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***Condylurini* DOBSON, 1883 (*Insectivora*, *Mammalia*) in the Pliocene of Poland**

(Pp. 291—314, pls. XIV—XVI, 5 text-figures)

***Condylurini* DOBSON, 1883 (*Insectivora*, *Mammalia*) w pliocenie Polski**

***Condylurini* DOBSON, 1883 (*Insectivora*, *Mammalia*) из плиоцена Польши**

Abstract. Numerous remains of the genus *Condylura* ILLIGER 1811, at present endemic in the New World, have been found in the abundant fossil material from the Middle and Late Pliocene of Poland. Two new fossil species of the genus *Condylura*, *Condylura kowalskii* n. sp. and *Condylura izabellae* n. sp., have been described. The occurrence of these forms in the fossil material from Poland fills the existing gap in our knowledge of the origin of these interesting moles.

INTRODUCTION

The subfamily *Talpinae* FISCHER von WALDHEIM, 1817 is distributed in a large portion of the Holarctic and the northern limit of its range coincides partly with the southern limit of perpetually frozen soil. In the Palaearctic their range includes the islands of Japan and the farthest jutting points of the south-eastern part of the Asiatic mainland on the east and the westernmost points of the European mainland on the west.

Fairly large numbers of the members of this group have been mentioned, especially in the most recent publications, from the fossil materials of Europe. Hence the dynamic picture of the origin, expansion and extinction of particular forms throughout the Neogene appears slowly more and more distinct.

Two forms of the *Scaptonychini* VAN VALEN, 1967, *Scaptonyx edwardsi* GAILLARD, 1899 and *Scaptonyx dolichochir* GAILLARD, 1899, have been recorded from the Miocene of France and also found in the Miocene of Nova Ves (Neudorf) in Czechoslovakia (ZAPFE, 1951). The systematic membership of the specimen

described by SEEMAN (1938) from Germany as *Scaptonyx jaegeri* has been called in question by HUTCHISON (1968). In his last paper HUTCHISON (1974) includes *Scaptonyx jaegeri* in the genus *Mygalea* SCHREUDER, 1940 and points to the resemblance of *Scaptonyx dolichochir* to the genus *Urotrichus* TEMMINCK 1841.

Out of the *Urotrichini* DOBSON, 1883 of Europe, *Paratalpa micheli* LAVOCAT, 1951 has been reported from the Miocene and, recently, Oligocene of France (HUGUENEY, 1972) and from the Miocene of Spain (GIBERT, 1974, 1975). The very interesting genus *Geotrypus* POMEL, 1848 has lately been found in the Miocene of France (HUGUENEY, 1972) and Sardinia (de BRUIJN and RÜMKE, 1974).

In the fossil materials of Europe the remains of the *Talpini* FISCHER von WALDHEIM, 1817 are the most numerous. The genus *Talpa* LINNAEUS, 1758 is common in the fossil localities all over the continent. *Talpa minuta* BLAINVILLE, 1838 has recently been found in large numbers in the Miocene deposits of France, Czechoslovakia and Spain. Numerous remains of *Talpa minor* FREUDENBERG, 1914, *Talpa fossilis* PETÉNYI, 1864, *Talpa episcopalis* KORMOS, 1930 and *Talpa europaea* LINNAEUS, 1758 have been reported from a number of Plio- and Pleistocene localities of Europe.

The Polish Plio- and Pleistocene localities have so far provided remains of *Talpa minor*, *Talpa fossilis* and *Talpa europaea* (KOWALSKI, 1956, 1958, 1960a, SULIMSKI, 1959, 1962; SKURATOWICZ, 1954).

KORMOS (1930) included *Talpa episcopalis* in the modern genus *Mogera* POMEL, 1848, whereas in RABEDER's (1972) opinion, *Talpa minor* is a still now existing form with a disjunctive distribution (Iberian Peninsula, Balkans, Caucasus and Japan). *Talpa fossilis*, so numerous in the materials from the early Pleistocene, falls entirely within the limits of variation of modern *Talpa europaea* L. (RABEDER, 1972).

Talpa chthonia BATE, 1937, described from the Pleistocene of Palestine, and *Talpa tyrrhenica* BATE, 1945 from Sardinia, according to that authoress, (BATE, 1937, 1945) correspond with *Talpa romana* THOMAS, 1902, which inhabits south-eastern Italy and Sicily.

The *Condylurini* DOBSON, 1883, differentiated sharply by their characters from other *Talpinae*, have not hitherto been recorded from the Old World, some fossil remains of the genus *Condylura* being known only from the Pleistocene of North America (HUTCHISON, 1968).

In the European fossil fauna the *Scalopini* DOBSON, 1883 are represented by *Alloscapanus sansaniensis* BAUDELLOT, 1968 and *Alloscapanus lemani* GIBERT, 1974, the latter recently described from Spain, but the systematic position of these forms is not, as yet, definitively determined. According to HUTCHISON (1974) *Alloscapanus* BAUDELLOT, 1968 is a synonym of *Proscapanus* GAILLARD, 1899.

