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Insectivora (Mammalia) from the Miocene of Grytsiv in Ukraine. I. Heterosoricidae VIRET & ZAPFE, 1951

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Abstract. *Dinosorex grycivensis* n. sp. is described from the late Middle Miocene locality Grytsiv in Ukraine. A discussion of its systematic position, its measurements and illustrations are also given.

Key-words: fossil mammals, Insectivora, Heterosoricidae, Miocene, Ukraine.

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I. INTRODUCTION

The oldest localities of terrestrial vertebrates in Ukraine and Moldova are synchronous with the Bessarabian substage of the Middle Sarmatian. In the western European biostratigraphic mammalian scale they represent the Vallesian. The fauna discovered near Grytsiv (Shepetovsky district of the Khmelnitsky region of Ukraine) is the oldest of the small mammal associations of the Ukrainian Vallesian. This fossil locality is situated in the eastern wall of an abandoned quarry, near the village of Grytsiv. The profile is here formed by a 10 m thick layer of middle Sarmatian limestone with karst hollows, filled with sediments containing fossil vertebrates. The limestone layer overlies sandy clays containing a brackish mollusk fauna, in the zone of contact. Above the limestone there is a zone of erosion marked by redeposited fragments of limestone and shells of *Mactra vitaliana* ORBIGNY and by seams of limestone with detritus and pebbles. This zone is covered by clay layers containing *Mactra podolica* EICHWALD in the upper part.

Thus, the karst sediments are situated inside the lower part of the Novomoskovski horizon of the Middle Sarmatian – Bessarabian. Karst hollows are filled mainly with redeposited limestone and brown greenish clays.

The bones of small and large mammals were accompanied by scarce remains of fishes and very numerous amphibians and reptiles. The following taxa of small mammals have been identified so far (number of remains in brackets; Chiroptera have not been studied):

Insectivora: *Schizogalerix* sp. (422), *Lanthanotherium* sp. (15), *Amphechinus* sp. (16), *Domninoides* sp. (323), *Proscapanus* sp. (3), Urotrichini sp. 1 (5), Urotrichini sp. 2 (4), *Plesiodimylus* sp. (40), *Dinosorex grycivensis* n. sp. (57), *Anourosoricodon* (= ? *Crusafontina*) sp. (349), ?*Asoriculus* sp. (12).

Lagomorpha: *Amphilagus sarmaticus* I. TOPACHEVSKY, 1987 (126).

Rodentia: *Miopetaurista* sp. (16), *Blackia* sp. (8), *Forsythia* sp. (4), *Sciurotamias* (= *Spermophilinus*) sp. (221), *Monosaulax* sp. (2), *Palaeomys* sp. (1), *Steneofiber* (?) sp. (3), *Leptodontomys* sp. (10), *Keramidomys* sp. (1), *Glis vallesiensis* AGUSTI, 1981 (5), *Muscardinus topachevskii* NESIN & KOWALSKI, 1997 (15), *Myoglis ucrainicus* NESIN & KOWALSKI, 1997 (63), *Paraglilurus* cf. *werenfelsi* ENGESSER, 1972 (3), *Miodyromys grycivensis* NESIN & KOWALSKI, 1997 (9), *Anomalomys* sp. (207), *Lophocricetus* sp. (8), *Cricetulodon complicidens* TOPACHEVSKY & SKORIK, 1992 (284), *Sarmatomys podolicus* TOPACHEVSKY & SKORIK, 1988 [= *Microtocricetus molassicus* FAHLBUSCH & MAYR, 1975 (KOWALSKI 1993)] (7).

As can be see from the systematic list, the mammalian fauna of Grytsiv represents biozone MN9, being, however, slightly older than the fauna of Can Llobateres in Spain.

The lack of murids and ochotonids is particularly striking.

The specimens described are housed in the collection of the Palaeontological Museum of the National Museum of Natural History in Kiev.

A c k n o w l e d g m e n t s. Authors are indebted to Mr Marek KAPTURKIEWICZ for the illustrations.

II. SYSTEMATIC PART

Family Heterosoricidae VIRET & ZAPFE, 1951

The systematic status of the heterosoricids is not finally established. Some authors (e. g. HUTTERER 1993) prefer to consider them as the subfamily (Heterosoricinae) of the Soricidae, others (e. g. REUMER 1987, ZIEGLER 1989) separate them from the Soricidae (sensu stricto) and elevate to the rank of a family. Authors of the present paper follow the second opinion.

Genus *Dinosorex* ENGESSER, 1972

Dinosorex grycivensis n. sp.

