# EARLY VILLANYIAN SITE OF HAJNÁČKA I (SOUTHERN SLOVAKIA)

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*devoted to Oldřich FEJFAR*

# Preface

How did far advance the knowledge on the pre-Quaternary fossil mammals from the Slovak territory of the Western Carpathians for the last 100 years of their investigation? Except for a few exceptions (ZAPFE´s research of Neudorf sites or FEJFAR´s researches of several sites etc.), mostly isolated records have been published in the scientific literature only. The main reason could be in the trend mainly for the study of Pleistocene mammals, fossils of which are found in the large quantity in karst areas (especially in caves). To the older periods, a lesser attention has been paid. The reasons are several: geological conditions, inadequate fossilisation background, and/or the research trended to other aspects than mammals or vertebrates resp.

However, a large quantity of new data on the pre-Quaternary (especially Neogene) ecosystems and major changes in the composition of mammal communities has been published for the last some years. The result of that is already well-known MN-zonation of terrestrial deposits not only in Europe, founded on the mammal records from suitable sites. One of these sites is Hajnáčka I in southern Slovakia, as a type locality for the MN 16 zone, Early Villanyian.

Fossil records from Hajnáčka, in older literature also known under the Hungarian name Ajnácskö, are already known from the 19th century, when EMIL VON EBECZKY collected accidental findings of skeleton remains of „mastodons" and tapirs. All these records were collected non-systematically without the regard to stratigraphical circumstances. However, these sensational fossils stimulated systematic researches of the site based on natural outcrops.

After the first pioneer field-works, realized by F. KUBINYI, J. SZABÓ, C. M. PAUL, J. S. KRENNER, and F. SCHAFARZIK in the second half of the 19th century, T. KORMOS carried out the first intentional excavations, yielding so more exact data on the site and its fauna. Later, O. FEJFAR established to KORMOS´s investigation and as the head of the field crew from Geological Survey in Prague started new excavations on the site in 1955. This new research was especially oriented to the exact age determination of the Hajnáčka fauna and to obtain as far as possible a complete picture of its assemblage. The results of his triennial field-work were published in the world-famous monograph „*The Lower Villafranchian Vertebrates from Hajnáčka near Filákovo in Southern Slovakia*" (1964). This important scientific study became a basis for subsequent investigations of the site already oriented to new geological, sedimentological, volcanological, paleomagnetic, floristic, and paleoecological aspects.

After more than 35 years from the last FEJFAR´s investigation, the new systematic research of Hajnáčka began under leadership of M. KUNDRÁT from the Gemer-Malohont Museum in Rimavská Sobota in 1996. One year later, the Department of Geology and Paleontology from Comenius University in Bratislava has been integrated to the research with M. SABOL as a new head of the excavations. This research, whose field-work part was finished in the summer of 2000, yielded a large quantity of new data, allowing so to specify our view to whole Hajnáčka taphocoenosis. All data are else not evaluated (e. g. finds of lower vertebrates and artiodactyls are still under study), but substantial part of these new ones is already presented in this work. I hope, it will be benefit not only for wide scientific community, similarly like FEJFAR´s monograph from 1964.

Finally, the first of all, I would like to thank to Prof. O. FEJFAR for his valuable advice and comments. Also, I express my appreciation to the editorial crew at Comenius University Press, to the staff of the Gemer-Malohont Museum, to many sponsors, and especially to all authors for patience and cooperation. My best thanks.

*The Editor*

# 8. RHINOCEROSES

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**Abstract.** This paper describes new fossil records of the rhinoceros *Dicerorhinus jeanvireti* GUÉRIN, 1972 discovered near village of Hajnáčka (southern Slovakia) during a paleontological excavation of the paleontological site Hajnáčka I in 1996 – 2000.

**Key words:** *Dicerorhinus jeanvireti,* Late Pliocene, Hajnáčka, Slovakia

## INTRODUCTION

Hajnáčka has been known as the finding site of fossil mammals since 1863. KUBINYI (1863 in KORMOS, 1917) presented the first written information on these records. He identified among other records also the remains of rhinoceroses giving them the name *Rhinoceros.* The next information on the Hajnáčka rhinoceroses was published by FUCHS (1879). This author mentions two or three species of the genus *Rhinoceros.* KORMOS (1917), investigating his own collections and reviewing the material from the collection of the former (Royal) Geological Institute in Budapest, confirmed only one species – *Rhinoceros* cf. *leptorhinus* CUV. (= *megarhinus* CHRISTOL). On the basis of her studies of some material (nasal bones) from Hajnáčka deposited at the Natural History Museum in Vienna, MOTTL (1939) identified, apart from the species *D. megarhinus* also the more advanced species of rhinoceros presuming it to be *C. etruscus* FALC. She considered the morphological differences in the development of the nasal bones as the main determining feature of the species. THENIUS (1955) reviewed the same material, however, he confirmed only the species *D. megarhinus.* In his opinion, the morphological differences in the development of the nasal partition were caused by sexual dimorphism. The most extensive research into the site realised FEJFAR (1964) in 1955 – 1958, but he determined only the species *Dicerorhinus megarhinus* (CHRISTOL, 1835).

The last research at the locality situated not far from the village of Hajnáčka near Fil'akovo (southern Slovakia), realised between 1996 and 2000 in co-operation with the Department of Geology and Paleontology of the Faculty of Sciences, Comenius University in Bratislava and the Gemer-Malohont Museum in Rimavská Sobota, yielded also the osteological remains of the rhinoceroses, which are presented in this paper.

## MATERIAL AND METHODS

The remains of rhinoceroses, as well as of some other vertebrates, discovered during the field works between 1996 and 2000, are very fragmentary. The overall number of 115 studied specimens of rhinoceroses includes: 5 fragments of mandibles, 41 teeth or their fragments, 26 fragments of ribs, 23 fragments of vertebrae, and 20 bones of limbs or their fragments. Although the material is very fragmentary, it is not rolled. It is supposed the material was probably not discovered in situ, however, it had not been moved for a long distance. The bones are coloured from light brown to brown or light dun, with rusty spots and black dendrites in some places.

Only the teeth and bones in good condition have been measured using the method of GUÉRIN (1980). The measurable specimens were also the subject of calculation of their proportional dimensions (ratio given in %). They were morphometrically compared with rhinoceros specimens from Hajnáčka collected by FEJFAR during his field works between 1955 and 1958 (FEJFAR, 1964), as well as with the remains of the species *Dicerorhinus megarhinus* (CHRISTOL, 1835), *Dicerorhinus jeanvireti* GUÉRIN, 1972 and *Dicerorhinus etruscus etruscus* (FALCONER, 1859) coming from some European Pliocene sites (GUÉRIN, 1972, 1980).

The described material is deposited at the Gemer-Malohont Museum, Rimavská Sobota. The Hajnáčka material discovered by FEJFAR in 1955-1958, which was used for comparison, is deposited at the Slovak National Museum – Natural History Museum, Bratislava. Each specimen is marked with both the museum registration number (capital Z plus number) and/or the original number assigned to it by FEJFAR in the course of his research (capital F plus number).