The interesting and abundant fossil materials from the Plio and Pleistocene localities in Poland contain a number of forms of the *Talpinae*, never recorded from the fossil faunae of that country before and, in some cases, from those of Europe, either.

Characteristics of localities: the material discussed in this paper comes from three Pliocene localities: Weże I and Rebielice Królewskie I and II. The fauna of Weże I is referred to the Upper Pliocene (KOWALSKI, 1962a, 1964) and its specific composition indicates a steppe environment. A breccia found there contained remains of many groups of animals, among which the *Leporidae* predominated quantitatively. There were also mammals associated with water environment, e.g. the *Desmaninae* (KOWALSKI, 1962, 1964; SULIMSKI, 1959, 1962; RZEBIK-KOWALSKA, 1971).

Rebielice Królewskie I and II, dated at the Upper Pliocene (Lower Villafranchian), are somewhat younger than Weże I. The fauna of Rebielice Królewskie consists of many species associated with water environment (among other

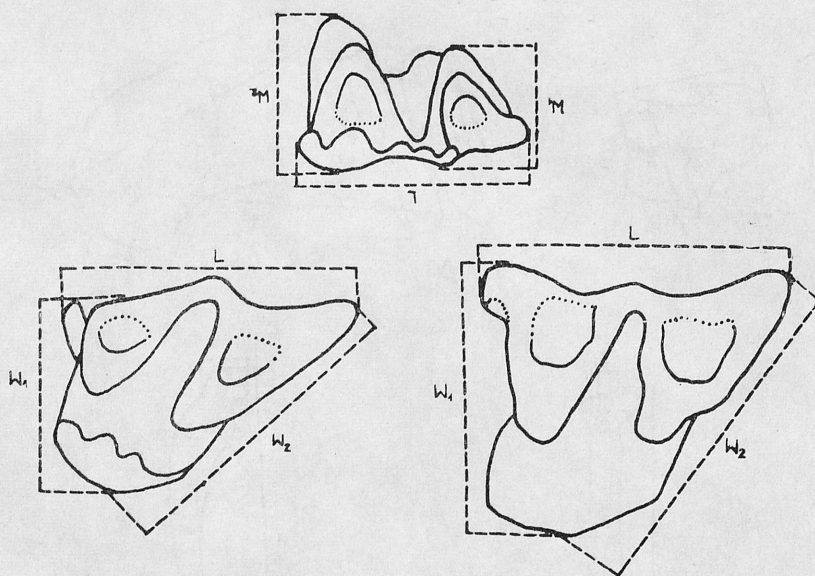


Fig. 1. Figures showing the method of measuring *Condylura* teeth

animals, numerous amphibians, turtles and, out of the mammals, *Desmana* — KOWALSKI, 1960b, 1964; RZEBIK-KOWALSKA, 1971).

Terminology and measuring methods: The revised HUTCHINSON'S (1968, 1974) nomenclature is used in the descriptions of teeth. The descriptions of the measurements of teeth and postcranial skeletal elements are given in Figures 1 and 2. All the measurements and readings were taken under an MST 130 microscope.

Acknowledgments: The author wishes to express his thanks to Prof. K. KOWALSKI, Director of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow for providing him with interesting materials of fossil *Talpinae* for study and for his extensive help during the study. He is indebted to Miss Anna WENDORFF for the carefully drawn figures and to Jacek OPIDOWICZ for the photographs.

