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TABLE 1: FLINT TL MEASUREMENTS AND RESULTANT AGES

Sample	*K4*	*K5*	*K6*	*K11*	*K12*	*K13*	*K14*
Palaeodose (krad)							
fine grain	33 ± 3	24.7 ± 1.5	28 ± 1.5	31.3 ± 1.5	29.4 ± 1.4	28 ± 1.8	23.5 ± 1.5
90-125 micron grains	32.2 ± 1.3	27.6 ± 1.3	27 ± 1.3	31.5 ± 2.3	31.9 ± 2.3	27.5 ± 1.8	25.2 ± 1.5
α_o (Ks^{-1})	1.26	0.35	1.60	0.93	1.59	0.94	0.43
K_2O (%)	0.115	0.059	0.076	0.178	0.076	0.062	0.197
a value	0.072	0.098	0.11	0.112	0.115	0.100	0.151
Dose-rates (mrad/a)							
D'_α	8.2	2.8	16.2	9.4	16.8	8.5	6.2
D_β	16.5	6.1	16.4	7.6	16.3	10.6	16.4
$D_{\gamma+c}$	85	85	85	85	85	85	85
Total	110	94	118	102	118	104	107
Age (ka)	300 ± 32	263 ± 27	238 ± 20	307 ± 28	250 ± 21.5	269 ± 26	219 ± 20

1. TL ages have been calculated using the palaeodose for fine grains. Error limits on the ages are at the 68% level of confidence, calculated on the Aitken and Alldred (1972) system.
2. α_o is the unsealed thick-source count-rate (per ks) for a 42 mm diameter zinc sulphide screen with the electronic threshold setting such that for a thorium only sample the fraction of pulses above the threshold would be 0.85.
3. The gamma dose-rate is derived from the gamma spectrometer measurements made near the find spot of K 4, 5 and 6, i.e. in layer K of Site C. The measured moisture content in the soil at that time was 0.16 of the dry weight. It is assumed that during antiquity the moisture content was 0.16 ± 0.05. The saturation water content was 0.21.
4. The value for the cosmic-ray dose rate has been taken as 13 ± 3 mrad/a, corresponding to an average overburden during burial of 2 metres.
5. D'_α has been taken as (0.75 ± 0.25) of the effective alpha dose-rate assuming homogeneity. The reduction is to allow for the possibility of some anti-correlation between alpha activity and TL sensitivity.

TABLE 2. IN-SITU GAMMA SPECTROMETER EVALUATIONS AT BELVÉDÈRE

	U		*Th*		*K_2O*		*Water content as % of dry weight WC*
	ppm		*ppm*		*%*		*%*
712a	2.3 ± 0.3	(2.7 ± 0.4)	8.2 ± 0.4	(9.6 ± 0.5)	1.73 ± 0.09	(2.03 ± 0.11)	15
c	2.6 ± 0.3		8.2 ± 0.4		1.92 ± 0.09		
d	2.4 ± 0.2	(2.7 ± 0.2)	7.7 ± 0.4	(8.8 ± 0.5)	1.55 ± 0.07	(1.76 ± 0.08)	12
e	2.4 ± 0.2		8.2 ± 0.4		1.56 ± 0.07		
f	3.1 ± 0.2		6.3 ± 0.3		1.45 ± 0.07		
g	2.02 ± 0.14	(2.34 ± 0.16)	8.4 ± 0.2	(9.7 ± 0.2)	1.62 ± 0.06	(1.88 ± 0.07)	14
h	1.83 ± 0.18		9.7 ± 0.3		1.65 ± 0.08		
i	2.14 ± 0.26		8.6 ± 0.4		1.49 ± 0.08		
j	1.59 ± 0.26		7.2 ± 0.4		1.19 ± 0.07		16
k	1.62 ± 0.16		5.8 ± 0.2		1.06 ± 0.05		13

The values quoted are the result of in situ measurement with a gamma spectrometer (sodium iodide). They have not been corrected for water content and hence the values appropriate to dried sediment will be higher by about 15% (on the basis of the water content that has been measured for 5 of the layers, as indicated).

THE MIDDLE PLEISTOCENE (SAALIAN) AND LATE PLEISTOCENE (WEICHSELIAN) MAMMAL FAUNAS FROM MAASTRICHT-BELVÉDÈRE, (SOUTHERN LIMBURG, THE NETHERLANDS)

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CONTENTS

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SUMMARY

The geological sequence exposed in the Belvédère pit consists of Cretaceous-Palaeocene limestone, Tertiary sediments, 5 to 8 metres Middle Pleistocene fluviatile deposits and 6 to 8 metres pre-Weichselian 'loess-like' and Weichselian loess deposits. The lower part of the fluviatile sediments, the coarse gravel, is covered with sandy deposits. The top of the fluviatile sequence consists of loamy sediments.

A sequence of five superposed different mammal fauna-associations from the Maastricht-Belvédère pit has been studied. The oldest association, Belvédère 1, (late Early Pleistocene-early Middle Pleistocene) from the base of the gravel is poorly known. The gravel itself contains a younger fauna-association (Belvédère 2) with tundra elements, for example *Coelodonta antiquitatis,* and is dated as Early Saalian. The base of the overlying sands has yielded a fauna (Belvédère 3) with a number of steppe-elements, such as *Ochotona pusilla* and *Cricetus cricetus praeglacialis.* The next fauna (Belvédère 4) collected from the loamy sediments indicates a more humid and wooded environment. The presence of *Emys orbicularis* in the loamy sediments shows that these sediments have been deposited in a rather warm interval of the Saalian period.

The succession of these Saalian Belvédère 2-4 faunas documents the palaeoecological change during the transition from a cold stadial period to a warm-temperate stage. The presence of a new *Apodemus* species *A. maastrichtiensis* in the faunas Belvédère 3 and 4 (Saalian) is noted.

The high frequency of young individuals amongst the larger mammals of the fauna Belvédère 4, which are found in association with archeological finds, is interpreted to be due to human hunting activity.

The same applies to the presence of the larger mammal remains of the youngest fauna (Belvédère 5) found at the base of the Weichselian loessic deposits. The arctic lemming *Dicrostonyx torquatus* which is abundantly present, indicates that this fauna must be dated as Early Weichselian.

1. INTRODUCTION

Since the archaeological investigations started in 1980, a large number of mammal fossils have been found in the Maastricht-Belvédère pit. Most of them have been collected at the Sites B, C and E (see Roebroeks, 1985) during the excavations and during a special campaign organized to search for fossils of micromammals in the deposits exposed in the Maastricht-Belvédère pit.

A large number of fossils of for example mammoth, woolly rhino and horse were collected from the sediments of the Caberg terrace many years ago. Some of them have been studied and described by Rutten (1909) and Cremers (1925, 1926). These fossils are stored in the Museum of Natural History Maastricht (NHMM) and the Netherlands National Museum of Geology and Mineralogy (R.G.M.) at Leiden. These fossils have been restudied, but are mentioned in this article only when the stratigraphical position of the specimen is known.

Five superposed different mammal fauna-associations from the Maastricht-Belvédère pit are described in this paper. Four of them have been found in the fluviatile deposits which overlie the Cretaceous-Palaeocene limestone and Tertiary sediments and which are covered with 'loess-like' and loess deposits. A detailed description of the lithostratigraphy is presented by Vandenberghe et al. (1985).

The base of the gravels (Unit 3), the lowermost part of the fluviatile deposits, has yielded the oldest fauna-association (Belvédère 1). Mammal fossils of a younger fauna-association (Belvédère 2) are found in the upper part of the gravels. The base of the overlying fine-grained Maas deposits (Unit 4) contains a fauna-association (Belvédère 3) which differs from the Belvédère 4 fauna-association from higher up in Unit 4. Unit 5.2, on top of the fluviatile sediments, partly consists of reworked material from the underlying sediments. The faunal remains from this Unit (site B, see Roebroeks, 1985) are regarded as being part of the fauna-association Belvédère 4.

The youngest fauna-association (Belvédère 5) collected at site E derives from Unit 6.2, the base of the Weichselian loessic deposits.

2. TERMINOLOGY AND MEASUREMENTS

All the elements of the upper jaw are indicated with a capital character, the elements of the lower jaw by a small character.

The terminology used with the description of the fossils and the way of measuring them are specific in some cases. The authors who describe and figure the nomenclature and the measuring methods are mentioned in the section dealing with the species concerned.

3. ACKNOWLEDGEMENTS

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4. SYSTEMATIC DESCRIPTIONS

4.1. PISCES

Drs. D. C. Brinkhuizen (B.A.I., Groningen) determined some fish remains. Amongst the fossils of the faunas Belvédère 3 and 4 there are pharyngeal teeth of carp-like fish (Cyprinidae) such as *Leuciscus cephalus* (Linnaeus, 1758), the chub, and *Chondrostoma nasus* (Linnaeus, 1758), the nase. Dental teeth of the pike, *Esox lucius* Linnaeus, 1758 indicate the presence of this species in the fauna Belvédère 4.

