

Late Pliocene Erinaceidae and Talpidae (Mammalia: Insectivora) from Varshets (North Bulgaria)

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Abstract. One hedgehog (*Erinaceus* cf. *lechei*), two moles (*Talpa* cf. *levantis* and "*Scalopoides*" cf. *copernici*), one shrew-mole (*Quyania* aff. *polonica*), and one desman (*Desmana* cf. *polonica*) are described from a Late Pliocene (MN17) karst fissure filling near the city of Varshets. Although the material is relatively well preserved, the exact determination was not possible because of the small samples and the fact that the taxonomy of the fossil forms from these groups is in a state of confusion. Up to now Late Pliocene remains of "*Scalopoides*" *copernici* and *Quyania polonica* have been known from Poland only. The occurrence of similar forms in Bulgaria during the Villanyian is considered as a relic situation, due to locally favorable conditions. The described insectivore assemblage is indicative of a temperate and humid climate, similar to the present-day conditions in SE Bulgaria.

Key words: insectivores, hedgehog, mole, shrew-mole, desman, Late Pliocene, Villanyian, MN17, paleoenvironment.

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I. INTRODUCTION

This report is the third part of a monographic treatment of the Late Pliocene small mammal fauna from Varshets (North Bulgaria). In the first part (POPOV 2001) the locality was described, a species list was presented (some of the determinations were preliminary), and a summary of the systematic research on voles and a synthetic overview of the fauna in terms of paleoecology and age was provided. The second paper concerned shrews (POPOV 2003) and besides a description of the remains, the shrew assemblage was compared with those from other European sites. Herein I provide descriptions of remains of Erinaceidae and Talpidae. The Pliocene representatives of these families on the Balkan Peninsula (south of the Danube) are still poorly known. The most numerous data exist for water moles (Desmaninae), being well represented in the lignit beds in Greece and Turkey (RÜMKE 1985; KOUFOS 2001).

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II. MATERIAL AND METHODS

The described specimens are housed in the collection of the Institute of Zoology, Bulgarian Academy of Sciences. The anatomical terminology employed here follows HUTCHISON (1974). The following measurements, presented in millimeters, were taken. Mandible (ocular-micrometer), (Fig. 1-A): 1. M-PMDH – postmandibular height; 2. M-HCP – height of coronoid process; 3. M-LP₁-P₄ - length of P₁-P₄; 4. M-LM₁-M₃ - length of M₁-M₃; (a) – alveolar length, (c) – coronar length; 5. M-PMDL - postmandibular length; 6. M-UWCP – upper width of coronoid process; 7. M-HMD/M₂ – lingual height of horizontal ramus of mandible under M₂; 8. M-L – legh of mandible.

Teeth (ocular-micrometer)(after HUTCHISON 1974): 1. L – length; 2. W – width.

Humerus (dial calipers),(Fig. 1-D): 1. H-MAXL – maximal length; 2. H-L1 – length from the baseline to the median point of the bicipital groove; 3. H-L2 – length from the baseline to the most distal point of the teres tubercle; 4. H-L3 – length from the baseline to the distal point of the pectoral tubercle; 5. H-MINW – minimal width of the shaft; 6. H-W1 – maximal width across the capitulum and the fossa for musculus flexorum digitorum ligament; 7. H-W2 – width between the most prominent points of the greater tuberosity and the median point of the bicipital groove; 8. H-MAXW – maximal width of the humerus.

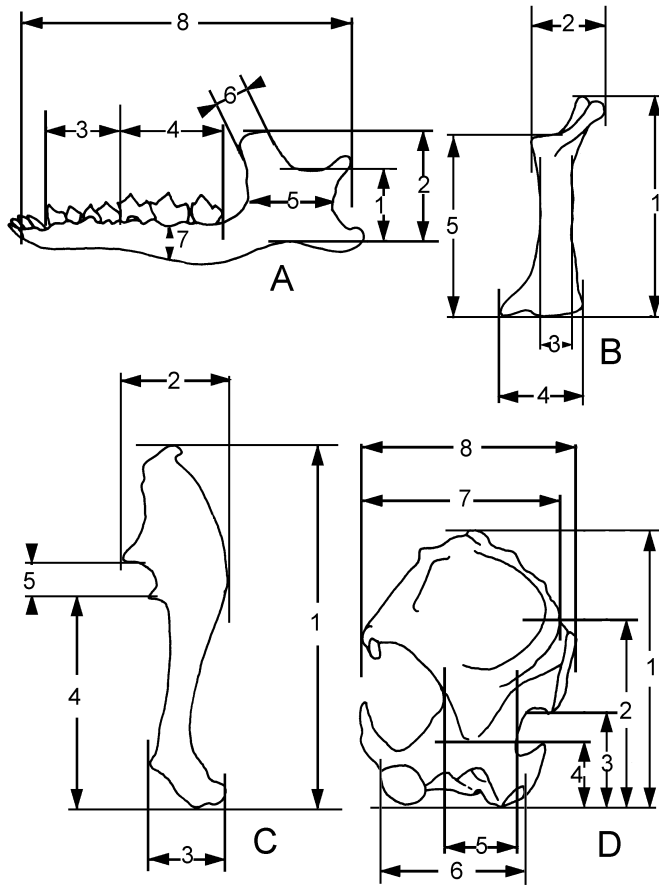


Fig. 1. Methods of measuring of the mandible (A), radius (B), ulna (C), and humerus (D). For details see “Material and methods”.

Ulna (dial calipers), (Fig. 1-C): 1. U-TL – total length; 2. U-APWOP – anterior-posterior width at the level of the olecranon process; 3. U-APWDE – the same at the level of distal epiphysa; 4. U-LD – length of the diaphysa; 5. U-HSC – height of the sigmoid cavity.

Radius (dial calipers), (Fig. 1-B). 1. R-TL – total length of radius; 2. R-APWPE – anterior-posterior width of the proximal epiphyse; 3. R-ARWDE – the same for the distal epiphyse; 4. R-APMWD – anterior-posterior minimal width of the diaphyse; 5. R-LC – length of the bone corpus.

In the tables the following descriptive statistics are shown: N – sample size; Min - Max – minimum and maximum observed values; X – mean; SD – standard deviation.

III. SYSTEMATICS

Family Erinaceidae FISCHER VON WALDHEIM, 1817

Subfamily Erinaceinae FISCHER VON WALDHEIM, 1817

Tribe Erinaceini FISCHER VON WALDHEIM, 1817

Genus *Erinaceus* LINNAEUS, 1758

Erinaceus cf. *lechei* KORMOS, 1934

(Fig. 2)

Material. 1I₃ (V342), 1 M₁, 1 M₂ (V172), 1 M₁, 1 fragments of mandible with P₄-M₃, 1 fragment of mandible with M₂-M₃; 1 fragment of mandible with I₁; 2 mandibular fragments without teeth (V220), 1 maxillary fragment with C - M¹, 1 P⁴ (V221).

Measurements:

Mandible and lower teeth (L x W)	Upper teeth (L x W)
M-HCP = 19.4; 15.7.	C ¹ = 2.40 x 1.75.
M-HMd/M ₂ = 7.0; 5.60; 7.00.	P ² = 2.05 x 1.70.
M-LP ₄ - M ₃ (c) = 13.1.	P ³ = 2.00 x 2.30.
M-LM ₁ -M ₃ (c) = 11.0;	P ⁴ = 3.50 x 4.95; 3.45 x 4.75.
I ₃ = 2.72 x 1.65; 2.75 x 1.85.	M ¹ = 4.85 x 5.65.
P ₃ = 1.92 x 1.80.	
P ₄ = 2.60 x 2.05.	
M ₁ = 4.85 x 3.15.	
M ₂ = 4.50 x 3.00.	
M ₃ = 2.60 x 2.00.	

D e s c r i p t i o n. C¹. The basal cross section regularly elliptical; the cingulum persists only on the anterointernal part of the crown base; one-cusped, only traces of anterior and posterior cuspules can be detected in lateral view; two-rooted.

P²: Considerably shorter than C¹ but wider, subtriangular in basal cross-section, one-cusped.

P³. Triangular in occlusal view with one main cusp.

P⁴. Clearly molarized, with one main cusp and two lower ones on the lingual part of the crown; the metastylar part of the crown is elongated postero-labially; the posterior emargination of the crown (in occlusal view) is considerable; the crown is slightly wider than longer; there are some traces of an anterior cingulum.

M¹. In occlusal view the tooth is quadratic, with four main cusps, the labial ones are higher. The metaconule present, connected with both hypo- and protocone. The lingual, posterior and especially anterior cingula are well developed. The parastyle is well pronounced as a small cusplet. Lingual roots are fused while the labial ones are separated.

