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Scaptonychini VAN VALEN, 1967, *Urotrichini* and *Scalopini* DOBSON, 1883 (*Insectivora, Mammalia*) in the Pliocene and Pleistocene of Poland

[With pls. III—VII, 5 text-figs.]

Scaptonychini VAN VALEN, 1967, _Urotrichini_ and _Scalopini_ DOBSON, 1883 (_Insectivora, Mammalia_) w pliocenie i plejstocenie Polski

Abstract. Numerous remains of the genus *Geotrypus* from the Pliocene and Pleistocene layers of Zamkowa Dolna Cave at Olsztyn near Częstochowa, as well as those of Kadzielnia and Kamyk have been identified and the new species *?Geotrypus copernici* n. sp. is described.

A description of the remains of *Scaptonyx* (?) *dolichochir* GAILLARD, 1899, from the Lower Pliocene of Podlesice and the Middle Pliocene of Rębielice Królewskie I is also given. Abundant remains of the genus *Neurotrichus*, now living in North America, obtained from this locality and from Zamkowa Dolna Cave, Kadzielnia and Kamyk have been studied. The new species *?Neurotrichus polonicus* n. sp. is described. The presence of this form in the fossil material from Poland fills up the gap in our knowledge of the origin and geographical expansion of this genus. The remains of the genus *Scapanulus* from the Pliocene deposits of Podlesice and Węże I have been identified and the new species *Scapanulus agrarius* n. sp. is described.

INTRODUCTION

The deposits filling the fissures in Jurassic limestones in the territory of Poland contain numerous remains of vertebrates, including mammals, of the period from the Lower Pliocene throughout the Middle Pleistocene. The author's previous paper (SKOCZEŃ, 1976) on the remains of the genus *Condylura* ILLIGER 1811 was the first part of a study on the subfamily *Talpinae*, abundantly represented in these faunas. The present work is the second part of this study. Although it has not yet included all the remains of the *Talpinae* collected at the localities under study, nevertheless it indicates that before the maximum of the Pleistocene glaciation their fauna was much richer than it is at present. Moreover, it shows the presence at that time of a member of still another genus now endemic in North America, i. e. *Neurotrichus* GÜNTER, 1888.

Terminology and methods of measuring. The modified HUTCHISON'S (1968, 1974) nomenclature is used in the descriptions of teeth. The methods

applied for measuring teeth and postcranial skeleton elements are given in Fig. 1. All the measurements were taken under an MST 130 microscope.

The materials described in this paper are in the possession of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow.

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I am also greatly indebted to Prof. Helmuth ZAPFE of the Austrian Academy of Sciences in Vienna for giving me access to the material of bones of *Scaptonyx edwardsi* GAILLARD. I thank Mrs. Anna WENDORFF for carefully made drawings and Mr. Jacek OPIDOWICZ for photographic work.

LOCALITIES

Podlesice: deposits of a deep cave, containing mostly remains of bats and those of insectivores, rodents and carnivores, referred to the Lower Pliocene (AGADJANIAN and KOWALSKI, 1978), although BERGGREN and VAN COUVERING (1974) thought that they represent the uppermost portion of the Miocene.

The deposits of Węże I, found in a vertical cave, contain a rich fauna of amphibians, reptiles and both small and big mammals. A list of animals of this locality will be found in papers by KOWALSKI (1964), CZYZEWSKA (1968, 1969), FAHLBUSCH (1969), RZEBIK-KOWALSKA (1971) and other workers. These deposits are considered to be from Middle Pliocene time.

Rębielice Królewskie I has provided a rich fauna of vertebrates, assigned to the Lower Villafranchian. The composition of this fauna is given in papers by MŁYNARSKI (1960), KOWALSKI (1960b), RZEBIK-KOWALSKA (1971) and others.

A fauna of small mammals has been found in Layer C of Zamkowa Dolna Cave at Olsztyn near Częstochowa. It is somewhat younger than the Middle-Villafranchian fauna of Rębielice Królewskie (RZEBIK-KOWALSKA, 1971). As regards rodents, it includes *Pliomys*, *Ungaromys*, *Lemmus* etc. and is analogous to the fauna of Osztramos 3 in Hungary.

Numerous remains of small mammals described chiefly by KOWALSKI (1960a) and recently by FAHLBUSCH (1969) and RZEBIK-KOWALSKA (1971) occurred in karst fissures filled with clay at Kadzielnia near Kielce. They are most probably Tiglian interglacial in age.

At Kamyk, as at the previous locality, the fissures containing remains of small vertebrates were filled with clay. The composition of this fauna is given in papers by KOWALSKI (1960a), FAHLBUSCH (1969) and RZEBIK-KOWALSKA (1971). It probably dates from the Günz glaciation.

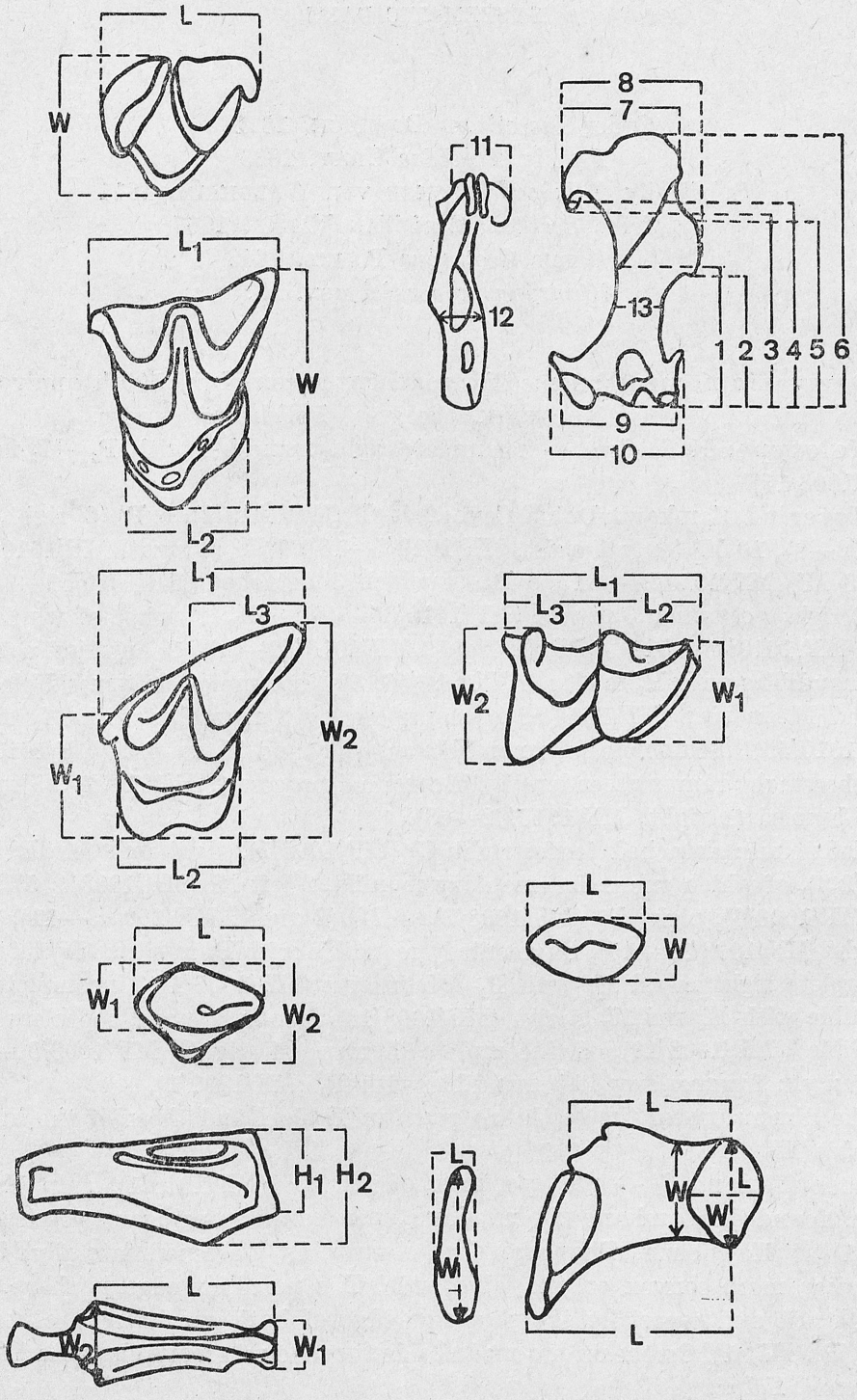

Fig. 1. Methods of measuring the teeth and postcranial skeletal elements according to HUTCHISON (1974)

SYSTEMATIC PART

Order *Insectivora* BOWDICH, 1821
Family *Talpidae* GRAY, 1825
Subfamily *Talpinae* FISCHER von WALDHEIM, 1811
Tribe *Scaptonychini* VAN VALEN, 1967
Genus *Geotrypus* POMEL, 1848
?Geotrypus copernici nov. sp.

Derivatio nominis: named for commemoration of the 500th anniversary of the birth of Mikołaj KOPERNIK, the great Polish astronomer.

Holotype: Kadzielnia — incomplete right mandible with P_4—M_2 in situ (MF/1008/17).

Material. Zamkowa Dolna Cave: left C^1 (MF/1010/1), 5 P^4 (2 right, MF/1010/2—6), 10 M^1 (only 1 right, MF/1010/7—16), 7 M^2 (4 right, MF/1010/17—23), 8 M^3 (MF/1010/24—31), 6 P_4, of which 3 detached (MF/1010/32—34), 15 M_1 (2 right), of which 3 in situ (MF/1010/35—46), 6 M_2 (2 right), of which 1 in situ (MF/1010/47—51), 4 M_3 (1 right, MF/1010/52—55), 2 anterior parts of left mandibles with P_4 in situ (MF/1010/56, 57), incomplete left mandible with P_4 and M_1 in situ (MF/1010/58), incomplete right mandible with M_1 in situ (MF/1010/59), incomplete left mandible with M_1 and M_2 in situ (MF/1010/60), detached right ramus ascendens with coronoid process (MF/1010/61), 5 incomplete humeri (1 right, MF/1010/62—66).

Kadzielnia: detached teeth: right C^1 (MF/1008/1), right and left P^4 (MF/1008/2,3), of which one in fragmentary maxilla, 2 left M^1 (MF/1008/4, 5), right M^2 (MF/1008/6), right P_4 (MF/1008/7), 4 M_1 (2 right, MF/1008/8—11), 4 M_2 (2 right, MF/1008/12—15), fragmentary mandible with P_4 in situ (MF/1008/16), incomplete right mandible with P_4—M_2 in situ (MF/1008/17), incomplete left mandible with M_1 and M_2 in situ (MF/1008/18), incomplete and toothless right mandible (MF/1008/19), 4 incomplete humeri (1 right, MF/1008/20—23).

Kamyk: fragmentary left mandible with P_4 (MF/1009/1).

The dimensions of the teeth are given in Table I and those of the humeri in Table II.

Description: C^1 — one specimen of left C^1 (MF/1010/1), talpoidal in shape, found in Zamkowa Dolna Cave and another analogous tooth (MF/1008/1) at Kadzielnia. They are characteristically flattened laterally, being somewhat more convex on the labial side. The posterior edge is sharp. The lingual side and especially the posterior edge of both specimens are heavily worn (Pl. III, 1). On the antero-medial side they lack a groove characteristic of the genus *Talpa*.

P^4 — three-rooted, nearly same height as molars (Pl. III, 2—4). It is high and elongated, has a big symmetrical paracone with a sharp posterior edge

Table·I

Measurements of the teeth and mandibles of ? Geotrypus copernici n. sp. from Zamkowa Dolna Cave and Kadzielnia

		Zamkowa Dolna Cave				Kadzielnia			
		N	min.	mean	max.	N	min.	mean	max.
C^1	L	1	-	2.00	-	1	-	1.80	-
	W		-	0.90	-		-	0.88	-
P^4	L	5	2.00	2.17	2.41	2	2.00	2.22	2.25
	W_1		0.95	1.06	1.15		1.10	1.12	1.15
	W_2		1.50	1.57	1.70		1.47	1.53	1.60
M^1	L_1	10	2.50	2.80	3.00	2	2.95	2.98	3.00
	L_2		1.55	1.65	1.81		1.62	1.66	1.70
	L_3		1.10	1.23	1.50		1.25	1.32	1.40
	W_1		1.52	1.77	2.00		1.82	1.91	2.00
	W_2		2.30	2.38	2.50		2.35	2.45	2.55
M^2	L_1	7	2.00	2.09	2.15	1	-	-	-
	L_2		1.55	1.58	1.60		-	1.55	-
	W^2		2.20	2.41	2.50		-	2.48	-
M^3	L	8	1.50	1.67	1.78		-	-	-
	W		1.40	1.73	1.90		-	-	-
P_4	L	6	1.60	1.77	2.00	3	1.85	1.92	2.00
	W		0.80	0.86	0.95		0.90	0.92	0.95
M_1	L_1	15	2.20	2.34	2.45	6	2.22	2.39	2.45
	L_2		1.10	1.24	1.40		1.20	1.29	1.35
	L_3		0.90	1.10	1.24		1.00	1.08	1.20
	W_1		1.10	1.21	1.30		1.20	1.27	1.30
	W_2		1.30	1.43	1.55		1.45	1.51	1.55
M_2	L_1	6	2.12	2.19	2.32	6	2.20	2.24	2.32
	L_2		1.11	1.17	1.22		1.05	1.19	1.30
	L_3		0.92	1.02	1.10		1.00	1.05	1.15
	W_1		1.20	1.30	1.35		1.35	1.42	1.45
	W_2		1.24	1.29	1.35		1.30	1.36	1.40
M_3	L_1	4	1.83	1.93	2.15		-	-	-
	L_2		1.00	1.16	1.40		-	-	-
	L_3		0.70	0.77	0.84		-	-	-
	W_1		1.00	1.15	1.45		-	-	-
	W_2		0.60	0.77	0.95		-	-	-
I_1 alv.-P_4		1	-	5.55	-		-	-	-
P_1 alv.-P_3			-	-	-	1	-	3.00	-
P_1- P_4		1	-	4.60	-		-	-	-
M_1- M_3 alv.		2	6.11	6.53	6.96	2	6.51	6.54	6.60
H. int. mand.:									
in P_4		3	1.41	1.61	1.72	1	-	1.74	-
in M_2		2	2.05	2.13	2.22	3	2.18	2.21	2.24
in M_3		2	2.00	2.00	2.00	3	2.11	2.18	2.25
Mandb. thickn.:									
in P_4		2	0.85	0.96	1.06	4	1.00	1.08	1.11
in M_2		2	1.04	1.17	1.35	4	1.25	1.41	1.50
in M_3		2	1.00	1.15	1.30	4	1.25	1.31	1.41

Table II

Measurements of the humeri of ? Geotrypus copernici n. sp. from Zamkowa Dolna Cave and Kadzielnia

	Zamkowa Dolna Cave /MF/1010/					Kadzielnia /MF/1008/			
	62	63	64	65	66	20	21	22	23
* 1.	-	-	-	-	-	4.25	4.05	3.60	-
2.	6.42	6.20	6.00	6.10	6.30	6.15	6.15	6.50	-
3.	-	-	-	-	-	-	-	-	-
4.	-	-	-	-	-	-	-	-	-
5.	9.11	8.55	-	8.40	-	8.50	8.55	8.90	-
6.	-	-	-	-	-	-	-	-	-
7.	-	-	-	-	-	-	-	-	-
8.	-	-	-	-	-	-	-	-	-
9.	5.93	6.10	5.49	6.00	-	5.50	5.60	5.70	5.34
10.	-	-	-	-	-	-	-	-	-
11.	-	-	-	-	-	-	-	-	-
12.	2.86	2.85	2.81	2.80	2.75	2.65	2.87	2.85	2.62
13.	2.65	2.91	2.60	2.62	2.65	2.60	2.55	2.65	2.48

* explanation of measurements see text-fig. 1.

and rounded anterior wall. The cylindrical cingulum surrounds the tooth all round. On the labial side the ectocingulum is distinctly broadened and on the lingual side its thin but high band surrounds the medially situated protocone. It is distinct on the anterior wall (Pl. III, 2—4). The roots are robust, in the upper part round in section, in the lower transversely flattened. The anterior root is the strongest, slightly arcuately bent and with a groove on the posterior side (Pl. III, 2—3).

