ANNALES HISTORICO-NATURALES MUSEI NATIONALIS HUNGARICI
Volume 90. Budapest, 1998 pp. 57–89.

Cricetids (Rodentia, Mammalia) of the Early Pleistocene vertebrate fauna of Somssich-hegy 2 (Southern Hungary, Villány Mountains)

J. HÍR

Municipal Museum
H–3060 Pásztó, Múzeum tér 5, Hungary

HÍR, J. (1998): Cricetids (Rodentia, Mammalia) of the Early Pleistocene vertebrate fauna of Somssich-hegy 2 (Southern Hungary, Villány Mountains). – *Annls hist.-nat. Mus. natn. hung.* **90**: 57–89.

Abstract – From the Early Pleistocene fauna of Somssich-hegy 2, three cricetid taxa were described by DÉNES JÁNOSSY (*Cricetulus* sp., *Allocricetus* sp., *Cricetus cricetus runtonensis*). A revision of the material by the present author found four species (*Allocricetus bursae, Allocricetus ehiki, Cricetus nanus, Cricetus runtonensis*). On the basis of a morphological analysis we can distinguish different evolutionary lines among the Hungarian Pleistocene *Cricetus*. With 33 figures and 28 tables.

INTRODUCTION

The locality Somssich-hegy 2 (pronounced as "shomshitsh-hedy") is situated on the top of the Somssich Hill, 9 m from a wine house, about 50 m E of a topographical reference-point (180.2 m above sea level) (JÁNOSSY 1986: Fig. 7). It was discovered by DÉNES JÁNOSSY and GYÖRGY TOPÁL in 1975. They begun the excavation from the surface and after 8 years a 8 m deep vertical fissure was unearthed. The infilling sediment was excavated in 47 layers (20–30 cm thickness). All of them yielded rich microvertebrate material. The detailed description of the locality and an evaluation of the fossil material are given by JÁNOSSY (1983, 1986, 1990) who listed and described three hamster taxa: *Cricetulus* sp., *Allocricetus* sp. and *Cricetus cricetus runtonensis* NEWTON.

The aim of this paper is to give a taxonomic treatment and a revision of this material based on detailed biometrical and morphological studies. The dispersion and the abundance of the hamsters give new data for the paleoecological evaluation of the section. The material is deposited in the Department of Geology and Paleontology, Hungarian Natural History Museum, Budapest.

METHODS

Measurements were taken using the ocular micrometer of a stereomicroscope to a theoretical accuracy of 0.01 mm. The following dimensions were measured (Fig. 1):

L M1–M3 – length of upper row of molars; L m1–m3 – length of lower row of molars; L – length of the tooth crown; Wa – anterior width of the tooth crown. In M1 molars, it was measured across the anterocone. In m1 molars, it was measured across the anteroconid. In M2 and M3 molars, it is the width across the protocone-paracone. In m2 and m3 molars, it is the width across the

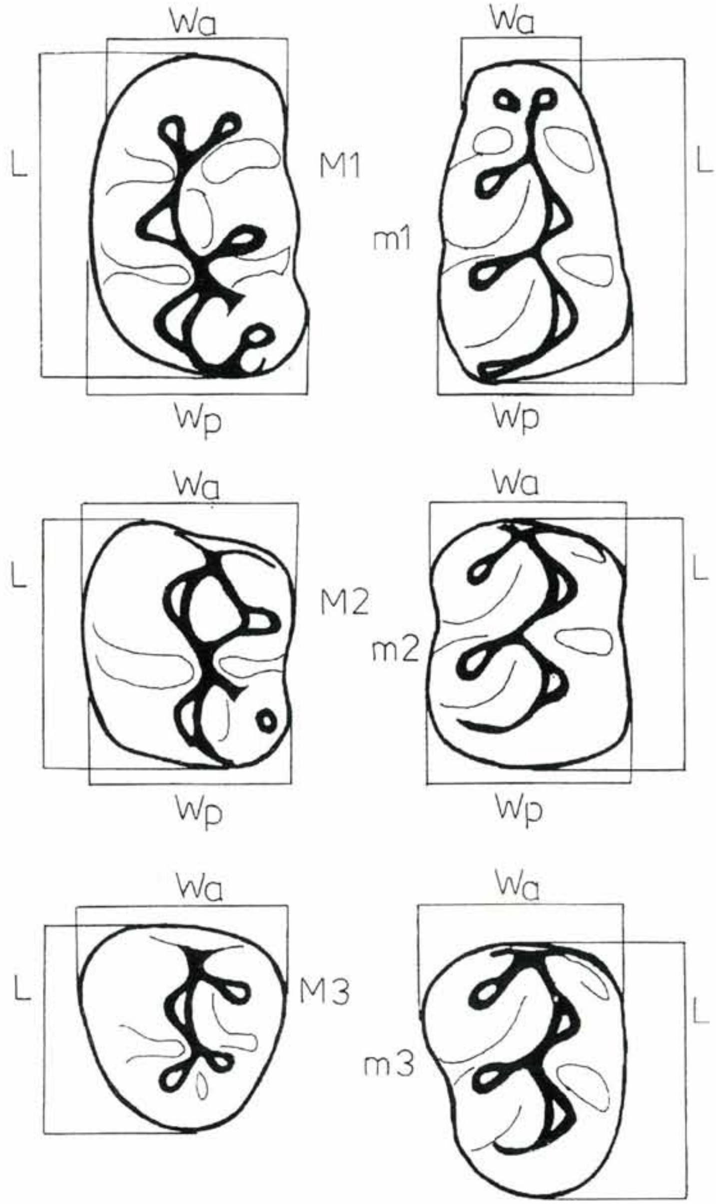


Fig. 1. Sketch of the investigated measurements on cricetid molars.

protoconid-paraconid. Wp – posterior width of the toothcrown. In M1 and M2 molars, it was measured across the hypocone-metacone, or across the hypoconid-metaconid in m1–m2 molars. This measurement was not taken in M3 and m3 molars. W max – the larger one from the Wa and Wp measurements of the m2 molars.

During the statistic treatment of the data the following parameters were computed:

n – sample size; min. – the minimal measurement; max. – the maximal measurement; X – arithmetic mean; median – median; SD – standard deviation; V – coefficient of variation; K – 95% confidence interval of the arithmetic mean (+ -); V'-100R/M where R is the difference between max. and min., and M is the mid-point between max. and min. (FREUDENTHAL & CUENCA BESCOS 1984).

The results are presented in Tables 7–28 and in the scatter diagrams (Figs 2–25).

The statistic morphological investigation is based on the nomenclature of MEIN & FREUDENTHAL (1971*a*, *b*). The creation of the different morphotypes is demonstrated on the Figs 26–32. The numerical data of the morphotype-analysis is given in Tables 1–6. For comparison, I quote the results of my previous investigations (HÍR 1997*a*) on the morphology of the Recent *C. cricetus* from Hungary and Early Pleistocene *C. praeglacialis* from Villány 8 and on *C. runtonensis solymarensis* (HÍR 1997*b*) from Solymár.

Among the comparative samples, Villány 8 is the type fauna of the Templom-hegy phase, which is the terminal unit of the Early Pleistocene in the traditional Hungarian Pleistocene vertebrate stratigraphical system (JÁNOSSY 1986, VAN DER MEULEN 1973). Recently KORDOS (1993) put Villány 8 into the *Mimomys savini* Partial Range Zone in his new biochronological system. The fauna of Solymár is correlated with the Late Middle Pleistocene on their basis of the evolutionary status of the *Arvicola* material (HEINRICH 1982, 1987).

SYSTEMATIC DESCRIPTION

Order Rodentia BOWDICH, 1821
Family Cricetidae ROCHEBRUNE, 1883
Subfamily Cricetinae MURRAY, 1866
Genus *Allocricetus* SCHAUB, 1930

Allocricetus bursae SCHAUB, 1930

The presence of this species was verified during the detailed biometrical study. As another result of this work we have to delete the *Cricetulus* sp. from the faunal list of JÁNOSSY (1983, 1986, 1990). The preliminary determination of this taxon was based on a traditional statement of the earlier Hungarian literature. *Cricetulus* was regarded as a typical element in the Nagyharsány-hegy phase by KRETZOI (1956)

Some Pleistocene *Allocricetus* populations from the Carpathian Basin were studied by HÍR (1989, 1993). The comparison with recent *Cricetulus* materials is given by HÍR (1994*a*). The scatter diagrams (Figs 8–13) were plotted using the data of these studies. The diagrams demonstrate that the *Allocricetus bursae* population of Somssich-hegy 2 has really small size, but those are closer to other *Allocricetus* samples than to the investigated *Cricetulus* populations.

The morphology of the *Allocricetus bursae* molars from Somssich-hegy 2 can be described with the percentage of the following elements.

M1		M2			
PAC+, PAST+	0%	ML+, PML+	0%		
PAC+, PAST-	2%	ML+, PML-	0%		
PAC-, PAST+	6%	ML-, PML+	0%		
PAC-, PAST-	92%	ML-, PML-	100%		
m1		m2		m3	
PAC+	0%	ALC+, ML+	13%	ALC+, ML+	3%
PAC-	100%	ALC+, ML-	75%	ALC+, ML-	12%
		ALC-, ML+	33%	ALC-, ML+	12%
		ALC-, ML-	47%	ALC-, ML-	73%

PAC = pre-anterocone cingulum (enamel conelet on the oral surface of the molar)
PAST = parastyle
ML = mesolophe, mesolophid
PML = posterior metalophule
ALC = antero-lingual cingulum

Compared to the frequency of these additional morphological elements in other Hungarian *Allocricetus* materials, the population of Somssich-hegy 2 is characterized by strongly reduced morphology. This feature is a common character of the *Cricetulus* materials (HÍR 1994*a*).

