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# A Comparative study on the dental morphology of the Early Pleistocene *Cricetus praeglacialis* SCHAUB, 1930 and recent Hungarian *Cricetus cricetus* L.

JÁNOS HÍR

ABSTRACT: The results of a detailed biometrical and statistic morphological study is given on the Early Pleistocene *Cricetus praeglacialis* material of Villány 8 and a recent Hungarian *Cricetus cricetus* population with the revised investigation of the *Cricetus praeglacialis* type-material. The most important conclusions are the next:

– the hamster of Villány 8 is identical with the *C. praeglacialis* typematerial;

– the differences between the fossil and the recent material are briefly the following: the measurements of *C. praeglacialis* are larger, the ranges of these measurements are broader, the morphological variability is broader as well;

– these differences establish the presence of two different species and not two subspecies like in the original description of SCHAUB, 1930;

– the evolutionary connection between the fossil and the recent species is probable, but the *C. praeglacialis* – *C. cricetus* line is only one of the four presumed philetic lines of the Hungarian Pleistocene hamsters.

## Introduction

The aim of this article is to give the metrical and statistic morphological comparision of a fossil and a recent *Cricetus* population. The reason of this investigation is the contribution to the clearing up of the long standing systematic problems of the Pleistocene *Cricetus* taxa.

The „large sized” cricetids are frequent elements of the Pleistocene faunas in Middle- and Eastern Europe, but they are relatively neglected by the scholars related to the arvicolids and the neogene cricetids. The tooth morphology of the different hamster species was regarded as uniform (KRETZOI, 1941) and the minor morphological characters were not studied.

The systematics of the Pleistocene *Cricetus* is still disputable. The original taxa known from the literature are the next.

*Cricetus cricetus major* WOLDRICH (1880), Vypustek.

*Cricetus cricetus runtonensis* NEWTON (1909), Norfolk.

*Cricetus cricetus praeglacialis* SCHAUB (1930), Betfia.

*Cricetus cricetus nanus* SCHAUB (1930), Betfia.

The subspecies, or species level of them was disputed for a long time,like the relation of them to the recent *Cricetus cricetus* and the relation of them to each other.

NEHRING (1893) criticised the identity of the *Cricetus c. major*. HELLER (1930, 1936, 1958) was of the opinion that *Cricetus cricetus* and *Cricetus runtonensis* are two different species on the basis of the morphological and metrical differences. KURTÉN (1960, 1968) attributed great importance of climatic factors in the dimensions of the cricetids refers to the Bergmann’ s rule. The *Cricetus c. major* was regarded as the ancestor of the modern *Cricetus* by KURTÉN (op. cit.). FAHLBUSCH (1976) was of the opinion that *Cricetus c. runto-*

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*nensis* is a later synonym of *Cricetus c. major* and classified the hamster population from Petersbuch 1 as *Cricetus major*. He excluded the possibility of the direct phyletic connection between *C. major* and present day *C. cricetus*. PRADEL (1985, 1988) rejected the importance of the Bergmann' s rule after the sense of KURTÉN (1960, 1968) and he contested the validity of the species *Cricetus major*: „All the big Pleistocene forms of hamsters …make up a common line leading to the recent Hamster *Cricetus cricetus*."

In the Hungarian literature JÁNOSSY (1979, 1986) classified the hamsters bearing similar dimensions with the recent species as *Cricetus praeglacialis*, or *Cricetus c. praeglacialis*. The names *Cricetus runtonensis*, or *Cricetus c. runtonensis* were applied to a larger form probable identical with *C. runtonensis* after the sense of PRADEL (1988). Unfortunately the extra large form of Tarkő was published under the same name. The name *Cricetus c. major* was applyed only to the extra large hamsters of the Eemian faunas (Varbó and Porlyuk). In the present situation the author of this article likes to give new results based on the intensive study of the abundant Hungarian populations and the re-investigation of the type materials. On the basis of the preliminary results we can presume the existence of four independent *Cricetus* lines in the Hungarian Pleistocene:

1. *C. praeglacialis – C. cricetus* line
2. *C. runtonensis* line
3. *C. major* line
4. *C. nanus* line

This paper deals with the first line only.

## Material

The *Cricetus praeglacialis* finds of the locality Villány 8 is the most abundant fossil hamster material of the Hungarian Early Pleistocene. It was collected by KRETZOI (1956) and JÁNOSSY (1979, 1986) in 1953 – 1955. The fauna is housed in the Geological Museum of Hungary.

The recent *Cricetus cricetus* material was collected by gipsy hamster-hunters in the surroundings of Dunaszentpál (Western Hungary, County Győr-Moson-Sopron) in 1952. The animals were bought by the Zoological Collection of the Hungarian Natural History Museum. (Inventary noumbers: 53.12.4 -53.12.26, 53.84.1. -53.84.27., 53.137.1. -53.137.16., 54.61.1. -54.61.26.)

The type material of the *Cricetus cricetus praeglacialis* is found in the Geological Museum of Hungary as well under the next inventary noumbers: Ob. 4170, Ob. 4177, Ob. 4188, Ob. 4199, Ob. 7142. These founds were collected by KORMOS (1914) in Betfia, close to Oradea (Nagyvárad), Romania. The material was studied by SCHAUB (1930). The holotype of the *Cricetus c. praeglacialis* was never assigned, only the complete mandible No. Ob. 7142 was marked as „original material", because it was figured by SCHAUB (1930, Taf. 2., Figs. 2., 4. text Fig. 21.).

Both Villány 8. and the recent material are rather abundant from statistical point of view. The type material from Betfia is unfortunately limited and insufficient for statistic morphological comparision.

## Methods

The measurements were taken using the ocular-micrometer of a stereomicroscope to an accuracy of 0.01 mm. The following dimensions were measured (Fig. 1.).

| | |
|---|---|
| L M1-M3 | length of upper row of molars, |
| Lm1-m3 | length of lower row of molars, |
| L | length of tooth crown, |
| Wa | anterior width of the toothcrown. In M1 molars it was measured across the anterocone, in m1 molars it was measured across the anteroconid. In M2, M3 molars it is the width across the protocone-paracone. In m2, m3 molars it is the width across the protoconid-paraconid. |
| Wp | posterior width of the toothcrown. In M1, 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, m3 molars. |

During the statistic elaboration of the data the next parameters were computed:

| | |
|---|---|
| n | sample size |
| min | the minimal measurement |
| max | the maximal measurement |
| x | arithmetic mean |
| median | median |
| SD | standard deviation |
| CV | coefficient of variation |
| K | 95% konfident intervall of the arithmetic mean (+ -) |
| V' | 100R/M. In which R is the difference between max. and min., and M is the mid-point between max. and min. (FREUDENTHAL et CUENCA BESCOS 1984). |

The statistic morphological investigation is based on the nomenclature of MEIN et FREUDENTHAL (1971 a, b). The creation of the different morphotypes is demonstrated on the figures 3.,6.,9.,12.,15.,17.,20.

## Results

The metrical results are presented in the tables I.-IX. and in the scatter diagrams (Figs. 2., 5., 8., 11., 14., 19. 22.) The dispersions of the morphotypes are presented in the diagrams (Figs. 3., 6., 9., 12., 16., 18. 21.) The data of the original mandibula of *C. c. praeglacialis* from Betfia are the next:

| L toothrow: 8.27, | m1 | m2 | m3 |
|---|---|---|---|
| | L: 3.25 | L: 2.5 | L: 2.77 |
| | Wa: 1.22 | Wa: 2.16 | Wa: 2.05 |
| | Wp: 1.8 | Wp: 2.05 | Wp: – |
| | morph.: E1a | morph.: 2,VL | morph.: VG |

Inside the type material the dimensions of this mandible are rather close to the averages. 6 paramethers are inside the 95% confidence intervals. In this way we can accept the original material as a real holotype.

No doubt about the identity of the Villány 8 population with the type material of *C. praeglacialis* from Betfia, because in the comparable lower dentition no significant differences.

The relation of the recent material with the studied fossil populations is not the same. In the majority of the investigated measurements significant differences were found. The dimensions of the recent *C. cricetus* are usually smaller and the variations are narrower. Beyond the basic parameters the difference is more striking in the Lm1/Lm2, Lm3/Lm2 and LM1/LM2, LM3/LM2 relations but in these cases the variation of the recent population is much wider (Tabs. V., IX.)

In the two scatter diagrams of fig. 22. clearly visible, that differences between the *Cricetus praeglacialis* and *Cricetus cricetus* are larger, than the differences between the two recent *Cricetus cricetus* subspecies.

In the morphology the most important trend between V8 and the recent population is the growing narrow in the morphological variability. The dominant morphotypes has always higher frequency in the recent molars. The presence of rare morphotypes are more typical in V8. In the m2, m3 molars we could arrenge the morphotypes into a morphodynamic scheme demonstrating a trend of simplification (Figs 17., 20.). This process begins with morphotypes bearing central ring and mesolophid. During the course of the evolution the central ring is teared and the mesolophid is shortened. Finally both of these elements are disappeared.

In the anterior region of the m2 molars the complete antero-lingual cingulum is more frequent in V8. In recent *C. cricetus* this element mainly disappeared and a tendency is visible for the formation of a unified anterocingulum (Figs. 15., 16.).

## Discussion

The presented metrical and morphological differences between the recent and the fossil taxa suggest the reason for the existence of two different species. The fossil form can not be a subspecies after the sense of SCHAUB (1930). It seems to be an independent species: *Cricetus praeglacialis*.