M^1—strong, sturdy, trapezoid (Pl. III). Protocone high, pointed, with clearly distinguished metaconule, which has a separate top (Pl. III, 5—7). Protoconule far less distinct. Sturdy paracone lower than metacone, semicircular on labial side. The conspicuous parastyle is connected with the protocrista by a shelf-like projection. The slightly cylindrical ectocingulum is visible at the labial base of the paracone. The labially projecting mesostyles are distinctly divided. The lingual root is broad, robust and transversely flattened. The anterior labial root is relatively long, transversely oval in section. The posterior labial root is robust, transversely flattened (Pl. III, 7). The central root is needle-like, placed at the centre of the tooth bottom, round in section and connected with the other roots by low ridges.

M^2. Similarly to M^1, it is robust, trapezoidal, having a high protocone and a distinct metaconule with a separate top (Pl. III, 8). The protoconule, as in M^1, is less marked. The anterior and posterior walls are nearly parallel (Pl. III, 9,10) and the bent parastyle is separated from the paracrista by a depression. The mesostyles are bipartite. The pre- and postcingulum occur fragmentarily in some specimens. The tooth has four roots, of which the lingual is the sturdiest, transversely flattened and wider at the bottom. Both labial roots are laterally

flattened and the needle-like central root is not connected with the other roots by means of ridges. The dimensions are given in Table I.

M^3 is nearly as long as wide (Table I). The protocone is high, with a poorly marked protoconule but conspicuous metaconule, having a separate top. The paracone is well developed, much higher than the reduced metacone. The paracrista is high and well developed, separated from the parastyle by a depression (Pl. III, 11). The mesostyles are deeply divided. The lingual root is the most massive and slightly flattened, the anterior labial root round in section, and the posterior one transversely flattened.

P_4. In comparison with the corresponding tooth of the genus *Talpa* it is somewhat squatter, on the lingual side flattened and symmetrical. The protoconid is conical and the poorly marked metaconid lies further towards the lingual side (Pl. IV, 1—3). The posterior portion of the tooth is surrounded by the well-developed postcingulid. The cylindrical precingulid passes into fragmentary soft ecto- and entocingulids and the very well developed postcingulid (Pl. IV, 1—3).

M_1. Its trigonid is much longer than the talonid, with the anterior wall convex and the labial edge rounded. The paracristid is not directly connected with the paraconid but forms a conspicuous projection (Pl. IV, 1—6). The protoconid is somewhat higher than the hypoconid but pushed further towards the lingual side. The metaconid and entoconid are nearly the same height, conical and connected by a very low ridge. The proto- and metaconid lie close to each other and are connected by a high ridge. The paraconid is a low triangular cuspid, having no connection with the metaconid. The robust but low entostylid lies opposite the entoconid. The relatively high crista obliqua with a characteristic ridgy projection ends at the base of the protocristid (Pl. IV, 1—6). The cylindrical precingulid is more or less distinctly marked at the base of the anterior wall of the tooth. The fragmentary ectocingulid occurs at the edge of the hypoflexid and the cylindrical entocingulid is sometimes visible on the lingual side. The anterior root is smaller and more oval, the posterior one bigger and transversely flattened. Both are bent inwards at the end (Pl. IV, 1).

M_2 is less robust than M_1 and the difference in height between the proto- and hypoconid is greater. The lingual inclination is equal in them. The meta- and entoconid are triangular, the former being somewhat higher than both the ento- and paraconid. The proto- and metaconid are further apart from each other than in M_2 and the depression between them is wider and deeper (Pl. IV, 4—6). The crista obliqua ends at the base of the protocristid. The hypoflexid is bordered by the fragmentary ectocingulid. The anterior and posterior cuspids are present. The anterior root is triangular in section, the posterior is robuster than the anterior and subsquare in section, both are directed obliquely backwards.

M_3 is smaller than M_2, its trigonid is considerably longer, wider and higher than the talonid (Pl. III). The crista obliqua, as in M_1 and M_2, ends at the base of the metacristid. The entoconid is broad, transversely flattened. The anterior

accessory cuspid is present. The anterior root is narrower than the posterior.

The mandible is talpoidal (Pl. IV, 4—6), with a characteristic outward bend of its anterior part. The horizontal branch narrows to the front, its terminal part showing a distinct mental thickening. The coronoid process is hooked backwards. The anterior mental foramen is placed at the height of P_2/P_3 and the other one at that of the posterior root of P_4. The end of the mandibular symphysis reaches the anterior margin of P_4.

Humerus. None of the four humeri from Kadzielnia (MF/1008/20—23) and the five from Zamkowa Dolna Cave (MF/1010/62—66) is preserved whole. Morphologically these humeri are characterized by their elongate shaft, relatively narrow distal part, more proximal position of the teres tuberculus and probably narrow proximal part (Pl. IV, 7—8). The trochlea is notably talpoidal, the olecranon crest shaped and situated analogously to that in the genus *Talpa*. The olecranon fossa is deep, its shape is characteristic of the genus *Talpa*. The teres tuberculus is very distinct and the greater tuberosity, as shown by the surface of break-off, was well developed and quite talpoidal.

The structure of these humeri indicates the moderately burrowing, perhaps partly aquatic way of life of this form.

Affinities. LAVOCAT (1951) gives the following characteristics of moles belonging to the genus *Geotrypus*: "Talpinés présentant des caniniformes coniques, aiguës, des prémolaires coniques dans certaines espèces, tendant à s'insérer obliquement sur la mandibule, la racine antérieure étant externe; le talonide tend à être proportionnellement un peu plus développé que dans *Talpa*."

C^1 from both Polish localities resembles this tooth in *Paratalpa* and *Geotrypus* in shape. The anterior margin of this tooth is rounded and the groove, characteristic of the genus *Talpa*, on its anterointernal side is missing. However, in comparison with the genus *Paratalpa* this tooth is too large and its evenly worn lingual side indicates the presence of P_1 situated in the mandible analogously to its situation in *Talpa*. P^4 is very characteristic and the fact that it belonged to a specimen of the genus *Geotrypus* is suggested, among other things, by its lying within the range of variation of this last genus from the Oligocene of France (Fig. 2). As can be seen from this figure, in a number of other characters it resembles also the tooth of the genus *Nuragha*, described by De BRUIJN and RÜMKE (1974).

The basal cingulum, as in P^4 of the French form, runs all round the tooth, is soft on the labial side and sharp on the lingual. The size and shape of the roots are analogous to those on P^4 of *Geotrypus* cf. *jungi* LAVOCAT, although the protocone of the Polish form is much more distinct and more related to that in *Mygatalpa* or *Nuragha*. Moreover, the maxillary fragment with P^4 in situ (MF/1008/2) is slightly bulged where this tooth is set and the lacrimal foramen is situated, as in *Geotrypus*, at the height between the roots of M^1.

M^1 of the Polish form differs from that in *Geotrypus* in the presence of the

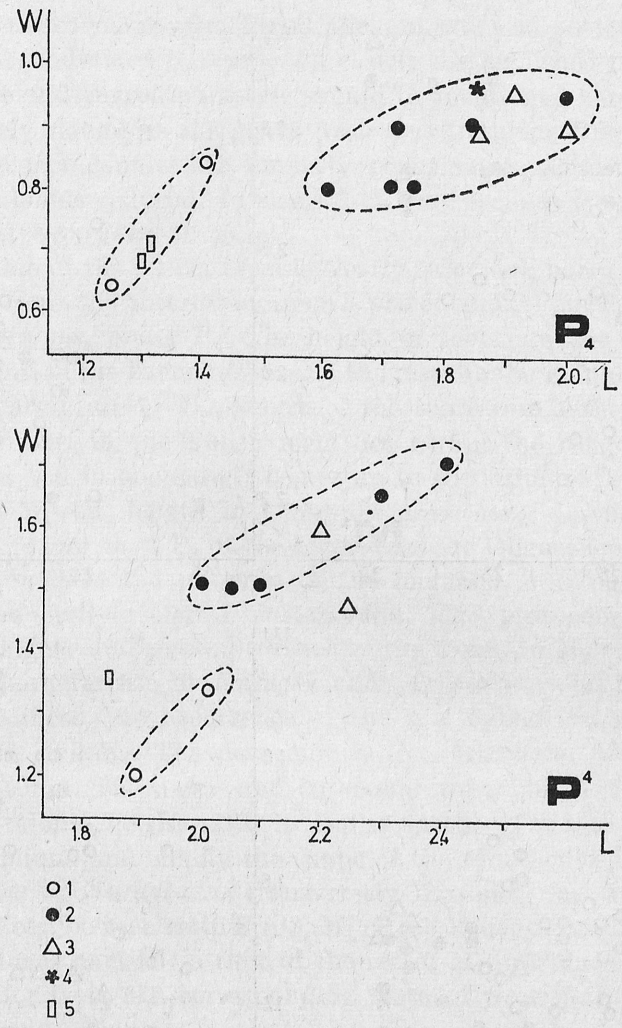

Fig. 2. Length and width of P_4^4 in *?Geotrypus copernici* n. sp. from the Polish Plio-Pleistocene deposits and of the genus *Geotrypus* from the European Oligocene and Miocene. 1 – *Geotrypus* cf. *jungi* (min. max. val.), (after Hugueney 1972), 2 – *?Geotrypus copernici* n. sp. from Zamkowa Dolna Cave, 3 – from Kadzielnia, 4 — from Kamyk, 5 — *Geotrypus oschiriensis* De Bruijn, Rümke 1974

paraconules and, especially, in its very conspicuous metaconules, deep division of the mesostyles, clearly distinguished parastyle, at the base of which on the labial side the cingulum is narrow and soft. In *Nuragha* M^1 is somewhat wider and its metaconule is not so distinct as in the Polish form. As can be seen in fig. 3, M^1 of the Polish form is larger than it is in *Geotrypus* cf. *jungi*, and yet it lies within the range of variation of this last. In M^2 it differs still more from *Geotrypus*, although as regards dimensions all the specimens from Zamkowa Dolna Cave lie within the range of variation of the French population of *Geotrypus* (Fig. 3). Morphologically M^2 of the Polish form more resembles this tooth

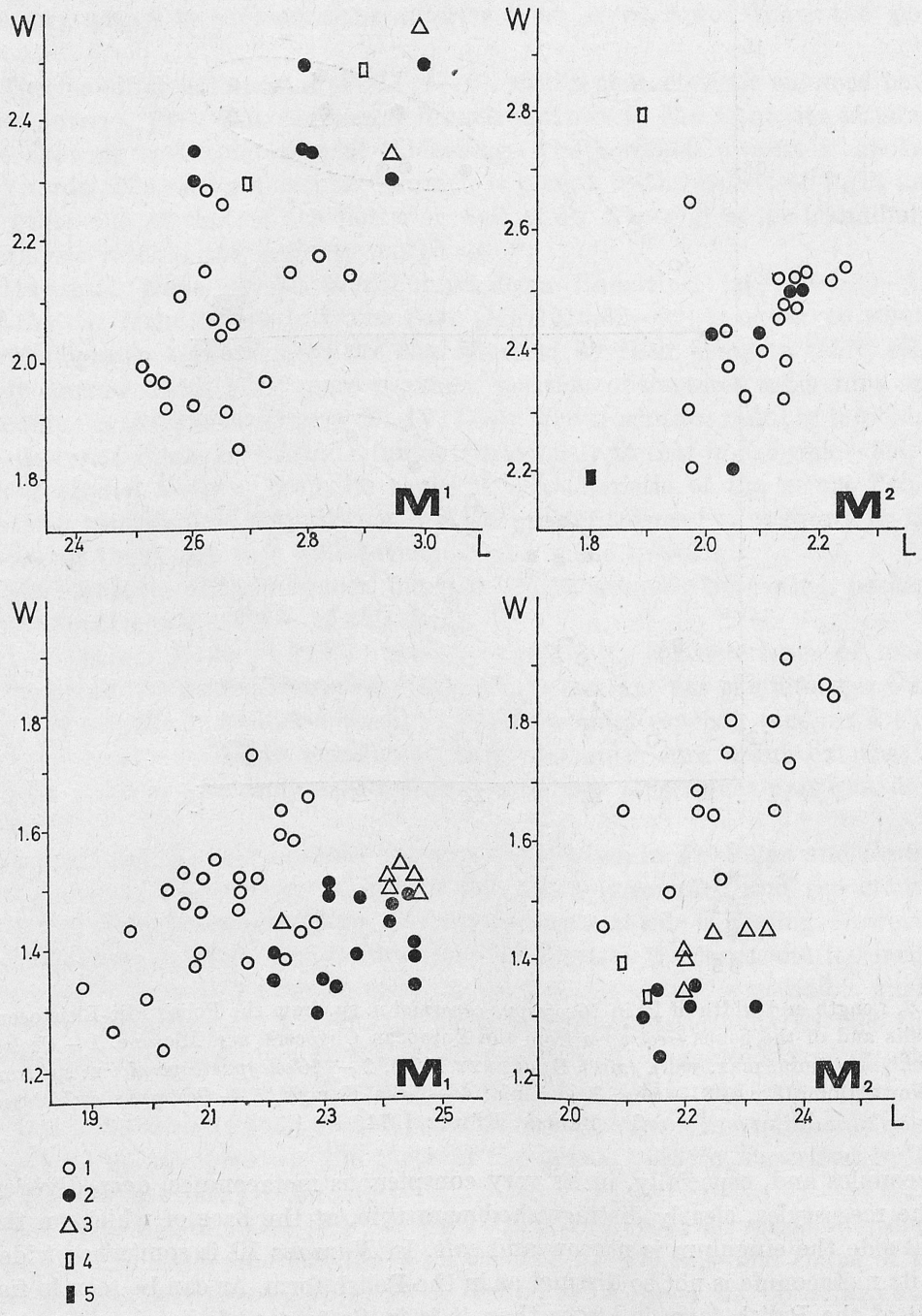

Fig. 3. Length and width of M_1^1, M_2^2 in ?*Geotrypus copernici* n. sp. from the Polish Plio-Pleistocene deposits and of the genus *Geotrypus* from the european Oligocene and Miocene. 1 — *Geotrypus* cf. *jungi* (after HUGUENEY 1972), 2 — ?*Geotrypus copernici* n. sp. from Zamkowa Dolna Cave, 3 — from Kadzielnia, 4 — *Geotrypus oschiriensis* DE BRUIJN, RÜMKE 1974 (max. val.), 5 — *Nuragha schreudere* DE BRUIJN, RÜMKE 1974 (max. val.)

of *Mygatalpa*, notably *Nuragha*. Its parallel anterior and posterior walls, deeply split mesostyle (undivided in *Nuragha*), clearly distinguished proto- and, above all, metaconule and curved parastyle should be mentioned here. In M^3 however this form closely resembles the genus *Geotrypus* from the Oligocene of France. The para- and metaconules are similarly conspicuous, mesostyles analogously divided and talonids reduced. In size M^3 of the specimes from Poland is very much like that *Geotrypus* cf. *jungi*.

