i o n : Here all teeth and dentary fragments larger than in *P. acridens* are lumped together.

Dentary – Three fragments from biozone C (inv. nos. NHMW 2005z0148/0000, 2005z0153/0000, 2005z0165/0001) show the tooth formula 2123 and the single-rooted p2. Eleven other fragments are not informative in this respect. The mental foramen is situated either under the anterior root of p4 (in 6 specimens) or between the roots of p4 (n=3). There is an enormous variability in the height of the dentary ranging from 3.05 to 4.40 mm in biozone C.

Teeth – The teeth differ from *P. acridens* most conspicuously in size. The p2 usually are single-rooted. However, in biozone C1 there are 4 isolated p2 with two roots each. In one specimen the roots are fused, in the others they are closely spaced. These double-rooted p2 are much too large for *P. acridens*. Moreover, there is no *P. acridens* in C1. They either belong to the large *Palaeoscaptor* or to the large *Amphechinus*. In both cases double-rooted p2 are unexpected. These double-rooted p2 are tentatively included in *P.* cf. *rectus*. Most m1 and, less distinct, the m2 differ from *P. acridens* in the longer trigonid. In both the ectocingulid is bent upwards under the protoconid. Most m1 from biozone B do not clearly show the prolongation of the trigonid. There are no m1 in biozone A. In some m1 from biozone C the trigonid is wider than the talonid, whereas it is narrower in most of the others. In the m3 the heel is much more reduced than in *P. acridens*. Only in one m3 from biozone A-B a short heel is preserved. In the other m3 there is a weak postcingulid instead of a heel. The upper teeth have been associated with the lower dentition by means of matching size. The M3 have a lingual heel with a protocone. In the M1 and M2 the paraconule is hardly distinguishable. It demarcates the origin of the weak pre- and postparaconule crista. There is neither a cuspidate metaconule nor a post-metaconule crista. In the M2 the hypocone is reduced, especially in the specimen from biozone C. Only one out of four M3 shows a vestigial metacone and a postpara crista.

Fig. 8: *Palaeoscaptor* cf. *rectus*: **1:** Left dentary fragment with p4-m3, occlusal view, Taatsiin Gol Right (sample TGR-C/2, biozone C, NHMW 2005z0165/0001), ca. 7.5x; **2:** Left dentary fragment with p4-m2, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0154/0001), ca. 7.5x; **3:** Left dentary fragment with p4-m2, occlusal view, IKH Argalatyn Nuruu (sample IKH-B/5, biozone C1, NHMW 2005z0195/0001), ca. 7.5x; **4:** Left dentary fragment with p4-m2, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0115/0001), ca. 7.5x; **5:** Right dentary fragment with m1-m3, occlusal view, Taatsiin Gol Right (sample TGR-Bad 5, biozone B, NHMW 2005z0129/0001), ca. 7.5x; **6:** Left M1, occlusal view, Tatal Gol (sample TAT-C/7, biozone B, NHMW 2005z0123/0001), ca. 10x; **7:** Left M2, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0115/0003), ca. 10x; **8:** Right M2, occlusal view, Khunug (sample TGW-A/2b, biozone C, NHMW 2005z0160/0001), ca. 10x; **9:** Left M3, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0115/0002), ca. 10x; **10:** Left M3, occlusal view, Tatal Gol (sample TAT-C/7, biozone B, NHMW 2005z0123/0001), ca. 10x.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D i s c u s s i o n : *Palaeoscaptor rectus* is, if found at all, usually very rare. From the holotype, a lower jaw with m2-m3 from the Hsanda Gol formation at Loh in Mongolia, no measurements are available. Comparative measurements have been published from a dentary with m2 from Tatal Gol (SULIMSKI 1970: 63) and from a larger sample, including 24 dentaries, from Ulantatal, Alxa Zouqi in Nei Mongol, China (HUANG 1984: tab. 3). The upper dentition is entirely unknown. The specimens under study compare roughly with the dentary from Tatal Gol, which was described under the name *Amphechinus* (*Palaeoscaptor*) cf. *rectus* by SULIMSKI (1970). The teeth from the Ulantatal sample, published as *Amphechinus rectus*, are mostly bigger. In order to know the size range of *P. rectus* it is important to know the size range of the species at the type locality or at least in the adjacent area. The type itself yields only little information, even if its size was known. This means, that we do not really know what *P. rectus* looks like and how large it is. Therefore the samples under study are named *Palaeoscaptor* cf. *rectus*. As the sample from biozone C1 includes the double-rooted p2, it is referred to *P.* aff. *rectus*. The teeth from this species are also somewhat bigger than in the *P.* cf. *rectus* from the other units.

The generic allocation of the species *rectus* is a matter of discussion. A concise history of the genus *Palaeoscaptor* was presented in the previous chapter. According to MCKENNA & HOLTON (1967: 8) *Palaeoscaptor* and *Amphechinus* differ in the number of roots in m3 and in the number of teeth between i1 (here i2) and p4: "*Palaeoscaptor* appears to have five; *Amphechinus* three." However, *Palaeoscaptor* only has four teeth between the big incisor (i2) and p4, namely i3, c, p3 and p2, whereas in *Amphechinus* and in *rectus* the p3 is lost. Therefore MCKENNA & HOLTON retain *Palaeoscaptor* for the species *acridens*, and refer *rectus* to *Amphechinus*. We agree with their conclusion that *P. acridens* is a more primitive species, with an additional premolar between c and p4. In our opinion the most important character to distinguish *Palaeoscaptor* and *Amphechinus* is the number of roots and the presence of a distinct heel in m3. Species with double-rooted m3 with a unicuspidate heel belong to *Palaeoscaptor*, those with single-rooted m3 to A*mphechinus*. Hence, *rectus* also should be included in *Palaeoscaptor*. *Palaeoscaptor rectus* differs from *P. acridens* in the considerably larger size, in the prolonged trigonid of m1 and less evident in m2, in the ectocingulid of m1 and m2 being bent upwards, in the loss of a lower premolar (p3), and in the near to complete loss of the heel in m3. TEILHARD (1926) described *Palaeoscaptor acridens* from Saint-Jacques in China on the basis of a dentary. However, based on its large size (length p4-m3 = 9 mm) and the presence of only one premolar between canine and p4 it belongs undoubtedly to *P. rectus*. BOHLIN (1942) took the Saint-Jacques specimen also into account. He mentioned the considerable size difference between it and the type dentary but not the differing number of premolars. He also interpreted the size to lie within the range of *P. acridens* and accepted TEILHARD´s determination.

***Palaeoscaptor gigas* (LOPATIN, 2002)**
(Fig. 9)

2002b *Amphechinus gigas* LOPATIN, sp. nov.; LOPATIN, p. 302-306, fig. 1-2.

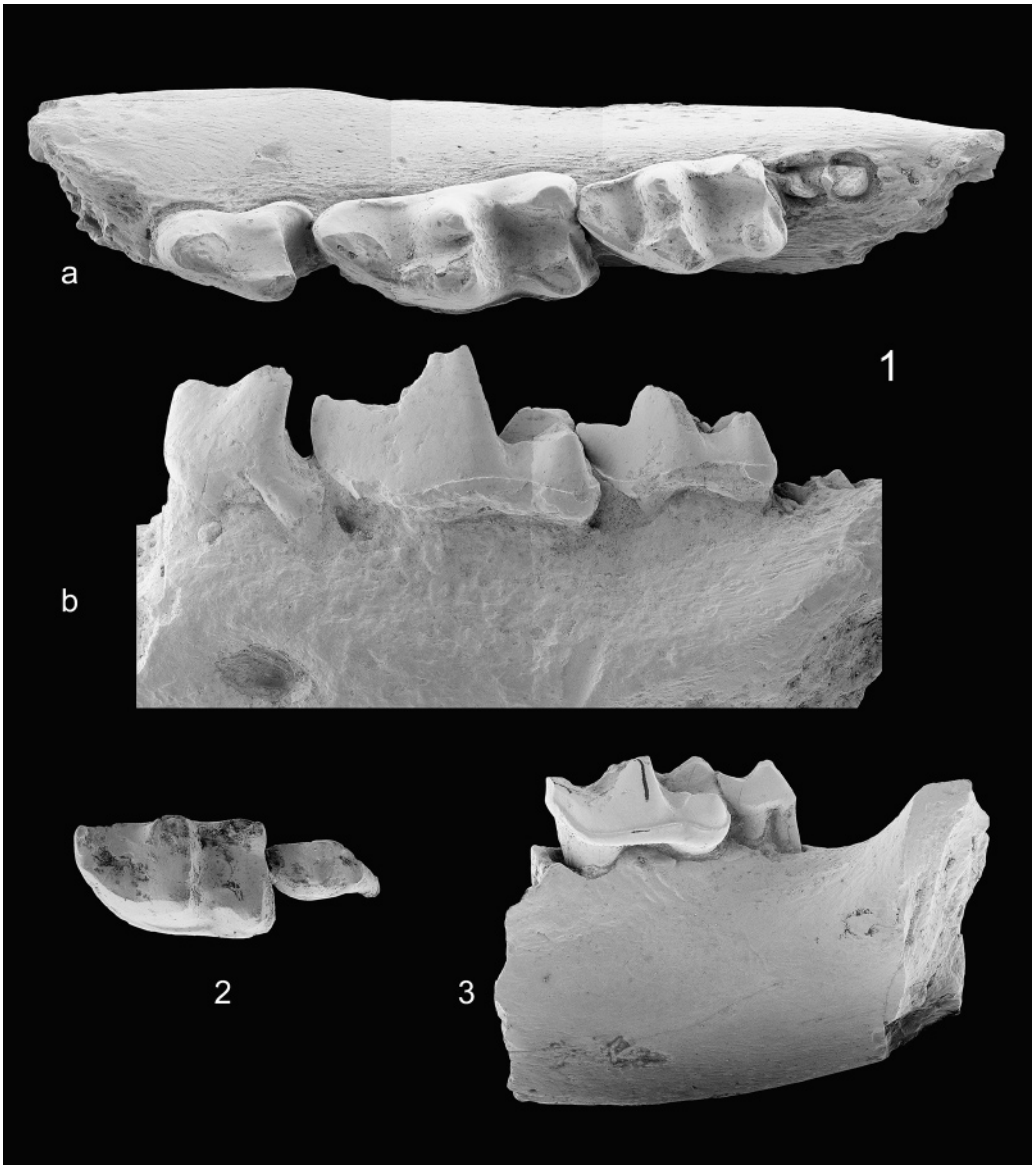


Fig. 9: *Palaeoscaptor gigas*: **1:** Right dentary fragment with p4-m2, a. occlusal view, b. buccal view, Taatsiin Gol Right (sample TGR-C/Bad 5, biozone C, NHMW 2005z0128/0001), ca. 7.5x; **2:** Left dentary fragment with m2-m3 (dentition only), occlusal view, Taatsiin Gol Right (sample TGR-C/2, biozone C, NHMW 2005z0166/0001), ca. 7.5x; **3:** Left dentary fragment with m2-m3, buccal view, Taatsiin Gol Right (sample TGR-C/Bad 5, biozone C, NHMW 2005z0128/0002), ca. 7.5xx.

Material and measurements:

Samples	Inv. no. (NHMW)	Object	Measurement
TGR-C/Bad 5, Biozone B	2005z0128/0001	right dentary fragment with p4-m2	lm1-m3-alveole 10.3 Lp4-m2 11.2; humm1 6.3 p4 3.43x1.83 m1 5.19x2.71x2.80 m2 3.73x2.34x2.26
	2005z0128/0002	left dentary fragment with m2-m3	m2 3.10x2.01x1.85 m3 >1.37x1.01
TGR-C/2, Biozone C	2005z0166/0001	left dentary fragment with m2-m3	lm1-alveole-m3 9.0
			humm1li 5.80
			m2 3.10x1.92x1.98
			m3 1.47x1.02
TGR-C/1, Biozone C	2005z0170/0000	left edentulous dentary	humm1li 7,10
	2005z0170/0000	left c inf.	2.10x1.12
	2005z0170/0000	? right P2	1.58x0.90
TAR-A/2, Biozone C	2005z0146/0000	right c inf.	c. 2.4x1.25
TGW-A/2a, Biozone C	2005z0156/0000	right D3	2.48x1.37

Description: As this species is morphologically rather similar to *P. rectus*, only the differences and the variable characters are emphasised.

Dentary – In all dentary fragments the mental foramen is situated between the roots of p4 or slightly posterior. One nearly edentulous fragment (NHMW 2005z0170/0000) preserves the broken i2 in its alveole, which is followed by the small alveole of the i3 and a larger one for the canine. The canine and the incisors are implanted increasingly procumbent. Between the canine alveole and the anterior alveole of the p4 there is a diastema with a tiny alveole with the root of the p2. In two other dentary fragments (NHMW 2005z0128/0001 and 2005z0166/0001) the alveole of the p2 is larger. In all the p2 was implanted vertically.

Teeth – In the only preserved p4 the tips of paraconid and protoconid are broken. The latter is slightly directed posteriorly. The metaconid is only a slight swelling on the crest descending on the lingual side of the protoconid. There is no ectocingulid. In the m1 the talonid is wider than the trigonid. The well-developed ectocingulid is slightly bent upwards below the protoconid, and the postcingulid directly joins the entoconid. The m2 is more compact and smaller than the m1, but in the course of the cingulids quite similar. The m3 is clearly double-rooted. Both specimens are worn posteriorly, but the absence of an extended heel is not due to wear. The isolated lower canines have been assigned to *P. gigas* because they are the largest erinaceine canines in the samples. One large upper deciduous shows erinaceine affinities and is also assigned to this species. It has a posterior crest, a small lingual heel without cusp and an anterior parastylar projection. This tooth is interpreted as D3.

Discussion: The above-described specimens clearly belong to *Palaeoscaptor* because of their double-rooted m3. Morphologically and in their evolutionary stage – single-rooted p2, elimination of a heel in m3 – they are quite similar to *P. rectus*. But they cannot be merged with this species because of their large size. *P.* cf. *rectus* is also recorded from biozones C and C1. The comparison of the sizes of the teeth of *P.* cf.

rectus (tab. 7) with those under study clearly shows that it is impossible to merge them. The teeth from *P. rectus* from Ulantatal, a sample including 24 dentaries, are distinctly smaller (HUANG 1984, tab. 3). The dentary from Tatal Gol (SULIMSKI 1970: 63) also is much smaller. The specimens under study morpho-metrically come closest to the dentary of *Amphechinus gigas* from the Early Oligocene Khunuk fauna, described by LOPATIN (2002b). The slightly smaller size of the present specimens does not exceed the expected natural variability. However, as this species has two alveoles for m3 it cannot belong to *Amphechinus*. The double-rooted m3, the strong ectocingulid of m1 and m2, bent upwards under the protoconid clearly show that the species *gigas* belongs to *Palaeoscaptor*.

We are not sure that the massive edentulous dentary (NHMW 2005z0170/0000) with the reduced p2 also belongs to *P. gigas*. The posterior part is broken. Hence it is not clear, whether the m3 was double-rooted or not. This specimen is only tentatively assigned to *P. gigas*.

***Palaeoscaptor tenuis* nov. spec.**

(Fig. 10)

E t y m o l o g y : Latin *tenuis* = lank, flimsy. The species has flimsy dentaries.

H o l o t y p e : Right dentary fragment with m1-m3 (NHMW 2005z0103/0001, Fig. 10/1).

M e a s u r e m e n t s of the holotype: H of the dentary under m1 (lingual) 2.31; Lm1-m3 4.85; m1 2.21x1.25x1.33; m2 1.64x1.12x1.03; m3 1.05x0.65

T y p e l o c a l i t y : Tatal Gol, TAT-Hü1 = TAT-D/1, Taatsiin Gol area, Valley of Lakes, Central Mongolia, section TAT-D/1 (HÖCK et al. 1999).

T y p e s t r a t u m : Hsanda Gol Formation

A g e : Early Oligocene, biozone A sensu HÖCK et al. (1999).

O c c u r r e n c e : samples TAT-C/1, TAT-D/1, TGR-A/13, TGR-A/14, IKH-B/a, SHG-AB/17-20, TAT-C/7, TGL-A/11b, TGR-B/1, TGR-AB/22, TGR-AB/21, SHG-A/15+20, SHG-A/20, TGW-A/2, TGW-A/2b, UNCH-A/3, Hsanda Gol and Loh Formations, biozones A-B, (mainly), C and D (very rare).

P a r a t y p e s : from sample sample TAT-D/1. – 3 dentary fragments with teeth, 9 isolated teeth (NHMW 2005z0103/0000-0002).

A d d i t i o n a l m a t e r i a l:

Biozone A, samples TAT-C/1, TGL-A/2, TGR-A/13, TGR-A/14. – 9 isolated teeth (NHMW 2005z0100/0000, 2005z0103/0000, 2005z0217/0000, 2005z0218/0000).

Biozone B, samples IKH-B/a, SHG-AB/17-20, SHG-AB/12, TAT-C/7, TGR-Bad 6, TGL-A11/b, TGR-B/1, TGR-AB/22, TGR-AB/21, SHG 15+20, SHG-A/20. – 11 dentary fragments with and without teeth, 2 right maxillary fragments with P2, 153 isolated teeth (NHMW 2005z0111/0000, 2005z0114/0000-0012, 2005z0116/0000, 2005z0121/0000, 2005z0127/0000, 2005z0126/0001, 2005z0132/0000, 2005z0134/0000, 2005z0137/0000, 2005z0140/0000, 2005z0142/0000).

Tab. 8.: *Palaeoscaptor tenuis*, sample statistics of the teeth.

loc.	meas.	n	R	m	s	V
Biozone A	Hum1	2	2.30-2.50	2.37		
Biozone B	Hum1	5	2.05-2.35	2.20		
Biozone C	Hum1	1		2.40		
Biozone A	Lm1-m3	1		4.85		
Biozone A	Li3	1		0.77		
	Wi3	1		0.58		
Biozone A	Li3/p2	4	0.60-0.89	0.81		
	Wi3/p2	4	0.40-0.55	0.50		
Biozone B	Li3/p2	9	0.78-1.00	0.88±0.05	0.060	6.82
	Wi3/p2	10	0.41-0.59	0.52±0.04	0.048	9.24
Biozone A	Lcinf.	2	1.15-1.17	1.16		
	Winf.	2	0.56-0.57	0.57		
Biozone B	Lcinf.	20	1.10-1.30	1.20±0.02	0.052	4.31
	Winf.	20	0.48-0.62	0.56±0.02	0.041	7.38
Biozone D	Lcinf.	2	1.22-1.26	1.24		
	Winf.	2	0.65-6.67	0.66		
Biozone A	Lp4	1	1	1.42		
	Wp4	1	0.90-1.02	0.97		
Biozone B	Lp4	7	1.39-1.52	1.43±0.06	0.060	4.20
	Wp4	8	0.77-0.90	0.85±0.04	0.044	5.20
Biozone C	Lp4	1		1.36		
	Wp4	1		0.79		
Biozone A	Lm1	3	2.17-2.23	2.20		
	Wam1	3	1.19-1.31	1.25		
	Wpm1	3	1.30-1.38	1.34		
Biozone B	Lam1	17	1.90-2.33	2.12±0.07	0.123	5.80
	Wpm1	20	1.09-1.28	1.19±0.03	0.055	4.62
	Wpm1	22	1.12-1.34	1.25±0.03	0.065	5.19
Biozone A	Lm2	3	1.64-1.77	1.71		
	Wam2	3	1.10-1.20	1.14		
	Wpm2	3	1.03-1.16	1.09		
Biozone B	Lm2	16	1.58-1.79	1.68±0.04	0.068	4.04
	Wam2	17	0.98-1.19	1.08±0.03	0.051	4.76
	Wpm2	17	0.95-1.14	1.05±0.03	0.058	5.53
Biozone C	Lm2	1		1.53		
	Wam2	1		1.00		
	Wpm2	1		0.99		
Biozone A	Lm3	2	1.05-1.05	1.05		
	Wam3	2	0.61-0.65	0.63		
Biozone B	Lm3	7	0.88-1.04	0.93±0.05	0.054	5.79
	Wam3	10	0.59-0.64	0.62±0.01	0.019	3.01
Biozone C	Lm3	1		0.93		
	Wam3	1		0.65		
Biozone D	Lm3	2	0.92-0.93	0.93		
	Wam3	2	0.56-0.61	0.59		
Biozone B	LD2	2	1.32-1.56	1.44		
	WD2	2	1.00-1.07	1.04		

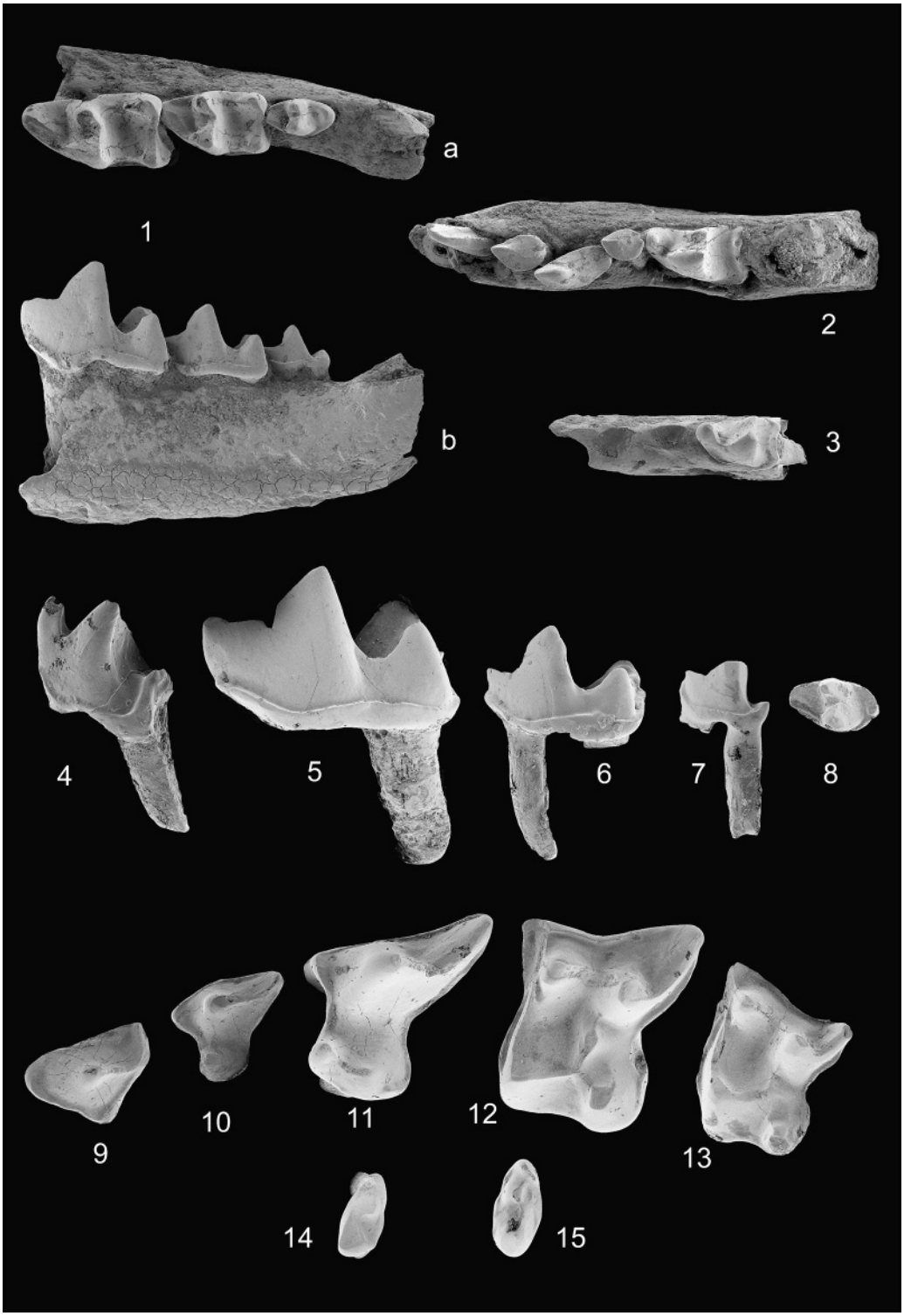
loc.	meas.	n	R	m	s	V
Biozone B	LP2	4	0.69-0.75	0.71		
	WP2	4	0.41-0.46	0.44		
Biozone B	LP3	9	1.00-1.27	1.15±0.08	0.094	8.16
	WP3	6	0.89-1.08	0.99±0.09	0.078	7.87
Biozone A	LP4	1		1.81		
	WP4	1		1.67		
Biozone B	LP4	6	1.70-2.04	1.84±0.13	0.115	6.25
	WP4	7	1.55-1.81	1.66±0.08	0.083	5.00
Biozone A	LbM1	5	1.87-1.92	1.89±0.03	0.023	1.22
	LliM1	5	1.46-1.61	1.54±0.08	0.058	3.76
	WaM1	4	2.02-2.24	2.16		
	WpM1	4	2.00-2.36	2.23		
	Wp/Lb	4	104.2-124.2	117.3		
Biozone B	LbM1	8	1.70-1.82	1.75±0.04	0.046	2.64
	LliM1	14	1.38-1.62	1.51±0.05	0.078	5.20
	WaM1	9	1.95-2.26	2.12±0.09	0.113	5.33
	WpM1	9	2.09-2.36	2.25±0.07	0.089	3.95
	Wp/Lb	6	121.4-130.4	126.6±4.31	3.757	2.97
Biozone A	LbM2	2	1.38-1.38	1.38		
	LliM2	2	1.22-1.25	1.24		
	WaM2	2	1.936-2.11	2.02		
	WpM2	2	1.45-1.54	1.50		
	Wa/La	2	139.9-152.9	146.4		
Biozone B	LbM2	14	1.27-1.41	1.34±0.03	0.052	3.88
	LliM2	15	1.00-1.19	1.11±0.03	0.059	5.29
	WaM2	10	1.63-1.95	1.80±0.08	0.105	5.83
	WpM2	14	1.27-1.60	1.42±0.06	0.102	7.16
	Wa/La	11	118.5-150.0	134.4±5.97	8.459	6.30
Biozone A	LM3	1		0.50		
	WaM3	1		1.00		
Biozone B	LM3	8	0.40-0.50	0.45±0.03	0.034	7.60
	WaM3	9	0.90-1.09	1.00±0.06	0.076	7.58

Biozone C, samples TGW-A/2, TGW-A/2b. – left dentary with p4 and m2, right m3 (NHMW 2005z0151/0000 (surface sampling), 2005z0158/0000)

Biozone D, samples UNCH-A/3, UNCH-A/4. – left dentary fragment with m3, 3 isolated teeth (NHMW 2005z0209/0000-0001, 2005z0211/0000).

M e a s u r e m e n t s : see Tab. 8, Diagr. 1.

D i f f e r e n t i a l d i a g n o s i s : Smallest species of the genus with the dental formula 2-1-2-3; mental foramen below anterior root of p4 or under p2; p2 single-rooted; m1 and m2 with well-developed pre- and ectocingulids tapering under the hypoconid; m3 with distinct heel. Upper M1 and M2 without distinct metaconule, without postmetaconule crista. *Palaeoscaptor tenuis* differs from *P. acridens* in the reduced number of lower premolars and in the smaller size, from *P. rectus* in its distinctly smaller size.


a
1
2
b
3
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D e s c r i p t i o n : Dentary and lower dentition – From the dentary only fragments of the horizontal ramus are preserved. Anyway, some of them yield information about the lower dental formula and the position of the mental foramen. The samples from biozone A, B and C yielded each one dentary fragment with the tooth formula 2-1-2-3. The first premolar, the p2, is single-rooted. The mental foramen is situated under the anterior root of p4 in both specimens from biozone A, in the only dentary from biozone C and in three out of four specimens from biozone B. In one dentary fragment from biozone B the mental foramen is below p2. One dentary fragment from biozone A shows the erupting i2 and p4 along with the i3, c inf. and p2. Obviously id2 and id3 have not been ejected, because their roots are still in the alveoles antero-buccal to i2 and i3, respectively.

The i3, c and p3 are single-rooted and show no peculiar characters. They were assigned to *P. tenuis* because of their small size.

In all p4 the paraconid is conical and lower than the protoconid. In most p4 the metaconid is only a bud attached to lingual face of the protoconid rather than a cusp. In few specimens the metaconid is more cuspidate. The ectocingulid is moderately developed. The lower molars are graded in size. Unworn m1 and m2 have a notched paralophid. In all m1 the talonid is wider than the trigonid, in the m2 it is narrower. The ectocingulid is well developed, tapering only below the hypoconid. The postcingulid does not join the postcristid. All m3 have two clearly separated roots. The heel is well developed and single-cusped in all specimens, except one from biozone B, where it is only partly worn and reduced to a postcingulid. This specimen is excluded from the sample statistics.