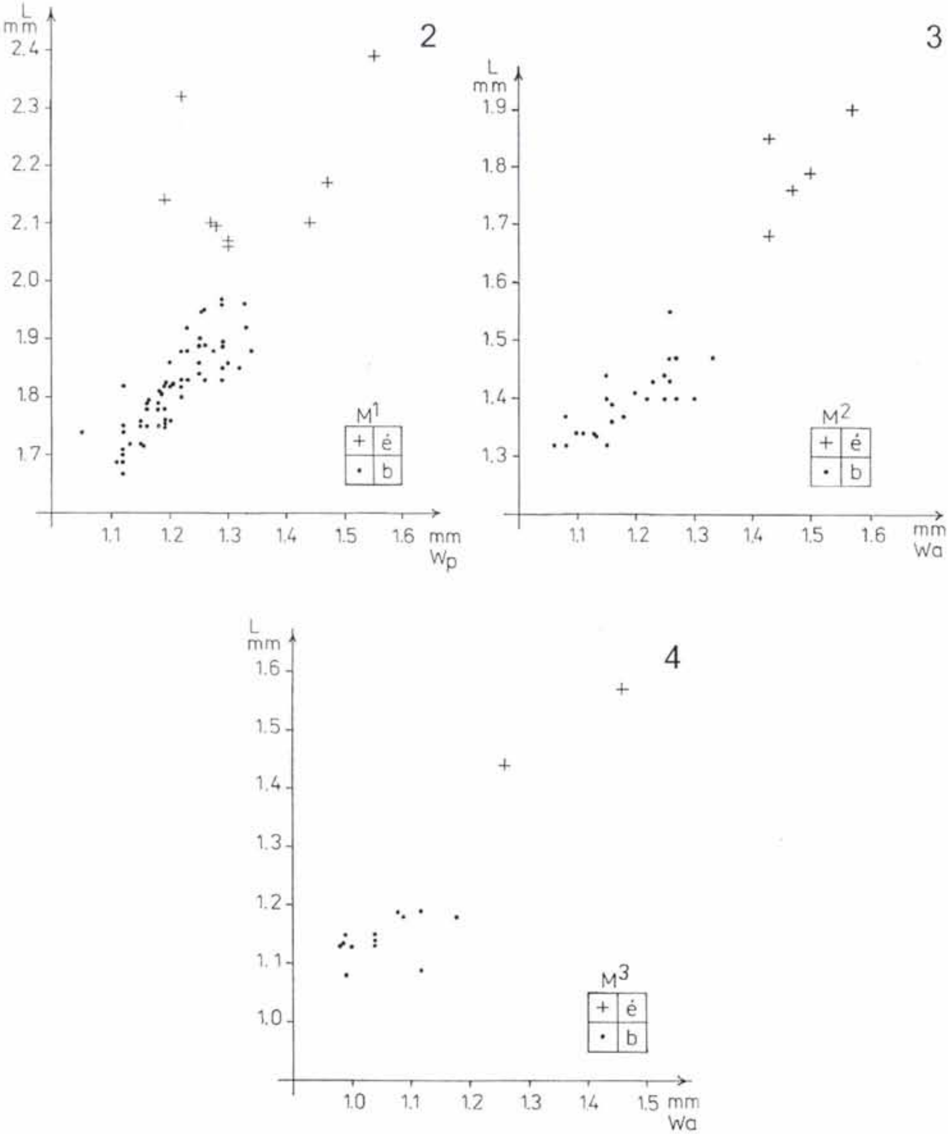
Allocricetus bursae is a very common species of the Hungarian Pleistocene vertebrate faunas. Its stratigraphical range is from the Betfia phase to the Varbó phase (Eemian). The morphology and the dimensions of the different populations are relatively well known, but the differences among them are not as characteristic as in Western Europe, where the description of different chrono-subspecies was possible (CHALINE 1972, 1975). The evolution of the *Allocricetus* genus in Western and in Central Europe seems to be different.

Allocricetus ehiki SCHAUB, 1930

The presence of this species is easy to verify on the basis of the dimensions (Figs 2–7).

The larger *Allocricetus* species was flourishing in the Late Villányian (MN 17) faunas of Villány 3 and Osztramos 3. (HÍR 1993). During the Biharian it became rare, but it was found in several Hungarian faunas: Hajnóczy Cave (HÍR 1992), Tarkő (HÍR 1989) and Villány 8 (HÍR, unpublished). The LAD of the *A. ehiki* was detected in the 8th layer of the Tarkő sequence.

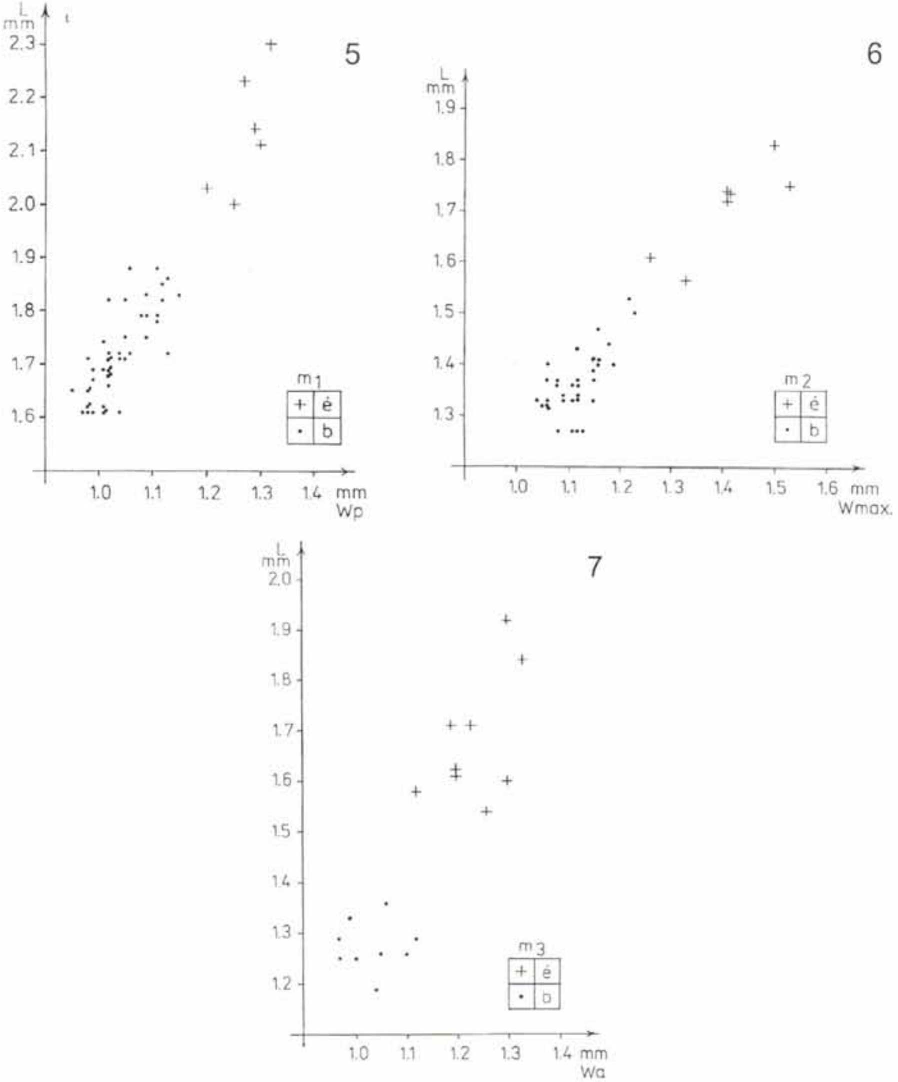
The dominancy curve of the *Allocricetus* species is more or less similar to the curve of *Apodemus* (Fig. 33). For this reason we can presume a relative humidity requirement of this taxon. This ecological preference was also found by JÁNOSSY (1986) based on the dominancy curves of the Tarkő Rockshelter, which is younger (Early Middle Pleistonene) than Somssich-hegy 2.



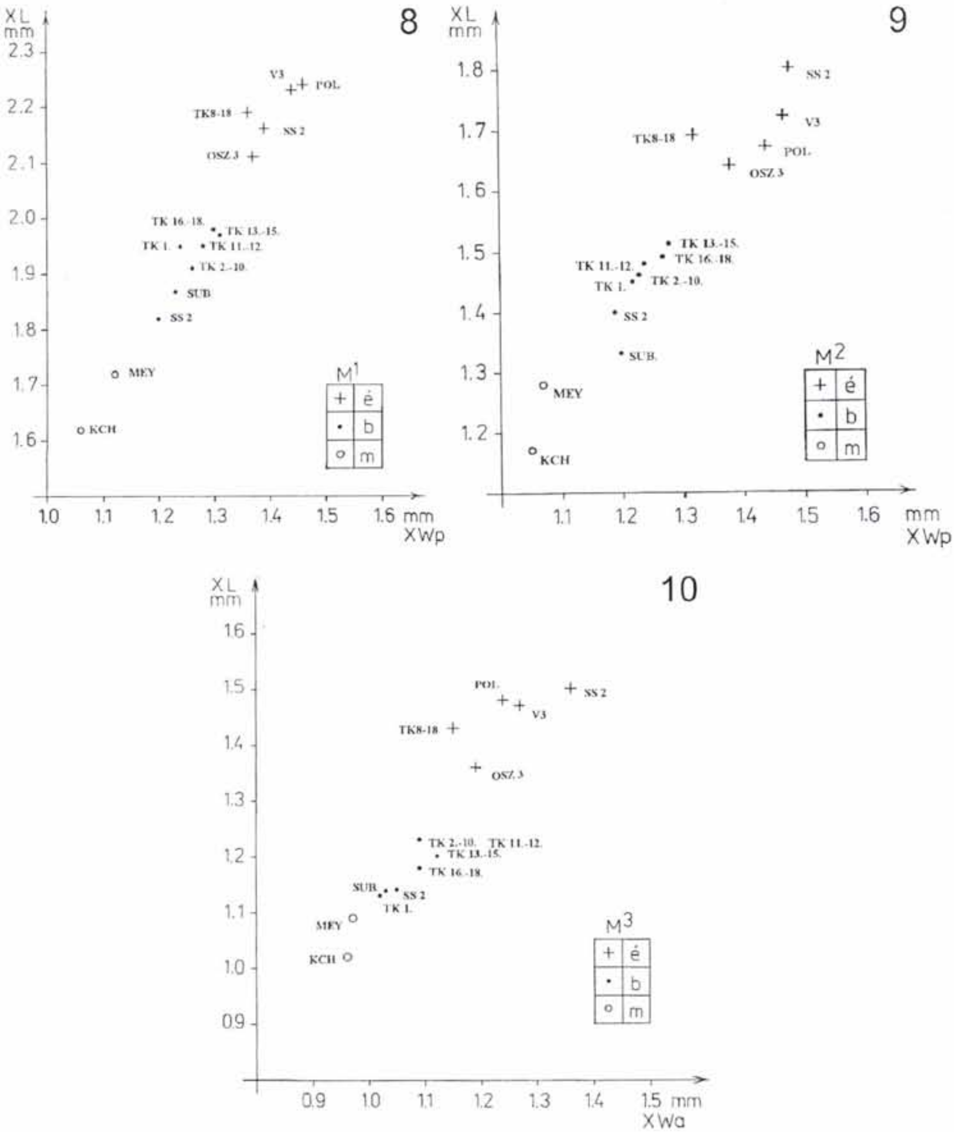
Figs 2–4. Scatter diagrams of the *Allocricetus* molars from Somssich-hegy 2: 2 = M1 molars, 3 = M2 molars, 4 = M3 molars (é = *A. ehiki*, b = *A. bursae*)

Cricetus nanus SCHAUB, 1930

It is not mentioned by JÁNOSSY (1986), but the biometrical study verified the presence of this species (Figs 17–19), which is the least common hamster of the locality. *C. nanus* is very abundant in the Early Biharian faunas the (HÍR 1994*b*), but in the following Nagyharsány-hegy phase it becomes rare. Its presence in the 14th layer of the locality is the possible LAD of *C. nanus* in the Carpathian Basin.