The evolutional connection between the recent *C. cricetus* and the Early Pleistocene *C. praeglacialis* is probable. On the basis of our investigations we can interprete the status of the recent species as a descendent of the *C.praeglacialis* with slightly smaller measurements and more simplifyed morphology. Unfortunately at present we have no abundant fossil materials from the Hungarian Middle Pleistocene period demonstrating a transitional status between the Villány 8 and the recent material.


## Acknowledgements

The author would like to express his sincere thanks to Prof. László Kordos, director of the Hungarian Geological Museum for his permission to study the *Cricetus praeglacialis* materials from Betfia and Villány 8. and to Dr. György Topál retired director of the Mammalological Collection of the Hungarian Natural History Museum for the possibility to study the recent *Cricetus cricetus* material from Dunaszentpál.

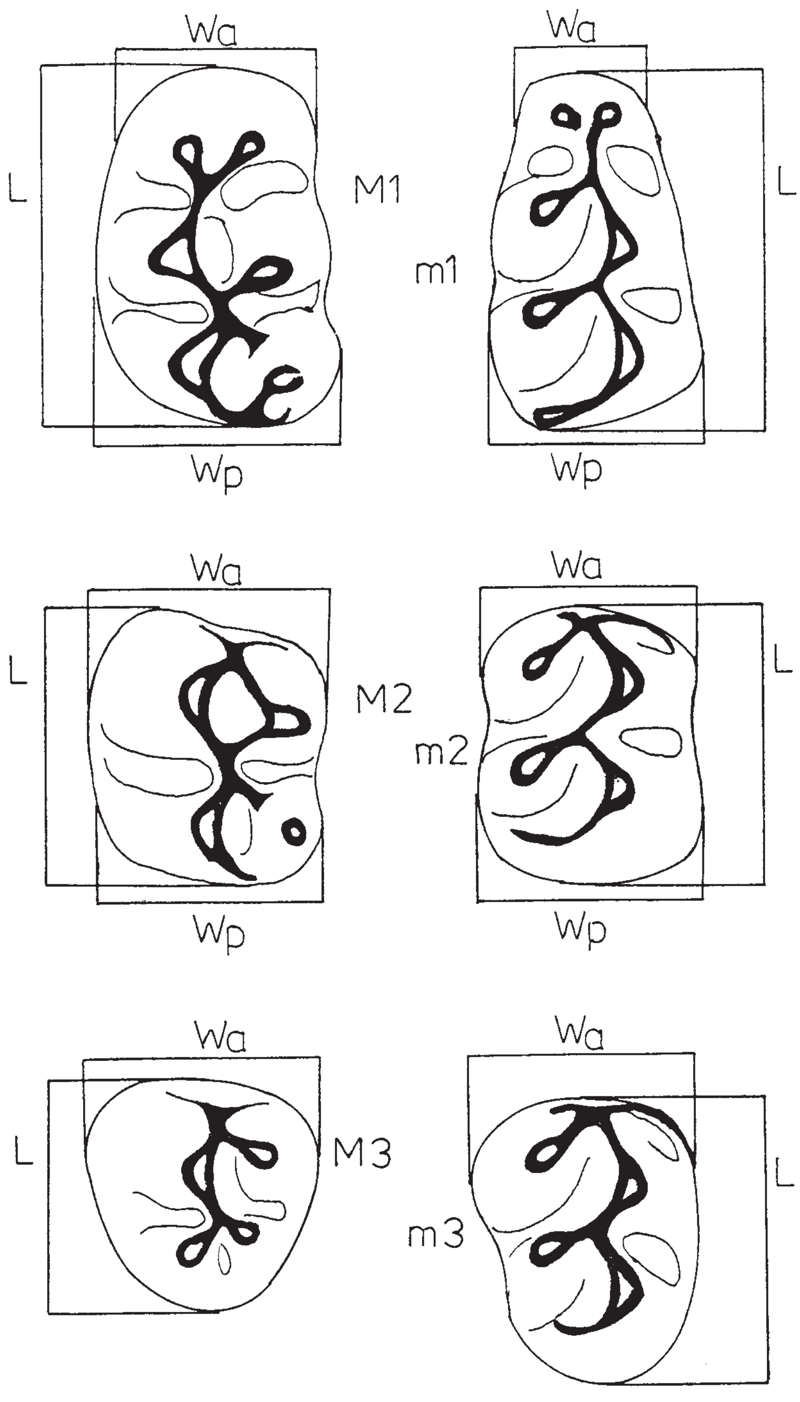



Fig. 1. Sketch of the investigated measurements on Cricetus molars

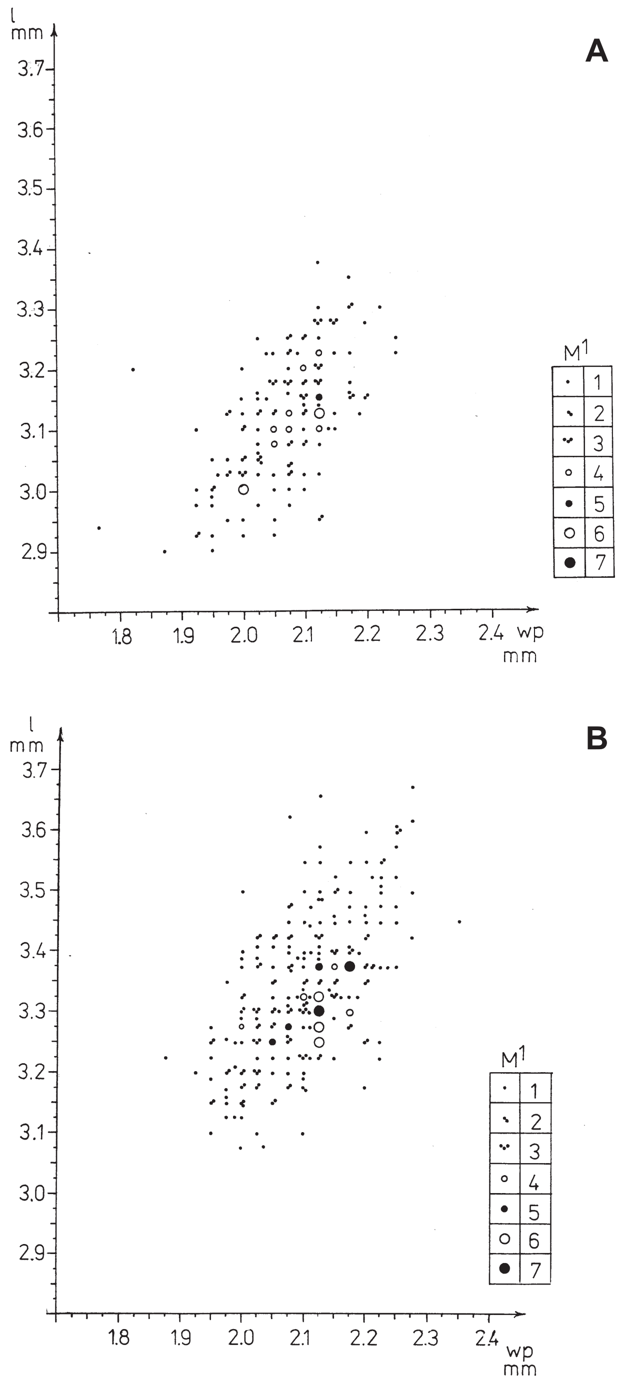



Fig. 2 . Scatter diagrams of M1 molars. A: recent material, B: Villány 8.
Explanation: 1-7= 1-7 molars with the same dimensions.