The mandible of the Polish form is clearly talpoidal, narrowing to the front (Pl. IV, 4—6). Here, the anterior foramen is placed under P_2 or P_2/P_3, the posterior one, as in *Geotrypus*, under P_4. The height of the mandible at M_2 and M_3 is analogous to that in the French form and the mandibular symphysis also reaches the anterior margin of P_4. The length of the tooth-row both for the premolar and the molar part of the Polish form lies within the range of variation of *Talpa europaea* and in one case it comes up to the value of 6.96 mm (Table I) similar to the M_1—M_3 length in *Geotrypus arambourgi* LAVOCAT. P_4 is lower and somewhat longer than P_4 of the form from the Oligocene of France (Fig. 2) and differs from it in the presence of the lingually situated metaconid, soft precingulid and well-developed postcingulid. The protocone of the French form is much higher and pushed further to the front. In M_1 of the Polish form the features characteristic of *Nuragha* and *Mygatalpa*, i. e. the shape of the tooth, its sturdiness, the occurrence of the soft cylindrical and fragmentary precingulid, are striking. The paraconid is low, triangular and not connected with the metaconid. The meta- and entoconid are robust and well developed. The trigonid: talonid height ratio is similar in them, and so is the character of the crista obliqua and chiefly the shape of the roots, of which the posterior, as in *Mygatalpa* or *Nuragha*, is transversely flattened and directed obliquely to the rear. As can be seen from Fig. 3, M_1 of the Polish form makes a set whose axis of variation is parallel to that of the set of M_1 in French *Geotrypus*. Both M_2 and M_3 differ from the corresponding teeth of *Geotrypus*, more resembling those in the genus *Talpa*.

The morphology of the humerus points to close affinities with the genus *Scalopoides*. E. g. their distal width ranges between 5.30 and 6.10 mm and the shaft width between 2.45 and 2.91 mm (i. e. 43.7—50.0% of distal width — Table II). In the genus *Scalopoides* the greatest value of the distal width is 5.30 mm and the maximum shaft width 2.33 mm (HUTCHISON, 1968, Table 15). The percentage ratio of these measurements lies within limits of 41.95—52.4% in *Scalopoides*. In structural details the distal part of the humerus of the Polish form closely resembles this part of the humerus in *Scalopoides*: the shape of the trochlea, position of the trochlear crest, outlines and depth of the olecranon fossa and the capitulum situated somewhat more distally to the fossa flexor digit. prof., which is turned somewhat more laterally than in *Scalopoides*. In connection with the elongation of the shaft the teres tuberculus is situated more proximally, at the same distance from the distal margin as in *Scalopoides*. Also the foramen for vessels is situated, as in this last form,

halfway down the shaft (Pl. IV, 7—8). The Polish form however differs from *Scalopoides* in its better developed, typical talpoidal greater tuberosity. The size of the humeri compared with that of the teeth of the Polish form calls into question their membership in the same species, which is supported by the correspondence of the number of humeri with the number of teeth and mandibular fragments in particular localities as well as the colour of the humeri consistent with that of the other remains and indicating their simultaneous fossilization. Nevertheless, the teeth included here are the largest of the teeth of the *Talpinae* found at these localities and then the largest humeri should be apportioned to them. The largest humeri are however typical of *Talpa europaea* (*T. fossilis*?), which form is also represented in the tooth material of these localities and in size corresponds to the humeri in question. Thus, no other teeth can be apportioned to the scalopoidal humeri but those described above.

Some suggestions concerning the humerus of the genus *Geotrypus* are given in descriptions by earlier authors. Thus, according to POMEL (1853), "il diffère du genre *Talpa* par ces avant-molaires et ses caniniformes subulées aiguës, par son humerus plus long à apophyse trochantérienne plus isolée placée comme dans celui des *Astromyctres*".

Geotrypus tomerdingensis, described as "*Talpa*" *tomerdingensis* by TOBIEN (1939), differs in the structure of humerus from the specimens described above chiefly in its large size (19.1 mm long) and besides it resembles the humerus of the genus *Condylura* in a number of characters. As emphasized by HUTCHISON (1974), in morphological structure it does not differ from the humerus of *Geotrypus antiquus* BLAINVILLE. HUGUENEY (1972) found also that the humerus described by TOBIEN is much larger than that of *Geotrypus* cf. *jungi*.

In the light of the above-discussed differences of the Polish form from and its similarities to the European species of the genus *Geotrypus* its description as the new species *?Geotrypus copernici* nov. sp. from the Plio-Pleistocene localities of Poland is well-founded.

Tribe *Scaptonychini* VAN VALEN, 1967
Genus *Scaptonyx* MILNE EDWARDS, 1872
Scaptonyx (?) *dolichochir* (GAILLARD, 1899)

1899: *Scaptonyx* (?) *dolichochir* sp. n.; GAILLARD, p. 30, fig. 20.
1951: *Scaptonyx* (?) *dolichochir* GAILLARD; ZAPFE, p. 475, fig. 15.
1974: *Urotrichus dolichochir* GAILLARD; HUTCHISON, p. 225, fig. 17.

Material. Podlesice: 1 incomplete left humerus (ME/1011/1). Węże I: 2 left mandibles with M_1—M_3 (MF/1012/1—2).

Rębielice Królewskie I: 5 fragmentary mandibles, of which 4 left, some with M_1 and M_2 (MF/1013/1—5), 1 M^2 (MF/1013/6), 6 humeri, of which 3 right, 2 almost complete (MF/1013/7—12).

Kadzielnia: 1 right mandible with M_1 and M_2 (MF/1014/1) and 1 detached M_2 (MF/1014/2).

The measurements of the teeth and mandibles are given in Table III and those of humeri in Table IV.

Table III

Measurements of teeth and mandibles of Scaptonyx /?/ dolichochir from Węże I, Rębielice Królewskie I and Kadzielnia

		Węże I				Rębielice Królewskie I				Kadzielnia			
		N	min.	mean	max.	N	min.	mean	max.	N	min.	mean	max.
M_1	L_1	1	-	1.50	-	5	1.40	1.46	1.55	1	-	1.52	-
	L_2		-	0.80	-		0.70	0.77	0.85		-	0.80	-
	L_3		-	0.70	-		0.65	0.70	0.75		-	0.72	-
	W_1		-	0.85	-		0.73	0.78	0.80		-	0.80	-
	W_2		-	1.00	-		0.90	0.95	1.00		-	1.00	-
M_2	L_1	2	1.60	1.70	1.80	2	1.50	1.52	1.54	1	-	1.60	-
	L_2		0.87	0.89	0.92		0.70	0.80	0.90		-	0.85	-
	L_3		0.73	0.80	0.88		0.60	0.72	0.84		-	0.75	-
	W_1		1.00	1.05	1.10		0.80	0.81	0.83		-	0.95	-
	W_2		0.95	1.07	1.10		0.80	0.82	0.85		-	0.95	-
M_3	L_1	1	-	1.45	-	M^2 1	-	1.54	-		-	-	-
	L_2		-	0.80	-		-	1.10	-		-	-	-
	L_3		-	0.65	-		-	0.72	-		-	-	-
	W_1		-	0.80	-		-	1.63	-		-	-	-
	W_2		-	0.60	-		-	2.05	-		-	-	-

No of mandible:	MF/1012/		MF/1013/					MF/1014/
	1	2	1	2	3	4	5	1
M_1 - M_3	4.55	4.40	-	4.40	4.25	4.10	-	4.20
M. int. mand. below:								
M_1	-	1.20	1.12	1.12	1.30	1.20	1.10	1.30
M^2	1.55	1.20	1.35	1.38	1.50	1.30	1.15	1.35
M_3	1.66	1.30	-	1.50	1.35	-	-	1.50
Thickn. mand. in:								
M_1	-	-	0.80	0.76	0.70	0.75	0.62	0.75
M^2	0.90	-	0.90	0.80	0.80	0.80	0.60	0.75
M_3	0.80	-	-	0.80	0.80	-	-	0.70

Description: M^2 from Rębielice Królewskie I (MF/1013/6), small in size (Table III) and with characters very closely resembling those in the genus *Urotrichus*, seems to belong nowhere but here. The proto- and notably metaconule are very conspicuous on the protocone. The metacingulum is vestigial, parastyle characteristically bent, mesostyles undivided and ectoflexus and postectoflexus open and subequal in size (Pl. V, 1). Out of the four roots, the anterior is transversely flattened and both posterior roots triangular in section. The central root is needle-like, with low ridges running to it from the neighbouring roots.

On M_1 the tops of the trigonid and talonid are subequal and the external edge of the talonid rounded. The tooth is dumpy in shape. The trigonid is narrower than the talonid (Pl. V, 2—4, Table III) and on ist convex anterior wall is the fragmentary precingulid. The poorly developed hypoflexid is limited

Table IV

Measurements of the humeri of Scaptonyx /?/ dolichochir from Podlesice and Rębielice I in comparison with those from La Grive-Saint-Alban /after Hutchison 1974/

	Podlesice MF/1011/1	Rębielice Królewskie I MF/1013/						La Grive-Saint-Alban	
		7	8	9	10	11	mean	Loc. L. 7 mean	Loc. M mean
* 1.	2.40	2.37	2.22	2.41	2.32	2.65	2.39	2.62	2.67
2.	3.20	3.55	3.15	3.33	3.41	-	3.36	3.24	3.37
3.	-	5.90	5.00	-	-	-	-	-	-
4.	-	5.90	5.65	-	-	-	-	5.48	-
5.	4.71	4.87	4.90	4.70	4.82	-	4.82	4.80	4.88
6.	-	7.10	6.70	-	-	-	6.90	7.10	7.21
7.	-	3.20	2.95	-	-	-	3.07	3.01	-
8.	-	3.40	3.15	-	-	-	3.27	3.30	-
9.	2.85	3.15	2.90	-	-	3.08	3.04	3.18	3.21
10.	-	3.41	-	-	-	3.35	3.38	-	3.70
11.	-	-	2.30	-	-	-	-	-	-
12.	-	1.05	1.10	-	-	-	1.07	1.29	1.29
13.	1.11	1.22	1.18	1.10	1.19	1.18	1.16	1.41	1.34

* explanation of measurements see text-fig. 1.

by the fragmentary ectocingulid (Pl. V, 3) and the crista obliqua joins the base of the protocristid close to the labial margin; this is why the hypoflexid is shallow. The proto-, meta- and entoconid are well developed and the talonid valley is large and deep, delimited by a ridge that connects the metaconid tan entoconid. The trigonid valley is considerably smaller and open. The anperior accessory cuspid is poorly developed in contradistinction to the well-developed entostylid. The posterior root is much thicker than the anterior and somewhat bending backwards.

The protoconid of M_2 is much higher than its hypoconid. The precingulid is well developed all along the base of the trigonid (Pl. V, 2—4) and only at the base of the paraconid pases into the entocingulid. The fragmentary ectocingulid connects the trigonid to the talonid. The crista obliqua joins the base of the protocristid halway across it. The talonid valley is delimited by a very well developed ridge that joins the ento- and metaconid. The trigonid valley is narrower and open. The anterior and posterior accessory cuspids are very conspicuous.

M_3 is characterized by features similar to those of M_2 only that the talonid is larger and the entostylid missing.

Mandible. Węże I has provided 2 left mandibles, one with M_1 and M_2 and the other with M_2 and M_3. Five damaged mandibles come from Rębielice Królewskie I, the least damaged one with M_1 (MF/1013/1) and two fragments with M_1 and M_2 (MF/1013/2, 3). The measurements of the teeth and mandibles are given in Table III. In the premolar portion of mandible MF/1013/1 there are 8 alveolar sockets, of which 4, probably those for two-rooted P_4 and P_3,

are oriented perpendicularly to the long axis of the mandible. The other ones are turned obliquely forward. The damaged portion of the mandible does not permit the definitive determination of the number of alveoli. The anterior mental foramen is situated at the height of the posterior root of P_2 (?) and the posterior one lies between the roots of M_1. The horizontal branch of the mandible is talpoidal, flat inside, moderately convex outside, gradually tapering to the front. The mandibular symphysis reaches to the boundary between P_2 and P_3. The posterior portion of the mandible is marked by the robust ascendent branch with a channel-like depression on the frontal side and a very distinct medial edge. The angle between the ascendent and the horizontal branch is analogous to that in *Urotrichus*. The masseteric fossa is deep, with clear-cut edges and there is a bulge, characteristic of *Urotrichus*, on the internal side (Pl. V, 2—3). The mandibular foramen is situated on its lower margin.

Humerus. 1 left humerus comes from Podlesice and 6 humeri, of which 3 are right, have been obtained from Rębielice Królewskie I. Their measurements are given in Table III. As can be seen from it, this was a small mole with a relatively narrow and elongate humerus. The distal and proximal widths of these humeri are similar. The distal edge of the teres tuberculus is halfway along the shaft. The teres tuberculus is separated from the pectoral crest by a wide furrow. The pectoral crest does not exceed the lesser tuberosity in size, the proximal edge of this last reaching below the proximal edge of the head. The surface for the origin of the triceps lateralis profundus is narrow, elliptic, situated on the most proximal edge of the lesser tuberosity. The well-developed bicipital fossa divides the pectoral crest from the lesser tuberosity. The clavicular facet is transversely elliptic in shape and separated from the head by a narrowing (Pl. V, 5). The deltoid process is sturdy, low and triangular, shifted to the proximity of the shaft. The olecranon fossa is deep and well developed. The trochlea is separated from the fossa for the flexor digitalis profundi by a conspicuous hollow. The supratrochlear fossa is oval and deep (Pl. V, 5).

Affinities. M^2 shows a number of characters indicative beyond a doubt of the fact that it belongs to *Urotrichini*. These are: the characteristic winding parastyle, undivided mesostyles, and typical triangular protocone with its uplifted top and clearly marked proto- and especially metaconule. The ecto- and postectoflexus are equal in size.

The M^2 under discussion resembles that of *Talpa incerte* from Barret Mountain (Hutchison, 1968, p. 102, Fig. 90) conspicuously in size and proportions as well as some morphological details only that in the North-American from the metastyle is not curved and the parastyle considerably less so.

However, the membership of the Polish form in the genus *Scaptonyx* is suggested by the following details: M_1 is similar in shape to M_1 of *Scaptonyx fusicaudatus*; the trigonid : talonid length ratios are very much alike; the junction of the crista obliqua with the protocristid is analogous to that in the contemporary *Scaptonyx*; the trigonid and talonid are nearly the same height in both forms; the thickness and arrangement of the roots in all the molars

are identical with those in the recent form; the lingual side of M_1 differs from that in the recent form in the presence of the ectocingulid at the base of the paraconid and the lack of the metastylid; in M_2 the height of the trigonid and talonid is the same as in the contemporary form, in which the crista obliqua is more lingually directed. In the fossil form the metacristid is missing whereas the pre-, ecto- and entocingulid are well developed, of which in the recent form the precingulid, restricted to the base of the paraconid, and the ectocingulid are distinguishable, but this last only very poorly.

The mandible, as in *Scaptonyx*, tapers regularly to the front and the alveoli, starting from that of P_3, are directed obliquely to the front. In the recent *Scaptonyx* there are 9 alveoli (I-C-Pm) in the anterior mandibular half. The anterior mental foramen is situated at the height of one-rooted P_3, whereas in the Polish form it lies at the height of the fifth alveolus, counting from the anterior margin of M_1.

The posterior mandibular part resembles that in the genus *Scaptonyx* in the slant and robustness of the ascendent branch, the shape of the mandibular fossa and the position of the posterior mental foramen.

From "*Scaptonyx*" *edwardsi* the Polish from differs in its more labially directed crista obliqua on M_1 and M_2, the lack of the metastylid and metacrystid on M_2, and the situation of the mental foramina, which in *S. edwardsi* are displaced frontal.

HUTCHISON (1974) is of the opinion that the "lectotype of "*Scaptonyx*" *edwardsi* is a possible candidate for association with (?) *Urotrichus dolichochir*".