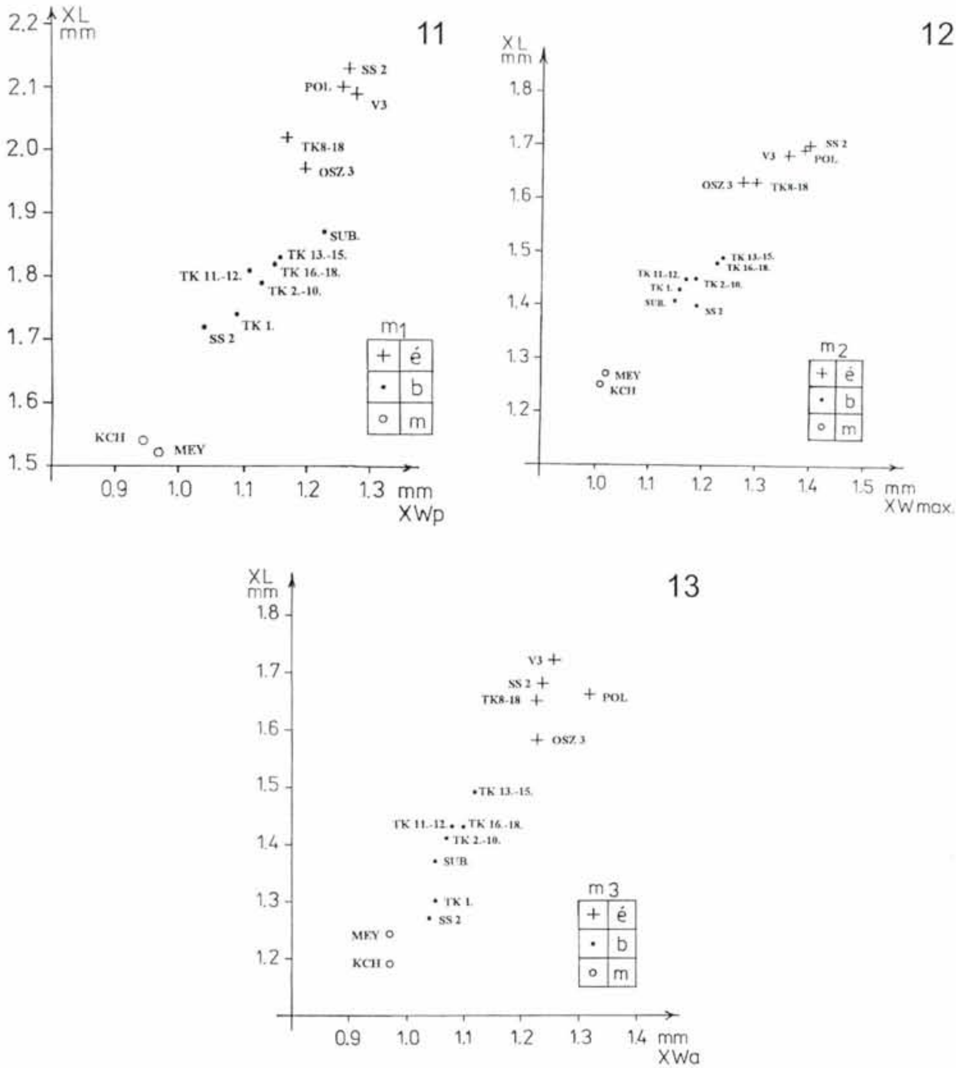
Figs 5–7. Scatter diagrams of the L and Wp measurements of the *Allocricetus* molars from Somssich-hegy 2: 5 = m1 molars, 6 = m2 molars, 7 = m3 molars (é = *A. ehiki*, b = *A. bursae*)



Figs 8–10. Scatter diagrams of the mean L and mean Wp values of molars of some *Allocricetus* and *Cricetulus* populations: 8 = M1 molars, 9 = M2 molars, 10 = M3 molars. Key of abbreviations: é = *A. ehiki*, b = *A. bursae*, m = *C. migratorius*, POL= different localities from Poland (PRADEL 1988), V3 = Villány 3 (HÍR 1993), OSZ 3 = Osztramos 3 (HÍR 1993), TK = Tarkő (HÍR 1994*a*), SS2 = Somssich-hegy 2, SUB = Subpiatra (HÍR & VENCZEL 1991), MEY = Meydan – recent material from Turkey (HÍR 1994*a*), KCH = Krak des Chevaliers – recent material from Syria (PRADEL 1981)

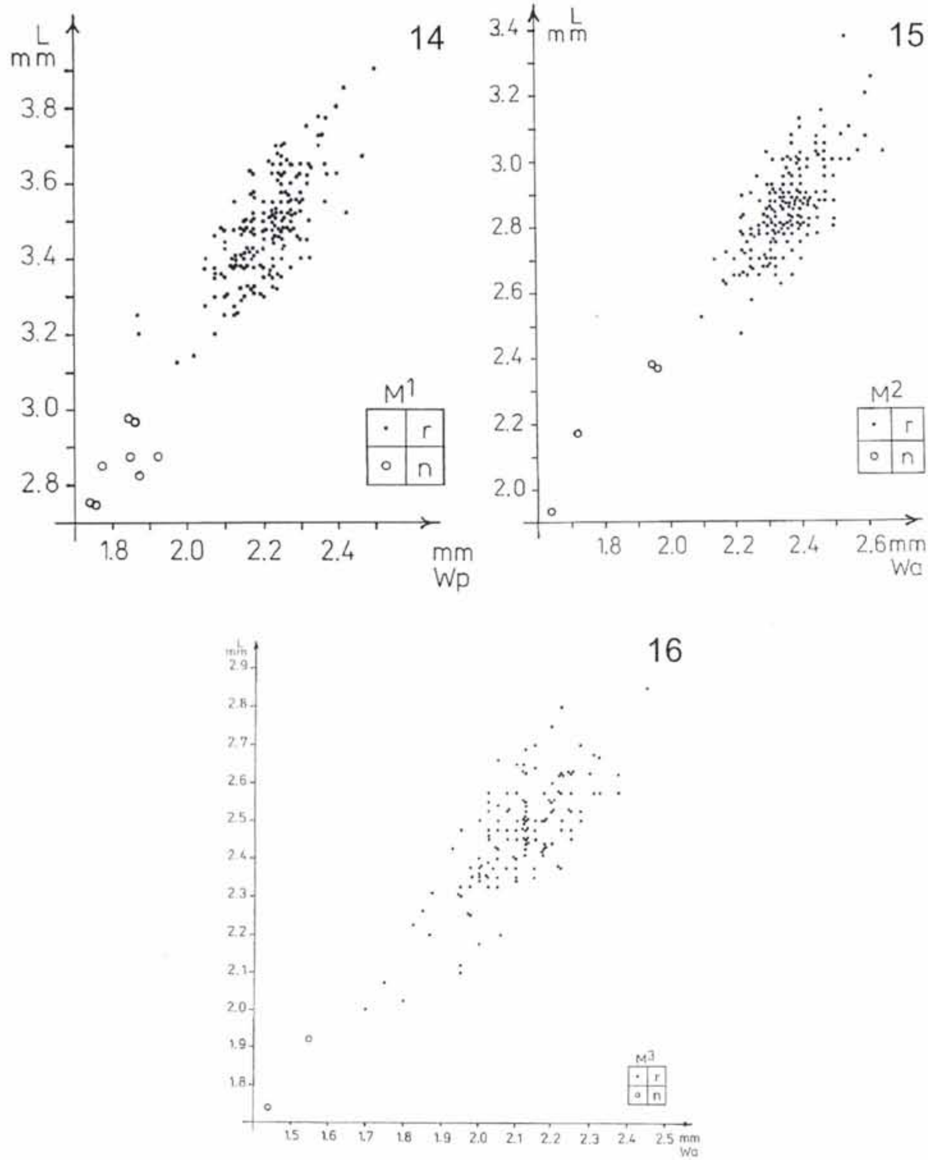
Cricetus runtonensis (NEWTON, 1909)

The most abundant hamster of the sequence is a rather large-sized *Cricetus*. Its dimensions are very close to *C. runtonensis* from the Polish localities of Kozi Grzbiet,

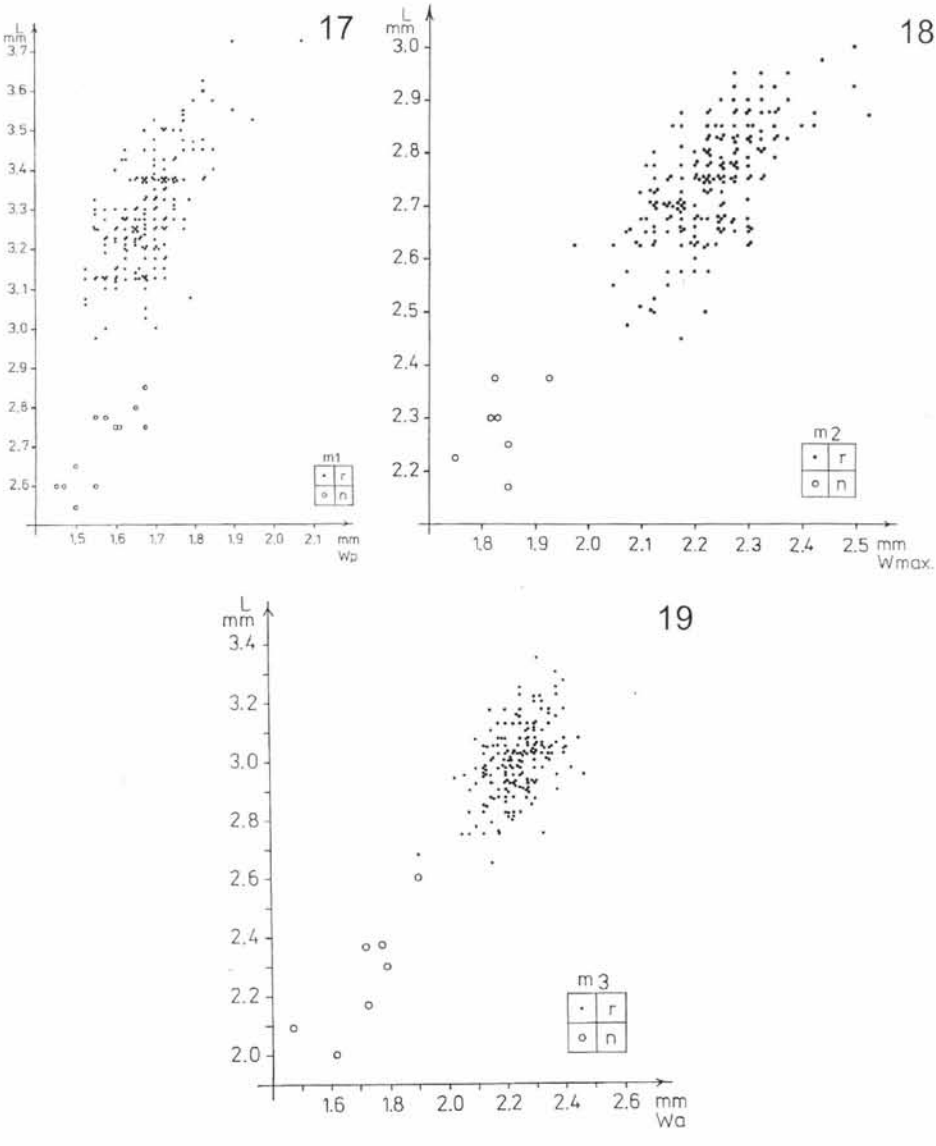


Figs 11–13. Scatter diagrams of the mean L and mean Wp values of molars of some *Allocricetus* and *Cricetulus* populations: 11 = m1 molars, 12 = m2 molars, 13 = m3 molars. Abbreviations are the same as in Fig. 8