4.2. AVES

The bird remains have been determined by Drs. P. Weesie, Institute for Earth Sciences, Utrecht.

Aves indet.

Fauna; Belvédère 4
Material: first phalange Dig. III, bone fragments

Remarks
The first phalange has no special morphological characters. It has the size of the heron (*Ardea cinerea*). The bone fragments are indeterminable and probably belong to small perching birds (Passeriformes).

Anatidae indet.

Fauna; Belvédère 4
Material: coracoid sin.

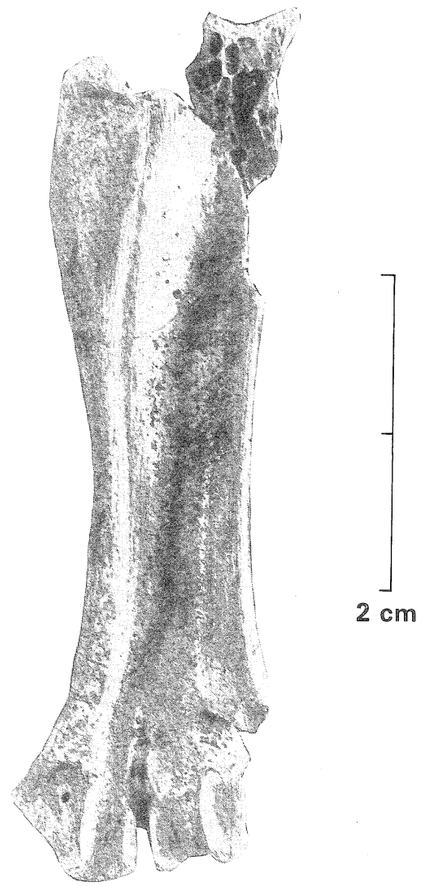

Fig. 1. *Nyctea scandiaca:* tarsometatarsale dext. (BWG 1), posterior view.

Remarks
The coracoid is incomplete. Proximally a small fragment is missing and the distal articulation surface is entirely broken off. Morphologically it looks like a coracoid of the Anseriformes. The size of the specimen from the Belvédère is intermediate between a mallard (*Anas platyrhynchos*) and a graylag goose (*Anser anser*).

Nyctea scandiaca (Linnaeus, 1758)
(Snowy owl)
(Fig. 1)

Fauna; Belvédère 5
Material: tarsometatarsale dext.

Remarks
The tarsometatarsale has been referred to this species on the basis of the identity in size and morphology with comparative material of the recent snowy owl.

4.3. REPTILIA

Emys orbicularis (Linnaeus, 1758)
(European pond tortoise)
(Fig. 2)

Fauna; Belvédère 4
Unit: 4b
Material: epiplastron dext., hypoplastron sin. (posterior part), xiphiplastron (anterior part).

Unit: 5.2.
Material: supra-pygale 2, fragm. costale, marginale 7 sin., marginale 9 dext., marginale 10 dext., fragm. hyoplastron, fragm. xiphiplastron.

Description and remarks (the nomenclature of the bones is figured in Fig. 2a and b)

The remains of the hypoplastron and the xiphiplastron from unit 4b are found together, close to the epiplastron. In view of their position in the layer and of their comparable size these remains probably belonged to one individual (see Fig. 2c). The length of the plastron has been estimated to be about 14 cm.

The difference in size of the remains from unit 5.2 indicate that they derived from at least two specimens. The imprint of the suture of the horny plates on the marginal bones shows that the costal horny plates partly overlie the marginal bones. This character is typical for *E. orbicularis* (Brinkerink, pers. comm., 1985), the only tortoise species known from Pleistocene deposits of North Western Europe (Stuart, 1979).

4.4. MAMMALIA

4.4.1. Insectivora

4.4.1.1. Erinaceidae

Erinaceus cf. *davidi* Jammot, 1973
(Hedgehog)
(Fig. 3a)

Fauna; Belvédère 4
Material: M2 dext.
Measurements: length –, width 5.05 mm.

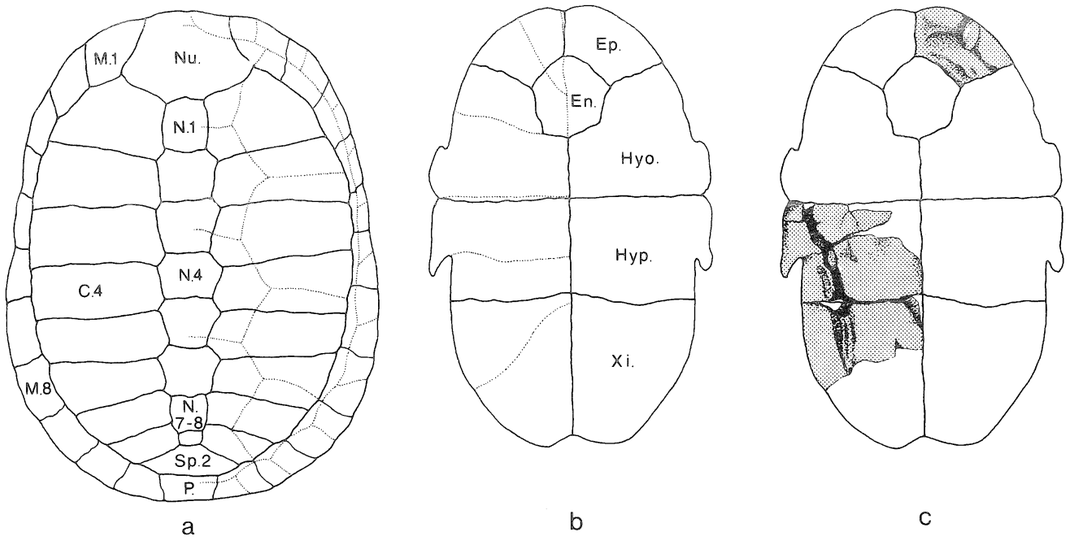

Fig. 2. Shell of *Emys orbicularis* L. (a and b modified from Stuart, 1979). Dotted lines on the right hand side of the shell indicate margins of the overlying horny plates. a: carapace; dorsal view. Nu = nuchal, N1-8 = neurals, C1-8 = costals, M1-11 = marginals, P = pygals, Sp 1-2 – supra-pygals b: plastron, ventral view. Ep = epiplastron, En = entoplastron, Hyo = hyoplastron, Hyp = hypoplastron, Xi = xiphiplastron. c: parts of plastron (dorsal view). Belvédère 4.

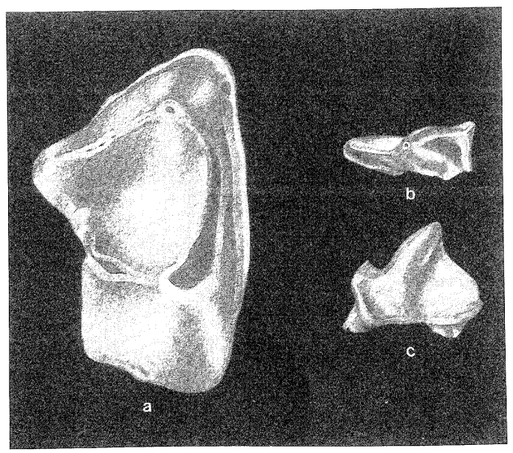

Fig. 3. a: *Erinaceus* cf. *davidi:* occlusal view of M2 dext. (BL 9-1); b-c: *Crocidura* cf. *leucodon:* P4 dext. (BL 4-16) a: occlusal view; b: buccal view. Enlargement 10 x.

Description
The element is incomplete. Hypocone and metacone are missing. The molar has a large protocone and a high and sharply pointed paracone. Protocone and paracone are connected by a high crest. A lower crest is present between paracone and metacone and a very low and short one between protocone and metaconule. The molar has a wide anterior cingulum and a narrow buccal one.

Remarks
There are a number of differences between the M2 of the living *Erinaceus europaeus* and the specimen from the Belvédère. The molar from the Belvédère has

- more pointed tubercles
- a crest between paracone and metacone (absent at the M2 of *E. europaeus*)
- a narrow buccal cingulum
- a more anteriorly situated metaconule

Because of these differences it is doubtful that the molar belongs to *Erinaceus europaeus. Aethechinus algirus,* the Vagrant Hedgehog, which lives in Africa and certain areas of Southern Europe can be distinguished from *E. europaeus* on the basis of differences of the anterior dental elements. The upper molars of these two species are more or less identical. Assignment to *Aethechinus algirus* is unlikely.

Jammot (1973) describes a new species *Erinaceus davidi* from the Middle Pleistocene site La Fage. It is the largest European hedgehog known so far (Jammot, 1973). The width of the M2 from the Belvédère fits within the range of the M2 of *E. davidi* from La Fage (M2 width; 4.6-6.1 mm, mean 5.2 mm (N=5)). Additionally the morphology of our specimen seems to correspond rather well to that of the M2 of *E. davidi* figured by Jammot, 1973 (Plate 2, Fig. 9).

4.4.1.2. Talpidae

Talpa europaea Linnaeus, 1758
(Mole)

Fauna; Belvédère 3
Material: M3 sin., m2 sin., m3 dext., humerus sin., ulna sin.