H o l o t y p e. Fragment of mandible with I_1-A_1 and M_1-M_2, without processes. No. 22-297/1.

M a t e r i a l. The list of specimens is given in Table I. Among them are remains of maxillae with I^1, A^1, P^4 - M^2, mandibles with all types of teeth, condyloid processes and some isolated upper and lower teeth.

T y p e l o c a l i t y. Grytsiv, Ukraine.

Type horizon. Early Late Miocene, MN9.

N a m e d e r i v a t i o n. Described from locality Grytsiv in Ukraine.

D i a g n o s i s. A middle size *Dinosorex* species; lower molars have a direct (or nearly direct) course of the hypolophid to entoconid (character known as "modus A"); their buccal and posterior cingula are large and posterior cingulum continues to the end of hypolophid, forming the vertical band in the postero-lingual corner of the teeth; the entocodid crest of lower molars is lacking; M_2 is only slightly smaller then M_1. Facets of the condyle are joined together by a narrow bridge.

Differential diagnosis. *Dinosorex grycivensis* n. sp. differs from *D. sansaniensis* by much smaller dimensions, the presence of "modus A" in lower molars, 3-4 lower antemolars, articular facets of condylus conected, horizontal ramus of mandible, especially below M_1, high and its lower margin convex. Besides, a structure of upper molars is different: in *D. grycivensis* n. sp. M^2 is only slightly smaller than M^1 and their protocones and hypocones are separated by deep valleys, closed from below by a shelfs; M^1 is rectangular, its length beeing smaller than width.

D. grycivensis n. sp. differs from *D. pachygnathus* by being smaller, by the presence of "modus A", by entoconid crests lacking in lower molars, slender I_1, 3-4 lower antemolars, P^4 (in relation to M^1) big and by rather long mesostyle of M^1.

It differs from *D. zapfei* by bigger size, M_2 only slightly smaller than M_1, the horizontal ramus of mandible high and its lower margin convex, buccal and posterior cingula of lower molars large and by their posterior cingula conected with the end of hypolophids by vertical bands.

Table I

Dinosorex grycivensis n. sp.

Number of fragmentary maxillae and detached upper teeth	Number of fragmentary mandibles and detached lower teeth	Total	Minimum number of individuals
20	37	57	14

Description of the holotype (Fig. 1A1 and 1A2). The horizontal ramus of the mandible is high (below M1 H = 4.00 mm) and its lower margin convex. The big mental foramen is situated below the trigonid of M2 (just below the antero-buccal corner of this tooth).

I_1 is long, its lower margin is convex and its apex turned up. The proximal part of this tooth is wide and its buccal surface wrinkled. Its distal part is much narrower and its buccal surface smooth. The buccal cingulum is very clear (pretty wide and protruding) in the upper part of the crown. It disappears in its lower part.

The number of lower antemolars is uncertain because only A_1 is present and edges of alveoli between A_1 and M_1 are damaged.

A_1 is big, unicuspid and deeply notched on its posterior side. The cusp is situated at the front of the tooth, at 1/3 of its length. The anterior part of the crow of A_1 is flat from both (lingual and buccal) sides, the posterior one slightly convex. Its buccal surface is slightly wrinkled. The tooth is devoid of cingulum.

M_1 is slightly longer than M_2 (LM_1/LM_2 ratio = 1.17). The talonid of M_1 is much wider than the trigonid and its outline, in occlusal view, nearly triangular. Its hypolophid is closely connected with the entoconid (modus "A"). The entoconid crest is absent. The protoconid/hypoconid valley reaches the buccal cingulum. The anterior cingulum is narrow and flat, the buccal and posterior ones are large and protruding. The posterior cingulum mounts to the end of the hypolophid on the postero/lingual corner of the tooth. The lingual cingulum is absent.

M_2 is slightly shorter than M_1 and its talonid is only slightly wider than its trigonid. In occlusal view the tooth is nearly rectangular in outline. Its other characters are identical with those of M_1.