**Abbreviations of the measurements:**

L – length, W – width, H – height, WPE – width of proximal epiphysis (transversal diameter of proximal epiphysis), DPE – antero-posterior diameter of proximal epiphysis, WD – width of diaphysis (transversal diameter of diaphysis), DD – antero-posterior diameter of diaphysis, WDE – width of distal epiphysis (transversal diameter of distal epiphysis), DDE – antero-posterior diameter of distal epiphysis, LPAS – length of proximal articular surface, WPAS – width of proximal articular surface, LDAS – length of distal articular surface, WDAS – width of distal articular surface.

## SYSTEMATIC PALEONTOLOGY

Order Perissodactyla OWEN, 1848
Suborder Ceratomorpha WOOD, 1937
Infraorder Tapiromorpha HAECKEL, 1866
Superfamily Rhinocerotoidea GRAY, 1825
Family Rhinocerotidae GRAY, 1821
Subfamily Rhinocerotinae GRAY, 1821
Tribe Rhinocerotini GRAY, 1821
Subtribe Rhinocerotina GRAY, 1821
Infratribe Rhinoceroti GRAY, 1821
Genus *Dicerorhinus* GLOGER, 1841

*Dicerorhinus jeanvireti* GUÉRIN, 1972
Figs. 8.1-5, Tabs. 8.1-14

1972 *Dicerorhinus jeanvireti* n. sp. – GUÉRIN: 53-150, 6 pl. 22 fig. 31 tab.
1964 *Dicerorhinus megarhinus* (CHRISTOL, 1835). – FEJFAR: 89-101, fig. 51-53, pl. 10, 11.
1980 *Dicerorhinus* (*Brandtorhinus*) *jeanvireti* GUÉRIN, 1972. – GUÉRIN: 434-609, pl. 10-15, fig. 57-84, tab. 84-120.

**Material:** see Table 8.1.
**Type locality:** Vialette, Haute Loire (France).
**Type stratum:** Early Villanyian

**Description and comparison:**

*Lower teeth* – Only three good preserved teeth were suitable for a morphometric evaluation – p3 sin. (B-2118), p4 dext. (B-3039), and m3 sin. (B-3016).

The crown of the **p3 sin.** (B-2118) without roots is preserved only. The tooth is moderately worn, the metalophid is connected with the hypolophid. The anterior and posterior valleys are of V- to wide V-shape. The difference between the levels of the valley bottoms makes 9.5 mm. Both the enamel and the cingulum in anterior and posterior walls were damaged due to the pressure of adjoining teeth. The

rest of the anterior cingulum is observable at the crown base of the internal wall, and even better at the crown base of the external wall. The rest of the posterior cingulum is preserved on the external wall. The external cingulum is absent, what is rather the feature of the species *D. jeanvireti*; the exterior cingulum of p3 of *D. e. etruscus* is usually developed (GUÉRIN, 1980).

**Tab. 8.1.** Well preserved specimens of *Dicerorhinus jeanvireti* from Hajnáčka.

| specimen | evid. num. | probe | found in | preservation |
|---|---|---|---|---|
| p3 sin. | B-2118 | 5/98? | 1999 | crown, without roots |
| p4 dext. | B-3039 | | 96/97 | crown, without roots |
| m3 sin. | B-3016 | - | 96/97 | crown, without roots |
| *scaphoideum* sin. | B-3443 | - | 96/97 | complete bone |
| *hamatum* sin. | B-2136 | - | 1999 | complete bone |
| *os metacarpale* III sin. | B-3552 | 5/98 | - | complete bone |
| *os metacarpale* IV dext. | B-3432 | - | 96/97 | complete bone |
| *os metatarsale* IV dext. | B-3512 | 5/98 | - | complete bone |

The studied third lower premolar metrically falls within the range of p3 of *D. e. etruscus* and is on the lower level of the dimensions of *D. jeanvireti* (Tab. 8.2, Fig. 8.1). The tooth is outside the range documented for p3 of *D. megarhinus* (GUÉRIN, 1980).

**Tab. 8.2.** Measurements of p3 (B-2118) from Hajnáčka and p3 of the Pliocene rhinoceroses documented by GUÉRIN (1980).

| p3 (in mm) | B-2118 | *D. jeanvireti* | *D. e. etruscus* | *D. megarhinus* |
|---|---|---|---|---|
| | Hajnáčka | GUÉRIN, 1980 | | |
| L max. | 34.0 | 33.0 – 38.0 | 31.5 – 37.0 | 35.0 – 44.0 |
| W max. | 23.0 | 23.0 – 27.0 | 21.5 – 29.0 | 22.0 – 31.5 |

The crown of **p4 dext.** (B-3039) without roots is preserved. The tooth is slightly worn, the metalophid and hypolophid are still separated. The both anterior and posterior valleys are of V-shape. The difference between the levels of the valley bottoms makes approximately 3.5 mm. The anterior cingulum is developed and it partially spreads to both internal and external wall. The enamel and the cingulum in the posterior wall have been damaged due to the pressure of a next tooth. The external cingulum is not present.

The tooth metrically falls into the range of the p4 of *D. megarhinus,* but its measures correspond to the maximum measurements of *D. jeanvireti* (GUÉRIN, 1980). The tooth is outside the range of *D. e. etruscus.* The p4 (B-3039) cannot be determined positively on the basis of its dimensions.

**Tab. 8.3.** Measurements of p4 (B-3039; F-2851/Z 26352 (FEJFAR, 1964)) from Hajnáčka and p4 of the Pliocene rhinoceroses documented by GUÉRIN (1980).

| p4 (in mm) | B-3039 | F-2851 (Z 26352) | *D. jeanvireti* | *D. e. etruscus* | *D. megarhinus* |
|---|---|---|---|---|---|
| | Hajnáčka | | GUÉRIN, 1980 | | |
| L max. | 41.4 | 38.0 | 37.0 – 40.5 | 35.0 – 39.5 | 37.5 – 48.0 |
| W max. | 30.0 | 29.0 | 24.0 – 31.0 | 24.0 – 31.0 | 27.5 – 38.0 |

The crown of **m3 sin.** (B-3016) without roots is preserved. One third of the tooth height is worn, the metalophid and the hypolophid are still isolated. The anterior valley is of wide V-shape, the posterior valley is of U-shape. The difference between the levels of the valley bottoms makes approximately

3 mm. The anterior cingulum, partially noticeable in front of the external wall, has been damaged due to the pressure of an adjoining tooth. The feeble posterior cingulum spreads neither to the internal, nor to the external wall of the tooth.