Upper teeth – There are only isolated upper teeth. The teeth anterior to P3 show no peculiarities. They have been allocated with the sample because of their small size. The P3 has an extended lingual heel with a protocone, a slightly projecting parastyle, and a marked buccal cingulum. In the P4 the posterior cusp of the lingual heel extends

⇦ Fig. 10: *Palaeoscaptor tenuis*: **1:** Right dentary fragment with m1-m3, holotype, a. occlusal view, b. buccal view, Tatal Gol Hügel (sample TAT-D/1, biozone A, NHMW 2005z0103/0001), ca. 10x; **2:** Right dentary fragment with i3, c inf., p2 and erupting i2 and p4, and the roots of id2 and id3, occlusal view, Tatal Gol Hügel (sample TAT-D/1, biozone A, NHMW 2005z0103/0002), ca. 10x; **3:** Right dentary fragment with p4, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0001), ca. 10x; **4:** Left p4, buccal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0002), ca. 15x; **5:** Left m1, buccal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0003), ca. 15x; **6:** Left m2, buccal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0004), ca. 15x; **7:** Right m3, buccal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0005), ca. 15x; **8:** Right m3, occlusal view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2005z0209/0001), ca. 15x; **9:** Left D2, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0006), ca. 15x; **10:** Left P3, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0007), ca. 15x; **11:** Left P4, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0008), ca. 15x; **12:** Left M1, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0009), ca. 15x; **13:** Right M2, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0010), ca. 15x; **14:** Left M3, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0011), ca. 15x; **15:** Left M3, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2005z0114/0012), ca. 15x.

more lingually, the parastyle projects only little. There is a distinct cingulum along the anterior, buccal and posterior crown-base. In the M1 and M2 the most important features are the absence of a cuspidate metaconule and of a postmetaconule crista. The M3 is strongly reduced with proto- and paracone and parastyle as the only cusps, as in most advanced erinaceines. Only in one M3 from biozone B a distinct metacone is preserved.

D i s c u s s i o n : In the above listed samples the smallest teeth and jaws referable to *Palaeoscaptor* are lumped together. The double-rooted m3 with the distinct posterior heel served as decisive criterion. In the m1 and m2 the ectocingulids are stronger than in *Amphechinus*. In every sample there is at least one significant element showing clear-cut *Palaeoscaptor* characters. The remainder has been allocated on the basis of matching size. Hence, the samples are highly probable homogeneous. *Palaeoscaptor tenuis* is intermediate in its evolutionary stage: its is more advanced than *P. acridens* in that it has lost one lower premolar, but it is less advanced the *P. rectus* in that the heel of its m3 is less reduced. *Palaeoscaptor tenuis* from the samples from biozone A has slightly larger teeth than those from the biozones B, C and D.

Genus *Amphechinus* Aymard, 1850

Type species: *Amphechinus arvernensis* (de Blainville, 1838)

Remarks: The erinaceines under study, which include single-rooted m3 without talonid, and m1 and m2 with a trigonid not compressed antero-posteriorly, are lumped together under the genus *Amphechinus*.

Amphechinus from biozone C and D

***Amphechinus taatsiingolensis* nov. spec.**
(Fig. 11)

E t y m o l o g y : After the type locality Taatsiin Gol.

H o l o t y p e : Left dentary fragment with p4-m3 (NHMW 2005z0152/0001, Fig. 11/1).

M e a s u r e m e n t s of the holotype: humm1 2.06; Lp4-m3 5.60; lm1-m3 4.46; p4 1.26x0.78; m1 2.03x1.07x1.24; m2 1.59x1.00x0.94; m3 0.87x0.58.

T y p e l o c a l i t y : Taatsiin Gol West, Valley of Lakes, Central Mongolia, section TGW-A/2a (Höck et al. 1999).

T y p e s t r a t u m : Hsanda Gol Formation.

A g e : Late Oligocene, biozone C (sensu Höck et al. 1999), situated directly above a basalt layer dated to around 28 my.

S t r a t i g r a p h i c r a n g e : Late Oligocene to Early Miocene, biozone C and D (sensu Höck et al. 1999).

P a r a t y p e s : from biozone C, sample TGW-A/2a. – 6 edentulous dentary fragments, right maxillary fragment with P3-P4, 275 isolated teeth (NHMW 2005z0152/0000, 2005z0152/0002-0017).

A d d i t i o n a l m a t e r i a l :

Biozone C, samples TGR-C/1, TAR-A/2, TGW-A/2b, TGW-A (surface), TGR-C/1b, TGR-C/10(T), TGR-C/2, TGW-A/1. – 47 dentary fragments, 6 maxillary fragments with teeth, 644 isolated teeth (NHMW 2005z0144/0000, 2005z0145/0000, 2005z0150/0000, 2005z0157/0000, 2005z0161/0000, 2005z0163/0000, 2005z0167/0000, 2005z0174/0000, 2005z0175/0000, 2005z0176/0000, 2005z0177/0000)

Amphechinus aff. *taatsiingolensis*

Biozone D, samples RHN-A/12, UNCH, UNCH-A/4, UNCH-A/3, LOG-A/1. – 17 dentary fragments, 2 maxillary fragments with teeth, 157 isolated teeth (NHMW 2005z0204/0000-0001, 2005z0212/0000, 2005z0210/0000, 2005z0208/0000, 2005z0222/0000).

M e a s u r e m e n t s : see Tab. 9, Diagr. 2.

D i f f e r e n t i a l d i a g n o s i s : Small species of *Amphechinus* characterized by the coexistence of the following traits: small size, dental tooth formula 2-1-2-3, p2 and most of the m3 single-rooted, but with elongated alveoli, which may be slightly separated by a lingual or buccal vestigial septum, respectively; m3 without talonid, but with a residual postcingulid; unworn M1 and M2 may have a small metaconule indicated as protuberance on the disto-buccal termination of the postprotocrista. This species is distinctly smaller than all European, North American and African species, assigned to *Amphechinus*. Because of their temporo-spatial proximity only the Asian species will be considered more precisely.

- *A. kansuensis* (BOHLIN, 1942), which is known from its type, a dentary fragment with p4 from Taben-Buluk, has a distinctly higher dentary (height below m1 = 3,2 mm).
- *A. akespensis* LOPATIN, 1999 from the Early Miocene Aral Formation near Akespe in Kazakhstan also is much bigger and has a m1 with an elongated trigonid and a strong etocingulid, which is bent upwards below the protoconid. In the p4 the paraconid is somewhat higher than the protoconid. This species resembles *Palaeoscaptor rectus* in size and overall morphology (see LOPATIN 1999, p. 184, fig. 2), and might be conspecific. However, as no m3 is preserved, this assumption cannot be corroborated.
- *Amphechinus bohlini* (BI, 2000) from the Early Miocene Suosuoquan Formation in the Junggar Basin, China, is only known by its lower dentition. The m3 is clearly single-rooted without any bifurcaton of its root. The lower antemolars and p4 are wider, and the m1 and m2 overall larger than in *A. taatsiingolensis*.
- *Amphechinus microdus* (LOPATIN, 1999) from the Early Miocene Aral Formation near Altynshokysu in Kazakhstan is quite similar in overall size, covering the upper part of the size range of *A. taatsiingolensis*. But its m3 is relatively smaller, with a length coming up to only 40% of the length of m2, whereas this percentage is c. 51% in the specimens under study. In *A. microdus* the m3 is clearly single-rooted without suggesting a fusion of two roots.
- *Amphechinus minimus* (BOHLIN, 1942) has been synonymised with *Parvericius montanus* KOERNER, 1940 by RICH & RASMUSSEN (1973), its most conspicuous trait being the antero-posteriorly compressed trigonid in m1. Hence it cannot be confused with *A. taatsiingolensis*.

Tab. 9: *Amphechinus taatsiingolensis* (biozone C) and *A.* aff. *taatsiingolensis* (biozone D), sample statistics of the teeth.

loc.	meas.	n	R	m	s	V
Biozone C	Lm1-m3	6	3.96-4.70	4.29±0.32	0.281	6.56
Biozone C	Lp4-m3	1		5.60		
Biozone C	Hum1	31	1.49-2.57	2.04±0.10	0.271	13.3
Biozone D	Hum1	8	1.71-2.26	2.08±0.16	0.178	8.55
Biozone C	Li3	1		1.01		
	Wi3	1		0.59		
Biozone C	Lcinf.	1		1.21		
	Winf.	1		0.55		
Biozone C	Lp2	2	0.78-0.87	0.83		
	Wp2	2	0.50-0.50	0.50		
Biozone C	Ld4	7	1.26-1.40	1.32±0.06	0.057	4.35
	Wd4	8	0.76-0.85	0.80±0.02	0.026	3.28
Biozone C	Lp4	57	1.11-1.59	1.38±0.03	0.100	7.22
	Wp4	101	0.64-1.02	0.81±0.01	0.074	9.03
Biozone D	Lp4	10	1.14-1.50	1.33±0.07	0.098	7.36
	Wp4	12	0.72-0.92	0.82±0.04	0.066	7.97
Biozone C	Lm1	114	1.67-2.33	1.97±0.03	0.142	7.21
	Wam1	142	0.90-1.28	1.10±0.01	0.078	7.13
	Wpm1	143	0.95-1.43	1.18±0.01	0.084	7.11
Biozone D	Lam1	11	1.94-2.51	2.13±0.12	0.169	7.91
	Wpm1	18	1.02-1.26	1.13±0.04	0.073	6.47
	Wpm1	19	1.12-1.36	1.22±0.04	0.071	5.84
Biozone C	Lm2	90	1.32-1.83	1.55±0.02	0.099	6.35
	Wam2	110	0.83-1.13	0.99±0.01	0.061	6.17
	Wpm2	98	0.81-1.22	0.99±0.01	0.070	7.03
Biozone D	Lm2	15	1.40-1.72	1.58±0.05	0.090	5.72
	Wam2	19	0.90-1.09	0.99±0.03	0.056	5.61
	Wpm2	17	0.90-1.10	0.99±0.03	0.064	6.51
Biozone C	Lm3	70	0.69-0.91	0.79±0.01	0.056	7.09
	Wam3	70	0.46-0.64	0.56±0.01	0.043	7.73
Biozone D	Lm3	9	0.64-0.88	0.75±0.08	0.084	11.2
	Wam3	9	0.50-0.61	0.54±0.08	0.092	7.64
Biozone C	LD3	1		1.10		
	WD3	1		0.88		
Biozone C	LP2	1		0.83		
	WP2	1		0.48		
Biozone D	LP2	3	0.78-0.79	0.79		
	WP2	3	0.39-0.47	0.44		
Biozone C	LP3	53	0.81-1.21	1.03±0.02	0.079	7.69
	WP3	53	0.71-1.05	0.88±0.03	0.091	10.3
Biozone D	LP3	1		0.89		
	WP3	1		0.83		

loc.	meas.	n	R	m	s	V
Biozone C	LP4	47	1.21-1.87	1.67±0.04	0.148	8.84
	WP4	38	1.05-1.66	1.50±0.04	0.133	8.88
Biozone D	LP4	9	1.56-1.79	1.69±0.06	0.074	4.36
	WP4	6	1.52-1.70	1.61±0.09	0.076	4.71
Biozone C	LbM1	91	1.39-1.93	1.66±0.02	0.118	7.04
	LliM1	115	1.14-1.75	1.44±0.02	0.110	7.63
	WaM1	94	1.56-2.24	1.90±0.03	0.123	6.73
	WpM1	85	1.63-2.39	2.03±0.03	0.151	7.45
	Wp/Lb	78	113.1-132.4	123.0±1.05	4.59	3.73
Biozone D	LbM1	18	1.44-1.89	1.66±0.06	0.120	7.24
	LliM1	24	1.30-1.70	1.51±0.05	0.111	7.58
	WaM1	19	1.64-2.21	1.88±0.08	0.166	8.80
	WpM1	17	1.81-2.27	1.98±0.08	0.146	7.37
	Wp/Lb	17	107.3-129.0	119.9±3.31	6.262	5.22
Biozone C	LbM2	83	1.07-1.57	1.32±0.02	0.094	7.16
	LliM2	91	0.87-1.33	1.13±0.02	0.085	7.47
	WaM2	80	1.42-2.02	1.74±0.03	0.119	7.03
	WpM2	82	1.17-1.69	1.43±0.02	0.097	6.97
	Wa/La	76	120.9-149.6	132.1±1.22	5.254	4.03
Biozone D	LbM2	10	1.23-1.38	1.30±0.04	0.053	4.06
	LliM2	14	0.92-1.30	1.09±0.06	0.098	8.94
	WaM2	9	1.52-1.81	1.67±0.07	0.089	5.34
	WpM2	9	1.17-1.45	1.34±0.09	0.109	8.09
	Wa/La	8	122.6-133.9	126.9±3.44	3.862	3.04
Biozone C	LM3	22	0.36-0.53	0.46±0.02	0.046	9.98
	WaM3	22	0.79-1.13	0.96±0.04	0.089	9.36
Biozone D	LM3	4	0.42-0.49	0.46		
	WaM3	4	0.90-1.00	0.95		

D e s c r i p t i o n : As the *Amphechinus* species are sufficiently described elsewhere, and as most species are quite similar in overall morphology we can confine ourselves to show the variability.

Dentary – The dental formula is 2-1-2-3. In the material from biozone C the mental foramen is situated under the p2 (n=3 specimens), under p3/p4 (5), under the anterior root of p4 (10) and below the posterior root of p4 (1). The correspondent shares in the referred material from biozone D are: under the anterior root of p4 (1), under the posterior root of p4 (2), under the anterior root of m1 (3, one with additional mental foramen between the roots of p4). In most dentaries the root of the single-rooted p2 is round to elongated. In two specimens from biozone C the alveole has a buccal and a lingual residual septum, thus indicating a bilaterally bifurcated root. One dentary has only a lingual septum, another a buccal, thus showing that the bifurcation is indicated only on the buccal or lingual side of the root.

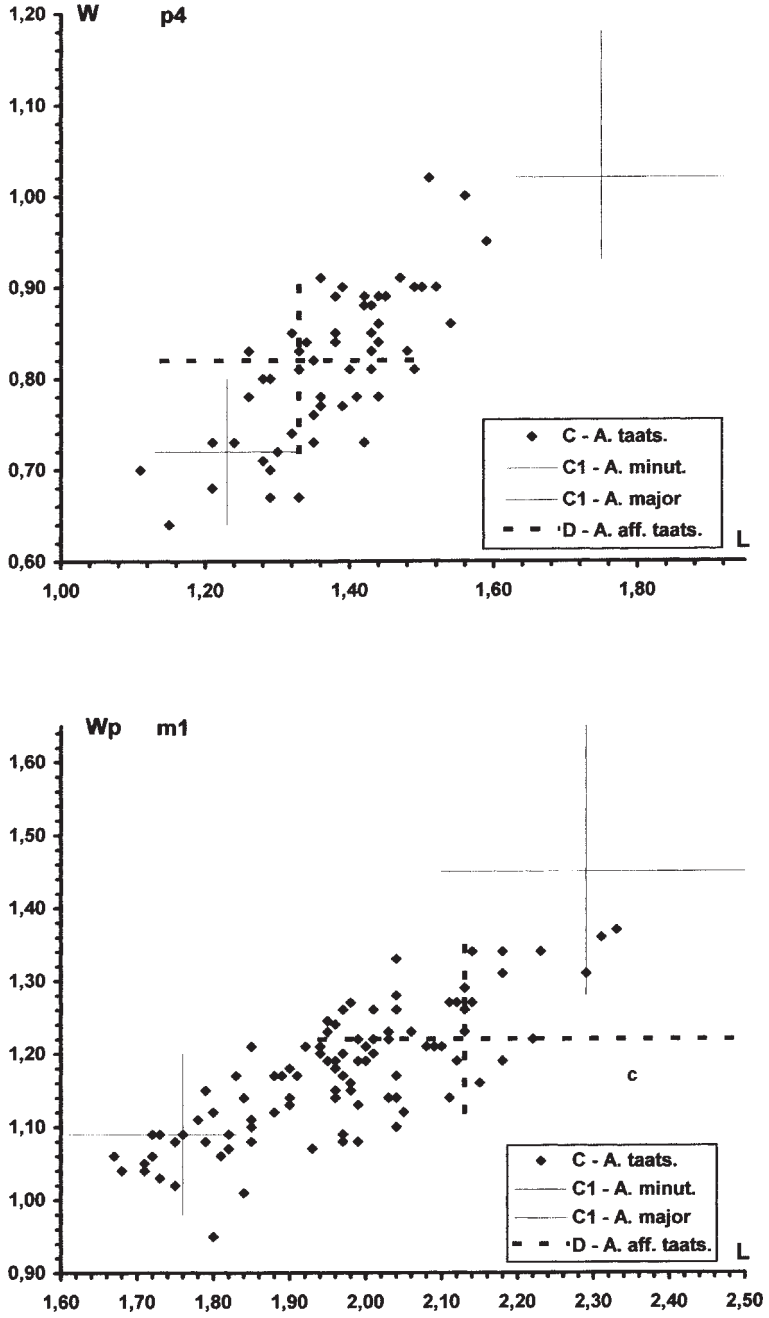


Diagram 2a: *Amphechinus* species from biozones C, C1 and D, scatter diagram of the length and width of p4 and m1.

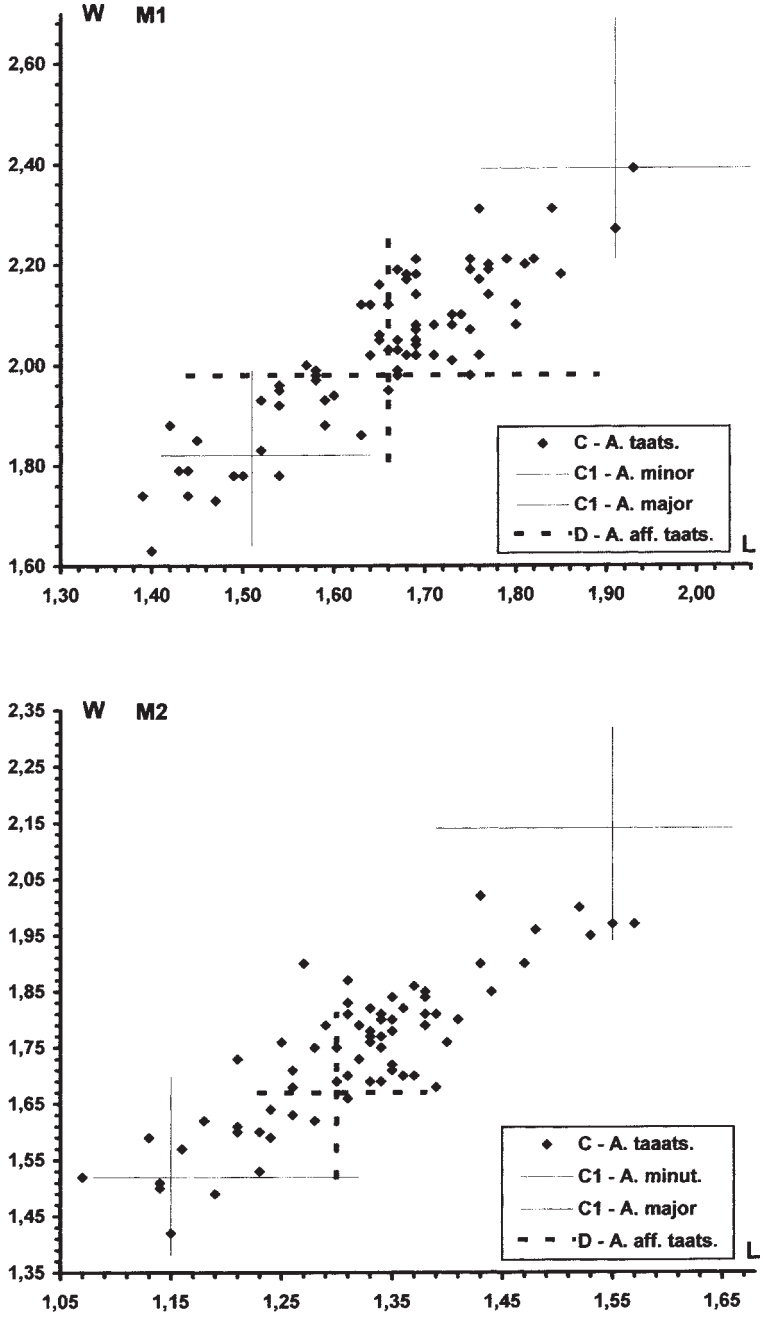
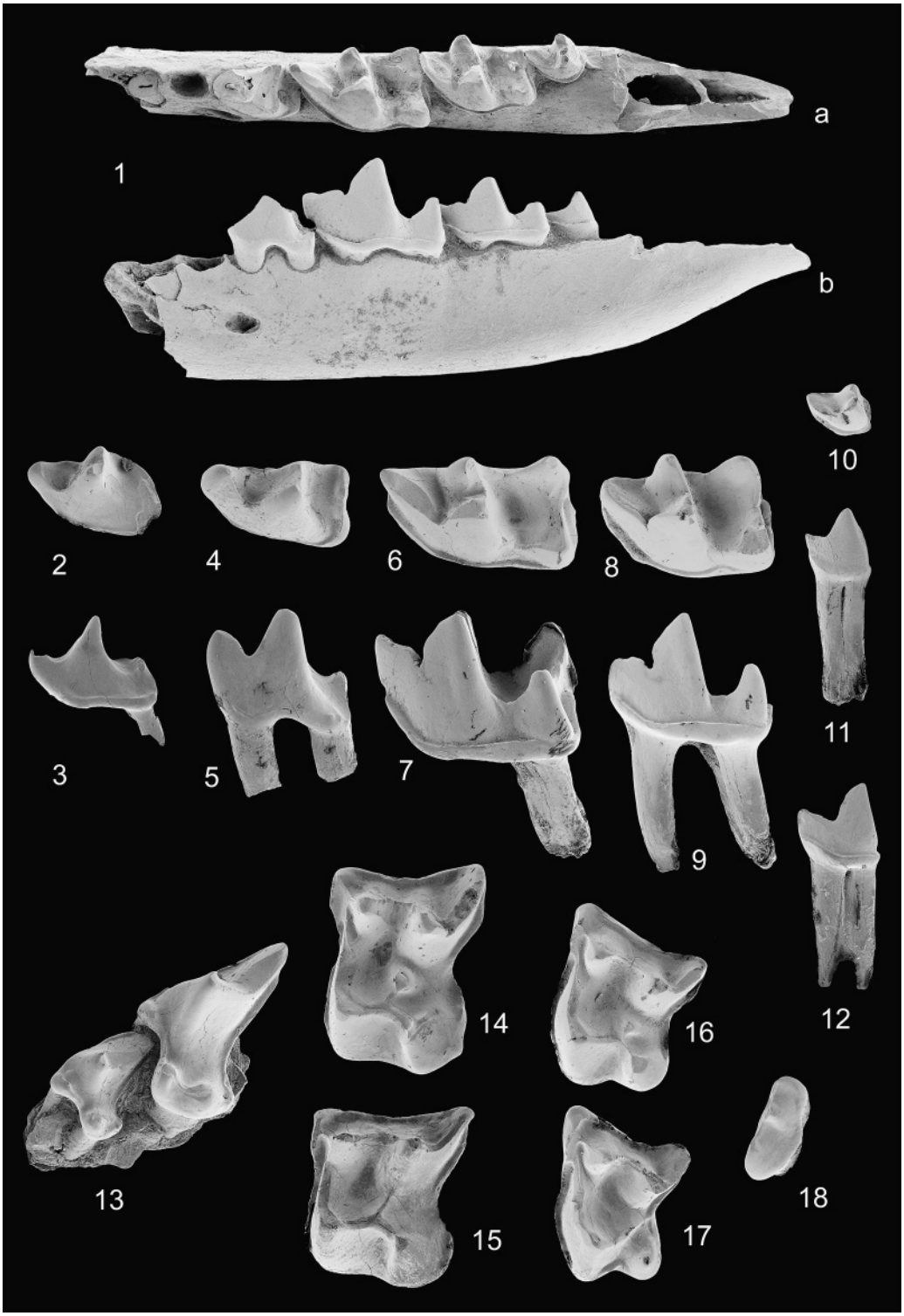


Diagram 2b: *Amphechinus* species, scatter diagram of the length and width of M1 and M2.


a
1
b
10
2
4
6
8
11
3
5
7
9
12
14
16
13
15
17
18

Teeth – In the sample statistics of the i3, c inf. and p2 only the in situ-specimens are included. In biozone D there are no dentaries with these teeth. i3 and c inf. are similar in shape and in the inclination of the root. They also can be confused with their deciduous predecessors. The p2 is the smallest of all and has a nearly perpendicular root. All p4 have a conical paraconid, which is lower than the protoconid. The cusps are separated by a deep notch. In the lower molars the ectocingulid is well developed and straight. In some unworn m1 and m2 the postcingulid joins the entoconid, in most of the others it is short. In biozone C 20 m3 are clearly single-rooted, not showing any fusion of two roots. But in 32 specimens a varying bifurcation indicates a once double-rooted m3. In biozone D all m3 are single-rooted.

In unworn M1 and M2 a metaconule is hinted by a distal protuberance of the termination of the postprotocrista (biozone C) or wholly absent (biozone D). The postprotocrista extends to the lingual basis of the metacone. There is no postmetaconule-crista.

D i s c u s s i o n : This species is highly variable in size. But the bivariate plots of length show a normal distribution for the sample of biozone C. In no tooth there is bimodal distribution, which we expect when the sample represents more than one species. There is no chance to divide the sample. Hence we are confident that it is homogeneous and that it includes only one species. The sample from biozone D covers only a part of the size range of *A. taatsiingolensis* from biozone C, because of its smaller sample size. Both samples agree in overall morphology with some exceptions. The mental foramen seems to be slightly shifted posteriorly and in the M1 and M2 there is no vestige of a metaconule. Therefore the sample from biozone D is designated *Amphechinus* aff. *taatsiingolensis*.

⇦ Fig. 11: *Amphechinus taatsiingolensis* nov. spec.: **1**: Left dentary fragment with p4-m3, holotype, a. occlusal view, b. buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0001), ca. 10x; **2**: Left d4, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0002), ca. 15x; **3**: Right d4, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0003), ca. 15x; **4**: Left p4, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0005), ca. 15x; **5**: Left p4, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0004), ca. 15x; **6**: Left m1, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0006), ca. 15x; **7**: Left m1, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0007), ca. 15x; **8**: Left m2, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0008), ca. 15x; **9:** Left m2, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0009), ca. 15x; **10:** Left m3, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0012), ca. 15x; **11:** Left m3, single-rooted, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0010), ca. 15x; **12:** Left m3, double-rooted, buccal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0011), ca. 15x; **13:** Right maxillary fragment with P4-M1, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0013), ca. 15x; **14:** Left M1 with metaconule, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0014), ca. 15x; **15:** Right M1 without metaconule, occlusal view, Tavan Ovoony Deng (sample RHN-A/12, biozone D, NHMW 2005z0204/0001), ca. 15x; **16:** Left M2 with metaconule, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0016), ca. 15x; **17:** Left M2 without metaconule, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0015), ca. 15x; **18:** Left M3, occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2005z0152/0017), ca. 15x.

Small *Amphechinus* from biozone C1

***Amphechinus minutissimus* nov. spec.**
(Fig. 12)

E t y m o l o g y : Latin *minutissimus* = the smallest, referring to the small size.

H o l o t y p e : Right M1 (NHMW 2005z0199/0001).

M e a s u r e m e n t s of the holotype: 1.48x1.18x1.72x1.78 (LbxLlixWaxWp).

T y p e l o c a l i t y : sample DEL-B/12, Valley of Lakes, Central Mongolia (Höck et al. 1999).

T y p e s t r a t u m : Hsanda Gol Formation.

A g e : Late Oligocene, biozone C1 (sensu Höck et al. 1999).

S t r a t i g r a p h i c r a n g e : Late Oligocene, Loh Formation and Hsanda Gol Formation, biozone C1 (sensu Höck et al. 1999).

P a r a t y p e s : from sample DEL-B/12. – 4 edentulous dentary fragments, 32 isolated teeth (NHMW 2005z0196/0000-0005, 2005z0199/0000, 2005z0199/0002-0005)

A d d i t i o n a l m a t e r i a l:

Biozone C1, samples RHN-A/9, IKH-A/5, RHN-A/7, LOH-C/1, IKH-B/5, TGW-A/5. – 3 edentulous dentary fragments, left maxillary fragment with M2, 26 isolated teeth (NHMW 2005z0180/0000, 2005z0185/0000, 2005z0184/0000, 2005z0191/0000, 2005z0193/0000, 2005z0201/0000).