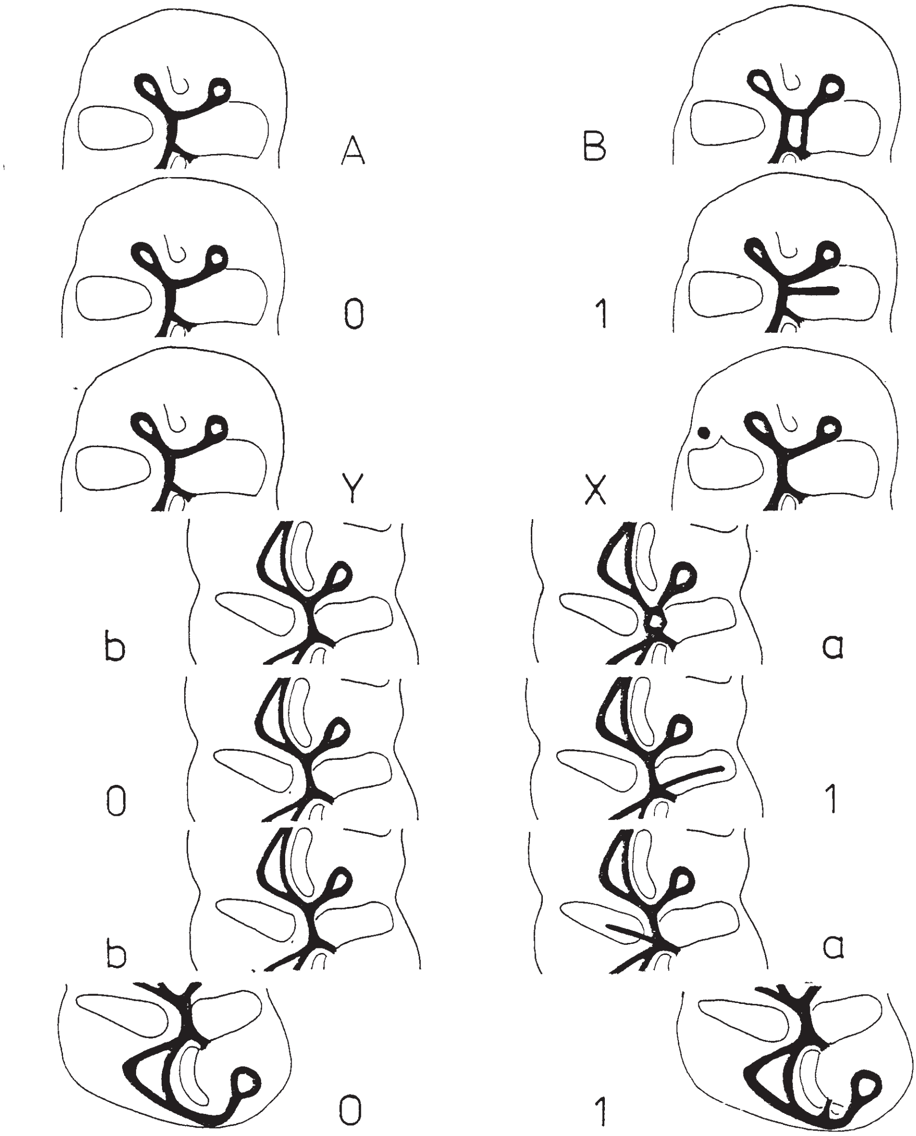



Fig. 3. The morphotypes of M1 molars.
A: anterolophule is simple, B: anterolophule is doubled.
0: labial eperon of the anterolophule is missing, 1: a low developed labial eperon is found.
Y: protostyle is missing, X: protostyle is found.
b: central ring is missing, a: central ring is found.
0: mesolophe is missing, 1: mesolophe is found.
b: entomesolophe is missing, a: entomesolophe is found.
0: posterolophule is simple, 1: posterolophule is ramified.

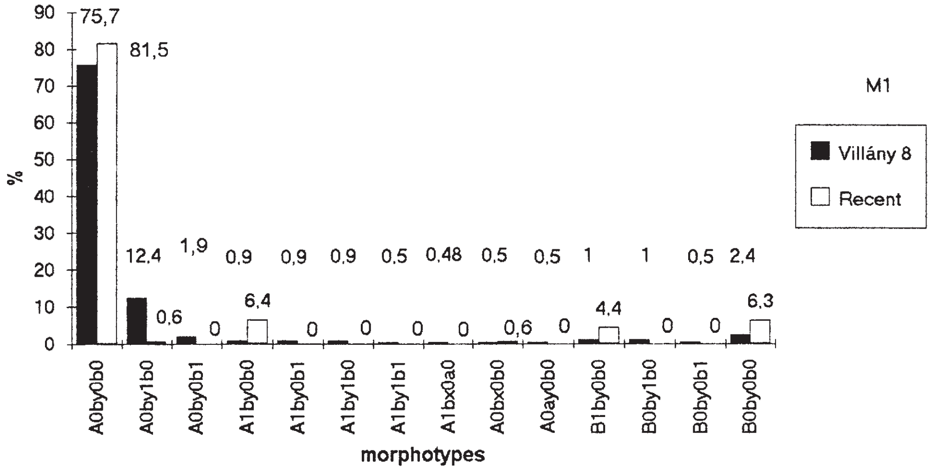



Fig. 4. The frequency of the M1 morphotypes

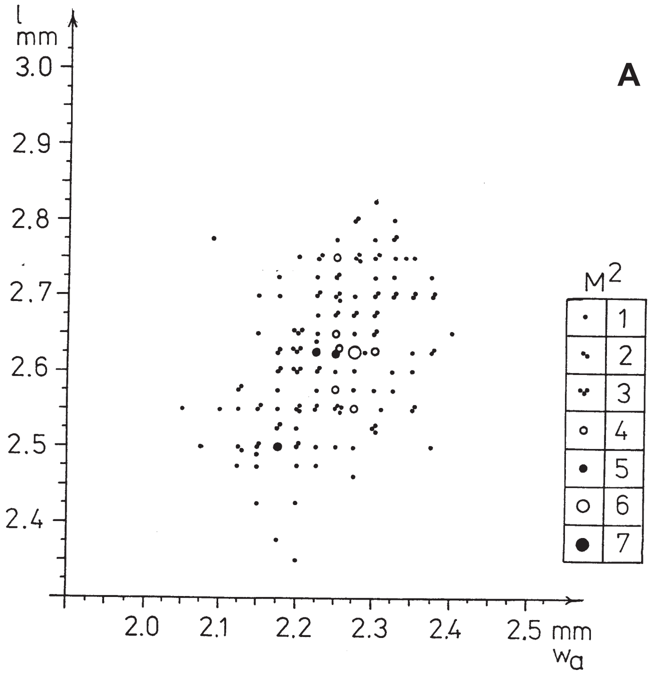
**Tab. I. Length of the complete toothrowes**

**upper toothrowes (LM1-M3)**

| | Recent | Villány 8 |
|---|---|---|
| n | 175 | 52 |
| min | 7.25 | 7.35 |
| max | 8.25 | 8.45 |
| X | 7.767216 | 7.915385 |
| median | 7.75 | 7.90 |
| SD | 0.223754 | 0.242897 |
| V ‘ | 12.90323 | 13.92405 |
| V | 2.880754 | 3.068667 |
| K | 0.033247 | 0.068025 |

**lower toothrowes (Lm1-m3)**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 167. | 147 | 12 |
| Min. | 7.55 | 7.5 | 7.95 |
| Max. | 8.6 | 8.95 | 9.15 |
| X | 8.021587 | 8.249762 | 8.303333 |
| Median | 8.0 | 8.25 | 8.225 |
| SD | 0.21335 | 0.244673 | 0.342008 |
| V ‘ | 13.0031 | 17.62918 | 14.03509 |
| CV | 2.659703 | 2.965818 | 4.118928 |
| K | 0.032456 | 0.039689 | 0.226863 |



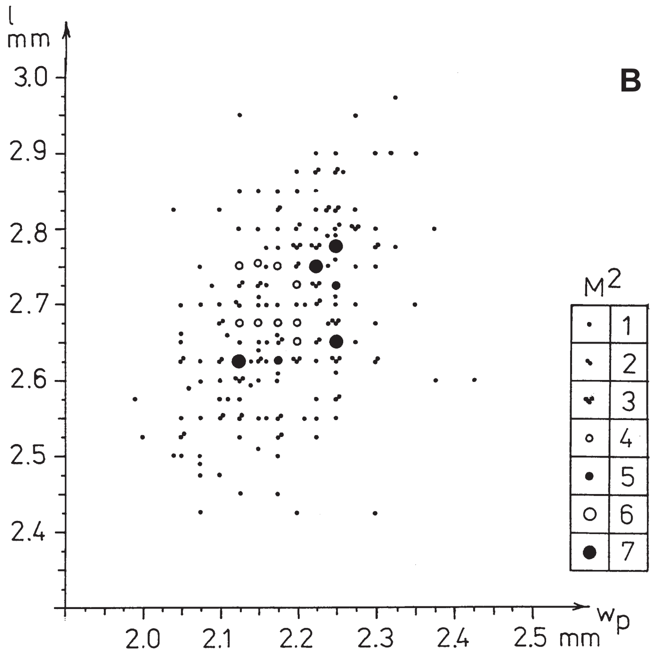




Fig. 5. Scatter diagrams of M2 molars. A: recent material. B: Villány 8. 1-7= Fig. 2.

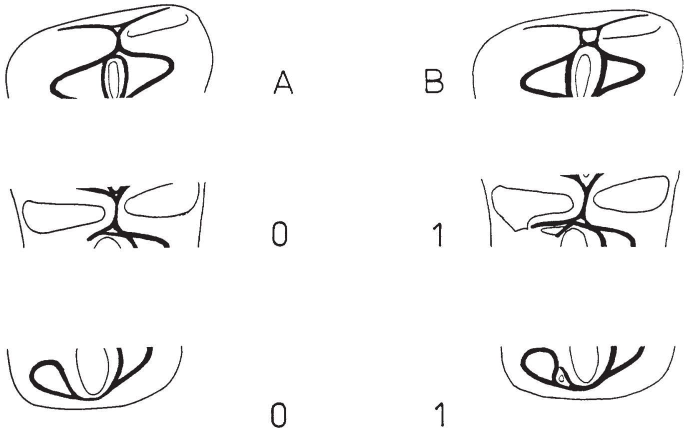



Fig. 6. The morphotypes of M2 molars.
A: anterolophule is simple, B: anterolophule is doubled,
0: mesolophe is missing, 1: mesolophe is found.
0: posterolophule is simple, 1: posterolophule is ramified.