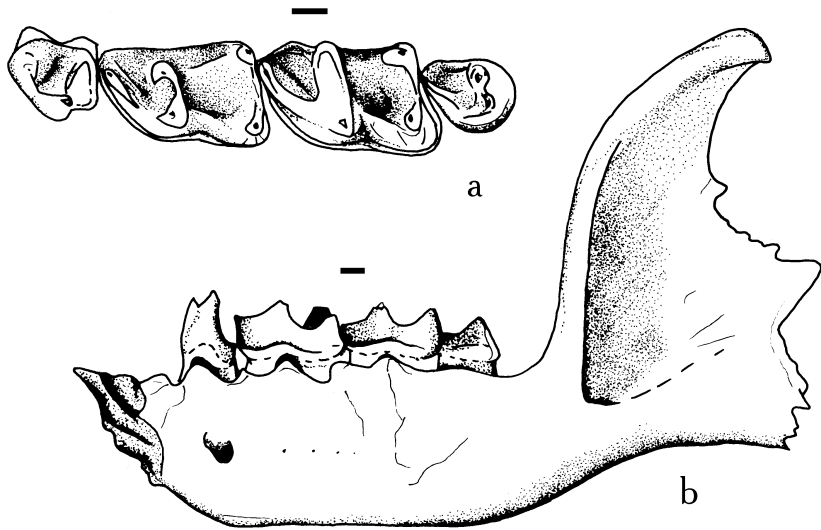


Fig. 2. *Erinaceus* cf. *lechei* – left mandibular fragment with P₄-M₃ (V220:1). a – lower teeth in occlusal view; b – mandible in labial view. Scale bars represent 1mm.

Mandible. The mandibular fragments available differ considerably in size. Two of them are robust (V220-1 and 3), while the remaining are relatively slender (V220-2, 4, 5). However, observations on a large sample of recent comparative material (*Erinaceus concolor*), show that such differences correspond to intraspecific variability connected with individual age. Consequently, the small mandibular fragments from Varshets can be considered as belonging to young individuals. The following description is based on the remaining material representing more or less adult specimens. The mandible is relatively robust with a massive but short horizontal ramus and high coronoid process. The upper part of the coronoid process is curved backward and its tip is relatively narrow. The mental foramen is under the posterior root of P₄ and placed on the middle of the horizontal branch.

I₃. In occlusal view the outline of the crown is irregularly elliptical, with a slight flattening of the antero-labial corner. The cingulid is poorly pronounced as an ill-defined inflated zone around the crown. The root is oval in cross-section. In one specimen it is vertically grooved.

P₃. The tooth is single-rooted, unicuspid, the crown outline is irregularly circular with its posterior half surrounded by a poorly individualized cingulid.

P₄. Simplified, there are no metaconid; the talonids is reduced; the proto- and paraconid are well developed, the first one is higher and slightly curved backward; there is a slight labial cingulid while the posterior one is better developed.

M₁, M₂. The first lower molar is longer than the second one; the talonids are longer than the trigonids; the entoconid is higher than the hypoconid; labial cingulids are well pronounced.

M₃. With three cusps: the paraconid is the lowest cusp, while the proto- and metaconids are high, situated close to each other; the trigonid is relatively well developed; there is a slight labial cingulid.

D i s c u s s i o n. The material under consideration shows small teeth size and in this respect it is very close to the Pliocene European species *E. samsonoviczi* SULIMSKI, 1959 (Węże I, Poland, MN15), *E. lechei* KORMOS, 1934 (Beremend, Hungary, Early Pleistocene), and *E. osztramosi* JANOSSY, 1972 (Osztramos 8, Hungary, Early Pleistocene). According to the data presented by JANOSSY (1972) the present material differs considerably from the last mentioned species in having

a longer P₄-M₂ row, but at the same time it is very similar to the first two ones. The hedgehog from Varshets, however, is somewhat different from the Polish species (*E. samsonoviczi*) (SULIMSKI 1959, 1962) in having smaller tooth dimensions (LP₄-M₃; LM₁-M₃; LM₁; LM₂) and “an oblique crest placed labially to ascending ramus” which runs to the condylar process (SULIMSKI 1959). Moreover, the Varshets material has a different position of the mental foramen, less molarized P₄ (lack of metaconid and reduced talonid), a better developed trigonid on M₃ and a higher coronoid process. Part of these differences concern the diagnostic features of *E. samsonoviczi*, so our material can not be attributed to this species. In size the material under study is close to *E. lechei*. According to KORMOS (1934), in *E. lechei* the paraconids in P₄ and M₃ are strongly reduced. In contrast, the specimen from Varshets shows a high paraconid of P₄ and a moderately reduced one on M₃.

The form from Varshets is similar in size to the medium sized *Erinaceus* sp. 1 from Betfia XIII (RZEBIK-KOWALSKA 2000) but has somewhat smaller lower teeth (M₁-M₂). Moreover the Romanian form has a large metaconid on P₄, while this cuspid is practically lacking in the specimen from Varshets. The described remains from Varshets belong to a form with larger P⁴, M¹ and M₃ than the small sized *Erinaceus* sp. 2 from Betfia-IX, but with smaller P₄ (Betfia-IX) and M₁ (Betfia-VII/1), (RZEBIK-KOWALSKA 2000). The teeth from Varshets are definitely smaller than the respective teeth belonging to the large sized *Erinaceus* sp. 3 from Betfia-V (RZEBIK-KOWALSKA 2000). Although the limited samples from these localities prevent detailed comparisons, the form from Varshets is more similar to *Erinaceus* sp. 2 (RZEBIK-KOWALSKA 2000).

The material is tentatively referred to as *E. lechei* on the basis of size similarity. Some differences in the structure of P₄ and M₃ of little known taxonomic importance hamper a conclusive determination.

Family Talpidae FISCHER VON WALDHEIM, 1817

Subfamily Talpinae FISCHER VON WALDHEIM, 1817

Tribe Talpini FISCHER VON WALDHEIM, 1817

Genus *Talpa* LINNAEUS, 1758

Talpa cf. *levantis* THOMAS, 1906

(Fig. 3: a-c; 4: a,b)

Material: 6 humeri (V27: 1-6), 24 fragments of humeri (V26: 1-2, V28 - 1, V75: 1 - 3; V323: 1 - 15; V338: 1 - 3); 12 radii (V29: 1 - 3, V30: 1 - 4; V324: 1 - 5); 6 fragments of ulna (V31 - 1, V32: 1 - 3; V326: 1 - 2); 16 fragments of mandible (V33: 1 - 2; V34: 1 - 5, V73: 1 - 3; V325: 1 - 6); 1 fragment of maxillae with P⁴ - M¹(V74).

D e s c r i p t i o n. P⁴. Subtriangular in occlusal outline; small anterior cingular cusplule (parastyle); there is a low but well individualized protocone, situated anterolingually; the protocone and paracone are well separated by a large basin, which is open anteriorly but it is closed posteriorly by a low ridge; the paracone has nearly the same height as M¹; three-rooted.

M¹. Subtriangular in occlusal outline; the posterolabial part of the tooth is moderately elongated; the parastyle is lacking; the highest cusp is the metacone; the mesostyle is undivided; the postero-flexus is shallow; the trigonid basin is open antero-posteriorly.

Mandible. The horizontal branch is talpoidal, slender, somewhat narrowing to the front, in the posterior half the ventral edge is convex, while in the anterior part it is concave. The coronoid process bends strongly forward; its tip is narrow. As a rule, there are two mental foramina – the anterior one is situated between P₂-P₁ or rarely under P₃. The second one is under M₁. In one specimen there are three foramina.

P₁. Subrectangular in occlusal outline; protoconid is high, centered over the anterior root; there is a small posterior cingular hill.

P₂. Smaller than P₃, oval in occlusal outline with a long axis oblique in relation to the tooth-row axis; a low but distinct entoconid and a very small parastylid.

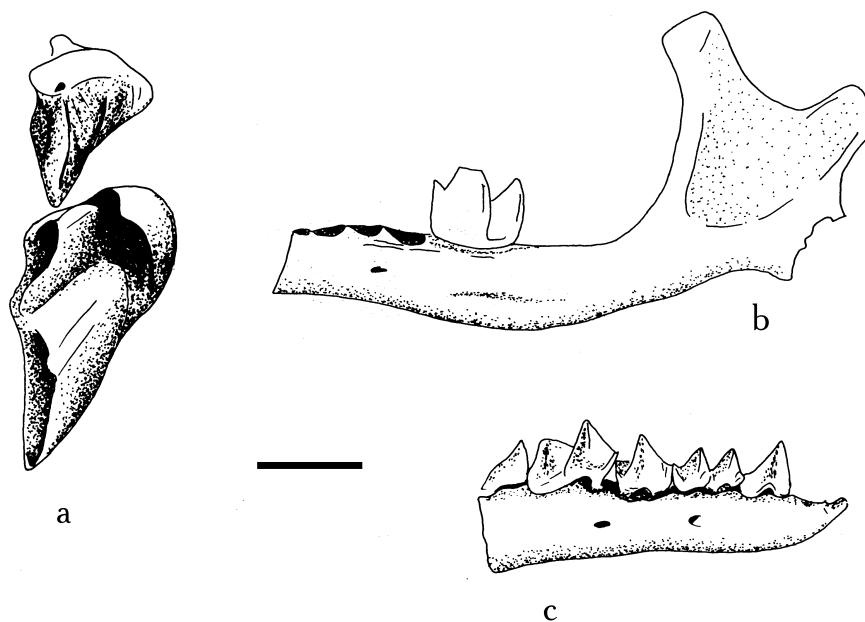


Fig. 3. *cf. levantis* – upper teeth and mandibular fragments. a – P⁴-M¹ right, occlusal view (V74); b – left mandibular fragment with M₂ (V73-1), c – right mandibular fragment with C₁-M₂ (V325-1). Scale bar represents 1mm.