Description of the remaining material. Infraorbital foramen is rather large and round and lies above P^4. The lacrimal aperture is also round and situated near the lower part of the infraorbital foramen, above a basis of the zygomatic arch. This

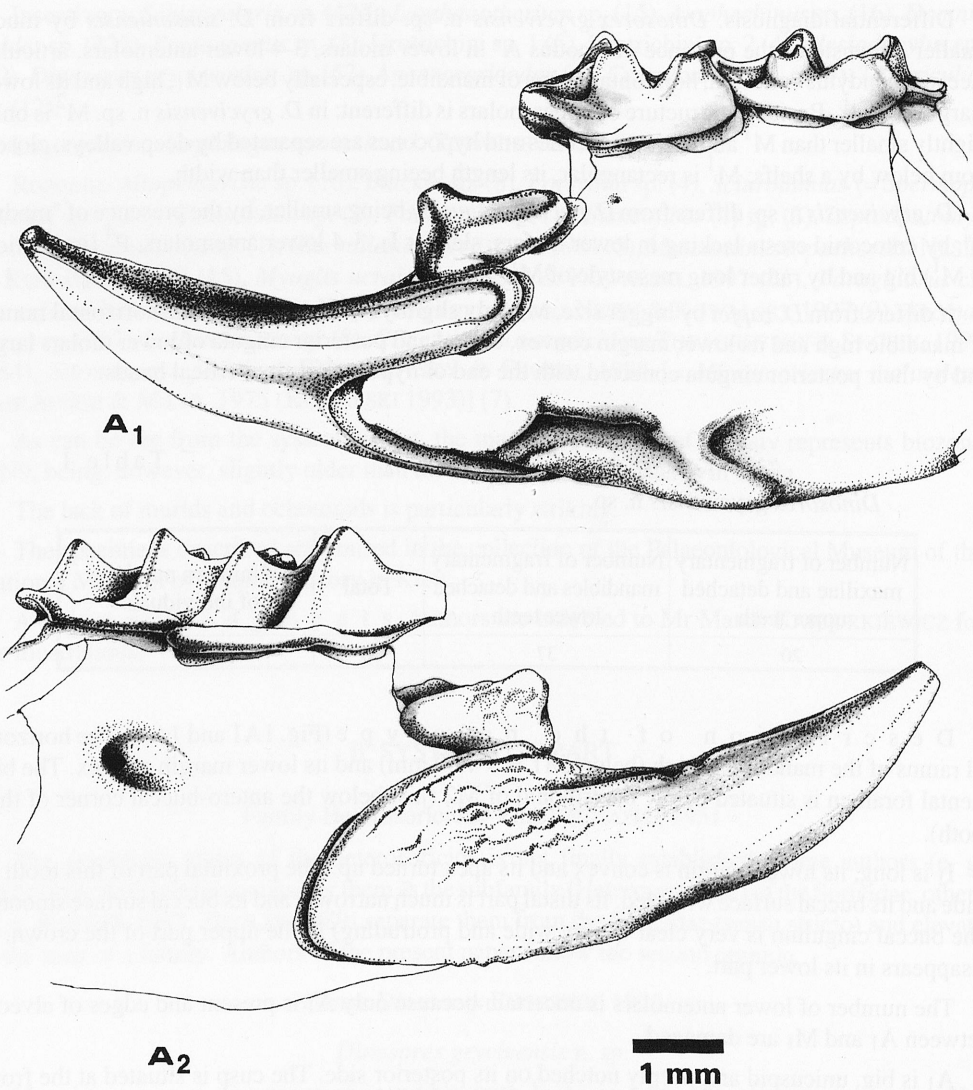

Fig. 1. *Dinosorex grycivensis* n. sp. from Grytsiv (holotype). A1 – fragment of right mandible with I_1-A_1 and M_1-M_2 (lingual side), A2 – the same fragment (buccal side), spec. no. 1.

basis is rather broad, visible between parastyle/mesostyle valley of M^1 and M^2, or a little shorter. I^1 is strong and bifid. Its upper margin is straight and only the apex is curved down. The buccal surface of the crown of I^1 is more or less wrinkled. The weak buccal cingulum is present only at the lower part of the crown (Fig. 2A).

At least 5 antemolars were present in the upper maxilla, but only A^1 and P^4 have been found. A^1 is large. Its buccal side is slightly convex, the lingual one being strongly concave. The tooth is also notched on its posterior side. The main cusp is high and lies nearer the anterior than the posterior side of the tooth. Its tip is connected with the anterior and posterior margins of the crown by sharp ridges. In its lower part, the posterior ridge splits into two branches. A third, less distinct

ridge runs from the tip to the small lingual cuspule. It divides the lingual concave side into two parts: a shallow anterior and a deep posterior one. A second cuspule, much bigger then the previous one, is situated in the postero/lingual corner of A^1. The antero/buccal cingulum is narrow, the postero/buccal and posterior ones are strong. The lingual cingulum is absent. The lingual and posterior surface of A^1 are wrinkled (Fig. 2B).