Measurements: (the humeri are measured according to the method figured by Jammot, 1973.)

humerus; width of the diaphysis 4.3 mm

Fauna; Belvédère 4
Material: I 1 dext., I 2 dext., I 2 sin., C dext., C sin., 3 P4 dext., 2 P4 sin., 2 M1 dext., M1 sin., 4 M2 dext., 3 M2 sin., 3 M3 dext., M3 sin, 2 mandibula dext., 2 mandibula sin., 3 c dext., 2 p2 dext., p2 sin., p3 dext., 5 m1 dext., 4 m2 dext., 4 m2 sin., 3 m3 dext., humerus dext., 4 humerus sin.

Measurements: (the molars are measured according to the method described and figured by Reumer, 1984)

	N	Min.	Max.	x̄
m1				
TRW	5	0.96	1.12	1.04
TAW	4	1.17	1.35	1.24
L	3	2.18	2.22	2.19
m2				
width	8	2.15	2.61	2.41
length	8	1.08	1.39	1.29
humerus;				
length	2	15.8	16.5	16.2
width of the diaphysis	5	4.1	4.7	4.3
distal width	5	8.4	9.1	8.8

Fauna; Belvédère 5
Material: humerus sin.

Measurements:
humerus; width of the diaphysis 4.0
distal width 8.6

Description and remarks
The fossils from Belvédère show much resemblance to material of the living *Talpa europaea.* There are a few differences. All M1 from Belvédère, except for one specimen, have a relatively small lingual part, the posterior crest on the protocone is poorly developed and the protocone itself is also smaller. These features are variable in the M1 of the living *Talpa europaea,* but their lingual part is usually larger and better developed.

The dental material from Belvédère is smaller than that of the living *T. europaea.* The means of length and width of the m2 from a single recent population (N = 30) from The Netherlands are 2.60 mm and 1.48 mm respectively. The humeri from the same population (N = 30) have about the same size (mean distal width 8.94) as those from the different units of the Belvédère.

Comparison with the measurements of humeri from the Middle Pleistocene site Petersbuch (Von Koenigswald, 1970) indicates that the humeri from Belvédère are much larger than those of *T. minor* and also larger than most of the humeri of *T. europaea* from Petersbuch. The dimensions agree better with the humeri from La Fage (Jammot, 1973). Dental material of *T. europaea* is poorly represented at the site Petersbuch and La Fage which makes comparison difficult.

4.4.1.3. Soricidae

The presence or absence of the pigmentation of the teeth is an important diagnostic character for the genera of this family. Unfortunately the material from Belvédère does not show any trace of pigmentation. Therefore, the determination is based on other morphological characters and on size.

The measurements and terminology are according to Reumer, 1984.

Sorex araneus Linnaeus, 1758
(Common shrew)

Fauna; Belvédère 3
Material: M1 dext., M2 dext., i dext. i sin.

Fauna; Belvédère 4
Material: 4 I dext., 9 I sin., 2 P4 dext., 6 P4 sin., 4 M1 dext., 5 M1 sin., 3 M2 dext., 4 M2 sin., mandibula with p4 dext., mandibula with m1 dext., mandibula with m2 and m3 dext., mandibula with m1 and m2 sin., 1 ramus dext., 2 rami sin., 5 i dext., 3 i sin., 4 p4 sin., 5 m1 dext., 6 m1 sin., 3 m2 dext., 1 m2 sin., 1 m3 sin.

Remarks
The Belvédère material is so similar to recent material of *S. araneus,* with which it has been compared, that we refrain from further description.

Sorex minutus Linnaeus, 1758
(Pygmy shrew)

Fauna; Belvédère 4
Material: 2 I sin., P4 dext., 2 P4 sin., 2 M1 sin., 4 M2 sin., mandibula with m1 and m2 dext., mandibula with m2 sin., 4 i dext., 2 sin., 2 m1 sin., 2 m2 dext.

Measurements:

		N	Min	Max.	x̄
i inf.	length	4	2.51	3.00	2.73
m1	TRW	3	0.58	0.67	0.61
	TAW	3	0.63	0.67	0.65
	L	3	1.03	1.10	1.06
m2	TRW	3	0.58	0.73	0.63
	TAW	3	0.58	0.71	0.63
	L	4	1.04	1.09	1.05
ramus	length –				
	height 3.02				
	LUF 0.54				
	LLF 0.80				
	HC 1.04				

Description and remarks
Characteristic for *Sorex minutus* is the small size and the great morphological resemblance with *Sorex araneus* except for the upper incisors, which are fissident in *S. minutus.* Additionally one specimen, which is little worn, possesses an isolated accessory cusp at the internal side of the talon, another feature not known in *S. araneus.*

The mental foramen of the mandibula is situated below the paraconid of the m1. This excludes determination as *S. minutissimus,* in which the mental foramen is situated below the middle of the m1 (Heim de Balsac, 1940).

The fossils of *S. minutus* from Belvédère are smaller than those from the Early Pleistocene site Tegelen (Reumer, 1984). Most of the mean values of the Belvédère fossils are also lower than those of the Ruscinian material studied by Reumer (1984). Apparantly the slight increase in size of *S. minutus* during the Late Pliocene and the Early Pleistocene according to Reumer (1984) did not continue during the Middle Pleistocene. Material of *S. minutus* from Middle Pleistocene sites like Sudmer-Berg-2 (Von Koenigswald, 1972), Miesenheim (own observations), Tornewton Cave (Rzebik, 1968) and Ehringsdorf (Heinrich, 1981c) is of similar size to that from the Belvédère-pit.

Neomys fodiens Pennant, 1771
(Water shrew)

Fauna; Belvédère 3
Material: I sin., mandibula with i and p4 - m3 sin., m2 sin.

Fauna; Belvédère 4
Material: I dext., P4 dext., P4 sin., M2 dext., mandibula dext., mandibula with p4 and m1 sin., mandibula sin., p4 dext., p4 sin., 3 m1 dext., 3 m1 sin., 2 m2 dext., m2 sin.

Measurements: see description and remarks

Description and remarks
The presence of *Neomys* fossils is clearly indicated by a number of mandibulae with condyles in which the articular facets are separated, and with unicuspulate lower incisors (see Chaline et. al., 1974). The upper incisors are fissident and have a large apex.

The molars of *Neomys* and *Sorex* resemble each other in morphology. The upper molars of *Neomys* have somewhat higher cusps and a better developed hypocone. The talonid of m1 and m2 of *Neomys* is better developed than the trigonid (Chaline et al., 1974). The isolated teeth have been determined as *Neomys* on these characters.
One of the three mandibles has a coronoid process with a height of 4.80 mm which is too high for *Neomys anomalus milleri* (Chaline et al., 1974). The value is within the range of *Neomys fodiens fodiens* (Chaline et al., 1974). The other mandibulae have a lower coronoid process with a height of 4.37 and 4.48 mm. These measurements fall in the ranges of both species.

Crocidura cf. *leucodon* (Hermann, 1780)
(Bicoloured shrew)
(Fig. 3b and c)

Fauna; Belvédère 4
Material: P4 dext.
Measurements: lenght 2.05 mm, height 1.66 mm.

Description and remarks
The lingual part of this P4 is broken off. The premolar has a well developed paracone slightly separated from the high metacone. In these characters it resembles a P4 of the biocoloured shrew *C. leucodon* and differs from the white-toothed shrew *C. russula* which has a more isolated and smaller paracone. Paracone and metacone of the P4 of *C. suaveolens* are also slightly separated but the anterior arm of the paracone is bent towards the lingual side (Chaline et al., 1974). The P4 of *C. leucodon* and the specimen from the Belvédère have a straight paracone.

Soricidae indet.

Fauna; Belvédère 3
Material: mandibula fragment

Fauna; Belvédère 4
Material: I dext., 2 P4 dext./sin., 2 M1 dext., 2 M1 sin., 3 M2 dext., M2 sin., 3 M1/M2 sin., 2 mandibula fragm., i sin., m1 dext., m2 dext., m2 sin.,

Remarks
Most of this material is incomplete and does not show any diagnostic characters. Therefore, it is impossible to give a specific determination.

4.4.2. Lagomorpha

4.4.2.1. Ochotonidae
Ochotona pusilla Pallas, (1769)
(Steppe pika)
(Fig. 4)

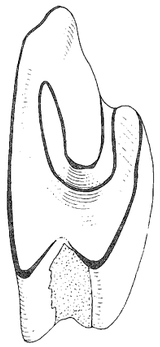

Fig. 4. *Ochotona pusilla:* occlusal view of P4 dext. (BZ 4-151). Enlargement 25 x.

Fauna; Belvédère 3
Material: P4 dext.
Measurements: length 0.88 mm., width 1.79 mm.

Description and remarks
The morphology of this specimen is characteristic of the P4 of *Ochotona.* The measurements of fossil and living species of *Ochotona,* given by Tobien (1972) indicate that the size of this specimen fits in the range of *O. pusilla.*

4.4.3. Rodentia

4.4.3.1. Sciuridae
Spermophilus (Urocitellus) cf. *undulatus* Pallas, 1779
(Longtailed souslik)
(Fig. 5)

Fauna; Belvédère 3
Material: M1/2 dext., M3 dext.