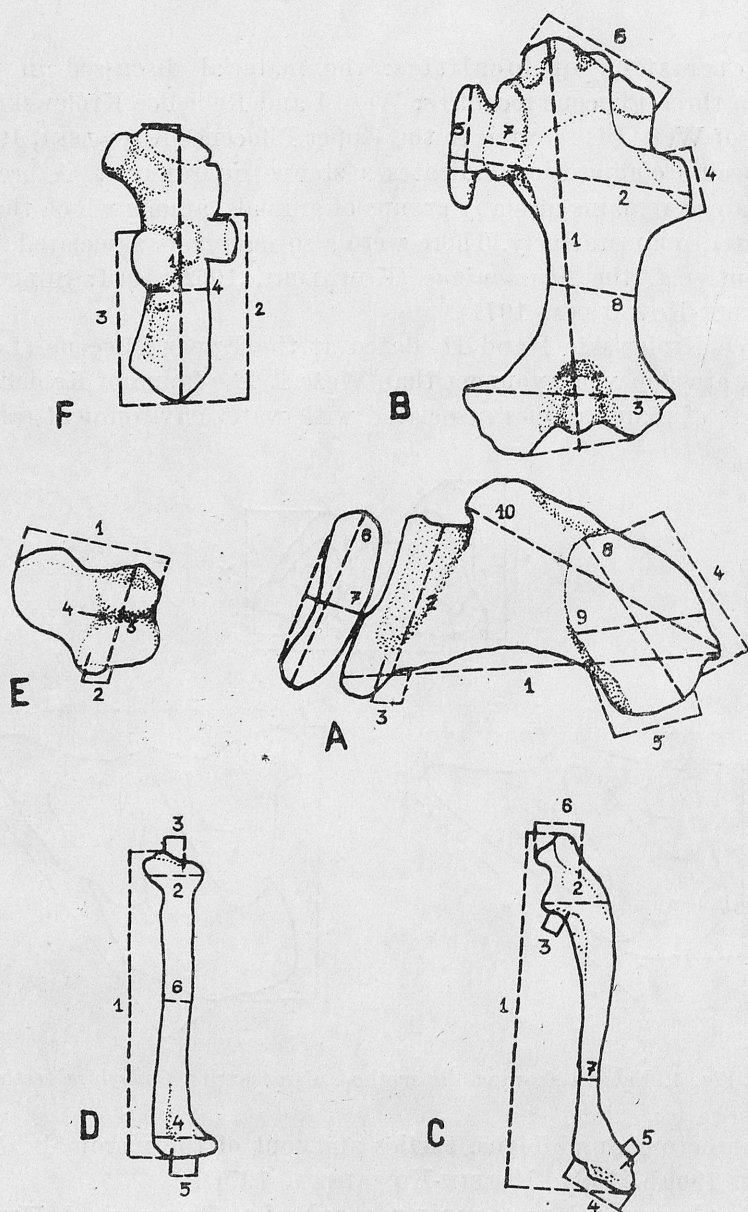


Fig. 2. Figures showing the method of measuring *Condylura* skeletal bones. A. Clavicula: 1 — total length, 2 — proximal width, 3 — prox. thickness, 4 — distal width, 5 — distal thickness, 6 — clavicular facet length, 7 — clavicular facet width, 8 — humeral facet length, 9 — humeral facet width, 10 — ventral process length. B. Humerus: 1 — total length, 2 — proximal width, 3 — distal width, 4 — teres tuberculus length, 5 — tuberositas major length, 6 — tuberositas minor and crista pectoralis, 7 — capitulum width, 8 — shaft width. C. Ulna: 1 — total length, 2 — proximal width, 3 — proximal thickness, 4 — distal width, 5 — distal thickness, 6 — olecranon crest width, 7 — shaft width. D. Radius: 1 — total length, 2 — proximal width, 3 — proximal thickness, 4 — distal width, 5 — distal thickness, 6 — shaft width. E. Astragalus: 1 — total length, 2 — total thickness, 3 — shaft height, 4 — minimum shaft thickness. F. Calcaneus: 1 — total length, 2 — length to the upper margin of the sustentaculum talare, 3 — length to the upper margin of the articular facet for talus, 4 — minimum width

SYSTEMATIC PART

Order *Insectivora* BOWDICH, 1821Family *Talpidae* GRAY, 1825Subfamily *Talpinae* FISCHER von WALDHEIM, 1811Tribe *Condylurini* DOBSON, 1883Genus *Condylura* ILLIGER, 1811*Condylura kowalskii* nov. spec.

Derivatio nominis: I dedicate this form to my colleague Prof. Kazimierz KOWALSKI, Director of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow.

Holotype: Rębielice Królewskie — undamaged right humerus (MF/1006/16).

Material: Węże I — left M^1 (MF/1005/3), incomplete right mandible (MF/1005/33) with M_2 in situ, incomplete left mandible (MZ. VIII/ Vm-301/8), 2 left humeri (MF/1005/1—2), one of them nearly complete. Rębielice Królewskie I — 2 M^1 (MF/1006/1—2), left M^2 (MF/1006/3), anterior fragment of right mandible with P_1 and P_2 in situ (MF/1006/4), middle fragment of left mandible with M_2 in situ (MF/1006/5), mandibular process (MF/1006/6), right M_1 (MF/1006/7—8), 2 right and 3 left M_2 (MF/1006/9—13), 2 left clavicles (MF/1006/14—15), 10 left and 8 right humeri (MF/1006/17—34), 6 of them undamaged (3 humeri, Nos. 31—34, come from Rębielice Królewskie II), 5 right and 6 left ulnae (MF/1006/35—45), radii (MF/1006/46—59), left femur (MF/1006/60), astragalus (MF/1006/61—67) and calcaneus (MF/1006/68—71).

The above-specified materials are in the possession of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow except the specimens marked with the symbol MZ, which are stored in the Muzeum Ziemi (Museum of Earth) in Warsaw.

Two skulls of contemporary *Condylura cristata* ILLIGER, 1811 from the U.S.A. territory, with their dentition fully preserved, and a number of bones of the postcranial skeleton (humeri and other bones of limbs) belonging to different specimens of contemporary *Condylura* were used as comparative material.

Description. Upper teeth. M^1 subtriangular, with protocone, semicircular in shape, bent and pushed out anteriorly (Fig. 3. 1). Para- and metaconules distinct, with isolated summits. In M_1 from Węże I the para- and metaconules are more conspicuously isolated. The summits of the paracone and metacone are the same height, as in contemporary *Condylura*. The paracone is somewhat narrower and shorter than the metacone and more open labially. The anterior accessory cuspid is exceptionally well developed and directed upwards, as it is in contemporary *Condylura*. On the labial side the mesostyle is semicircular, convex, with a slightly marked furrow, which delimits it at the top. The ectoflexus and postectoflexus are deep and pocket-like, as in the modern form. The tooth has four roots. The lingual root is the robustest, semicircular on the lin-