A^2, A^3 and A^4 are lacking in the material, but their alveoli are visible. Alveoli of A^2 and A^3 are more or less of the same size. They are oval in outline and their length is two times smaller than their width. The alveolus of A^4 is a litte larger and situated parallely to the anterior margin of P^4.

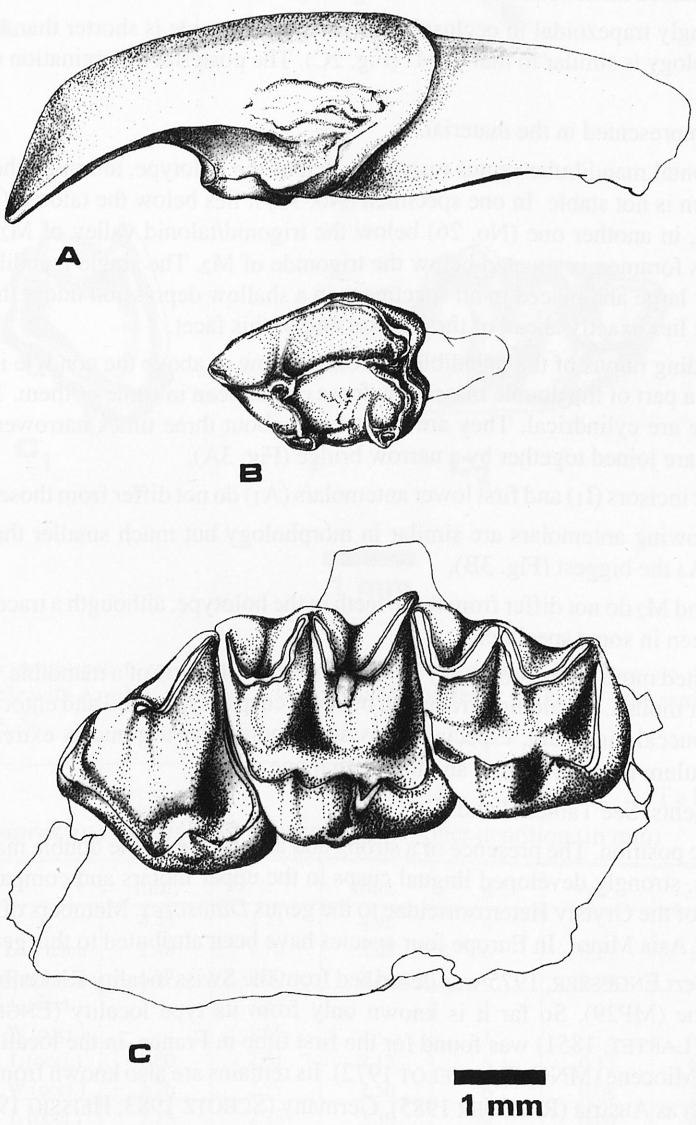

Fig. 2. *Dinosorex grycivensis* n. sp. from Grytsiv. A – left I^1, spec. no. 38, B – left A^1, spec. no. 55, C – fragment of left maxilla with P^4 - M^2, spec. no. 44.

In comparison to M^1, P^4 is not very big. It is characterized by the distinct parastyle, strong paracone and not very long metastyle. The hypoconal flange is very deep. The strong protocone, conical in shape, forms the antero-lingual corner of the crown. The lingual side of the tooth is short and its outline nearly square. In some specimens vestigial hypocone (in the shape of a denticle) can be seen. The cingulum is present on the buccal and especially on the anterior side of P^4 (Fig. 2C).

M^1 is massive, nearly quadrate in occlusal view, but its length is always a little shorter than its width. The parastyle is absent and the anterior side of the tooth stright. The mesostyle is more or less split. The buccal side is not straigth, but in the shape of "W". The metaloph is absent. The deep trigon valley is open and communicates with the deep hypoconal flange by a rather low bridge. The protocone and hypocone are high, pointed and separated by the distinct depression. This depression is closed from below by a shelf (Fig. 2C).

M^2 is strongly trapezoidal in occlusal view (its posterior side is shorter than the anterior one) but its morphology is similar to that of M^1 (Fig. 2C). The posterior emargination of M^1 and M^2 is absent.

M^3 is not represented in the material.

The horizontal mandibular ramus resembles that of the holotype, although the position of the mental foramen is not stable. In one specimen (No. 16) it lies below the talonid (postero - buccal corner) of M_1, in another one (No. 26) below the trigonid/talonid valley of M_2. In most of the specimens this foramen is situated below the trigonide of M_2. The single mandibular foramen is comparatively large and placed in all specimens in a shallow depression under the lower facet of the condyle. It lies exactly ahead of the anterior end of this facet.