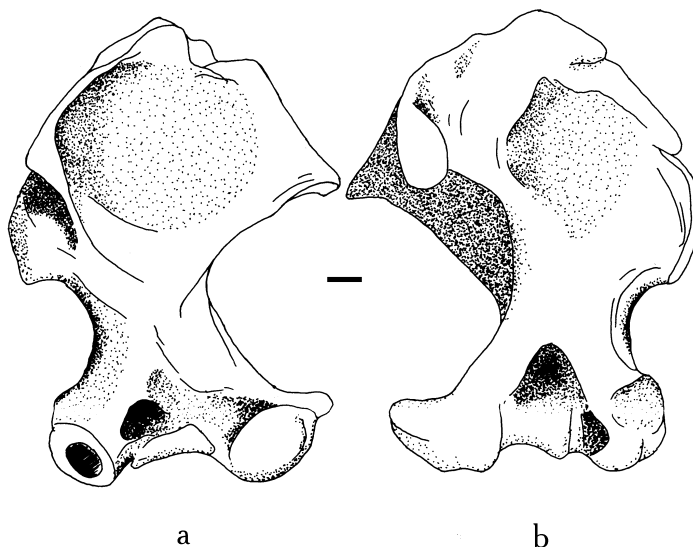


Fig. 4. *cf. levantis* – left humerus (V-27: 1) in anterior (a) and posterior (b) view.

P₃. Smaller than P₄, oval in occlusal outline, with a wider posterior part; this part is somewhat basined labially; a low parastylid and entoconid are present.

P₄. Elongated version of the previous premolar; the posterior edge of the protoconid is sharp; low entoconid; there are weak prae-, ecto- and postcingulids.

M₁. The talonid is longer and wider than the trigonid; the entostylid is always present, rather prominent; there is no postcingulid; crista obliqua terminates anteriorly at the base of the protoconid.

nid; the hypoflexid is relatively shallow; the paracristid is in the shape of an obtuse angle; proto- and hypoconids are the highest cusps; the metaconid is very small.

M₂. Trigonid and talonid about equal in length and width; an entostylid and small anterior cingular cuspule are present; crista obliqua extends anteriorly to the base of the metaconid; hypoflexid deeper than in M₁; cingulids are absent.

M₃. The talonid is considerably narrower than the trigonid; the entostylid and postcingulid are lacking.

Humerus. The humeri are adaptively and morphologically very similar to that of recent *T. europaea*. They have a robust and short shaft and long teres tubercle. The axis of the head is subparallel to the long axis of the base. This head is situated rather laterally.

Ulna. Very similar to that of recent *T. europaea* but somewhat smaller.

Radius. Analogous in shape to that in modern *T. europaea*.

Measurements: see Table I.

D i s c u s s i o n. Three size groups of *Talpa*-moles have commonly been reported from Late Pliocene and Quaternary localities in Europe. The large-sized group consists of the fossil species *Talpa episcopalis* KORMOS, 1930 and the recent species *T. romana* THOMAS, 1902. The medium-sized group is represented by the fossil species *Talpa fossilis* PETENYI, 1864 (= *T. praeglacialis* KORMOS, 1930) and the modern species *Talpa europaea* LINNAEUS, 1758. The fossil small-sized moles were usually reported as *Talpa minor* FREUDENBERG, 1914 (type locality Hundsheim, RABEDER 1972) (= *T. gracilis* KORMOS, 1930, Somlyóberg bei Püspökfürdő = Betfia 2, Early Biharian; H-MAXL = 10.0 - 11.5, H-MAXW = 7.7 - 8.2), very similar to the recent "caecoid" moles, which have more or less restricted distributions ranging linearly from the Iberian Peninsula to the Middle East and Caucasus. One species of this group, *T. levantis*, occurs today in Bulgaria (POPOV & MILTCHEV 2001). This species differs from *T. europaea* in the following features: smaller overall size, but wider M₁ and M₂ (Table 1); lack of parastyles on P⁴ and M¹ (these elements are very conspicuous in the comparative material of *T. europaea* from SE Bulgaria); there is no entostylid on M₃ (this element always presents in *T. europaea*, although sometimes it is rather poor); in occlusal view, the greatest width of P₄ is in its posterior part (in *T. europaea* the greatest width of this tooth is in the middle part of the crown); the tip of the coronoid process is rather narrow (in *T. europaea* it is wide, very often with a well pronounced extension, directed backward). Interestingly enough, there are no statistically significant differences in the size of the lower premolars, in the width of M₃ and in the postmandibular height (Table I).

The measurements of the fossil remains (Table I) indicate that the mole from Varshets belongs to the third (small-sized) group. The comparisons of the mandibular fragments from Varshets with these of *Talpa minor* from the type locality (Hundsheim), show many similarities, especially in respect to the lectotype, designated by RABEDER (1972). The close proximity concerns mainly the shape of the coronoid process and some of the measurements. On the other hand *Talpa minor* from Hundsheim lacks an anterolingual cusp on P⁴ (RABEDER 1972, Taf. 1: Fig. 1a). Additionally, the mole from Varshets is larger than *Talpa minor* from many European localities (e. g. KOWALSKI 1956, 1958, 1960; SULIMSKI 1959, 1969; VON KOENIGSWALD 1970; HELLER 1959; BRUNNER 1934, 1954, 1957; RZEBIK-KOWALSKA 2000), being very similar to the recent comparative material of *T. levantis* from South-East Bulgaria (Table I). Beside this, the form from Varshets is similar to this species in lacking parastyles on the P⁴ and M¹, an entostylid on the M₃ and the shape of the tip of the coronoid process. These comparisons show that the form from Varshets is nearly identical with the recent *T. levantis* from SE Bulgaria. Beside this, the size characteristics of *T. levantis* presented in Table 1 show that the size range, at least in recent caecoid moles, is relatively large, overlapping with the smaller mountain forms of *T. europaea* (POPOV & MILTCHEV 2001). So, the separation caecoid/europoid moles should be based on qualitative criteria as well. In this respect it is important to note that both the fossil form from Varshets and the recent *T. levantis* from SE Bulgaria are similar in size with *T. fossilis* from Betfia IX (Romania, Early Pleistocene), (RZEBIK-KOWALSKA 2000). As mentioned above, the last species is usually regarded within the evolutionary lineage of *T. euro-*

Table I

Measurements *Talpa cf. levantis* from Varshets in comparison with recent *T. levantis* and *T. europaea* from SE Bulgaria. For abbreviations – see Material and methods