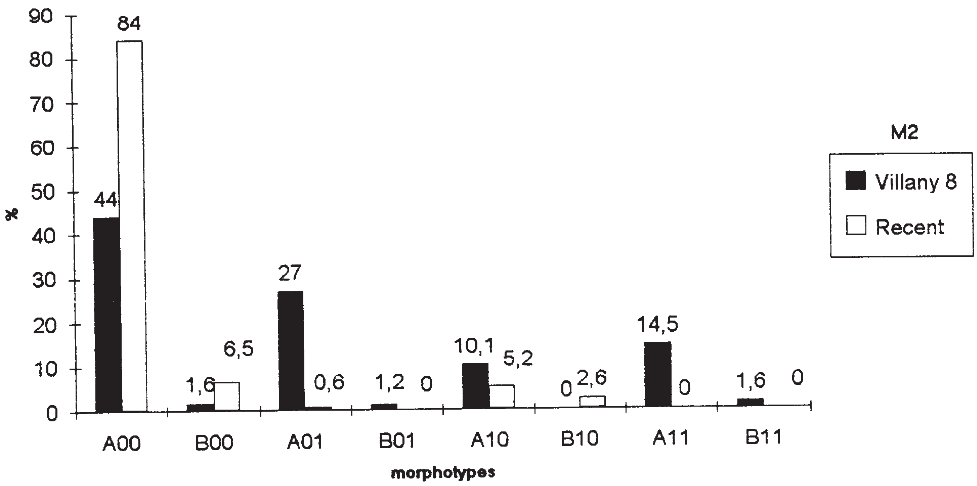
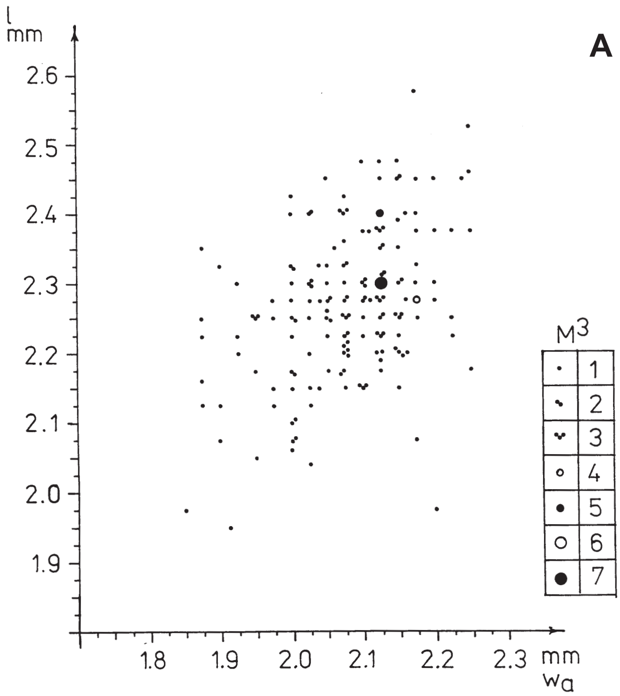



Fig. 7.The frequency of the M2 morphotypes.



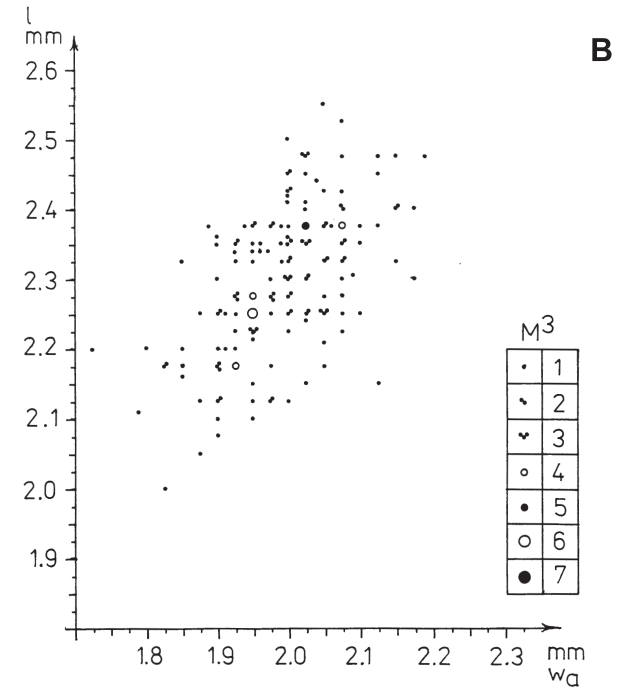




Fig. 8. Scatter diagrams of M3 molars. A: recent material, B: Villány 8. 1-7= Fig. 2.

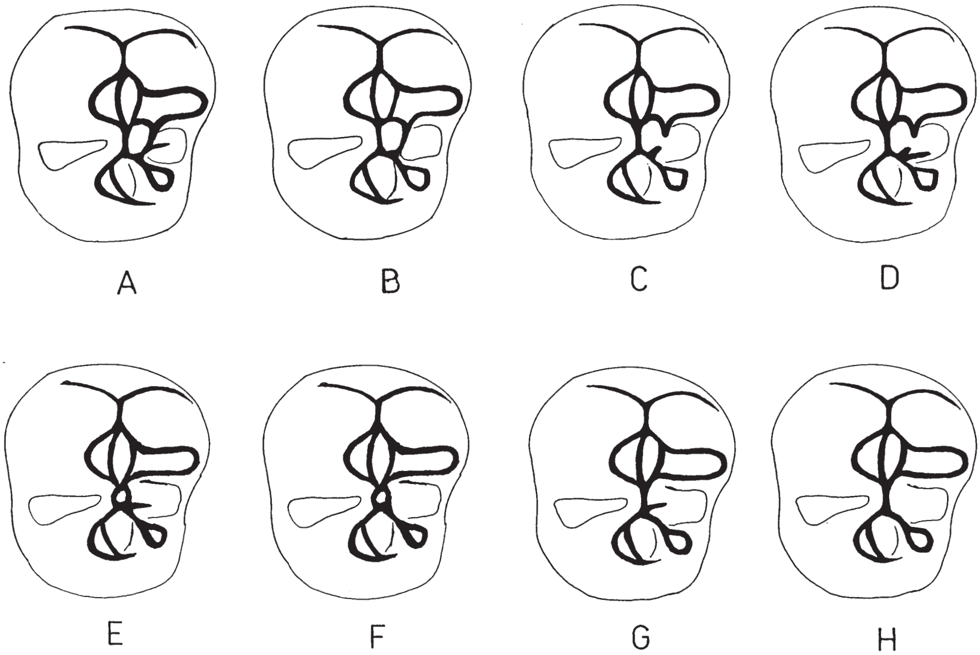



Fig. 9. The morphotypes of M3 molars.
A: central ring with mesolophe. B: central ring without mesolophe. C: opened central ring without mesolophe. D: opened central ring with mesolophe. E: reduced central ring with mesolophe. F: reduced central ring without mesolophe. G: mesolophe without central ring. H: no central ring, no mesolophe.

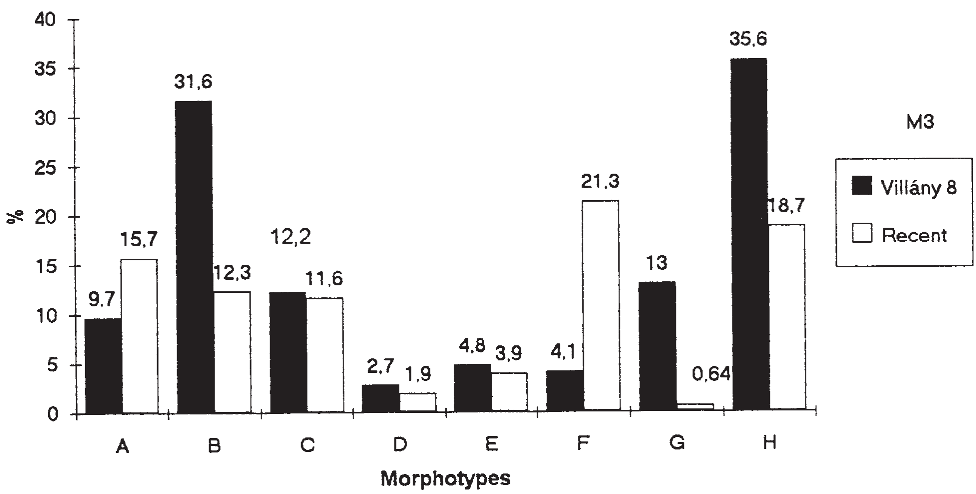
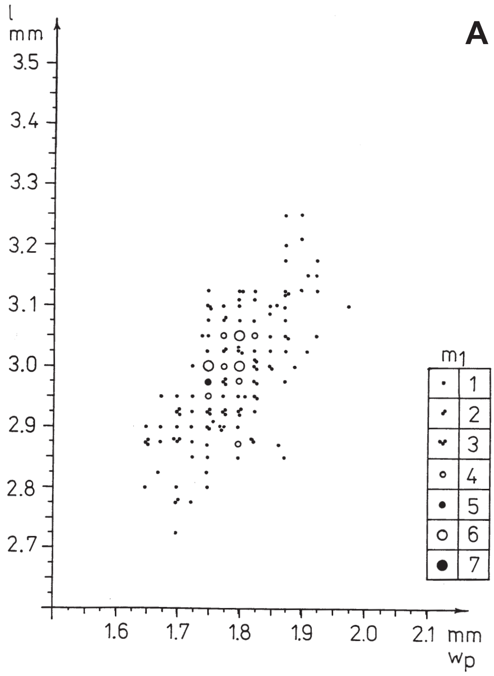



Fig. 10. The frequency of M3 morphotypes .