The dimensions of the tooth (Tab. 8.4, Fig. 8.3) are within the range documented for m3 of *D. e. etruscus* and also for *D. jeanvireti*, but the tooth is smaller than m3 of *D. megarhinus* (GUÉRIN, 1980). Considering the morphometric features of the described tooth, it is assigned to the species *D. jeanvireti.*

**Tab. 8.4.** Measurements of m3 (B-3016), the former records of m3 (FEJFAR, 1964) from Hajnáčka, and m3 of the Pliocene rhinoceroses documented by GUÉRIN (1980).

| **m3** (in mm) | B-3016 | F-2852 (Z 26355) | F-3968 (Z 26353) | F-6485 (Z 26354) | *D. jeanvireti* | *D. e. etruscus* | *D. megarhinus* |
|---|---|---|---|---|---|---|---|
| | Hajnáčka | | | | GUÉRIN, 1980 | | |
| L max. | 50.5 | 50.0 | 50.4 | 51,1 | 43.3 – 52.0 | 41.0 – 50.0 | 48.0 – 62.0 |
| W max. | 28.4 | 31.0 | 31.2 | 30.8 | 26.0 – 33.0 | 26.0 – 33.0 | 29.5 – 37.0 |

**Scaphoideum sin.** (*os carpi radiale*, B-3443). According to GUÉRIN (1980), the scaphoideum of *D. jeanvireti* is slightly longer and wider, and distinctly higher than those of *D. megarhinus*, which results in the larger height to length ratio of *D. jeanvireti.* The lateral side of the scaphoideum of *D. megarhinus* is higher than the medial one, while this one applied to *D. jeanvireti* conversely (GUÉRIN, 1980).

The scaphoideum (B-3443) falls within the range of both the species *D. megarhinus* and *D. jeanvireti.* Its dimensions considerably exceed the maximum ones of *D. e. etruscus.* The both height/length ratio of the whole bone and the width/length ratio of the proximal articular surface are very closed to the ratios of *D. jeanvireti.* The two more proportional dimensions (Tab. 8.6) of the two species compared are very similar. Probably, the bone could be assigned to the species *D. jeanvireti.*

**Tab. 8.5.** Measurements of the scaphoideum (B-3443), the former records of scaphoideums (FEJFAR, 1964) from Hajnáčka, and specimens of the Pliocene rhinoceroses documented by GUÉRIN (1980). Some dimensions of the former Hajnáčka records are re-measured (see the parenthesis).

| **scapho-ideum** (in mm) | B-3443 | Z 25720 | F-3523 (Z 25690) | F-3165 (Z 25691) | F-4011 (Z 25689) | *D. jeanvireti* | *D megarhinus* | *D. e. etruscus* |
|---|---|---|---|---|---|---|---|---|
| | Hajnáčka | | | | | GUÉRIN, 1980 | | |
| L | cca. 94 | (98.0) | - | - | (95.0) | 95.0 – 103.0 | 83.0 – 106.0 | 67.0 – 82.5 |
| W | cca. 60 | - | (55.0) | - | (56.5) | 56.0 – 62.0 | 50.0 – 72.5 | 41.0 – 51.0 |
| H | 71.5 | (70.0) | 71.0 (73.0) | - | 76.0 (74.0) | 72.0 – 83.0 | 64.5 – 78.0 | 52.5 – 65.0 |
| LPAS | cca. 54 | cca. (55) | 58.0 (54.4) | - | 57.0 (55.0) | 51.0 – 57.0 | 51.0 – 61.0 | 42.0 – 48.0 |
| WPAS | cca. 59 | - | 57 (cca 55) | - | 56.0 (57.4) | 44.0 – 64.0 | 42.0 – 63.0 | 40.0 – 49.0 |
| LDAS | cca. 75 | (72.7) | - | 72.0 | 72.0 (76.8) | 68.0 – 77.0 | 58.0 – 80.0 | 55.0 – 65.0 |
| WDAS | 35.3 | (34.3) | (29.5) | - | (35.8) | 33.0 – 34.0 | 27.5 – 36.0 | 25.0 – 31.0 |

**Tab. 8.6.** Width to length and height to length ratios of scaphoideum.

| Ratio in % | B-3443 | Z 25720 | F-4011 (Z 25689) | *D. jeanvireti* | *D. megarhinus* |
|---|---|---|---|---|---|
| | Hajnáčka | | | GUÉRIN, 1980 | |
| W/L | 63.8 | - | 59.5 | 60.5 | 60.5 |
| H/L | 76.1 | 71.4 | 77.9 | 76.8 | 74.1 |
| W/LPAS | 109.3 | - | 104.4 | 102.0 | 94.8 |
| W/LDAS | 47.1 | 47.2 | 46.6 | 45.6 | 45.6 |

**Hamatum sin.** (*os carpale IV*, B-2136). The dimensions of the hamatum (B-2136) are larger than those observed in *D. e. etruscus.* However, they fall within the observed ranges for *D. jeanvireti* and *D. megarhinus* (GUÉRIN, 1980), and are very near to the records from Vialette (GUÉRIN, 1972). The

length is slightly larger than maximal length of *D. jeanvireti* mentioned by GUÉRIN (1972, 1980). The bone cannot be classified on the grounds of proportional measure comparison, because the width/length ratio assigns the bone to *D. jeanvireti*, while the height/length ratio to *D. megarhinus* (Tab. 8.8).
When comparing dimensions of the hamatum (B-2136) with the former records from Hajnáčka (FEJFAR, 1964), it corresponds with the specimen F-3372 (Z 25725), but is noticeably smaller than F-4221 (Z 25882).

Hence, on the basis of metric features, it is not possible to determine the bone B-2136 to the particular species. Like the other described bones, it could be presumably classified as the species *D. jeanvireti*.

**Tab. 8.7.** Measurements of the hamatum, B-2136 and the former records from Hajnáčka (FEJFAR, 1964), the records from Vialette (GUÉRIN, 1972), and the specimens of the Pliocene rhinoceroses documented by Guérin (1980).

| **hamatum** (in mm) | B-2136 | F-3372 (Z 25725) | F-4221 (Z 25882) | *D. jeanvireti* | | | *D. jeanvireti* | *D. megarhinus* | *D. e. etruscus* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | V 280 | V 281 | Vt 621 | | | |
| | Hajnáčka | | | Vialette | | | GUÉRIN, 1980 | | |
| L max. | 101.0 | 95.0 | - | 97.0 | 97.0 | - | 93.0 – 97.0 | 94.0 – 102.0 | 75.0 – 87.5 |
| L anatomic | 73.0 | 71.0 | - | 72.0 | 72.0 | 82.0 | 69.0 – 82.0 | 66.5 – 83.5 | 53.0 – 67.0 |
| W | 73.0 | 69.0 | 77.0 | 70.0 | 70.0 | 70.0 | 70.0 – 76.0 | 66.0 – 78.0 | 55.5 – 73.0 |
| H | 56.5 | 56.0 | 63.0 | 54.0 | 56.0 | 61.0 | 53.0 – 61.0 | 50.0 – 62.0 | 44.0 – 52.0 |

**Tab. 8.8.** Ratios of width and height to maximal length of hamatum.

| Ratio in % | B-2136 | F-3372 (Z 12725) | *D. jeanvireti* | | *D. jeanvireti* mean | *D. megarhinus* mean |
|---|---|---|---|---|---|---|
| | | | V 280 | V281 | | |
| | Hajnáčka | | Vialette | | GUÉRIN, 1980 | |
| W / L max. | 72.3 | 72.6 | 72.2 | 72.2 | 74.8 | 76.1 |
| H / L max. | 55.9 | 59.0 | 55.7 | 57.7 | 59.4 | 57.4 |

***Os metacarpale III* sin.** (B-3552) is considerably larger than those of *D. e. etruscus*, it falls within the metacarpal III range of *D. megarhinus* and *D. jeanvireti* (GUÉRIN, 1980). The width-length proportional dimensions are close to the average of those of *D. jeanvireti*, and are lower than those of *D. megarhinus*. It means the rhinoceros from Hajnáčka reveals, just like *D. jeanvireti*, slender metapodials as the evolutionary older species *D. megarhinus*.