Measurement	Varshets					<i>T. levantis</i>					<i>T. europaea</i>					Significant differences (<i>levantis/europaea</i>)	
	N	min	max	X	SD	N	min	max	X	SD	N	min	max	X	SD	t-criterium	P
LP ⁴	1	–	–	1.70	–	10	1.65	1.87	1.75	0.072	14	1.77	2.05	1.92	0.080	-5.40	0
WP ⁴	1	–	–	1.25	–	10	1.10	1.35	1.19	0.084	14	1.00	1.25	1.08	0.076	3.27	0.003
LM ¹	1	–	–	2.50	–	10	2.60	3.00	2.81	0.113	14	2.60	3.10	2.85	0.154		
WM ¹	1	–	–	1.40	–	10	1.52	1.90	1.72	0.113	14	1.65	2.20	1.82	0.142		
L P ₁	2	1.27	1.32	–	–	12	1.20	1.50	1.32	0.080	15	1.32	1.62	1.50	0.094	-5.45	0
W P ₁	2	0.59	0.60	–	–	12	0.47	0.65	0.57	0.420	15	0.60	0.77	0.64	0.047	-4.29	0
L P ₂	2	0.82	0.87	–	–	10	0.75	1.00	0.85	0.090	13	0.85	0.97	0.90	0.040		
W P ₂	2	0.45	0.47	–	–	10	0.42	0.57	0.46	0.046	13	0.37	0.55	0.44	0.048		
L P ₃	2	0.92	0.95	–	–	10	0.82	1.07	0.96	0.075	13	0.92	1.10	1.00	0.048		
W P ₃	2	0.45	0.57	–	–	10	0.42	0.55	0.50	0.045	13	0.42	0.72	0.54	0.092		
L P ₄	2	1.37	1.40	–	–	11	1.32	1.55	1.45	0.066	14	1.40	1.60	1.49	0.058		
W P ₄	2	0.70	0.75	–	–	11	0.65	0.82	0.76	0.051	14	0.67	0.80	0.72	0.042		
L M ₁	2	2.00	2.05	–	–	8	2.05	2.27	2.16	0.090	15	2.17	2.55	2.33	0.096	-3.85	0
W M ₁	2	1.30	1.32	–	–	8	1.37	1.62	1.50	0.085	15	1.27	1.52	1.39	0.097	2.61	0.02
L M ₂	3	2.40	2.50	2.45	0.051	10	2.40	2.62	2.49	0.085	13	2.47	2.85	2.65	0.111	-3.82	0.001
W M ₂	4	1.27	1.50	1.38	0.096	10	1.37	1.70	1.54	0.121	13	1.25	1.55	1.41	0.092	2.74	0.012
L M ₃	4	2.00	2.17	2.06	0.076	11	2.12	2.27	2.17	0.046	13	2.10	2.35	2.25	0.079	-2.94	0.008
W M ₃	4	1.07	1.32	1.19	0.115	11	1.17	1.42	1.28	0.076	13	1.05	1.35	1.24	0.083		
M-PMDH	1	–	–	4.00	–	12	4.00	4.50	4.26	0.171	13	4.00	4.75	4.43	0.260		
M-HCP	2	5.8	6.65	–	–	21	6.40	7.15	6.73	0.238	63	6.44	8.05	7.39	0.347	-8.12	0
M-LP ₁ -P ₄ (a)	2	4.20	4.35	4.28		11	3.90	4.40	4.18	0.188	14	4.15	5.00	4.62	0.208	-5.44	0
M-LM ₁ -M ₃	7	5.75	6.50	6.19	0.247	12	6.00	7.00	6.63	0.314	34	6.70	7.60	7.15	0.241	-5.94	0
M-PMDL	4	4.32	4.65	4.50	0.150	12	4.25	5.15	4.57	0.272	12	5.25	5.90	5.66	0.210	-11.0	0
M-UWCP	3	1.25	1.92	1.60	0.335	12	1.10	2.25	1.49	0.296	13	1.80	2.70	2.25	0.257	-6.88	0
M-HMD/M ₂	15	2.00	2.30	2.11	0.090	21	1.85	2.60	2.21	0.172	72	2.15	3.00	2.49	0.178	-6.27	0
M-L	1	–	–	20.00	–	18	18.30	21.30	20.10	0.739	41	21.10	23.80	22.47	0.764	-11.07	0
H-MAXL	10	12.9	14.3	13.70	0.442	36	12.60	14.80	13.66	0.604	90	14.60	17.80	16.29	0.822	-17.44	0
H-L1	20	8.6	10.7	9.50	0.481	22	8.50	10.30	9.48	0.411	7	10.20	12.40	11.44	0.894	-8.00	0
H-L2	17	5.0	6.2	5.68	0.315	22	5.40	6.60	5.99	0.321	7	6.50	7.80	7.04	0.419	-6.98	0
H-MINW	26	3.5	4.4	3.90	0.261	22	3.40	4.60	3.80	0.286	7	4.30	4.80	4.63	0.189	-7.13	0
H-W1	21	7.1	8.3	7.74	0.322	39	6.70	8.30	7.61	0.369	111	8.00	9.90	8.99	0.434	-17.7	0
H-MAXW	11	9.4	11.1	10.36	0.634	39	9.40	11.00	10.06	0.463	102	10.40	13.40	11.89	0.692	-15.27	0
R-TL	9	11.1	12.5	11.69	0.414	3	11.00	12.90	11.93	–	9	11.40	12.40	12.03	0.364		
R-APWPE	10	3.3	4.4	3.87	0.387	3	3.20	3.90	3.67	–	9	3.20	3.90	3.66	0.264		
R-ARWDE	11	4.1	4.6	4.29	0.144	3	4.20	5.00	4.50	–	9	3.70	4.70	4.37	0.296		
R-APMWD	12	1.7	2.1	1.91	0.124	3	1.60	1.70	1.67	–	9	1.50	1.90	1.75	0.123		
R-LC	9	9.3	10.4	9.89	0.401	3	9.20	9.70	9.43	–	9	9.80	10.80	10.39	0.289	-5.08	0.0004
U-APWOP	2	5.0	5.1	–	–	4	4.80	5.00	4.95	–	8	5.00	5.70	5.35	0.244	-3.07	0.01
U-APWDE	2	3.6	3.7	–	–	4	3.80	4.60	4.10	–	8	3.60	4.40	4.08	0.290		
U-LD	2	9.4	10.4	–	–	4	9.90	10.60	10.25	–	8	10.20	11.10	10.65	0.287		
U-HSC	5	1.5	2.5	1.90	0.424	4	1.90	2.80	2.37	–	8	1.60	2.20	1.84	0.206		

paea. Nevertheless, on the basis of similarity in teeth morphology and the shape of the coronoid process, the fossil mole from Varshets is considered as belonging to the group of caecoid moles, very close to the recent *T. levantis*.

Regardless the similarity in measurements, the identification of the fossil material from Varshets with the recent *T. levantis* meets some difficulties, related to contemporary genetic data (FILIPUCCI *et al.* 1987) and the unsatisfactory taxonomy of the recent and especially of the fossil forms (DOUKAS *et al.* 1995). The recent molecular investigations on the European moles indicate the occurrence of five gene pools, while only three groups can be recognized on the basis of the traditional morphological features (see above). For instance, the genetic distance between the two small-sized species, *T. occidentalis* CABRERA, 1907 and *T. caeca* SAVI, 1822, is greater than the difference between *T. caeca* and the other European moles. In this respect, *T. caeca* seems to be the closest recent relative of the hypothetical ancestor of European moles. According to genetic evidences the divergence of the recent European moles took place between three and one million years (FILIPUCCI *et al.* 1987). Within the light of the above data, it should be mentioned that the recent small-sized species occurring in Bulgaria (*T. levantis*), differs morphologically from the westernmost form of this size group, *T. occidentalis*, as described by VAN CLEEF-RODERS & VAN DEN HOEK OSTENDE (2001). In particular, *T. occidentalis* possesses, although weak, a parastyle on M¹ (VAN CLEEF-RODERS & VAN DEN HOEK OSTENDE 2001, Fig. 2) and the greatest width of the occlusal surface of P₄ is in the middle of the crown. In these respects it is more similar to my comparative material of *T. europaea*.

According to ROBERT (1983), *T. minor* evolved in *T. caeca* (s. l.) by enlargement. The present material does not correspond to this hypothesis. The comparisons between the form from Varshets (Late Pliocene) and *T. minor* from Hundsheim (late Middle Pleistocene, RABEDER 1972) show that they have comparable dimensions.

Beside *T. minor*, another small-sized species, *Talpa csarnotana* KRETZOI, 1959, is known from the Late Pliocene of Central Europe. The original description of this species is rather poor. According to KRETZOI (1959), the size of the humeri is comparable with this of *T. minor* but somewhat more robust. STORCH (1978) published a photograph and measurements of the humeri of *T. csarnotana* from the type locality, which show many similarities to the bones from Varshets in general shape and size. VAN CLEEF-RODERS & VAN DEN HOEK OSTENDE (2001) assume that this species is a junior synonym of *T. minor* because "...it is unlikely that Csarnota contains different smaller *Talpa* species than other Hungarian localities of similar age...".

The above data, comparisons and discussion suggest that the small-sized Late Pliocene – Early Pleistocene fossil forms of *Talpa* from Europe, usually considered as *T. minor* (s. l.), represent the ancestral stock of the recent moles of this group. However, for the time being it is difficult to reconstruct the exact phylogenies and to substantiate the homogeneity of the small-sized fossil moles. So, the material from Varshets is tentatively referred to as *T. levantis*, on the basis of the overall morphological similarity with recent comparative material from SE Bulgaria.

Tribe ?Scalopini DOBSON, 1883

Genus ? *Scalopoides* WILSON, 1960

"*Scalopoides*" cf. *copernici* (SKOCZEŃ, 1980)

(Fig. 5. a, b)

Material: Three humeri (V24: 1- 2; V322) and one fragmentary humerus (V25-1).

Description. Medium-sized mole with humerus moderately specialized fossorially: teres tubercle short longitudinally and situated rather proximally; short, elongate and slender; distal and proximal ends relatively narrow. The proximal part is wider than the distal one; the "Scalopine"-ridge is presented as a weak muscle scar and there is no distinct break on the plane of the bone. The pectoral crest is not very prominent, reaching distally about halfway down the shaft. Pectoral tubercle situated somewhat laterally on the shaft in anterior view.