M e a s u r e m e n t s : see Tab. 10, Diagr. 2.

Tab. 10: *Amphechinus minutissimus* n. sp., biozone C1. sample statistics of the teeth.

meas.	n	R	m	s	V
Hum1	6	1.55-1.86	1.73±0.12	0.103	5.99
Lcinf.	3	0.96-1.11	1.06		
Winf.	3	0.46-0.58	0.53		
Lp4	4	1.13-1.33	1.23		
Wp4	5	0.64-0.80	0.72		
Lam1	10	1.61-1.83	1.76±0.05	0.066	3.75
Wpm1	16	0.90-1.16	1.02±0.04	0.068	6.70
Wpm1	16	0.98-1.20	1.09±0.04	0.064	5.86
Lm2	9	1.31-1.55	1.42±0.07	0.085	6.00
Wam2	8	0.83-1.02	0.90±0.08	0.062	6.89
Wpm2	9	0.83-1.00	0.88±0.04	0.050	5.73
Lm3	1		0.70		
Wam3	1		0.47		
LP3	1		0.81		
WP3	2	0.79-0.80	0.80		

meas.	n	R	m	s	V
LP4	2	1.46-1.55	1.51		
WP4	1		1.46		
LbM1	8	1.41-1.64	1.51±0.07	0.082	5.45
LliM1	9	1.18-1.41	1.28±0.06	0.092	7.13
WaM1	9	1.55-1.82	1.71±0.10	0.101	5.87
WpM1	7	1.64-1.99	1.82±0.13	0.133	7.31
Wp/Lb	7	114.6-126.8	120.4±5.08	4.472	3.11
LbM2	9	1.08-1.32	1.15±0.06	0.074	6.42
LliM2	9	0.85-1.12	0.95±0.06	0.079	8.30
WaM2	9	1.38-1.70	1.52±0.08	0.098	6.45
WpM2	9	1.07-1.30	1.20±0.06	0.077	6.38
Wa/La	9	127.8-139.3	132.3±3.41	4.18	3.16

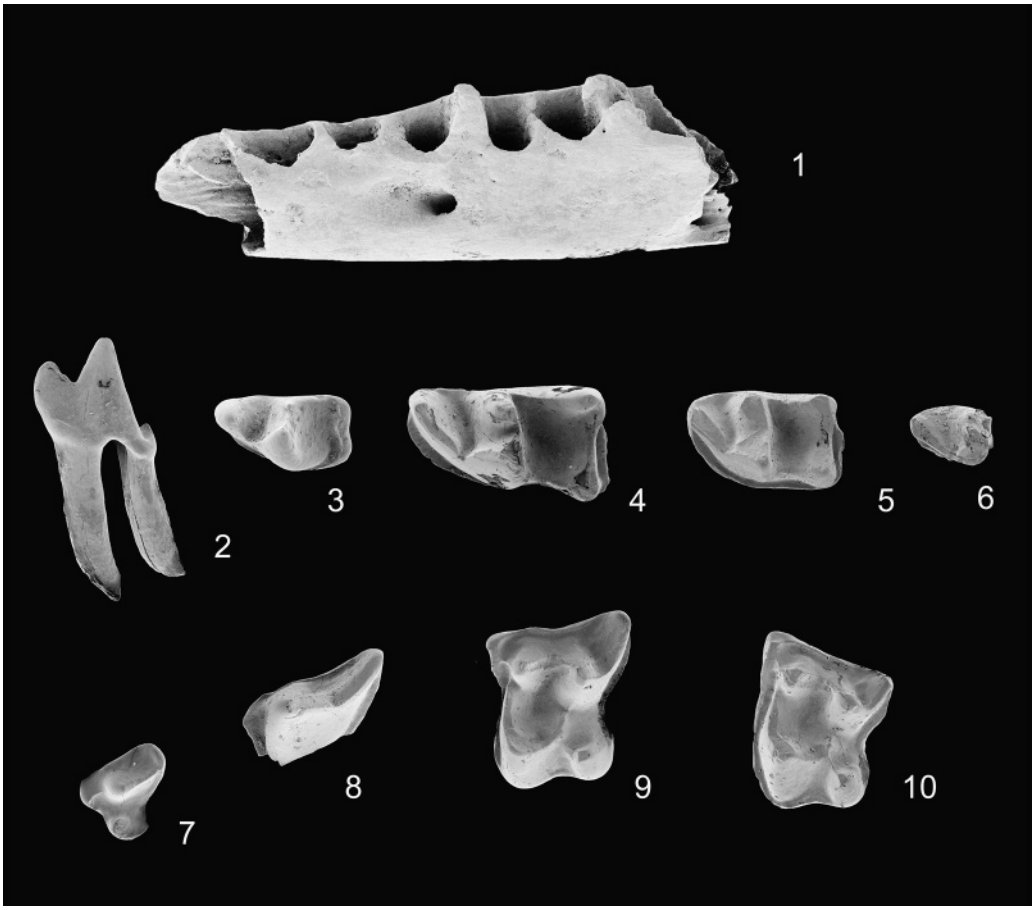


Fig. 12: *Amphechinus minutissimus* nov. spec.: **1:** Left edentulous dentary fragment, occluso-buccal view (sample DEL-B/12, biozone C1, NHMW 2005z0199/0002), ca. 15x; **2:** Left p4, buccal view (sample DEL-B/12, biozone C1, NHMW 2005z0196/0001), ca. 15x; **3:** Right p4, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0196/0002), ca. 15x; **4:** Right m1, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0196/0003), ca. 15x; **5:** Right m2, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0199/0003), ca. 15x; **6:** Right m3, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0199/0004), ca. 15x; **7:** Left P3, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0196/0004), ca. 15x; **8:** Right P4, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0199/0005), ca. 15x; **9:** Right M1, holotype, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0199/0001), ca. 15x; **10:** Left M2, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0196/0005), ca. 15x.

D i f f e r e n t i a l d i a g n o s i s : Smallest *Amphechinus* species known so far. It differs from all species of the genus in its distinctly smaller size, and it is characterised by the co-occurrence of the following traits: dental formula 2-1-2-3, p2 single-rooted, m3 single-rooted without vestige of a talonid or postcingulid, M1 and M2 without metaconule.

D e s c r i p t i o n : Lower jaw and dentition – There are two dentary fragments preserving the mental foramen below the anterior root of p4. One edentulous dentary fragment shows the elongated alveole of the p2, and seven specimens and one isolated m3 show that the m3 is invariably single-rooted. The p4 has a conical paraconid which is lower than the protoconid. Both cusps are separated by a notch. The ectocingulid is only moderately developed. In the m1 and m2 pre- and ectocingulid are continuous. The postcingulid extends to the entoconid but does not join it.

Upper dentition – The P3 has a straight buccal margin. Between parastyle and protocone there is a mesial emargination. The only characteristic feature of the M1 and M2 is the invariable absence of a metaconule.

D i s c u s s i o n : In biozone C *Amphechinus* is represented by one species with an extremely large range in size. In biozone C1 there is a clear bimodal distribution in the size of all teeth without any overlap. The bimodality is with certainty no sample bias due to small sample sizes. The small species, *A. minutissimus,* covers the lowermost part of the size range of *A. taatsiingolensisis*. But there is no indication that *A. minutissimus* is more advanced than *A. taatsingolensis*. One is tempted to interpret the size relations between the *Amphechinus* species from biozone C and C1 as a splitting up of *A. taatsingolensis* into two species. However this means, that *A. taatsiingolensis* no more existed after biozone C. It should not have reappeared in biozone D. The relationships between the species remain obscure.

Large *Amphechinus* from biozone C1

***Amphechinus major* nov. spec.**
(Fig. 13)

E t y m o l o g y : Latin *major* = larger. *A. major* is larger than *A. minutissimus* from the same biozone.

H o l o t y p e : Right M1 (NHMW 2005z0198/0001, Fig. 13/8).

M e a s u r e m e n t s of the holotype: 1.93x1.76x2.28x2.38 (LbxLlixWaxWp).

T y p e l o c a l i t y : Section DEL-B/12, Valley of Lakes, Central Mongolia (Höck et al. 1999).

T y p e s t r a t u m : Hsanda Gol Formation.

A g e : Late Oligocene, biozone C1 (sensu Höck et al. 1999).

S t r a t i g r a p h i c r a n g e : Late Oligocene, Loh Formation and Hsanda Gol formation, biozone C1 (sensu Höck et al. 1999)

P a r a t y p e s : from sample DEL-B/12. – 2 right dentary fragments with teeth, right edentulous dentary fragment, 139 isolated teeth (NHMW 2005z0198/0000, 2005z0198/0002-0010).

A d d i t i o n a l m a t e r i a l :

Biozone C1, samples RHN-A/9, LOH-C/1, IKH-A/5, RHN-A/7, IKH-B/5, TGW-A/5, LOH-B/3. – 3 edentulous dentary fragments, 55 isolated teeth (NHMW 2005z0179/0000,

2005z0181/0000, 2005z0183/0000-0001, 2005z0186/0000, 2005z0192/0000, 2005z0194/0000, 2005z0202/0000, 2005z0203/0000).

M e a s u r e m e n t s : see Tab. 11, Diagr. 2.

D i f f e r e n t i a l d i a g n o s i s : Medium-sized *Amphechinus*-species with well-developed metaconules in most of the M1, and moderately developed metaconules in most of the M2. It is distinctly larger than *A. minutissimus*, and *A. taatsiingolensis* from the same region. It differs from *A. microdus* from the Early Miocene of Kazakhstan in the bigger size of m1, m3 and M2 and in the presence of metaconules on M1 and M2. It differs from *A. bohlini* from the Early Miocene of the Junggar Basin, China, in the longer p4, the smaller m1 and m2, in the bigger m3 and in the more anterior position of the mental foramen. All the other *Amphechinus* species from North America, Europe, Africa and Asia cannot be confused, because they are much bigger.

D e s c r i p t i o n : Dentary – There are two dentary fragments preserving the mental foramen below the anterior root of p4, three with one elongate alveole for the single-rooted m3, and one specimen the alveole of the single-rooted p2. The only marked morphological difference between *A. major* and the other *Amphechinus* species presented here is the presence of a conical metaconule in nearly all M1 and in the majority of the M2 of *A. major*. In some M1 and M2 there is even a weak postmetaconule crest which joins the marked metacingulum.

Tab. 11: *Amphechinus major*, biozone C1 sample statistics of the teeth.

meas.	n	R	m	s	V
Hum1	3	2.28-2.68	2.42		
Li3/ci	1		1.12		
Wi3/ci	1		0.55		
Lcinf.	10	1.26-1.45	1.38±0.05	0.063	4.56
Winf.	10	0.57-0.88	0.66±0.07	0.090	13.6
Ld4	1		1.59		
Wd4	1		0.89		
Lp4	11	1.63-1.93	1.75±0.06	0.091	5.18
Wp4	20	0.93-1.18	1.02±0.03	0.065	6.34
Lam1	21	2.10-2.50	2.29±0.05	0.116	5.08
Wpm1	28	1.20-1.49	1.33±0.03	0.069	5.21
Wpm1	36	1.28-1.65	1.45±0.03	0.093	6.47
Lm2	28	1.71-2.00	1.83±0.03	0.078	4.27
Wam2	38	1.09-1.31	1.19±0.02	0.052	4.39
Wpm2	30	1.04-1.28	1.18±0.01	0.067	5.66
Lm3	5	0.86-1.01	0.95±0.08	0.061	6.48
Wam3	5	0.65-0.75	0.71±0.06	0.040	5.63
LP3	11	1.12-1.27	1.20±0.04	0.060	4.96
WP3	9	1.02-1.14	1.07±0.03	0.034	3.16

meas.	n	R	m	s	V
LP4	11	1.75-2.14	1.93±0.09	0.125	6.47
WP4	6	1.70-1.92	1.80±0.10	0.086	4.77
LbM1	17	1.58-2.06	1.88±0.06	0.111	5.88
LliM1	23	1.41-1.77	1.64±0.04	0.088	5.36
WaM1	20	1.81-2.41	2.21±0.06	0.132	5.96
WpM1	17	1.95-2.53	2.34±00.07	0.137	5.86
Wp/Lb	16	116.5-131.3	123.9±2.55	4.634	3.74
LbM2	12	1.39-1.66	1.55±0.05	0.076	4.93
LliM2	14	1.18-1.47	1.31±0.05	0.082	6.27
WaM2	12	1.94-2.32	2.14±0.07	0.109	5.09
WpM2	11	1.54-1.83	1.71±0.06	0.085	4.97
Wa/La	12	128.3-146.3	138.3±3.37	5.084	3.68
LM3	1		0.56		
WaM3	1		1.18		

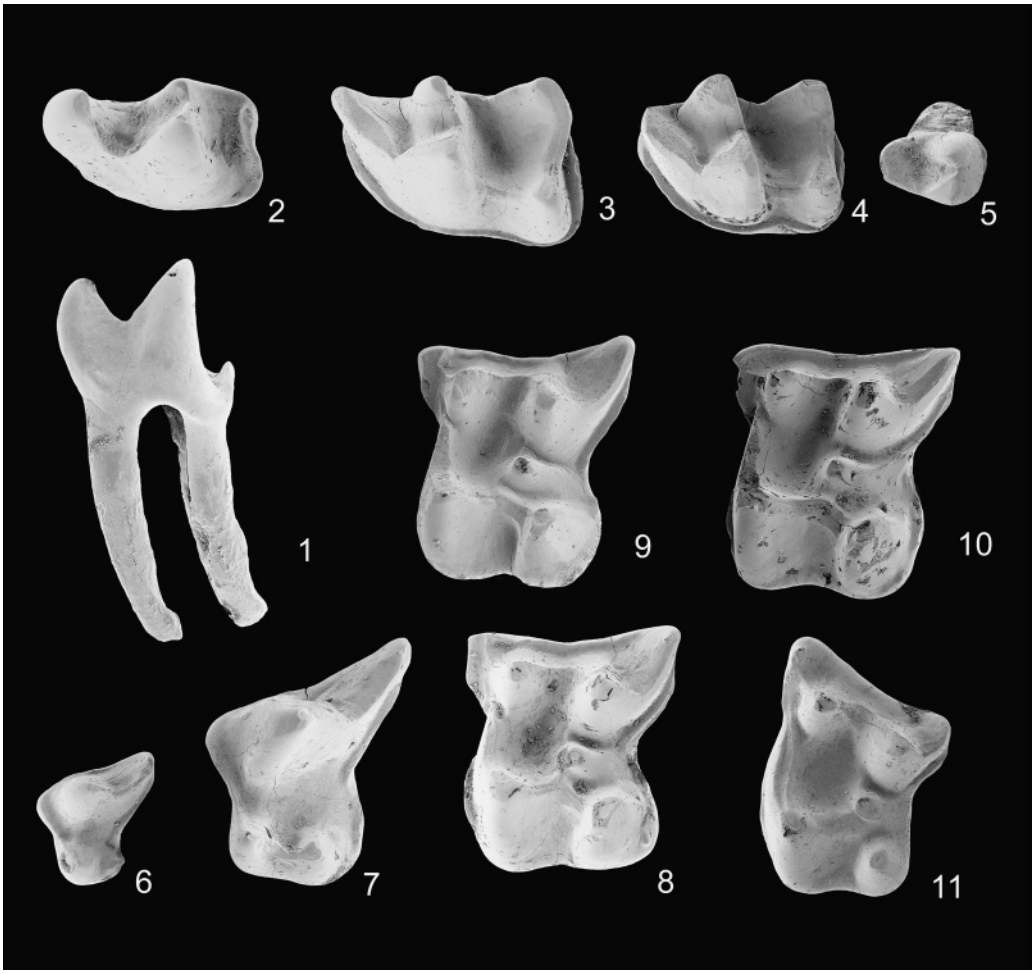


Fig. 13: *Amphechinus major* nov. spec.: **1:** Right p4, buccal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0004), ca. 15x; **2:** Left p4, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/000), ca. 15x; **3:** Left m1, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0005), ca. 15x; **4:** Left m2, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0006), ca. 15x; **5:** Right m3, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0007), ca. 15x; **6:** Left P3, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0008), ca. 15x; **7:** Right P4, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0003), ca. 15x; **8:** Right M1, holotype, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0001), ca. 15x; **9:** Right M1, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0009), ca. 15x; **10:** Right M1 with a postmetaconule-crest joining the metacingulum, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0183/0001), ca. 15x; **11:** Left M2, occlusal view (sample DEL-B/12, biozone C1, NHMW 2005z0198/0010), ca. 15x.

D i s c u s s i o n : *A. major* is the largest of the *Amphechinus* species under study. There is only a minor overlap in the size of some tooth positions with *A. taatsiingolensis*. The phylogenetic relationships between the different *Amphechinus* species remain obscure.

Genus *Parvericius* KOERNER, 1940

Type species: *Parvericius montanus* KOERNER, 1940

***Parvericius buk* nov. spec.**
(Fig. 14)

E t y m o l o g y : Buk = abbreviation of Builstyn Khudag. The section, where the type material was collected is located in the Builstyn Khudag area.

H o l o t y p e : Left m1 (NHMW 2005z0215/0001, Fig. 14/4).

M e a s u r e m e n t s of the holotype: 2.32x1.60x1.70 (LxWaxWp).

T y p e l o c a l i t y : Builstyn Khudag, Valley of Lakes, Central Mongolia, section BUK-A/12+14 (HÖCK et al. 1999)

T y p e s t r a t u m : Loh Formation.

A g e : Late Miocene, biozone E (sensu HÖCK et al. 1999), correlated with Baodean Chinese Mammal Age.

O c c u r r e n c e : With the inclusion of the referred material from samples ODO-A/1 and LOH-A/2 the stratigraphic range extends back to biozone D1/1 (Early to Middle Miocene).

P a r a t y p e s : from sample BUK-A/12+14. – Left and right dentary fragment with p4-m1, left maxillary fragment with M2-M3, 92 isolated teeth and tooth fragments (NHMW 2005z0215/0000-0009)

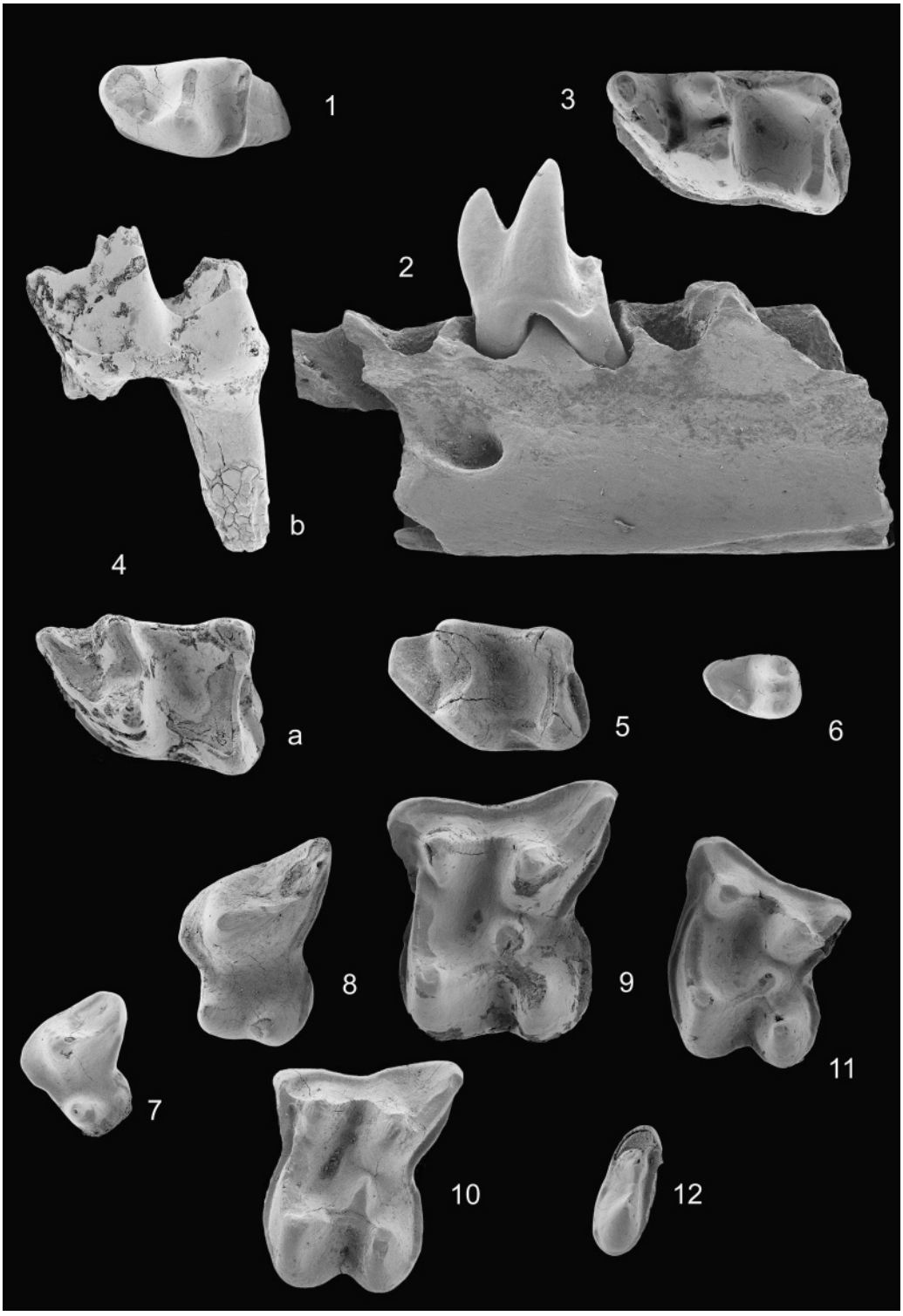
A d d i t i o n a l m a t e r i a l:

Biozones D1/1 and D1/2, samples ODO-A/1, LOH-A/2. – right dentary fragment without teeth, left dentary with p4 (very small, only tentative here), 23 isolated teeth and tooth fragments (NHMW 2005z0213/0000-0001, 2005z0214/0000-0002).

M e a s u r e m e n t s : see Tab. 12.

D i f f e r e n t i a l d i a g n o s i s : The genus *Parvericius* differs from all other erinaceines in the anteroposteriorly compressed trigonid of the m1 and m2. *Parvercius buk* differs from the only other species of the genus, *P. montanus*, in the less marked ectocingulids of the lower molars, in the P4 being distinctly shorter than the M1, and in the metaconule on M1 and M2, which is indicated as swelling on the termination of the postparacrista.

D e s c r i p t i o n : Painstaking descriptions of all teeth are published in RICH & RASMUSSEN (1973: 32). Hence we can do with a short listing of the features characteristic for the genus *Parvericius*, and the differences to *P. montanus*.


1
3
2
b
4
a
5
6
8
9
11
7
10
12

Dentary – One dentary fragment from the type locality shows the mental foramen under the posterior root of p4. In the two referred specimens it is below the anterior root of p4.

Teeth – All isolated teeth constitute a homogeneous sample on the basis of matching size. Furthermore, there is only one erinaceine species in the samples from biozones D1 and E, respectively. The i3/p2 and the lower canines show no peculiar features. In unworn p4 the paraconid is conical and distinctly lower than the protoconid. Both are separated by a deep notch. The metaconid is a bud closely attached to the lingual face of the protoconid. There is a marked postcingulid, but only a moderately developed pre- or ectocingulid. The most conspicuous character of the m1 and, less clearly, in the m2 is the anteroposteriorly compressed trigonid. Pre- and ectocingulid are continuous and moderately developed, tapering below the hypoconid. The postcingulid does not join the postcristid. In the m1 and m2 from biozone D1 the ectocingulid is somewhat better developed. The m3 is single-rooted and has a short precingulid. There is no vestige of a postcingulid. The P3 have a straight buccal margin and a lingual heel with a faint protocone. The precingulid projects slightly. There is no cuspidate parastyle. In the P4 the hypocone extends more lingually than the protocone. The metacrista is bent distobucally. Instead of a cuspidate parastyle there is a slightly projecting precingulum. The P4 is distinctly shorter than the M1. In unworn M1 and M2 a faint metaconule is delimited by a constriction of the postprotocrista. The hypocone has only a faint anterior crista. The preprotocrista grades into the preparaconule crista in the absence of a paraconule. In unworn M1 and M2 there is a shallow notch between preparaconule crista and the paracone. The precingulum joins the parastylar projection. The M3 has a weak precingulum. It is a mediolaterally elongated blade with a protocone and an equally large paracone. Its two roots are fused.

⇦ Fig. 14: *Parvericius buk* nov. spec.: **1:** Left p4, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0003), ca. 15x; **2:** Left dentary fragment with p4, buccal view, Loh (sample LOH-A/2, biozone D1/2, NHMW 2005z0213/0001), ca. 15x; **3:** Right m1, occlusal view, Olon Ovoony Khurem (sample ODO-A/1, biozone D1/1, NHMW 2005z0214/0001), ca. 15x; **4:** Left m1, holotype, a. occlusal, b. buccal views (sample Builstyn Khudag, BUK-A/12+14, biozone E, NHMW 2005z0215/0001), ca. 15x; **5:** Left m2, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0001), ca. 15x; **6:** Right m3, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0005), ca. 15x; **7:** Right P3, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0006), ca. 15x; **8:** Left P4, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0007), ca. 15x; **9:** Right M1, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0008), ca. 15x; **10:** Left M1, occlusal view, Olon Ovoony Khurem (sample ODO-A/1, biozone D1/1, NHMW 2005z0214/0002), ca. 15x; **11:** Left M2, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0009), ca. 15x; **12:** Right M3, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2005z0215/0002), ca. 15x.

Tab. 12: *Parvericius buk*, Biozone D1 & E, sample statistics of the teeth.

loc.	meas.	n	R	m	s	V
Biozone D1	Hum1	1		3.05		
Biozone E	Hum1	2	2.81-3.60	3.21		
Biozone D1	Lcinf.	1		1.58		
	Winf.	1		0.78		
Biozone E	Lcinf.	5	1.45-1.52	1.48±0.04	0.031	2.11
	Winf.	5	0.82-0.88	0.85±0.03	0.022	2.54
Biozone D1	Lp2	1		0.97		
	Wp2	1		0.65		
Biozone E	Lp2	11	1.05-1.30	1.19±0.05	0.067	5.62
	Wp2	11	0.69-0.83	0.76±0.03	0.040	5.24
Biozone D1	Ld4	1		1.66		
	Wd4	1		1.04		
Biozone D1	Lp4	4	1.61-1.72	1.67	0.051	3.07
	Wp4	5	0.92-1.10	1.02±0.09	0.068	6.64
Biozone E	Lp4	4	1.48-1.59	1.55		
	Wp4	6	1.01-1.09	1.05±0.04	0.033	3.09
Biozone D1	Lam1	1		2.47		
	Wam1	2	1.38-1.39	1.39		
	Wpm1	2	1.48-1.53	1.51		
Biozone E	Lam1	2	2.32-2.54	2.43		
	Wam1	2	1.52-1.60	1.56		
	Wpm1	4	1.62-1.70	1.65		
Biozone D1	Lm2	2	1.81-1.96	1.89		
	Wam2	4	1.19-1.26	1.25		
	Wpm2	3	1.20-1.24	1.22		
Biozone E	Lm2	3	2.02-2.05	2.03		
	Wam2	6	1.33-1.39	1.35±0.03	0.029	2.18
	Wpm2	7	1.26-1.40	1.32±0.05	0.051	3.84
Biozone E	Lm3	2	1.01-1.01	1.01		
	Wam3	2	0.74-0.74	0.74		
Biozone E	Lcsup	1		0.91		
	WCsup	1		0.61		
Biozone E	LP2	7	0.85-1.07	0.93±0.07	0.071	7.60
	WP2	7	0.59-0.66	0.63±0.02	0.022	3.53
Biozone E	LP3	6	1.16-1.26	1.22±0.06	0.048	3.91
	WP3	2	1.23-1.28	1.26		
Biozone D1	LP4	2	1.68-1.82	1.75		
	WP4	2	1.47-1.78	1.63		
Biozone E	LP4	2	1.83-1.92	1.88		
	WP4	1		1.88		

loc.	meas.	n	R	m	s	V
Biozone D1	LbM1	3	1.93-2.19	2.03		
	LliM1	5	1.66-1.89	1.75±0.14	0.107	6.11
	WaM1	5	2.16-2.28	2.20±0.07	0.048	2.16
	WpM1	5	2.29-2.51	2.38±0.11	0.080	3.37
	Wp/Lb	3	107.8-123.3	117.2		
Biozone E	LbM1	11	2.00-2.36	2.23±0.07	0.100	4.48
	LliM1	14	1.76-1.99	1.88±0.04	0.065	3.47
	WaM1	11	2.33-2.58	2.47±0.05	0.070	2.84
	WpM1	12	2.50-2.76	2.66±0.06	0.088	3.31
	Wp/Lb	10	113.3-125.0	119.3±2.97	3.944	3.30
Biozone D1	LbM2	1		1.66		
	LliM2	1		1.39		
	WaM2	1		1.95		
	WpM2	1		1.72		
	Wa/La	1		117.5		
Biozone E	LbM2	7	1.69-1.78	1.74±0.04	0.035	1.99
	LliM2	8	1.42-1.63	1.53±0.06	0.065	4.26
	WaM2	8	2.09-2.28	2.21±0.05	0.059	2.67
	WpM2	7	1.71-1.98	1.84±0.10	0.101	5.52
	Wa/La	6	118.8-133.3	126.7±6.34	5.520	4.36
Biozone E	LM3	2	0.60-0.61	0.61		
	WaM3	2	1.36-1.38	1.37		

D i s c u s s i o n : *Parvericius* has been described by KOERNER (1940) on the basis of material from the Deep River Bed of Montana, which are correlated with the Arikareean or Hemingfordian (Early or Middle Miocene). RICH & RASMUSSEN (1973) synonymised *Palaeoerinceus minimus* BOHLIN, 1942 from the Late Oligocene deposits of Taben Buluk in Western Kansu and *Amphechinus* (*Palaeoerinaceus*) cf. *minimus* (BOHLIN, 1942) from Nareen Bulak (Late Oligocene) with *Parvericius montanus*. The new material from the Builstyn Khudag area extends the range of the genus to the Late Miocene. Among the referred material there is a small dentary fragment with p4 – humm1 2.50; p4 1.49x1.00 – which is not included in the sample statistics. It does not differ morphologically from the other specimens. We do not think that it represents a second erinaceine in biozone D1. Because of its small size it is only tentatively referred to *P. buk*.