It should be emphasized that in a number of characters the M^2 and lower molars of the Polish *Scaptonyx* (?) *dolichochir* resemble the dentition of *Neurotrichus polonicus* n. sp. These are the analogous lingual shift of the trigonid in relation to the talonid on M_1, the analogous direction of the crista obliqua and its junction with the protocristid wall, and the identical development of the crista obliqua on all the molars in these two forms. The height of the trigonid and talonid in M_1—M_3 and the development of the pre-, ecto- and entocingulid are similar in both forms and the trigonid : talonid valley size ratio is also equal.

In the posterior portion of the mandibles the characters common to the two forms are the robust structure of the ascendent branch, the deep masseteric fossa and the position and direction of the mandibular foramen. These forms differ in the development of the horizontal branch, for *S. dolichochir* has a more subtle and talpoidal mandible, whereas the mandible of *Neurotrichus polonicus* n. sp. is more massive, in the molar part considerably thickened and with a relatively straight lower edge. The posterior foramen is situated in the same place in both forms.

The mandible of the Polish *Scaptonyx* (?) *dolichochir* has a number of characters common with that of *Talpidae* indet. I, described by ZAPFE (1951, p. 469, Fig. 11) from Nova Ves. M_2 of this specimen is nearly identical with this tooth of the Polish form as regards structural details and size. The morpho-

logy of the mandible is very similar in them as regards both the posterior part and horizontal branch. The posterior foramen is situated in the same place and the alveoli of the anterior part are analogously inclined and equal in size. The mandibular foramen has the same situation in both forms. The foregoing data refer the mandible of *Talpidae* indet. I to *Scaptonyx* (?) *dolichochir*.

We cannot help the impression that the Polish form *Scaptonyx* (?) *dolichochir* shows a close correspondence with the North-American fossil form, *Achlyoscapter longirostris* HUTCHISON, 1968 (pp. 96—101, Figs. 84—99), from the Late Miocene (Barstovian) of Oregon. The identity of these two forms with respect to the size, proportions and morphology of M_1 and M_2 the accordance of the direction of their cristae obliquae, the same proportions of the trigonid and talonid valleys, the analogous development of the pre-, ecto- and entocingulids and the same shape of the mandibles are here striking. The lenght of the M_1—M_3 tooth-row is the same in both forms.

The humerus of *Scaptonyx* (?) *dolichochir* from the Polish localities agrees with the iconographic data in HUTCHISON'S (1974, p. 253, Fig. 17) and ZAPFE'S (1951, p. 476, Fig. 15) works. They are also identical (of. Table IV) with the humeri from La Grive-Saint-Alban (data after HUTCHISON, 1974). In morphological details these humeri quite resemble that of *Urotrichus* only that their shape is slimmer. Hence, HUTCHISON includes this mole in the genus *Urotrichus*.

Genus *Neurotrichus* GÜNTER, 1880
?Neurotrichus polonicus n. sp.

Derivatio nominis: from Poland.

Holotype: incomplete right mandible with P_4—M_2 (MF/1016/1) from Kadzielnia (Pl. IV, Figs. 5—7).

Material. Rębielice Królewskie I: undamaged P^4 (MF/1015/1), 3 M^1 (MF/1015/2—4), of which one is right, right M^3 (MF/1015/5), incomplete premolar portion of right mandible with P_3 (MF/1015/6), incomplete premolar portion of right mandible with M_1 (MF/1015/7), 2 middle fragments of left mandibles with M_1 and M_2 (MF/1015/8, 9), posterior part of left mandible with M_2 and M_3 (MF/1015/10), right M_1 (MF/1015/11), 3 M_2 (1 left (MF/1015/12—14), right and left M_3 (MF/1015/15, 16). Further, 6 clavicles (MF/1015/17—22), of which 3 right ones, 4 relatively little damaged, 13 humeri (MF/1015/23—35), among them 7 nearly complete, incomplete ulna (MF/1015/36) and almost complete radius (MF/1015/37).

Zamkowa Dolna Cave near Częstochowa, layer C: 3 M^1 (two right) (MF/1017/1—3), right M^2 (MF/1017/4), right M_1 (MF/1017/5), right M_2 (MF/1017/6), right and left M_3 (MF/1017/7, 8) and undamaged right humerus (MF/1017/9).

Kadzielnia: 2 incomplete right mandibles (MF/1016/1, 2), one with P_4—M_2 and other with M_1—M_2, relatively little damaged left and right humeri (MF/1016/3, 4).

Description. The only specimen of P^4 (MF/1015/1) from Rębielice Królewskie I has characters which refer it clearly to the genus *Neurotrichus*. Its measurements are given in Table V. The paracone of this tooth is conical, its anterior sagittal margin being lightly arcuate. The anterior wall is horizontally semicircular, the posterior ridge sharp, without additional cones and connected with the small metastyle. The broad ledge-like precingulum merges into the similarly ledge-like ectocingulum, which in the posterior part of the tooth is united with the base of the metastyle. On the internal side of the tooth the precingulum passes into the well-developed entocingulum, which reaches the protocone. The postcingulum is well developed, the protocone conical, round in section, and its top reaches one-third of the height of the paracone.

Table V

Measurements of teeth and mandibles of ? Neurotrichus polonicus n. sp. from Rębielice Królewskie I, Zamkowa Dolna Cave and Kadzielnia

		Rębielice Królewskie I				Zamkowa Dolna Cave				Kadzielnia			
		N	min.	mean.	max.	N	min.	mean	max.	N	min.	mean	max.
P^4	L	1	-	1.70	-	-	-	-	-	-	-	-	-
	W_1		-	0.80	-	-	-	-	-	-	-	-	-
	W_2		-	1.22	-	-	-	-	-	-	-	-	-
M^1	L	3	2.40	2.40	2.40	3	2.20	2.33	2.49	-	-	-	-
	L_1		1.28	1.33	1.40		1.12	1.14	1.18	-	-	-	-
	L_2		1.18	1.29	1.35		1.10	1.27	1.40	-	-	-	-
	W_1		1.20	1.40	1.51		1.10	1.20	1.30	-	-	-	-
	W_2		2.70	2.82	2.90		2.42	2.58	2.68	-	-	-	-
M^2	L	1	-	2.00	-	1	-	1.80	-	-	-	-	-
	L_1		-	1.48	-		-	1.26	-	-	-	-	-
	L_2		-	1.00	-		-	0.92	-	-	-	-	-
	W_1		-	2.00	-		-	1.78	-	-	-	-	-
	W_2		-	2.45	-		-	2.45	-	-	-	-	-
P_3	L	1	-	0.91	-		-	-	-	-	-	-	-
	W		-	0.60	-		-	-	-	-	-	-	-
P_4	L		-	-	-		-	-	-	1	-	1.22	-
	W		-	-	-		-	-	-		-	0.74	-
M_1	L	3	1.85	1.92	1.95	1	-	1.71	-	2	1.70	1.75	1.80
	L_1		0.90	0.96	1.00		-	1.00	-		0.84	0.92	1.00
	L_2		0.85	0.99	1.00		-	0.71	-		0.80	0.83	0.86
	W_1		0.97	1.07	1.10		-	0.88	-		0.85	0.86	0.88
	W_2		1.22	1.26	1.30		-	1.18	-		1.10	1.10	1.10
M_2	L	9	1.96	2.02	2.10	1	-	1.91	-	2	1.85	1.87	1.90
	L_1		1.00	1.10	1.12		-	1.11	-		1.00	1.00	1.00
	L_2		0.85	0.95	1.00		-	0.80	-		0.85	0.87	0.90
	W_1		1.10	1.16	1.20		-	1.07	-		1.10	1.10	1.10
	W_2		1.10	1.21	1.30		-	1.10	-		1.10	1.10	1.10
M_3	L	4	1.70	1.75	1.82	1	-	1.73	-	1	-	1.80	-
	L_1		0.96	1.00	1.10		-	1.10	-		-	0.97	-
	L_2		0.50	0.70	0.77		-	0.63	-		-	0.83	-
	W_1		0.90	0.97	1.00		-	0.97	-		-	1.00	-
	W_2		0.80	0.84	0.90		-	0.87	-		-	0.80	-
P_2 alv.- P_4			-	3.00	-		-	-	-		-	-	-
M_1 - M_3 alv.			5.45	5.57	5.70		-	-	-		5.20	5.30	5.40
H. int. mandb. below M_2			1.75	1.86	2.00		-	-	-		-	1.80	-

The tooth has three roots, the anterior root, round in section, the posterior, longitudinally flattened, and the lateral, oval.

M^1 — Three specimens of M^1 have been collected at Rębielice Królewskie I and another three at Zamkowa Dolna Cave near Częstochowa. They are triangular in shape, elongate (Table V), bearing a conspicuous protocone, with a pointed and high top. The protoconule is clearly distinguished but the metaconule still more so. This last has a separate top (Pl. VI, 1). At the base of the protocone the fragmentary pre- and postcingulum occur between the proto- and metaconule and the ridge. At the base of the posterior wall the narrow metacingulum runs for all its width. The ectocingulum is visible, notably at the base of the robust parastyle. The postectoflexus is very shallow and the mesostyles exhibit a poor division. The lingual root is short and semicircular and both labial roots are transversely flattened. The central root is small and needle-like and low ridges extend to it from the other roots. M^1 from Zamkowa Dolna Cave is more delicate in shape and differs somewhat in measurements (Table V).

M^2 is represented by two specimens, one from Rębielice Królewskie I and the other, stuck in a fragmentary mandible, from Zamkowa Dolna Cave. The protocone of these teeth is triangular and has a clearly distinguished metaconule with a distinct top (Pl. VI, 2). The protoconule is less conspicuous. As in M^1, the fragmentary pre- and postcingulum are present at the base of the protocone. The metacingulum, also as in M^1, extends for all the width of the posterior wall of the tooth and is united with the curved metastyle (Pl. VI, 2). Precingulum is missing, parastyle curved and separated from paracrista. Ecto- and postectoflexus are more or less equal in size and open. Anterior root transversely flattened, labial roots triangular in section, connected with thin needle-like central root by low ridges. Measurements given in Table V.

The alveoli of the lower premolars and a few extant premolars indicate that all the premolars were two-rooted and P_4 and P_1 exceeded the other ones in size.

P_3 attached to the mandible from Rębielice Królewskie I (MF/1015/6) has two roots clinging to each other (Pl. VI, 3, 4). Its dumpy protoconid is shifted above the anterior root. The tiny entoconid is marked on the posterior margin. The posterior surface of the protoconid is relatively broad with a longitudinal middle furrow. The postcingulid is slightly visible at the base of tooth.

The only specimen of P_4 is stuck in mandible MF/1016/1; its measurements are given in Table V. The protoconid of this tooth is dumpy, rounded, relatively symmetrical (Pl. VI, 5—7). The low paracristid extends from the parastylid, situated anteriorly, towards the top. Distinct metaconid situated on posterior side, more lingually. Posterior wall of protocone flattened, high pre- and postcingulid well developed and partly passing into ectocingulid. Lingual wall of tooth flattened and devoid of cingulid. Entoconid distinct in transverse posterior margin of tooth, separated from protoconid by a furrow. The roots are parallel, round in section, the posterior stouter than the anterior.

M_1 — Three specimens have been obtained from Rębielice Królewskie I, one from Zamkowa Dolna Cave and two from Kadzielnia. Their trigonid nearly equal in height to and narrower than talonid (Table V). Labial edge of both halves of tooth rounded (Pl. VI, 5—7). The anterior wall of the trigonid is convex, with the fragmentary precingulid at its base; this extends only halfway along its width. The fragmentary ectocingulid connects the talonid with the trigonid. The crista obliqua reaches the base of the protocristid at one-third of its width on the labial side; as a result, the hypoflexid is reduced. The trigonid is longer than the talonid and open. The para-, meta- and entoconid are robust, round in section. The trigonid valley is open, whereas the talonid valley partly closed by the entoconid, long at the base, and the poorly developed entocristid. The entostylid is robust.

M_2 — Nine specimens of this tooth come from Rębielice Królewskie I (some in situ), one from Zamkowa Dolna Cave and two in mandibles from Kadzielnia. The protoconid of these teeth is higher than the hypoconid, this last being pushed out somewhat farther labially (Pl. VI, 5—7). The crista obliqua meets the base of the protocristid in the middle of its width. The ectocingulid, as in M_1, connects the base of the talonid with the trigonid. On the anterior wall of the tooth there is the moderately broad, well-developed precingulid, which surrounds also the base of the paraconid (Pl. VI, 5—7). Para-, meta- and entoconid similar to those in M_1, only perhaps somewhat less massive. Trigonid valley open, talonid valley closed by very conspicuous entocristid.

M_3 — Four detached specimens and two in situ have been obtained from Rębielice Królewskie I, two detached ones from Zamkowa Dolna Cave and one tooth in situ from Kadzielnia. Trigonid broader than talonid (Table V). Precingulid and ectocingulid like those in M_2, crista obliqua united with the base of the protocristid in the middle of its width. Talonid valley limited by broad entocristid.

Mandible. Five mandibular fragments (2 right and 3 left) have been found at Rębielice Królewskie I and 2 right fragments at Kadzielnia. Their measurements are given in Table VI. The ascending and horizontal rami from an angle analogous to that in the genus *Urotrichus*. As in this genus, too, the frontal edge of the ascending ramus is massive, with a furrow in the middle. Masseteric fossa deep, with well-defined edges, on inner side characteristically convex. Mandibular foramen situated close under mylohyoidal crest line. The place of break-off of the angular process shows that it was flattened and lamellar. The mandible tapers forward (Table V) and in its anterior part is bent labially (Pl. VI, 7). The mandibular symphysis ends in the area between P_2 and P_3. The anterior mental foramen is situated under P_2 or between P_2 and P_3, the posterior one between the roots of M_1. The alveoli premolars are round and indicate that these teeth had two roots each.

As regards the postcranial skeleton, Rębielice Królewskie I provided 6 clavicles, of which four were measurable (Table VI). These clavicles are relatively sturdy and their shafts are short and stocky (Pl. VI, 8, 9). The manubrial

articular facet is reniform and its ventral part broadened. The humeral articular facet is square in outline, with two protruding corners lying at the anteroposterior diagonal. The two articular facets are not parallel to each other. The ventral process is comparatively long and forms 75.2—83.3% of the greatest lenght of clavicle and its end is parallel to the manubrial articular facet. This process is inclined to the long axis of the clavicle at an angle of c. 45°. It is joined by the ventromedial crest of a complicated shape, the end of which also reaches the margin of the manubrial articular facet (Pl. VI, 8, 9).

Table VI

Measurements of the clavicula and radius of ? Neurotrichus polonicus n. sp. from Rębielice Królewskie I, in comparation with those of Neurotrichus gibbsii rec. /after Hutchison 1968/ and Urotrichus talpoides rec.

Clavicula

No	Length	Shaft width	Manub. art. fac.		Hum. art. fac.		Proc. ventr. length	Proc. lg / max. lg
			width	length	width	length		
Rębielice Król. I./MF/1015/								
17.	4.20	0.95	2.32	1.02	1.92	1.70	3.16	75.20
18.	4.20	1.00	2.44	1.10	1.90	1.96	3.50	83.30
19.	4.37	1.04	2.25	1.16	1.80	1.90	3.41	78.00
20.	4.32	0.98	2.20	1.00	1.78	1.40	-	-
21.	-	0.83	-	-	1.82	1.50	-	-
22.	-	0.90	2.39	1.00	-	-	-	-
Neurotrichus gibbsii rec.								
1.	4.08	-	-	-	-	-	3.17	78.00
Urotrichus talpoides rec.								
1.	5.10	0.78	2.08	1.12	1.82	1.50	3.62	71.00
2.	5.35	0.80	2.18	1.10	1.96	1.40	3.72	70.00

Radius

No	Length	Proximal		Distal		Shaft		Prox. width / length
		width	thickn.	width	thickn.	width	thickn.	
Rębielice Król. I./MF/1015/37/								
37.	8.80	1.60	1.25	1.80	1.10	0.95	0.68	18.20
Neurotrichus gibbsii rec.								
1.	7.55	1.57	-	-	-	-	-	21.00
2.	8.40	1.71	-	-	-	-	-	20.00
3.	7.84	1.84	-	-	-	-	-	23.00
Urotrichus talpoides rec.								
1.	-	1.60	1.02	-	-	0.95	0.58	-
2.	-	1.38	0.96	-	-	0.65	0.53	-

Humerus. Thirteen specimens (6 left) of this bone, of which seven nearly complete, have been derived from Rębielice Królewskie I, one almost undamaged specimen from Zamkowa Dolna Cave and two humeri (left and right, one less damaged) from Kadzielnia.