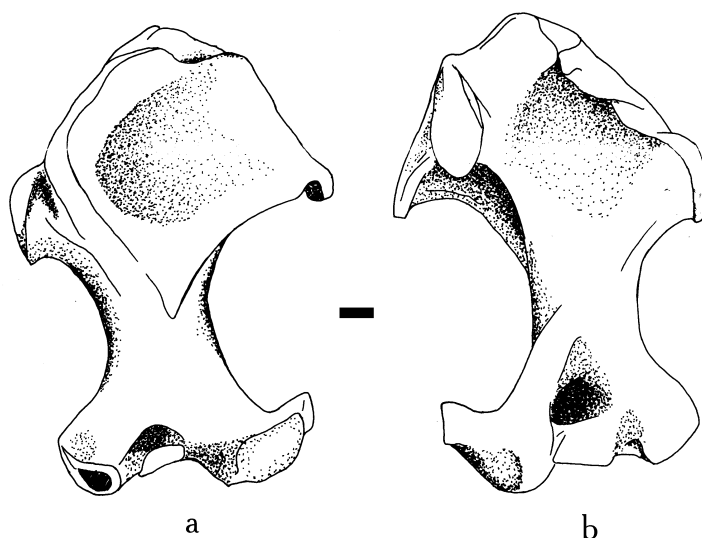


Fig. 5. “*Scalopoides*” cf. *copernici* – left humerus (V-24: 1) in anterior (a) and posterior (b) view. Scale bar represents 1mm.

Measurements: see Table II.

Discussion. In size and general proportions the humeri under consideration are outside of the variability of *Talpa* cf. *levantis* from the locality. The bones are adaptively and morphologically very similar to that of some *Scalopini*-moles with humeri moderately specialized fossorially (slender shaft, proximal shifting of the short teres tubercle, relatively narrow distal end), such as *Yanshuhella primaeva* (SCHLOSSER, 1924) and *Proscapanus primitivus* HUTCHISON, 1974. On the other hand the absence of a true “Scalopine”-ridge and the lack of a well pronounced notch between the proximal edge of the lesser tuberosity and the head question the attribution of the available humeri to the tribe Scalopini.

Table II

Measurements (mm) of the humeri of “*Scalopoides*” cf. *copernici* from Varshets and Poland (data from SKOCZEŃ 1980 – Zamkowa Dolna Cave, Kadzielnia). For abbreviations – see Material and methods

No:	Varshets				Poland				
	24-1	24-2	25-1	322	N	min	max	X	SD
1.H-MAXL	13.4	12.7	–	12.8	–	–	–	–	–
2. H-L1	9.5	9.6	–	9.5	6	8.40	9.11	8.67	0.27
3. H-L2	7.0	6.8	6.4	6.60	8	6.0	6.50	6.23	0.17
5. H-MINW	3.2	3.0	2.8	3.0	9	2.48	2.91	2.63	0.12
6. H-W1	6.5	6.0	6.1	6.15	8	5.34	6.10	5.71	0.27
8. H-MAXW	9.3	8.4	–	8.80	–	–	–	–	–

The general shape of the humeri from Varshets is somewhat similar to that of the genus *Geotrypus* POMEL, 1848 (SKOCZEŃ 1980), (tribe *Scaptonychini* VAN VALEN, 1967) but the known European species are considerably larger (STORCH & QIU 1983). The separation and phylogenetic reality of this tribe are questionable (ZIEGLER 1990; VAN DEN HOEK OSTENDE 2001) but in any case the taxa referred to this tribe are closely related to the Old World *Talpini* (STORCH & QIU 1983; ZIEGLER 1990; VAN DEN HOEK OSTENDE 2001).

The humeri available compare more closely with ?*Geotrypus copernici* SKOCZEŃ, 1980 from the Villanyian and Biharian of Poland than any other mole species in most details. The differences concern only the somewhat more massively-build humeri from Varshets (Table II). The humeri from Varshets are definitively larger than the material from Wölfersheim, tentatively referred to this species (DAHLMANN 2001). According to STORCH & QIU (1983) it seems better to put *Geotrypus copernici* outside of the genus *Geotrypus*. They confirm the suggestion of SKOCZEŃ (1980) that the morphology of the humerus points to close affinities with the genus *Scalopoides*. The absence of teeth in the material from Varshets does not permit more detailed analysis in this respect, thus the use of quotation mark for the generic name. The cf.-species determination is caused by the fragmentary state of the humeri from the Polish localities, preventing more detailed comparisons and evaluation of the size differences.

Tribe Urotrichini DOBSON, 1883

Genus *Quyania* SORCH et QIU, 1983

Quyania aff. *polonica* SKOCZEŃ, 1980

(Fig. 6. a-c; 7. a-b; 8. a-d)

Material: Three fragments of mandible with M₁-M₃, 1M₂ (V23: 4 – 5; V339), one complete humerus and two fragmentary ones (V23: 1 - 3).

Measurements: Humerus – see Table III;

Mandible:

HPC = 5.5;

HMd/M₂ = 1.95;

LcM₁-M₃ = 5.50; 5.30;

LaM₁-M₃ = 5.10;

M₁ (L x W) = 1.75 x 1.12; 1.80 x 1.10;

M₂ (L x W) = 1.92 x 1.10; 2.12 x 1.25;

M₃ (L x W) = 1.65 x 0.90; 1.72 x 1.00.

Description. Mandible. The horizontal ramus is relatively slender and tapered to the front. The anterior mental foramen is situated between the roots of P₃, the posterior one – slightly posteriorly in relation to the posterior root of M₂. The mandibular foramen is situated close under the myolo-hyoidal crest. The coronoid process is narrow and tapering towards the tip, which is curved backwards. The condylar process is long and about equidistant from other processes. The angular process is incomplete, but apparently deep and plate-like.

M₁. The trigonid is narrower and shorter than the talonid. Both the proto- and metaconids are conical, situated very close together and connected by a high crest. The paraconid is well developed, situated slightly lingually in relation to the medial axis of the tooth. The metaconid and the elongated entoconid are separated by a talonid notch (only a trace of an entocristid can be observed). The precingulid is developed only on the anterolabial base of the tooth and it gradually disappears towards the protoconid. The entostylid is small but well visible. The crista obliqua approaches the base of the protoconid nearly in the middle of its width. There is a small notch between the end of the crista obliqua and the wall of the proto-metaconid complex. The ectocingulid is well pro-

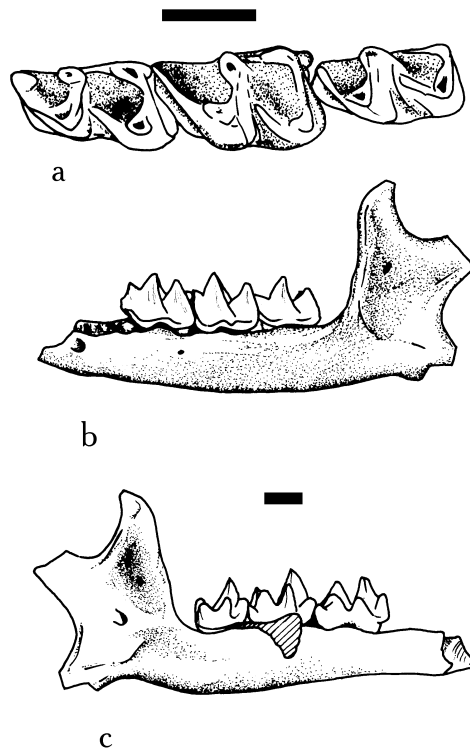


Fig. 6. *Quyania* aff. *polonica* – left mandible with M_1 - M_3 (V339); a – lower molars in occlusal view; b – mandible in labial view; c – mandible in lingual view. Scale bars represent 1mm.

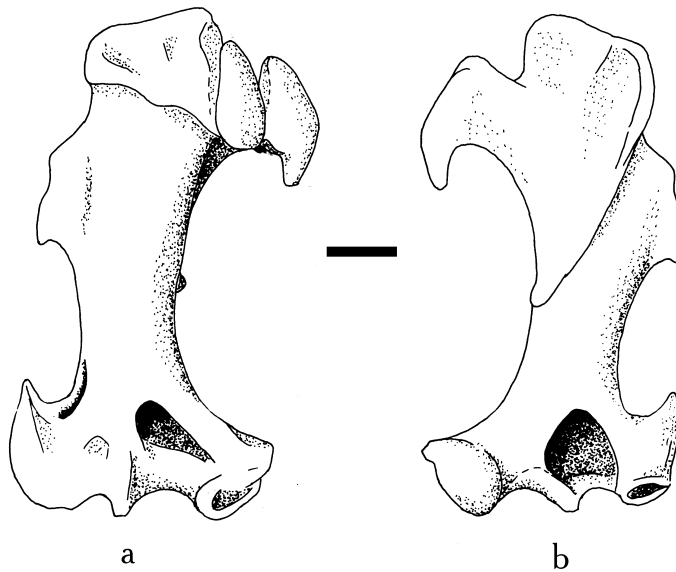


Fig. 7. *Quyania* aff. *polonica* – right humerus (V-23: 1) in posterior (a) and anterior (b) view. Scale bar represents 1mm.