Erinaceinae gen. et sp. indet.
(Figs. 15–16)

Material and measurements:

Sample	Inv. no. (NHMW)	Object	Measurement
Biozone A		Erincaeinae gen. et sp. indet. 1	
HL-A/1	2005z0093/0001	right dentary fragment with p4-m1	humm1 1.98 p4 1.17x0.76 m1 1.76x1.06x1.13
	2005z0093/0002	Left ?D2	0.91x0.68
TAT/D1	2005z0105/0001	Right M1	1.58x1.35x1.95x1.95
Biozone D		Erincaeinae gen. et sp. indet. 2	
RHN-A/12	2005z0205/0001	Left M1	2.30x1.98x2.50x2.65
	2005z0205/0002	Left M2	1.59x1.32x2.21x1.65
		(M1+M2 probably one individual)	
	2005z0205/0000	Right m3	0.93x0.71
	2005z0205/0000	Left P3	1.28x–

Description and Discussion: The small dentary, the ?D2, and the M1 from biozone A are lumped together because of their small size. In the dentary fragment the mental foramen is situated between the roots of p2 and p4. There is a diastema between p4 and the alveole of p2. The possible D2 has a lingual heel without protocone and three widely-spaced delicate roots. The M1 differs morphologically from *Palaeoscaptor tenius* in the discontinuous anterior cingulum. All three specimens fall below the range of *P. tenius* and represent the smallest erinaceine in biozone A. However, they agree in size with *A. taatsiingolensis* and *A. minutissimus* from biozones C and C1 respectively. In the M1 of *A. taatsiingolensis* the anterior cingulid may be discontinuous. But we do not expect both *Amphechinus* species so early. May be they represent an admixture from higher strata. As no clear decision is possible we have to confine ourselves to leaving the exact determination open.

The large M1 and M2 from biozone D probably are from one individual. The small metaconule of the M1 is worn. In the M2 there is not even a buccal extension of the postprotocrista, hence also no vestige of a metaconule. In the M2 the hypocone is reduced to a small swelling of the postcingulum. The anterior cingulum is continuous in both teeth. The M1 is much too large for *A. major*. Though the M2 agrees in size well with *A. major*, it differs from this species in the reduced hypocone. The m3 and the P3-fragment agree in size and morphology with *A. major*. Both upper molars may belong to *Palaeoscaptor rectus* or a closely related from. However, this species is not represented in biozone D by any other teeth. Moreover, the upper dentition of *P. rectus* is not known from the type locality nor from the other so far published localities (Tatal Gol, Sulimski 1970; Ulantatal, Huang 1984). But the M2 referred to this species in biozones B and C have a hypocone, which is only slightly reduced.

We prefer to leave the exact determination of these large teeth open and name them Erinaceineae gen. et sp. indet. 2.

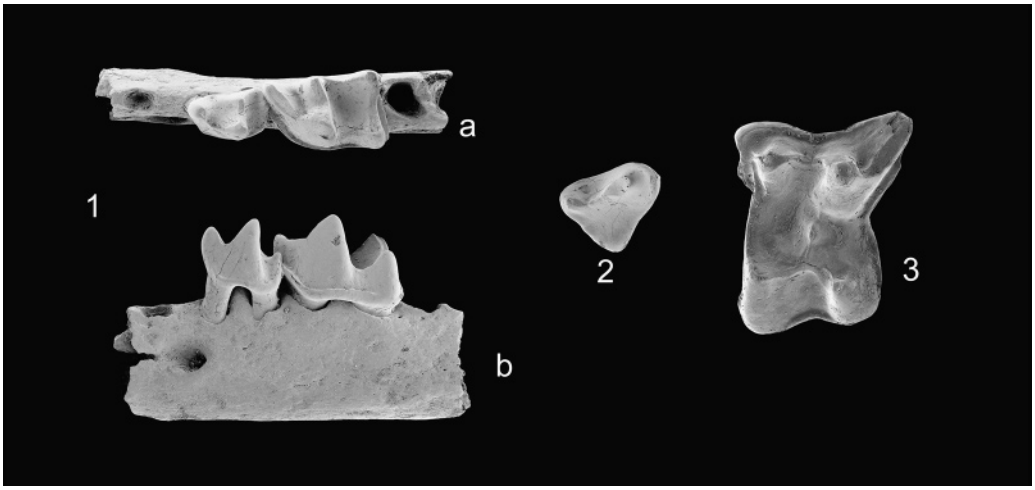


Fig. 15: Erinaceinae gen. et sp. indet. 1: **1:** Right dentary fragment with p4-m1, a. occlusal view, b. buccal view, Khongil (sample HL-A/1, biozone A, NHMW 2005z0093/0001), ca. 15x; **2:** Left ?D2, occlusal view, Khongil (sample HL-A/1, biozone A, NHMW 2005z0093/0002), ca. 15x; **3:** Right M1, occlusal view, Tatal Gol Hügel (sample TAT-Hü/1, biozone A, NHMW 2005z0105/0001), ca. 15x.

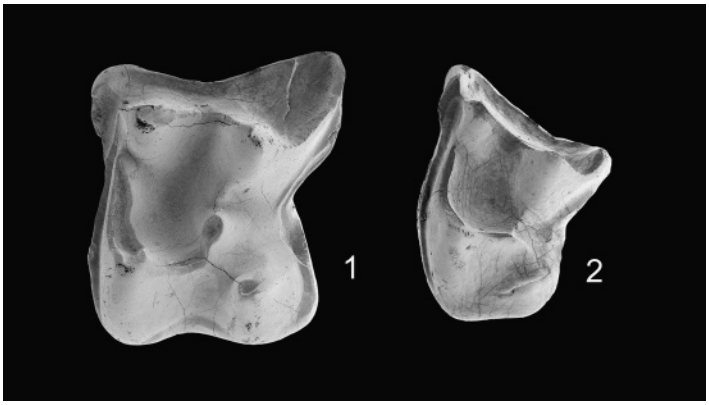


Fig. 16: Erinaceinae gen. et sp. indet. 2: **1:** Left M1, occlusal view, Huch Teeg (sample RHN-A/12, biozone D, NHMW 2005z0205/0001), ca. 15x; **2:** Left M2, occlusal view, Huch Teeg (sample RHN-A/12, biozone D, NHMW 2005z0205/0002), ca. 15x.

4.3. Order Soricomorpha GREGORY, 1910

4.3.1. Family Soricidae G. FISCHER, 1814

Subfamily Heterosoricinae VIRET & ZAPFE, 1951

Genus *Gobisorex* SULIMSKI, 1970

Type species: *Gobisorex kingae* SULIMSKI, 1970

Gobisorex kingae Sulimski, 1970
(Fig. 17)

M a t e r i a l :

Biozone A, samples SHG-C/2, TAT-D/1Hü1, TAT-D/1/Hü6, TGR-A/14. – 1 I sup., 1 M1, 1 maxillary fragment with P4-M1, 2 m1, 2 m2, 1 mandibular fragment with m1-2, 1 mandibular fragment with m1-3 (NHMW 2006z0017/0000, 2006z0018/0000, 2006z0019/0000, 2006z0020/0000).

Biozone B, samples DEL-B/7, IKH-A/1, IKH-A/2, SHG-A/15, SHG-AB/17-20, TGR-AB/22, TGR-B/1. – 3 I sup., 2 M1, 2 M2, 1 maxillary fragment with P4-M1, 1 i inf, 1 m1, 1 m2, 1 mandibular fragment with m1-2, 1 mandibular fragment with m1-3 (NHMW 2006z0021/0000, 2006z0022/0000, 2006z0023/0001, 2006z0024/0000, 2006z0025/0000, 2006z0025/0001, 2006z0026/0000, 2006z0026/0001, 2006z0027/0001).

Biozone C, sample TGR-C/1. – 2 I sup (NHMW 2006z0028/0000).

Biozone C1, sample IKH-B/5. – 1 A1 (NHMW 2006z0029/0001).

Biozone D, sample UNCH-A/3. – 1 I sup (NHMW 2006z0030/0001).

Unstratified surface find, sample UNCH-3/0. – 1 mandibular fragment with m1-2 (NHMW 2006z0030/0000).

M e a s u r e m e n t s : see Tab.13.

Tab. 13: *Gobisorex kingae*, sample statistics of the teeth.

		$\bar{x}$, s, V	n, min. - max.			$\bar{x}$, s, V	n, min. - max.
I sup.	- L	2.44, 0.106, 4.34	3, 2.32 - 2.52	i inf.	- L		1, 3.88
	- H	1.42, 0.088, 6.20	5, 1.32 - 1.56				
A1	- L		1, 1.60	m1	- L	2.09, 0.088, 4.20	7, 1.92 – 2.20
	- W		1, 1.20		- TrW	1.26, 0.100, 7.94	7, 1.16 - 1.40
					- TaW	1.34, 0.083, 6.19	5, 1.24 - 1.44
P4	- L		2, 1.60 – 1.88	m2	- L	1.82, 0.060, 3.30	7, 1.76 - 1.92
	- W		2, 1.56 – 1.80		- TrW	1.23, 0.048, 3.90	6, 1.16 - 1.28
					- TaW	1.23, 0.059, 4,80	6, 1.16 - 1.32
M1	- labL	1.77, 0.115, 6.50	4, 1.60 - 1.84	m3	- L		1, 1.40
	- mesW	1.76, 0.108, 6.14	4, 1.60 - 1.84		- W		1, 1.00
	- distW	1.85, 0.154, 8.32	4, 1.64 – 2.00				
M2	- labL		2, 1.56 - 1.60	MandH-		2.34, 0.156, 6.67	5, 2.16 - 2.52
	- mesW		2, 1.72 - 1.88	metaconid of m1			
	- distW		2, 1.56 - 1.60				

D e s c r i p t i o n : 15 of 27 specimens are black discoloured, whereas the remainder are light brown or even transparent with dark red to black coloured apices.

Upper jaw and dentition: In one maxillary fragment (with P4-M1) three alveoli in front of P4 are visible, the part further mesially is broken off. Foramen infraorbitale in both specimens beginning above the middle of the mesial root of P4 and ending above the mesostyle of M1.

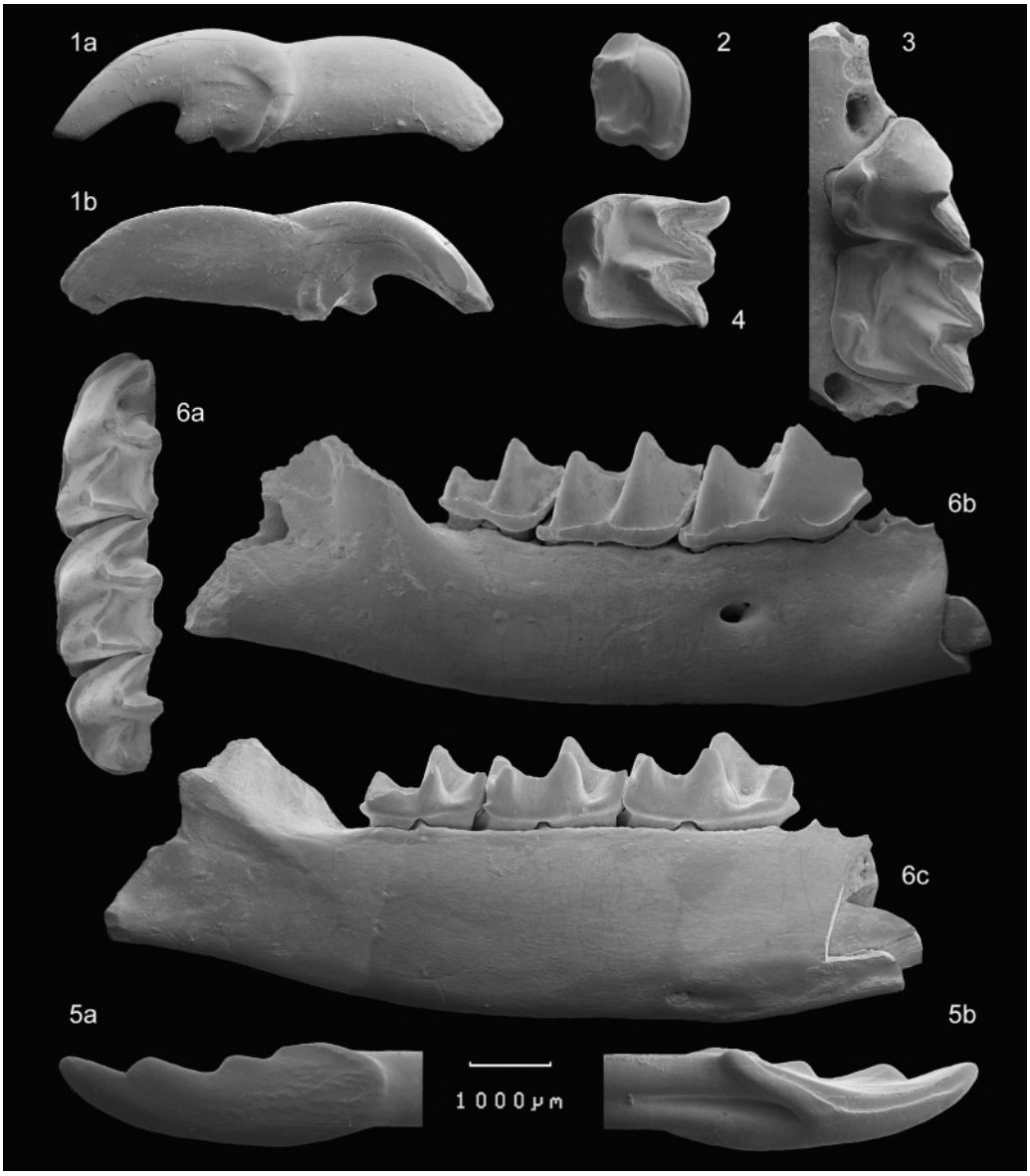


Fig. 17: *Gobisorex kingae* SULIMSKI, 1970: **1:** Right I sup. (reversed), a. labial view, b. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0030/0001); **2:** Right A1 (reversed), occlusal view, Ikh Argalatyn Nuruu (sample IKH-B/5, biozone C1, NHMW 2006z0029/0001); **3:** Left maxillary fragment with P4-M1, occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2006z0025/0001); **4:** Right M2 (reversed), occlusal view, Taatsiin Gol Right (sample TGR-AB/22, biozone B, NHMW 2006z0026/0001); **5:** Right i inf (reversed), a. labial view, b. lingual view, Ikh Argalatyn Nuruu, IKH-A/2, biozone B, NHMW 2006z0023/0001); **6:** Right dentary fragment with m1-m3 (reversed), a. occlusal view, b. labial view, c. lingual view, Taatsiin Gol Right (sample TGR-B/1, biozone B, NHMW 2006z0027/0001).

I sup. with a continuously rounded dorsal outline, a fissident apex, a small talon cusp and a strong disto-labial cingulum. Root without labial or lingual hollow or longitudinal groove.

A1 one-rooted, crown with a longitudinal ridge and a lingual crest running from the tip of the paracone and ending in a small cuspule on the lingual cingulum. A second, just discernible smaller cuspule follows right distally. A third and also very small cuspule is situated at the distal base of the longtudinal ridge. The tooth is encircled by a high cingulum; the mesio-lingual portion is confluent with the longitudinal ridge.

P4 with an inflated dominant paracone, a bulbous protocone with a weak labial ridge and a distally adjacent swelling of the cingulum (hypocone). The lingual cusps are integrated into a continuous cingulum. The distal basin is deeply excavated. The strong cingulum in front of the paracone shows - perhaps due to wear - no distinct parastyle.

M1 and M2 quadrate to subquadrate in outline. Basis of protocone sometimes projecting lingually. In unworn specimens the post-protocone-crest is well separated from the hypocone and ends somewhat labially. Stronger wear leads to an almost complete endoloph. Trigon- and talon-basin deeply excavated.

Lower jaw and dentition: Two mandibles with an almost complete mesial part exhibit 5 alveoli in front of m1. Foramen mentale situated behind a large depression and below hypoflexid or distal root of m1. Foramen postsymphyseale located close to the ventral margin, below the entocristid of m1, at the end of a short groove. In two specimens a longitudinal groove can be found on the ventral margin.

i inf. tricuspulate, with a very weak distal cuspule. Labial cingulid only disto-dorsally developed.

m1 slender with high entocristid. Hypoconulid closely attached to entoconid. In some specimens the labial edge of the protoconid is confluent with the disto-labial cingulid. This feature might differ between m1 and m2 of one mandible. Strong labial cingulid in most specimens interrupted at the basis of the protoconid. A lingual cingulid is developed only below the opening of the trigonid.

The m2 resembles m1 in most features except the mesio-distally more compressed trigonid (as usual for m2) and a continuous uninterrupted labial cingulid. The m3 with rectangular talonid. Since the distal part is slightly damaged (with only hypoconid preserved), nothing can be said about entoconid and hypoconulid. Labial cingulid with a short interruption at the labial basis of the hypoconid. Lingually a weak cingulum is located below the opening of the trigonid.

D i s c u s s i o n : *Gobisorex kingae* was described from the classical locality of Tatal Gol, 20 km east of Loh, in Central Mongolia (N 45°17', E 101°35') based on two mandibular fragments with distal part of i inf. and m1-3 (Holotype) and with m1-3 respectively (SULIMSKI 1970). Both specimens were found in layers consisting of brick-red clays with sandy parts below a basalt, which is probably identical with basalt I in HÖCK et al. (1999) dated to an age of 31.5 Ma (GRADZINSKI et al. 1968). In that case the "classical" layers should be part of the Hsanda Gol Formation and Early Oligocene in age.

SULIMSKI (1970: 68) was uncertain about the systematic position of his new taxon: and stated that "it is possible that *Gobisorex* nov. gen. represents an earlier stage of soricine

evolution showing, at the same time, some resemblances to heterosoricines". STORCH et al. (1998) reviewed the type specimens and found diagnostic features of heterosoricines.

Further reports of *Gobisorex* come from the Early Oligocene Buran Fauna (*Gobisorex* cf. *kingae* in GABUNIA & GABUNIA 1987 see LOPATIN 2002c) in eastern Kazakhstan and from several lower Miocene localities of the northern Aral region in Kazakhstan: Altynshokysu (*Gobisorex kingae* and aff. *kingae* in BENDUKIDZE 1993, *Gobisorex* sp. in LOPATIN 1999, and *Gobisorex akhmetievi* LOPATIN, 2004[c]), Shokysu (*Gobisorex kingae* in LOPATIN 1996) and Akotau (*Gobisorex* aff. *kingae* in LOPATIN 1996).

Gobisorex aff. *kingae* in BENDUKIDZE (1993), together with Heterosoricidae gen. indet. in LOPATIN (1999), both from the Lower Miocene of Altynshokysu too, was transferred to a new genus and species: *Atasorex edax* LOPATIN, 2004[c].

An Early Miocene fragmentary mandible with the distal part of m1 and a complete m2 from the Altynshokysu locality, North Aral Region (Kazakhstan) – previously designated as *Gobisorex kingae* in BENDUKIDZE 1993 and *Gobisorex* sp. in LOPATIN 1999 - was described as a new species by LOPATIN (2004c): *Gobisorex akhmetievi* LOPATIN, 2004. The species is distinguished from *G. kingae* SULIMSKI 1970 by: larger teeth (length of m2: 2.0 vs. 1.7 in SULIMSKI 1970), the greater heights of the horizontal ramus (2.20 below m1 vs. 1.7 in SULIMSKI 1970), and the presence of a lingual cingulid in m2.

In the material at hand the highest values (2.52, 2.44) for heights of mandible are found in the oldest specimens from biozone A, the lowest (2.16, 2.20) in biozone B. The values for m2-L (1.76 – 1.92) close the gap in size between SULIMSKI's 1.7 and LOPATIN's 2.0. SULIMSKI (1970) did not mention absence or presence of a lingual cingulid in any lower molar of the type material from Tatal Gol, although his figures 2H2 and 2H3 might indicate the presence of a lingual cingulid at least in the mesial portion of m1.

According to SULIMSKI's description the type material seems to differ from the specimens at hand by a suite of characters: I inf. with continuous disto-labial cingulid, low entocristids in m1-2, m2 without continuous labial cingulid, hypoconulid and foramen postsymphyseale lacking, foramen mentale below mesial root of m1 and mandible without lower notch. Judging from the drawings and the plate (SULIMSKI 1970, figs. 2G-H, pl. 19) the heights of the entocristids compares very well with the specimens described herein, also the position of the foramen mentale (below hypoflexid); hypoconulids are visible, not really cusp-like, but somewhat separated from the entoconids, and the labial cingulid of m2 seems not to be interrupted at the basis of the protoconid (pl. 19, figs. 8a & 9a).

The length of the disto-labial cingulid of the lower incisor is - to a certain degree - rather variable and therefore not sufficient to distinguish species. A groove on the lower margin of the mandible (if "lower notch" means this at all) is developed only in 2 out of 4 specimens,and so is variable as well. According to REUMER (1998) the possession of a "small foramen of unknown function present on the medial face of mandible near the ventral margin below M_1 or M_2", i.e. a foramen postsymphyseale, is one of the diagnostic features of the subfamily Heterosoricinae. Prof. Mieczyslaw WOLSAN - Institute of Paleobiology, Polish Academy of Sciences Warszawa – was so kind to examine the type specimens in his care and stated the presence of this foramen in both mandibles as well as the continuous labial cingulid in the lower m2. Somewhat surprising on first sight might be the variation in size at least in some positions. But it has to be kept in

mind that the material is relatively scarce, the origin of the specimens is different concerning the age and the geographical position, and differences of a similar degree can be found even in heterosoricine populations of a single locality: *Dinosorex* aff. *zapfei* from Sandelzhausen/S Germany (ZIEGLER 2000); *Heterosorex neumayrianus* from Wintershof-West/S Germany (ZIEGLER 1989), or *Dinosorex pachygnathus* from Anwil/Switzerland (ENGESSER 1972).

Nevertheless, due to the same reasons it can not be excluded, that the material represents more than one species. Especially since further heterosoricine material – representing at least two additional species – is preserved.

Heterosoricinae gen. et sp. indet. 1
(Fig. 18.1)

M a t e r i a l :

Biozone B, sample TGR-AB/21. – 1 M3 (NHMW 2006z0031/0001).

M e a s u r e m e n t s : M3: L x W = 0.88 x 1.32

D e s c r i p t i o n : Dark-brown or white in colour. Protocone weaker and lower than paracone. Pre-protocone-crest not connected to the paracone but as a cingulum-like structure reaching far labially, almost to the basis of the indistinct parastyle. Post-protocone-crest ending free in a deep central basin. Metacone crest-like and extending as a continuos ridge far lingually without connection to the basis of the protocone.

D i s c u s s i o n : If the upper molars assigned to *Gobisorex kingae* really belong there, an M3 of the size of the tooth at hand could be expected. However, in the course of the pre-protocone-crest this M3 differs clearly from the M1 and M2 assigned to *Gobisorex*.

Heterosoricinae gen. et sp. indet. 2
(Fig. 18.2)

M a t e r i a l :

Biozone B, sample SHG-AB/17-20. – 1 A1 (NHMW 2006z0032/0001).

M e a s u r e m e n t s : L x W = 1.40 x 0.80

D e s c r i p t i o n : Dark-brown in colour. A1 slender in occlusal view, one-rooted, crown with a longitudinal ridge and a lingual crest running from the tip of the paracone and ending in a small cuspule on the lingual cingulum. A second cuspule is situated close to the disto-lingual portion of the cingulum in the imaginary elongation of the distal end of the longitudinal crest.The tooth is encircled by a moderately developed cingulum.

D i s c u s s i o n : This tooth is not very much different in length but less robust and relatively slender as compared to the specimen attributed to *Gobisorex kingae*: W: Lx100 = 57 % versus 75 % in the latter and therefore does certainly not represent this genus. But it might correspond to the M3 from TGR-AB/21 (Heterosoricinae gen. et sp. indet. 1).

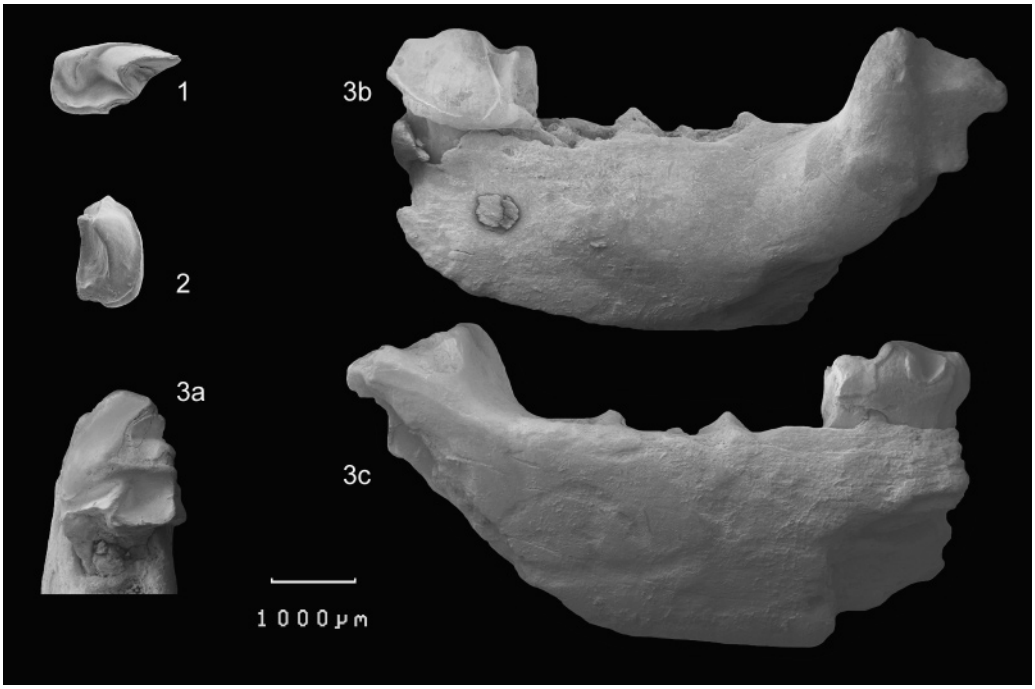


Fig. 18: Heterosoricinae gen. et sp. indet. 1-3: **1:** Heterosoricinae gen et sp. indet. 1. Left M3, occlusal view, Taatsiin Gol Right (sample TGR-AB/21, biozone B, NHMW 2006z0031/0001); **2:** Heterosoricinae gen. et sp. indet. 2. Right A1 (reversed), occlusal view, Hsanda Gol (sample SHG-AB/17-20, biozone B, NHMW 2006z0032/0001); **3:** Heterosoricinae gen. et sp. indet. 3. Left mandibular fragment with m1, a. occlusal view, b. labial view, c. lingual view, Tavan Ovoony Deng (sample RHN-A/7, biozone C1, NHMW 2006z0033/0001).