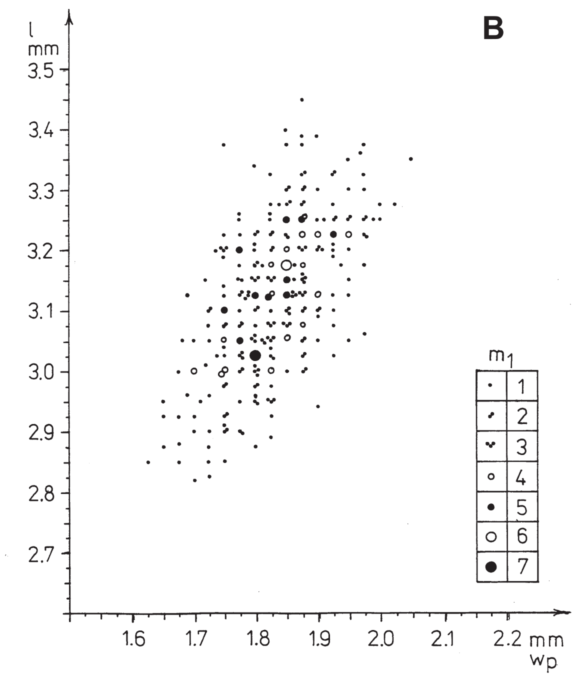




Fig. 11. Scatter diagrams of m1 molars. A: recent material, B: Villány 8. 1-7= Fig. 2.

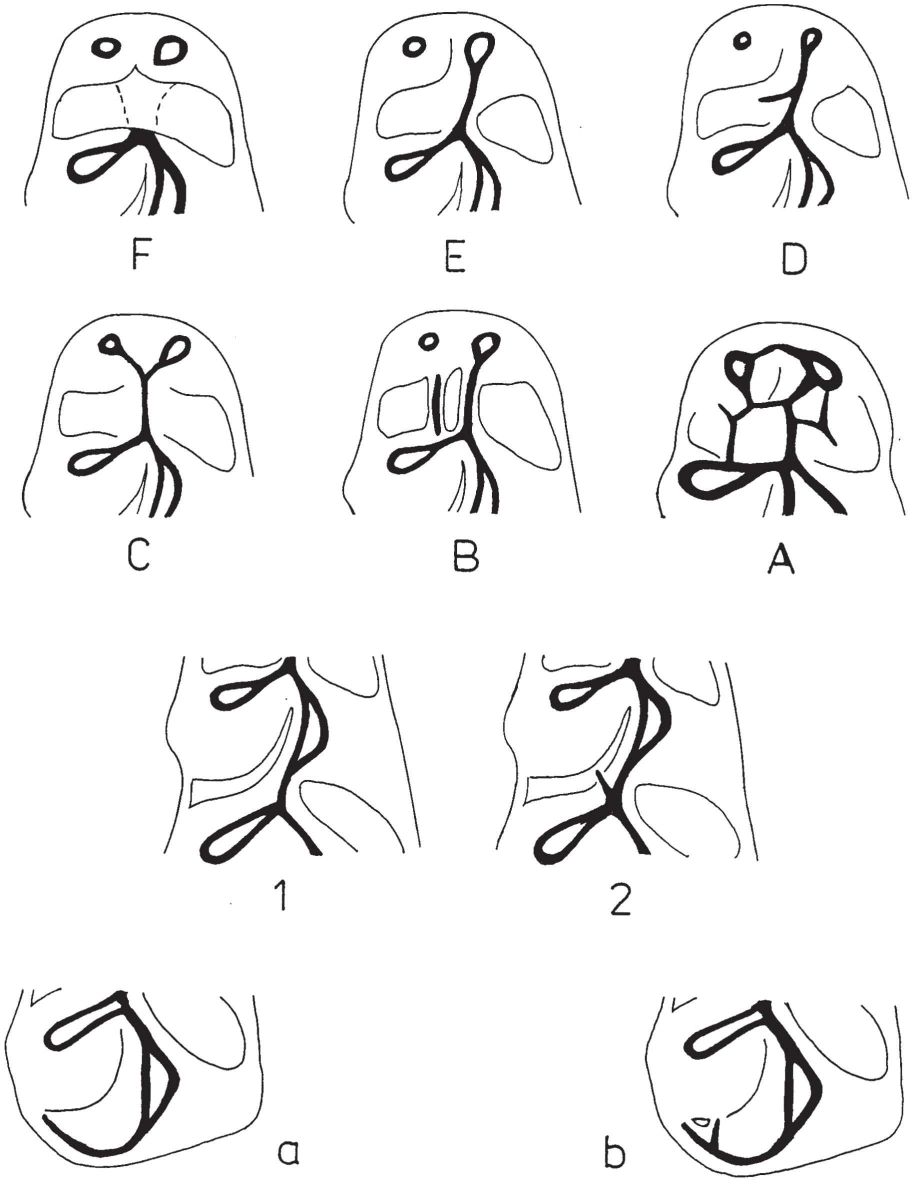



Fig. 12.The morphotypes of m1 molars.
A: anterolophulid is doubled and complicated by accessoric elements. B: anterolophulid is doubled without accessoric elements. C: anterolophulid is Y-shaped and connected to both two conelets of the anteroconid. D: anterolophulid is connected only to the buccal conelets of the anteroconid and has a lingual eperon. E: = D 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 found. a: posterolophulid is simple. b: posterolophulid is ramified.

**Tab. II. Metrical data of the upper M1 molars.**

**Length (LM1)**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 176 | 288.0 | 4 |
| Min. | 2.90 | 3.075 | 3.15 |
| Max. | 3,375 | 3,675 | 3,37 |
| X | 3.118739 | 3.33333 | 3.2525 |
| median | 3.125 | 3.325 | 3.245 |
| SD | 0.099148 | 0.116705 | |
| V ‘ | 14.62948 | 17.77778 | |
| CV | 3.179096 | 3.501151 | |
| K | 0.01469 | 0.013502 | |

**Anterior width (WaM1).**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 176 | 286 | 4 |
| Min | 1.625 | 1.625 | 1.77 |
| Max | 2.025 | 2.0 | 1.90 |
| X | 1.77183 | 1.809587 | 1.815 |
| Median | 1.775 | 1.8 | 1.795 |
| SD | 0.064706 | 0.070268 | |
| V ‘ | 21.91781 | 20.68966 | |
| CV | 3.651915 | 3.88307 | |
| K | 0.009587 | 0.008158 | |

**Posterior width (WpM1).**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 176 | 287 | 4 |
| Min | 1.825 | 1.875 | 2.05 |
| Max | 2.25 | 2.35 | 2.22 |
| X | 2.070568 | 2.102237 | 2.12 |
| Median | 2.075 | 2.1 | 2.105 |
| SD | 0.072499 | 0.192821 | |
| V ‘ | 20.8589 | 22.48521 | |
| CV | 3.501396 | 9.172159 | |
| K | 0.010742 | 0.022347 | |

**Tab. III. Metrical data of upper M2 molars**

**Length (LM2)**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 176 | 255 | 1 |
| Min | 2.35 | 2.425 | |
| Max | 2.825 | 2.975 | |
| X | 2.619466 | 2.688173 | 2.62 |
| Median | 2.625 | 2.675 | |
| SD | 0.092011 | 0.099532 | |
| V ‘ | 18.35749 | 20.37037 | |
| CV | 3.512572 | 3.702587 | |
| K | 0.013632 | 0.012241 | |

**Anterior width (Wa M2).**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 176 | 254 | 1 |
| Min | 2.05 | 1.987 | |
| Max | 2.4 | 2.425 | |
| X | 2.244506 | 2.18597 | 2.17 |
| Median | 2.25 | 2.175 | |
| SD | 0.06506 | 0.072556 | |
| V ‘ | 15.73034 | 19.85494 | |
| CV | 2.898629 | 3.325719 | |
| K | 0.009639 | 0.008958 | |

**Posterior width (WpM2).**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 175 | 253 | 1 |
| Min | 1.12 | 1.0 | |
| Max | 2.20 | 2.25 | |
| X | 2.046417 | 2.011909 | 1.95 |
| Median | 2.05 | 2.025 | |
| SD | 0.100936 | 0.103028 | |
| V ‘ | 65.06024 | 76.92308 | |
| CV | 4.932327 | 5.120885 | |
| K | 0.014998 | 0.012721 | |

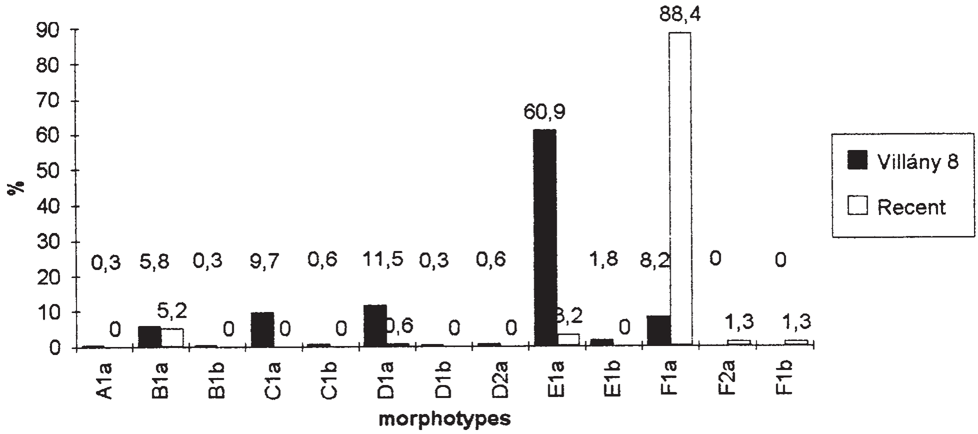



Fig. 13. The frequency of m1 morphotypes.