The metacarpal III (B-3552) metrically corresponds with the former specimen from Hajnáčka (FEJFAR, 1964) and with metacarpals of *D. jeanvireti* mentioned by GUÉRIN (1972, 1980).

**Tab. 8.9.** Measurements of the metacarpal III, B-3552 and the former record from Hajnáčka (FEJFAR, 1964), the records from Vialette (GUÉRIN, 1972), and the specimens documented by GUÉRIN (1980).

| **Mc III** (in mm) | B-3552 | F-3093 (Z 25740) | *D. jeanvireti* | | | *D. jeanvireti* | *D. megarhinus* | *D. e. etruscus* |
|---|---|---|---|---|---|---|---|---|
| | | | V298 | Vt 620 | Vt 621 | | | |
| | Hajnáčka | | Vialette | | | GUÉRIN, 1980 | | |
| L | 230.0 | 236.5 | 229.0 | 219.0 | 236.0 | 211.0 – 237.0 | 213.0 – 243.0 | 192.0 – 220.5 |
| WPE | 65.0 | 66.0 | 66.0 | 62.0 | 68.0 | 57.0 – 69.0 | 56.0 – 75.0 | 48.5 – 58.0 |
| DPE | 55.0 | 56.0 | 58.0 | 57.0 | 56.0 | 48.0 – 58.0 | 48.0 – 58.0 | 42.0 – 51.0 |
| WD | 58.7 | 53.4 | 52.0 | 56.0 | 59.0 | 51.0 – 63.0 | 51.5 – 68.0 | 45.0 – 53.5 |
| DD | 22.6 | 23.4 | 24.0 | 22.0 | 21.0 | 20.0 – 24.0 | 18.5 – 25.0 | 18.0 – 24.5 |
| WDE | 68.0 | 68.0 | 66.0 | 64.0 | - | 60.0 – 71.0 | 60.0 – 80.0 | 49.0 – 61.0 |
| WDAS | 58.0 | 57.0 | 51.0 | 51.0 | 55.0 | 48.0 – 58.5 | 49.0 – 63.0 | 43.0 – 50.0 |
| DDE | 48.0 | 51.0 | 49.5 | 47.0 | 51.0 | 42.0 – 53.5 | 45.5 – 53.0 | 35.0 – 43.0 |

**Tab. 8.10.** Ratios of width and diameter to length of metacarpal III.

| Ratio in % | B-3552 | Z 25740 F-3093 | *D. jeanvireti* | | | *D. jeanvireti* mean | *D. megarhinus* mean |
|---|---|---|---|---|---|---|---|
| | | | V298 | Vt 620 | Vt 621 | | |
| | Hajnáčka | | Vialette | | | Guérin 1980 | |
| WPE/L | 28.3 | 27.5 | 28.8 | 28.3 | 28.8 | 28.0 | 29.7 |
| WD/L | 25.8 | 22.6 | 22.7 | 25.6 | 25.0 | 25.4 | 27.0 |
| DD/L | 9.7 | 9.5 | 10.5 | 10.0 | 8.9 | 9.7 | 9.9 |
| WDE/L | 29.6 | 28.8 | 28,8 | 29.2 | - | 29.0 | 31.2 |
| WDAS/L | 24.4 | 21.2 | 22.3 | 23.3 | 23.3 | 23.6 | 25.0 |

***Os metacarpale IV* dext.** (B-3432). Metacarpals IV of *D. jeanvireti* are longer in average than those of *D. megarhinus*. The ranges of the other dimensions of these species overlap each other. The metacarpals of *D. e. etruscus* are noticeably smaller than those of the above-mentioned two species (GUÉRIN, 1980).

All dimensions of the metacarpal IV (B-3432) are larger than the documented maximum for *D. e. etruscus* (GUÉRIN, 1980). Its length is beyond the maximal value of *D. megarhinus* (GUÉRIN, 1980). The metacarpal IV (B-3432) is metrically very close to the records from Vialette (GUÉRIN, 1972) and also to the mean of *D. jeanvireti* observed by GUÉRIN (1980). The bone is very thin. Its thinness is markedly apparent from the proportional measurements (Tab. 8.12), which also classify the record from Hajnáčka as the species *D. jeanvireti.*

**Tab. 8.11.** Measurements of the metacarpal IV, B-3432 and Z 25868 (F-6475; FEJFAR, 1964) from Hajnáčka, the records from Vialette (GUÉRIN, 1972), and the specimens documented by GUÉRIN (1980).

| **Mc IV** | B-3432 | F- 6475 (Z 25868) | *D. jeanvireti* | | | | | *D. jeanvireti* | *D. megarhinus* | *D. e. etruscus* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V297 | Vt 620 d. | Vt 620 s. | Vt 621 d. | Vt 621 s. | | | |
| | Hajnáčka | | Vialette | | | | | GUÉRIN, 1980 | | |
| L | 196.0 | - | 190.0 | cca. 180 | 185.0 | 198.0 | 200.0 | 180.0 – 201.0 | 172.0 – 189.0 | 157.0 – 177.0 |
| WPE | 48.0 | 49.0 | 52.0 | 45.5 | 50.0 | 56.0 | 57.0 | 45.5 – 57.0 | 48.0 – 54.0 | 40.0 – 45.5 |
| DPE | 46.0 | 47.5 | 44.0 | 45.0 | 41.0 | 42.0 | 41.0 | 41.0 – 46.5 | 36.5 – 47.0 | 32.0 – 40.0 |
| WD | 41.5 | 40.0 | 38.0 | 40.5 | 41.0 | 40.5 | 45.0 | 37.0 – 45.0 | 34.0 – 46.0 | 27.0 – 38.0 |
| DD | 19.5 | 26.0 | 20.0 | cca. 22 | 21.0 | 28.0 | 22.0 | 20.0 – 28.0 | 22.5 – 33.5 | 19.0 – 26.5 |
| WDE | 50.5 | - | 45.0 | 53.0 | 44.0 | 47.0 | 44.0 | 43.0 – 50.0 | 44.5 – 53.0 | 38.0 – 46.0 |
| WDAS | 45.0 | - | 50.0 | - | - | - | - | 38.0 – 53.0 | 41.0 – 49.0 | 34.0 – 42.0 |
| DDE | 45.5 | - | 45.5 | 47.0 | 46.0 | 48.0 | 47.5 | 44.5 – 48.0 | 40.0 – 47.0 | 31.5 – 43.0 |

d. = dexter, s. = sinister

**Tab. 8.12.** Ratios of width to length of metacarpal IV.

| Ratio in % | B-3432 | *D. jeanvireti* | | | | | *D. jeanvireti* mean | *D. megarhinus* mean |
|---|---|---|---|---|---|---|---|---|
| | | V297 | Vt 620 d. | Vt 620 s. | Vt 621 d. | Vt 621 s. | | |
| | Hajnáčka | Vialette | | | | | GUÉRIN, 1980 | |
| WPE/L | 24.7 | 27.4 | 25.3 | 27.0 | 28.3 | 28.5 | 26.7 | 28.1 |
| WD/L | 20.9 | 20.0 | 22.5 | 22.2 | 20.5 | 22.5 | 20.9 | 21.6 |
| WDE/L | 25.8 | 23.9 | 29.4 | 23.8 | 23.7 | 22.0 | 24.8 | 27.4 |
| WDAS/L | 23.0 | 26.3 | - | - | - | - | 23.6 | 23.9 |

***Os metatarsale IV* dext.** (B-3512). Metatarsals IV of *D. e. etruscus* are markedly smaller than those of the two others Pliocene species – *D. jeanvireti* and *D. megarhinus*. When comparing the average measures of the bones mentioned by GUÉRIN (1980), metatarsals IV of *D. jeanvireti* are longer, but more slender than those of *D. megarhinus*.