Heterosoricinae gen. et sp. indet. 3

(Fig. 18.3)

M a t e r i a l :

Biozone C1, sample RHN-A/7. – 1 mandibular fragment with m1 (NHMW 2006z0033/0001).

M e a s u r e m e n t s : MandH-entoconid of m1: 2.84, MandW-middle of m3: 1.40

D e s c r i p t i o n : White in colour. Mandible very high and robust compared to the specimens of *G. kingae* at hand (MandH below entoconid of m1 between 2.16 and 2.52; MandW in the middle of m3 between 1.12 and 1.24). Foramen mentale below hypoconid of m1. The m1 is strongly worn and corroded. Labial cingulid very weak at the basis of the protoconid but then rising somewhat upwards at the disto-labial edge of the protoconid. It is visible again at the mesial basis of the hypoconid, i.e. the labial cingulid seems to be sligtly divided by the hypoflexid.

D i s c u s s i o n : The specimen differs by its robust mandible and the unusual development of the labial cingulid of m1 from the specimens assigned to *Gobisorex kingae*.

Subfamily Crocidosoricinae REUMER, 1987

***Taatsiinia* nov. gen.**

E t y m o l o g y : In allusion to the river Taatsiin.

T y p e s p e c i e s : *Taatsiinia hoeckorum* nov. gen. nov. spec.; no other species included.

D i a g n o s i s : Crocidosoricine soricid with upper M1-2 with a considerable distal emargination and a short but strong mesio-lingual cingulum. M1 with a rounded, M2 with a ridge-like hypocone. Root of upper incisor without longitudinal lingual groove. In m1-2 the labial edge of the protoconid is confluent with the disto-labial cingulid.

Mandible with 4 alveoli for 4 one-rooted (?) lower antemolars in front of p4 and the foramen mentale below the mesial root of p4.

D i f f e r e n t i a l d i a g n o s i s : Comparisons are restricted to the oldest, Oligocene non-heterosoricine soricids.

- *Crocidosorex* LAVOCAT, 1951 – as understood here – includes type species *C. piveteaui* LAVOCAT, 1951 from the Early Miocene of Marcoin (Puy-de-Dôme) only and is therefore not known from pre-Miocene localities (HUGUENEY 1997). Nevertheless it is included in comparisons because of the taxonomical confusion with *Oligosorex*. For a discussion about the content of these two genera see VAN DEN HOEK OSTENDE (2001). *Crocidosorex* differs in lower molars with – aside from a pre-cingulid – no other labial cingulid and a p4 without disto-lingual crest (LAVOCAT 1951).
- *Oligosorex* KRETZOI, 1959 - according to VAN DEN HOEK OSTENDE (2001) - includes the species *antiquus* (POMEL, 1853), *reumeri* HOEK OSTENDE, 2001, and *thauensis* (CROCHET, 1975). It differs in lower molars where the hypoflexid opens well above the labial cingulid and the disto-labial edge of the protoconid is not confluent with the disto-labial cingulid and by the possession of only three alveoli for one-rooted lower antemolars (see BRUIJN & RÜMKE 1974, CROCHET 1975, GIBERT 1975, ZIEGLER 1989, VAN DEN HOEK OSTENDE 2001).
- *Srinitium* HUGUENEY, 1976 is known by 2 named species: the Early Oligocene *Srinitium marteli* HUGUENEY, 1976 (MP 23-24; *S.* cf. *marteli* from Ehrenstein 8, MP 22, might be the earliest known non-heterosoricine) and the Late Oligocene *Srinitium caeruleum* ZIEGLER, 1998[a] (MP 28 from Herrlingen 8), and some undescribed, un-named forms (see RZEBIK-KOWALSKA 1998). *S. marteli* differs in M1-2 with metaloph and metaconule and without or with weaker mesio-lingual cingulum, and by a more mesially placed foramen mentale, below p2 instead of mesial root of p4 (see HUGUENEY 1976). *S. caeruleum* was referred to this genus mainly on the basis of its unreduced antemolar region and lacks any metaloph or metaconule in the upper molars. It differs from *Taatsiinia* by the lacking or weaker mesio-lingual cingulum in M1-2 and a broader hypoconal flange in M1 (see ZIEGLER 1998a).

- *Ulmensia* ZIEGLER, 1989 differs in the overall more massiv appearance (i.e. dominating cusps and relatively shallow valleys), upper molars with a weaker hypocone and without mesio-lingual cingulum, 3 instead of 4 alveoli for lower antemolars, a distal cuspule on p4 which seems to be a building of the labial rather than the lingual cingulum (*Taatsiinia*), and larger size.

Soricidae sp. from the Late Oligocene of Yindirte (Taben Buluk, Gansu Province, China) is represented by one m2. A single lower molar at least of an early soricid is hardly sufficient for determination, but according to the figures of that specimen it differs at least by a very high labial cingulid (BOHLIN 1942: fig. 5f).

Shrew remains with an age of ± 28 my were discovered in Early Arikareean, Late Oligocene strata in Nebraska, but a detailed description is not yet available (BAILEY 1999).

***Taatsiinia hoeckorum* nov. spec.**
(Fig. 19)

E t y m o l o g y : Dedicated to Prof. Dr. Volker HÖCK and Doz. Dr. Gudrun DAXNER-HÖCK in recognition of their outstanding contributions to our knowledge of stratigraphy and vertebrate palaeontology in Mongolia.

H o l o t y p e : Right M1 (NHMW 2006z0036/0001, biozone B, sample TGR-B/1)

M e a s u r e m e n t s of the holotype: labL x mesW/distW = 1.12 x 1.24/1.40

T y p e l o c a l i t y and horizon: Orographic right side of Taatsiin Gol (Gol = river), Taatsiin Gol Area, Valley of Lakes, Central Mongolia. Section TGR-B/1, biozone B, Hsanda Gol Formation, Lower Oligocene.

T y p e s t r a t u m : Hsanda Gol Formation.

O c c u r r e n c e : Samples SHG-AB/17-20, SHG-A/20, and TGR-B/1; biozone B, Hsanda Gol-Formation, Lower Oligocene.

P a r a t y p e s : from Biozone B, sample TGR-B/1. –1 I sup., 1 M2, 1 mandibular fragment with part of m1 and m2 (NHMW 2006z0036/0002, 2006z0036/0003, 2006z0036/0004).

A d d i t i o n a l m a t e r i a l :

Biozone B, samples SHG-AB/17-20, SHG-A/20. – 1 M2, 1 M, 1 m1, 1 mandibular fragment with p4, m1 and part of m2 (NHMW 2006z0034/0000, 2006z0035/0000).

M e a s u r e m e n t s : I sup.: L x H = 0.94 x 0.80; M2: labL x mesW/distW = 0.98 x 1.18/1.20, 1.04 x 1.24/-; p4: L x W = 0.78 x 0.54; m1: L x TrW/TaW = 1.28 x 0.68/0.72, - x -/0.72, 1.24 x 0.68/0.72; m2: L x TrW/TaW = 1.20 x 0.72/0.72; MandH-m2 = 1.04, 1.00.

D i a g n o s i s : As for genus.

D e s c r i p t i o n : SHG-AB/17-20 and TGR-B/1: All specimens dark brown in colour.

Upper dentition: I sup. not fissident. Dorsal side of apex in lingual view continuously rounded, disto-labial cingulum ending before reaching the dorsal margin of the tooth. Root with shallow labial and without lingual groove. Crown small in relation to root as compared to "modern" soricids.

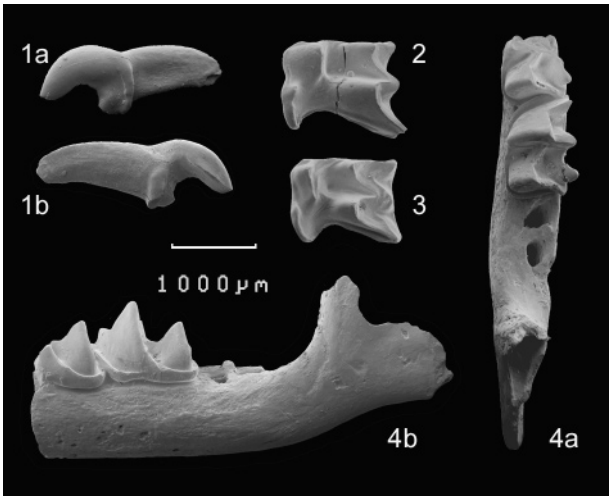


Fig. 19: *Taatsiinia hoeckorum* nov. gen. nov. spec.: **1:** Left I sup., paratype, a. labial view, b. lingual view, Taatsiin Gol Right (sample TGR-B/1, biozone B, NHMW 2006z0036/0002); **2:** Right M1 (reversed), holotype, occlusal view, Taatsiin Gol Right (sample TGR-B/1, biozone B, NHMW 2006z0036/0001); **3:** Right M2 (reversed), paratype, occlusal view, Taatsiin Gol Right (sample TGR-B/1, biozone B, NHMW 2006z0036/0003); **4:** Left mandibular fragment with part of m1 and m2, paratype, a. occlusal view, b. labial view, Taatsiin Gol Right (sample TGR-B/1, biozone B, NHMW 2006z0036/0004).

M1 and M2 with deep distal emargination and narrow hypoconal flange. Hypocone small and rounded in M1 and more ridge-like in M2. Distal cingulum starts at the distal basis of the protocone integrates the hypocone, gets very weak in the depth of the distal emargination, and ends at the metastyle. Pre-protocone-crest ending approximately below the tip of the paracone (in one M2 very weakly reaching the parastyle). Other cingula at the mesio-lingual basis of the protocone and between proto- and hypocone. No metaloph.

Lower jaw and dentition: Horizontal ramus in front of m1-trigonid and ascending ramus of the mandible lacking; mesio-ventral margin of the internal temporal fossa just preserved; foramen mandibulare situated below the distal part of the internal temporal fossa. Ventral margin of the horizontal ramus straight.

Mesial part of m1 from TGR-B/1 broken off. In m1 and m2 the disto-labial edge of protoconid is confluent with the disto-labial cingulid; the mesio-labial cingulum ends before reaching the transition. In m1 the cingulum is slightly bent somewhat behind the transition in labial view. Crista obliqua ending ± in the middle of the protocristid, hypoflexid deep. Entoconid not well rounded but in thickness forming a unit with the relatively high and slightly comma-shaped entocristid. Hypocristid concave, hypoconulid well separated from entoconid. The hypoconulid of m1 fits into the notch between mesio-labial cingulum and parastyle of the following m2. Weak lingual (interrupted below metaconid) and well-developed labial cingulid, the latter interrupted at the distal basis of the protoconid.

SHG-A/20: Mandible and teeth white and dark brown in colour and partly transparent. Four antemolar alveoli are visible in front of the two-rooted p4. The dorsal wall of the incisor-alveole is somewhat inclined upwards in relation to the dorsal margin of the mandible. Foramen mentale is situated below mesial root of p4.

The p4 with V-shaped wear surface, a small paraconid and well-developed cingulids on both sides. The lingual cingulid ends in a strong distal cuspule (hypoconid) which fits between the end of the labial cingulid and the parastyle of m1. On the other hand the parastyle of m1 is partly situated upon the disto-lingual cingulid of the p4.

In m1 – like in the type material – the disto-labial edge of the protoconid is confluent with the disto-labial cingulid and also the slight cingulid step behind the transition is developed. The lingual cingulid is strong but – since it is almost invisible below the entoconid – it seems to start from the mesial slope of this cusp; it ends at the mesial basis of the parastyle. The m2 is too fragmentary for a description.

D i s c u s s i o n : These specimens are kept together as one taxon because of their corresponding morphology (i.e. deep distal emargination and mesio-lingual cingulum in M1-2, and the continuous connection between disto-labial edge of protoconid and disto-labial cingulid in m1-2), size and similar age (Early Oligocene).

Although the confluence of the disto-labial edge of the protoconid and the disto-labial cingulid in m1-2 has only been reported for the Early Miocene genera *Carposorex* CROCHET, 1975 and *Aralosorex* LOPATIN, 2004, it is present in other early soricids too: for instance *Heterosorex* (ZIEGLER 1989), *Quercysorex* (ZIEGLER 1998a), *Gobisorex*, *Srinitium* (ZIEGLER 1998a), and *Ulmensia* (ZIEGLER 1989).

However, there is some variation: usually it is more conspicuous in the m1 than in the m2, and often the cingulid forms only a peak below the hypoflexid without a clear connection between edge and cingulid. But as far as we know these characters are never found in the Allosoricinae and Limnoecinae or the "modern" sub-families Soricinae and Crocidurinae.

The absence of a longitudinal groove on the lingual face of the root of I sup. is stated here as a character of this taxon. The same character was stated by DOBSON (1890) and DOBEN-FLORIN (1964) to occur in some other taxa. Thus far, however, no further studies about its distribution among shrews have been done. Our preliminary results suggest that the groove is absent in Soricinae but present in most Crocidurinae and variably present in Crocidosoricinae (DAHLMANN et al. in press).

Tavoonyia nov. gen.

E t y m o l o g y : A combination of Tav- and –voony. In allusion to the area were the type material was found: Tavan Ovoony Deng.

T y p e s p e c i e s : *Tavoonyia altaica* nov. spec.; no other species included.

D i a g n o s i s : Crocidosoricine shrew. Root of I sup. without longitudinal lingual groove. M1 with rounded hypocone, a moderate distal emargination, and a distal cingulum only. 3 lower antemolars in front of p4; 3rd alveole in front of p4 with a mesial ridge. Lower molars with a weak lingual cingulid. In m1 the disto-labial edge of the protoconid is connected to the labial cingulum, in m2 the connection is indistinct. First and second lower molar with high entocristid. m3 with somewhat mesio-distally compressed trigonid and without hypoconulid.

D i f f e r e n t i a l d i a g n o s i s :

- *Aralosorex* LOPATIN, 2004[b] differs by the deviating configuration of distal crests of p4, forming more or less a distolingual basin, and upper molars with small hypocone and without metaloph.

- *Carposorex* Crochet, 1975 differs by a lower number of lower antemolars.
- *Clapasorex* Crochet, 1975 differs by a more distally placed foramen mentale, m1-2 with lower entocristids, the lacking of a labial protoconid-cingulid-connection in m1 (and m2), and M1 with reduced hypocone.
- *Crocidosorex* Lavocat, 1951 differs by lower molars with - aside from a pre-cingulid - no other labial cingulid and a p4 without disto-lingual crest (Lavocat 1951). See differential diagnosis of *Taatsiinia* for the relation *Crocidosorex-Oligosorex*.
- *Florinia* Ziegler, 1989 differs by a more distally situated foramen mentale.
- *Lartetium* Ziegler, 1989 differs by m1-2 with lower entocristids and the lack of a labial protoconid-cingulid-connection in m1 (and m2).
- *Miocrocidosorex* Lopatin, 2004[b] differs at least by a lower number of lower antemolars and a m1 with a very wide trigonid-opening caused by a very long pre-protocristid (reminiscent of the European Plio-Pleistocene genus *Deinsdorfia* Heller, 1963).
- *Miosorex* Kretzoi, 1959 differs by the lack of a labial protoconid-cingulid-connection in m1 (and m2) and M1 with reduced hypocone.
- *Oligosorex* Kretzoi, 1959 differs by the lack of a labial protoconid-cingulid-connection in m1 (and m2).
- *Soricella* Doben-Florin, 1964 differs by an I sup. with a shorter crown and a root with a lingual groove, m1-2 where the hypolophid ends in the entoconid and is not separated by a groove, and M1 with reduced hypocone.
- *Srinitium* Hugueney, 1976 differs by M1 with lingual cingulum and reduced hypocone. *S. caeruleum* differs by a higher number of lower antemolars. See also differential diagnosis for *Taatsiinia* nov. gen.
- *Taatsiinia* nov. gen. differs by a higher number of lower antemolars, m1-2 with lower entocristids, a more rounded not elongate upper incisor, and M1-2 with mesio-lingual cingulum.
- *Ulmensia* Ziegler, 1989 differs by a more distally placed foramen mentale and M1 with reduced hypocone.

***Tavoonyia altaica* nov. gen. nov. spec.**

(Fig. 20)

Etymology: In allusion to the Altai Mountains delimiting the Valley of Lakes to the W, SW and S.

Holotype: Left M1 (NHMW 2006z0037/0001, biozone C1, sample RHN-A/9).

Measurements of the holotype: labL x mesW/distW = 1.24 x 1.28/1.40

Paratypes: from Biozone C1, sample RHN-A/9. – 1 M1, 2 mandibular fragments: 1with p4-m1, 1 with m2 (NHMW 2006z0037/0002, 2006z0037/0003, 2006z0037/0004).

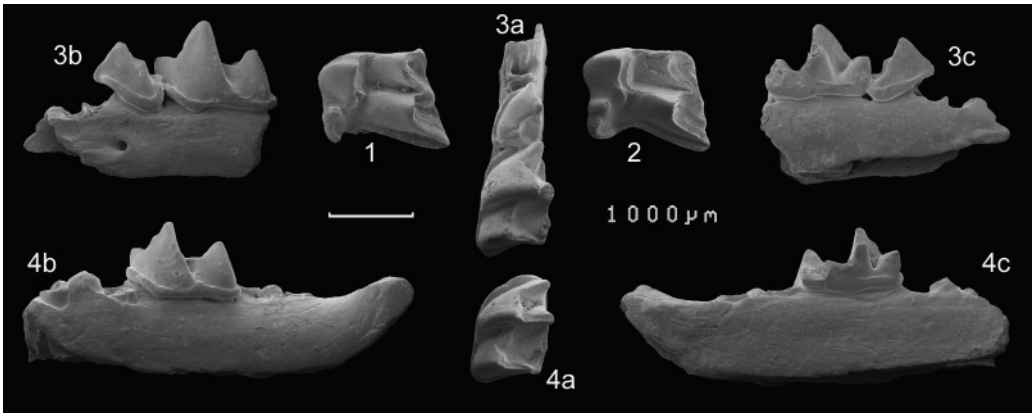


Fig. 20: *Tavoonyia altaica* nov. gen nov. spec.: **1:** Left M1, holotype, occlusal view, Tavan Ovoony Deng (sample RHN-A/9, biozone C1, NHMW NHMW 2006z0037/0001); **2:** Rigth M1 (reversed), paratype, occlusal view, Tavan Ovoony Deng (sample RHN-A/9, biozone C1, NHMW 2006z0037/0002); **3:** Left mandibular fragment with p4-m1 (reversed), paratype, a. occlusal view, b. labial view, c. lingual view, Tavan Ovoony Deng (sample RHN-A/9, biozone C1, NHMW 2006z0037/0003); **4:** Left mandibular fragment with m2 (reversed), paratype, a. occlusal view (m2), b. labial view, c. lingual view, Tavan Ovoony Deng (sample RHN-A/9, biozone C1, NHMW 2006z0037/0004).

T y p e l o c a l i t y and horizon: Tavan Ovoony Deng, Taatsiin Gol Area, Valley of Lakes, Central Mongolia. Sample RHN-A/9, biozone C1, Loh Formation, Upper Oligocene.

T y p e s t r a t u m : Loh Formation.

S t r a t i g r a p h i c r a n g e: At present restricted to the type locality and horizon.

M e a s u r e m e n t s : p4: L x W = 0.80 x 0.60; m1 L x TrW/TaW = 1.36 x 0.80/0.80; m2: L x TrW/TaW = 1.28 x 0.80/ - .

D i a g n o s i s : As for genus.

D e s c r i p t i o n : Teeth and mandibles light brown in colour.

Upper dentition: I sup. elongate, not fissident; talon cusp broken off. Root with a shallow labial and without lingual groove.

M1 with a well-rounded hypocone, placed close to the free-ending post-protocone-crest, a moderate distal emargination (with its deepest point rather lingually) and a rather short hypoconal flange. Only a distal cingulum starting with the hypocone is developed. In one specimen a cuspule is following distally. Trigon basin closed distally by a rather high connection between protocone and distal slope of metacone and additionally by a vestigial spur (incomplete metaloph) coming from the protocone an ending abruptely before reaching the slope of the metacone. Parastyle with a distal crest.

Lower jaw and dentition: 3 alveoli in front of p4: two small and one large with a mesial ridge (3rd in front of p4). Mental foramen below the mesial root of the p4.

Fourth premolar with a v-shaped wear-surface (two distal crests ending halfway down the cusp, the stronger labial one ending in a small cuspule). Distal cingulum-cuspule (hypoconid) closes the gap between labial cingulid and paraconid of m1. Labial cingulid high and narrow.

In the m1 the disto-labial edge of the protoconid is confluent with the disto-labial cingulid. Nevertheless, the labial cingulid is not really interrupted at the basis of the protoconid but a faint ascending connection rests, giving the impression of a peak at the opening of the hypoflexid.

In the m2 the confluence is indistinct and the impression of a peak dominates. Labial tooth basis undulate in m1 and straight in m2. In both positions the high lingual cingulid reaches from the para- to the metaconid. Entocristid high and straight, hypoconulid separated from entoconid.

D i s c u s s i o n : A well-rounded hypocone seems to be a rare feature among early Crocidosoricines and as far as we know it is described thus far only for the species of the European genus *Lartetium*. But this taxon can be distinguished by other characters very easily. Another unusual character is the mesial ridge of the 3rd alveole in front of the incisor. Remarkable is the stronger development of the disto-labial crest of the p4 in relation to the disto-lingual one. Perhaps indistinct characters like this one are already indicative for a separation into the modern subfamilies Soricinae and Crocidurinae.

Crocidosoricinae gen. et sp. indet. 1

(Fig. 21.1)

M a t e r i a l :

Biozone B, sample TGR-AB/21. – 1 edentulous mandibular fragment (NHMW 2006z0038/0001).

D e s c r i p t i o n : Dark brown in colour. Horizontal ramus, upper part of ascending ramus and angular process broken off. Small condylar process widely damaged. Internal part of the lower condylar facet partly preserved. Foramen mandibulare below the middle of the ventral margin of the internal temporal fossa.

Crocidosoricinae gen. et sp. indet. 2

(Fig. 21.2)

M a t e r i a l :

Biozone B, sample TGR-AB/21. – 1 A sup (NHMW 2006z0039/0001).

M e a s u r e m e n t s : A sup.: L x W: 0.92 x 0.80.

D e s c r i p t i o n : Heart-shaped tooth, white in colour with orange tip.

D i s c u s s i o n : The specimen seems too large to belong to Crocidosoricinae indet. gen. et sp. 1 from the same locality and section.

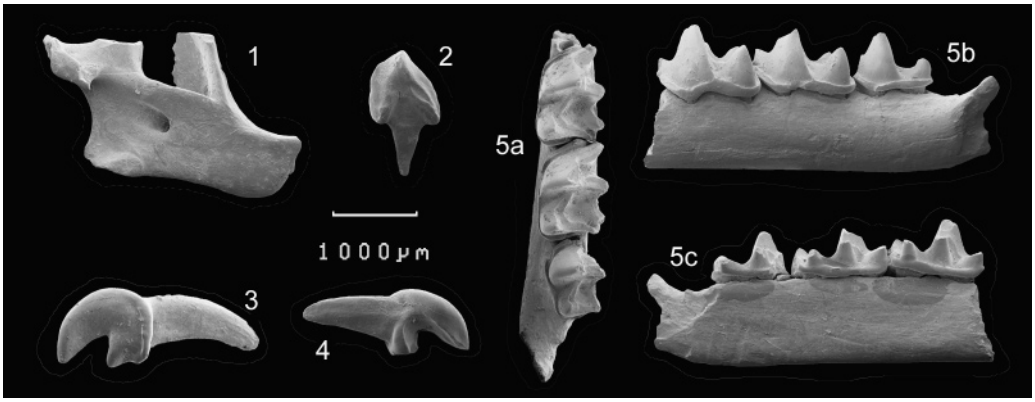


Fig. 21: Crocidosoricinae gen. et sp. indet. 1-3: **1:** Crocidosoricinae gen. et sp. indet. 1. Left mandibular fragment, lingual view, Taatsiin Gol Right (sample TGR-AB/21, biozone B, NHMW 2006z0038/0001); **2:** Crocidosoricinae gen. et sp. indet. 2. Left A sup., occlusal view, Taatsiin Gol Right (sample TGR-AB/21, biozone B, NHMW 2006z0039/0001); **3.-5:** Crocidosoricinae gen. et sp. indet. 3; **3:** Left I sup., labial view, Taatsiin Gol Right (sample TGR-AB/22, biozone B, NHMW 2006z0040/0001); **4:** Right I sup. (reversed), lingual view, Taatsiin Gol Right (sample TGR-AB/22, biozone B, NHMW 2006z0040/0002); **5:** Left mandibular fragment with m1-3, a. occlusal view, b. labial view, lingual view, Taatsiin Gol Right (sample TGR-AB/22, biozone B, NHMW 2006z0040/0003).

Crocidosoricinae gen. et sp. indet. 3
(Fig. 21.3–5)

M a t e r i a l :

Biozone B, sample TGR-AB/22. – 2 I sup., 1 mandibular fragment with m1-3 and 1 edentulous mandibular fragment (NHMW 2006z0040/0000, 2006z0040/0001, 2006z0040/0002, 2006z0040/0003).

M e a s u r e m e n t s : I sup.: L x H = 0.96 x 0.76, 1.04 x 0.88; m1: L x TrW/TaW = 1.16 x 0.66/0.70; m2: L x TrW/TaW = 1.12 x 0.68/0.68; MandH-m2 = 1.00.

D e s c r i p t i o n : All specimens dark brown in colour.

Upper dentition: Both I sup. almost unworn and with nearly circular outline (labial view). Talon cusp well developed, disto-labial cingulum ending at the dorsal margin. Labial side of root with a very shallow depression.

Lower jaw and dentition: Ascending ramus of mandible in labial view with a straight mesial margin and a semi-circular thickening at the top of the coronoid process ending in a vertical directed coronoid spicule. External temporal fossa ending ± at the ventral margin of the attachment of the condylus. Internal temporal fossa broad and high, foramen mandibulare below the middle of its ventral margin. Condylar facets and angular process broken off.

In m1-2 labial cingulid not interrupted at the basis of the protoconid and not really confluent with the disto-labial edge of this cusp, but the cingulum forms a peak below the hypoflexid. A slight step is developed in the distal part of the labial cingulid of m1.

Continuous lingual cingulid somewhat weak below entoconid, but without the impression of a start from the labial slope of the entoconid (like in the m1 of *Taatsiinia hoeckorum* from SHG A/20).

Paraconid of m3 broken off. Disto-labial edge of protoconid not confluent with the cingulid. Labial cingulid ending at the distal basis of the entoconid. Lingual cingulid weak in the distal part but strong from the metaconid onward. Trigonid somewhat reduced in size, entoconid and hypoconulid probably not separated.

D i s c u s s i o n : Size and many morphological features of these specimens are similar to *Taatsiinia hoeckorum* nov. gen., nov. spec. except the indistinct connection of the disto-labial protocone-edge with the labial cingulum. Instead, the continuous cingulid shows a peak below the hypoflexid in labial view. It can not be excluded that this is only due to intra-specific or intra-generic variation. Both characters can be found for instance in one mandible of *Ulmensia antecedens* ZIEGLER, 1998 from the Late Oligocene of Herrlingen 9: connection in m1, cingulid-peak in m2 (ZIEGLER 1998a, pl. 7 fig. 81). Since in the mandible attributed to *Taatsiinia* both m1 and m2 show the connected state, whereas in the material at hand both molars show the peak, we prefer to keep them separate.

Crocidosoricinae gen. et sp. indet. 4
(Fig. 22.1)

M a t e r i a l :

Biozone B, TGR-AB/22. – Maxillary fragment with M1-2 (NHMW 2006z0041/0001).

M e a s u r e m e n t s : M1: labL x mesW/distW = 1.32 x 1.32/1.40; M2: labL x mesW/distW = 1.20 x 1.32/1.30.

D e s c r i p t i o n : Bone and teeth light brown in colour.

Teeth quadrate (M1) to sub-quadrate (M2) in occlusal outline, with deep distal emargination and narrow hypoconal flange. No metaloph. Pre-protocone-crest ends below the tip of the paracone. Hypocone separated from protocone by a valley. Distal cingulum starts somewhere lingually behind the post-protocone-crest and runs continuously to the metastyle. Hypocone ridge-like.