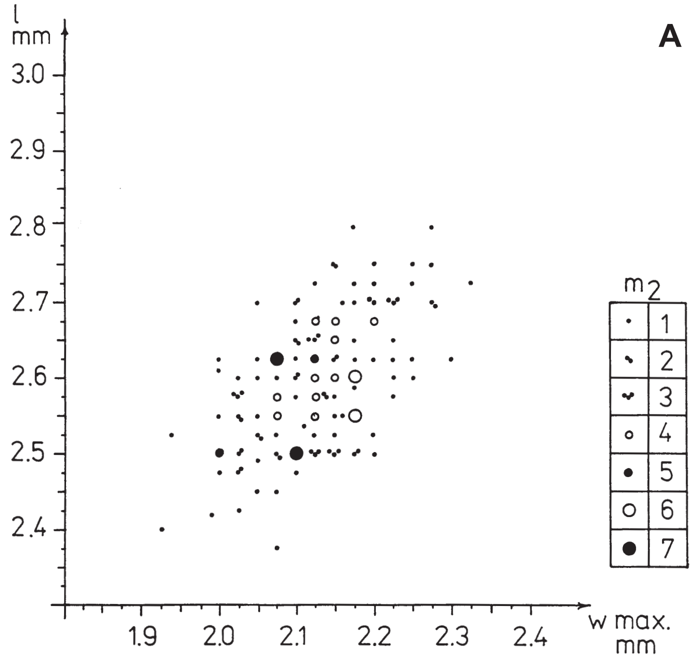
**Tab. IV. Metrical data of upper M3 molars .**

**Length (LM3)**

| | Recent | Villány 8 |
|---|---|---|
| n | 175 | 171 |
| Min | 1.95 | 2.0 |
| Max | 2.575 | 2.55 |
| X | 2.269103 | 2.297585 |
| Median | 2.275 | 2.30 |
| SD | 0.106856 | 0.105323 |
| V ‘ | 27.62431 | 24.17582 |
| CV | 4.709155 | 4.584078 |
| K | 0.015877 | 0.015833 |

**Anterior width (Wa M3)**

| | Recent | Villány 8 |
|---|---|---|
| n | 175 | 168 |
| Min | 1.85 | 1.725 |
| Max | 2.25 | 2.187 |
| X | 2.079426 | 1.991167 |
| Median | 2.10 | 2.0 |
| SD | 0.08797 | 0.080413 |
| V ‘ | 65.78049 | 23.61963 |
| CV | 4.230486 | 4.038486 |
| K | 0.013071 | 0.012196 |



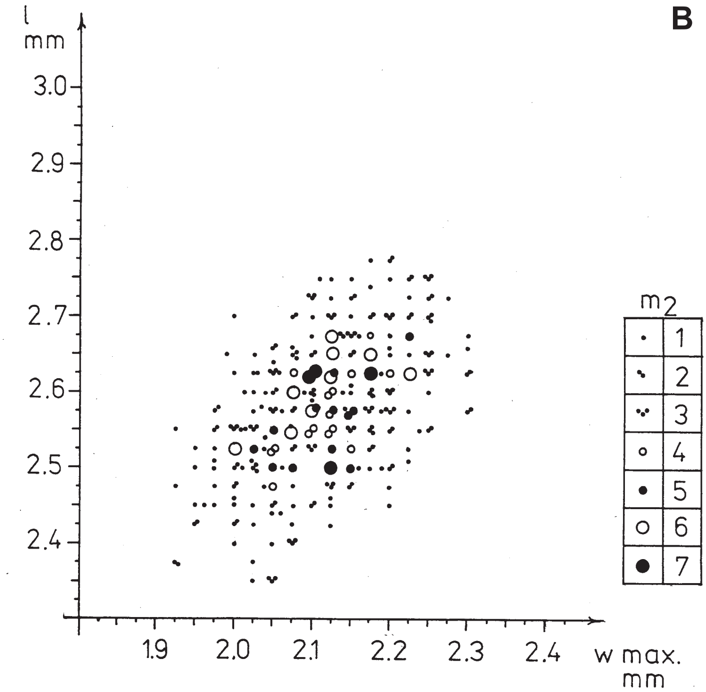




Fig. 14. Scatter diagrams of m2 molars. A: recent material, B: Villány 8. 1-7= Fig. 2.

**Tab. V. Proportions in complete upper toothrowes**

**LM1 / LM2 relations**

| | Recent | Villány 8 |
|---|---|---|
| n | 175 | 135 |
| Min | 1.081 | 1.162162 |
| Max | 1.308 | 1.349515 |
| X | 1.191074 | 1.248886 |
| Median | 1.19 | 1.243243 |
| SD | 0.035377 | 0.040651 |
| V ‘ | 19.00377 | 14.91848 |
| CV | 2.970199 | 3.25499 |
| K | 0.005257 | 0.006883 |

**LM3 / LM2 relations**

| | Recent | Villány 8 |
|---|---|---|
| n | 175 | 77 |
| Min | 0.744 | 0.747748 |
| Max | 1.03 | 0.961905 |
| X | 0.86656 | 0.861473 |
| Median | 0.864 | 0.865 |
| SD | 0.041094 | 0.108252 |
| V ‘ | 32.24352 | 25.05269 |
| CV | 4.742251 | 5.097209 |
| K | 0.006106 | 0.024586 |

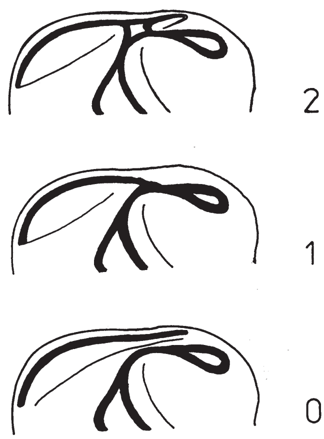



Fig. 15. The morphotypes of the anterior region of m2 molars.
2: antero-lingual cingulum and anterolophulid. 1: reduced anterolophulid without ALC.
0: No ALPLD, no ALC. Unified anterocingulum.

## Tab. VI. Metrical data of lower m1 molars

### Length (L m1)

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 168. | 358. | 19. |
| Min | 2.725 | 2.82 | 2.87 |
| Max | 3.25 | 3.45 | 3.37 |
| X | 2.988393 | 3.127682 | 3.118947 |
| Median | 3.0 | 3.125 | 3.1 |
| SD | 0.09879 | 0.122508 | 0.132325 |
| V ‘ | 17.57322 | 20.09569 | 16.02564 |
| CV | 3.305796 | 3.916882 | 4.242622 |
| K | 0.014983 | 0.012708 | 0.065498 |

### Anterior width (Wa m1)

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 167. | 353. | 19. |
| Min | 0.85 | 1.0 | 1.15 |
| Max. | 1.375 | 1.5 | 2.47 |
| X | 1.156754 | 1.263261 | 1.277368 |
| Median | 1.15 | 1.25 | 1.25 |
| SD | 0.116923 | 0.086696 | 0.089495 |
| V ‘ | 47.19101 | 88.0 | 24.42748 |
| CV | 10.10786 | 6.86284 | 7.006202 |
| K | 0.017787 | 0.009057 | 0.044298 |

### Posterior width (Wp m1)

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| N | 169. | 345. | 19 |
| Min | 1.65 | 1.625 | 1.6 |
| Max | 1.975 | 2.05 | 2.0 |
| X | 1.790805 | 1.828359 | 1.796316 |
| Median | 1.8 | 1.825 | 1.8 |
| SD | 0.064338 | 0.073206 | 0.100897 |
| V ‘ | 17.93103 | 23.12925 | 22.22222 |
| CV | 3.592679 | 4.003942 | 5.616861 |
| K | 0.009729 | 0.007736 | 0.049941 |

## Tab. VII. Metrical data of lower m2 molars

### Length (Lm2)

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 170 | 454 | 28 |
| Min. | 2.375 | 2.35 | 2.39 |
| Max | 2.80 | 2.775 | 3.0 |
| X | 2.593076 | 2.577958 | 2.551071 |
| Median | 2.60 | 2.575 | 2.52 |
| SD | 0.081433 | 0.83788 | 0.123118 |
| V ‘ | 16.42512 | 16.58537 | 22.63451 |
| CV | 3.14041 | 3.250151 | 4.826133 |
| K | 0.012278 | 0.007716 | 0.048573 |

### Anterior width (Wa m2)

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 169 | 446 | 28 |
| Min | 1.90 | 1.85 | 1.87 |
| Max | 2.30 | 2.25 | 2.4 |
| X | 2.104885 | 2.091618 | 2.069286 |
| Median | 2.125 | 2.10 | 2.07 |
| SD | 0.0683 | 0.073151 | 0.123646 |
| V ‘ | 19.04762 | 19.5122 | 24.82436 |
| CV | 3.24482 | 3.497325 | 5.975304 |
| K | 0.010328 | 0.006797 | 0.048781 |

### Posterior width (Wp m2)

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 168 | 444 | 28 |
| Min | 1.925 | 1.825 | 1.92 |
| Max. | 2.325 | 2.30 | 2.34 |
| X | 2.10719 | 2.084041 | 2.066607 |
| Median | 2.125 | 2.075 | 2.05 |
| SD | 0.076472 | 0.084519 | 0.105146 |
| V ‘ | 26.44706 | 23.0303 | 19.71831 |
| CV | 3.62912 | 4.049523 | 5.08785 |
| K | 0.011599 | 0.00783 | 0.041482 |

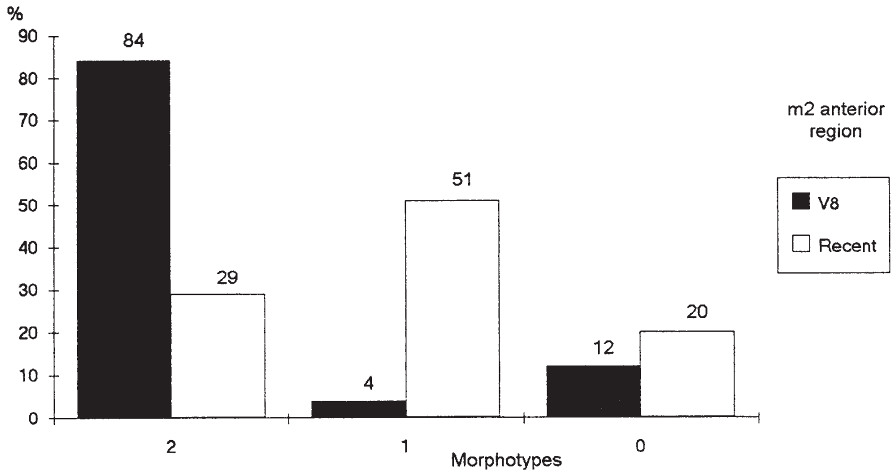



Fig. 16. The frequency of the m2 anterior region morphotypes.