The measurements of the metatarsal IV (B-3512) are within the range of *D. jeanvireti*, but the metatarsal is longer than the maximal length of *D. megarhinus* observed by GUÉRIN (1980). The width dimensions are within the range of the both mentioned species. All dimensions of B-3512 are very close to those of *D. jeanvireti* from Vialette (GUÉRIN, 1972). The width/length ratios of B-3512 are

also nearer to those of the species *D. jeanvireti.* The metatarsal IV (B-3512) is relatively long and slender, which ranks the specimen to the species D. *jeanvireti.*

The former record from Hajnáčka (F-3200 (Z 25 737); FEJFAR, 1964) is more robust, mainly in the diaphysis, than the metatarsal IV, B-3512. This is noticeable from the diaphysis width/bone length ratio, which is closer to the values of *D. megarhinus.*

**Tab. 8.13.** Measurements of the metatarsal IV, B-3512 and the former record F-3200 (Z 25737; FEJFAR, 1964) from Hajnáčka, the records from Vialette (GUÉRIN, 1972), and the specimens documented by GUÉRIN (1980).

| Mt IV dext. | B-3512 | F-3200 (Z 25737) | *D. jeanvireti* | | | *D. jeanvireti* | *D. megarhinus* | *D. e. etruscus* |
|---|---|---|---|---|---|---|---|---|
| | | | V253 | V254 | Vt 624 | | | |
| | Hajnáčka | | Vialette | | | GUÉRIN, 1980 | | |
| L | 188.0 | 186.0 | 182.0 | 183.5 | 174.0 | 168.0 – 188.5 | 164.0 – 182.0 | 142.0 – 163.0 |
| WPE | 49.0 | 50.0 | 48.0 | 48.0 | 52.0 | 44.0 – 52.0 | 42. – 55.0 | 30.0 – 42.0 |
| DPE | 44.2 | 44.0 | 45.0 | 45.0 | 41.0 | 40.5 – 49.0 | 38.0 – 53.5 | 33.0 – 41.0 |
| WD | 34.0 | 37.0 | 35.0 | 35.0 | 36.0 | 31.0 – 38.0 | 32.0 – 37.0 | 22.0 – 31.0 |
| DD | 27.0 | 32.0 | 30.0 | 30.0 | 23.0 | 23.0 – 36.0 | 22.0 – 35.0 | 20.0 – 28.0 |
| WDE | 40.0 | 46.0 | 40.0 | 39.0 | 37.0 | 40.0 – 44.0 | 39.0 – 42.0 | 29.0 – 41.5 |
| WDAS | 38.5 | 43.0 | 41.0 | 42.0 | - | 37.0 – 45.0 | 35.5 – 42.0 | 28.5 – 35.0 |
| DDE | 40.5 | 43.0 | 44.5 | 44.0 | 44.0 | 41.0 – 49.5 | 40.5 – 47.0 | 33.0 – 39.0 |

**Tab. 8.14.** Ratios of width to length of metatarsal IV.

| Ratio in % | B-3512 | F-3200 (Z 25737) | *D. jeanvireti* | | | *D. megarhinus* mean | *D. jeanvireti* mean |
|---|---|---|---|---|---|---|---|
| | | | V253 | V254 | Vt 624 | | |
| | Hajnáčka | | Vialette | | | GUÉRIN, 1980 | |
| WPE / L | 26.1 | 26.7 | 26.4 | 26.2 | 29.9 | 28.4 | 27.2 |
| WD / L | 18.1 | 19.9 | 19.2 | 19.1 | 20.7 | 19.6 | 19.4 |
| WDE/ L | 21.3 | 23.1 | 22.0 | 21.3 | 21.3 | 23.0 | 23.1 |
| WDAS / L | 20.5 | 23.1 | 22.5 | 22.9 | - | 22.2 | 22.0 |

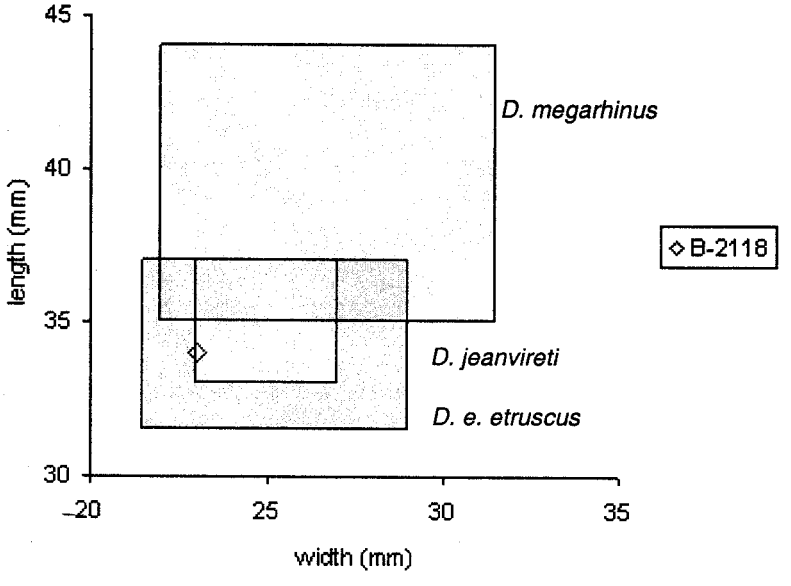


**Fig. 8.1.** Metric comparison between p3 (B-2118) from Hajnáčka, and p3 of the Pliocene rhinoceroses documented by GUÉRIN (1980).

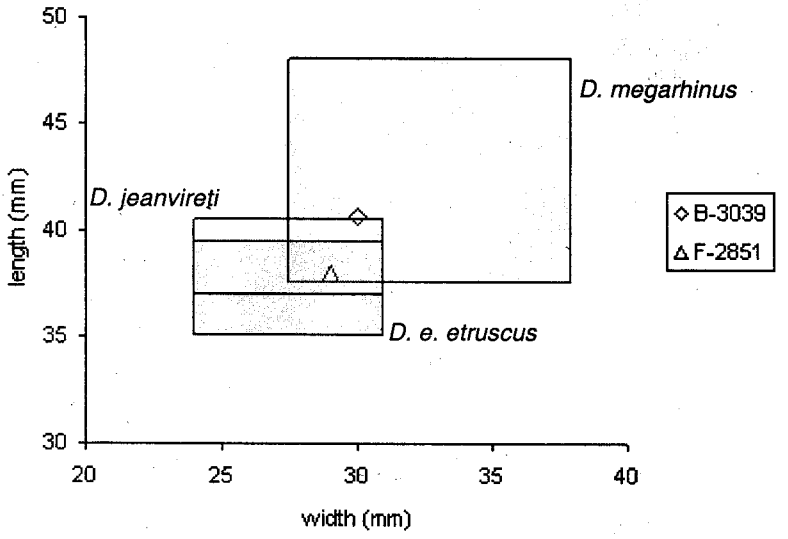


**Fig. 8.2.** Metric comparison between p4 (B-3039), p4 (F-2851; FEJFAR, 1964) from Hajnáčka, and p4 of the Pliocene rhinoceroses documented by GUÉRIN (1980).