In shape and size these specimens resemble the humerus of contemporary *Urotrichus talpoides* Temm. (Pl. V, 6, 7; Table VII). In the proximal part of the humerus the proximal edge of the lesser tuberosity descends somewhat beyond the proximal margin of the head. The crest of the surface for the origin of the triceps lateralis profundus extends somewhat below the distal margin of the head, more or less at the level of the edge of the greater tuberosity. On some humeri this crest is prominent and conspicuous. The elongate head is declined from the long axis of the humerus by c. 25° and its long axis is parallel to the inclination of the articular surface of the greater tuberosity, the margin of which does not overtop the distal margin of the head. The robust and well-developed deltoid process is placed more or less in the middle of the edge of the greater tuberosity, which is separated from the head by a neck. The teres tuberculus is sturdy and well-developed and its lenght ratio to the shaft ranges within limits of 70.0—77.4% (Table VIII). The well-developed olecranon fossa is situated asymmetrically in relation to the long axis of humerus. A deep narrowing separates the trochlea from the fossa flexor digitorum ligamenti (Pl. III, 6). The ectepicondyle is study and long, the entepicondyle short and weak and the entepicondylar foramen large and oval. The hollow under the trochlea on the ventral side of the humerus is deep and round. The pectoral ridge begins with the prominent pectoral tubercle somewhat above the distal edge of the teres tuberculus and then passes at a right angle into the pectoral crest. The radial articular facet is bulgy and its longer axis oriented at an angle of 45° to the long axis of humerus (Pl. VI, 6).

Ulna. One incomplete specimen of the ulna comes from Rębielice Królewskie I. It is a relatively long and delicate bone, flattened laterally and sinusoidal in shape (Pl. VI, 10). The olecranon process is comparatively short and the triceps scar transversely elliptic and occupying only the lateral one-third of the proximal crest, which compared with that in shrew forms a less obtuse angle with the shaft. The abductor fossa is deep and the narrow and elongate abductor tubercle extends to the articular margin of the anconal process, which is well-developed and has a blunt frontal edge (Pl. VI, 10). The lower surface of the slightly slanting semilunar fossa passes into the wide oblique articular surface for the radius. On the opposite side is the very large brachial scar with a foramen for vessels below it (Pl. VI,10).

Radius. This bone is represented by one nearly complete specimen from Rębielice Królewskie I. Its measurements are given in Table VI. It is a long, slim bone with an even shaft subcircular in section; there in only a slight eminence in its middle part. The proximal acetabulum is round and the capitular process was, as evidenced by the fracture surface, low. The distal crest for the attachment of the radial head of abductor pollicis longis goes away from it.

Table VII

Measurements of the humeri of ? Neurotrichus polonicus nov. sp. from Rębielice Królewskie I, Zamkowa Dolna Cave and Kadzielnia in comparison with humeri of fossil and recent Urotrichus talpoides

	Length	Prox. width	Distal width	Ter. tub. length	Tuber. major length	Tuber. minor length	Shaft	
							width	thickn.
Rębielice Król. I.	8.40-9.10 M=8.66 N=8	3.90-4.40 M=4.17 N=8	4.35-4.85* M=4.62 N=5	6.00-6.72 M=6.42 N=12	6.00-6.10 M=6.05 N=2	2.32-2.65 M=2.54 N=8	1.71-1.82 M=1.78 N=13	1.60-1.75 M=1.66 N=13
Zamk. Dolna Cave	8.30	4.15	4.00	5.95	-	2.60	1.65	1.50
Kadzielnia	7.80 N=1	3.90 N=1	3.80 N=1	5.75-6.00 N=2	-	2.35-2.40 N=2	1.65 N=2	1.50 N=2
Urotr. talp. fossilis	8.40-9.42 M=8.97 N=8	3.65-4.00 M=3.84 N=8	4.30-4.85 M=4.64 N=6	5.25-6.50 M=5.97 N=9	6.60-6.80 M=6.67 N=6	2.18-2.55 M=2.36 N=7	1.55-1.80 M=1.66 N=9	1.35-1.65 M=1.47 N=9
recent	9.00 N=2	3.85-4.05 N=2	4.70-4.80 N=2	5.83-6.10 N=2	6.25-6.60 N=2	2.23-2.35 N=2	1.55-1.65 N=2	1.30-1.45 N=2

* explanation of the measurement no 10 see text-fig. 1
measurement no 9 4.00-4.25
M=4.16
N=11

Table VIII

Comparative measurements of teeth, the teeth row length and the depth of the mandibles of "Scaptonyx" edwardsi, ? Neurotrichus columbianus /after Hutchison 1974, 1968/ and ?Neurotrichus polonicus nov. sp.

	Length			Trigonid width			Talonid width		
	S. edw.	N. col.	N. pol.	S. edw.	N. col.	N. pol.	S. edw.	N. col.	N. pol.
P_3	0.75	-	0.91	0.50	-	-	-	-	0.60
P_4	0.98	1.40	1.22	0.62	-	-	-	0.81	0.74
M_1	1.67	1.90-2.07 M=1.99	1.70-1.95 M=1.83	1.07	-	0.85-1.10 M=0.95	1.23	1.23-1.33 M=1.29	1.10-1.30 M=1.19
M_2	1.86	2.00-2.13	1.85-2.10 M=1.99	1.22	-	1.04-1.20 M=1.13	1.15	1.17-1.30	1.10-1.30 M=1.18
M_3	-	1.80	1.70-1.82 M=1.75	-	0.97	0.90-1.00 M=0.98	-	-	0.80-0.90 M=0.83
M_1- M_3 alv.	4.60	5.90	5.20-5.70 M=5.44	-	-	-	-	-	-
H. int. mand. below M_2	1.45	-	1.75-2.00 M=1.84	-	-	-	-	-	-

The distal part of the radius is very characteristic, symmetrical, with a number of depressions for the attachment of tendons.

Affinities. The characters that refer the above-described form to the *Urotrichini* are as follows: P^4 resembles that *Urotrichus* in the shape and size of the paracone, the curvature of the anterior and posterior margins, the height and situation of the protocone and the cingulum running all round the tooth; the wider and more conspicuous pre- and postcingulum differ this tooth of the fossil form from that in the modern members of the genus *Urotrichus*.

M^1, as in *Urotrichus*, is triangular and has the triangular protocone with a steep pointed top and similarly shaped proto- and metaconules. The paracrista is analogous to that in *Urotrichus* and the parastyle similarly curved. The paracone is much higher than the metacone, both being identical with these elements in *Urotrichus*. The metastyle in both forms is similar. The characters of M^2 such as its triangular shape and triangular paracone, paracone: metacone height ratio, shape of the parastyle and metastyle, presence and shape of the proto- and metaconule, and undivided metastyle indicate distinct affinities with the genus *Urotrichus*.

On the other hand, the metacingulum, the well-developed postcingulum and ectocingulum at the base of the parastyle, the lack of the premetacrista and the somewhat shallower postectoflexus differ M^1 of the Polish fossil form from this tooth in modern *Urotrichus*. In M^2 of the fossil form these differences are manifested by the sturdier metaconule and preparaconule crest, the metacingulum connected with the metastyle, and the fragmentary pre-, post- and ectocingulum. The characters which bring P_3 close to its counterpart in the contemporary members of *Urotrichus* are the shift of the protoconid — dumpy with the entoconid sharply discriminated in both forms — above the anterior root. P_4 resembles that of *Urotrichus* in its dumpy shape, the shift of the protoconid above the anterior root, and the very conspicuous postcingulid. In both forms the posterior wall of the protoconid is flattened, the roots are parallel, the posterior one being thicker. The cylindrical precingulid passes into the fragmentary entocingulid. M_1—M_3 resemble these teeth in *Urotrichus* in size, proportions, the shape of the trigonid and talonid, the roundedness of the labial edges, the direction of the crista obliqua, and the morphological details of the lingual side of teeth.

The Polish fossil form shares a number of characters with the modern genus *Neurotrichus* as well as *?Neurotrichus columbianus* described by HUTCHISON (1968, pp. 55—58, Fig, 41). And thus, e. g. P_3 is very similar to this tooth of modern *Neurotrichus* in shape, size, the shift of the protocone above the anterior root, the presence of the pre- and postcingulid, and the slightly marked elongate depression which divides the posterior surface of the protocone.

M_1—M_3 bear particularly striking similarities to the modern genus *Neurotrichus* and *?Neurotrichus columbianus* not only in size (Table VIII) but also as regards the trigonid: talonid length ratio, the size of the trigonid-talonid valley, identical in these forms, the direction of the crista obliqua and its junc-

tion with the protocristid. In the Polish form the para-, meta- and entoconid and the pre-, ecto- and entocingulid are shaped analogously with those in the modern forms. The tooth-row length of the Polish *?Neurotrichus* resembles that of *?Neurotrichus columbianus* (Table VIII). There is besides a great correspondence between these two forms in the shape of the mandible, which gradually tapers to the front and forms no ventral bend nor mental thickening characteristic of *Urotrichus*. The mandibular symphysis, as in modern *Neurotrichus*, ends on the boundary between P_2 and P_3. In the Polish form the premolar alveoli are also round in outline and there are two mental foramina, of which the posterior is however shifted farther backwards (Pl. VI, 5). In its mandible angular relation between the ascending and horizontal rami is the same as in the genus *Neurotrichus*. The morphological details of the ascending ramus, its robustness, the presence of an elongate depression in the anterior margin, the position of the mandibular foramen close to the edge of the mylohyoidal crest, the characteristic bulge on the inner side of this part of mandible, the conspicuous masseteric fossa and the lamellar angular process are identical with these details in modern *Neurotrichus gibbsi*.

The Polish fossil form resembles "*Scaptonyx*" *edwardsi* GAILLARD in many characters. We must mention here, above all, the presence of the cingulid on the premolars and molars and two roots on the premolars, and the extent of the mandibular symphysis. The trigonid is higher than the talonid and the horizontal ramus of mandible tapers to the front in both forms.

"*Scaptonyx*" *edwardsi* differs, however, from the Polish form in a number of essential characters, e. g. in the shape and width of the protoconid of P_3 and P_4 and the wide setting of their robust roots. The crista obliqua of M_1 and M_2 in "*Scaptonyx*" *edwardsi* runs more distinctly in the direction of the metaconid and metastylid and the posterior foramen lies between P_4 and M_1. The differences between these two forms in tooth measurements, the length of the M_1—M_3 tooth-row, and the height of mandible at M_2 are presented in Table VIII.

The Polish fossil form is similar to modern *Scaptonyx fusicaudatus* EDWARDS in the shape of P_4, the length and height of its protoconid, the lingual position of the delicate metaconid, the flattening of the lingual side of the tooth, the massive metacingulid, parallel roots, similarly shaped M_1 and analogously situated mental foramina.

The main differences between them are one-rooted P_2 and P_3 of *S. fusicaudatus*, lack of equally well-developed cingulid on its M_1—M_3 and the crista obliqua running toward the metaconid on its M_2 and M_3. In both these teeth the metastylid is conspicuous in contradistinction to the Polish form. In *S. fusicaudatus* the lingual side of M_3 is particularly well developed, its metaconid, metastylid and entocristid are robust and wall off the inner space of the tooth.

The clavicles selected from the fossil material are identical in shape with those of *Neurotrichus gibbsi* GÜNTHER. Their comparison was based on the precise drawings published by HUTCHISON (1968, p. 23, Fig. 8) and the somewhat

too general drawings presented by CAMPBELL (1939, p. 5, Figs. 13, 14). The characteristic feature of these clavicles, shared with the genus *Neurotrichus*, is the subsquare humeral articular facet with two opposite small processes. The dominant element of the clavicles of both these forms is, in addition, the ventral process, which in *Neurotrichus* is richly sculptured and its end almost covers the groove for vessels.

In comparison with modern *Neurotrichus gibbsi* (acc. to HUTCHISON'S data, 1968) the clavicles of the Polish form are somewhat larger (Table VI). According to REED (1951), the length: height ratio for the clavicle of *N. gibbsi* is 2. 5 and according to HUTCHISON (1968) the ratio of the lenght of the ventral process to the maximum lenght of the clavicle is 78. 0% and then it lies within the range of variation of the fossil clavicles from Poland (Table VI).

A comparison of the clavicles of the fossil and modern members of *Urotrichus* with the clavicles of the Polish form discussed above reveals essential differences. As can be seen from Fig. 4, the clavicle of *Urotrichus* is considerably longer, slimmer, and its articular surfaces are still more unparallel to each

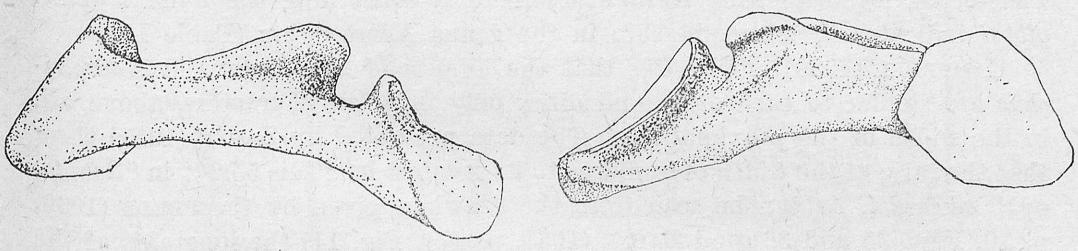

Fig. 4. Clavicle of recent *Urotrichus talpoides* (left-anterior, right-posterior aspects)

other than in *Neurotrichus*. The length of the ventral process forms 70 and 71% of the greatest length of the clavicles in *Urotrichus* against 75.2—83.3% in the Polish fossil form. The humeral articular facet of the clavicle in *Urotrichus* is ovate, with two opposite processes. The end of the ventral process does not reach the margin of the manubral articular facet, nor does it cover the groove for vessels. There are no foramina for vessels in the shaft and the ventromedial crest is slightly marked and straight. The curvature of the clavicle of *Urotrichus* is greater than in *?Neurotrichus polonicus* n. sp.

The fossil humeri described in this paper are very similar both in shape and in size to those of the modern *Urotrichus talpoides* and the fossil *Urotrichus* (Taku Nosu Cave in Japan) (Table VII. Pl. V, 6—8). The humeri of *N. polonicus* n. sp, are, however, somewhat broader in the proximal part and the teres tuberculus is more prominent and longer than in *U. talpoides* (Table VII). The lesser tuberosity of the Polish fossil form is noticeably broader than in both modern and fossil *Urotrichus talpoides* from Japan and pushed out much further proximad. Its proximal edge extends just beyond the proximal margin of the head. Moreover, on the posterior side of the proximal part the fossil humeri from all Polish localities have surfaces for the origin of the triceps

lateralis prof. and triceps medius superficialis and a distinct crest for the origin of the brachialis anticus (Pl. V, 6—7). In the distal part of the Polish humeri the olecranon fossa is more sharply outlined and deeper than that in *Urotrichus*, being also asymmetrical and oblique in relation to the long axis of the bone (Pl. V, 6—8). These characters would point to a better adaptation of the fossil form under study to the underground ways of life. The humerus of *?N.polonicus* n. sp. shows a number of characters that refer it to the genus *Neurotrichus*. These are the above-mentioned analogously shaped and situated impressions of the attachment of the triceps medius superficialis and triceps lateralis profundus and a distinct crest which somewhat resembles the "scalopine ridge". A common feature in the distal part is the olecranon fossa, analogous in shape and dimensions, including depth, to that in *Neurotrichus*, with sharply defined edges, and identically shifted towards the anterior margin of the humerus. The deltoid process is more conspicuous than in modern *Neurotrichus* and resembles that in *Scaptonyx*.