Measurements:	M1/2	length 2.94 mm	width 3.58 mm
	M3	length 3.24 mm	width 3.19 mm

Fauna; Belvédère 5
Material: P3 dext., M1/2 dext., dp4 dext., p4 dext., m1/2 dext., 2 m1/2 sin., m3 sin.

Measurements:	P3	length 1.78 mm	width 1.99 mm
	M1/2	length 2.65 mm	width 3.31 mm
	dp4	length 1.97 mm	width 1.81 mm
	p4	length 2.19 mm	width 2.27 mm
	m1/2	length 2.41 mm	width 2.99 mm
		length 2.47 mm	width 3.02 mm
		length 2.56 mm	width –
	m3	length –	width –

Description
The upper molars are characterized by a relatively small protocone, fairly weak developed lophs and a more or less distinct metaconule. The posteroloph is well developed and connected with the posterior arm of the protocone. There is no posterior cingulum. The upper molars M1/2 show some variation in the development of the anterior cingulum. The specimen from fauna Belvédère 3 has a larger cingulum than the one from fauna Belvédère 5.

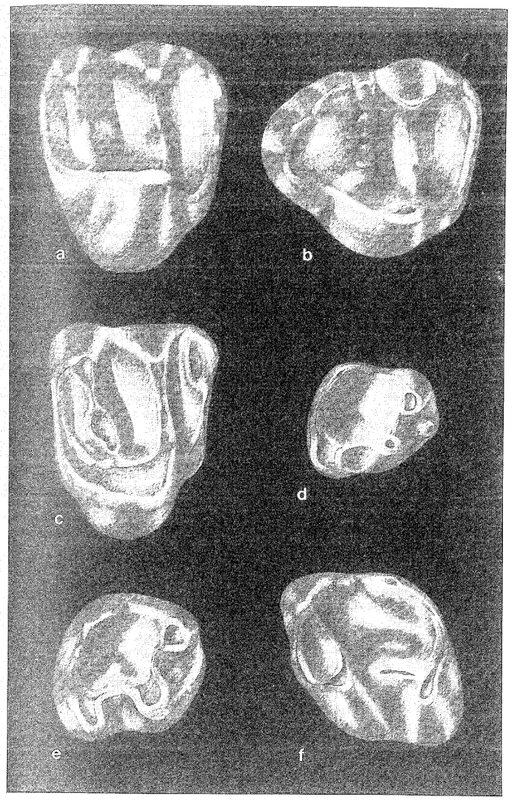

Fig. 5. *Spermophilus (U.)* cf. *undalatus:* a and b: Belvédère 3; c-f: Belvédère 5. a: M1/2 dext. (BZ 1-162); b: M3 dext. (BZ 1-161); c: M1/2 dext. (BWG 104); d: dp4 dext. (BWG 101); e: p4 dext. (BWG-103); f: m1/2 sin. (BWG-107). Enlargement 10 x.

The little worn crown of the milk-molar has thin enamel, well developed lophs and a distinct anteroconid. The lower (pre)molars have a large protoconid, a distinct posterior margin of the trigonid basin and a rounded outline. The floor of the talonid basin of the p4 is crenulated. That of the molars is rather smooth. The P3 has one root, the M1/2 and M3 three and the p4 two roots.

Remarks
The Sciurid teeth from the Belvédère faunas 3 and 5 belong to a medium-sized groundsquirrel. The material show characters of *S. (U.) undulatus* from the Late Pleistocene site Crayford (Mayhew, 1975). In spite of the small variation in the development of the anterior cingulum, it is thought that all the material belongs to one single species.

4.4.3.2. Gliridae Thomas, 1987
Terminology and measurements are according to Daams (1981)

Eliomys quercinus Linnaeus, 1766
(Garden dormouse)

Fauna; Belvédère 4
Material: m2 dext.
Measurements; length 1.36 mm., width 1.61 mm.

Description
The molar is low-crowned, nearly unworn and has three roots. There are 4 ridges on the occlusal surface without any extra ridges. Its size and morphology corresponds with the living *E. quercinus.*

4.4.3.3. Cricetidae

Cricetus cricetus praeglacialis Schaub, 1930
(Hamster)
(Fig. 6a)

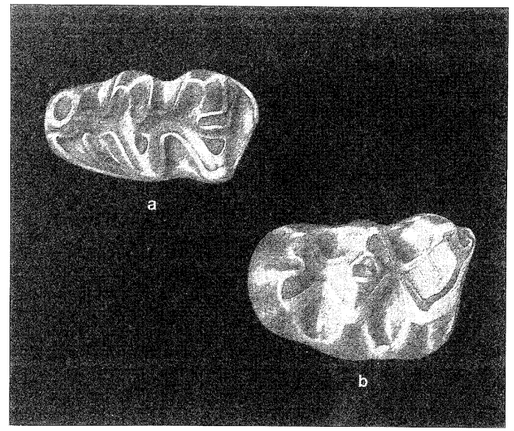

Fig. 6. a: *Cricetus cricetus praeglacialis:* m1 sin. (BZ 1-171), Enlargement 10 x; b: *Cricetulus migratorius:* M1 dext. (BWG 115). Enlargement 20 x.

Fauna; Belvédère 3 ,
Material: m1 sin.
Measurements: length 3.28 mm., width 1.80 mm.

Description and remarks
The specimen is a worn m1 with a morphology which is characteristic for *Cricetus.* The two tubercles of the anteroconid have about the same size. The two anteroconid-tubercles of the m1 of the living *Cricetus cricetus* differ in size, are more isolated from each other and situated more labially than those of the specimen from the Belvédère.

The symmetrical anterior part of the m1 and the size correspond very well with *Cricetus cricetus praeglacialis* known for instance from the Early Pleistocene sites Nagyharsányberg, Beremend (Schaub, 1930) and Les Valerots (Chaline, 1972). The molar from the Belvédère is larger than the m1 of *Cricetus cricetus* from Ehringsdorf (length 2.90 mm.) (Heinrich, 1981c) but too small to be assigned to *Cricetus major* (see Fahlbusch, 1976).

Cricetulus migratorius (Pallas, 1773)
(Grey hamster)
(Fig. 6b)

Fauna; Belvédère 5
Material: M1 dext.
Measurements: M1 length 1.65 mm, width 1.23 mm

Description and remarks
The small hamster is represented by only one, worn first upper molar. The morphology of the specimen resembles that of the M1 molars of *Cricetulus migratorius* from Arnissa (Mayhew, 1978). Mayhew preferred to use the name *Cr. migratorius* rather than the name *Allocricetus bursae* for Late Pleistocene small hamsters because in his opinion dental material of *Allocricetus bursae* is indistinguishable from the living *Cr. migratorius*.

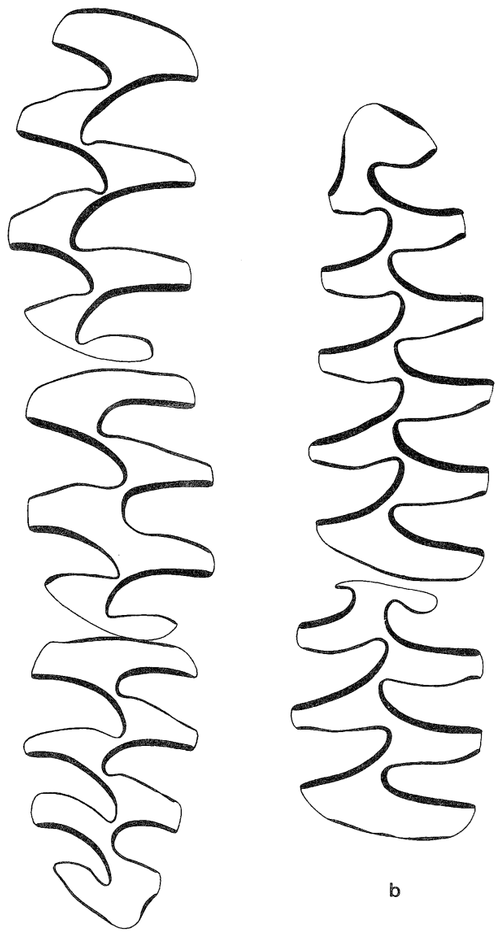

Fig. 7. a and b: *Dicrostonyx torquatus:* a: M1-M3 sin. (BWG 171); b: m1-m2 sin. (BWG 353). Enlargement 20 x.

4.4.3.4. Arvicolidae
The terminology is according to Van der Meulen, 1973.

Dicrostonyx torquatus (Pallas, 1779)
(Arctic lemming)
(Fig. 7)

Fauna; Belvédère 5
Material: maxilla with M1 and M2 dext., maxilla with M1 - M3 sin., Maxilla with M2 and M3 dext., maxilla with M2 and M3 sin., 8 M1 dext., 9 M1 sin., 7 M2 dext., 7 M2 sin., 11 M3 dext., 10 M3 sin. 2 mandibulae with m1 and m2 dext., mandibula with m1-m3 sin., 3 mandibula with m1 and m2 sin., 37 m1 dext., 32 m1 sin., 34 m2 dext., 31 m2 sin., 8 m3 dext., 16 m3 sin.