The ascending ramus of the mandible is broken below or above the condyle in all specimens. Nevertheless, a part of the double masseteric fossa can be seen in some of them. The upper facets of the condyle are cylindrical. They are shorter and about three times narrower than the lower facets. Facets are joined together by a narrow bridge (Fig. 3A).

First lower incisors (I_1) and first lower antemolars (A_1) do not differ from those of the holotype.

Three following antemolars are similar in morphology but much smaller than A_1. A_2 is the smallest and A_4 the biggest (Fig. 3B).

Also M_1 and M_2 do not differ from those teeth in the holotype, althougth a trace of an entoconid crest can be seen in some specimens.

M_3 is situated more or less obliquely in relation to the long axis of a mandible. It is the smallest of all the lower molars. Its talonid is reduced, but both cusps (hypoconid and entoconid) are clearly visible. The buccal cingulum, especially this surrounding the trigonid is extremely large. The posterior cingulum is much narrow and the lingual one absent.

Measurements. See Tables II and III.

Systematic position. The presence of a strong and acuspulate I_1, the double masseteric fossa in the mandibles, strongly developed lingual cusps in the upper molars and comparatively big size refer remains of the Grytsiv Heterosoricidae to the genus *Dinosorex*. Members of *Dinosorex* lived in Europe and Asia Minor. In Europe four species have been attributed to this genus.

D. huerzeleri ENGESSER, 1975 was described from the Swiss locality Rickenbach, dated to the Late Oligocene (MP29). So far it is known only from its type locality (ENGESSER 1975). *D. sansaniensis* (LARTET, 1851) was found for the first time in France, in the locality Sansan, dated to the Middle Miocene (MN6) (BAUDELOT 1972). Its remains are also known from other European countries, such as Austria (RABEDER 1985), Germany (SCHÖTZ 1983, HEISSIG 1989, FAHLBUSCH et al. 1974 and others), Moldova (LUNGU 1981), Yugoslavia (RABEDER 1978), Spain (AGUSTI & GIBERT 1982, AGUSTÍ et al. 1986 and others) and Switzerland (BOLLIGER 1992, KÄLIN 1993). They are dated from the end of the Early (MN4-5) to the Late Miocene (MN10). *D. pachygnathus*