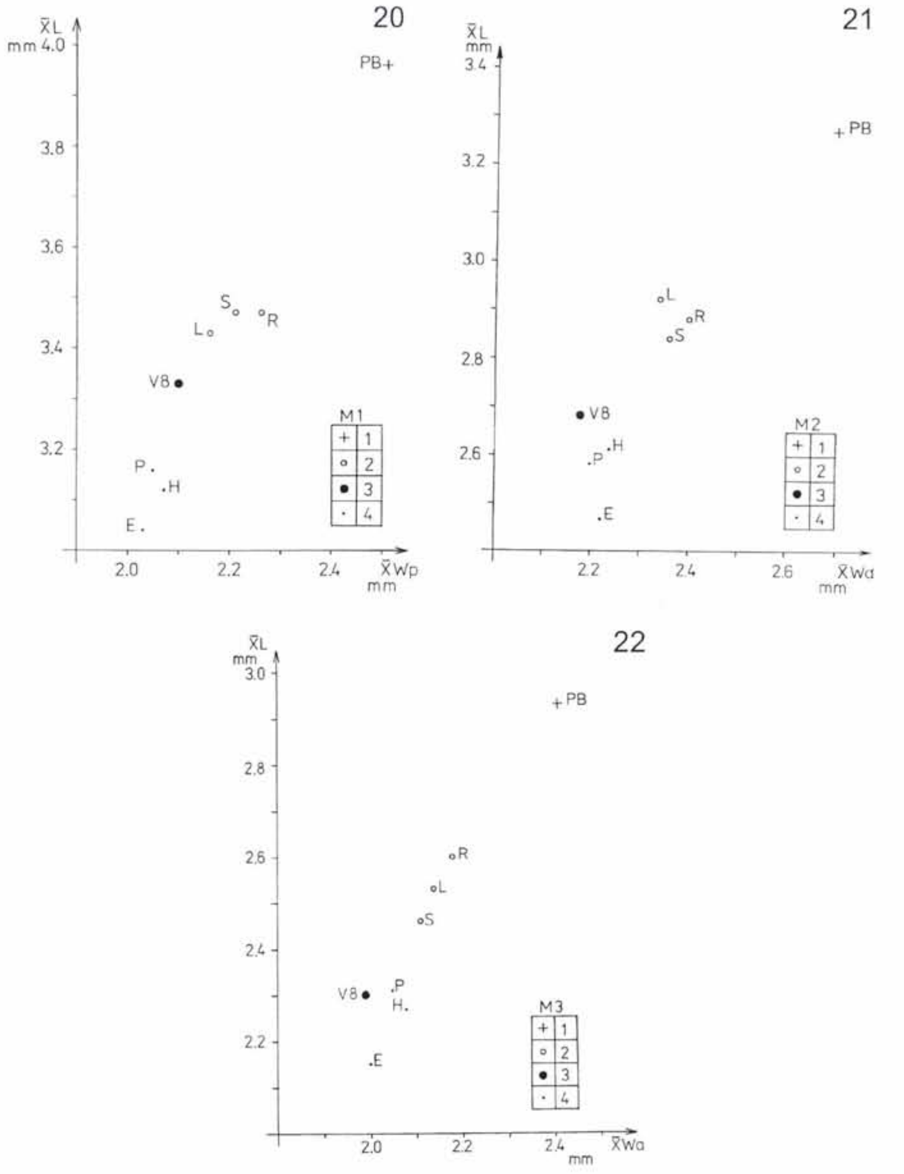
Zamkowa Dolna and Zalesiaki 1 (PRADEL 1988). The measurements of the recent *C. cricetus* and Early Pleistocene *C. praeglacialis* are smaller than the *C. runtonensis* group. But *Cricetus major* is larger than *C. runtonensis* (Figs 20–25).



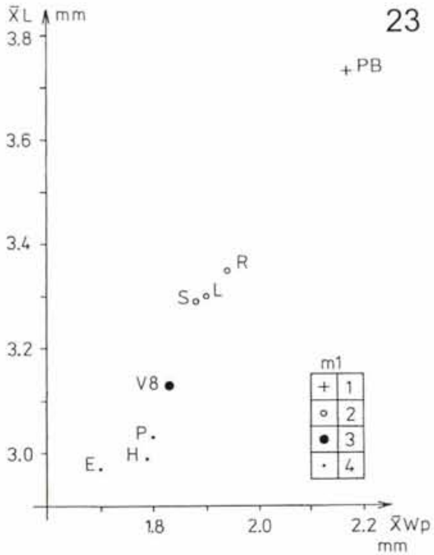
Figs 14–16. Scatter diagrams of the L and Wp measurements of the *Cricetus* molars from Somssich-hegy 2: 14 = M1 molars, 15 = M2 molars, 16 = M3 molars (r = *C. runtonensis*, n = *C. nanus*)

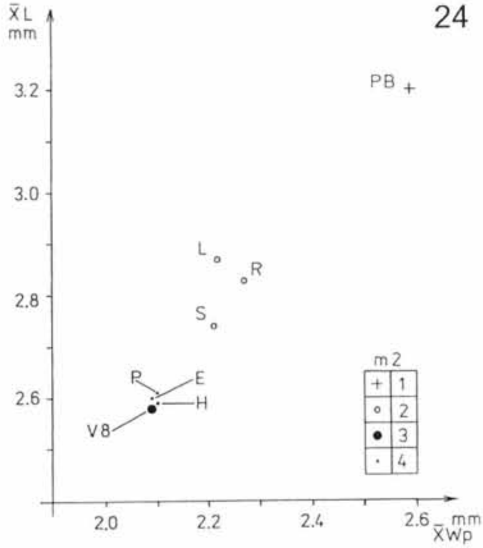


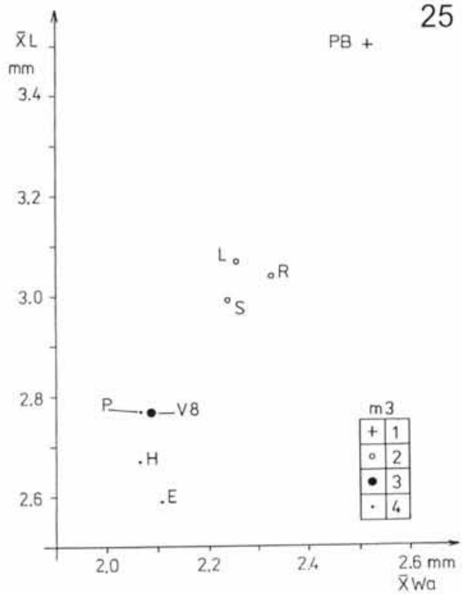
Figs 17–19. Scatter diagrams of the L and Wp measurements of the *Cricetus* molars from Somssich-hegy 2: 17 = m1 molars, 18 = m2 molars, 19 = m3 molars (r = *C. runtonensis*, n = *C. nanus*)



Figs 20–22. Scatter diagrams of the mean L and mean Wp values of molars of some European fossil and Recent *Cricetus* populations: 20 = M1 molars, 21 = M2 molars, 22 = M3 molars. Explanation: 1: *C. major*, 2: *C. runtonensis* group, 3: *C. praeglacialis*, 4: *C. cricetus* group. PB = Petersbuch (FAHLBUSCH 1976), S = Somssich-hegy 2, R = Poland, different localities (PRADEL 1988), L = Solymár (HÍR 1996), V8 = Villány 8 (HÍR 1996), P = Recent hamster from Poland (PRADEL 1981), H = Recent hamster from Hungary (HÍR 1996), E = Recent hamster from Germany (FAHLBUSCH 1976)







Figs 23–25. Scatter diagrams of the mean L and mean Wp values of molars of some European fossil and Recent *Cricetus* populations: 23 = m1 molars, 24 = m2 molars, 25 = m3 molars. Abbreviations are the same as in Fig. 20