Measurements:

		N	Min.	Max.	$\bar{x}$
M1;	length	11	2.45	2.95	2.69
	width	18	1.36	1.57	1.46
M2;	length	16	1.90	2.28	2.09
	width	18	1.37	1.62	1.48
M3;	length	18	2.19	2.70	2.36
	width	21	1.23	1.50	1.36
m1;	length	45	3.20	4.15	3.70
	width	56	1.23	1.51	1.39
m2;	length	50	1.52	2.36	1.90
	width	63	1.20	1.65	1.38
m3;	length	17	1.37	2.00	1.78
	width	21	1.07	1.42	1.28

Description
The molars are rootless and lack crown-cementum. The enamel thickness is conspicuously differentiated. The enamel of the posterior sides of the triangles is thicker than at the anterior side in the upper molars. In the lower molars the situation is reversed. The enamel is absent at the tips of the salient angles.

The M1 comprises an anterior lobe, five alternating, closed triangles and postero-buccally a narrow elongated field. The entire posterior side of the M1 lacks enamel (morphotype 1 of Agadjanian & Von Koenigswald, 1977). The morphology of the posterior part of most of the M2 molars is the same as that of the M1 (morphotype 1 of Agadjanian & Von Koenigswald, 1977). Only two specimens out of nineteen have a different morphology. They have enamel at the posterior side of TC4 and a small third lingual re-entrant angle (morphotype 2 of Agadjanian & Von Koenigswald, 1977). The M3 has an anterior lobe, four triangles and a posterior cap. Some molars have enamel only at the postero-buccal side of the cap (morphotype 2 of Agadjanian & Von Koenigswald, 1977). Others have enamel at the postero-buccal and the postero-lingual side of the cap (morphotype 3 of Agadjanian & Von Koenigswald, 1977). But there are also specimens in which there is no enamel at the posterior side (morphotype 1 of Agadjanian & Von Koenigswald, 1977).

The m1 has a posterior lobe, 7 triangles and an anterior cap. The morphology of the anterior cap is variable. Twelve specimens (20%) have a simple cap without re-entrant angles (morphotype 1 of Agadjanian, 1976). Six specimens (10%) have a sixth re-entrant angle at the lingual side (LRA 6) (morphotype 2 of Agadjanian, 1976). The other specimens (70%) have a sometimes poorly developed LRA 6 and a shallow fifth buccal re-entrant angle (BRA 5) (morphotype 3 and 4 of Agadjanian, 1976). A sixth buccal salient angle (BSA 6) is present in 4 specimens (6%) with morphotype 4 of Agadjanian, 1976. In 3 specimens the T8 is closed and one of them has also a T9. These molars can also be assigned to morphotype 4 of Agadjanian (1976).

The m2 and the m3 have the normal *Dicrostonyx* pattern.

Remarks
In the recent fauna one can distinguish two species belonging to the genus *Dicrostonyx; D. hudsonius* (Pallas, 1779) which inhabits an isolated territory in Labrador (Canada) and *D. torquatus* (Pallas, 1779) with a holarctic distribution. Four fossil *Dicrostonyx* species have been described from European Pleistocene deposits; *D. gulielmi, D. henseli, D. simplicior* and *D. antiquitatis. D. antiquitatis* is known from the Early Middle Pleistocene site Les Valerots (Chaline, 1972). This species only has 5 closed triangles in the m1. The other species are more advanced in having m1 with at least 7 closed triangles. They differ from each other in the patterns of the occlusal surfaces of the M1, M2, M3 and m1. Agadjanian (1976) distinguishes four different morphotypes for each of the different elements. These morphotypes have been numbered I through IV, the higher the number, the more complicated the occlusal pattern. In the opinion of Agadjanian & Von Koenigswald (1977) there are, apart from *D. antiquitatis,* four living and fossil species all together. *D. simplicior* and *D. hudsonius* characterized by M1 and M2 which belong exclusive to morphotype I, *D. gulielmi* (= *D. henseli* and partly *D. torquatus*) with three subspecies *D. gulielmi rotundus, D. gulielmi henseli* and *D. gulielmi gulielmi* characterized by M1 and M2 showing the preponderance of morphotypes I, II and III respectively. The fourth species, *D. torquatus,* is characterized by the occurrence of morphotypes III and IV of the M1 and M2. The relative frequencies of the different morphotypes change during the Middle and Late Pleistocene (Agadjanian, 1976 and Agadjanian & Von Koenigswald, 1977). The distribution of the different morphotypes of the M1 and the M2, in particular, can be used stratigraphically. The M1 and M2 with a high frequency of morphotype I are restricted to the Middle Pleistocene. The M1 and the M2 with a Middle Weichselian age mostly have morphotype I and sometimes morphotype II. The other morphotypes are more frequent in more recent material.

All M1 and nearly all M2 from Belvédère 5 belong to morphotype I. Only 2 M2 (out of 19) are more complicated (morphotype 2). This suggests that the fauna has a pre-Middle Weichselian age.

According to Jánossy (1954) all these morphotypes are present in the recent *D. torquatus* and he suggest therefore that all the fossil material referred to *D. simplicior, D. gulielmi* and *D. henseli* should be assigned to *D. torquatus.* This opinion has been supported by Chaline (1972), Van der Meulen in Van der Meulen & Zagwijn (1974) and the present author. The distinction of fossil *Dicrostonyx* (sub)species on the base of the relative frequency of morphotypes as purposed by Agadjanian & Von Koenigswald (1977) can only be done if sufficient material is available. So, for practical reasons it is preferable to assign all fossil material which falls within the variation of *D. torquatus,* to that species.

Clethrionomys glareolus (Schreber, 1780)
(Bank vole)

Fauna; Belvédère 3
Material: M1 dext., M1 sin., M2 dext., 2 M2 sin., m1 dext., m1 sin., m3 dext., 3 m3 sin.

Measurements:

		N	Min.	Max.	$\bar{x}$
M1	length	2	1.74	1.90	1.82
	width	2	0.92	0.96	0.94
M2	length	3	1.22	1.44	1.35
	width	3	0.79	0.94	0.87
m1	length	2	2.02	2.17	2.09
	width	2	0.91	0.95	0.93
m3	length	4	1.11	1.32	1.23
	width	4	0.59	0.68	0.63

Fauna; Belvédère 4
Material: 8 M1 dext., 11 M1 sin., 8 M2 dext., 7 M2 sin., 8 M3 dext., 10 M3 sin., 6 m1 dext., 11 m1 sin., 16 m2 dext., 6 m2 sin., 16 m3 dext., 15 m3 sin.

Measurements:

		N	Min.	Max.	$\bar{x}$
M1	length	18	1.67	1.96	1.79
	width	18	0.83	1.09	0.93
M2	length	15	1.24	1.45	1.33
	width	15	0.70	0.93	0.82
M3	length	17	1.41	1.72	1.56
	width	18	0.62	0.79	0.73
m1	length	12	1.97	2.25	2.06
	width	14	0.83	0.94	0.87
m2	length	17	1.20	1.36	1.30
	width	20	0.72	0.87	0.78
m3	length	28	1.11	1.53	1.27
	width	28	0.57	0.85	0.69

Description and remarks
The molars have two roots each and relatively thick enamel. The elements of young specimens are rootless and have thinner enamel. The molars have crown-cement in the re-entrant folds and the salient angles are rounded at their tips. The m1 has four narrowly confluent triangles and a fifth triangle which is broadly confluent with a simple anterior cap. The morphology of the M3 is variable. In some a well developed fourth lingual salient angle is present, in other M3 it is small or absent. A fourth buccal salient angle is incipient or absent. The morphology of these molars is similar to those of the living *Clethrionomys glareolus.*

Arvicola cantiana/terrestris

(Fig. 8a)

Fauna; Belvédère 3
Material: M1 dext., M1 sin., M3 dext., 3 M3 sin., m1 dext. m1 sin., 2 m2 sin., m3 dext., m3 sin.