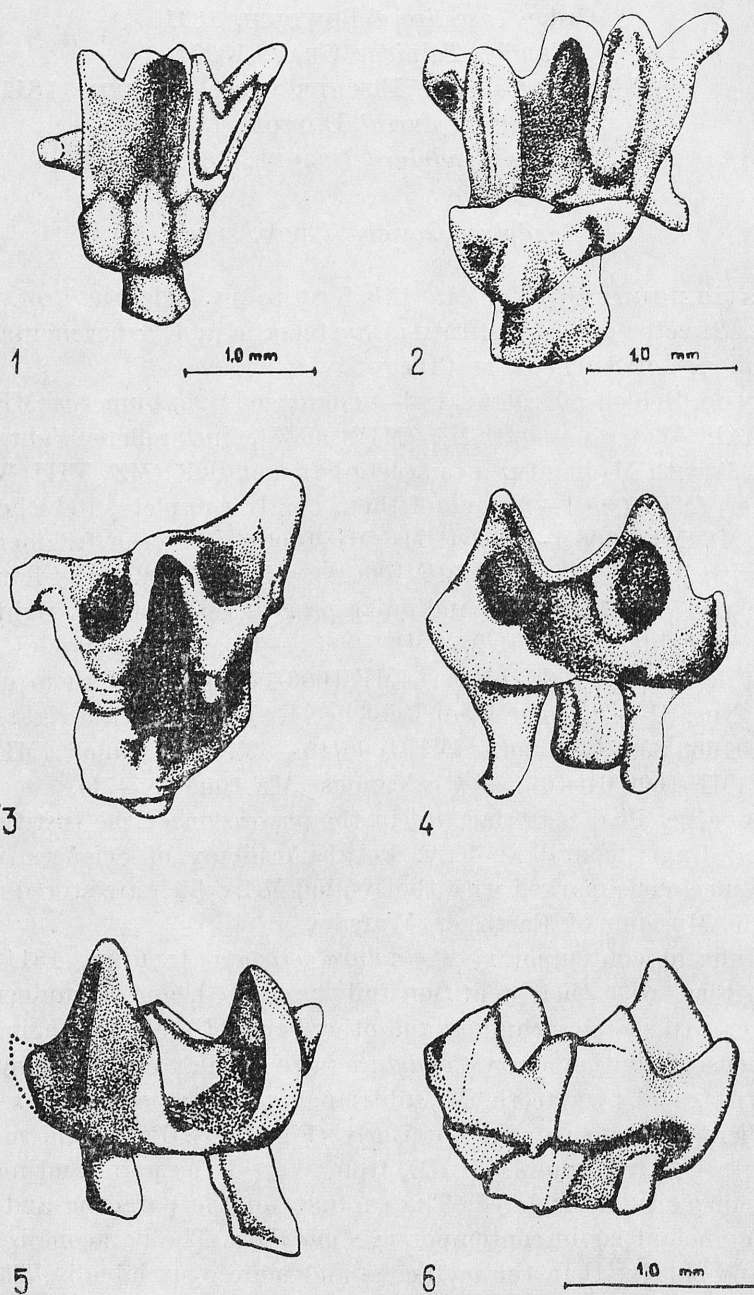


Fig. 3. *Condylura kowalskii* n. sp.: 1 — M^1 from Węże I, MF/1005/3, labial view. 2, 3, 4 — M^2 from Rębielice Królewskie I, MF/1006/3 labial, occlusal and lingual view. 5, 6 — M^1 from Rębielice Królewskie I, MF/1006/1, labial and lingual view

Table I

Comparison of measurements of the upper and lower dentition of *Condylura kowalskii* n. sp. from the Pliocene of Poland and of *Condylura cristata*

M ¹			M ²			M ₁			M ₂		
length	width 1	width 2	length	width 1	width 2	length	width 1	width 2	length	width 1	width 2
Weże I (MF/1005/3)											
—	—	1.41	—	—	—	—	—	—	1.51	0.80	0.82
Rebielice Królewskie I (MF/1006/1—13)											
2.02	1.91	1.45	2.00	1.73	—	1.65	0.71	0.92	1.60	0.90	0.85
2.02	2.05	1.37	—	—	—	1.65	0.80	0.95	1.68	0.89	0.90
—	—	—	—	—	—	—	—	—	1.70	0.86	0.88
—	—	—	—	—	—	—	—	—	1.70	0.87	0.95
—	—	—	—	—	—	—	—	—	1.71	0.88	0.85
—	—	—	—	—	—	—	—	—	1.73	0.90	0.85
—	—	—	—	—	—	—	—	—	1.73	0.90	0.92
<i>Condylura cristata</i> (rec.).											
2.10	1.90	1.30	1.90	1.70	1.65	1.63	0.90	1.00	1.70	1.00	1.05
2.25	1.80	1.29	1.90	1.70	1.95	1.80	0.70	1.00	1.76	1.05	1.02
Depth of jaw below: Weże I (MF/1005/3,33)			M ₂			M ₃			Length of M ₁ —M ₃ :		
<i>Condylura cristata</i> (rec.)			1.61			1.41			4.31 (alv.)		
			2.20			2.00			5.11		
			2.33			2.10			5.25		