**Tab. VIII. Metrical data of lower m3 molars**

**Length (L m3)**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 168. | 364. | 25. |
| Min | 2.30 | 2.425 | 2.6 |
| Max | 3.0 | 3.05 | 3.0 |
| X | 2.673631 | 2.768118 | 2.7712 |
| Median | 2.675 | 2.775 | 2.77 |
| SD | 0.120143 | 0.113622 | 0.092481 |
| V ‘ | 26.41509 | 22.83105 | 14.28571 |
| CV | 4.493625 | 4.104683 | 3.337205 |
| K | 0.018222 | 0.011689 | 0.038888 |

**Anterior width (Wa m3)**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 167 | 353 | 25 |
| Min | 1.875 | 1.85 | 1.87 |
| Max | 2.25 | 2.375 | 2.32 |
| X | 2.07444 | 2.090705 | 2.0524 |
| Median | 2.075 | 2.1 | 2.06 |
| SD | 0.07697 | 0.087002 | 0.105959 |
| V ‘ | 18.18182 | 24.85207 | 21.47971 |
| CV | 3.710615 | 4.155462 | 5.162693 |
| K | 0.01171 | 0.009089 | 0.044555 |

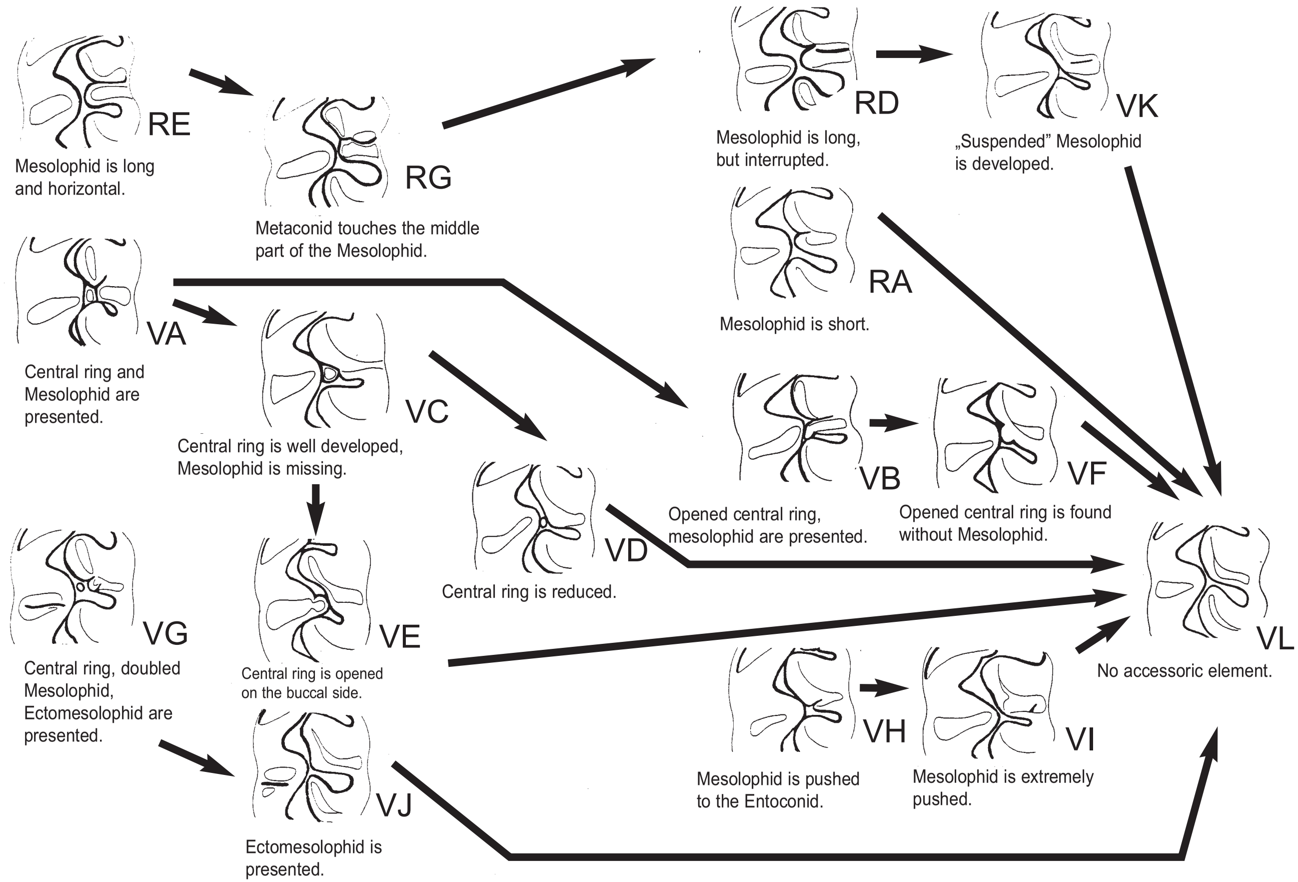



Fig. 17. Morphodynamic scheme of the morphotypes on the central region of m2 molars.

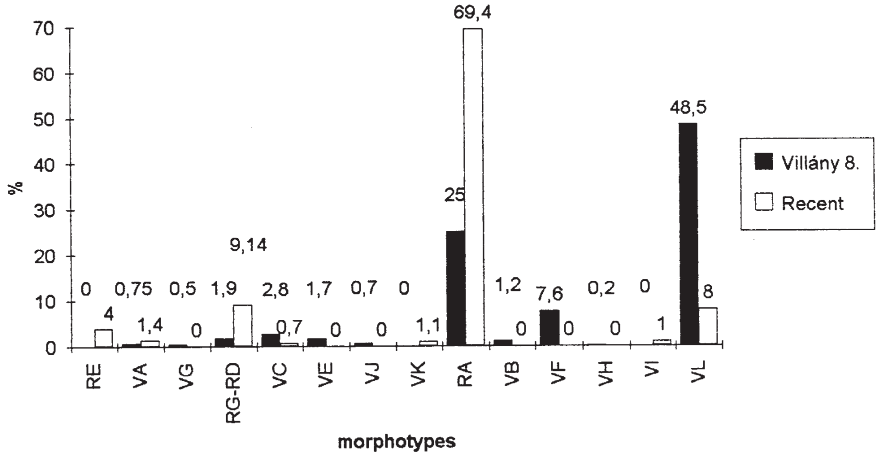



Fig 18. The frequency of the m2 central region morphotypes.

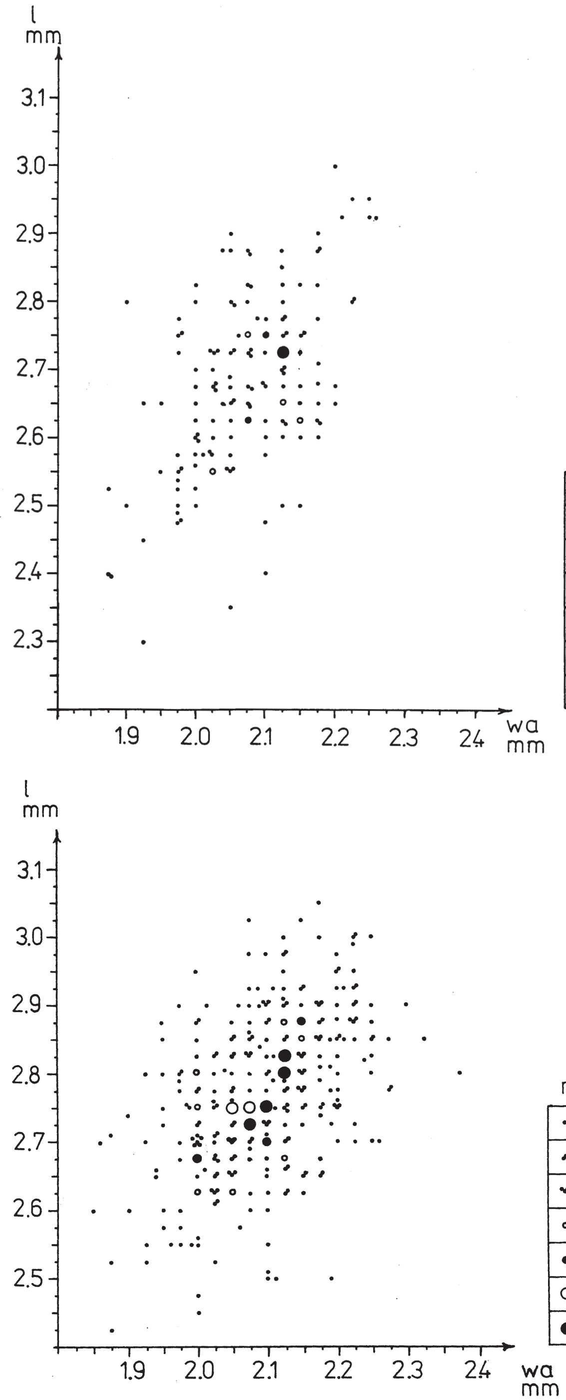



Fig. 19. Scatter diagrams of m3 molars. A: recent material, B: Villány 8. 1-7= Fig. 2.