Measurements:

		N	Min.	Max.	$\bar{x}$
M1	length	1	3.04		
	width	1	1.74		
M3	length	1	2.23		
	width	2	1.06	1.12	1.09
m1	length	–			
	width	2	1.48	1.56	1.52
m2	length	1	2.17		
	width	1	1.32		
m3	length	1	2.12		
	width	2	0.98	1.13	1.06

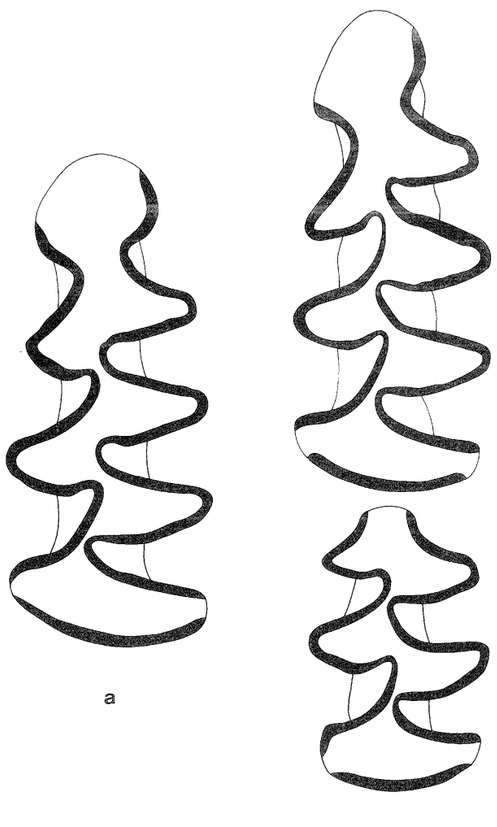

Fig. 8. a: *Arvicola cantiana/terrestris:* m1 sin. (BL 3-306); b: *Arvicola terrestris:* m1 and m2 sin. (BWG 501). Enlargement 20 x.

Fauna; Belvédère 4
Material: 6 M1 dext., M1 sin., 7 M2 dext., 1 M2 sin., 6 M1/M2, 2 M3 dext., 2 M3 sin., 3 m1 dext., 2 m1 sin., 4 m2 dext., 4 m2 sin., 4 m3 dext., 3 m3 sin.

Measurements:

		N	Min.	Max	x̄
M1	length	7	2.92	3.20	3.08
	width	7	1.66	1.80	1.74
M2	length	7	2.12	2.57	2.27
	width	7	1.31	1.62	1.44
M3	length	4	1.86	2.20	2.10
	width	4	1.15	1.24	1.20
m1	length	5	3.21	3.88	3.65
	width	5	1.30	1.60	1.51
m2	length	5	2.13	2.34	2.20
	width	6	1.27	1.48	1.37
m3	length	5	1.94	2.11	1.98
	width	5	0.97	1.18	1.05

Description and remarks
All the molars are rootless, their re-entrant folds are partly filled with crown-cement. The m1 comprises, a posterior loop, three closed triangles and a relatively large anterior loop. The enamel on the convex side of the triangles is as thick as that on the concave side. The mean size of the m1 is somewhat larger than those of *Arvicola cantiana* from Westbury-sub-Mendip (Bishop, 1982). They have about the same size as the molars of *A. terrestris* from Rhenen which have a mean length of 3.53 mm. (N = 2) (Van Kolfschoten, 1981).
Arvicola molars in which the enamel thickness is not differentiated are currently determined as *A. cantiana/terrestris* indicating the transitional stage in the evolution from *A. cantiana* to *A. terrestris.*

Arvicola terrestris (Linneaus, 1758)
(water vole)
(Fig. 8b)

Fauna; Belvédère 5
Material: 2 m1 sin., m2 sin.

Measurements:

		N	Min.	Max.	x̄
m1	length	1	–	–	3.78
	width	2	1.55	1.65	1.60
m2	length	1	–	–	2.18
	width	1	–	–	1.40

Description
The *Arvicola* teeth from Belvédère 5, the m1 in particular, show a differentiation of the enamel thickness. In the lower teeth the enamel on the convex side of the triangles is somewhat thinner than on the concave side (see Fig. 8b). This type of enamel-thickness differentiation and the size of the material allow the determination of this material as *Arvicola terrestris.*

Remarks
The *Arvicola* teeth from Belvédère 5 differ from the *Arvicola* teeth from the faunas 3 and 4 by their enamel differentiation. The mean length of the m1 of recent watervoles from England is about 4.35 mm (Stuart, 1982). The measurements of those of *A. terrestris terrestris* and *A. terrestris exitus* from Poland are respectively 4.18 mm and 3.91 mm (Nadachowski, 1982). This indicates that the modern watervole is a little larger than the one from the fauna Belvédère 5.

Pitymys McMurtrie, 1831 and *Microtus* Schrank, 1798.

A large number of molars represent the genera *Pitymys* or *Microtus* in the faunas Belvédère 3, 4 and 5. The molars agree in the absence of roots, the presence of abundant crown-cement in the synclines and differentiation of the enamel thickness at both sides of the triangles. Only the occlusal patterns of m1 and partly those of M2 and M3 are useful for determination.

The occlusal surface of the m1 displays a posterior lobe, 3 to 5 closed triangles and a variably shaped anterior field. One can distinguish five different morphotypes amongst the m1 from the Maastricht-Belvédère pit.

– morphotype 1 (Fig. 9a) is characterized by three closed triangles T1, T2 and T3 and two broadly confluent triangles T4 and T5. The anterior field consists of T6, T7 and AC 3. Morphotype 1 characterizes the European species of the genus *Pitymys.*

– morphotype 2 (Fig. 9d) is characterized by four closed triangles, a T5 which is broadly confluent with the anterior field. T6 is small, T7 well developed. This morphotype is typical of the living *Microtus oeconomus* (= *M. ratticeps*).

– morphotype 3 (Fig. 9b): The m1 of this type has five closed triangles and an anterior field with a well developed T7. T6 is incipient or absent. This type is characteristic of the living *Microtus gregalis.*

– morphotype 4 (Fig. 9f) molars have five closed triangles, a short anterior loop, well developed T6 and T7 and a deep LRA 4. The tip of LRA 4 lies in front of BRA 3. BRA 4 and LRA 5 are incipient or absent. This type is characteristic of *M. nivalis.*

– morphotype 5 molars have five closed triangles. The anterior field has well developed T6 and T7. BSA 4, LSA 5, LRA 5 and usually BRA 4 are well developed. *Microtus arvalis* and *M. agrestis* have a m1 with this type of morphology.

To quantify these differences a number of measurements have been taken. Fig. 10 shows the parameters and the way they have been measured. The relation between the parameters b and f is visible in Fig. 11.

Fig. 11 shows a larger cluster including all morphotypes except for the two specimens which lie in the left lower corner of the diagram. The latter two have been determined as *M. gregalis.*

Within the large cluster there is a higher concentration of observations in its right-lower part, and another less clear concentration in the left upper part. The specimens from Belvédère 3 are concentrated in the right-lower part of the larger cluster. They are determined as *M. arvalis* and/or *M. agrestis.*

The observations from the Belvédère 4 specimens are clearly divided between the two concentrations in the cluster: the specimens in the right-lower part, determined as *M. arvalis* and/or *M. agrestis,* and the three specimens in the left-upper part, determined as *M. oeconomus.*

The lower m1 of Belvédère 5, within the larger cluster, can be devided in two concentrations. One in the left-upper part (specimen with morphotype 2, determined as *M. oeconomus*) and another in the right-lower part (specimens with morphotype 4 and 5). However the subdivision is not clear enough and taking into account the other characters it is decided to determine all *Microtus* molars as *M. oeconomus* (see also the remarks under *M. oeconomus*).

The morphologies of the M3, m2 and m3 of the different *Pitymys* and *Microtus* species are very similar. The presence of more than one species of one of these or both genera in the different faunas makes a specific determination of these molars impossible. Therefore, they will be described as *Pitymys* sp or *Microtus* sp. in Belvédère 4, representing both genera, or as *Microtus* sp. in Belvédère 3 in which only the presence of *Microtus* sp. is indicated sofar. However, an exception can be made for those M2, which have an extra postero-lingual triangle. They are determined as *M. agrestis.* The M1 of *M. agrestis* may or may not have this extra triangle.

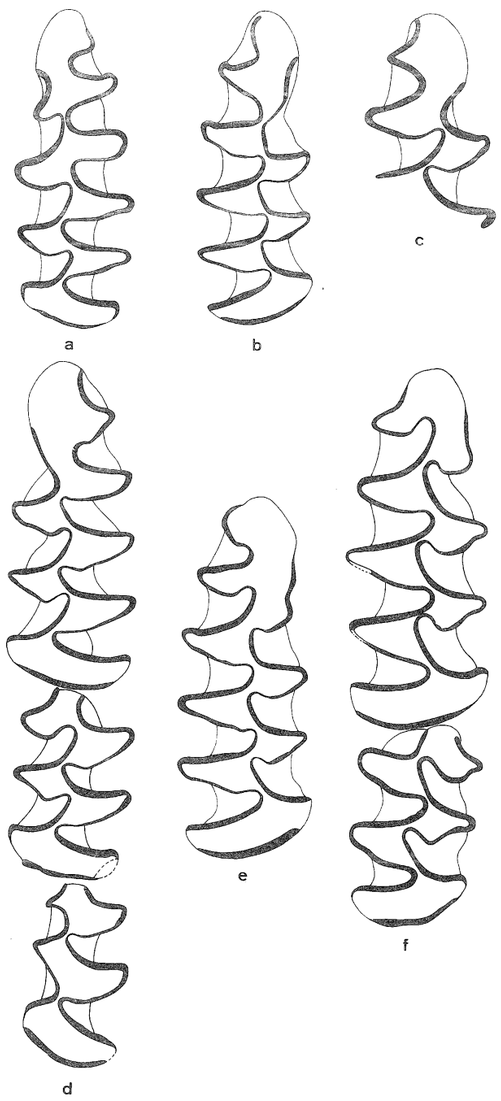

Fig. 9. a: *Pitymys* cf. *subterraneus:* m1 sin. (BL 6-475); b: *Microtus gregalis:* m1 dext. (BZ 1-451); c - f: *Microtus oeconomus* (= *M. ratticeps*): c: m1 dext. (BL 8-409); d: m1-m3 sin. (BWG 542); e: m1 dext. (BWG 521); f: m1 and m2 dext. (BWG 531). Enlargement of all the figures about 20 x.