gual side and short, the anterior root is thin, needle-like, and the posterior one is strongly transversely flattened. The fourth root is centrally situated, it is thin, needle-like and round in section. M^2 — protocone, as in M^1 , semicircular, bent forward (Fig. 3. 2, 3, 4). Para- and metaconules very distinct and disposed symmetrically. Paracone and metacone equal in height, the latter being somewhat narrower than the former (Table I). Mesostyle characteristically convex on labial side (Fig. 3. 4), with a slightly marked division. Parastyle bent more than in modern *Condylura*. In contradistinction to the modern form the metastyle is not bent. The ectoflexus and postectoflexus are deep and pocket-like, just as they are in the recent form (Fig. 3. 3, 4). Lingual root sturdy, broad, and flattened along the long tooth axis. Two posterior labial roots are considerably weaker and shorter (Fig. 3. 4). Unlike M_1 the fossil M_2 exceeds M_2 of modern specimens of *Condylura* under comparison in length and width (Table I).

Mandible and lower teeth. Both mandibles from Weże I (MF/1005/33 and MZ VIII/Vm 301/8) have characteristic features of the mandible of *Condylura*, that is, a delicate and light shape and a typical narrowing behind the posterior edge of M_3 . The mandibular fossa is shallow and extensive, the mandibular foramen situated analogously to that in recent *Condylura* (Pl. XIV, Figs. 3—4). The angular process of both mandibles was narrow, typical of contemporary *Condylura*. In the mandible MF/1005/33 the lower margin of this process is round in section. The mandibular process of the other mandible, judging by its base, was identical in shape with that of modern *Condylura*. The mandibular process (MF/1006/6) found at Rebiełice Królewskie I is also identical with the corresponding part in modern specimens. The alveoli of all the three molars, preserved in the mandible MZ VIII/Vm 301/8, indicate that the roots of these teeth were round in section and fairly widely disposed. The middle fragment of the mandible from Rebiełice Królewskie, with M_2 in situ also refers it to *Condylura*.

Both premolars, P_1 and P_2 , from Rebiełice Królewskie are identical in structure with these teeth in recent *Condylura*. Although they are damaged, the details of their morphology are clearly concurrent with the corresponding details of the recent species. Their spacing in the fossil form (external margins) is 2.0 mm., whereas in two contemporary specimens it is 2.25 and 2.40 mm. The height of the mandible between P_1 and P_2 of the fossil form is 1.33 mm. and the thickness of the upper edge in the same place is 0.51 mm. The corresponding mean dimensions of the mandible of recent *Condylura* are, respectively, 1.60 and 0.65 mm. The remaining measurements are given in Table I.

M_1 — as in the contemporary form, its trigonid and talonid are subequal in height and length. The trigonid is narrower than the talonid (Fig. 3. 5, 6, Table I). The paraconid is somewhat worse developed, while the metaconid is considerably robuster and passes into the slightly lower, poorly distinguished metastylid, the base of which is joined with the entoconid, which is broad at the bottom (Fig. 3. 5, 6). In this situation the prefossid and postfossid are closed and lingually demarcated. The posterior accessory cuspid is ill-developed. The anterior