A comparison of the measurements of humeri from the Polish Plio- and Pleistocene localities with REED'S (1951) data concerning the humeri of *N. gibbsi* indicates their membership in the genus *Neurotrichus* (Table IX).

CAMPBELL (1939) emphasizes that the humeri of *Scaptonyx* and *Neurotrichus* are similar to each other and differ only in a few characters, above all, in the width of the proximal part. The data presented by ZAPFE (1951) show that the ratio of the width of humerus to its greatest length is 55.2% in "*Scaptonyx*" *edwardsi*. As can be seen from the drawings given by CAMPBELL (1939, p. 10, Figs. 35 and 36) and ZAPFE (1951, p. 474, Fig. 14) the long axis of the humeral head is subparallel to the long axis of the bone in both forms of *Scaptonyx*, whereas in *Neurotrichus* and *Urotrichus* it forms an angle of c. 25° with this axis. Moreover, the olecranon fossa is situated centrally and has a symmetrical triangular shape in both *Scaptonyx* forms (vide CAMPBELL), whereas both in *Neurotrichus* and in *Urotrichus* it is situated asymmetrically to the long axis of humerus and displaced to the front. The entepicondylar foramen is identical as regards its position and shape in *Scaptonyx* and in *Neurotrichus*. On the other hand, in the humeri described by ZAPFE (1951) the situation of the supratrochlear fossa is typical of the genus *Talpa*. The deltoid process of *Scaptonyx* is conspicuous and pointed, whereas in *Neurotrichus* and *Urotrichus* it is a small hillock on the edge of the greater tuberosity. The humeral capitulum articulating with the radius is more convex and rounded in *Scaptonyx* (vide CAMPBELL).

Two measurements that I managed to take on the fragmentary ulna (MF/1015/36) from Rębielice Królewskie I and their comparison with the dimensions given by HUTCHISON (1968) for *N. gibbsi* suggest that this bone belonged to a member of the genus *Neurotrichus*.

The only radial bone obtained from Rębielice Królewskie I compared with the measurements given for *N. gibbsi* (HUTCHISON, 1968) is a little longer and

Table IX

Percentage, comparative measurements of the humeri of Neurotrichus gibbsi /after Reed 1951/, ? Neurotrichus polonicus n. sp., Urotrichus talpoides rec. and "Scaptonyx" edwardsi /after Seeman 1938, and Zapfe 1951/

	prox. width / l. humerus	dist. width / l. humerus	l. teres tub. / l. humerus	l. great. tub. / l. humerus	l. lesser tub. / l. humerus	shaft width / l. humerus	shaft thickn. / l. humerus
N. gibbsi rec.	48.0-51.3	52.9	54.0	33.6	19.7	21.2	18.7
?N. polonicus n. sp.	44.3-50.7 M=48.1 N=8	51.6-56.0 M=52.8 N=4	49.4-56.0 M=52.4 N=8	28.8-30.7 N=2	16.6-22.6 M=19.7 N=5	19.2-21.7 M=20.5 N=8	18.4-20.2 M=19.0 N=8
Zamkowa Dolna Cave	50.0	48.3	54.2	-	19.3	20.0	18.0
Kadzielnia	50.0	-	52.0	31.3	16.6	21.1	19.2
Urotr. talp. foss.	40.0-45.2 M=42.5 N=8	42.3-47.6 M=43.7 N=8	49.0-60.1 M=56.5 N=8	23.4-27.2 M=26.0 N=6	- - -	17.2-19.6 M=18.4 N=8	15.5-17.6 M=16.2 N=8
Urotr. talp. rec.	42.8-44.4 N=2	41.1-45.0 N=2	60.0-61.7 N=2	24.0 N=2	- -	17.2-18.3 N=2	14.4-16.1 N=2
"Scaptonyx" edward.	55.0 55.5	50.0 /after Seeman 1938/ 51.6 /after Zapfe 1951/					

subtler in its proportions (Table VI). Nevertheless, its membership in the genus *Neurotrichus* seems highly probable.

Summing up the characters of the Polish fossil form discussed above, I think that its inclusion in the genus *Neurotrichus* and the erection of a new species, *?Neurotrichus polonicus* n. sp., are justified.

Tribe *Scalopini* Dobson, 1883
Subtribe *Parascalopina* Hutchison, 1968
Genus *Scapanulus* Thomas, 1912
Scapanulus agrarius n. sp.

Derivatio nominis: After the Academy of Agriculture in Cracow, where this work has been performed.

Holotype: Podlesice: left humerus, relatively less damaged (MF/1018/2).

Material. Podlesice: 1 incomplete manubrium (MF/1018/1), 17 humeri (MF/1018/2—18), of which 10 are left, including one less damaged (holotype), incomplete left ulna (MF/1018/19), 4 astragals (MF/1018/20—23).
Węże I: 2 humeri (MF/1019/1, 2), of which one is left.

Description. Only two modern moles, i. e. *Scapanulus* and *Parascalops*, have such a characteristic manubrium of the sternum, with a dorsal ridge be-

Table X

Measurements of the manubrium of Scapanulus agarius u. sp. from Podlesice /MF/1018/1/ in comparation with those of Scalopinae rec.

	High of frontal part H_1	Max. hight dorso-ventr. crest H_2	Maximal width: frontal part W_1	Maximal width: of wings W_2	$W_1 : H_1$	$H_1 : H_2$	$W_2 : W_1$
					in per cent		
1. Scapanulus agrarius n. sp.	3.58	4.42	1.63	2.23 *	45.5	79.4	73.1
2. Parascalops breweri /rec./	4.52 4.95	4.87 5.52	2.12 2.55	3.15 3.50	46.9 51.5	92.8 89.7	67.3 73.5
3. Scapanus latimanus /rec./	5.82	6.08	4.00	3.10	68.4	96.2	53.0

* an estimated measurement

tween two lateral alae. This ridge, dividing the anterior vena cava into two branches, is perforated at the level of the alae (Fig. 5, Pl. VII, 1). Under the dorsal ridge there is a deep symmetrical fossa limited by the lateral alae with even margins, which widen gradually posteriorly (Fig. 5) and end perpendicularly to the long axis of the manubrium. A very prominent ridge, with a characteristic keel in the anterior part, occurs on the ventral side. Further it passes into the triangular frontal part ot the manubrium. The base of this triangle is formed by the anterolaterobasal articular tubercles of heterotopic ossicles,

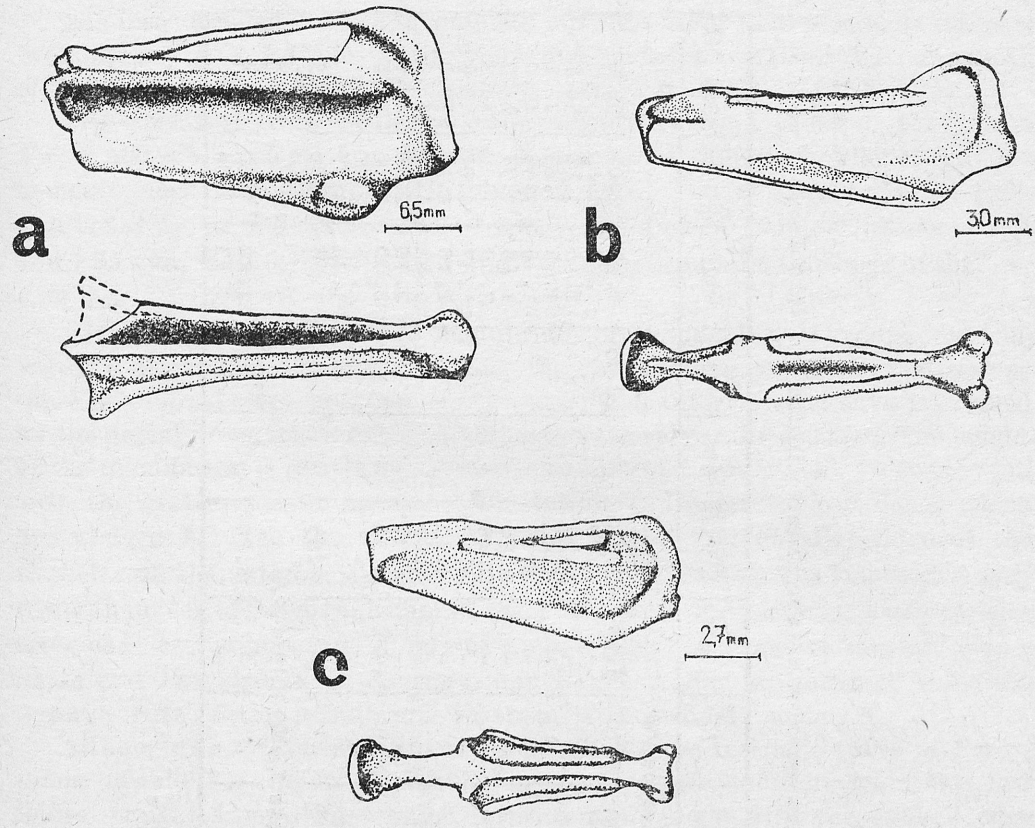

Fig. 5. Comparative figures of manubrium: a — *Scapanulus agrarius* n. sp. from Podlesice (MF/1018/1), b — *Scapanus latimanus* rec., c — *Parascalops breveri* rec. (lateral and dorsal aspects)

thrust somewhat to the front (Fig. 5, Pl. VII, 1). A rounded head, very convex on the dorsal side and giving rise to the dorsal ridge, forms the vertex of the triangle. The measurements of the manubrium compared with those in the modern *Scalopinae* are given in Table X.

From among 17 humeri from Podlesice only one (holotype) is not damaged very much. The measurements of these humeri are presented in Table XI. They are elongate in shape and their olecranon fossa has a characteristic semicircular outline. The groove between the trochlea and the fossa for the flexor digiti is reduced by the extension of the trochlea. The teres tuberculus is situated more proximally than in the modern *Scalopinae* (Table XI). The greater tuberosity is relatively well developed and its clavicular articular facet is positioned obliquely to the long axis of the comparatively long shaft. The long axis of the capitulum is oriented rather mediodistally to the long axis of the shaft. The lesser tuberosity is conspicuous, the "scalopine ridge" missing. The entepicondyle is thin and pointed and the ectepicondyle ends acutely. The supratrochlear fossa has a relatively distal position.

Table XI

Measurements of the humeri of Scapanulus agrarius n. sp. from Podlesice and Węże I

No	Measure--ments:	1	2	4	5	6	7	8	9	10	11	12	13	13:9 /%/
						Podlesice /MF/1018/2-17/								
2.		2.60	4.25	5.75	6.00	8.52	5.10	5.10	3.85	-	2.85	1.90	2.00	52.0
3.		3.25	-	-	-	-	-	-	4.90	-	-	1.80	1.80	36.7
4.		2.65	-	-	-	-	-	-	3.55	-	-	1.80	1.80	50.7
5.		3.62	-	-	-	-	-	-	4.40	-	-	1.65	1.85	42.2
6.		3.00	-	-	-	-	-	-	4.15	-	-	1.95	1.95	47.0
7.		-	-	-	-	-	-	-	3.70	-	-	1.65	1.77	48.0
8.		-	4.55	-	6.00	-	-	-	4.48	-	-	2.00	2.10	46.8
10.		3.00	5.00	-	6.30	-	-	-	4.10	-	-	1.87	1.87	45.6
11.		3.00	5.32	-	6.70	-	-	-	4.40	-	-	2.10	2.20	50.0
12.		2.80	-	-	-	-	-	-	4.05	-	-	1.82	1.90	46.2
13.		2.80	-	-	-	-	-	-	4.30	-	-	2.10	2.10	49.0
14.		-	-	-	-	-	-	-	4.30	-	-	2.00	2.00	46.5
15.		-	-	-	-	-	-	-	-	-	-	2.15	2.00	-
16.		-	-	-	-	-	-	-	-	-	-	1.80	1.75	-
17.		3.30	-	-	-	-	-	-	3.85	-	-	1.65	1.90	48.9
						Węże I /MF/1019/1,2/								
1.		2.65	4.05	5.40	-	-	-	-	3.80	4.00	-	1.80	1.80	47.4
2.		-	4.35	-	-	-	-	-	-	-	-	1.73	1.84	-

The measurements of the incomplete left ulna from Podlesice is as follows: proximal width — 1.7 mm, shaft width and thickness — 1.2 > 1.1 mm, width of distal part — c. 3.5 mm, its thickness — 0.97 mm (Pl. VII, 5).

Two astragals from Podlesice differ essentially from those of the genera *Talpa* and *Parascalops*. The trochlea is somewhat oblique in shape, with an elongate neck and characteristic rounded head. The measurements of these two bones are as follows: overall lenght — 3.8 and 4.0 mm, thickness — 1.50 and 1.55 mm, shaft height — 1.80 and 2.12 mm, minimum thickness of shaft — 1.32 mm.

Affinities. As regards the manubrium of *Scapanulus*, HUTCHISON (1968) writes that "it most closely resembles that of *Parascalops*. As in *Parascalops* there is a dorsal ridge between the two alae. The anterior vena cava is divided by the dorsal ridge, and a foramen perforates the ridge near the alae. The lenght of the manubrium is relatively shorter than that of *Parascalops*". In connection with the greater measurements of the tetrahedral heterotopic ossicles, which are wedged between the articular surface of the ventromedial ridge of the clavicle and the anterobasilateral part of the manubrium, this last part is narrower than it is in the manubrium of the *Parascalops*. Admittedly, these ossicles are a characteristic feature of only two modern genera of moles, namely, *Scapanulus* and *Parascalops*. In *Scapanus* and *Scalopus* they are missing, hence the anterior part of the manubrium in them is accordingly wider.

Although its measurements and proportions more resemble those in *Parascalops* (Table X), the fossil manubrium here described differs from this last in its straight frontal line, which forms a right angle with the ventral edge of manubrium (Fig. 5, Pl. VII, 1), whereas, as can be seen in the photograph, in modern *Parascalops* this line is arcuate. The anterobasilateral part of the manubrium in the place of support of the heterotopic articular ossicles is, in addition, more convex in modern *Parascalops* than in the fossil form (Fig. 5, Pl. VII, 3). In this last the maximum bulge of the keel is more conspicuous than in modern *Parascalops* and it forms a characteristic incurvation in the anterior part (Pl. VII, 1). The dorsal ridge passes into the anterior edge of the manubrium forming an oval head in the fossil specimen, whereas in modern *Parascalops* this part is more triangular in shape (Pl. VII, 1, 3). The alae of manubrium in modern *Parascalops* have a typical dilatation in the anterior part, absent from the fossil form.

A number of the above-mentioned characters bring the fossil manubrium close to the corresponding bone of modern *Scapanus*. In both these forms the frontal part (in lateral aspect) is rectangular and very convex dorsally (Pl. VII, 1, 2). The situation of the alae is strikingly similar, they go off from the anterior edge at a right angle. In both forms the margins of the alae are even and they widen gradually backwards. The anterior part of the keel, its shape and bend toward the maximum bulge are identical in them and the protrusion of the tubercles of the heterotopic articular ossicles to the front is similar (Pl. VII, 1, 2). In HUTCHISON'S (1968) opinion, the less lateral protrusion of these

tubercles is an essential character of the manubrium of *Scapanulus* and it is just what occurs in the Polish fossil form.