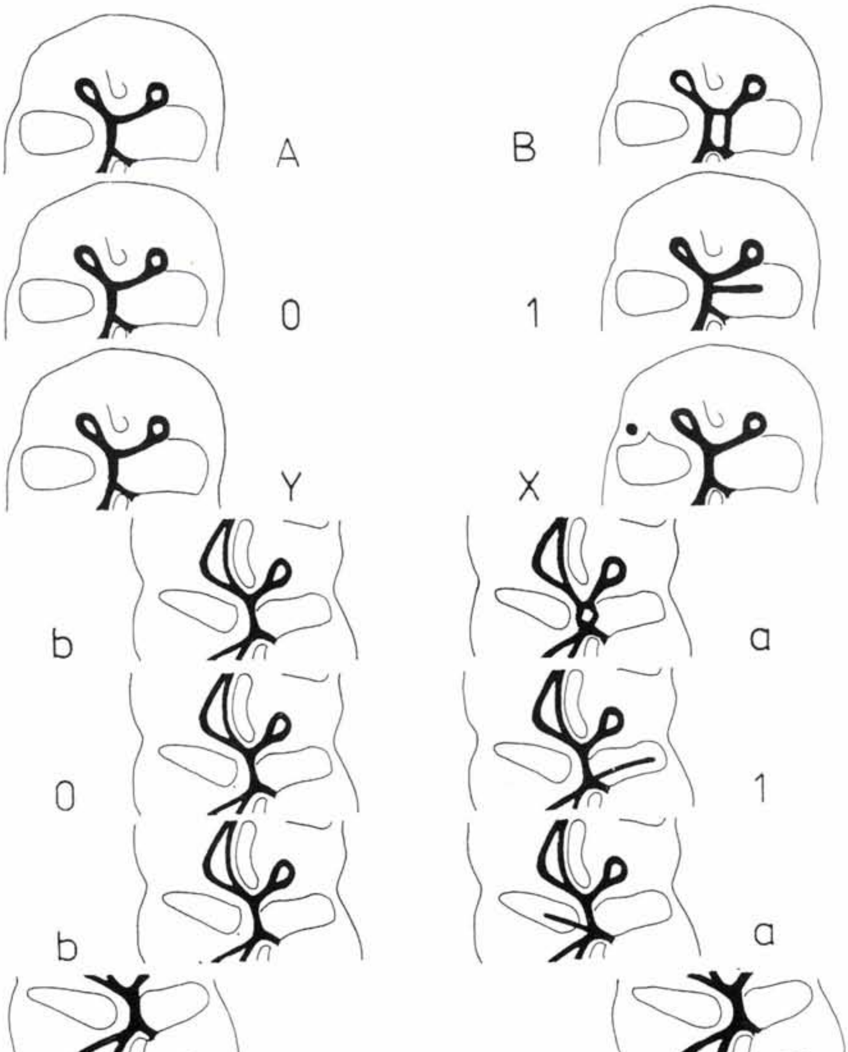


Fig. 26. The morphotype classification system of the *Cricetus* M1 molars. Explanation: A = anterolophule is simple; B = anterolophule is doubled; 0 = labial eperon of the anterolophule is missing; 1 = labial eperon of the anterolophule is found; Y = protostyle is missing; X = protostyle is found; b = central ring is missing; a = central ring is found; 0 = mesolophe is missing; 1 = mesolophe is found; b = entomesolophe is missing; a = entomesolophe is found; 0 = posterolophule is simple; 1 = posterolophule is ramified. (E.g. AOYb0b0 is the morphotype without any additional elements. A0Yb1b0 is the morphotype bearing mesolophe.) The distribution of the morphotypes is given in Table 1

Table 1. Percentage of the morphotypes of the M1 molar in the four investigated *Cricetus* materials

	C. cricetus recent	*C. praeglacialis* Villány 8.	*C. runtonensis solymarensis* Solymár	*C. runtonensis runtonensis* Somssich-hegy 2
Aobyobo	81.5	75.7	62.5	75
Aoby1b0	0.64	12.4	–	3
A0by0b1	–	1.9	35.0	11
A1by0b0	6.4	0.95	–	–
A1byob1	–	0.95	–	1.2
A1by1b0	–	0.95	–	–
A1by1b1	–	0.48	–	–
A1bx0a0	–	0.48	–	–
A0bx0b0	0.6	0.48	–	–
A0ay0b0	–	0.48	–	–
B1by0b0	4.4	0.95	–	–
B0by1b0	–	0.95	–	1.2
B0by0b1	–	0.48	–	1.8
B0by0b0	6.3	2.4	–	3.6
A0by1b1	–	–	2.5	1.8
B0by1b1	–	–	–	1.2

Table 2. Percentage of the morphotypes of the M2 molars in the four investigated *Cricetus* materials

	C. cricetus recent	*C. praeglacialis* Villány 8.	*C. runtonensis solymarensis* Solymár	*C. runtonensis runtonensis* Somssich-hegy 2
A00	83.8	44.0	19.0	16.2
B00	6.5	1.6	2.7	1.2
A01	0.6	27	70.3	64.8
B01	–	1.2	8.1	4.9
A10	5.2	10.1	–	0.6
B10	2.6	–	–	1.2
A11	–	14.5	2.7	6.2
B11	–	1.6	–	1.8
A00+central ring	0.6	–	–	–
B00+central ring	0.6	–	–	–

Table 3. Percentage of the morphotypes of the M3 molars in four investigated *Cricetus* materials

	C. cricetus	*C. praeglacialis*	*C. runtonensis solymarensis*	*C. runtonensis runtonensis*
A	15.7	9.7	18	13
B	12.3	24.75	6	8.4
C	11.6	12.2	12	3.8
D	1.9	2.7	–	4.6
E	3.9	4.8	12	9.2
F	28.3	4.1	–	10.7
G	0.64	13	23	11.4
H	25.7	28.7	29	38.9

Remarks to the results of the morphotype-analysis

M1 (Fig. 26, Table 1). The most reduced morphotype A0bY0b0 (without any additional elements) is the dominant one in the studied materials. Only the frequency of the ramified posterolophule (A0bY0b1) is remarkable in the Solymár material.

M2 (Fig. 27, Table 2). In the recent material and in the sample of Villany 8 the reduced type is dominant (A00), but among the molars from Solymár and Somssich-hegy 2 the dominant one is the type bearing ramified posterolophule (A01).

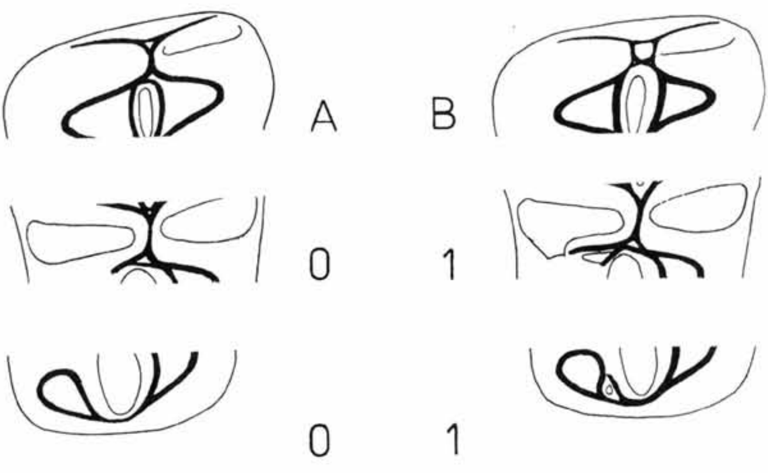


Fig. 27. The morphotype classification system of the *Cricetus* M2 molars. Explanation: A = anterolophule is simple; B = anterolophule is doubled; 0 = mesolophe is missing; 1 = mesolophe is found; 0 = posterolophule is simple; 1 = posterolophule is ramified. The distribution of the morphotypes is given in Table 2

Table 4. Percentage of the morphotypes of the m1 molars in the four investigated *Cricetus* materials

	C. cricetus	*C. praeglacialis*	*C. runtonensis solymarensis*	*C. runtonensis runtonensis*
	recent	Villány 8.	Solymár	Somssich-hegy 2
A1A	0	0.3	0	0
B1A	5.2	5.8	2.8	10
B1B	0	0.3	0	1.3
C1A	0	9.7	13.8	7.3
C1B	0	0.6	0	0.7
C2A	0	0	0	1.3
D1A	0.6	11.5	31.7	20
D1B	0	0.3	0	0
D2A	0	0.6	0	1.3
E1A	3.2	60.9	24.3	35
E1B	0	1.8	0	0.7
E2A	0	0	0	1.3
F1A	88.4	8.2	26	18.7
F2A	1.3	0	0	0
F1B	1.3	0	1.4	0

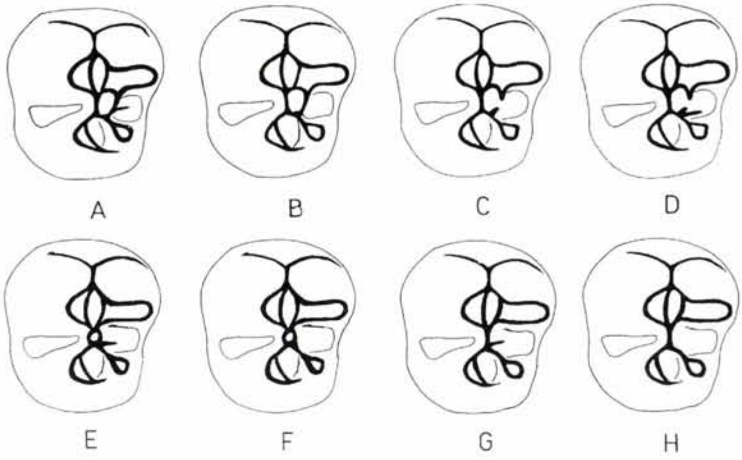


Fig. 28. The morphotype classification system of the *Cricetus* M3 molars. Explanation: A = central ring with mesolophe; B = central ring without mesolophe; C = opened central ring without mesolophe; D = opened central ring with mesolophe; E = reduced centrtal ring with mesolophe; F = reduced central ring without mesolophe; G = mesolophe without central ring; H = no central ring, no mesolophe. The distribution of the morphotypes is given in Table 3