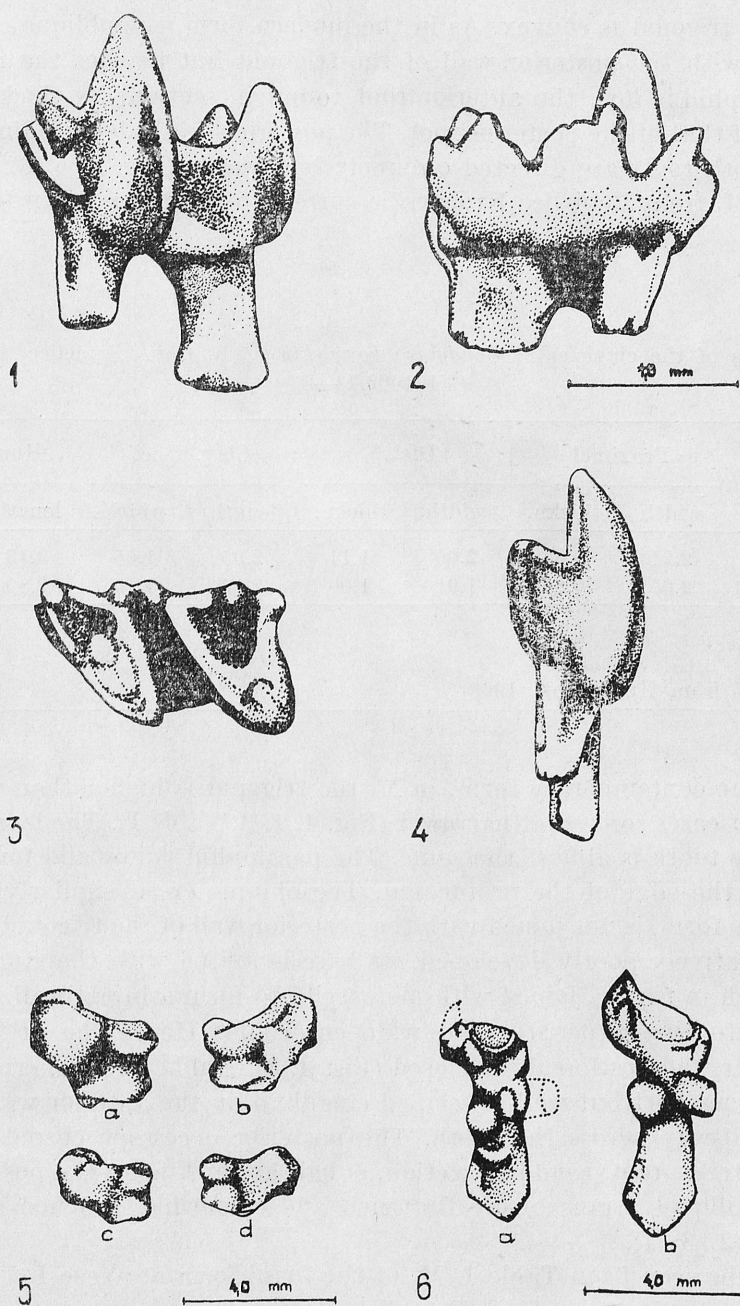


Fig. 4. *Condylura kowalskii* n. sp.: 1—4; M₂ from Rębielice Królewskie I, MF/1006/9, labial, lingual, occlusal and anterior side views. 5 — Astragalus of *Condylura*: 5a — *Condylura cristata* rec. 5b — *Condylura kowalskii* n. sp. from Rębielice Królewskie I, MF/1006/62, c, d, — *Condylura izabellae* n. sp. from Rębielice Królewskie I, MF/1006/63—64. 6 — Calcaneus of *Condylura*: 6a — *Condylura kowalskii* n. sp. from Rębielice Królewskie I, MF/1006/68, 6b — *Condylura cristata*

wall of the trigonid is convex. As in the modern form, the oblique crest is not connected with the posterior wall of the trigonid but reaches the metastylid. The paralophid is low, the anterior root round in section, its thickness being one-third of that of the posterior root. The posterior root is longitudinally flattened and both roots are directed obliquely backwards (Fig. 3. 5, 6). Both specimens of M_1 from Rebielice Królewskie correspond to the modern form in size (Table I).

Table II

Measurements of the clavicles of *Condylura kowalskii* n. sp. from Rebielice Królewskie I (MF/1006/14—15)

Nr	Total length	Proximal		Distal		Clav. facet		Humer. facet	
		width	thickn.	width	thickn.	length	width	length	width
14	5.60	2.21	0.85	2.00	1.11	2.95	1.55	3.13	2.09
15	5.60	2.05	0.85	1.91	1.00	2.50	1.55	2.80	1.98
<i>Condylura cristata</i> recent 6.00 (from HUTCHISON, 1968)									

As in the contemporary form, in M_2 the trigonid is higher than the talonid and in most cases somewhat narrower (Fig. 4. 1, 3, Table I). The length of both parts of the tooth is almost the same. The paralophid is low and forms a right angle with the edge of the protoconid. The oblique crest, similarly to that in the modern form, is not joined with the posterior wall of the trigonid. The paraconid is relatively poorly developed, its base is united with the sturdier metaconid, which in turn is joined with metastylid to form a broad wall, at its base merging into the entocristid and wide entoconid. Hence the prefossid and, in particular, the postfossid are closed (Fig. 4. 3). Unlike the modern form, this tooth has the short but well-developed cingulum on the anterior wall, where it extends half-way across the tooth. The posterior accessory cuspid is present and the anterior root, round in section, is half as thick as in the posterior root, which is obliquely transversely flattened and somewhat widened at the end (Fig. 4. 1, 2, 3, 4).

As will be seen from Table I, M_2 of the fossil form at Weże I differs much in length from the form from Rebielice Królewskie.

Clavicle. Two left clavicles (MF/1006/14, 15 — Pl. XIV, fig. 5.) were found in the material from Rebielice Królewskie. Their dimensions are given in Table II. The characteristic feature of these clavicles is their antero-posterior flattening, owing to which the dorsal and ventral edges are relatively sharp. The conspicuous ventral process occurs on the ventral edge in the proximal half of the bone (Pl. XIV, Fig. 5). The manubrial articular facet is reniform and the humeral arti-

Table III

Comparison of measurements of the humeri of *Condylura* ILLIGER 1811 from the Pliocene of Poland and of *Condylura cristata*