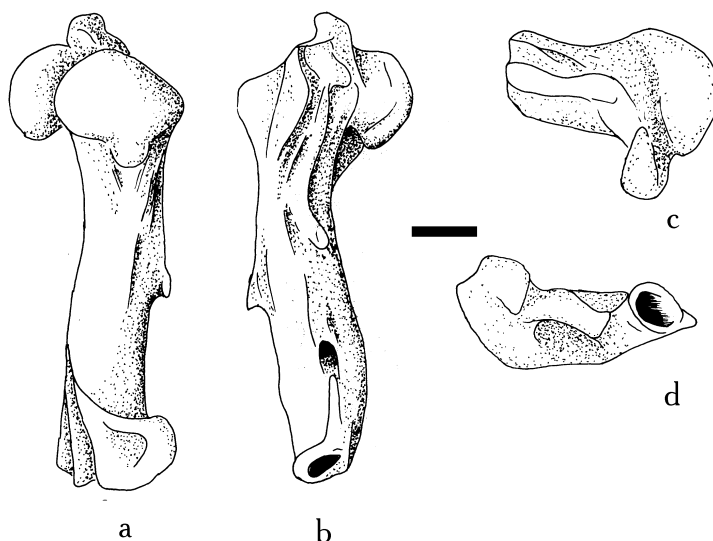


Fig. 8. *Quyania* aff. *polonica* – right humerus (V-23: 1) in lateral (a), medial (b), proximal (c) and distal (d) view. Scale bar represents 1mm.

Table III

Measurements (mm) and ratios (%) of the humeri of *Quyania* aff. *polonica* from Varshets in comparison with humeri of fossil and recent Urotrichini. The comparative measurements are from the following sources: 1) STORCH & QIU 1983, Table 5, the first two specimens of *Q. chowi*; 2) SKOCZEŃ 1980, Table IV, Rebielice Królewskie I (RK-I) – the first two specimens (NF1013: 7–8) and Table VII – Rebielice Królewskie I, mean values; 3) HUTCHISON 1974: mean values from localities L7 and M of La Grive Saint-Alban (GSA); 4) SKOCZEŃ 1993 – Zamkova Dolna (ZD) and Kadzielnia (Kd). The ratios are calculated by the present author. For abbreviations of measurements – see Material and methods

	Fossil forms											Recent forms ¹⁾				
	<i>Quyania</i> aff. <i>polonica</i> Varshets			<i>Q. chowi</i> Ertemte 2 ¹		<i>Scaptonyx</i> (?) <i>dolichochoir</i>		<i>Quyania polonica</i>			<i>Neurotrichus gibbsi</i>	<i>Urotrichus pilirostris</i>	<i>U. talpoides</i>			
	1	2	3	1	2	7	8	L7	LM	X	?	?	1	1	1	2
1. H-MAXL	7.85	(7.80)	–	6.60	7.40	7.10	6.70	7.10	7.21	8.66	8.30	7.80	7.60	6.90	9.4	9.6
2. H-L1	6.25	6.70	–	5.00	5.30	4.87	4.90	4.80	4.88	6.20	–	–	5.60	4.60	6.2	6.4
3. H-L2	4.10	4.50	–	3.40	3.60	3.55	3.15	3.24	3.37	4.20	–	–	3.40	3.10	3.8	4.1
4. H-L3	3.30	3.20	–	3.10	3.20	2.37	2.22	2.62	2.67	3.50	–	–	3.40	3.20	3.8	4.2
5. H-MINW	1.70	1.65	1.70	1.40	1.40	1.22	1.18	1.41	1.34	1.78	1.65	1.65	1.60	1.30	1.8	1.8
6. H-W1	3.75	–	3.75	3.00	3.30	3.15	2.90	3.18	3.21	4.16	–	–	3.60	3.20	4.6	4.5
7. H-W2	3.90	3.55	–	3.20	–	3.20	2.95	3.01	–	4.17	4.15	3.90	3.80	3.30	4.4	4.3
8. H-MAXW	4.10	4.30	–	–	–	3.40	3.15	3.30	–	4.50	–	–	–	–	–	–
2/1	79.6	85.9	–	75.8	71.6	68.6	73.1	67.6	67.7	–	–	–	73.7	66.7	66.0	66.7
3/1	52.2	57.7	–	51.5	48.6	50.0	47.0	45.6	46.7	–	–	–	44.7	44.9	40.4	42.7
4/1	42.0	41.0	–	47.0	43.2	33.4	33.1	36.9	37.0	–	–	–	44.7	46.4	40.4	43.7
5/1	21.6	21.1	–	21.2	18.9	17.2	17.6	19.9	18.6	20.5	19.9	21.1	21.0	18.8	19.1	18.8
6/1	47.8	–	–	45.5	44.6	44.4	43.3	44.8	44.5	48.0	–	–	47.4	46.4	48.9	46.9
7/1	49.7	45.5	–	48.5	–	45.1	44.0	42.4	–	48.1	50.0	50.0	50.0	47.8	46.8	44.8
8/1	52.2	55.1	–	–	–	47.9	47.0	46.5	–	–	–	–	7.60	–	–	–

nounced on the labial mouth of the hypoflexid. Neither an entocingulid nor a postcingulid are present.

M₂. The tooth is larger than M₁. The trigonid is longer but narrower than the talonid. The protoconid is the highest cusp. The proto- and metaconids are set not so close together as in M₁ and the protocristid is lower in the central part. The crista obliqua ends slightly before the middle of the posterior trigonid wall. The entostylid is robust. The well expressed precingulid runs from the anterior part of the paraconid to the labial base of the protoconid. The ectocingulid is well developed between the proto- and hypoconid and connected with the praecingulid at the base of the protoconid. In one of the two M₂ available the talonid basin is closed lingually by a conspicuous entocristid, while in the other one it is open – there is no entocristid. The entocingulid is very slight while the postcingulid is missing.

M₃. The trigonid is wider and longer than the talonid. The crista obliqua runs towards the median part of the protocristid but it is separated from the respective wall by a notch. The talonid basin is partially closed by a well developed entocristid. The precingulid is prominent while the ectocingulid persists only between the bases of the proto- and hypoconid. The ento- and postcingulid are missing. There is no entostylid.

Humerus. The teres tuberculus and the pectoral ridge are well developed. The latter one reaches distally beyond the half-way point along the shaft. The teres tuberculus is shifted proximally, so its distal end is situated more proximally than the proximal tubercle. The proximal part of the teres tubercle passes into the shaft gradually. The pectoral tubercle is well pronounced and situated rather laterally, so it can be seen in posterior view. The long axis of the humeral head is slightly declined from the long axis of the shaft. The “Scalopine”-ridge is quite prominent, slightly curved and directed from beneath the middle of the head to the lesser tuberosity. The notch between the greater tuberosity and the humeral head is well pronounced. In anterior view, the trochlea is narrow and connected to the capitulum by a narrow articular bridge. The branchialis fossa is deep. The olecranon fossa is well developed and situated obliquely in relation to the long axis of the shaft.

Discussion. The humeri can not be directly associated with the jaw fragments, but size, general morphology and evolutionary level are in agreement. Most probably they belong to the same species, taking into account the lack of evidence for occurrence of other species with similar morphology within the assemblage.

In some respects the available humeri show some similarities with shrew-moles with slight fossorial specialization such as the recent species *Scaptonyx fuscicaudatus* MILNE EDWARDS, 1872 (*Scaptonychini*, Talpinae). The available lower teeth differ however from the recent species by the presence of two roots on P₃ (if correctly estimated on the basis of the available alveoli), a precingulid on M₁, and its better development on M₂ (cf. HUTCHISON 1974), lack of a metastylid on M₂, labial termination of the crista obliqua of M₂ and M₃ (cf. STORCH & QIU 1983). As concerns the fossil species referred tentatively to the genus (HUTCHISON 1974) – “*Scaptonyx*” *edawrdsi* (GAILLARD, 1899)(La Grive-Saint-Alban, France, Tortonian) the specimens from Varshets differ in having larger size, more labial termination of the crista obliqua not reaching the metacristid or talonid notch (cf. HUTCHISON 1974). Comparisons with the holotype (humerus, La Grive-Saint-Alban, France, Tortonian) of *Scaptonyx* (?) *dolichochoir* GAILLARD, 1899 (Table 3) indicate that the Varshets specimens are larger and differ in proportions. According to HUTCHISON (1974) the material from the type locality is better referred to as *Urotrichus* TEMMINCK, 1842. According to STORCH & QIU (1983) the material from the Polish Ruscian and Villanyian localities, originally described as *Scaptonyx* ? *dolichochoir* (SKOCZEŃ 1980), should be designated as *Urotrichus*, also. The humeri from Varshets are clearly different from the above mentioned Polish specimens in size and proportions (Table 3).