Regarding the humerus, it is related to that of *Scapanulus* and then the *Scalopini*, above all, in the lack of a groove between the trochlea and the fossa for the flexor digiti prof., which groove has undergone a reduction owing to the expansion of the trochlea (Pl. VII, 4). Out of the living *Scalopini*, *Scapanulus*, according to REED (1951), has the longest humerus in relation to its width and in this respect is comparable with *Condylura*.

The humeri from Podlesice and Węże I described above differ from those of modern *Scapanulus* chiefly in having a narrower teres tuberculus, being less robust, and lacking the "scalopine ridge" (sensu CAMPBELL, 1939).

In a number of characters our humeri resemble those of the genus *Scalopoides* WILSON, described by WILSON (1960) and HUTCHISON (1968). In the first place, the teres tuberculus preserved in four specimens from Podlesice is shorter than in modern *Scapanulus* and quite similar to that in *Scalopoides*, not excluding its position. The passage of the teres tuberculus into the lesser tuberosity, as may be judged from the holotype, coincides with that in *Scalopoides*. Moreover, the percentage ratio of the proximal width to the overall lenght of humerus calculated on the basis of the data given by HUTCHISON (1968, p. 71, Table 15) is 66.2 and 70.4% for the American form (UK 10084 and UK 10085) against 60.0% in the Polish form. The ratio of the shaft width to the distal width, however, appears strikingly similar, it ranges between 36.7 and 52.0% (mean — 46.7%, N = 15) for those of American *Scalopoides*. These data suggest that the humeri from Podlesice belong to *Scalopoides*-like moles.

The common origin of the manubrium and these humeri is also indicated by the fact that two of the humeri are the same colour as the manubrium and then their fossilization proceeded simultaneously under the same conditions.

According to HUTCHISON (1968), the ulna of *Scapanulus* is characterized by the well-developed semilunar fossa, the arch of which may even exceed a semicircle. The characters that bring this bone close to that of the genus *Scapanus* are the analogous radial articular facet and the lateral olecranon crest with a typical small bulge above the abductor scar of tubercle. The terminal process (Pl. VII, 5) is identical with that in *Scapanus*, with a longitudinal groove which ends in a round depression. On the other hand, the lunar articular facet is similar in shape to that *Parascalopus* (Pl. VII, 5).

To sum up, the data collected and discussed above suggest that the Polish fossil form belongs to the genus *Scapanulus*, while the differences pointed out justify the erection of a new species, *Scapanulus agrarius* nov. sp.

Remarks on Phylogeny and Zoogeography of Fossil *Talpinae*

It will not be possible to obtain a full picture of the Polish fossil fauna of Pliocene and Pleistocene *Talpinae* until the whole of material has been

elaborated. None-the-less, even now we have made a number of interesting observations regarding the forms worked out so far.

We are struck, above all, by the abundance of forms among talpids in Poland as well as throughout Europe at that time, contrasting with the present state, and at the same time by the degree of their differentiation hardly inferior to the contemporary one. According to HUTCHISON (1974), this abundance Haslach period was the time of origin of the most numerous forms.

The contemporary relicts of the Miocene talpid fauna occurring in south-eastern and eastern Asia indicate the Asiatic centre of dispersal of these forms.

Scaptonyx (?) *dolichochir*, living in the Pliocene and Pleistocene of Poland and then for a long time, not unlike the genus *Talpa*, was a common species all over Europe and, what is more interesting, compared with the materials from La Grive-Saint-Alban (see Table 4), shows no significant differences.

It is besides interesting that this small shrew-mole occurred together with the larger form "*Scaptonyx*" *edwardsi* GAILLARD (ZAPFE, 1951) and in the territory of Poland clearly accompanied *?Neurotrichus polonicus* n. sp., which exceeds it in size.

The presence of *Scapanulus* in Lower Miocene and Upper Pliocene deposits is another detail of an emerging picture of the zoogeography of *Talpinae* in that period.

Geotrypus, an Oligocene-Miocene mole showing already advanced adaptations to the underground ways of life, in Europe recorded from the Upper Oligocene and Lower Miocene of France (LAVOCAT, 1951; HUGUENEY, 1972), the Miocene of Sardinia (Oschiri) (DE BRUIJN and RÜMKE, 1974) and the Oligocene (Aquitanian) of Germany (TOBIEN, 1939), was probably a commonly occurring form in this period. According to HUTCHISON'S data (1974, p. 256, Fig. 24), this branch supposedly became extinct in the Upper Miocene. The Polish material thus prolong their existence up to the Early Pleistocene and its extinction would have been connected with the peculiar conditions of this period.

As regards the genus *Neurotrichus* and its origin, there is little similarity, according to ZIGLER (1971) in the pattern of tooth loss between *Neurotrichus* and any talpid of the Old World. In his opinion, it is possible to present convincing arguments for the origin of *Neurotrichus* from some North-American Miocene lines "rather than from any immigrant stock closely related to living Old World genera".

This Late-Miocene (Barstovian) talpid was presumably in ZIGLER'S opinion, *Achyoscapter longirostris* HUTCHISON, which has a complete dentition, has unknown interfamiliar affinities and is sufficiently generalized to be an ancestor to *Neurotrichus* or another living American mole.

In this connection, a valuable argument for the derivation of American moles from the Old World is the discovery of the genus *Condylura* (SKOCZEŃ, 1976), at present a North-American endemit, of origin unknow so far, in Polish Pliocene materials.

The situation of another North-American endemit, *Neurotrichus gibbsi* seems to be analogous. Its closest relative is *Urotrichus talpoides* (*Dymecodon pilirostris*) from Japan.

The present distribution (clearly of a relict nature) of *Neurotrichus gibbsi* on dampy slopes of the Pacific coast of North America, from the south part of British Columbia to central California (WALKER, 1964), is clearly stamped with its connection with the Ice Age. *Scapanus townsendii* (BACHMAN), *Sylvilagus bachmani* (WATERHOUSE) and *Neotoma fuscipes* BAIRD, occurring in the so-called Californian centre (DE LATTIN, 1967) have a similar distribution.

The paths of *Condylura* and *Neurotrichus* were probably different. The first of them, in connection with its semiaquatic ways of life, travelled along rivers and water reservoirs, whereas *Neurotrichus*, as a par excellence terrestrial form, migrated through dry or damp wooded areas.

Contemporary *Neurotrichus gibbsi*, according to WALKER (1964), penetrates the surface covered by dead plants and leaves. Owing to the faculty of placing its palm parallel to the surface of the ground it is very nimble, which no doubt was of great importance to its expansion. Moreover, its faculty of burrowing do a depth of 30 cm gives it additional possibilities of protection agains predatory animals.

In HUTCHISON'S (1968) opinion, the three tribes *Uropsilinae*, *Urotrichini* and *Scalopini*, shared by North America and South-east Asia, indicate closely faunal ties between these regions at various times during the later Tertiary. In each case, however, the imigrant appears to have been an ambulatory or only moderately fossorially specialized mole".

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STRESZCZENIE

Z materiałów kopalnych dolnoplioceńskiego stanowiska Podlesice oraz środkowoplioceńskiego Rębielice Królewskie I opisano, po raz pierwszy z terenu Polski, szczątki *Scaptonyx* (?) *dolichochir* GAILLARD. W tym opisano po raz pierwszy fragmenty żuchw tej formy oraz niektóre zęby.

Na podkreślenie zasługuje występowanie tej formy w tak rozległym czasie, jak również rozległym terytorium. Polskie okazy z wyżej wymienionych stanowisk, porównane z okazami z miocenu Francji (La Grive-Saint-Alban) oraz z miocenu Czechosłowacji (Nova Ves), nie wykazują istotnych różnic.

Z plioceńskich stanowisk Podlesice i Węże I zidentyfikowano szczątki kostne rodzaju *Scapanulus*. Opisano nowy gatunek *Scapanulus agrarius* n. sp. Jego obecność w plioceńskich materiałach Polski, jak również obecność innych opisanych w niniejszej pracy form wskazuje na, wysoki już w tym czasie, poziom zróżnicowania podrodziny *Talpinae*, równy niemal współczesnemu, oraz na rozprzestrzenianie się tych form z centrum południowo-wschodniej Azji.

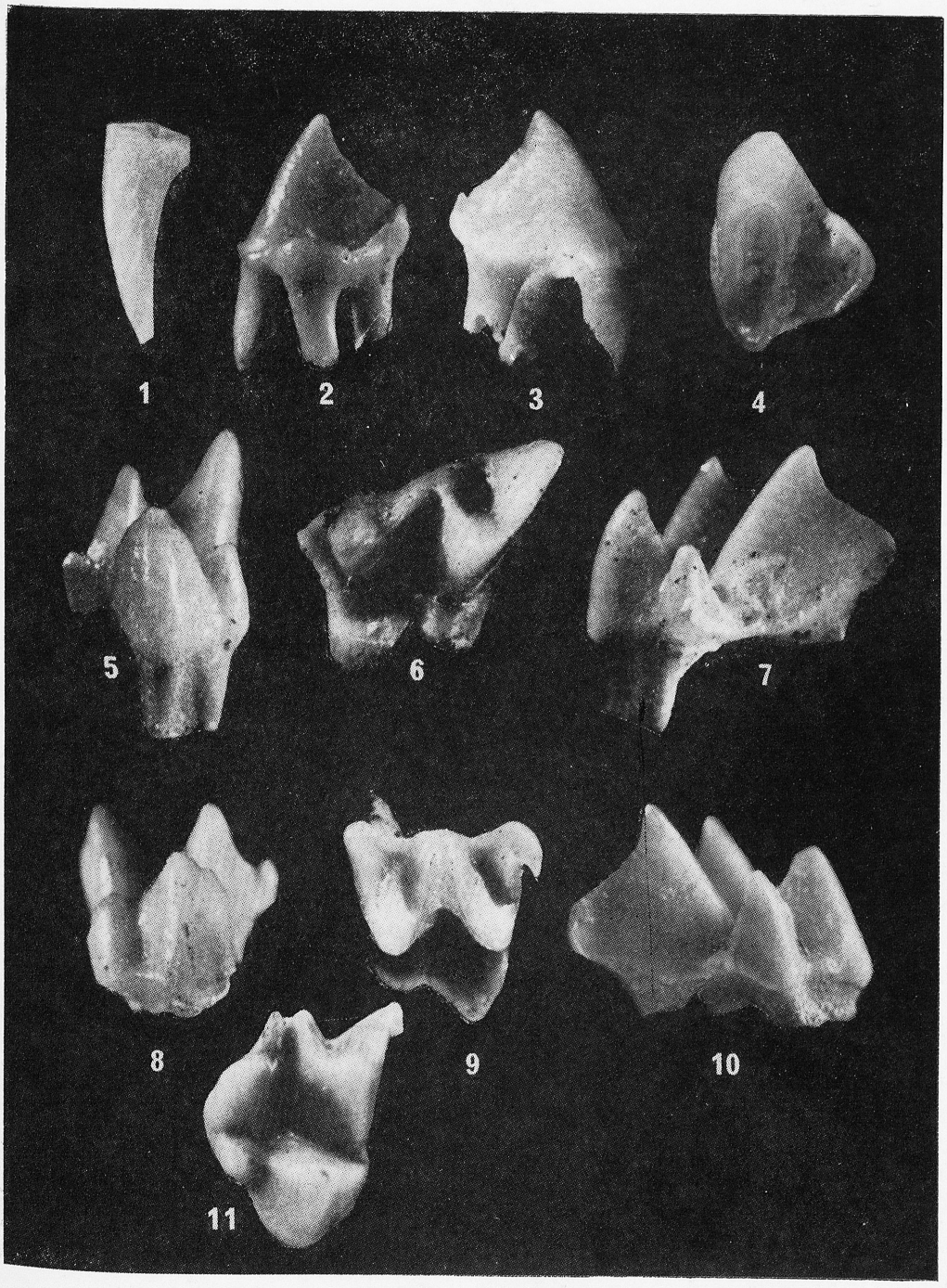
Z plioceńskich i plejstoceńskich stanowisk Jaskini Zamkowej Dolnej w Olsztynie k. Częstochowy, Kadzielni i Kamyka zidentyfikowano liczne szczątki rodzaju *Geotrypus*. Opisano nowy dla Polski gatunek *?Geotrypus copernici* n. sp. Znalezisko to przedłuża znany zasięg czasowy tej formy aż do środkowego plejstocenu.

Z tychże stanowisk opracowano wreszcie liczne szczątki rodzaju *Neurotrichus*. Opisano nowy gatunek *?Neurotrichus polonicus* n. sp. Jest on drugim, w polskich materiałach kopalnych, przedstawicielem kopalnym endemicznych dziś dla Ameryki Północnej *Talpinae*.

Redaktor pracy: dr hab. L. Sych

Plate III

Upper teeth of *?Geotrypus copernici* n. sp. from Zamkowa Dolna Cave: Fig. 1 — C^1 (MF/1010/1), lingual view, 2—4: P^4 (MF/1010/2) lingual, labial and occlusal views, 5—7: M^1 (MF/1010/7), lingual, labial and occlusal views, 8—10: M^2 (MF/1010/17), lingual, occlusal and lateral views, 11 : M^3 (MF/1010/24), occlusal view



S. Skoczeń

Plate IV

?*Geotrypus copernici* n. sp., Fig. 1—3: fragment of right mandible with P_4 and M_1 in situ (MF/1010/58) from Zamkowa Dolna Cave, lingual, labial and occlusal views, 4—6: middle part of left mandible from Kadzielnia (MF/1018/18) with M_1 and M_2 in situ, lingual, labial and occlusal views, 7—8: left humerus from Zamkowa Dolna Cave (MF/1010/62), anterior and posterior views