Pitymys cf. *subterraneus* (de Sélys Long-champs, 1836)
(Pine vole)
(Fig. 9a)

Fauna; Belvédère 4
Material: m1 sin.
Measurements: L = 2.51, W = 0.90, a = 1.35, b = 0.03, c = 0.17, d = 0.19, e = 0.69, f = 0.19.

Description and remarks
The most remarkable character of this specimen is the

broadly confluent triangles T4 and T5. The triangles T1 and T3 have an antero-posteriorly compressed appearance. The salient angles BSA 3 and LSA 4 have a rounded outline. The small size of the molar and its occlusal pattern are characteristic of *Pitymys subterraneus*.

Microtus gregalis (Pallas, 1779)
(Narrow-skulled vole)
(Fig. 9b)

Fauna; Belvédère 3
Material: m1 dext. (Fig. 9b)
Measurements: L = 2.45, W = 0.81, a = 1.35, b = 0.02, c = 0.02, d = 0.19, e = 0.52, f = 0.06

Fauna; Belvédère 5
Material: m1 (broken)
Measurements: W = 0.84, b = 0.02, c = 0.04, d = 0.20, e = 0.54, f = 0.10

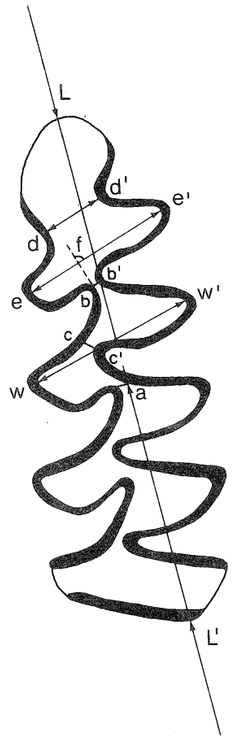

Fig. 10. Occlusal surface of *Microtus* m1 sin. illustrating the parameters that were measured. L-L' = L; W-W' = W; a-L = a; b-b' = b; c-c' = c; d-d' = d; e-e' = e; e-f = f.

Description and remarks
The juvenile specimen from Belvédère 5 consists of an anterior part only. Both molars have an incipient BRA 4. This type of morphology is characteristic of *M. gregalis*.

Microtus oeconomus (Keyserling et Blasius, 1841)
(= *M. ratticeps*)
(Root vole)
(Fig. 9c-f)

Fauna; Belvédère 4
Material: 2 m1 dext., 1 m1 sin. (Fig. 9c)
Measurements:

	L	W	a	b	c	d	e	f
N	–	2	2	3	2	3	3	3
Min.	–	0.87	1.19	0.18	0.02	0.33	0.52	0.06
Max.	–	0.93	1.23	0.20	0.04	0.45	0.61	0.14
x̄	–	0.90	1.21	0.19	0.03	0.41	0.56	0.09

Description and remarks
The three specimens are incomplete. Their morphology corresponds to morphotype 2 characterized by a high b-value, a low c-value and by the absence or presence of an incipient T6. Except for the juvenile molars they have a wide anterior field (d = 0.44 and 0.45 respectively). The size and the morphology of these specimen are similar to the m1 of *M. oeconomus*.

Fauna; Belvédère 5
Material: 2 M1 dext., M1 sin., 2 M2 dext., 2 M2 sin., 2 M3 sin., mandibula with m1 and m2 dext., mandibula with m1-m3 sin., 11 m1 dext., 7 m1 sin., 5 m2 dext., m2 sin., m3 dext., 3 m3 sin.

Measurements:

m1	L	W	a	b	c	d	e	f
N	14	17	16	16	16	14	17	16
Min.	2.50	0.84	1.26	0.02	0.02	0.20	0.54	0.02
Max.	3.13	1.05	1.56	0.25	0.05	0.46	0.78	0.29
x̄	2.78	0.95	1.41	0.13	0.04	0.38	0.67	0.14
SD	14.96	4.93	7.06	7.77	0.97	7.78	6.20	7.75

		N	Min.	Max.	x̄
M1	length	1	–	–	2.18
	width	1	–	–	1.23
M2	length	3	1.48	1.79	1.62
	width	4	0.79	1.11	0.91
M3	length	–	–	–	–
	width	1	–	–	1.01
m2	length	7	1.48	1.64	1.55
	width	3	0.85	1.03	0.98
m3	length	3	1.39	1.44	1.41
	width	4	0.76	0.93	0.84

Description and remarks
The m1 molars have a variable shaped anterior part representing the morphotypes 2, 4 and 5 characteristic of *M. oeconomus, M. nivalis* and *M. arvalis/M. agrestis* respectively (Fig. 9, c-f). The anterior cap of the morphotype 5 molars is shorter than those of *M. arvalis* and *Microtus agrestis* from Belvédère 3 and 4. The variability causes the large standard deviation of most of the parameters. Fig. 11 shows that a subdivision of the different types based on the parameters b and f can hardly be made. The other parameters give the same results.

The m1 of Late Pleistocene and living *M. oeconomus* from Poland shows the same variability in the pattern (Nadachowski, 1982).

Microtus agrestis Linnaeus, 1971
(Short-tailed vole)

Fauna; Belvédère 4
Material: 2 M1 dext., 2 M1 sin., 6 M2 dext., 8 M2 sin.

Measurements:

		N	Min.	Max.	x̄
M1	length	3	2.20	2.23	2.21
	width	4	1.02	1.19	1.11
M2	length	11	1.20	1.74	1.55
	width	14	0.71	1.09	0.96

□ *M.gregalis* Belvédère 3
× *M.gregalis* Belvédère 5
■ *M.oeconomus* Belvédère 4
\+ *M.oeconomus* Belvédère 5
○ *M.arvalis* or *M.agrestis* Belvédère 3
• *M.arvalis* or *M.agrestis* Belvédère 4

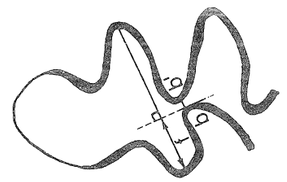

Fig. 11. Relation between b and f for the m1 assemblages of *Microtus* from Belvédère 3-5.

Description and remarks
The morphology of the M2 of the living *M. agrestis* differs from the morphology of the M2 of other *Microtus* species by having an extra small salient angle on their postero-lingual side. This extra salient angle may also be present in M1; If present its size is variable. Some M1 have a well developed one, others a very smalle one.

About half of the M2 molars (14 out of 29) of *Microtus* from Belvédère 4 belong to *M. agrestis.* Only 4 out of 28 M1 molars have an extra salient angle. The feature is absent in the 5 M1 and 2 M2 from Belvédère 3 and the 3M1 and 4 M2 from Belvédère 5.

Microtus arvalis and/or *M. agrestis*
(Short-tailed vole and/or common vole)

Fauna; Belvédère 3
Material: mandibula with m1 and m2 dext., 4 m1 dext., 1 m1 sin.

Measurements:
m1

	L	W	a	b	c	d	e	f
N	3	4	3	4	4	4	4	4
Min.	2.37	0.88	1.21	0	0.03	0.20	0.61	0.17
Max.	2.91	0.98	1.58	0.03	0.07	0.33	0.84	0.32
$\bar{x}$	2.61	0.93	1.37	0.02	0.06	0.26	0.55	0.22

m2: length: 1.52, width 0.98. mm

Fauna; Belvédère 4
Material: 22 m1 dext., 18 m1 sin.

Measurements:
m1

	L	W	a	b	c	d	e	f
N	16	27	26	29	28	29	29	29
Min.	2.25	0.77	1.17	0	0	0.11	0.60	0.18
Max.	3.04	1.03	1.50	0.05	0.05	0.34	0.82	0.32
$\bar{x}$	2.54	0.90	1.32	0.03	0.03	0.23	0.75	0.28

Description and remarks
All m1 have the typical arvalid morphology with five closed triangles and well developed T6 and T7 (morphotype 5). The anterior field has a variable shape mainly caused by the variation in the development of the BRA 4. Also the depth of LRA 5 and the development of BSA 5 and LSA 6 is variable.

This type of morphology is characteristic of the living species *M. agrestis* and *M. arvalis.* The morphology of the M2 shows that both species are represented in Belvédère 4. The presence of *M. agrestis* in Belvédère 3 has not been indicated sofar.

Pitymys/Microtus sp.