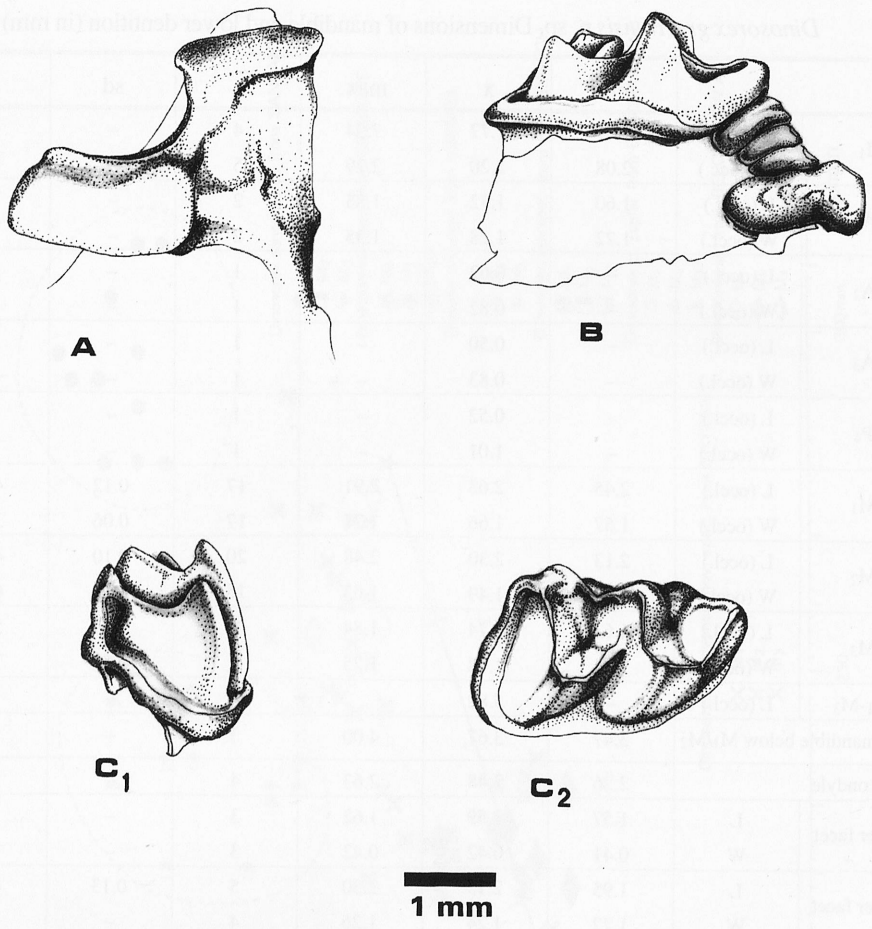

Fig. 3. *Dinosorex grycivensis* n. sp. from Grytsiv. A – condyle (posterior wiev), spec. no. 13, B – fragment of right mandible with A_1 - M_1, spec. no. 8, C1 – right M_1 (posterior wiev), C2 – the same tooth (occlusal wiev), spec. no. 32.

Table II

Dinosorex grycivensis n. sp. Dimensions of upper dentition (in mm)

		min.	x	max.	n	sd	cv
I^1	L	4.45	4.73	4.96	4		
	L of talon	2.48	2.70	3.03	6	0.22	8.15
	H of talon	1.87	2.00	2.14	6	0.09	4.50
A^1	L (occl.)	–	2.34	–	1	–	–
	W (occl.)	–	1.66	–	1	–	–
P^4	L (occl.)	1.80	2.01	2.13	6	0.13	6.47
	W (occl.)	2.26	2.37	2.50	6	0.08	3.37
M^1	L (occl.)	2.13	2.25	2.36	9	0.09	4.00
	W (occl.)	2.50	2.61	2.75	8	0.08	3.06
M^2	L (occl.)	1.98	2.07	2.16	5	0.07	3.38
	W (occl.)	2.18	2.33	2.42	5	0.09	3.86

Table III

Dinosorex grycivensis n. sp. Dimensions of mandible and lower dentition (in mm)

		min.	x	max.	n	sd	cv
I_1	L (bucc.)	7.51	7.77	7.94	4	–	–
	W (bucc.)	2.08	2.20	2.29	5	–	–
A_1	L (occl.)	1.60	1.72	1.85	2	–	–
	W (occl.)	1.22	1.28	1.35	2	–	–
A_2	L (occl.)	–	0.62	–	1	–	–
	W (occl.)	–	0.82	–	1	–	–
A_3	L (occl.)	–	0.50	–	1	–	–
	W (occl.)	–	0.83	–	1	–	–
P_4	L (occl.)	–	0.52	–	1	–	–
	W (occl.)	–	1.01	–	1	–	–
M_1	L (occl.)	2.45	2.63	2.91	17	0.12	4.56
	W (occl.)	1.57	1.66	1.77	17	0.06	3.61
M_2	L (occl.)	2.13	2.30	2.48	20	0.10	4.35
	W (occl.)	1.32	1.49	1.65	18	0.10	6.71
M_3	L (occl.)	1.63	1.74	1.84	5	0.09	5.17
	W (occl.)	1.03	1.18	1.25	5	0.09	7.63
M_1-M_3	L (occl.)	–	5.82		1	–	–
H of mandible below M_1/M_2		3.47	3.67	4.00	3	–	–
H of condyle		2.26	2.48	2.63	4	–	–
Upper facet	L	1.57	1.59	1.62	3	–	–
	W	0.41	0.42	0.42	3	–	–
Lower facet	L	1.95	2.15	2.30	5	0.13	6.05
	W	1.22	1.24	1.26	4	–	–

ENGESSER, 1972 was first described from Anwil in Switzerland, locality of the Middle Miocene age (MN7+8) (ENGESSER 1972). Besides of Anwil it was also noted from the early Late Miocene (MN9) of Germany (BOLLIGER & RUMMEL 1994) and Spain (AGUSTÍ et al. 1982). The last species, *D. zapfei* ENGESSER, 1975, was originally described from the Middle Miocene (MN6) of Devinska Nova Ves (formerly Neudorf)) in Slovakia (ENGESSER 1975, ZAPFE 1951). Later it was also mentioned in Germany (BOLLIGER & RUMMEL 1994, ZIEGLER & FAHLBUSCH 1986 and others), Poland (RZEBIK-KOWALSKA 1994) and Switzerland (KÄLIN 1993). These remains are dated from the Early Miocene (MN4) to the earliest Middle Miocene MN6).