Nr	Total length	Width		Teres tuberc.	Tuber. major,*	Tuber. minor**	Capit. width	Shaft	
		prox.	dist.					width	thickn.
<i>Condylura kowalskii</i> n. sp. Weże I (MF/1005/1,2)									
1	—	—	4.62	1.81	—	—	—	2.11	2.00
2	9.95	6.40	5.21	1.92	2.82	—	0.91	2.12	2.45
Rębielice Królewskie (MF/1006/16—33)									
16	10.62	7.21	5.63	1.95	2.82	4.21	1.03	2.65	2.60
17	11.00	7.23	—	2.12	3.51	4.89	1.15	—	2.32
18	11.15	6.75	5.77	1.91	—	4.55	1.31	2.44	2.31
19	11.33	7.23	5.45	1.93	3.43	4.58	1.11	2.62	2.45
20	11.34	7.44	5.62	2.05	—	4.71	1.23	2.43	2.37
21	11.57	7.28	5.71	1.97	2.81	4.75	1.00	2.75	2.47
22	11.52	7.33	5.83	1.65	2.77	4.63	1.03	2.68	2.63
23	11.78	7.25	5.68	2.15	3.42	5.05	1.14	2.62	2.42
24	11.45	6.45	5.65	2.04	3.37	4.48	0.92	2.42	2.25
25	—	6.71	—	2.00	2.81	4.74	1.27	2.61	—
26	—	—	6.00	1.71	—	—	—	2.75	2.55
27	—	—	5.42	2.12	—	—	—	2.72	2.62
28	—	—	5.95	1.68	—	—	—	2.55	2.45
29	—	—	—	2.22	—	—	—	2.78	2.58
30	—	—	—	—	—	—	—	2.55	2.62
31	—	—	5.81	—	—	—	—	2.53	2.41
32	—	—	5.11	—	—	—	—	2.56	2.51
33	—	—	5.12	—	—	—	—	2.71	2.43
<i>Condylura izabellae</i> n. sp. Rębielickie Królewskie (MF/1007/1)									
1	—	4.92	—	1.52	1.83	—	0.85	1.83	1.71
<i>Condylura cristata</i> (rec.) Pennsylvania									
1	12.91	8.10	6.25	2.56	3.85	5.15	1.15	2.85	2.75
2	12.82	8.15	6.46	2.33	3.75	4.85	1.25	2.92	2.65
3	—	8.22	—	2.21	3.48	4.82	1.22	—	—

* without deltoid process

** with pectoral crest

cular facet oval, with a small indent on the dorso-internal side, whereas on the opposite edge there occurs a rounded process for the attachment of the distal portion of the cleidodeltoid muscle. The two articular surfaces are noticeably not parallel to each other (Pl. XIV, Fig. 5).

Humerus. Two left humeri, MF/1005/1—2, have been derived from the materials collected at Weże I; their measurements are given in Table III. Rębie-lice Królewskie supplied 19 humeri, MF/1006/16—34, of which 10 were left; their measurements are included in Table III. The width-length ratio of these bones indicates the moderately underground ways of life of these moles. The proximal part of the humerus is well developed, its width equals 63% of the bone length. The clavicular articular surface is elliptic, parallel to the long axis of the humerus and separated from the bone head by a well-developed groove. The head of the humerus is somewhat deflected to the side from the long axis of the bone (Pl. XV, Fig. a). The deltoid process, in the shape of a truncated cone, is well developed and the terete tubercle is quite distinct and its end is not united with the minor tuberosity. The bicipital fossa is well developed.

The characteristic feature of the distal part is the relatively large, obliquely outlined olecranon fossa and the trochlear ridge symmetrically situated in the middle of the trochlea (Pl. XV, Fig. a).

Table IV

Measurements of the ulnae of *Condylura kowalskii* n. sp. from Rębielice Królewskie I (MF/1006/35—45)

Nr	Total length	Proximal		Distal		Olecr. crest width	Shaft	
		width	thickn.	width	thickn.		width	thickn.
35	16.65	3.35	1.55	3.61	1.11	—	1.11	0.92
36	—	2.81	1.55	—	—	4.82	—	—
37	—	2.91	1.42	—	—	—	—	—
38	—	3.05	1.52	—	—	4.75	—	—
39	—	3.11	1.61	—	—	—	—	—
40	—	3.19	1.45	—	—	—	—	—
41	—	3.23	1.65	—	—	—	—	—
42	—	—	—	3.52	1.10	—	—	—
43	—	—	—	3.52	1.10	—	—	—
44	—	—	—	3.63	1.05	—	1.14	1.07
45	—	—	—	3.82	1.11	—	1.05	1.00

Ulna. A total of 11 ulnae, MF/1006/19—27, have been obtained from Rębie-lice Królewskie; seven of them are left and only one complete. The measurements of these bones are given in Table IV. The ulnae are characterized by their slender build and sinusoid shape. The olecranon process is relatively short, the proximal crest forms a right angle with the shaft. The lateral and medial olecranon crests are well developed. The anconeal process is conspicuous and slender, whereas the coronoid process is low. The semilunar fossa is wide and poorly developed (Pl. XVI, Fig. 1). The angle formed by the articular surface of the distal part and the long axis of the shaft is much more acute than in the genus *Talpa*.