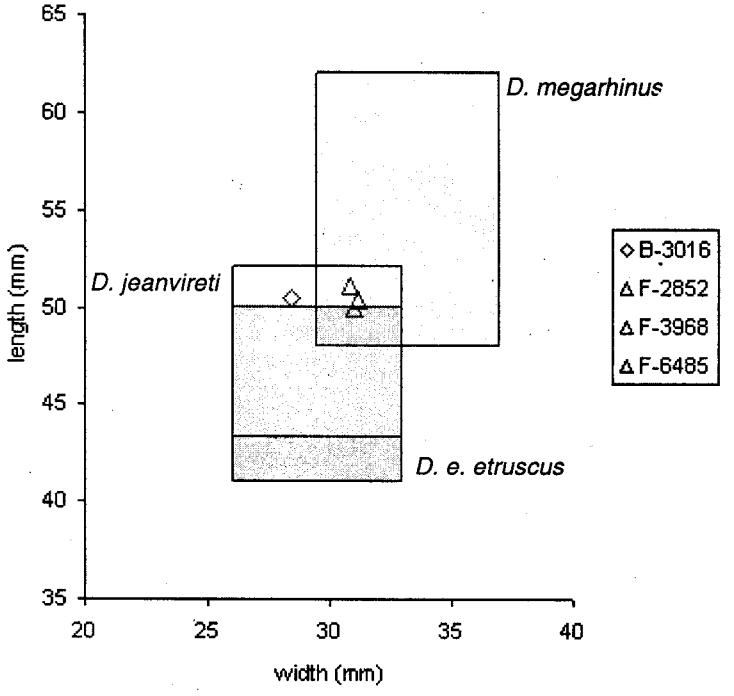


**Fig. 8.3.** Metric comparison between m3 (B-3016), the former records of m3 (FEJFAR, 1964) from Hajnáčka, and m3 of the Pliocene rhinoceroses documented by GUÉRIN (1980).

*Dicerorhinus* sp.
Tab. 8.15

**Material:** see Table 8.15.

**Description:** Besides the above described teeth and bones, that were assigned to *D. jeanvireti*, some other remains of rhinoceroses have been discovered at Hajnáčka during the paleontological field works in 1996 – 2000.

**Tab. 8.15.** Fragmentary specimens from Hajnáčka.

| material | registration number | probe | discovered in | preservation |
|---|---|---|---|---|
| *mandible* | | | | |
| mandible | B-3630 | 3/98 | - | fragment of incisive part (*pars incisiva*) |
| mandible | B-3577 | 3/98 | - | fragment of molar part (*pars molaris*) |
| mandible | B-3442 | - | 96/97 | fragment of molar part (*pars molaris*) |
| mandible | B-3656 | 3/98 | - | fragment of mandibular ramus (*ramus mandibulae*) |
| mandible | B-3430 | - | 96/97 | fragment of molar part (*pars molaris*) |
| *lower teeth* | | | | |
| p3 sin. | B-2118 | 5/98? | 1999 | crown, without roots |
| m3 sin. | B-3016 | - | 96/97 | crown, without roots |
| m1 dext. | B-3039 | - | 96/97 | crown, without roots |
| m | B-3034 | - | 96/97 | fragment of protoconid |
| m | B-3151 | - | 96/97 | fragment, unidentified |
| m dext. | B-3160 | - | 96/97 | fragment of entoconid |
| dens inf., 2 specimens | B-3162 | - | 96/97 | fragments, unidentified |
| dens inf., 2 specimens | B-3174 | - | 96/97 | fragments, unidentified |
| dens inf., 2 specimens | B-3166 | - | 96/97 | fragment, unidentified |
| *upper teeth* | | | | |
| D4 sin. | 3030 | - | 96-97 | incomplete crown, without roots |
| P3 or P4 dext. | 3076 | - | 96-97 | incomplete crown, without roots |
| P sin. | B-3026 | - | 96/97 | heavily worn tooth, without ectoloph |
| M dext. | B-3025 | - | 96/97 | fragment of ectoloph |
| M dext. | B-3032 | - | 96/97 | fragment, unidentified |
| M dext. | B-3033 | - | 96/97 | fragment of metaloph |
| M dext. | B-3091 | - | 96/97 | fragment of ectoloph |
| M dext. | B-3097 | - | ? | fragment of protoloph |
| M SUP | B-3098 | - | 96/97 | fragment of metaloph |
| M sup. | B-3578 | - | 1998 | fragment, unidentified |
| M sin. | B-3557 | - | 1998 | fragment of protoloph |
| M sin. | B-3568 | - | 1998 | preserved only ectoloph |
| M sin. | B-3163 | - | 96/97 | fragment of ectoloph |
| M, 2 specimens | B-3164 | - | 96/97 | fragment of ectoloph |
| M dext. | B-3622 | - | 1998 | preserved only ectoloph |
| M or P | B-4564 | 3/98 | 2000 | fragment, unidentified |
| *unidentified teeth* | | | | |
| dens sup. | B-3161 | - | 96/97 | fragment, unidentified |
| dens sup., 2 specimens | B-3165 | - | 96/97 | fragments, unidentified |
| dens sup. | B-3636 | - | 1998 | fragment, unidentified |
| M?, P? | B-3105 | - | 96/97 | fragment, unidentified |
| dens | B-3158 | - | 96/98 | fragment of root, unidentified |
| dens | B-3173 | - | 96/97 | fragment of root, unidentified |
| dens, 2 specimens | B-3176 | - | 96/97 | fragments, unidentified |
| *ribs* | | | | |
| costa, 7 specimens | B-3187, 3188, 3189, 3387, 3459, 3463, 3465 | - | 96-97 | fragment |
| costa | B-3528 +3535 | 4/98 | 1998 | fragment |
| costa, 13 specimens | B-2138-2140, B-2142-2144, B-2146-2149, B-2153- 2155 | 5/98? | 1999 | fragment |