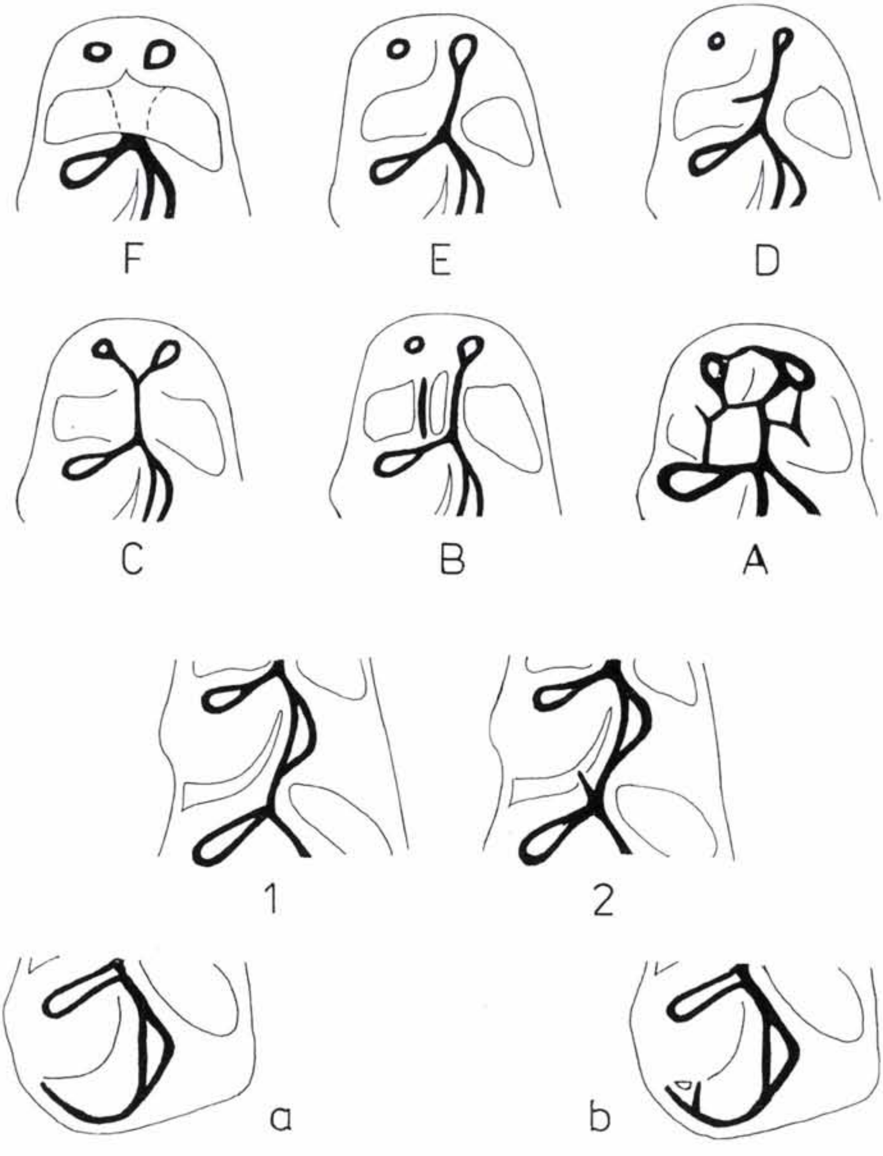
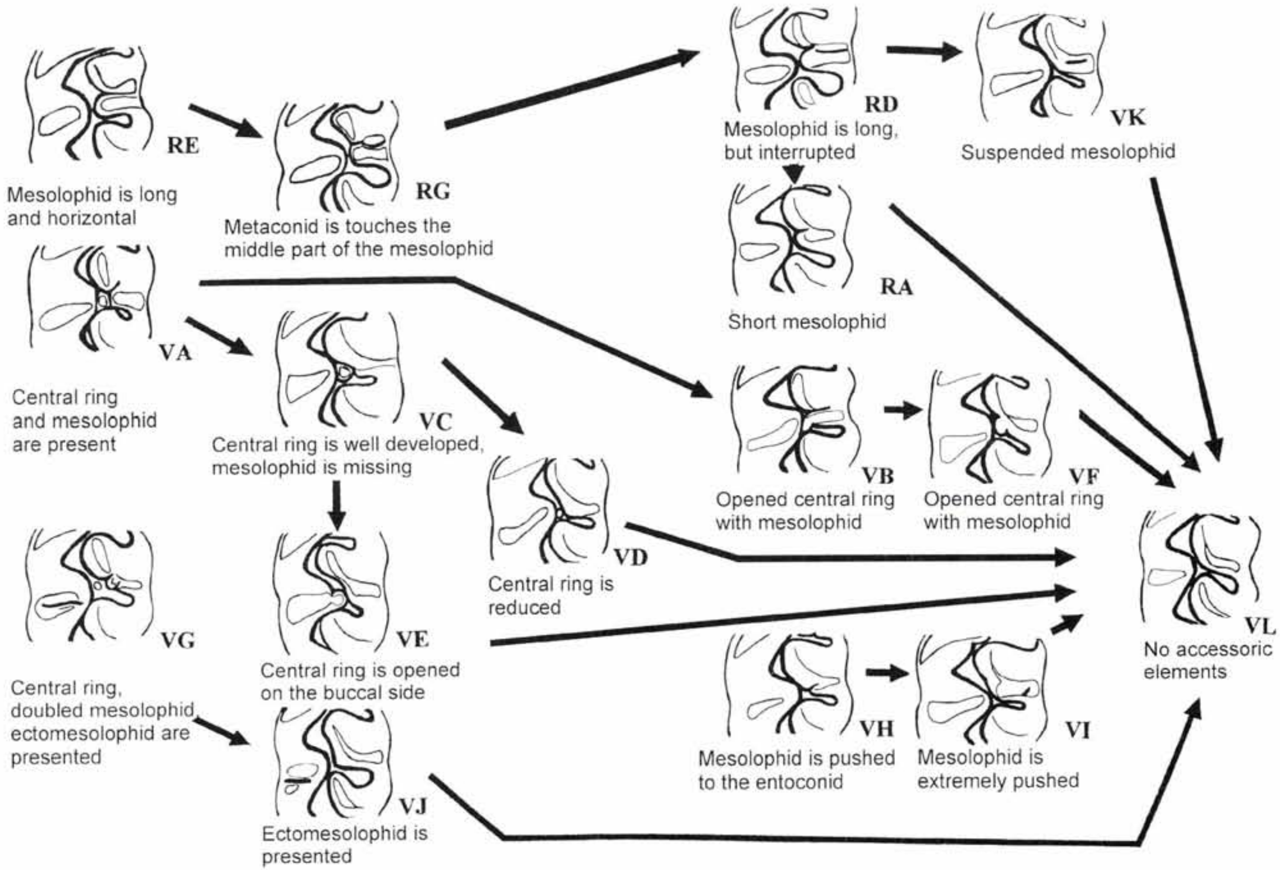


Fig. 29. The morphotype system of the *Cricetus* m1 molars. Explanation: A = anterolophulid is doubled and complicated by accessory elements; B = doubled anterolophulid without accessory elements; C = anterolophulid is Y-shaped and connected to both conelets of the anteroconid; D = anterolophulid is connected only to the buccal conelet of the anteroconid and has a lingual eperon; E = same as D but without lingual eperon; F = anterolophulid is reduced, it does not emerge from the level of the anterosinusid; 1 = mesolophid is missing; 2 = a reduced mesolophid is is found; a = posterolophulid is simple; b = posterolophulid is ramified. The distribution of the morphotypes is given in Table 4

Table 5. Percentage of the morphotypes of the m2 molars in the four investigated *Cricetus* materials

	C. cricetus recent	*C. praeglacialis* Villány 8.	*C. runtonensis solymarensis* Solymár	*C. runtonensis runtonensis* Somssich-hegy 2
RE	4	0	11	0
VA	1.4	0.75	0	6
VG	0	0.5	0	0
RG-RD	11.26	1.9	5.7	0
VC	0.7	2.8	0	1.2
VE	0	1.7	8.6	0
VJ	0	0.7	0	0
VK	0	1.1	0	0
RA	73.64	28.4	11.4	27.3
VB	0	1.2	0	6.8
VF	0	7.6	1.4	3.1
VH	0	0.2	0	0
VI	1	0	0	1.2
VL	8	51.9	14.3	42.2
VD	0	2.2	0	0.6
SA	0	0	2.9	1.9
SB	0	0	11.4	0.6
SI	0	0	4.3	0.6
BA	0	0	0	1.9
SS1	0	0	0	3.7
SS2	0	0	0	1.9
SS3	0	0	0	1.2
SC	0	0	4.3	0
SD	0	0	1.4	0
SE	0	0	15.7	0
SF	0	0	4.3	0
SG	0	0	1.4	0
SH	0	0	1.4	0

Fig. 30. Morphodynamic scheme of the morphotypes of the central region of m2 molars in the Recent Hungarian *Cricetus cricetus* material and in the *C. praeglacialis* population of Villány 8. The distribution of the morphotypes is given in Table 5



M3 (Fig. 28, Table 3). The morphology of this molar is rather variable. In the dispersion of the different types we could not find unambiguous tendencies.

m1 (Fig. 29, Table 4). The "morphotype-spectrum" of the recent and Villány 8 materials are unimodal, because the frequencies of the dominant morphotypes are very high. In the Solymár and Somssich-hegy 2 samples the importance of dominant and subdominant types is stronger. The morphology of the Recent material is the most reduced and most homogeneous. The material of Somssich-hegy 2 is the most variable.

m2 (Figs 30–31, Table 5). The morphology of this molar is very variable. The morphotypes from the recent and the Villány 8 materials give a morphodynamic scheme demonstrating a trend of simplification. This process begins with morphotypes bearing a central ring and mesolophid. During the course of phylogeny the central ring is split and the mesolophid is shortened. Finally both of these elements disappear.

But the direct application of this scheme is impossible in the other two materials. The frequency of the "extra types" (different from the Recent-Villány 8 types) is 12% in Somssich-hegy 2, but 47% is in Solymár. The common feature of these morphotypes is the presence of an extra morphological element: the "paramesolophid" (Fig. 31). By the side of the normal MSLD another enamel ridge develops starting from the hypolophulid, or from the joining point of the ectolophid and the hypolophulid. This element is not named in the nomenclature of MEIN & FREUDENTHAL (1971*a*, *b*).

On the basis of the evolutionary trends the Villány8–Recent and Somssich-hegy 2–Solymár pairs strongly differ. In the V8–Recent line the morphology simplified but in the Somssich-Solymár line the morphological variability is advanced.

m3 (Fig. 32, Table 6). On the basis of the presence and the development of five elements we could create an analytic morphotype system for the m3 molars. The morphological characters of the m3 is very similar to the m2. In Villány 8 the central ring is more frequent than in the recent material.

The "paramesolophid" and the ectomesolophid are found in the Somssich-hegy 2 and in the Solymár materials. The morphological variability is highest in Solymár and lowest among the Recent species.

Table 6. The distribution of the morphotypes of the m3 molars in the four investigated *Cricetus* materials

	C. cricetus	*C. praeglacialis*	*C. runtonensis solymarensis*	*C. runtonensis runtonensis*
	recent	Villány 8.	Solymár	Somssich-hegy 2
14000	7.7	54.6	–	35.0
13000	0.8	10.6	–	4.0
11000	–	10.6	–	5.4
04000	47.7	5.7	2.3	8.8
03000	0.8	1.3	2.3	4.7
05000	40.0	1.0	4.6	2.7

01000	3.1	4.5	2.3	14.0
10000	–	11.24	–	13.5
00000	–	1.0	–	3.4
07000	–	–	–	0.7
15210	–	–	–	2.7
03100	–	–	–	1.35
06000	–	–	–	0.7
16100	–	–	–	0.7
13100	–	–	–	0.7
14100	–	–	–	0.7
00001	–	–	2.3	–
03010	–	–	2.3	–
04010	–	–	4.6	–
05010	–	–	16.3	–
04011	–	–	7.0	–
04110	–	–	2.3	–
04121	–	–	2.3	–
04210	–	–	7.0	–
04211	–	–	4.6	–
05111	–	–	7.0	–
05210	–	–	4.6	–
05211	–	–	4.6	–
05221	–	–	2.3	–
12110	–	–	2.3	–
14210	–	–	4.6	–
14211	–	–	2.3	–
15010	–	–	2.3	–
15110	–	–	2.3	–
15120	–	–	2.3	–
15111	–	–	2.3	–
15221	–	–	2.3	–

Table 7. Length of the upper toothrows (M1 – M3) of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	4	1	–	11
min.	4.325	–	–	8.1
max.	4.47	–	–	8.9
X	4.405	5.7	–	8.497727
median	4.4125	–	–	8.4
SD	0.067206	–	–	0.292501
V	1.525679	–	–	3.442108
V'	3.297328	–	–	9.411765
K	0.166846	–	–	0.209043