The material from Varshets shows many similarities with *Quyania* (*Q. chowi* STORCH & QIU, 1983, late Turolian or Ruscian of inner Mongolia, China) and *Neurotrichus* (cf. STORCH & QIU 1983): 1) horizontal ramus of mandible evenly tapered anteriorly; 2) talonid basin (M₁-M₃) partly

closed by entoconid and entocristid, having a talonid notch; 3) presence of a precingulid on M_1 ; 4) crista obliqua terminating halfway across the protocristid and separated from the posterior wall of the trigonid by a notch; the trigonid not compressed antero-posteriorly; 5) trochlea of humerus narrowing towards the capitulum and connected to the capitulum by a thin bridge of the articular facets. In these characters the material is clearly different from the recent genus *Urotrichus*. The situation of the pectoral tubercle, however, does not agree with the “*Neurotrichus-Quyania* state”, being identical with “*Urotrichus* – state”. Additionally, the humeri from Varshets show greater proximal extension of the pectoral crest and its proximal edge is oblique in relation to the long axis of the bone. In these respects they are similar to the recent *U. talpoides* (cf. STORCH & QIU 1983, Text.-fig. 20) and *Neurotrichus minor* SKOCZEŃ, 1993 (SKOCZEŃ 1993, Fig. 4). In *Neurotrichus gibbsi*, *N. polonicus*, *Q. chowi*, and *U. (Dymecodon) pilirostris* (TRUE, 1886) this edge is nearly perpendicular to the humeral axis (cf. SKOCZEŃ 1980, 1993, Fig. 4; STORCH & QIU 1983, Figs. 17, 18, 19, 21). In these characters the form from Varshets seems more fossorially adapted. Regardless of the above similarities with the recent *U. talpoides*, the shape of the mandible and the above mentioned dental features, being more informative for generic assignment, indicate that the material from Varshets does not belong to *Urotrichus*.

According to comparisons between *Neurotrichus* and *Quyania* (STORCH & QIU 1983) the material from Varshets is more similar to the first genus in having an anterior mental foramen situated under P_3 , and a more fossorially specialized humerus. Up to now three fossil species have been tentatively referred to the genus *Neurotrichus*: *N. polonicus* SKOCZEŃ, 1980, *N. minor* SKOCZEŃ, 1993, and *N. columbianus* HUTCHISON, 1968. However, as pointed out by STORCH & QIU (1983), the last species is closely related to *Yansuella* and does not belong to the tribe *Urotrichini* at all. The generic status of the remaining two species is still controversial. According to STORCH & QIU (1983) some characters of *N. polonicus* (e. g. double rooted lower premolars, broad posterior wall of the protoconid of P_3) speak in favor for its inclusion in *Quyania*. This point of view is followed here. Regardless the generic designation, *Q. polonica* fits well in an ancestor-descendant relationship with *Q. chowi* being more advanced by having greater size, weaker development of cingula, and in particular, in having a precingulid on M_1 which extends only halfway across the anterior wall of the trigonid (STORCH & QIU 1983). In many respects *Q. polonica* seems more advanced than the recent North American species, *N. gibbsi* too, and a parallel evolution of *Q. polonica* and *N. gibbsi* has been supposed (STORCH & QIU 1983). This hypothesis is confirmed by the molecular data as well (SHINOHARA *et al.* 2003). The discovery of *Q. minor* from Weze 2, Poland, a small sized but specialized mole-shrew (SKOCZEŃ 1993), questioned the consideration of the larger size as an evolutionary advanced trait. Nevertheless, according to the position of the anterior mental foramen, the reduction of the precingulid on M_1 , the relatively massive and fossorially specialized humerus (proximal end of the teres tubercle somewhat angled, pectoral tubercle bends laterally) the form from Varshets seems rather advanced also. It can be considered as a specialized form of the *Quyania*-phylum. In size and general morphology the material from Varshets is closest to *Q. polonica*. The differences concern the position of the mental foramen, some details in the structure of the lower molars, the inclination of the humeral head, the position of the pectoral tubercle, the proximal extension of the pectoral crest with an oblique edge. The limited material from Varshets does not permit the evaluation of the taxonomic value of these differences and the determination remains tentative.

Subfamily Desmaninae THOMAS, 1912

Genus *Desmana* GULDENSTAEDT, 1777

Desmana cf. *polonica* PASHKOV et TOPACHEVSKYJ, 1990

(Fig. 9: a, b)

Material: One fragment of left mandible with P_4 , M_2 , M_3 (V22-1), 1 M_1 (No: V22-2); 1 rostral part of skull with C^1 , P^1 , P^2 (left) and C^1 , P^2 (right) (V340); 1 P^3 (V343).

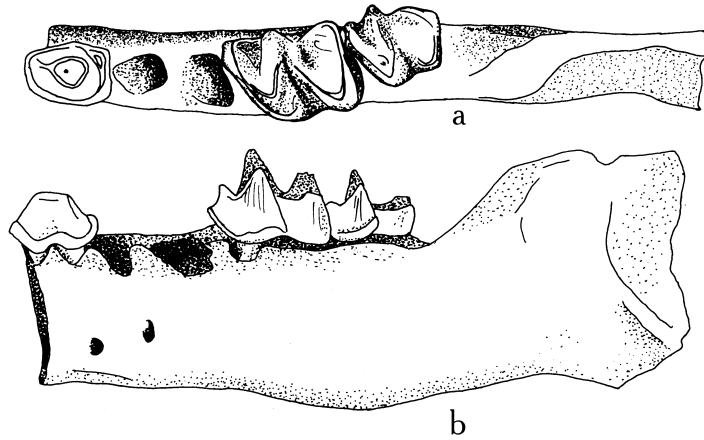


Fig. 9. *Desmana cf. polonica* – left mandibular fragment with P₄, M₂-M₃ (V22-1).

Measurements.

Lower teeth (L x W) and mandible	Upper teeth (L x W)
P ₄ = 2.25 X 1.57. W/L = 69.77 %.	C ¹ = 1.75 x 1.32; 1.67 x 1.25.
M ₁ = 3.25 x 2.27.	P ¹ = 1.50 x 1.25.
M ₂ = 3.17 x 2.30.	P ² = 2.27 x 1.65; 2.17 x 1.50.
M ₃ = 2.35 x 1.70.	P ³ = 2.00 x 1.65.
M-LM ₁ -M ₃ (a) = 8.10.	
Height of horizontal branch of mandible under P ₄ = 3.75; thickness = 1.8.	
Height of horizontal branch of mandible under M ₃ = 3.85; thickness = 2.1.	

Description. C¹. The posterior and anterior cingula are well developed. The cross section of the crown is elliptical with a more convex labial side. There is no labial cingulum.

P¹. The tooth is double rooted. In occlusal view, the crown has a well pronounced posterolingual extension – the outline is oval- triangular.

P². The tooth is longer than wide. In occlusal view, its greatest width is at the second third of the crown. The posterior and especially the anterior cingulum are well developed. There is a sharp posterocrista running from the tip to the cingulum.

P³. Three roots. The crown outline is a rounded triangle with a convex basal side (situated lingually); the apex of the triangle is a result of the lingual extension of the crown, which bears a small but well individualized protocone.

Mandible. Two foramina are observable on the buccal side; the anterior one is under the posterior end of P₄; the posterior foramen is between the roots of M₁.

P₄. The protoconid is massive and large. The paraconid is poorly individualized. There is no metaconid. The entoconid is low but well pronounced, separated from the posterocingulid. The labial cingulid, and especially its anterolabial part is well developed, while the lingual cingulid is weaker, interrupted in the middle part of the crown.

M₁-M₂. The trigonid is surrounded by a cingulid, which lingually disappears toward the metaconid. The proto- and hypoconid are separated by a broad but shallow valley (hypoflexid) which

narrows lingually. There is a thin postcingulid, which ends lingually by a well pronounced entostylid.

M₃ is smaller than the previous molars. The talonid is broad, lacking an entostylid. Labially, the trigonid is surrounded by a cingulid. There is no lingual cingulid.