| material | registration number | probe | discovered in | preservation |
|---|---|---|---|---|
| costa, 5 specimens | B-4541-4543, B-4603, B-4609 | 3/98 | 2000 | fragment |
| *vertebral column* | | | | |
| vertebra cervicalis | B-3641 | 5/98 | | complete without spinosus process (processus spinosus) |
| v. cervicalis | B-2180 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. cervicalis | B-2176 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. cervicalis | B-2169 | 5/98 | 1999 | incomplete vertebral body (corpus vertebrae) |
| v. thoracalis | B-2173 | 5/98 | 1999 | incomplete vertebra |
| vertebra unidentified | B-3338 | - | 96-97 | fragment of vertebral body (corpus vertebrae) |
| v. cervicalis | B-2174 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. thoracalis | B-2178 | 5/98 | 1999 | complete, without spinosus process (processus spinosus) |
| v. thoracalis | B-2170 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. thoracalis | B-2171 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. thoracalis | B-2172 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. thoracalis | B-2179 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. thoracalis | B-2184 | 5/98? | 1999 | fragment of vertebral body (corpus vertebrae) |
| vertebra | B-3286 | - | 96-97 | fragment of vertebral body (corpus vertebrae) |
| v. thoracalis | B-3287 | - | 96-97 | fragment of vertebral body (corpus vertebrae), juv., unfused both caudal and articulate facets, |
| v. thoracalis | B-3539 | 5/98 | | vertebral body (corpus vertebrae), incomplete |
| v. thoracalis | B-3541 | 5/98 | | vertebral body (corpus vertebrae), incomplete |
| v. thoracalis | B-3543 | ? | | vertebral body (corpus vertebrae), incomplete |
| v. cervicalis | B-2175 | 5/98 | 1999 | vertebral body (corpus vertebrae) |
| v. thoracalis | B-2177 | 5/98 | 1999 | vertebral body (corpus vertebrae), incomplete |
| v. cervicalis | B-3288 | - | 96/97 | vertebral body (corpus vertebrae), incomplete |
| v. cervicalis | B-4560 | 3/98 | 2000 | vertebral body (corpus vertebrae) |
| v. caudalis | B-3285 | - | 96/97 | vertebral body juv., unfused both cranial and caudal articulate facets |
| *thoracic limb* | | | | |
| humerus | B-2181 | ? | - | fragment – head (caput humeri) |
| os metacarpale dext. | B-3156 | - | 96/97 | fragment – distal part |
| os metacarpale | B-3423 | - | 96/97 | fragment – incomplete distal part |
| os metacarpale ? | B-3345 | - | 96/97 | fragment – unfused distal articulate facet |
| *pelvic limb* | | | | |
| pelvis | B-3518 | 5/98 | - | fragment – ala ossis ilium with tuber coxae |
| femur dext. | B-3545 | 5/98 | - | fragment – trochlea femoris |
| femur dext. | B-2182 | ? | - | fragment – caput femoris |
| femur sin. | B-3634 | 5/98 | - | fragment – caput femoris |
| femur dext. | B-3519 | 5/98 | - | fragment – condylus lateralis |
| femur dext. | B-3544 | 5/98 | - | fragment – condylus medialis |
| femur | B-3309 | - | 96/97 | fragment – condylus medialis |
| phalanx I | B-3229 | - | 96/97 | complete |
| phalanx I | B-3250 | - | 96/97 | complete |
| phalanx I | B-3253 | - | 96/97 | incomplete, broken during excavations |
| phalanx III | B-3550 | 5/98 | - | incomplete, broken during excavations |

The found fragments are as follows: 5 fragments of mandibles, 12 fragments of lower teeth, 21 fragments of upper teeth, 5 unidentifiable fragments of teeth, 26 fragments of ribs, 23 fragments of vertebrae (2 cervical, 18 thoracic, 2 lumbar, 1 caudal) and 15 fragmentary bones of limbs (1 humerus fragment, 3 metacarpal fragments, 1 pelvic fragment, 6 femur fragments, 4 phalanges). This material (Tab. 8.15) is very fragmentary, so its poor condition does not allow a morphometric description and its more precise determination. These specimens are mentioned here in order to give a complex view of the research results, whereas they can be determined only as the genus *Dicerorhinus* sp.

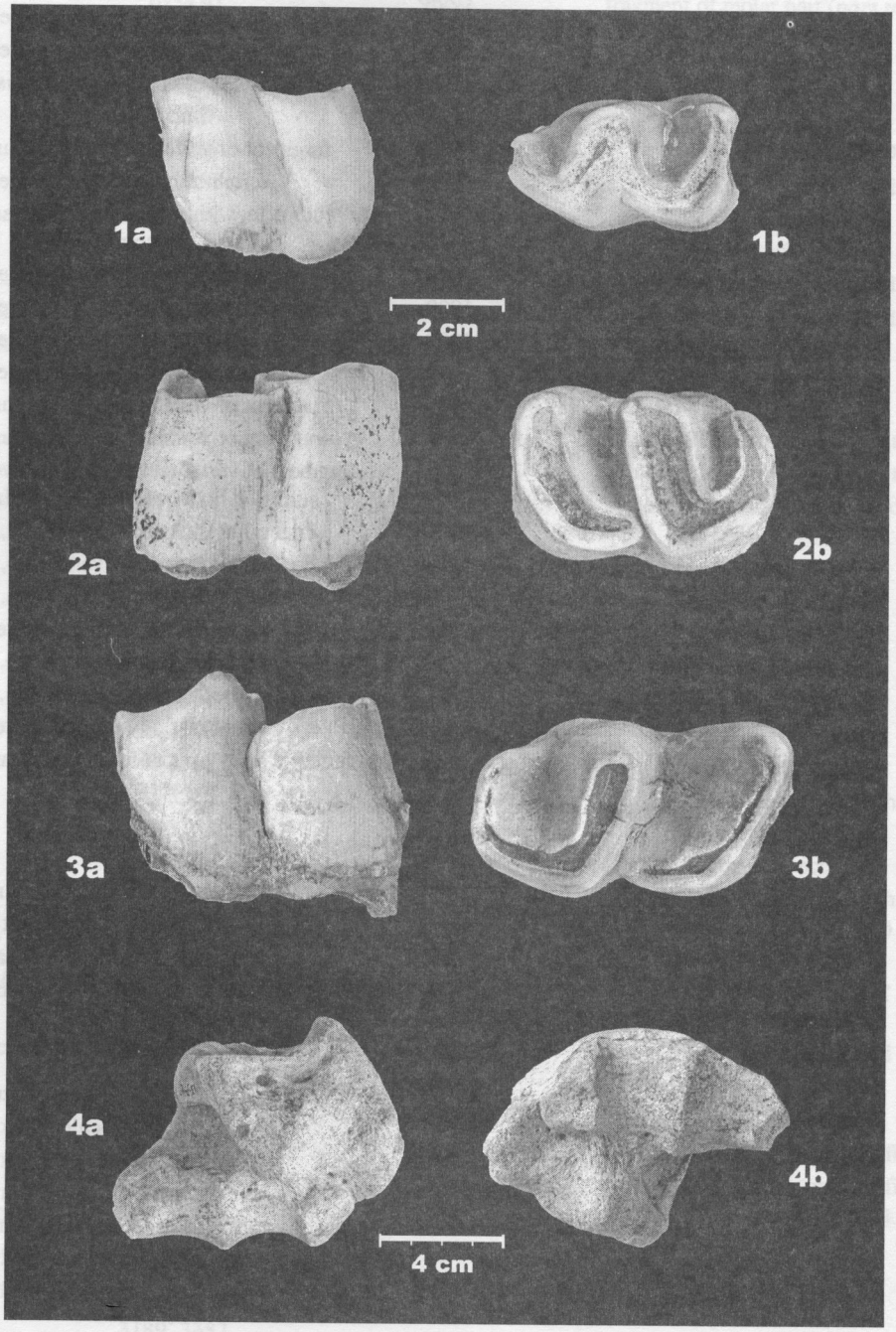


**Fig. 8.4.** *Dicerorhinus jeanvireti* GUÉRIN, 1972.
1. p3 sin. (B-2118): a – labial view, b – occlusal view; 2. p4 dext. (B-3039): a – labial view, b – occlusal view; 3. m3 sin. (B-3016): a – labial view, b – occlusal view; 4. scaphoideum sin. (B-3443): a – lateral view, b – distal articular surface.