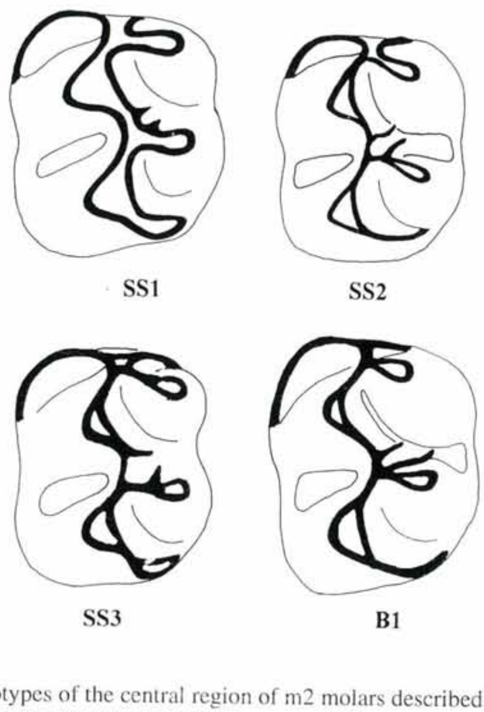


Fig. 31. Special morphotypes of the central region of m2 molars described from the *C. runtonensis* material from Somssich-hegy 2 bearing "doubled mesolophid"

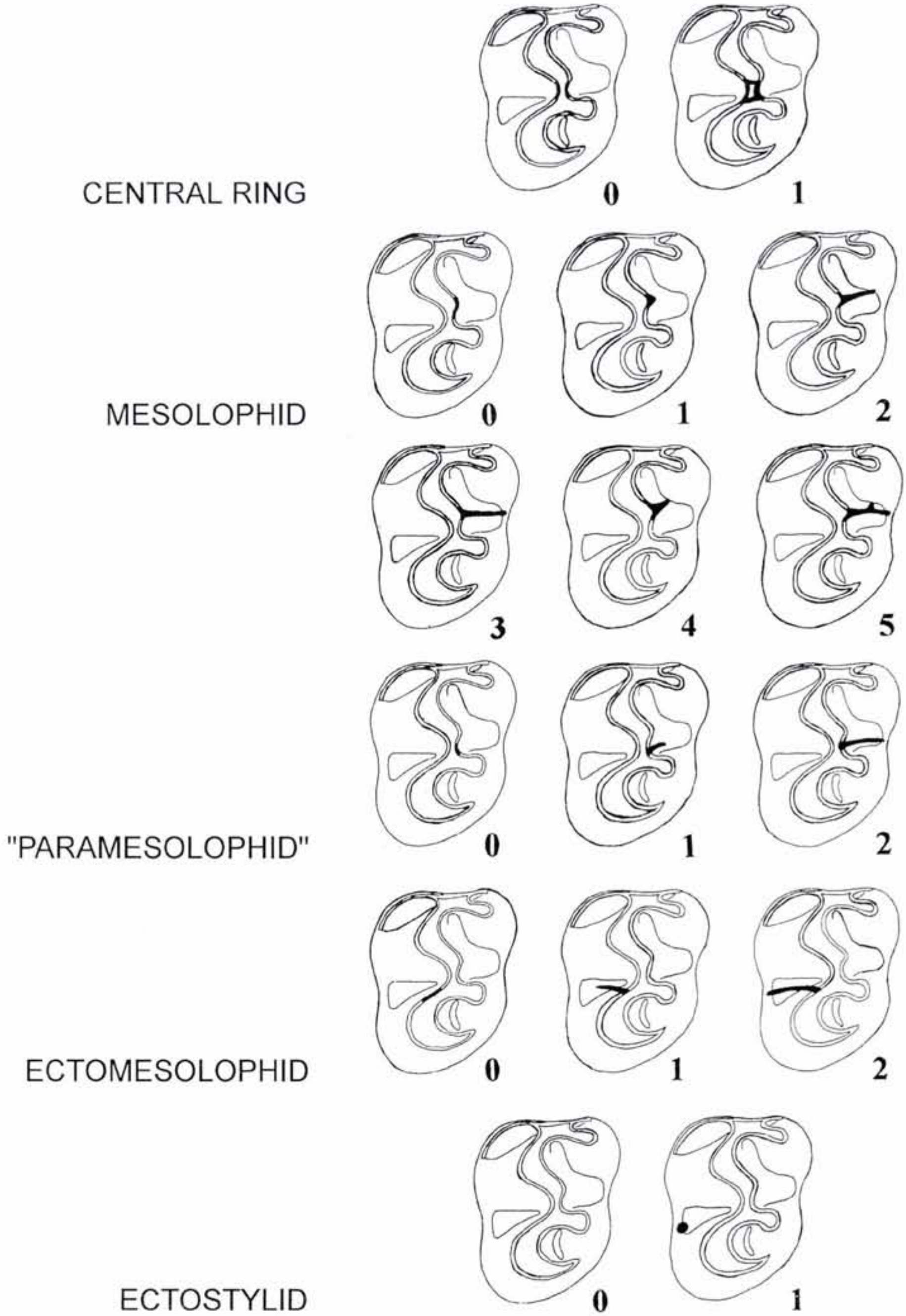


Fig. 32. The morphotype classification system of the *Cricetus* m3 molars. The distribution of the morphotypes is given in Table 6

Table 8. Length of the lower toothrows (m1 – m3) of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	4	3	2	33
min.	4.225	5.2	6.75	7.9
max.	4.95	5.5	7.425	9.45
X	4.4875	5.383333	7.0875	8.826667
median	4.3875	–	–	8.8
SD	0.330719	–	–	0.297058
V	7.369781	–	–	3.365456
V'	15.80381	–	–	17.86744
K	0.821045	–	–	0.107126

Table 9. LM1/LM2 ratio in the upper toothrows of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	6	2	1	54
min.	0.740157	1.257353	–	1.130081
max.	0.783582	1.296089	–	1.311321
X	0.765981	1.276721	1.252632	1.234994
median	0.769486	–	–	1.231258
SD	0.017469	–	–	0.037227
V	2.280.64	–	–	3.014355
V'	5.699742	–	–	14.84712
K	0.021719	–	–	0.010233

Table 10. LM3/LM2 ratio in the upper toothrows of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	5	2	1	25
min.	0.742857	0.823529	–	0.777778
max.	0.85	0.858333	–	0.934609
X	0.805619	0.840931	0.899482	0.856814
median	0.833333	–	–	0.848214
SD	0.049421	–	–	0.036888
V	6.134554	–	–	4.305202
V'	13.45291	–	–	18.31724
K	0.07858	–	–	0.015586

Table 11. Lm1/Lm2 ratio in the lower toothrows of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	8	3	3	59
min.	1.194175	1.233871	1.2	1.106195
max.	1.29703	1.294643	1.247191	1.27551
X	1.260087	1.273732	1.222796	1.194588
median	1.265531	–	–	1.188571
SD	0.030993	–	–	0.037195
V	2.459578	–	–	3.113617
V'	8.257447	–	–	13.7659
K	0.0238	–	–	0.009768

Table 12. Lm3/Lm2 ratio in the lower toothrows of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	5	4	2	69
min.	0.910891	0.919355	0.898876	0.995478
max.	1.0	1.073171	1.155556	1.213592
X	0.961357	1.002402	1.027216	1.090939
median	0.979798	–	–	1.08547
SD	0.039748	–	–	0.047948
V	4.134565	–	–	4.395136
V'	9.326425	–	–	19.74713
K	0.063199	–	–	0.11629

Table 13. L M1 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	61	9	6	187
min.	1.666	2.058	2.75	3.125
max.	1.974	2.394	2.975	3.9
X	1.816852	2.165444	2.875	3.477294
median	1.82	2.135	2.8625	3.475
SD	0.074644	0.1155656	0.088034	0.135959
V	4.108424	5.336781	3.062055	3.909918
V'	16.92308	15.09434	7.860262	2.918149
K	0.019273	0.096426	0.092365	0.019435

Table 14. Wa M1 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	60	9	6	185
min.	0.64	1.036	1.45	1.6
max.	1.12	1.9	2.525	2.17
X	0.95785	1.306111	1.720833	1.893795
median	0.938	1.218	1.575	1.9
SD	0.082593	0.310752	0.402	0.090962
V	8.62276	23.79219	23.36079	4.803174
V'	54.54545	58.85559	54.08805	30.23873
K	0.021505	0.259288	0.421778	0.013073

Table 15. Wp M1 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	60	9	6	183
min.	1.05	1.275	1.75	1.875
max.	1.344	1.554	1.925	2.5
X	1.2053	1.390889	1.8375	2.211891
median	1.202	1.4	1.85	2.225
SD	0.068382	0.106353	0.064711	0.093102
V	5.67341	7.646372	3.521681	4.209166
V'	24.5614	19.72428	9.52381	96.0
K	0.017805	0.088739	0.067895	0.013453

Table16. L M2 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	25	5	4	188
min.	1.316	1.68	1.93	2.47
max.	1.554	1.904	2.375	3.375
X	1.39728	1.7964	2.2125	2.852149
median	1.4	1.79	–	2.85
SD	0.058017	0.08574	–	0.135268
V	4.152131	4.752531	–	4.74267
V'	16.58537	12.5	–	34.21728
K	0.024514	0.135745	–	0.019336

Table 17. Wa M2 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	25	5	4	187
min.	1.064	1.428	1.638	2.1
max.	1.33	1.568	1.95	2.65
X.	1.18588	1.4788	1.815	2.359973
median	1.162	1.47	–	2.36
SD	0.077	0.058405	–	0.093233
V	6.528941	3.949518	–	3.950595
V'	22.22222	9.345794	–	29.47368
K	0.032715	0.092865	–	0.013363

Table 18. Wp M2 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	25	4	4	183
min.	0.994	1.344	1.484	1.9
max.	1.22	1.47	1.862	2.52
X	1.08676	1.41	1.7295	2.165093
median	1.078	–	–	2.16
SD	0.059	–	–	0.093233
V	5.454996	–	–	4.306189
V'	20.41554	–	–	30.31674
K	0.025049	–	–	0.013508

Table 19. L M3 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	15	2	2	141
min.	1.078	1.442	1.736	2
max.	1.19	1.568	1.92	2.85
X	1.1396	1.505	1.828	2.462989
median	1.134	–	–	2.475
SD	0.03512	–	–	0.143519
V	3.081765	–	–	5.82701
V'	9.876543	–	–	35.05155
K	0.019405	–	–	0.023859

Table 20. Wa M3 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	14	2	2	141
min.	0.98	1.26	1.44	1.7
max.	1.176	1.456	1.55	2.45
X	1.047143	1.358	1.465	2.108461
median	1.036	–	–	2.125
SD	0.061026	–	–	0.143519
V	5.827826	–	–	6.806796
V'	18.18182	–	–	36.14458
K	0.035229	–	–	0.023859