At the first sight, *Dinosorex* from Grytsiv resembles *D. zapfei*. Its size is not very big and lower molars are characterized by a direct contact of the hypolophid with the entoconid ("modus A"), a character known, so far, only in *D. zapfei*. Besides, these teeth, as in *D. zapfei*, are devoid of entoconid crests.

A close analysis showed, however, that the size of the Grytsiv *Dinosorex* is intermediate between the small *D. zapfei* and bigger *D. pachygnatus* and *D. sansaniensis* (see scatter-diagram, Fig. 4). Besides, in contrast with *D. zapfei* the buccal and posterior cingula of their lower molars

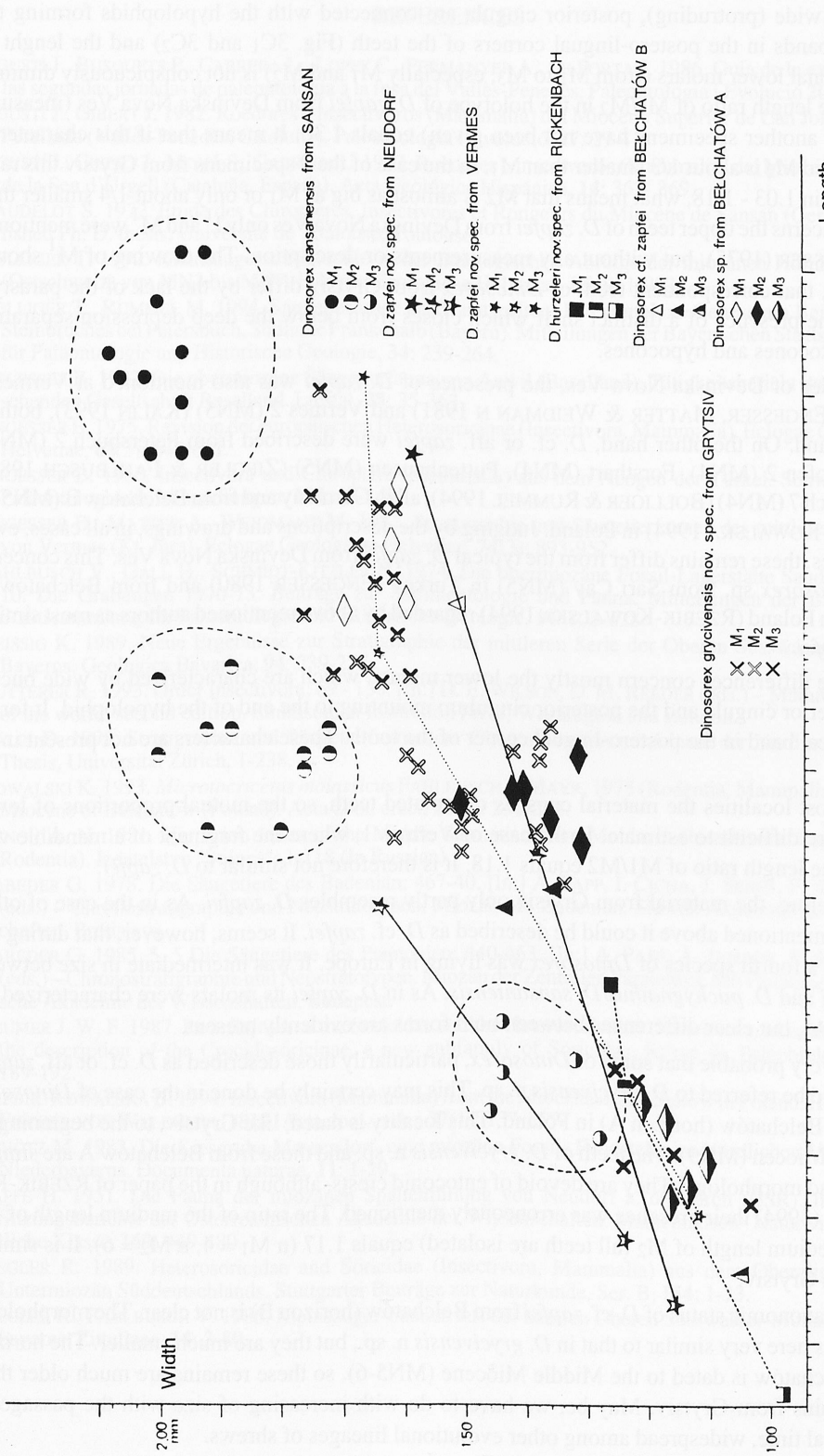

Fig. 4. Scatter-diagram showing the length and width of M_1, M_2 and M_3 in *Dinosorex* (after ENGESSER 1975), completed with *Dinosorex* cf. *zapfei* from Bełchatów B, *Dinosorex* sp. from Bełchatów A and *Dinosorex grycivensis* n. sp. from Grytsiv.