D i s c u s s i o n : The molars seem somewhat too large to associate them with the material referred to as Crocidosoricinae gen. et sp. indet. 3 from the same locality and section.

Crocidosoricinae gen. et sp. indet. 5
(Fig. 22.2)

M a t e r i a l :

Biozone B, sample SHG-A/15. – 1 mandibular fragment with p4 and trigonid of m1 (NHMW 2006z0042/0001).

M e a s u r e m e n t s : p4: L x W = 0.72 x 0.48.

D e s c r i p t i o n : Whole specimen dark brown in colour.

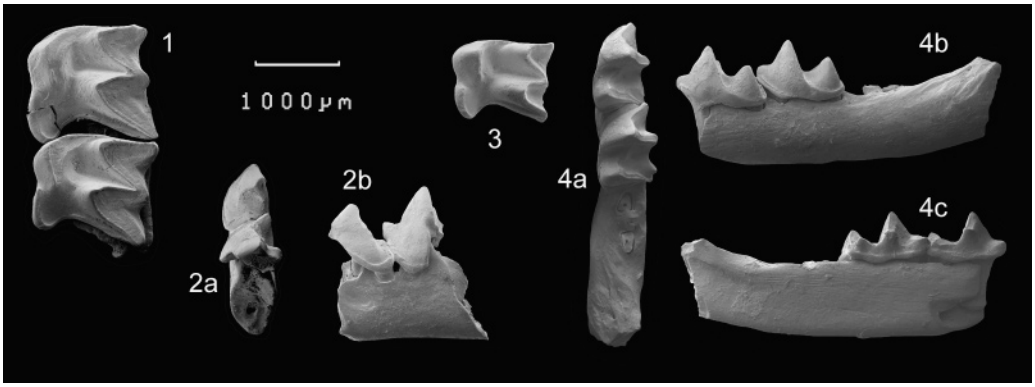


Fig. 22: Crocidosoricinae gen. et sp. indet. 4-6: **1:** Crocidosoricinae gen. et sp. indet. 4. Left maxillary fragment with M1-2, occlusal view, Taatsiin Gol Right (sample TGR-AB/22, biozone B, NHMW 2006z0041/0001); **2:** Crocidosoricinae gen. et sp. indet. 5. Left mandibular fragment with p4 and trigonid of m1, a. occlusal view, b. labial view, Hsanda Gol (sample SHG-A/15, biozone B, NHMW 2006z0042/0001); **3.-**4: Crocidosoricinae gen. et sp. indet. 6); **3:** Right M2 (reversed), occlusal view, Tatal Gol (sample TAT-C/7, biozone B, NHMW 2006z0043/0001); **4:** Left mandibular fragment with m1-2, a. occlusal view, b. labial view, c. lingual view, Tatal Gol (sample TAT-C/7, biozone B, NHMW 2006z0043/0002).

The p4 besides the mesial crest with two distal crests ending halfway down the main cusp. Disto-basal cuspule very small. Cingulids on both sides relatively low. Foramen mentale between the roots of p4.

Crocidosoricinae gen. et sp. indet. 6
(Fig. 22.3-4)

M a t e r i a l :

Biozone B, sample TAT-C/7. – 1 M2, 1 Mandibular fragment with m1-2 (NHMW 2006z0043/0001, 2006z0043/0002).

M e a s u r e m e n t s : M2: labL x mesW/distW: 1.04 x 1.24/1.12; m2: L x TrW/TaW = 1.10 x 0.68/0.68.

D e s c r i p t i o n : Mandible and teeth white in colour.

M2 with moderate distal emargination and relatively wide hypoconal flange. Hypocone low and more an oval-shaped swelling of the cingulum than a real cusp. The distal cingulum ends far labially and – keeping its width – almost rectangular to the metastyle. No other cingula developed. Short pre-protocone-crest ending mesially approximately below the middle of the lingual slope of the paracone.

Mandible in front of m1 lacking. The m1 somewhat corroded in its mesio-labial part. In m1 and m2 the disto-labial protoconid-edge is confluent with the disto-labial cingulid, which is isolated from the mesio-labial part.

Crocidosoricinae gen. et sp. indet. 7
(Fig. 23.1–4)

M a t e r i a l :

Biozone C, samples TGR-C/1, TGW-A/2a. – 1 I sup., 1 i inf., 1 m1, 1 m2 (NHMW 2006z0044/0000, 2006z0046/0001, 2006z0046/0002).

Biozone C1, sample DEL-B/12. –1 i inf. and 1 mandibular fragment with m2-3 (NHMW 2006z0047/0001, 2006z0047/0002).

Unstratified surface find, sample TGW-A/0. – 1 mandibular fragment with p4-m1 (NHMW 2006z0045/0000).

M e a s u r e m e n t s : I sup.: L x H = 1.16 x 0.96; i inf.: L = 1.32, 1.36; p4: L x W: 0.68 x 0.48; m1: L x TrW/TaW: 1.20 x 0.68/0.72, 1.12 x - / -; m2: L x TrW/TaW = 1.12 x 0.68/0.68, 1.08 x 0.72/ - , m3: L x W = 0.88 x 0.60; MandH-m2 = 0.92.

D e s c r i p t i o n : All teeth and mandibles white in colour or slightly transparent. Some of the teeth (I sup., i inf., p4) with orange apices.

Upper dentition: I sup. with a relatively stout crown, apex and talon cusp strong. Disto-labial cingulum ends at the dorsal margin. Root and crown approximately equal in length. Root triangular in lateral view, with very shallow labial and without lingual groove.

Lower jaw and dentition: No alveoli in front of p4 preserved, foramen mentale below mesial root of p4. i inf. with a short bicuspulate crown which is not in line with the root, a strongly upwards turned apex, a well-developed disto-labial and a strong symphyseal cingulid.

The p4 is encircled by a cingulid except for the end of the mesial crest. V-shaped wear surface, distal crests ending halfway down the main cusp in a smaller lingual and a stronger labial cuspule. The latter is at its basis connected to the distal cingulid by a faint ridge.

Lower first and second molar with a continuous low labial cingulid, broadest in both positions in its mesio-labial portion. The lingual cingulid is relatively high and in m1 very strong below the opening of the trigonid. Hypoconulid in m1 and m2 somewhat distally bent and separated from entoconid. Entocristid moderately high (sloping mesially). Disto-labial edge of protoconid in m1 connected to the disto-labial cingulid, in one m2 this connection is totally lacking, in another m2 a faint suggestion of this connection remains. Hypoflexid in m2 opens well above the labial cingulid.

The m3 with somewhat reduced talonid, hypolophid ends in entoconid, obviously no distinct hypoconulid. Continuous labial and very weak lingual cingulid.

D i s c u s s i o n : The lower molars correspond very well in size and – with the exception of the protoconid-cingulid-connection – in morphology, all incisors have coloured apices and correspond in size with the other specimens, and these are the only soricid remains from TGW-A, TGW-A/2a and DEL-B/12, and the only non-heterosoricine soricid remains from TGR-C/1. Therefore we assume that this material represents one single taxon.

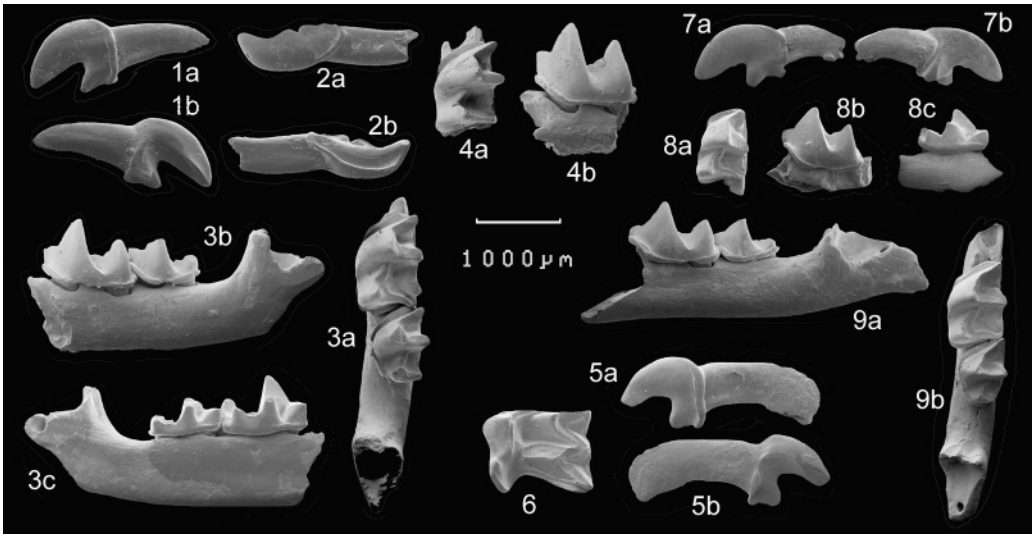


Fig. 23: Crocidosoricinae gen. et sp. indet. 7-9: **1.-4:** Crocidosoriciae gen. et sp. indet. 7: **1:** Right I sup. (reversed), a. labial view, b. lingual view, Khunug (sample TGW-A/2a, biozone C, NHMW 2006z0046/0001); **2:** Left i inf, a. labial view, b. lingual view, Del (sample DEL-B/12, biozone C1, NHMW 2006z0047/0001); **3:** Left mandibular fragment with m2-3, a. occlusal view, b. labial view, c. lingual view, Del (sample DEL-B/12, biozone C1, NHMW 2006z0047/0002); **4:** Left m2, a. occlusal view, b. labial view, Khunug (sample TGW-A/2a, biozone C, NHMW 2006z0046/0002); **5.-6:** Crocidosoricinae gen. et sp. indet. 8; **5:** Left I sup., a. labial view, b. lingual view, Taatsiin Gol Right (sample TGR-C/2, biozone C, NHMW 2006z0048/0001); **6:** Left M2, occlusal view, Taatsiin Gol Right (sample TGR-C/2, biozone C, NHMW 2006z0048/0002); **7.-8:** Crocidosoricinae gen. et sp. indet. 9; **7:** Right I sup. (reversed), a. labial view, b. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0049/0001); **8:** Right m1 (reversed), a. occlusal, b. labial, c. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0049/0002); **9:** Right mandibular fragment with m2-3 (reversed), a. occlusal view, b. labial view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0049/0003).

Crocidosoricinae gen. et sp. indet. 8

(Fig. 23.5–6)

M a t e r i a l :

Biozone C, sample TGR-C/2. – 1 I sup., 1 M2 (NHMW 2006z0048/0001, 2006z0048/0002).

M e a s u r e m e n t s : I sup.: L x H = 1.04 x 0.92; M2: labL x mesW/distW = 1.06 x 1.36/1.28.

D e s c r i p t i o n : Both teeth transparent or white in colour, I sup. with light orange apices. Crown of the I sup. somewhat corroded, relatively stout with a well-rounded dorsal margin and a strong talon cusp. Disto-labial cingulum ends at the dorsal margin. Root one and a half times as long as the crown, tongue-shaped in lateral view (see Crocidosoricinae indet. 7), and with very shallow labial and without lingual groove.

M2 rectangular in occlusal outline, with strong distal emargination. Metacone broken off, hypocone small but pointed. Pre-protocone-crest ending mesially approximately below the middle of the lingual slope of the paracone, post-protocone-crest free-ending, no metaloph. A small cingulum is developed at the mesio-lingual basis of the protocone. Labially a cingulum reaches from the para- to the metastyle, getting strong between para- and mesostyle and meso- and metastyle, respectively.

D i s c u s s i o n : The crown of the I sup. is morphologically very similar to the I sup. attributed to Crocidosoricinae indet. 7 from TGW A/2a. However, in ventral view there are slight differences in the basal part of the talon-cusp, that might be due to wear or corrosion. The roots of the two I sup. show differences in lenght (absolute and in relation to their crown) and form (lateral view): triangular in Crocidosoricinae gen. et sp. indet. 7, tongue-shaped here, that seem to exceed intra-specific variation. Remarkable is the labial cingulum in the M2.

Crocidosoricinae gen. et sp. indet. 9
(Fig. 23.7–8)

M a t e r i a l :

Biozone D, sample UNCH-A/3. – 5 I sup., 1 m1, 1 mandibular fragment with m2-3 (NHMW 2006z0049/0000, 2006z0049/0001, 2006z0049/0002, 2006z0049/0003).

M e a s u r e m e n t s : I sup.: L x H = 1.08 x 0.78; L x TrW x TaW: m1 = 0,96 x 0.60 x 0.64; m2 = 0.98 x 0.68 x 0.64; m3: L x W = 0.76 x 0.56; MandH-m2: 0.80.

D e s c r i p t i o n : Except for one specimen, all upper incisors are strongly damaged and corroded. Root with short labial and without lingual groove.

Ventral and dorsal margin of the mandible diverging mesially: heights of mandible below hypoconid of m3 = 0.72, below paraconid of m2 = 0.96.

In m1 and m2 the hypoflexid opens well above the labial cingulid. The opening itself looks like a fold with an abrupt transition to the labial wall. Crista obliqua meets protolophid below the tip of the protoconid. Hypolophid almost straight, hypoconulid separated from entoconid. Entocristid short and of moderate height. Labial cingulid very weak below hypoflexid and especially in m1 drawn almost to the bottom side of the tooth, thus causing a convex tooth basis (distal or mesial view) below the hypoflexid. Lingual cingulid relatively high in m1, lower in m2 and m3.

The m3 with reduced talonid, consisting of crista obliqua, hypoconid, and a short hypolophid.

D i s c u s s i o n : This taxon counts among the smallest soricids and mammals in general ever known, comparable in size to the extant *Suncus etruscus*, the species of the fossil genus *Paenelimnoecus* or the Late Miocene/Early Pliocene *Sorex minutoides* from Ertemte-2 and Bilike in Inner Mongolia, China (Storch 1995, Qiu & Storch 2000).

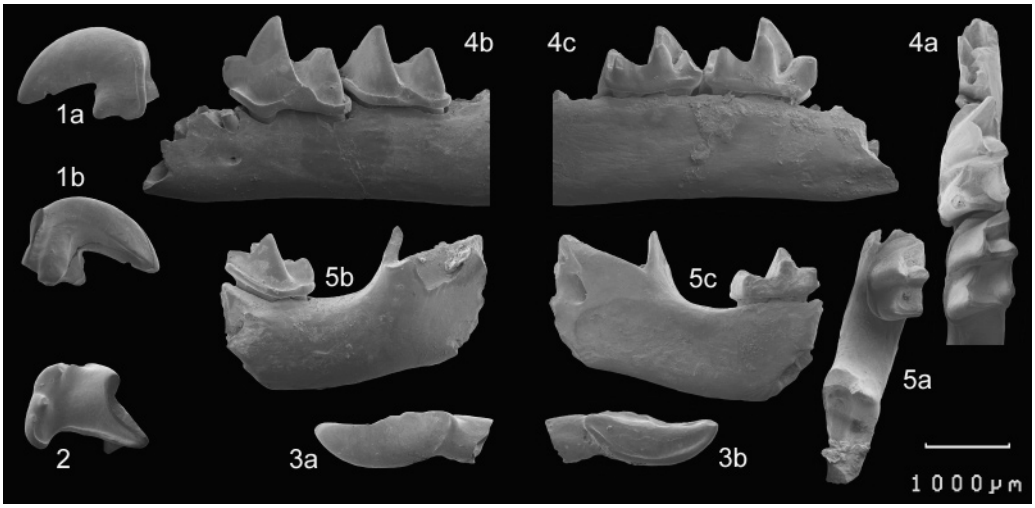


Fig. 24: Crocidosoricinae gen. et sp. indet. 10: **1:** Right I sup. (reversed), a. labial view, b. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0050/0001); **2:** Left P4, occlusal view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0050/0002); **3:** Left i inf., a. labial view, b. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0050/0003); **4:** Right mandibular fragment with m1-2 (reversed), a.occlusal view, b. labial view, c. lingual view, Unkheltseg, UNCH, biozone B or D, NHMW 2006z0051/0001); **5:** Left mandibular fragment with m3, a. occlusal view, b. labial view, c. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0050/0004).

Crocidosoricinae gen. et sp. indet. 10
(Fig. 24)

M a t e r i a l :

Biozone D, sample UNCH-A/3. – 2 I sup., 1 P4, 2 i inf., 1 m1, 1 m1-fragment, 5 mandibular fragments: 2x with m1-2, 3x with m3 (NHMW 2006z0050/0000, 2006z0050/0001, 2006z0050/0002, 2006z0050/0003, 2006z0050/0004).

Unstratified surface find, section UNCH. – 2 mandibular fragments: 1 with m1-2, 1 with m2-3 (NHMW 2006z0051/0000, 2006z0051/0001).

M e a s u r e m e n t s : I sup.: L = 1.52; m1: L x TrW/TaW = 1.44 x 0.80/0.84; m2: L x TrW/TaW = 1.32 x 0.84/0.84, 1.32 x 0.80/0.84; m3: L x W = 1.00 x 0.76, 1.08 x 0.80; MandH-m3 = 1.32, 1.28, 1,36.

D e s c r i p t i o n : Teeth and mandibles white or white and grey in colour; I sup. with orange coloured apex.

Upper dentition: I sup. elongate, not fissident; talon cusp broken off. Root with a shallow labial and without lingual groove.

Lower jaw and dentition: 5 alveoli in front of m1: possibly for a two-rooted p4 and 3 one-rooted lower antemolars. Mental foramen below the distal root of p4.

In m1 and m2 the disto-labial edge of the protoconid is always confluent with the disto-labial cingulid. Nevertheless, the labial cingulid is not really interrupted at the basis of the protoconid but a faint ascending connection remains, giving the impression of a peak at the opening of the hypoflexid. A short lingual cingulid is situated only below the opening of the trigonid. Labial tooth basis undulate in m1 and straight in m2. Entocristid straight and moderately high, hypoconulid separated from entoconid. m3 with mesio-distally somewhat compressed trigonid, without hypoconulid and without labial protoconid-cingulid connection. Labial cingulid ends at the labial basis of the hypoconid. Very weak lingual cingulids – partly only a faint suggestion – below the opening of the trigonid and the entocristid.

D i s c u s s i o n : Very conspicious are the extremely strong and sharp-edged labial cingulids in m1 and m2.

Crocidosoricinae gen. et sp. indet. 11
(Fig. 25.1)

M a t e r i a l :

Biozone D, sample UNCH-A/3. – 1 M sup.-fragment; 2 mandibular fragments: 1x with p4-m2, 1x with m1-2 (NHMW 2006z0052/0000, 2006z0052/0001).

M e a s u r e m e n t s : M sup.: L = 1.04; p4: L x W = 0.64 x 0.54; m1: L x TrW x TaW = 1.16 x 0.80 x 0.80, - x 0.80 x 0.80; m2: L x TrW x TaW = 1.12 x 0.82 x 0.78, 1.20 x 0.78 x 0.76; MandH-m2 = 1.20.

D e s c r i p t i o n : Teeth and mandibles brown in colour. Mandible in front of p4 only in one specimen partly preserved, showing 3 alveoli, i.e. at least 3 one-rooted lower antemolars, in front of p4.

The p4 with two distal crests ending halfway down the main cusp. The crown is encircled by a cingulid. Distally the cingulid exhibits a small cuspule that is mesio-labially connected to the main cusp by a faint ridge.

First and second lower molar with relatively low entocristid (continuously sloping mesially). Disto-labial edge of the protoconid in both positions confluent with the disto-labial cingulid, but labial cingulid not interrupted. Lingual cingulid broadest below opening of the trigonid and reaching from paraconid to mesial slope of entoconid. Lingual and labial tooth-basis undulate, labially more pronounced in m1 than in m2.

Subfamily Soricinae G. Fischer, 1814

Tribus Soricini G. Fischer, 1814

Genus *Sorex* Linnaeus, 1758

Type species: *Sorex araneus* Linnaeus, 1758

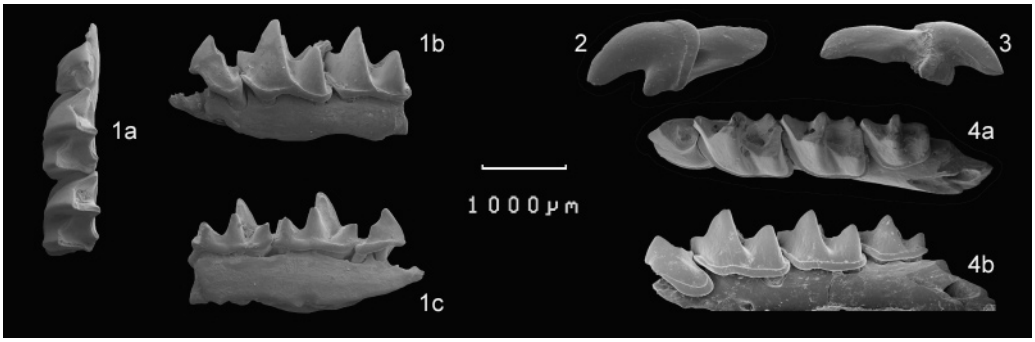


Fig. 25: Crocidurinae gen. et sp. indet. 11 and *Sorex* sp. ?: **1:** Crocidosoricinae gen. et sp. indet. 11. Right mandibular fragment with p4-m2 (reversed), a. occlusal, b. labial, c. lingual view, Unkheltseg (sample UNCH-A/3, biozone B or D, NHMW 2006z0052/0001); **2.-4:** *Sorex* sp. ?: **2:** Right I sup. (reversed), labial view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0053/0001); **3:** Left I sup., lingual view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0053/0002); **4:** Left mandibular fragment with p4-m3, a. occlusal view, b. labial view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0053/0003).

Sorex sp. ?

(Fig. 25.2-4)

M a t e r i a l :

Biozone E, samples BUK-A/12+14. – 2 I sup., 1 mandibular fragment with p4-m3 (NHMW 2006z0053/0001, 2006z0053/0002, 2006z0053/0003).

M e a s u r e m e n t s : I sup.: L x H = 1.08 x 0.84, 1.20 x 0.84; p4: L x W = 0.84 x 0.64; m1: L x TrW/TaW = 1.26 x 0.76/0.76; m2: L x TrW/TaW = 1.16 x 0.68/0.68; m3: L x W = 0.92 x 0.6; MandH-m1 = 1.16.

D e s c r i p t i o n : All teeth white to transparent and with orange to light-red coloured apices.

Upper dentition: I sup. relatively stout with a long talon cusp and a broad continuous disto-labial cingulum ending on the disto-dorsal margin of the tooth.

Lower jaw and dentition: Mandibular fragment exhibits a foramen mentale below the hypoflexid of m1.

The p4 with hook-shaped wear surface, disto-lingual basin, and high lingual and labial cingulid.

First and second lower molar with high entocristids. Hypoconulid somewhat separated from entoconid. Crista obliqua meets protocristid ± below tip of protoconid. Lingual basis in lingual view navicular. Lingual and labial cingula well developed.

The m3 with somewhat reduced talonid, perhaps due to wear only the hypoconid is discernible as a cusp within the u-shaped talonid crests. Labial cingulum reaching distally behind the hypoconid, lingual cingulum lacking.

D i s c u s s i o n : The Late Miocene record of the genus *Sorex* is scarce and specified forms (species level) in Asia are restricted to the locality of Ertemte-2 in Inner Mongolia, China (STORCH et al. 1998). As *Sorex* sp. the genus is known from the Latest Miocene of Selety-1A in W Siberia and the Late Miocene of Lufeng, Yunnan Province, S China. Fossil records from Mongolia itself are Pliocene in age and come from several localities in the Valley of Great Lakes and the northern central part of the country (*Sorex* sp.), but unfortunately no detailed descriptions are made thus far (STORCH et al. 1998).

The species from Ertemte-2 differ at least in the following characters from the material at hand:

Sorex ertemteensis STORCH, 1995 in having fissident upper incisors and narrower lower molars which strongly overhang the jaw labially; *Sorex minutoides* STORCH, 1995 is smaller in size, except the upper incisors; and *Sorex pseudoalpinus* RZEBIK-KOWALSKA, 1991 has distinctly larger dimensions (STORCH 1995). *Sorex* sp. from the Lower Pliocene of Bilike, Inner Mongolia, China, is distinguished by an elongated upper incisor with a straight upper margin and a more unreduced talonid of m3 (QIU & STORCH 2000). Due to the scarce remains and the rather indistinct nature of the characters we refrain from any further comparisons.

Tribus Neomyini MATSCHIE, 1909

***Builstynia* nov. gen.**

E t y m o l o g y : After the type locality Builstyn Khudag.

T y p e s p e c i e s : *Builstynia fontana* nov. gen. nov. spec.; no other species included.

D i a g n o s i s : I sup. not fissident; upper molars broad with strongly emarginated distal margin and relatively narrow hypoconal flange, distal cingulum interrupted at the deepest point of the distal emargination; i inf. bicuspulate; a1 reduced in size as compared to p4, m1-2 relatively broad with shallow hypoflexid, relatively short talonid, weak entoconid and low or moderate entocristid; labial basis of m1 strongly inclined disto-ventrally in labial view; m3 talonid reduced in size and morphology; condylus with narrow and high interarticular area and broad lower articular facet (in lingual view ending in line with distal margin of internal temporal fossa). Coronoid process somewhat tilted laterally, condylus medially.

D i f f e r e n t i a l d i a g n o s i s : *Builstynia* differs from all other genera of the tribe Neomyini by a not fissident upper incisor and the shortened talonid of m1-2.

***Builstynia fontana* nov. gen. nov. spec.**
(Fig. 26)

E t y m o l o g y : *Fontanus* = Latin for well. In allusion to the type locality Builstyn Khudag, Khudag = Mongolian for well.

H o l o t y p e : Right mandibular fragment with distal part of incisor, a1, p4 and m1 (NHMW 2006z0054/0001, biozone E, sample BUK-A/12+14).

M e a s u r e m e n t s of the holotype: L x W: a1 = 0.40 x 0.48; p4 = 1.00 x 0.72 ;m1: L x TrW x TaW = 1.36 x 0.92 x 0.92

T y p e l o c a l i t y and horizon: Builstyn Khudag, Taatsiin Gol Area, Valley of Lakes, Central Mongolia. Section BUK-A/12+14, biozone E, Loh Formation, Upper Miocene.

T y p e s t r a t u m : Loh Formation.

O c c u r r e n c e : At present restricted to the type locality and horizon.

P a r a t y p e s : from Biozone E, samples BUK-A/12+14. – 6 I sup., 1 A sup., 2 M1, 1 M2, 9 i inf., 2 m1, 1 m2, 4 mandibular fragments with 1x p4-m2; 1x m1-2, 1x m2, and 1x m3 and condylus (NHMW 2006z0054/0000, 2006z0054/0002, 2006z0054/0003, 2006z0054/0004, 2006z0054/0005, 2006z0054/0006, 2006z0054/0007, 2006z0054/0008, 2006z0054/0009).

M e a s u r e m e n t s : see Tab. 14.

D i a g n o s i s : As for genus.

Tab. 14: *Builstynia fontana* nov. gen. nov. spec., sample statistics of the teeth

		$\bar{x}$, s, V	n, min. - max.			$\bar{x}$, s, V	n, min. - max.
I sup.	- L	1.92, 0.212, 11.0	3, 1.68 - 2.08	i inf.	- L	3.29, 0.153, 4.65	6, 3.08 - 3.44
	- H	1.22, 0.053, 4.34	3, 1.16 - 1.26				
A sup.	- L		1, 0.96	a1	- L		1, 0.40
	- W		1, 0.72		- W		1, 0.48
				p4	- L		2, 1.00 - 1.04
					- W		1, 0.72
M1	- labL		2, 1.28 - 1.36	m1	- L	1.42, 0.046, 3.22	5, 1.36 - 1.48
	- lingL		2, 1.32		- TrW	1.02, 0.061, 5.97	5, 0.92 - 1.08
	- mesW		2, 1.40 - 1.60		- TaW	0.99, 0.044, 4.44	5, 0.92 - 1.04
	- distW		2, 1.64 - 1.80				
M2	- labL		1, 1.20	m2	- L	1.39, 0.023, 1.67	3, 1.36 - 1.40
	- lingL		1, 1.20		- TrW	1.00, 0.040, 4.00	3, 0.96 - 1.04
	- mesW		1, 1.56		- TaW		2, 0.96
	- distW		-				
MandH-m2		1.50, 0.023, 1.54	4, 1.48 - 1.52	m3	- L		1, 1.12
					- W		1, 0.68

D e s c r i p t i o n : All teeth and bones white in colour or transparent and most teeth with yellow to orange coloured apices.

Upper dentition: I sup. not fissident; in labial view with rounded dorsal and undulate distal margin, and a small talon cusp. Root with labial hollow (as usual in modern soricids) and without lingual groove, characteristic for some early soricids and eventually for crocidurine shrews (DAHLMANN et al. in print.).