Discussion. According to RÜMKE (1985) the fossil desmanins belong to three groups 1) small forms with straight I¹ with a bilobate tip and I₁ with crown which does not overhand the root anteriorly; the P₂ and P² are longer than P₃ and P³, respectively; 2) small forms (LM₁ from 2.20 to 3.00; LM¹ from 2.45 to 3.35 mm) with pointed tip of I¹ and the crown of the I₁ overhands the root anteriorly; the P₂ and the P² are of the same length as P₃ and P³, respectively; 3) medium to large forms (LM₁ from 2.25 to 4.00; LM¹ from 2.75 to 4.80 mm) with pointed tip of I¹ and the crown of the I₁ overhands the root anteriorly; the P₂ and P² are longer than P₃ and P³, respectively.

Various names have been employed for the first group. Initially it was defined under the name *Dibolia* RÜMKE, 1985. Later, RZEBIK-KOWALSKA and PAWŁOWSKI (1994) found that this name is a junior homonym of *Dibolia* LATREILLE, 1829 (Coleoptera) and proposed the name *Ruemkelia*. On the other hand HUTTERER (1995) and DAHLMANN (2001) regard *Archaeodesmana* TOPACHEVSKYJ & PASHKOV, 1983 as the correct generic name for *Dibolia* RÜMKE, 1985. The last point of view is followed here. The second group presented above comprises species belonging to the genus *Galemys* KAUP, 1829, while the third one embraces the species of the genus *Desmana* GULDENSTAEDT, 1777 (RÜMKE 1985).

The remains belong to a medium sized form of water-mole. It is clearly smaller than *Desmana meridionalis* TOPACHEVSKYJ & PASHKOV, 1990, *D. nogaica* TOPACHEVSKYJ & PASHKOV, 1990, and *D. thermalis* KORMOS, 1930 (= *D. crassidens* KRETZOI, 1953). The last species has a single rooted P¹, while in the form from Varshets this tooth is double-rooted. At the same time it is larger than *Galemys kormosi* (SCHREUDER, 1940), *Archaeodesmana pontica* (SCHREUDER, 1940), *A. gettica* TERZEA, 1980 (= *A. bifida* (ENGESSER, 1980)) (from this species the specimen from Varshets differs also in having an entoconid on P₄), *Desmana verestshagini* (TOPACHEVSKYJ, 1961) (from the last species the mandible under consideration differs also in lacking any trace of a metaconid on P₄), *Archaeodesmana acies* DAHLMANN, 2001 from Wölfersheim, Germany (MN15, upper part), (DAHLMANN 2001). The size of the mandible under study is comparable with that of *Desmana nehringi*, *D. polonica* and *D. kujalnikensis* (RZEBIK-KOWALSKA 1971; TERZEA 1980; PASHKOV & TOPACHEVSKYJ 1990; DAHLMANN, 2001). However, it is slightly more slender than the specimens of *D. nehringi*, described by SCHREUDER (1940), but the lower teeth are slightly larger than the respective teeth of *D. nehringi* from Villany 3, Rebielice Królewskie 1A, Beremend 1 – 3 (RÜMKE 1985), and Wölfersheim (DAHLMANN 2001). Moreover, the form described by SCHREUDER (1940) differs in having a metaconid on P₄ and the position of the posterior mental foramen (for details see RZEBIK-KOWALSKA 1971). In these characters the mandible from Varshets is close to the Polish material from Rebielice Królewskie 1A, Poland (MN16), referred initially to *D. nehringi* (RZEBIK-KOWALSKA 1971). The differences between the Pliocene Polish forms and the Villafranchian ones from Hungary and Germany (SCHREUDER 1940) are considered by RZEBIK-KOWALSKA (1971) as evolutionary changes within the scope of one species - *Desmana nehringi*. On the other hand PASHKOV & TOPACHEVSKYJ (1990), on the basis of the structure of the upper premolars and proportions of P₄, referred the Polish form to a separate species, *Desmana polonica*. Width/length ratio of P₄ in *D. nehringi* ranges from 55.5 % to 64.0 %, while in the *D. polonica* and *D. kujalnikensis* this index falls between 68.1 % and 76.6 %. According to RÜMKE 1985 this index ranges between 67 and 77% in the form from Rebielice Królewskie 1A. This criterion and the similarities with the Polish remains mentioned allow the consideration of material from Varshets as closely related to *D. polonica*. The fact that the form from Varshets is younger than the Polish ones but more similar to them than to *D. nehringi* from the Villafranchian of Hungary and Germany speaks in favor of the hypothesis that *Desmana polonica* is rather a separate evolutionary branch than a phylogenetic stage within the *D. nehringi* lineage.

Although very similar to *Desmana polonica*, the mandible from Varshets shows some differences: more robust molars, a slender horizontal ramus, a more posterior setting of the anterior mental foramen. However, the scarce material available does not permit the evaluation of these differences and prevents more detailed comparisons with *D. kujalnikensis*. The latter species is characterized mainly by the size and structure of the upper and lower premolars, but there is no information about the size and structure of the molars, the situation of mental foramina, etc. However, the lack of any trace of a paraconid on P₄ of our material points rather to *D. polonica* than to *D. kujalnikensis*.

IV. DISCUSSION

According to the paleoenvironmental reconstructions based on voles and shrews (POPOV 2001, 2003) the climate during the time of deposition (MNQ17, about 2.23 MY B. P.) was relatively humid and mild with a mosaic landscape of forests and meadows. The studied insectivore assemblage may contribute further in this respect.

Usually *Erinaceus* is considered as a genus embracing opportunistic forms so its presence in the assemblage is of a limited paleoecological importance. Nevertheless, having in mind the habitat requirements of the recent European species, the presence of the remains of hedgehogs indicates a temperate climate and mosaic landscape of forests, shrubbery and open areas.

The present-day small-sized moles of the genus *Talpa* occur in the southern parts of Europe and adjacent territories of West Asia. The occurrence of such a form in Varshets suggests a relatively warm climate, similar to the contemporary climate in the south-eastern part of the country where a similar species, *Talpa levantis*, exists. The abundance of moles suggests relatively humid conditions such as deciduous forests and fresh meadows on soft soils.

The presence of *Desmana* cf. *polonica* no doubt indicates the occurrence of open water in the surroundings of the locality.

The occurrence of *Quyania* aff. *polonica* (tribe Urotrichini) and "*Scalopoides*" cf. *copernici* (tentatively referred to tribe Scalopini) in Varshets is of particular biogeographic and paleoenvironmental importance. Their present-day relatives occur in Eastern Asia and North America. The recent members of Urotrichini frequent humid forests rich in decaying litter. The recent species *Scapanulus oweni* THOMAS, 1912, the single Old World member of Scalopini, inhabits coniferous mountain forests of Kansu, Sichuan and Shensi in China. Up to now, similar forms from Villanyian and Biharian are known only from Poland. The absence of these species from large territories of Europe during the Late Pliocene and Early Pleistocene may be attributed to the gradual cooling and drying of the climate. It can be assumed that their occurrence in Varshets is of a relic character and can be attributed to the local conditions. The present day climatic and environmental conditions speak in favor of this assumption. The recent climate of the Berkovitsa and Varshets basins is more mild, not so continental and dry as the climate on the nearest parts of the Danubian Plain (BONDEV 1991). On the slopes of the hills near Berkovitsa natural stands of *Castanea sativa* occur, while near the locality there is a forest of *Aesculus hippocastanum*. Having in mind that the main features of the relief determining this regional climatic peculiarity were formed during the first half of the Pliocene (VAPTZAROV 1997) it can be supposed that, as today, during the time of deposition the area of Varshets was a refuge where forest vegetation and accompanying fauna found shelter. These species did not survive the further cooling of the climate during the Pleistocene and perished. Their relatives or ecological analogues nowadays occur locally in the mainstay areas of the Tertiary flora – in East Asia and North America. The environmental conditions in these areas may give an idea about the past environment during the time of deposition. For example, the recent climate in S Japan where *Urotrichus* spp. occur is as follows: mean July temperature – 28°C; mean January temperature – 5°C; mean year precipitation – 1900 mm; mean annual temperature amplitude – 16°C. The vegetation is presented by leaf and mixed coniferous forests with evergreen elements. It can be sup-

posed that similar conditions were characteristic for the studied area during the Late Villanyian. This is confirmed by the late Pliocene flora of the Sofia basin (PALAMAREV 1982). It is composed by the following tree genera: *Ginkgo*, *Quercus*, *Fagus*, *Castanea*, *Carpinus*, *Populus*, *Salix*, *Alnus*, *Ulmus*, and *Acer*. The forests were composed mainly of *Quercus hartwissiana*, *Q. cerris*, *Fagus orientalis*, and *Carpinus betulus*. Such communities occur nowadays in Strandzha Mt, SE Bulgaria (BONDEV 1991). This is also the area where *Talpa levantis*, a species very similar to the fossil mole from Varshets, occurs. The climatic parameters in this region are comparable with those from E Asia, presented above, but the annual precipitation is lower – 980 mm. Taking into account the recent conditions in the area of Varshets, it can be concluded that the studied insectivore assemblage points to a climate close to the recent one, but with higher January temperatures and annual precipitation.

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