are very wide (protruding), posterior cingula are connected with the hypolophids forming the vertical bands in the postero-lingual corners of the teeth (Fig. $3C_1$ and $3C_2$) and the lenght of successional lower molars (from M_1 to M_3, especially M_1 and M_2) is not conspicuously diminishing. The length ratio of M_1/M_2 in the holotype of *D. zapfei* from Devinska Nova Ves (measurements of another specimens have not been given) equals 1.30. It means that if this character is really valid M_2 is about 1/3 smaller than M_1. In the case of the 9 specimens from Grytsiv this ratio falls within 1.03 - 1.18, what means that M2 is almost as big as M_1 or only about 1/4 smaller than it. As concerns the upper teeth of *D. zapfei* from Devinska Nova Ves only I^1 and M^1 were mentioned by ENGESSER (1975), but without any measurements or description. The drawing of M^1 shows, however, that correspondent teeth of *Dinosorex* from Grytsiv differ by the lack of the parastyle and by the presence of a distinct shelf which closes from below the deep depression separating their protocones and hypocones.

Besides of Devinska Nova Ves, the presence of *D. zapfei* was also mentioned at Vermes 1 (MN5) (ENGESSER, MATTER & WEIDMAN N 1981) and Vermes 2 (MN5) (KÄLIN 1993), both in Switzerland. On the other hand, *D.* cf. or aff. *zapfei* were described from Petersbuch 2 (MN4), Erkertshofen 2 (MN4), Forsthart (MN4), Puttenhausen (MN5) (ZIEGLER & FAHLBUSCH 1986), Petersbuch 7 (MN4) (BOLLIGER & RUMMEL 1994), all in Germany and from Bełchatów B (MN5-6) (RZEBIK-KOWALSKA 1994) in Poland. Judging by the descriptions and drawings, in all cases, even in Vermes, these remains differ from the typical *D. zapfei* from Devinska Nova Ves. This concerns also *Dinosorex* sp. from Sari Çay (MN5) in Turkey (ENGESSER 1980) and from Bełchatów A (MN9) in Poland (RZEBIK-KOWALSKA 1994) regarded by above mentioned authors as most similar to *D. zapfei.*

These differences concern mostly the lower molars, which are characterized by wide buccal and posterior cingula and the posterior cingulum mounting to the end of the hypolophid. It forms the vertical band in the postero-lingual corner of the tooth. These characters are not present in *D. zapfei.*

In most localities the material consists of isolated teeth, so the mutual proportions of lower molars are difficult to estimate. In the case of Vermes 1, where the fragment of a mandible was found, the length ratio of M1/M2 equals 1.18. It is therefore not similar to *D. zapfei.*

Therefore, the material from Grytsiv only partly resembles *D. zapfei.* As in the case of other remains mentioned above it could be described as *D.* cf. *zapfei.* It seems, however, that during the Miocene a fourth species of *Dinosorex* was living in Europe. It was intermediate in size between *D. zapfei* and *D. pachygnathus/D. sansaniensis.* As in *D. zapfei* its molars were characterized by "modus A", but clear differences between both forms are evidently present.

It is very probable that some of *Dinosorex*, particularily those described as *D.* cf. or aff. *zapfei,* also could be referred to *D. grycivensis* n. sp. This may certainly be done in the case of *Dinosorex* sp. from Bełchatów (horizon A) in Poland. This locality is dated, like Grytsiv, to the beginning of the Late Miocen (MN9). The teeth of *D. grycivensis* n. sp. and those from Bełchatów A are similar in size and morphology. They are devoid of entoconid crests, although in the paper of RZEBIK-KOWALSKA (1994) their presence was erroneously mentioned. The ratio of the medium length of M_1 to the medium length of M_2 (all teeth are isolated) equals 1.17 ($n\ M_1 = 4$, $n\ M_2 = 6$). It is similar to that in Grytsiv.

The taxonomic status of *D.* cf. *zapfei* from Bełchatów (horizon B) is not clear. The morphology of teeth is here very similar to that in *D. grycivensis* n. sp., but they are much smaller. The horizon B of Bełchatów is dated to the Middle Miocene (MN5-6), so these remains are much older then the remains from Grytsiv. May be, we have to do with increasing of size with the passage of geological time, widespread among other evolutional lineages of shrews.

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