A sup. with strongly asymmetric occlusal outline (labial side reaching further distally than the lingual and being continuously convex). The longitudinal crest is distally confluent with a high but narrow labial cingulum. Lingual cingulum partly even higher and very broad.

M1 and M2 relatively broad as compared to their length (especially one M1) and with strong distal emargination. Post-paracone-crest and pre-metacone-crest unite somewhat before the mesostyle. Pre-protocone-crest ending at the lingual slope of the paracone; post-protocone-crest free-ending, no metaloph. Hypocone well isolated from protocone by a wide valley. At the mesio-lingual basis of the protocone a weak cingulum-like structure is visible. Hypocone more as a swelling of the mesio-distal cingulum than a rounded cusp. Distal cingulum well-developed but lacking in the depth of the distal emargination.

Lower jaw and dentition: Of three available horizontal rami only in one a foramen mentale is discernible below the hypoflexid of m1. The only preserved ascending ramus lacks almost the complete angular process and the upper part of the coronoid process, but the latter was obviously not tilted laterally. Mesial margin of the coronoid process oblique and straight (not concave). Internal temporal fossa of medium size, with a straight lower margin roughly parallel to the upper margin of the horizontal ramus. Upper condylar facet low, broad, and cylindrical; separated from the lower articular facet by a high and - compared to the lower facet - narrow interarticular area. The lower facet is strongly elongated lingually and shifted mesially, ending in lingual view below a vertical line made by the distal margin of the internal temporal fossa. In labial view the lingual part of the lower articular facet is hidden behind the lower sigmoid notch. Upper pterygoid fossa close to the interarticular area deeply excavated and with a weak elevation (pterygoid spicule) close to the upper sigmoid notch. External temporal fossa ending just below the upper sigmoid notch.

i inf. bicuspulate in unworn stage. A cingulid surrounds the complete disto-labial margin and vanishes on the ventral side. A relatively high symphyseal cingulid follows the ventral basis. The a1 very small and suppressed by the p4. The latter is asymmetric in occlusal view with a considerable labial overhang and shows the typical soricine disto-lingual basin, one main cusp with a suggestion of a parastylid, and lingual and labial cingulids.

The general appearance of the m1 is very stout due to a dominant protoconid, a shortened talonid and a shallow hypoflexid that opens high above the labial cingulid. Labial tooth basis somewhat undulate, lingual basis navicular; lingual cingulid weaker than the well-developed labial one. Entoconid small and close to the metaconid, entocristid low or moderately developed. Hypoconulid well separated from entoconid, hypocristid convexe.

In contrast to the m1 the m2 gives a more "normal" impression, since the protoconid is less dominant, the talonid is less reduced in length and the hypoflexid is deeper and opens just above the labial cingulid. Both molars show a conspicuous labial overhang especially the region below the hypoconid of m1 is ventrally prolonged, i.e. the labial margin of this tooth is strongly inclined disto-ventrally in relation to the upper margin of the jaw (in labial view).

The m3 is partly damaged. Its talonid is reduced in length and consists only of hypoconid and crista obliqua. Labial cingulid well developed, but it is uncertain if there was a lingual one too.

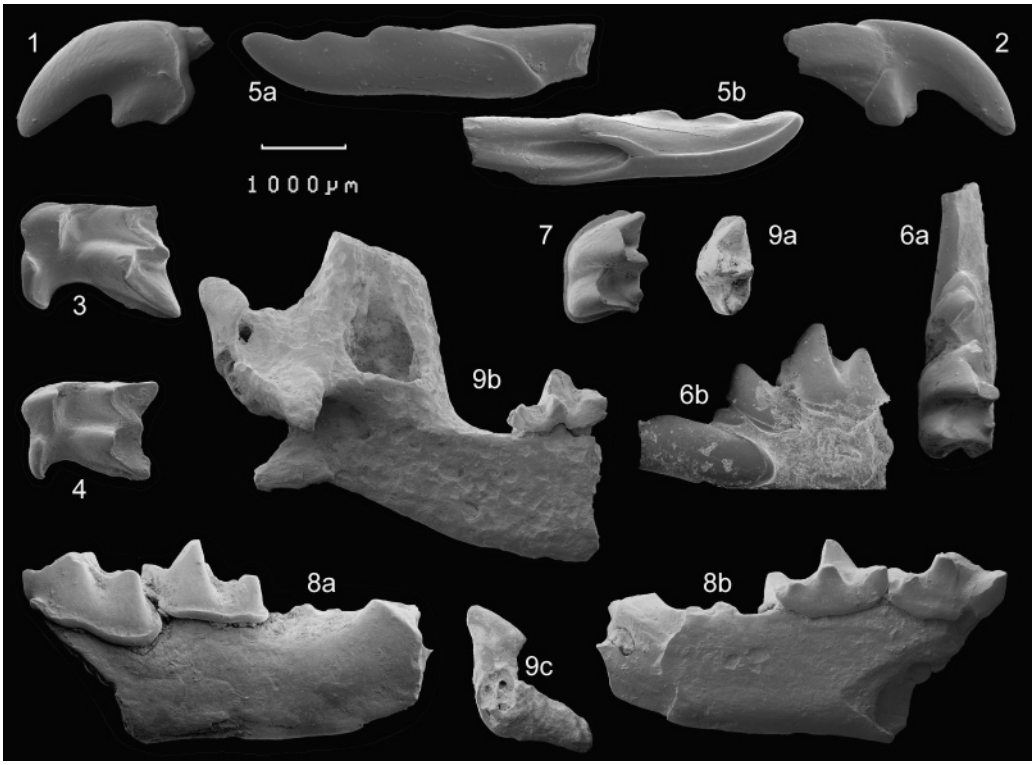


Fig. 26: *Builstynia fontana* nov. gen. nov. spec.: **1:** Left I sup., paratype, labial view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0002); **2:** Right I sup. (reversed), paratype, lingual view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0003); **3:** Right M1 (reversed), paratype, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0004); **4:** Left M2, paratype, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0005); **5:** Right I inf. (reversed), paratype, a. labial view, b. lingual view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0006); **6:** Left mandibular fragment with distal part of incisor, a1, p4 and m1 (reversed), holotype, a. occlusal view, b. labial view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0001); **7:** Left m2, paratype, occlusal view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0007); **8:** Left mandibular fragment with m1-2, paratype, a. labial view, b. lingual view, Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0008); **9:** Left mandibular fragment with m3, paratype, a. occlusal view (m3), b. lingual view, c. distal view (condylus), Builstyn Khudag (sample BUK-A/12+14, biozone E, NHMW 2006z0054/0009).

D i s c u s s i o n : According to the morphology of the medially tilted condyle, the laterally tilted coronoid process, size and arrangement of the lingual cusps, the free-ending post-protocone-crest, and the deep distal emargination of M1-2 this is clearly a neomyine shrew. Together with the Late Miocene Neomyini indet. from Khirgiz-Nur, Mongolia (STORCH et al. 1998) and European *Asoriculus* records from Portugal, Spain, Italy and Greece (RZEBIK-KOWALSKA 1998), *Builstynia* belongs to the oldest known representatives of the tribe. Although older, the above mentioned characters are more

derived than in the Lower Pliocene *Parasoriculus tongi* Qiu & Storch, 2000 from Bilike, Huade County, Inner Mongolia, which is considered the most plesiomorphic member of the tribe and a sister taxon to all other neomyines (Qiu & Storch 2000). *Soriculus praecursus* Flynn & Wu, 1994 from the lower Pliocene (Yushean) of the Yushe Basin, Shanxi Province, China, seems to be more similar in M2-morphology (M1 not preserved) and the inclination of condylus and coronoid process, but differs at least by an unicuspide lower incisor and m1-2 with high entoconids and unreduced talonids.

In a minor degree, the distal inclination of m1-2 in labial view can also be observed in *P. tongi*. The non-fissident incisor is unique among Neomyini, but this feature is supposed to be insignificant on tribal level, since the fissident and the non-fissident state can be found in Beremendiini (see Qiu & Storch 2000) and even in one genus: *Sorex*. Nevertheless the erection of a new genus seems justified, since the combination of available characters forbids its affiliation to any of the other neomyine genera.

4.3.2. Family Talpidae Fischer von Waldheim, 1817

Talpidae incertae sedis

Mongolopala nov. gen.

E t y m o l o g y : After Mongolia and pala = Latin for shovel.

T y p e s p e c i e s : *Mongolopala tathue* nov. gen. nov. spec.; no other species included.

D i a g n o s i s : Mandible with distal foramen mentale below hypoflexid of m1. Lower molars with crista obliqua ascending relatively high but ending well below tip of metaconid, with a relatively wide lingual talonid opening, and with discontinuous labial cingulids. Upper molars with weakly divided mesostyle, weak or lacking distal cingulum, well-developed protoconule and less individualized metaconule. Lingual cusps with an extensive lingual slope and a common completely rounded lingual basis without any emarginations or prominences. M2 with short post-metacone-crest.

D i f f e r e n t i a l d i a g n o s i s : Comparisons are restricted to the early talpids of Late Eocene and Oligocene age.

- *Desmanella* Engesser, 1972 differs by upper molars with better individualized lingual conules, a distally more extensive metaconule-region and stronger cingula.
- *Domninoides* Green, 1956 differs by lower molars with a crista obliqua whose lingual ending is practically identical with the metastylid, and with crests forming more acute angles (Green 1956).
- *Eotalpa* Sigé, Crochet & Insole, 1977 differs by upper molars with stronger parastyles, very weak lingual conules, a prominent lingual extension of the protocone and without mesial cingula, the deeply divided mesostyle of M1, the marked labial emargination, and the longer post-metacone-crest of M2. (Sigé et al. 1977).
- *Galeospalax* Pomel, 1848 was described on the basis of a humerus. Since no other material is known thus far, this genus is excluded from comparison.

- *Geotrypus* POMEL, 1848 differs in many characters, for example lower molars with low-ending crista obliqua, upper molars without individualized proto- or metaconulus or M2 with longer post-metacone-crest (VAN DEN HOEK OSTENDE 1989, 2001; HUGUENEY 1972; ZIEGLER 1990, 1998a).
- *Hugueneya* VAN DEN HOEK OSTENDE, 1989 differs - aside from its larger size - by lower molars with a crista obliqua ending lower and more labially on the protocristid; and upper molars with deeply divided mesostyles.
- *Mongoloscapter* LOPATIN, 2002[a], known by the type-specimen only, differs at least by high-crowned lower molars (although the m2-3 of the holotype seem to be strongly worn there is a large distance between the basis of the teeth and the basis of the lingual cusps) and a very high paraconid on m3.
- *Mygatalpa* SCHREUDER, 1940 differs by upper molars with a better divided mesostyle and less individualized lingual conules, M2 with mesial and distal margin running almost parallel, with longer post-metacone-crest, and with an irregular lingual basal outline, i.e. emargination between protoconus and metaconulus (SCHREUDER 1940, HUGUENEY 1972).
- *Myxomygale* FILHOL, 1890 differs by lower molars with high entocristids or distinct metastylids, by upper molars with a smaller lingual portion, i.e. the lingual cusps have shorter lingual slopes, and M2 with longer post-metacone-crest (DOUKAS 1986, HOEK OSTENDE 1989, HUGUENEY 1972, ZIEGLER 1990, 1998b).
- *Paratalpa* LAVOCAT, 1951 differs by upper molars with deeply divided mesostyles, M2 with longer post-metacone-crest, and lower molars with lower ending crista obliqua.
- *Pseudoparatalpa* LOPATIN, 1999 differs by a more mesially placed foramen mentale, a more labially ending crista obliqua in m2, lower molars with mesio-distally less compressed ridges, and by a larger size (upper molars unknown). The genus includes the type species *Pseudoparatalpa shevyrevae* LOPATIN, 1999 from the Lower Oligocene (Chilikty Formation) of Donguz-Tau, W Kazakhstan and a second species, *P. lavrovi*, from the Lower Miocene of the localities Sayaken and Altynshokysu, E Kazakhstan (Aral Region) originally referred to *Mygalea* as a new species: *Migalea lavrovi* BENDUKIDZE, 1993 (LOPATIN 1999).
- *Quadrodens* MACDONALD, 1970 (= *Palaeoscalopus* MACDONALD, 1970) differs from *Mongolopala* already by its extremely massive lower teeth with voluminous cusps and by m1 with crista obliqua ending below the protoconid. *Quadrodens* was described as an erinaceid whereas very similar material was referred to the family Talpidae as *Palaeoscalops* one page later. MCKENNA & BELL (1997) united both genera as *Quadrodens* in the category Talpidae incertae sedis. However, on the basis of the drawings in MACDONALD (1970) none of the two affiliations seems to be rather convincing.
- *Talpa* LINNAEUS, 1758 differs already by upper molars with less divided mesostyles and less individualized lingual conules, M2 with longer post-metacone-crest, and by lower molars with a lower and more labially ending crista obliqua.

Mongolopala tathue nov. gen. nov. spec.

(Fig. 27)

E t y m o l o g y : After the abbreviation of the type locality Tatal Gol, TAT-Hü (ü = ue).

H o l o t y p e : Right maxillary fragment with M1-3 (NHMW 2006z0055/0001, biozone A, sample TAT-Hü1).

M e a s u r e m e n t s of the holotype: L x W: M1 = 1.84 x 1.68; M2 = 1.60 x 1.84; W: M3 = 1.64

T y p e l o c a l i t y and horizon: Tatal Gol, Taatsiin Gol Area, Valley of Lakes, Central Mongolia. Section TAT-Hü1, biozone A, Hsanda Gol Formation, Lower Oligocene.

T y p e s t r a t u m : Hsanda Gol Formation.

O c c u r r e n c e : Samples SHG-C/1, TAT-Hü1 and TGL-A/2; biozone A, Hsanda Gol Formation, Lower Oligocene.

P a r a t y p e s : from Biozone A, sample TAT-Hü1. – 1 m1, 1 mandibular fragment with m1-3 (NHMW 2006z0055/0000, 2006z0055/0002).

A d d i t i o n a l m a t e r i a l :

Biozone A, samples SHG-C/1, TGL-A/2. – 1 M1, 1 M2, 1 mandibular fragment with m1-3 (NHMW 2006z0056/0001, 2006z0056/0002, 2006z0057/0000).

Measurements: M1: L x W = 1.84 x 1.72; M2: L x W = 1.60 x 1.92; m1: L x TrW/TaW = 1.84 x -/ 1.20, - x -/1.20, - x -/1.24; m2: L x TrW/TaW = 1.72 x 1.12/1.20, 1.80 x 1.20/1.24; m3: L x W = 1.36 x 0.96, 1.32 x 1.00; MandH-entoconid of m2 = 1.80, 1.84.

D i a g n o s i s : As for genus.

D e s c r i p t i o n : Teeth and jaws either black or white in colour.

Upper dentition: M1 with rounded lingual basis. Protoconule closer to protocone than the metaconule, well individualized and separated from protocone by a lingual groove. Metaconule well developed as a pointed peak on the post-protocone-crest. Post-metaconule-crest confluent with a very weak and discontinuous (type-specimen) or continuous and stronger distal cingulum (second specimen). Pre-protoconule-crest confluent with the mesial cingulum. The latter merges into the parastyle. Parastyle without connection to the paracone. Mesostyle weakly twinned. Labial cingula occur somewhat distally to the parastyle and between meta- and mesostyle.

In M2 the parastyle is connected to the paracone and isolated from the mesial cingulum (this gap between parastyle and cingulum is filled by the metastyle of M1). Post-metacone-crest shorter than pre-paracone-crest. In the type-specimen the post-metaconule-crest is virtually lacking whereas it is connected to a very weak and short distal cingulum in the second M2.

The mesial fragment of M3 shows no differences to M2.

Lower jaw and dentition: Mandible with foramen mentale below hypoflexid of m1.

First lower molar either damaged in its mesial part or with trigonid broken off. Crista obliqua ascending relatively high but ending well below the tip of the metaconid.

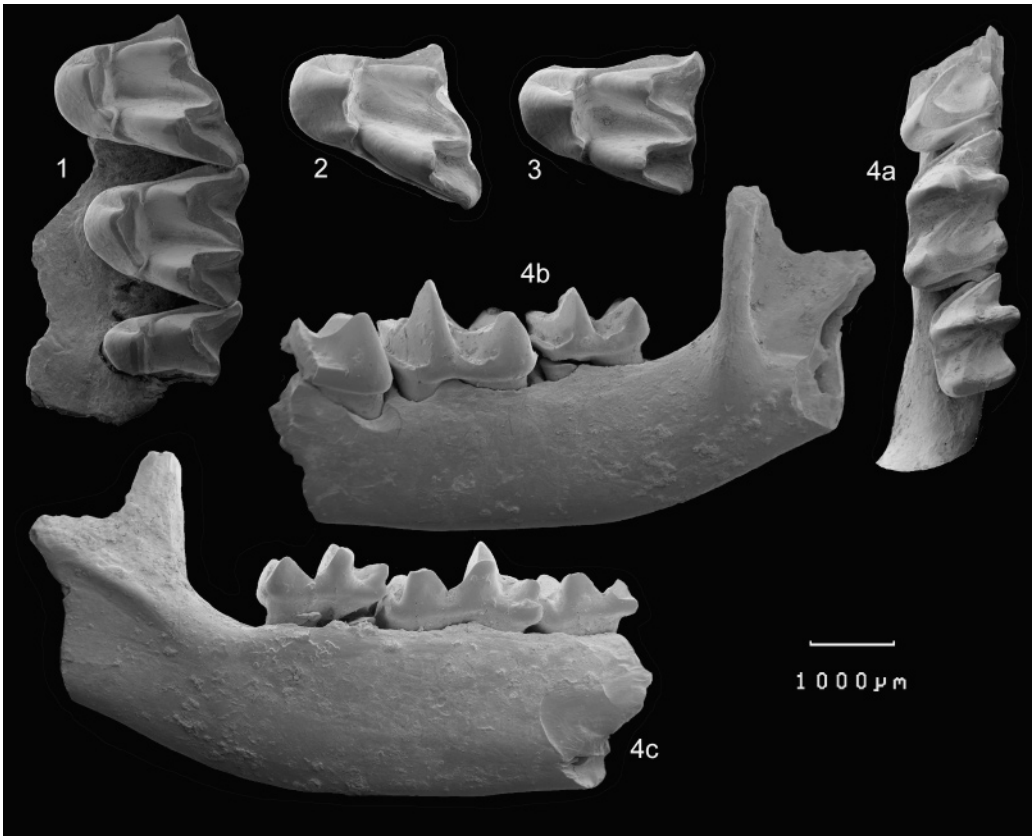


Fig. 27: *Mongolopala tathue* nov. gen. nov. spec.: **1:** Right maxillary fragment with M1-3 (reversed), holotype, occlusal view, Tatal Gol (sample TAT-Hü/1, biozone A, NHMW 2006z0055/0001); **2:** Right M1 (reversed), occlusal view, Hsanda Gol (sample SHG-C/1, biozone A, NHMW 2006z0056/0001); **3:** Right M2 (reversed), occlusal view, Hsanda Gol (sample SHG-C/1, biozone A, NHMW 2006z0056/0002); **4:** Left mandibular fragment with distal part of m1-m3 (reversed), paratype, a. occlusal view, b. labial view, c. lingual view, Tatal Gol (sample TAT-Hü/1, biozone A, NHMW 2006z0055/0002).

Meta- and entocristid meet very low, leaving an upside-down triangular opening between meta- and entoconid. Labial cingulum interrupted at least at the disto-labial basis of the hypoconid. The distal part of the cingulum is connected to the entostylid.

In one m1 of unworn stage the labial cingulids are remarkably broad developed and on the surface of the entostylid a tiny longitudinal ridge is discernible. This tooth shows a weak lingual cingulid below the paraconid. In the other m1 this region is not preserved.

In m2 the crista obliqua ends somewhat lower and meta- and entocristid are somewhat weaker developed than in m1. Labial cingulid interrupted at the basis of the protoconid and at the disto-labial basis of the hypoconid. Lingually a weak cingulid is developed below the paraconid.

In m3 the talonid is somewhat narrower than the trigonid. Only a trace of a metacristid

is discernible. Lingual and distal cingulids are lacking.

D i s c u s s i o n : The Oligocene record of the family Talpidae comprises the genera *Hugueneya* HOEK OSTENDE, 1989 and *Domninoides* GREEN, 1956, Scalopini; *Myxomygale* FILHOL, 1890, *Paratalpa* LAVOCAT, 1951 and *Pseudoparatalpa* LOPATIN, 1999, Urotrichini; *Mygatalpa* SCHREUDER, 1940, Desmaninae (Uropsilinae in HOEK OSTENDE 2001); *Geotrypus* POMEL, 1848 and *Talpa* LINNAEUS, 1758 Talpini; and *Desmanella* ENGESSER 1972, *Galeospalax* POMEL 1848 and *Quadrodens* MACDONALD 1970, Talpidae incertae sedis. Only four of them - *Myxomygale*, *Geotrypus*, *Pseudoparatalpa*, and *Mygatalpa* - are already known from the Early Oligocene. Oligocene records of the genus *Talpa* LINNAEUS, 1758 are considered questionable (MCKENNA & BELL 1997).

Among these genera, size and overall morphology of the material at hand, especially the configuration of lingual cusps and mesostyles in the upper molars and the high ascending crista obliqua in the lower molars, agree best with the European urotrichine genus *Myxomygale* FILHOL, 1890. MCKENNA & BELL (1997) stated *Myxomygale* for the Middle Miocene of Asia Minor, this is most probably founded on material from Sari Çay originally described by ENGESSER (1980) as *Desmanodon* nov. sp. and referred to *Myxomygale* by VAN DEN HOEK OSTENDE (1989), but finally included in the new genus *Theratiskos* also by VAN DEN HOEK OSTENDE (2001). At present the genus *Myxomygale* comprises six species: *M. antiqua* FILHOL, 1890, *M. vauclusensis* CROCHET, 1995 [*M.* cf. *antiqua* in HUGUENEY 1972], *M. minor* ZIEGLER, 1990, *M. hutchisoni* (ZIEGLER, 1985), *M. engesseri* DOUKAS, 1986, and *M. gracilis* ZIEGLER, 2003. The generic assignment of *M. engesseri* is doubted by CROCHET (1995). Among these species *Mongolopala tathue* nov. spec. shows affinities with the early forms *M. antiqua* and *M. vauclusensis* (CROCHET 1995; DOUKAS 1986; FILHOL 1890; HOEK OSTENDE 1989; HUGUENEY 1972; ZIEGLER 1985, 1990). Another potential relative might be *Pseudoparatalpa* from the Lower Oligocene and Lower Miocene of Kazakhstan. Whether there are closer phylogenetic relations between the three genera or not is hard to decide, especially since no humeri and no teeth apart from molars of *Mongolopala* are known and the record of *Pseudoparatalpa* is poor as well. For the same reasons any tribal or even sub-family assignment of the new genus would be hazardous.

Talpidae gen. et sp. indet. 1
(Fig. 28.1-2)

M a t e r i a l :

Biozone A, sample TAT-C/3. – 1 M2, 1 M3 (NHMW 2006z0058/0001, 2006z0058/0002).

M e a s u r e m e n t s : M2: L x W = 2.00 x 2.36; M3: 1.20 x 1.82.

D e s c r i p t i o n : Both teeth white in colour. M2 and M3 with individualized lingual conules. Pre-protoconule-crest in M2 and M3 and post metaconule-crest in M2 labially merely reaching beyond the lingual basis of paracone and metacone respectively. Neither mesial nor distal cingulum. Parastyle projecting mesially in M2 (straight in M3). A short cingulum-like or even cuspule-like structure is developped between meso- and metastyle of M2.

D i s c u s s i o n : See Talpidae gen. et sp. indet. 2.

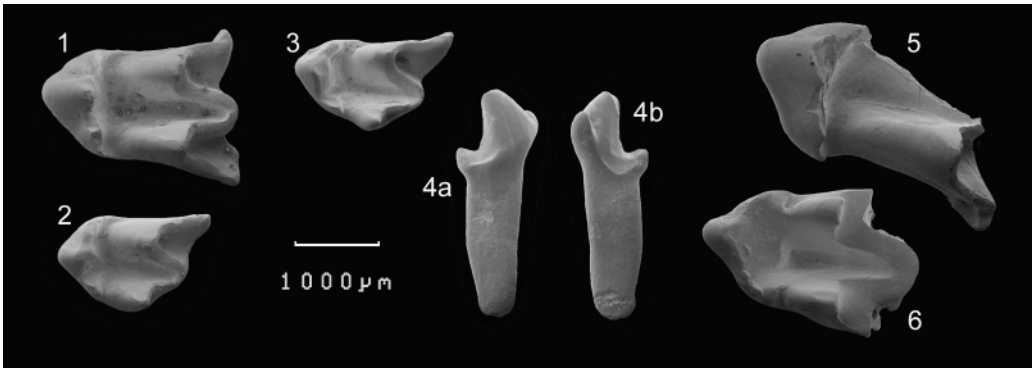


Fig. 28: Talpidae gen. et sp. indet. 1-5: **1.-2:** Talpidae gen. et sp. indet. 1: **1:** Left M2, occlusal view, Tatal Gol (sample TAT-C/3, biozone A, NHMW 2006z0058/0001); **2:** Left M3, occlusal view, Tatal Gol (sample TAT-C/3, biozone A, NHMW 2006z0058/0002); **3:** Talpidae gen. et sp. indet. 2. Left M3, occlusal view, Tatal Gol, TAT-Hü/1, biozone A, NHMW 2006z0059/0001); **4:** Talpidae gen. et sp. indet. 3. Left I1 ?, a. labial view, b. lingual view, Tatal Gol, TAT-Hü/1, biozone A, NHMW 2006z0060/0001); **5:** Talpidae gen. et sp. indet. 4. Left M1, occlusal view, Tatal Gol Right (sample TGR-AB/21, biozone B, NHMW 2006z0061/0001); **6:** Talpidae gen. et sp. indet. 5. Right M2 (reversed), occlusal view, Tatal Gol Right (sample TGR-AB/21, biozone B, NHMW 2006z0062/0001).

Talpidae gen. et sp. indet. 2
(Fig. 28.3)

M a t e r i a l :

Biozone A, sample TAT-Hü/1. – 1 M3 (NHMW 2006z0059/0001).

M e a s u r e m e n t s : M3: L x W = 1.16 x 1.88.

D e s c r i p t i o n : Protoconule weakly individualized, metaconule clearly separated from metacone. No cingula, except one small and short cingulum-like structure between protocone and protoconulus. Preparacone-crest and parastyle slightly projecting mesially.

D i s c u s s i o n : Despite the similarities in size and general morphology with the M3 of Talpidae gen. et sp. indet. 1 this M3 is listed as a separate taxon mainly because of the more slender developement of all structures and minor morphological details. Nevertheless it can not be excluded that Talpidae indet. 1 and 2 represent one single taxon.

Talpidae gen. et sp. indet. 3
(Fig. 28.4)

M a t e r i a l :

Biozone A, sample TAT-Hü/1. – 1 I1 ? (NHMW 2006z0060/0001).

M e a s u r e m e n t s : compare Fig. 28.4 and scale.

D e s c r i p t i o n : Black in colour. Basal outline crescent-shaped (convex labially) in occlusal view. The tooth shows one main cusp forming a "bifid" or "fissident" "apex" together with a smaller mesio-lingually placed cusp. A second small cusp forms the distal "talon". A weak labial cingulum is developed between main and distal cusp. Traces of use exist at the distal slope of the main cusp. Set off from the rounded upper part of the main cusp a "facet" is discernible at the lingual tooth basis between the two smaller cusps. One single strong root.

D i s c u s s i o n : This left I1 deviates from other I1 by its – aside from the basal part – mesially well rounded main cusp. Usually the mesial side of a first upper incisor forms a more or less flat area. Contact facets to adjacent teeth are lacking, i.e. there was no or only a weak contact to these teeth, for example to the right I1.

Talpidae gen. et sp. indet. 4
(Fig. 28.5)

M a t e r i a l :

Biozone B, sample TGR-AB/21. – 1 M1 (NHMW 2006z0061/0001).

M e a s u r e m e n t s : compare Fig. 28.5 and scale.

D e s c r i p t i o n : M1 almost white in colour with paracone and tip of protocone and metaconule broken off; tip of protoconule preserved. Judging from the preserved parts the metaconule probably had a separate tip, too. Protocone placed rather mesially. Mesostyle divided but mesial part broken off together with paracone. Metaconule clearly separated from lingual slope of metacone by a deep valley. Metastyle – perhaps due to wear - somewhat separated from post-metacone-crest. Apart from a short distal cingulum lingually adjacent to the metastyle no further cingula are discernible. Post-metaconule-crest together with some sort of "post-metaconule-area" somewhat projecting distally; thus causing a slightly concave distal basis.