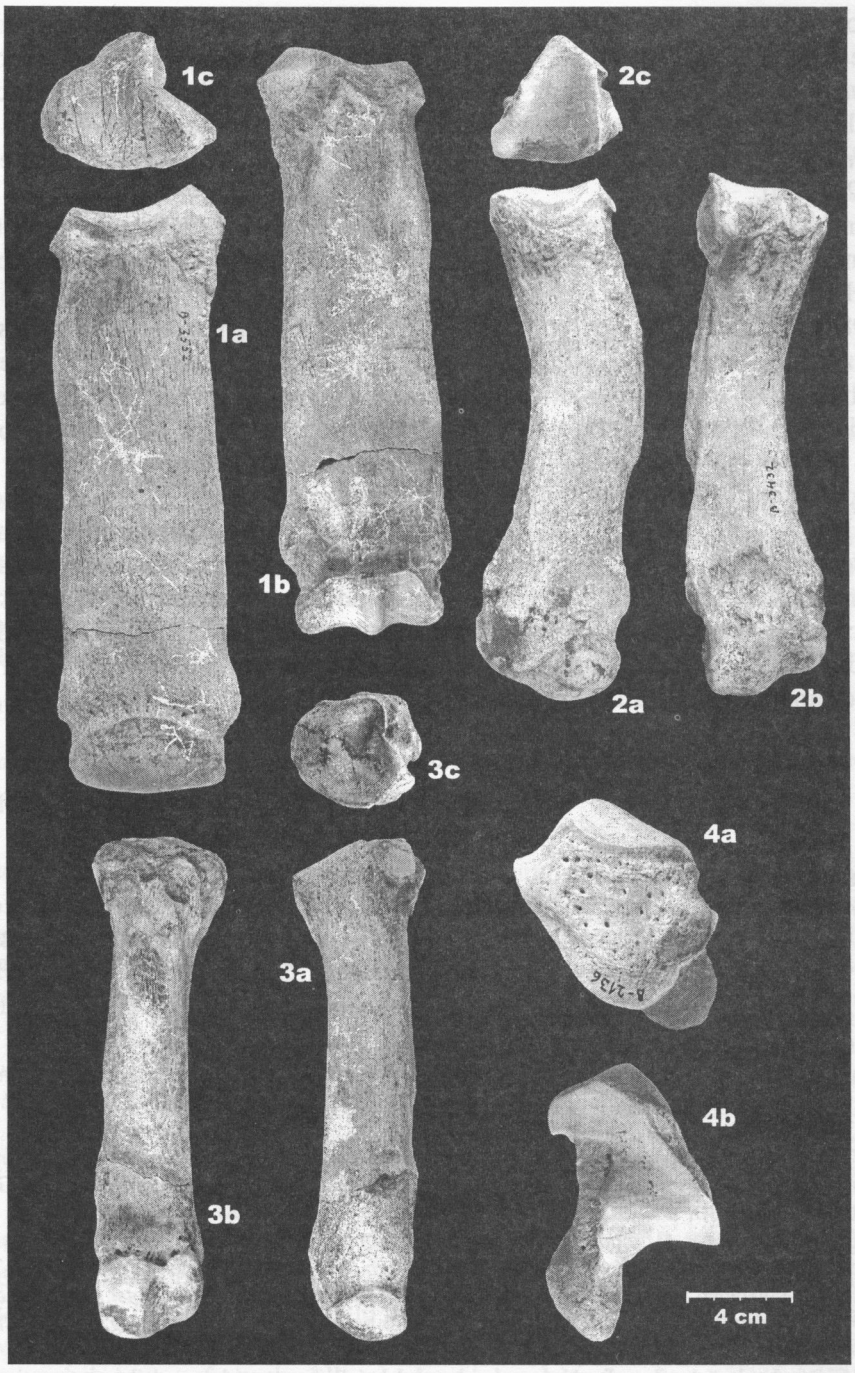


**Fig. 8.5.** *Dicerorhinus jeanvireti* GUÉRIN, 1972.
1. metacarpus III sin. (B-3552): a – dorsal view, b – volar view, c – proximal articular surface; 2. metacarpus IV dext. (B-3432): a – dorsal view, b – volar view, c – proximal articular surface; 3. metatarsus IV dext. (B-3512): a – dorsal view, b – plantar view, c – proximal articular surface; 4. hamatum sin. (B-2136): a – dorsal view, b – medial view.

## DISCUSSION AND CONCLUSION

Most of the involved rhinoceros remnants are fragmentary. Only two carpals, two metacarpals and one metatarsal bone are well preserved, three lower teeth are in a relative good state of preservation. These remnants were convenient for morphometric analysis and comparison with the former records from Hajnáčka, as well as with rhinoceros remains from some Pliocene European sites.

The three lower teeth p3 sin. (B-2118), p4 dext. (B-3039), and m3 sin. (B-3016) metrically correspond to those of *D. e. etruscus* and *D. jeanvireti,* but morphologically more correspond to the lower teeth of *D. jeanvireti*, mainly considering the absence of the external cingulum. The determination of the metapodial bones has been more perspicuous. They are within the metrical range of *D. jeanvireti* and *D. megarhinus*, but they are thinner in relation to their length, which is the feature of *D. jeanvireti* (GUÉRIN, 1972, 1980).

The fragmentary bone remains were determined only as *Dicerorhinus* sp. It is most likely that also these specimens represent *D. jeanvireti,* since the presence of two other Pliocene rhinoceroses was not confirmed at Hajnáčka.

GUÉRIN (1980) considers *D. jeanvireti* and *D. e. etruscus* to be characteristic species of rhinoceroses of the MN 16 zone. *D. megarhinus*, which is evolutionary older than the other two mentioned species, is typical for the MN 14 zone. Its evolutionary later form is typical for the MN 15 zone.

On the basis of the determination of the rhinoceros records from Hajnáčka I to the species *D. jeanvireti,* the sediments, where these fossils have been found are dated to the MN 16 zone, which corresponds accordingly BRUIJN et al. (1992) to the Villanyian. This dating corresponds also to the former research at this site (FEJFAR & HEINRICH, 1987), concerning mainly the micromammals.

*Dicerorhinus jeanvireti* is a very good indicator of its environment. This rhinoceros occupied a thin mixed forest interrupted with extensive zones of grass and ferns. The climate was relatively humid and warm. The accompanying fauna in the forest environment comprised mainly of cervids, „mastodons", and tapirs, and in the case of grass prairie of antelopes and horses (GUÉRIN, 1972). The similar environment can be supposed at the site Hajnáčka I.

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