Table 21. L m1 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	45	6	12	187
min.	1.61	2	2.537	2.975
max.	1.876	2.296	2.85	3.725
X	1.718911	2.134	2.701	3.292385
median	1.708	2.126	2.75	3.275
SD	0.081267	0.113243	0.098711	0.138956
V	4.727797	5.3066112	3.654601	4.220525
V'	15.26104	25.78397	11.62057	22.38806
K	0.024748	0.14079	0.06637	0.01997

Table 22. Wa m1 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	45	6	12	187
min.	0.546	0.756	0.91	1.1
max.	0.756	0.98	1.2	1.55
X	0.652667	0.842667	1.0775	1.302845
median	0.658	0.84	1.075	1.3
SD	0.052016	0.075118	0.082806	0.08711
V	7.69724	8.914282	7.685003	6.6861
V'	32.25806	45.71429	27.48815	33.96226
K	0.01584	0.09339	0.055676	0.012519

Table 23. Wp m1 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	45	6	12	187
min.	0.952	1.204	1.45	1.725
max.	1.148	1.316	1.7	2.275
X	1.038533	1.271333	1.583917	1.883856
median	1.022	1.281	1.5875	1.875
SD	0.051178	0.040687	0.08302	0.083714
V	4.927889	3.200374	5.241416	4.443743
V'	18.66667	17.02128	15.87302	27.5
K	0.015585	0.050585	0.05582	0.012031

Table 24. L m2 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	32	6	7	202
min.	1.27	1.568	2.17	2.45
max.	1.526	1.834	2.375	3
X	1.366906	1.703333	2.25	2.741584
median	1.36	1.729	2.3	2.75
SD	0.062924	0.097666	0.076048	0.103936
V	4.603396	5.733822	3.32815	3.791086
V'	18.3187	15.63786	9.020902	20.18349
K	0.023055	0.120424	0.07979	0.014369

Table 25. Wa m2 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	32	6	7	200
min.	1.064	1.26	1.725	1.975
max.	1.23	1.526	1.925	2.475
X	1.122188	1.4	1.817571	2.212055
median	1.12	1.414	1.82	2.216
SD	0.044673	0.093706	0.062045	0.079203
V	3.98085	6.69328	3.413637	3.58052
V'	14.47254	19.09548	10.9589	58.42697
K	0.016368	0.1165	0.065098	0.011005

Table 26. Wp m2 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	31	6	7	199
min.	0.966	1.26	1.75	1.837
max.	1.218	1.498	1.85	2.55
X	1.100645	1.390667	1.806143	2.203075
median	1.106	1.407	1.82	2.212
SD	0.061712	0.093146	0.039401	0.102786
V	5.606893	6.697973	2.181526	4.665579
V'	23.07692	17.25888	5.555556	32.50513
K	0.022985	0.115805	0.04134	0.014317

Table 27. Lm3 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	9	9	7	178
min.	1.19	1.54	2	2.65
max.	1.358	1.92	2.6	3.35
X	1.274	1.683333	2.259143	2.993233
median	1.26	1.624	2.25	3.0
SD	0.049497	0.128977	0.209165	0.126133
V	3.885202	0.07662	9.258615	4.213926
V'	13.18681	21.96532	26.08696	23.33333
K	0.0413	0.107616	0.219456	0.018582

Table 28. Wa m3 of the cricetids from Somssich-hegy 2

	A. bursae	*A. ehiki*	*C. nanus*	*C. runtonensis*
n.	9	9	7	176
min.	0.966	1.12	1.47	1.85
max.	1.12	1.33	1.9	2.47
X	1.036778	1.237778	1.700286	2.238006
median	1.036	1.204	1.72	2.2435
SD	0.057771	0.067085	0.132504	0.093042
V	5.572131	0.054198	7.793027	4.157349
V'	14.7651	17.14286	25.51929	28.7037
K	0.048203	0.05811	0.139023	0.013785

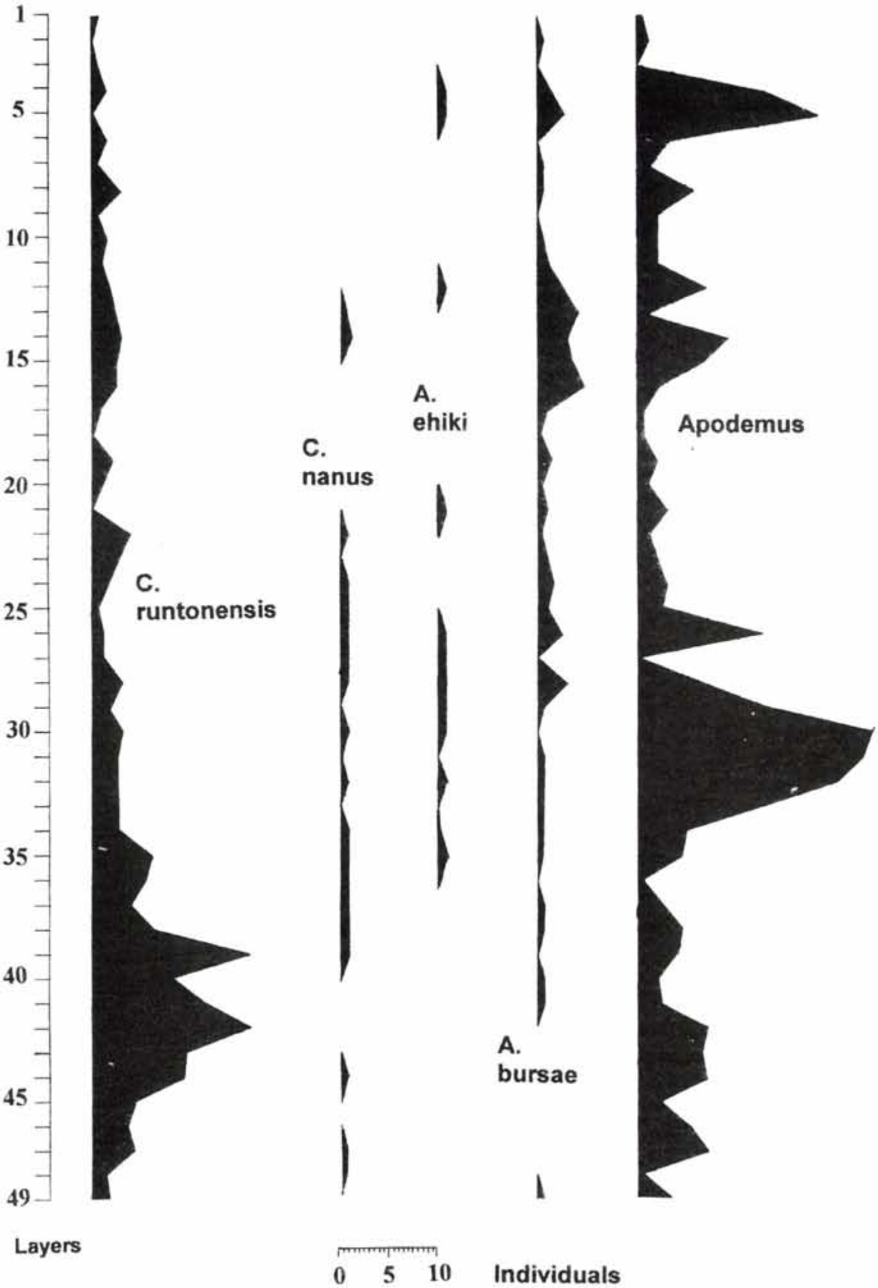


Fig. 33. The distribution of the cricetids and *Apodemus* individuals in the sequence of Somssich-hegy 2

CONCLUSIONS

After the biometrical and morphological analysis of the *Cricetus* finds from Somssich-hegy 2 and from the above mentioned other localities we can draw the following conclusions.

1. The largest hamster finds of Somssich-hegy 2 are the oldest representatives of the real "large sized" (larger than *C. nanus*) *Cricetus* in the Carpathian Basin.

2. The evolution of *Cricetus* in the Hungarian Pleistocene probably occurred in three independent lines. In this question the opinion of the present author differs from the statement of PRADEL (1985) who declared that all the big Pleistocene hamsters make up a common line leading to the recent *C. cricetus*.

In the *C. praeglacialis-C. cricetus* line the measurements decreased and the morphology simplified (HÍR 1997*a*).

The second one is the *C. runtonensis* line. We tried to verify the evolutionary relation between the hamster materials of Somssich-hegy 2. and Solymár on the basis of the measurements (Figs 20–25) and after the results of the morphotype-analysis, e.g. the dominancy of A01 type in M2 molars (Table 2), the subdominant position of F1a type in m1 molars (Table 4), and the presence of the m2 and m3 morphotypes with mesolophid and "paramesolophid" in both materials. In the *C. runtonensis* line the measurements slightly increased and the morphology became complicated (HÍR 1997*b*) .

The third evolutionary line is probably the *C. major* line which is poorly represented in the Hungarian fossil material and it was not studied in details by the author (with the exception of a small sample from the fauna of Subpiatra, Romania: HÍR & VENCZEL 1991). This species was found in two periods of the Hungarian Pleistocene: the Tarkő Phase and the Eemian (Varbó Phase). JÁNOSSY (1986) published the hamster from Tarkő as "*C. runtonensis*", but this determination is erroneous as demonstrated by the extra large dental measurements of the material.

3. In the sequence of Somssich-hegy 2 the *C. runtonensis* has maximal abundancy between the 39–43 layers (Fig. 33). In this level the most frequent arvicolids are *Lagurus* species (JÁNOSSY 1990, Fig. 2). Based on its dominancy we can presume the preference of this hamster for arid, continental climate, although it is not characteristic of all Pleistocene hamsters, e.g. *C. runtonensis* ssp. from Solymár and *C. major* in Tarkő and Subpiatra lived in a forested biotope (HÍR 1996*c*, HÍR & VENCZEL 1991).

The material of Somssich-hegy 2 represents the Nagyharsányhegy Phase of the Hungarian Early Pleistocene (JÁNOSSY 1986). KORDOS (1993) determined it as the type-fauna of the *Mimomys savini – Mimomys pusillus* zone. We found four hamster species in the fauna which represents the highest diversity of the cricetids during the Pleistocene in the Carpathian Basin. These four species were found together in Hungary only in the fauna of the Hajnóczy Cave in Northern Hungary (Bükk Mountains) (HÍR 1992), where *Mimomys savini* and *Mimomys pusillus* were found as well.

Acknowledgements – The author would like to express his sincere thanks to Prof. DÉNES JÁNOSSY for his permission to study the fauna of Somssich-hegy 2. The study was supported by the Hungarian Scientific Research Fund (OTKA grant No. T-014412).

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