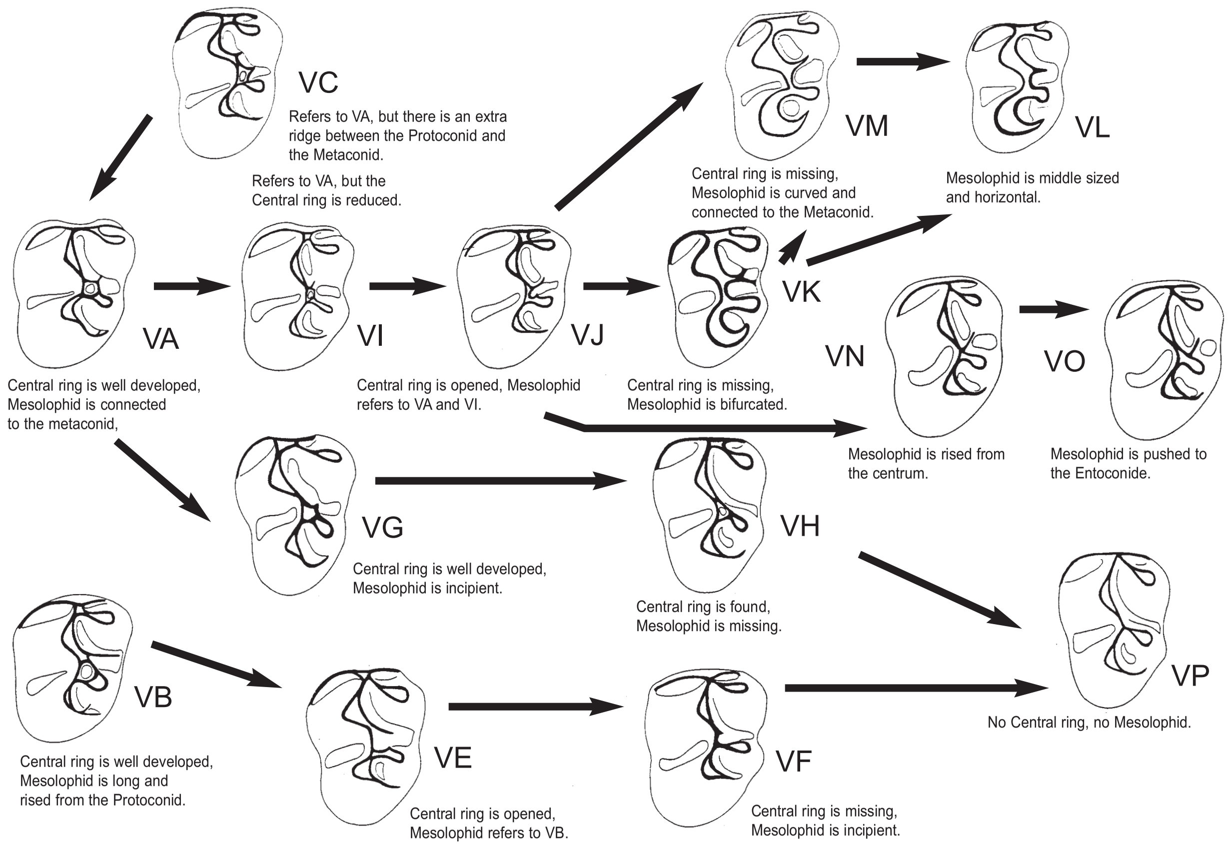



Fig. 20. Morphodynamic scheme of the morphotypes of m3 molars.

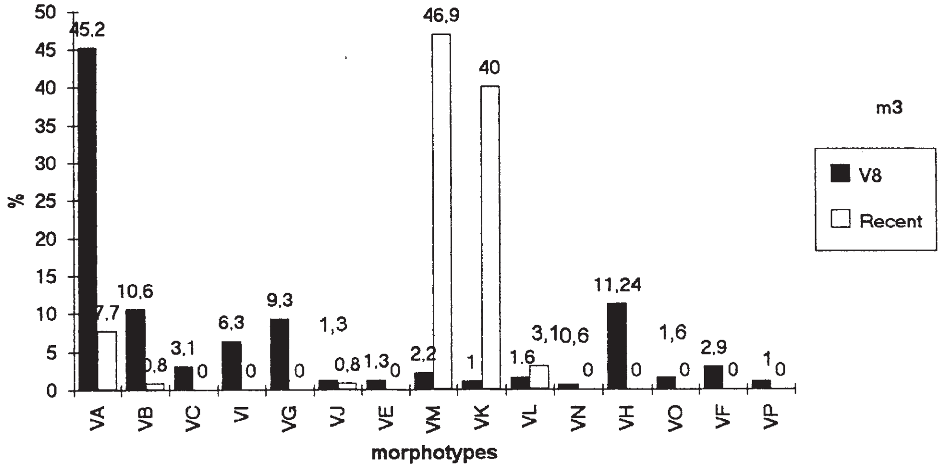



Fig. 21. The frequency of the m3 morphotypes.

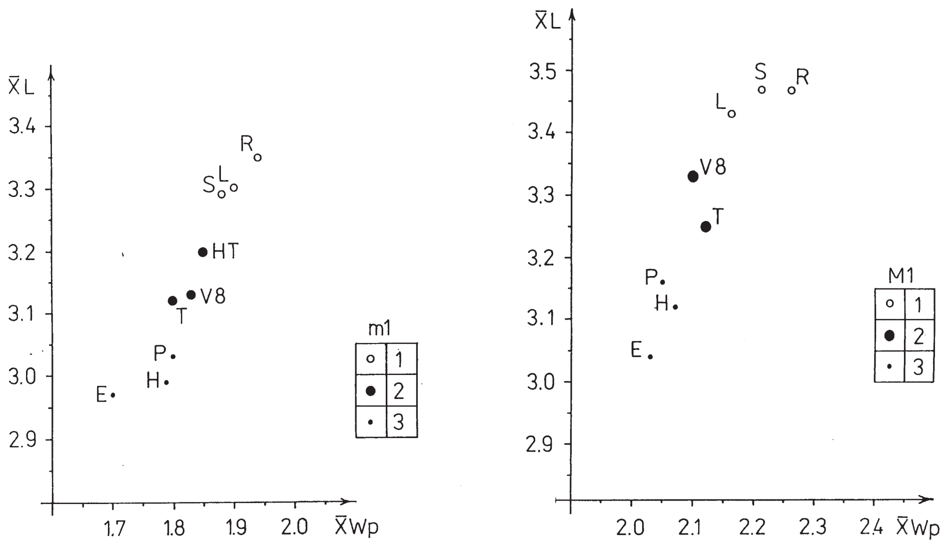



Fig. 22. Scatter diagram of the mean values of M1 and m1 molars of some fossil and recent *Cricetus* populations from Europe.

1: *C. runtonensis* group; L: *Cricetus* sp. from Solymár (Hungary) (HÍR, 1997)
R: *Cricetus runtonensis*, Poland (PRADEL, 1988) S: *Cricetus runtonensis*, Somssich-hegy 2 (Hungary) (HÍR, 1998)
2: *C. praeglacialis* group; HT: holotype T: type material (Tabs. II., VI., V8.): Villány 8 (Tabs. II., VI.);
3: *C. cricetus* group; E: *C. cricetus* ssp. recent, Germany (FAHLBUSCH, 1976)
H: *C. cricetus* ssp. recent, Hungary (Tabs. II., VI.); P: *C. cricetus* ssp. recent, Poland (PRADEL, 1981)

**Tab. IX. Proportions in complete lower toothrowes**

**L m1 / L m2 relations**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 166 | 143 | 16 |
| Min | 1.087379 | 1.102804 | 1.148 |
| Max | 1.5625 | 1.322917 | 1.3 |
| X | 1.366106 | 1.21684 | 1.233958 |
| Median | 1.403138 | 1.217627 | 1.230687 |
| SD | 0.120775 | 0.038563 | 0.040146 |
| V ‘ | 35.85983 | 18.14826 | 12.4183 |
| CV | 8.840847 | 3.169108 | 3.253415 |
| K | 0.018429 | 0.006343 | 0.022079 |

**L m3 / L m2 relations**

| | Recent | Villány 8 | *C. praeglacialis* typematerial |
|---|---|---|---|
| n | 166 | 144 | 18 |
| Min | 0.893204 | 0.961905 | 1.011673 |
| Max | 1.435897 | 1.181818 | 1.150794 |
| X | 1.216611 | 1.073947 | 1.09103 |
| Median | 1.23953 | 1.07619 | 1.096348 |
| SD | 0.108927 | 0.039507 | 0.032075 |
| V ‘ | 46.60115 | 20.51692 | 12.86683 |
| CV | 8.953311 | 3.678684 | 2.939891 |
| K | 0.016621 | 0.006475 | 0.016414 |

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Dr. HÍR János
H-3060 PÁSZTÓ
P.o.b. 15.