D i s c u s s i o n : See Talpidae gen. et sp. indet. 5.

Talpidae gen. et sp. indet. 5
(Fig. 28.6)

M a t e r i a l :

Biozone B, sample TGR-AB/21. – 1 M2 (NHMW 2006z0062/0001).

M e a s u r e m e n t s : compare Fig. 28.6 and scale.

D e s c r i p t i o n : M2 mainly black in colour except the white tips of the roots and the white dentine of the ectoloph. Tooth strongly worn with para- and metastyle broken off. Proto- and metaconule still discernible as cusps. Basis of protocone strongly projecting lingually. Protoconule and metaconule connected to the lingual slope of the corresponding labial cusps. A pre-protoconule-crest is weakly developed a post-metaconule-crest is just discernible. No cingula in the preserved parts.

D i s c u s s i o n : M1 and M2, i.e. Talpidae gen. et sp. indet. 4 and 5, agree very well in size, but differ in morphology. Whereas in the M2 (Talpidae gen. et sp. indet. 5) the trigon-basin is closed mesially and distally by rather high connections between paracone and protoconule and metacone and metaconule respectively, the trigon-basin of the M1 (Talpidae gen. et sp. indet. 4) is opened distally almost down to its basis. Admittedly, the degree of closure varies intraspecifically and even between M1 and M2 of a single specimen to a certain extend, but in this case the separation as two different taxa seems justified.

Both teeth differ in their respective combination of morphological characters from the corresponding positions – as far as they are known at all – in Eocene and Oligocene talpids (see differential diagnosis of *Mongolopala*) as well as from the North American talpoid family Proscalopidae (WILSON 1960; REED 1960, 1961; BARNOSKY 1981; KORTH 1992).

Talpidae gen. et sp. indet. 6
(Fig. 29.1)

M a t e r i a l :

Biozone B, TGR-AB/21. – 1 M3 (NHMW 2006z0063/0001).

M e a s u r e m e n t s : M3: L x W: 1.12 x 1.76

D e s c r i p t i o n : Tooth black in colour. Protoconule somewhat individualized, metaconule separated from protocone. Metaconule low and only weakly developed. No cingula. Mesostyle weakly divided.

D i s c u s s i o n : Seems too small for an affiliation with Talpidae indet. 4 or 5 from biozone B. But is close in morphology to Talpidae indet. 2 from TAT-Hü/1, biozone A.

Talpidae gen. et sp. indet. 7
(Fig. 29.2)

M a t e r i a l :

Biozone C, sample TGW-A/2a. – 1 maxillary fragment with P4 and M1 (NHMW 2006z0064/0001).

M e a s u r e m e n t s : P4: L x W = 1.44 x 1.02; M1: L x W = 2.12 x 1.80.

D e s c r i p t i o n : Teeth and maxillary fragment white in colour and partly corroded.

P4 with triangular basal outline. Paracone rounded mesially but with a distal crest ending in a small stylus (probably not confluent with the cingulum). The lingual cingulum reaches from the parastyle to the distal end of the tooth, with an incorporated, rather mesially placed, low protocone. Labially the cingulum becomes almost invisible at the tooth-basis below the tip of the paracone. Three roots – below mesial end, distal end, and protocone – are visible from the outside, due to the corrosion of the maxillary.

M1 with large parts, for example of the paracone, lacking and with heavy corrosion. The degree of individualization of the lingual cuspules (if there were cuspules at all) is hard to judge, since the tip of the lingual cusp-complex is broken off. However, its lingual slope shows no valleys but it can not be excluded that there were at least separated tips.

A distal crest ("post-metaconule-crest") is confluent with a relatively strong distal cingulum. Parastyle small, probably no mesial cingulum. Mesostyle un- or weakly divided.

D i s c u s s i o n : In size the fragment corresponds with the teeth described as Talpidae gen. et sp. indet. 8, and its morphology – as far as it is identifiable at all - would not really hinder it. Since the material comes from different sections attributed to different biozones we prefer to keep them separate in this description too. Further finds will have to show whether this material represents one single taxon or not.

Talpidae gen. et sp. indet. 8
(Fig. 29.3–4)

M a t e r i a l :

Biozone C1, sample TGW-A/5. – 1 M2, 1 m2, 1 m inf. fragment (NHMW 2006z0065/0000, 2006z0065/0001, 2006z0065/0002).

M e a s u r e m e n t s : M2: mesW = 1.96, midW = 2.12; m2 : L x TrW/TaW = 2.00 x 1.36/1.32; m inf.: TaW = 1.36.

D e s c r i p t i o n : All teeth light-coloured and transparent.

M2 moderately worn, with post-metacone-crest broken off. No protoconule developed. Metaconule only discernible as a step in the wear surface of the endoloph. Pre-protocone-crest ending mesially approximately below the middle of the lingual slope of the paracone, not reaching a short and vestigial mesial cingulum besides the parastyle. The large and bulbous parastyle is connected at right angles to the end of the pre-paracone-crest by a thin ridge. A cingulum-like structure follows the mesio-labial margin of the parastyle. Mesostyle divided and the crests involved distinctly longer (i.e. reaching further labially) than the pre-paracone-crest. Distal tooth basis partly destroyed, but the post-metaconule-crest was probably confluent with a short distal cingulum, that obviously did not reach the metastyle. Trigon-basin mesially and distally closed.

The m2 with a mesio-distally strongly compressed trigonid. Crista obliqua very low, somewhat concave in occlusal view, and ending far lingually at the basis of the metaconid thus causing a wide hypoflexid Entocristid somewhat higher than crista obliqua and concave too, thus causing a narrow talonid. Metastylid lacking. Small parastylid weakly connected to the paraconid by a vestigial ridge. Lingual cingulid at least below the basis of the paraconid. Lingual tooth basis undulated (drawn up below metaconid) but partly corroded so it is uncertain if there are further lingual cingulids. Labial cingulid interrupted at the basis of proto- and hypoconid and connected to a prominent endostylid.

D i s c u s s i o n : These teeth are tentatively united because of their corresponding dimensions and their provenance from the same locality and section. Most remarkable is the lower m2. Its trigonid is extremely compressed mesio-distally, even more than in *Yunoscaptor* Storch & Qiu, 1991 from the Late Miocene locality of Lufeng, Yunnan-Province, SW China, whose m2 already have a really short trigonid in relation to its width (Storch & Qiu 1991). Compared to the m2 the upper M2 seems rather unspectacular. Somewhat peculiar is the short pre-paracone-crest and its connection to the parastyle. M2 and m2, if they really belong together, might well be described as a new genus, but at present there are too many uncertainties to do so.

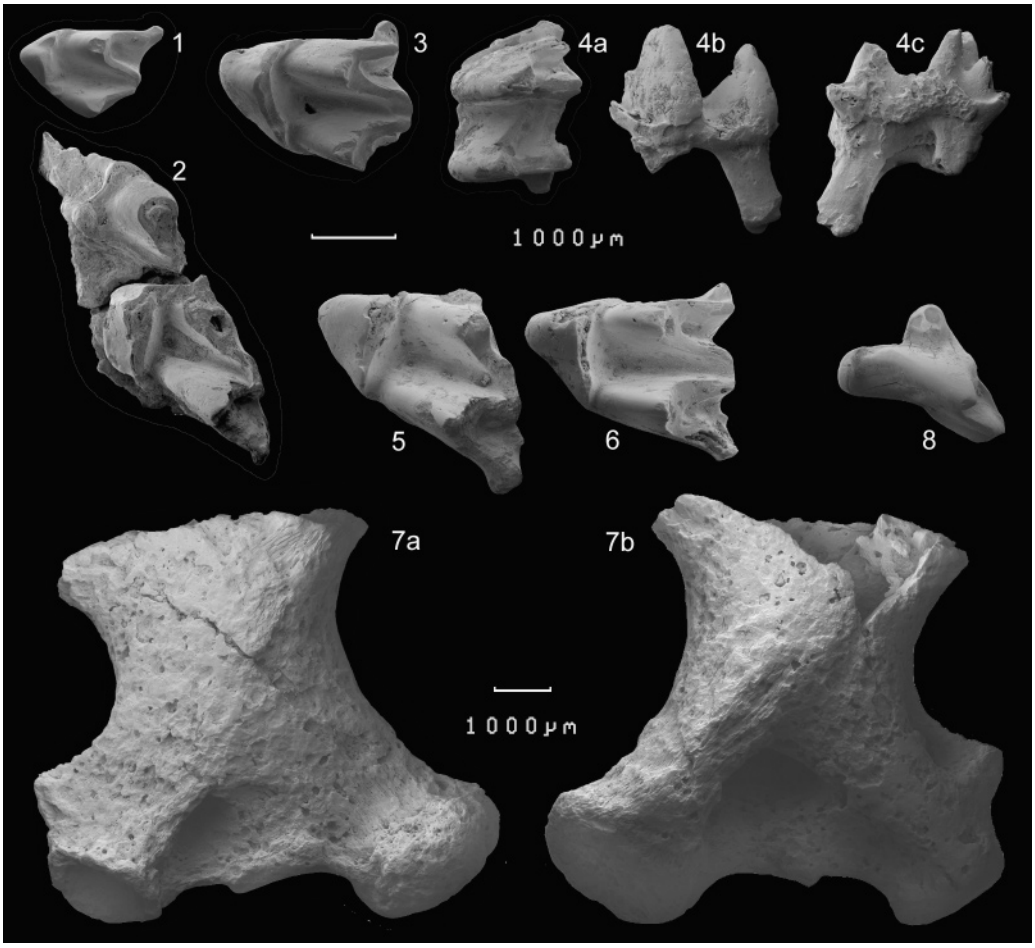


Fig. 29: Talpidae gen. et sp. indet. 6-9 and cf. *Asiapternodus mackennai* LOPATIN 2003: **1:** Talpidae gen. et sp. indet. 6. Right M3 (reversed), occlusal view, Taatsiin Gol Right (sample TGR-AB/21, biozone B, NHMW 2006z0063/0001); **2:** Talpidae gen. et sp. indet. 7. Right maxillary fragment with P4-M1 (reversed), occlusal view, Khunug (sample TGW-A/2a, biozone C, NHMW 2006z0064/0001); **3.-4:** Talpidae gen. et sp. indet. 8; **3:** Right M2 (reversed), occlusal view, Khunug (sample TGW-A/5, biozone C1, NHMW 2006z0065/0001); **4:** Left m2, a. occlusal view, b. labial view, c. lingual view, Khunug (sample TGW-A/5, biozone C1, NHMW 2006z0065/0002); **5.-7:** Talpidae gen. et sp. indet. 9; **5:** Left M1, occlusal view, Luugar Khudag (sample LOG-A/1, biozone D, NHMW 2006z0066/0001); **6:** Right M2 (reversed), occlusal view, Luugar Khudag (sample LOG-A/1, biozone D, NHMW 2006z0066/0002); **7:** Left humerus, a. cranial view, b. caudal view, Luugar Khudag (sample LOG-A/1, biozone D, NHMW 2006z0066/0003); **8:** cf. *Asiapternodus mackennai* Lopat in 2003. Right P4 (reversed), occlusal view, Tatal Gol (sample TAT-Hü/1gr, biozone A, NHMW 2006z0067/0001).

Talpidae gen. et sp. indet. 9
(Fig. 29.5–7)

M a t e r i a l :

Biozone D, sample LOG-A/1. – 1 M1, 1 M2 and 1 Humerus fragment (NHMW 2006z0066/0001, 2006z0066/0002, 2006z0066/0003).

M e a s u r e m e n t s : M1: L x W = 2.52 x 2.08; M2: L x W = 2.16 x 2.44; Humerus: DS: 3.88, BdwE: 7.71.

D e s c r i p t i o n : Material black in colour and with strongly corroded surface.

Dentition: Both teeth somewhat worn, but strongly corroded. Enamel partly with holes and rough. Crucial characters therefore unidentifiable.

M1 and M2 without or with only poorly individualized lingual conules. In M1 the post-protocone-crest is confluent with a short distal cingulum ending below the apex of the metacone. A small cusp-like or cingulum-like structure is indicated distally to the mesostyle. Size of the parastyle and configuration of the mesostyle are hardly identifiable. The latter was probably distinctly divided.

The M2 is somewhat better preserved than the M1. Trigon-basin deep, i.e. mesially and distally well closed-off. Mesostyle well divided. No cingula.

Humerus: Surface of this distal humerus fragment strongly corroded. The preserved parts indicate an advanced fossorial stage. Pectoral tubercle situated almost in the middle of the shaft. Notch between trochlea and fossa m. flexor digitorum relatively wide (roughly equivalent to the width of the trochlea itself).

D i s c u s s i o n : For the stout and massive humerus most talpid subfamilies can be excluded and an allocation within the Talpinae, more precise within the talpine tribes Talpini or Scalopini seems unavoidable. Even most representatives of these two tribes can be excluded by one or the other morphological feature. The humerus can not be attributed to one of the neogene Talpinae hitherto known with humeri from China and Central Asia: *Quanyia* Storch & Qiu, 1983, *Yanshuella* Storch & Qiu, 1983, *Yunoscaptor* Storch & Qiu, 1991, and *Hugueneya* van den Hoek Ostende, 1989 (Storch & Qiu 1983, 1991, Lopatin 2004c).

The specimen at hand corresponds well with the humerus of the extant *Talpa europaea* and the miocene *Proscapanus* Gaillard, 1899 (comp. Ziegler 2003: 629, fig. 4G, *Proscapanus sansaniensis* (Lartet, 1851) from Petersbuch 31).

M1 and M2 correspond very well in size and morphology and most probably represent one single taxon. In size the teeth might harmonize with the humerus (as far as an even vague statement about a size-ratio between teeth and humerus is possible at all). They differ from the molars known from *Talpa* and *Proscapanus* as well as from the above mentioned genera *Quyania*, *Yanshuella*, and *Yunoscaptor*.

M1 and M2 of some taxa – e.g. *Hugueneya* (Tribus Scalopini), *Paratalpa* Lavocat, 1951 (Tribus Urotrichini), or *Desmanodon* Engesser, 1980 (Talpidae incertae sedis) – show a superficial similarity with our material, but differ in details.

4.3.3. Soricomorpha incertae sedis

Genus *Asiapternodus* LOPATIN, 2003

Type species: *Asiapternodus mackennai* LOPATIN, 2003

cf. *Asiapternodus mackennai* LOPATIN, 2003
(Fig. 29.8)

M a t e r i a l :

Biozone A, sample TAT-Hü1. – 1 P4 (NHMW 2006z0067/0001).

M e a s u r e m e n t s : P4: labL x W = 1.80 x 1.48.

D e s c r i p t i o n : Tooth black in colour with three roots. Occlusal outline more or less Y-shaped. Paracone high and dominating but "mesio-distally" relatively compressed and slender (see Fig. 29.8). Parastylar lobe strongly protruding mesially. Parastyle low as compared to the paracone, but rounded and clearly cusp-like, with a faint ridge on the distal and on the lingual face. Protocone only discernible as a poor swelling of the disto-lingual cingulum. Labial cingulum between basis of paracone and metastyle.

D i s c u s s i o n : *Asiapternodus mackennai* LOPATIN, 2003 was originally described within the Apternodontidae MATTHEW 1903, a paleogene family of in the majority North American zalambdodont Soricomorpha (LOPATIN 2003b). Outside North America apternodontids have only been been reported from the Eocene of Mongolia and China (see TONG 1997, ASHER et al. 2002, LOPATIN 2003b). Recently this family has been divided into the Apternodontidae sensu stricto with the genus *Apternodus* MATTHEW, 1903, the Oligoryctidae ASHER et al. 2002 with the genus *Oligoryctes* HOUGH, 1956, and the Parapternodontidae with the genera *Parapternodus* BOWN & SCHANKLER 1982 and *Koniaryctes* ROBINSON & KRON, 1998 (ASHER et al. 2002). LOPATIN (2003b: 187) stated that "*Asiapternodus* is most similar to *Parapternodus*". We refrain from any familiar assignment for this genus or the material at hand.

Asiapternodus mackennai is known by a maxillary fragment with P4-M3 (holotype), a mandibular fragment with m1-2, and an isolated m3 from the Middle Eocene locality Khaichyn-Ula 2 in Mongolia.

The tooth at hand shows similarities in size and morphology with the P4 of the holotype (see LOPATIN 2003b: fig. 3a). However, the paracone of the P4 from Khaichyn-Ula 2 seems to be more rounded or inflated and the occlusal outline shown in fig. 3b LOPATIN (2003b) seems to be unattainable with our specimen. Considering these differences, the difference in age and the scarce material we prefer the designation as cf. *Asiapternodus mackennai*.

5. Conclusions

5.1 Composition of the didelphid and insectivore faunas from the Valley of Lakes localities (Tab. 15)

The record of soricomorphs is rather scanty in all biozones except biozone E, where the soricids come up to nearly one third of the insectivore fauna. The occurrence of only one insectivore species in biozone D1 is a bias due to the small sample size. In biozone E the high number of soricines is conspicuous. The soricid diversity is highest in biozone B though the specimen numbers are low. Usually the erinaceids show the highest diversity among the insectivores, especially the erinaceines.

Tab. 15: List of marsupials, erinaceomorphs and soricomorphs (numbers are numbers of specimens, only specimens with unquestionable provenience are included).

Species/biozone	A	B	C	C1	D	D1	E
Didelphimorphia							
Didelphidae							
Asiadidelphis zaissanense	1	8					
Asiadidelphis tjutkovae	1						
Erinaeomorpha							
Erinaceidae							
Tupaiodontinae							
Zaraalestes minutus	627	1196			189		
Zaraalestes sp.		4					
Brachyericinae							
Exallerix pustulatus nov. spec.			2				
Exallerix sp					1		
Erinaceinae							
Palaeoscaptor acridens	31	243	72	1	31		
Palaeoscaptor cf. *rectus*	1	43	24	11			
Palaeoscaptor gigas		2	6				
Palaeoscaptor tenuis nov. spec.	13	166	2		4		
Ampphechinus taatsiingolensis nov. spec.			980				
Ampphechinus aff. *taatsiingolensis* nov. spec.					176		
Amphechinus minutissimus nov. spec.				77			
Amphechinus major nov. spec.				201			
Parvericius buk nov. spec.						25	95
Erinaceinae gen. et sp. indet. I	3						
Erinaceinae gen. et sp. indet. II					4		
S o r i c o m o r p h a							
Soricidae							
Heterosoricinae							
Gobisorex kingae	9	13	2	1	1		
Heterosoricinae gen. et sp. indet. 1		1					
Heterosoricinae gen. et sp. indet. 2		1					
Heterosoricinae gen. et sp. indet. 3				1			

Tab. 15 (continued).

Species/biozone	A	B	C	C1	D	D1	E
Crocidosoricinae							
Taatsiinia hoeckorum nov. gen. nov. spec.		8					
Tavoonyia altaica nov. gen. nov. spec.				4			
Crocidosoricinae gen. et sp. indet. 1		1					
Crocidosoricinae gen. et sp. indet. 2		1					
Crocidosoricinae gen. et sp. indet. 3		4					
Crocidosoricinae gen. et sp. indet. 4		1					
Crocidosoricinae gen. et sp. indet. 5		1					
Crocidosoricinae gen. et sp. indet. 6		2					
Crocidosoricinae gen. et sp. indet. 7			4	2			
Crocidosoricinae gen. et sp. indet. 8			2				
Crocidosoricinae gen. et sp. indet. 9					7		
Crocidosoricinae gen. et sp. indet. 10					12		
Crocidosoricinae gen. et sp. indet. 11					3		
Soricinae							
Sorex sp. ?							3
Builstynia fontana nov. gen. nov. spec.							27
Talpidae							
Mongolopala tathue nov. gen. nov. spec.	6						
Talpidae gen. et sp. indet. 1	2						
Talpidae gen. et sp. indet. 2	1						
Talpidae gen. et sp. indet. 3	1						
Talpidae gen. et sp. indet. 4		1					
Talpidae gen. et sp. indet. 5		1					
Talpidae gen. et sp. indet. 6		1					
Talpidae gen. et sp. indet. 7			1				
Talpidae gen. et sp. indet. 8				3			
Talpidae gen. et sp. indet. 9					3		
Soricomorpha incertae sedis							
cf. *Asiapternodus mackennai*	1						
Sum	697	1698	1095	301	431	25	125

5.2 Comparison of Oligocene and Miocene Mongolian marsupials and insectivores with related taxa from selected areas.

The temporal and spacial occurrences and the ranges of the taxa are taken from MCKENNA & BELL (1997) if no other publication is cited here.

Didelphimorphia – The occurrence of didelphids is restricted to sporadic finds from biozones A and B. The Oligocene and Miocene records of didelphids from Asia on the whole are extremely rare and restricted to some herpetotheriine teeth from the Late Eocene and Early Oligocene of the Zaysan Basin in Kazakhstan, the Middle Eocene of Jiangsu Province, China, and the Early-to-Middle Eocene Kartal Fm. of Turkey. Miocene marsupials from Asia are confined to two peradectine species, *Siamoperadectes*

minutus Ducrocq et al., 1992 from Thailand, and *Sinoperadectes clandestinus* Storch & Qiu, 2002 from Jiangsu Province, China (Storch & Qiu 2002).

Herpetotheriinae – We provide evidence from Early Oligocene sections of the Valley of Lakes for the occurrence of the same two herpetotheriine species previously described from Kazakhstan. There are no Miocene records of didelphids known so far in Central Asia. As compared to Oligocene European herpetotheriine genera, the teeth of *Asiadidelphis* from Kazakhstan and Mongolia are more similar to *Peratherium* than to *Amphiperatherium*.

In Europe there is a long continuous record of didelphids from the Early Eocene on, the Peradectinae being restricted to the Early Eocene. In the Oligocene there are the two herpetotheriine genera *Amphiperatherium* and *Peratherium*. The last *Amphiperatherium* vanished at the end of the Early Miocene.

In North America the majority of Peradectinae became extinct at the end of the Eocene, *Nanodelphys* extending its range until the Early Oligocene. There are some questionable Middle Miocene holdovers of the two peradectine genera *Nanodelphys* and *Alloedectes*. The Herpetotheriinae are known from two Oligocene genera. One of them extended to the Middle Miocene.

Erinaceomorpha – Common to all present biozones is the clear preponderance of erinaceids. By far the most common species is *Zaraalestes minutus* in biozones A and B, followed by *Palaeoscaptor acridens*. The insectivore sample of biozone C is dominated by *Amphechinus tsaatsiingolensis*, which scores about 90%. The majority of biozone C1 is made up of two *Amphechinus* species. In biozone D the tupaiodontines reappeared and match in specimen numbers roughly the erinaceines. Within the erinaceids the brachyericines are scarce.

Tupaiodontinae – The Middle Eocene species *Entomolestes grangeri* Matthew, 1909 from Wyoming was referred to Tupaiodontinae by Butler (1988) and McKenna & Bell (1997). Storch & Dashzeveg (1997), however, excluded this North American species on the basis of a suite of dental characters from tupaiodontines which they restricted to the central and eastern Asiatic genera *Tupaiodon*, *Ictopidium*, and *Zaraalestes*. Following Storch & Dashzeveg (1997) we consider therefore the Tupaiodontinae an endemic central and eastern Asiatic group. Their temporal range comprises so far the Middle Eocene through Late Early Oligocene. In the Early Oligocene samples from biozones A and B under study they represent the vast majority of erinaceids. The records from the samples UNCH-A/3 and UNCH-A/4 in the Early Miocene biozone D represent holdovers and the latest records of this subfamily thus far.

Brachyericinae – Brachyericines are known from the Early Oligocene through the Early Miocene of Asia (Mongolia, Kazakhstan, and Xinjiang and Gansu Provinces of China) and from the early through Late Miocene of North America where they were fairly diverse. They never reached Western Asia and Europe.

Galericinae – The earliest known Galericinae have been recorded from Middle Eocene deposits of North East China and Mongolia (Wang & Li 1990, Lopatin 2004a) and from the Latest Eocene of Mongolia (Lopatin 2005). The two Middle Eocene species, *Eochenus* Wang & Li, 1990 and *Eogalericius* Lopatin, 2004[a], appear to show some tupaidontine affinities as far as can be seen from the figured specimens. The Late Eo-

cene *Oligochenus* LOPATIN, 2005 also seems to differ from galericines. *Neurogymnurus indricotherii* LOPATIN, 1999 from the Early Oligocene of Western Kazakhstan seems to be the first uncontested galericine in Asia (LOPATIN 1999). In the Early Oligocene of Mongolia their niche was obviously occupied by the tupaiodontines. In the Miocene the galericines became wide-spread and diverse in Asia. In Europe the first erinaceids were galericines which appeared after the Grande Coupure in the Early Oligocene.

Erinaceinae – Europe: In the Late Oligocene the erinaceines appeared, whereas the galericines nearly vanished. The latter reappeared in the Orleanian and became the dominant insectivores in most Late Early to Late Miocene insectivore faunas (ZIEGLER 1999).

North America: The Erinaceinae are known only from Miocene faunas. The Galericinae span the Oligocene and Miocene, but they are less diverse than in Europe.

Soricomorpha – In contrast to the Erinaceomorpha the relatively few soricid and talpid remains come from numerous discrete horizons or faunas and only some of them have yielded a larger number of specimens. Essential features (e.g. shape and number of antemolars) are only rarely available. Thus the combination of specimens, comparisons and the designation of taxa is extremely hampered and the results remain uncertain or even doubtful. The zalambdodont soricomorph cf. *Asiapternodus mackennai* LOPATIN, 2003 is preserved by only one specimen.

Soricidae – The earliest known member of the family Soricidae appears to be *Soricolestes soricavus* LOPATIN, 2002 from the Middle Eocene locality Khaychin-Ula II in Mongolia (LOPATIN 2002c). The oldest unambiguous soricid in the Palaeogene of Asia is so far the heterosoricine *Gobisorex kingae* SULIMSKI, 1970 from the Early Oligocene Hsanda Gol Formation, Gobi Desert, Mongolia (SULIMSKI 1970). This species was also recorded in the faunas under study, covering the biozones A-D, thus extending its range into the Early Miocene. Younger heterosoricines are known from the Early Miocene of Kazakhstan: *Gobisorex akhmetievi* LOPATIN, 2004, *Atasorex edax* LOPATIN, 2004, and from the Middle Miocene of Nei Mongol, China: *Mongolosorex qiui* QIU, 1996 (QIU 1996, LOPATIN 2004c).

Early representatives of the subfamily Crocidosoricinae come from the Early Miocene of Kazakhstan: *Aralosorex kalini* LOPATIN, 2004 and *Miocrocidosorex zazhigini* LOPATIN, 2004 (LOPATIN 2004b).

The Neogene record of Soricinae in Central Asia starts in the late Miocene with the tribes Anourosoricini, Blarinellini, Soricini, and the genus *Paenelimnoecus* in Nei Mongol and with the tribe Neomyini in Mongolia (STORCH et al. 1998, QIU & STORCH 2005). Thus the presence of *Sorex* sp. (Soricini) and *Builstynia fontana* nov. gen. nov. spec. (Neomyini) in biozone E (Late Miocene) does not exceed the state of our present knowledge.

Apart from Central Europe, Oligocene and even Miocene shrews are scarcely preserved in the fossil record. The material at hand does not suggest closer relations to European, North American, and even Central Asian (e. g., Kazakhstan, Inner Mongolia) taxa.

Talpidae – Thus far the only Oligocene talpid from Mongolia is the scaptonychine *Mongoloscapter zhegalloi* LOPATIN, 2002 from the Taatsiin Gol locality described by

LOPATIN (2002a). A diverse talpid fauna was recorded from the Early Oligocene Buran fauna, eastern Kazakhstan (LOPATIN 2002a). From the Early Oligocene Chilikti fauna, western Kazakhstan, the urotrichine *Pseudoparatalpa shevyrevae* LOPATIN, 1999 was described. The species *P. lavrovi* (BENDUKIDZE, 1993) was described from the Early Miocene of the North Aral region (see LOPATIN 1999). From the Early Miocene of this region also *Desmanella* (Uropsilinae), *Hugueneya* (Scalopini), *Myxomygale* (Scaptonychini) were recorded (LOPATIN 2004c). From the Middle Miocene of Nei Mongol, *Desmanella*, *Proscapanus*, *Quyania* and *Yanshuella* are known. The two latter taxa continue into the Late Miocene.

Like in the soricids no closer relations to European, North American, or Central Asian taxa are discernible in the talpid material under study.

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