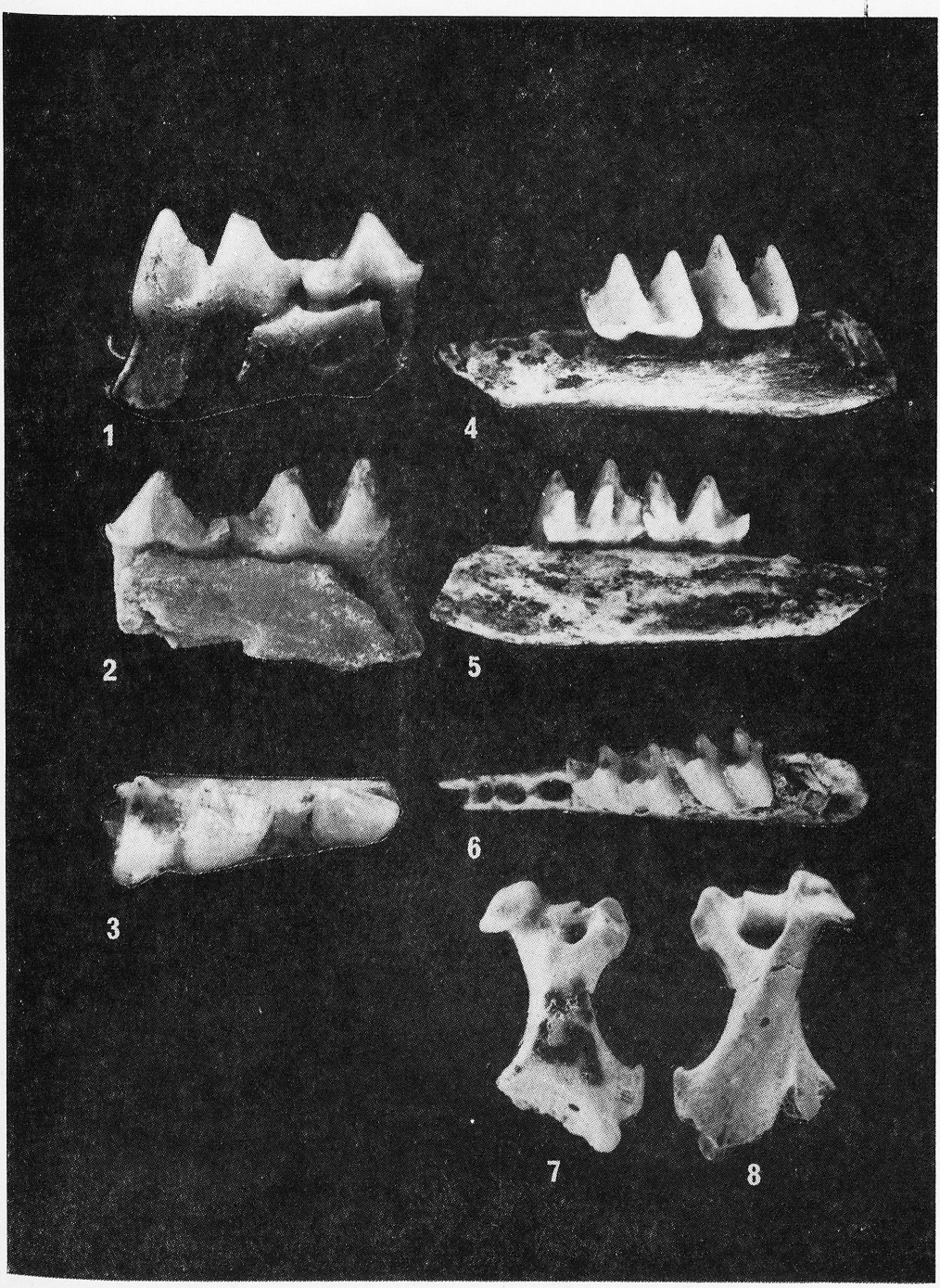


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Plate V

Dentition and humerus of *Scaptonyx* (?) *dolichochir* from Rębielice Królewskie I and Kadzielnia. Humerus of ?*Neurotrichus polonicus* n. sp. from Rębielice Królewskie I and Kadzielnia in comparison with those of recent *Urotrichus*. Fig. 1: M^2 of *Scaptonyx* (?) *dolichochir* from Rębielice Królewskie I (MF/1013 (6), occlusal view, 2—4: middle-posterior part of right mandible from Kadzielnia (MF/1014/1) with M_1 and M_2 in situ, labial, lingual and occlusal views, 5: left humerus from Rębielice Królewskie I (MF/1013/7), anterior and posterior views, 6: right humerus of ?*Neurotrichus polonicus* n. sp. from Rębielice Królewskie I (MF/1015/17), anterior and posterior views, 7: left humerus of this form from Kadzielnia (MF/1016/3), anterior and posterior views, 8: right humerus of recent *Urotrichus talpoides*, anterior and posterior views

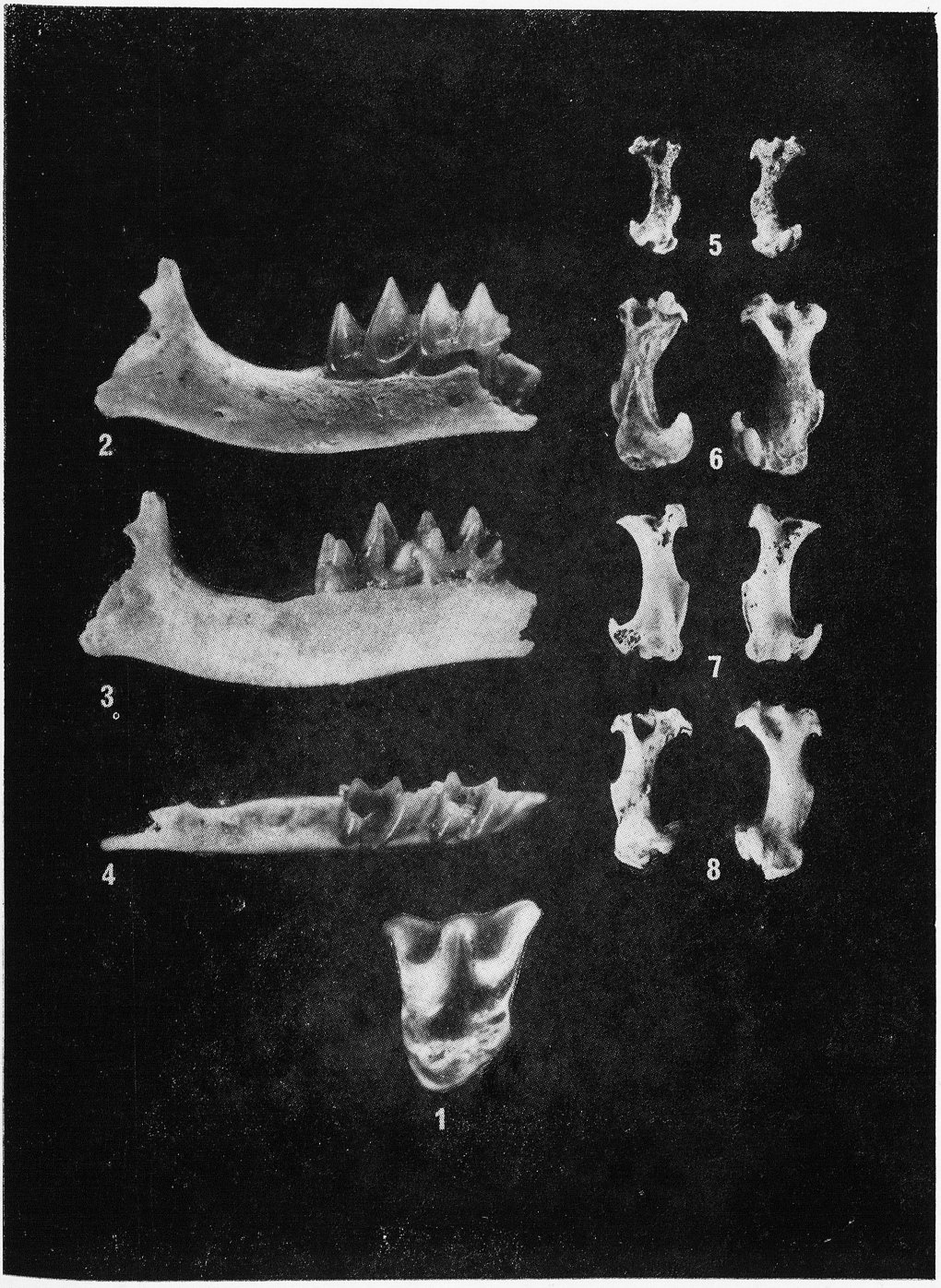

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Plate VI

Dentition, mandibles and posteranial skeletal elements of ?*Neurotrichus polonicus* n. sp. from Rębielice Królewskie I. Fig. 1: M^1 (MF/1015/2), occlusal and labial views, 2: M^2 (MF/1015/5), lateral view, 3—4: premolar part of right mandible (MF/1015/6) with P_3 in situ, labial and lingual views, 5—7: right incomplete mandible from Kadzielnia (MF/1016/1) with P_4—M_2 in situ, labial, lingual and occlusal views, 8—9: clavicle from Rębielice Królewskie I (MF/1015/17) anterior and posterior views, 10: left ulna (MF/1015/36) in comparison with those (11) of recent *Urotrichus talpoides*

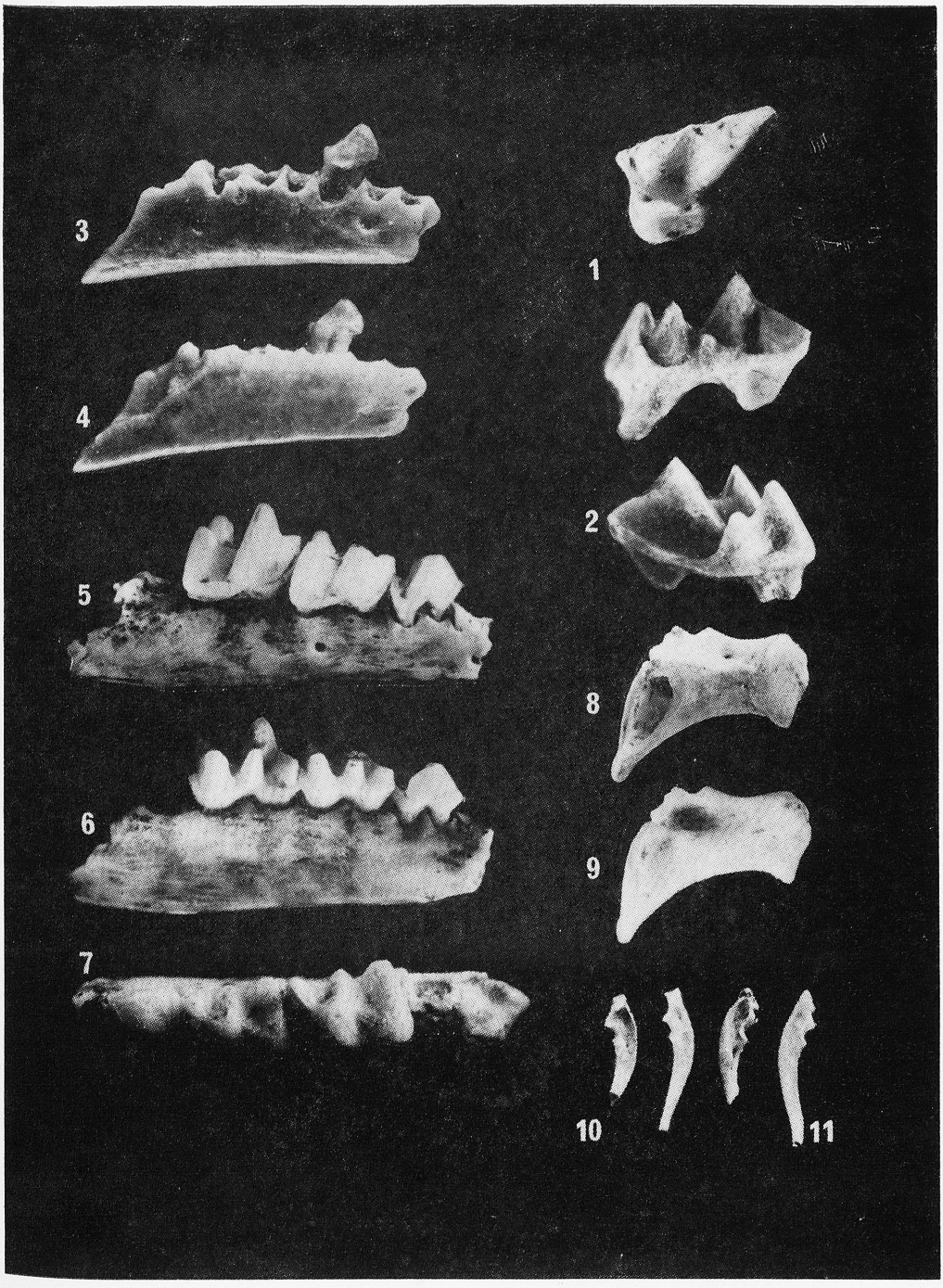

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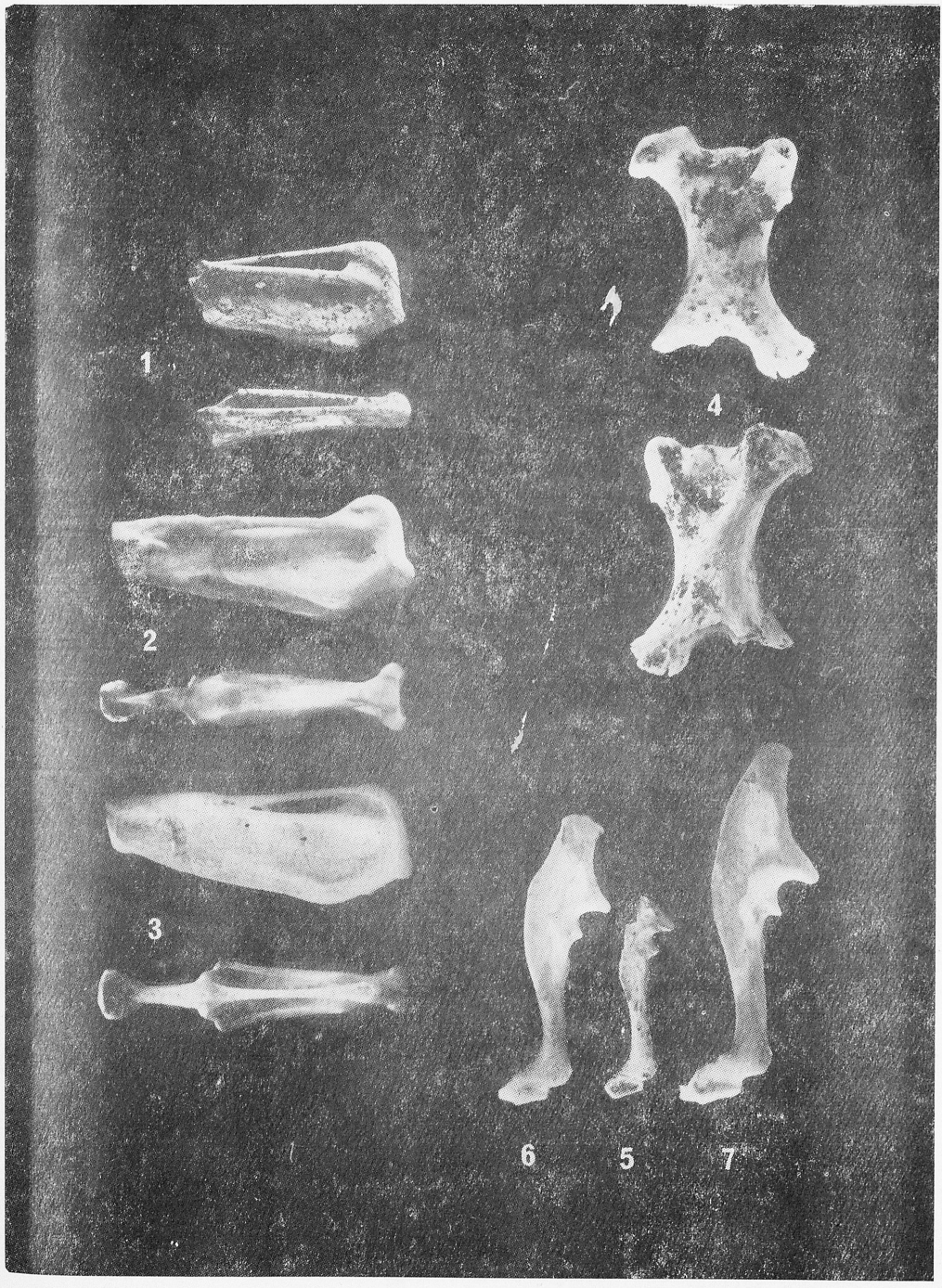
Plate VII

Postcranial skeletal elements of *Scapanulus agrarius* n. sp. in comparison with those of recent moles. Fig. 1: manubrium of *Scapanulus agrarius* n. sp. from Podlesice (MF/1018/1) lateral and dorsal views, 2: manubrium of *Scapanus latimanus* rec., 3: *Parascalops breveri* rec., lateral and dorsal views, 4: left humerus of *Scapanulus agrarius* n. sp. from Podlesice (MF/1018/3), anterior and posterior views, 5: left ulna of *Scapanulus agrarius* n. sp. (MF/1018/19) in comparison with of those recent *Parascalops breveri* (6) and recent *Scapanus latimanus* (7)



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