Fauna; Belvédère 4
Material: 13 M1 dext., 11 M1 sin., 12 M2 dext., 3 M2 sin., 2 M1/2, 12 M3 dext., 17 M3 sin., 17 m2 dext., 22 m2 sin., 12 m3 dext., 12 m3 sin.

Remarks
The molars have a morphology which is characteristic and similar for many species of the genera *Pitymys* and *Microtus,* both represented in Belvédère 4. Therefore a specific determination of these molars is impossible.

The morphology of the M3 is very variable. Most of the specimen have 3 lingual salient angles, others have 4. BSA3 is well developed, BSA 4 incipient or absent. It is difficult to distinguish the M3 of *Pitymys,* which are diagnostic for some of the species of this genus, from the M3 of *Microtus.* Therefore, all M3 from this fauna are described as *Pitymys/Microtus* sp.

Microtus sp.

Fauna; Belvédère 3
Material: 4 M1 dext., M1 sin., 2 M2 dext., 3 M2 sin., 4 M1/2, 3 M3 dext., 3 M3 sin., m1 dext., 3 m2 dext., 4 m2 sin., 8 m1/m2, 6 m3 dext., 5 m3 sin.

Remarks
The remarks applying to the material described as *Pitymys/Microtus* sp. are partly valid for material determined as *Microtus* sp. The genus *Pitymys* is excluded because it has not been indicated in Belvédère 3 sofar.

4.4.3.5. Muridae
The terminology and the measurements are according to Van der Weerd, 1976.

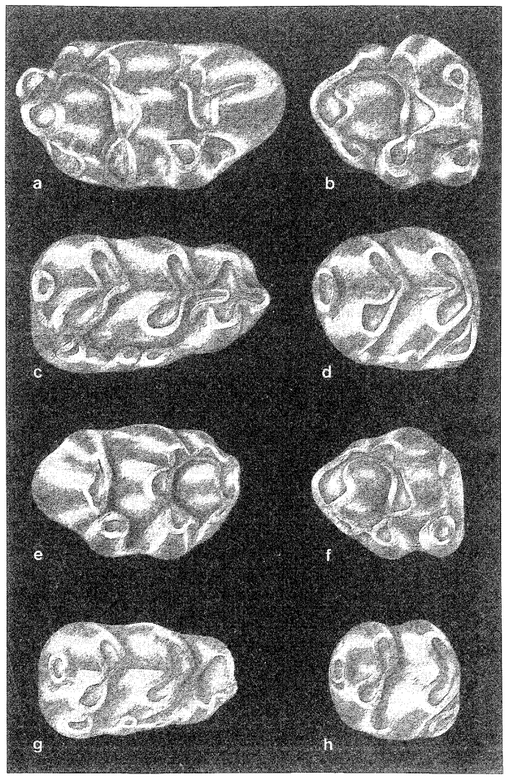

Fig. 12. a-d: *Apodemus sylvaticus:* a: M1 dext. (BL 7-603); b: M2 dext. (BL 6-605); c: m1 dext. (BL 6-615); d: m2 dext. (BL 6-624); e-h: *Apodemus maastrichtiensis* n. sp.: e M1 sin. (BL 7-701); f: M2 dext. (BL 6-703); g: m1 dext. (BL 6-731); h: m2 dext. (BL6-718). Enlargement 20 x.

Apodemus sylvaticus Linnaeus, 1758
(Wood mouse)
(Fig. 12a-d)

Fauna; Belvédère 3
Material: 2 M1 dext., 1 M2 dext., 1 M2 sin., 1 M3 sin.*, 2 m1 dext., 1 m1 sin., 1 m2 dext., 1 m3 sin.*

Measurements:

		N	Min.	Max.	$\bar{x}$
M1	length	2	1.89	1.96	1.93
	width	2	1.19	1.21	1.20
M2	length	2	1.12	1.28	1.20
	width	2	1.11	1.16	1.14
M3	length	1	–	–	0.91
	width	1	–	–	0.82
m1	length	3	1.79	1.88	1.84
	width	3	1.04	1.12	1.08
m2	length	1	–	–	1.19
	width	1	–	–	0.99
m3	length	1	–	–	0.92
	width	1	–	–	0.77

* These molars belong to *A. sylvaticus* or to *A. maastrichtiensis* n. sp.

Fauna: Belvédère 4
Material: 9 M1 dext., 6 M1 sin., 6 M1 dext., 5 M2 sin., 3 M3 dext.*, 8 M3 sin.*, 5 m1 dext., 9 m1 sin., 8 m2 dext., 8 m2 sin., 12 m3 dext.*, 4 m3 sin.*

Measurements:

		N	Min.	Max.	$\bar{x}$
M1	length	14	1.79	2.04	1.93
	width	14	1.12	1.28	1.19
M2	length	11	1.15	1.39	1.26
	width	11	1.06	1.22	1.13
M3	length	11	0.79	0.95	0.84
	width	11	0.73	0.91	0.82
m1	length	13	1.69	1.91	1.80
	width	13	0.94	1.15	1.05
m2	length	16	1.14	1.27	1.21
	width	16	1.00	1.18	1.10
m3	length	16	0.81	1.07	0.95
	width	16	0.75	0.92	0.86

Description and remarks
The variation in the morphology of the molars corresponds to that of the molars of *A. sylvaticus* described by Pasquier, 1974. Determination as *A. flavicollis,* of which the molars closely resemble those of *A. sylvaticus,* has been excluded because of the presence of a well developed t9 in nearly all the M2 from the Belvédère. The size of the molars of both *A. flavocollis* and *A. sylvaticus* varies considerably during the Pleistocene. The specimens from the Belvédère are smaller than those from the late Middle Pleistocene sites Le Lazaret, Orgnac and Prince Grimaldi (Pasquier, 1974).

The *A. sylvaticus* molars from Rhenen, except for the M1, are about the same size as those from Belvédère. The M1 from Rhenen are smaller (Van Kolfschoten, 1981).

The separation of *A. sylvaticus* and *A. maastrichtiensis* n. sp. in the Belvédère material is dealt with in the following section.

Apodemus maastrichtiensis n. sp.

Holotype: m1 dext. coll.nr. BL6-731 (Fig. 12g)

Paratype: M1 sin., coll.nr. BL7-701 (Fig. 12e)
M2 dext. coll.nr. BL6-703 (Fig. 12f)
m2 dext. coll.nr. BL6-718 (Fig. 12h)
Etymology: named after the town Maastricht in which the site Belvédère is situated
Type locality: Maastricht-Belvédère, Unit 4
Stratigraphic range: Middle Pleistocene
Other localities from which this species is known: Fransche Kamp, Wageningen (The Netherlands) and Miesenheim (Western Germany).

Diagnosis: a small to middle sized *Apodemus.* The M1 with 3 or 4 roots (most of them have 3) a t9 which is smaller than the t6 and a narrow, elongated t7. The t3 of the M2 is incipient or absent, t7 and t9 are small. The slopes of the cusps of m1 and m2 are more or less vertical and the angle formed by the chevrons is large. The anterior part of m1 is isolated in most of the specimen. The antero-labial cusp of m2 is small.

Differential diagnosis
A. maastrichtiensis n. sp. differs from all other *Apodemus* species in the high steepness of the slopes of the cusps in its lower molars.

Remarks on differences between *A. maastrichtiensis* n. sp. and other species of the genus *Apodemus.*

A. maastrichtiensis n. sp. differs from *A. sylvaticus* because of its smaller size (see Fig. 13) and by the development of t7 and t9 in the upper molars M1 and M2. These tubercles are better developed in the molars of *A. sylvaticus.* The t3 which is incipient or absent in the M2 of *A. maastrichtiensis* n. sp. is much larger in the second upper molar of *A. sylvaticus.* The lower molars of *A. sylvaticus* have cusps with less steep slopes and the angle formed by the chevrons is smaller.
A. maastrichtiensis n. sp. differs from *A. microps* in the size of the t3 of M2 which is better developed in *A. microps.* Only a small number of specimen of *A. microps* (2 out of 114) show a reduction of the t3 (Steiner, in Niethammer & Krapp, 1978). The t9 of M1 and M2 of *A. microps* are also larger than those of *A maastrichtiensis* n. sp.. The position of the cusps of the lower molars of *A. microps* corresponds much better to that of the lower molars of *A. sylvaticus.*

A. agrarius has a M2 without a t3. In this character there is resemblance with some of the molars of *A. maastrichtiensis* n. sp. However, *A. agrarius* differs in the morphology of the other molars. The t7 of M1 and M2 is well developed. There are no accessory cusps on the labial cingulum of m1. The m2 of *A. agrarius* is longer and has an extra cusp labial to the hypoconid.

The molars of *A. mystacinus* are much larger and more complicated with a large number of accessory cusps in m1 and m2 (see Niethammer & Krapp, 1978).

The Pliocene *A. jeanteti* is much larger than *A. maastrichtiensis* n. sp. (length M1 2.15-2.75, Pasquier, 1974).

A. occitanus and *A. dominans* are larger than *A. maastrichtiensis* n. sp. The morphology of the molars of *A. occitanus* and *A. dominans* resemble more