Radius. Fifteen radii, MF/1006/46—60, all of them damaged, have been found in the material from Rebielice Królewskie I; their measurements are given in Table V. They are delicate bones of dainty mould and a relatively even shaft. The capitular process is more rounded than the corresponding element

Table V

Measurements of the radii of *Condylura kowalskii* n. sp. and *Condylura izabellae* n. sp. from Rebielice Królewskie I

Nr	Total length	Proximal		Distal		Shaft	
		width	thickn.	width	thickn.	width	thickn.
<i>Condylura kowalskii</i> n. sp. (MF/1006/46—60)							
46	—	2.35	1.62	—	—	1.11	1.11
47	—	2.61	1.51	—	—	—	—
48	—	2.23	1.31	—	—	0.95	0.82
49	—	—	—	2.63	1.52	1.15	0.82
50	—	2.61	1.52	—	—	1.02	0.95
51	—	2.40	1.60	—	—	1.10	0.95
52	—	2.25	1.36	—	—	0.92	0.80
53	—	2.48	1.60	—	—	—	—
54	—	2.55	1.60	—	—	—	—
55	—	2.50	1.55	—	—	—	—
56	—	—	—	2.55	1.40	—	—
57	—	—	—	2.60	1.45	1.18	0.82
58	—	—	—	2.65	1.58	1.10	0.80
59	—	—	—	2.56	1.45	—	—
60	—	—	—	—	1.48	—	—
<i>Condylura cristata</i> (rec.)							
	11.55	—	—	2.84	—	—	—
<i>Condylura izabellae</i> n. sp. (MF/1007/1—4)							
1	—	—	—	1.75	1.20	0.95	0.65
2	—	—	—	1.78	1.11	0.85	0.60
3	—	—	—	1.80	1.06	—	—
4	—	—	—	1.35	0.85	0.70	0.45

in the genus *Talpa* and the ulnar articular facet is relatively broad, with a sharp distal protuberance. In the middle part of the external edge of the shaft there is a delicate outline of a tuberosity for the attachment of the tendon of the long abductor muscle of the thumb. The distal part of the radius has its margin slightly arched in outline, without any visible tuberosities. The long axis of the anconeus articular surface and the long axis of the shaft form a right angle (Pl. XVI, Fig. 2).

Femur. One right femur, MF/1006/61, with its distal part destroyed, has been distinguished from Rebiełice Królewskie I. Its measurements are as follows: proximal width — 2.83 mm, head thickness — 1.55 mm, shaft width and thickness — 1.00×1.00 mm. The rounded head, lack of the intertrochanteric crest, and the lesser trochanter, better developed and more projecting than it is in *Talpa*, are the characteristic morphologic features of this femur.

Table VI

Measurements of the astragali of *Condylura* from Rebiełice Królewskie I (MF/1006/61—67), and *Condylura cristata*

Nr	Total length	Total thickn.	Shaft hight	Minim. shaft thickn.	3:1 in %
	1	2	3	4	
61	2.55	1.39	1.81	1.21	71.0
62	2.65	1.49	1.59	1.29	60.0
63	2.80	1.11	1.65	1.10	60.0
64	2.85	1.21	1.71	1.00	60.0
65	2.94	1.21	2.00	1.10	68.0
66	3.24	1.57	2.30	1.00	71.0
67	3.30	1.51	2.35	1.11	71.2
<i>Condylura cristata</i> (rec.)					
	3.75	1.85	2.65	1.41	70.7

Table VII

Measurements of the calcanei of *Condylura* from Rebiełice Królewskie I (MF/1006/68—71) and *Condylura cristata*

Nr	Total length	Length to upper margin			3:1 in %	Minimum width	4:1 in %
		sust. talare	art. fac. for talus				
	1	2	2:1 in %	3	4		
68	4.50	3.40	75.5	2.85	63.5	1.45	32.2
69	4.50	3.43	76.2	2.82	62.6	1.40	31.7
70	4.55	3.40	74.7	2.85	62.6	1.40	31.0
71	5.20	4.15	79.8	3.40	65.4	1.55	29.8
Condylura cristata (rec.)							
	6.38	4.81	75.6	4.15	65.2	1.80	28.2

Astragalus. In the fossil *Condylura* this bone is marked by its stocky build, rather low trochlea, which merges into the relatively broad neck, flattened dorso-ventrally and passing, in turn, through a comparatively low narrowing into the head (Fig. 4. 5). The shaft or trochlea, compared with that of other forms, is rather less regular. In the percentage ratio to the bone length it is lower (narrower) than in the genus *Talpa* and ranges from 60.0 to 71.0 (Table VI). Seven specimens of the astragalus, MF/1006/62—68, have been found in the materials from Rębielice Królewskie. They differ from each other to the same extent as do, e.g. *Talpa minor* and *Talpa europaea*. The smallest specimens of the astragalus, 2.55—2.65 mm long, may belong to the small form of *Condylura* described below.

Calcaneus. The four specimens of the calcaneus obtained from Rębielice Królewskie very much resemble the modern *Condylura* in shape and structure. As can be seen from Table VII, the allometric indices of particular measurements of the fossil calcanei, compared with those of the recent form, are strikingly concurrent. This bone of the fossil form is characterized by the slipper-shaped tuberosity of calcaneus, transversely convex and with a pointed top. Anteriorly it passes into the well-developed posterior articular surface (Fig. 4. 6), and the round medial articular surface is situated on the laterally projecting arm of the sustentaculum talare. At the anterior pole of this bone is the oval cuboid articular surface delimited by a bent process on the medial side (Fig. 4. 6). On the bottom side the calcaneus is convex with a small depression in the posterior part of its tuberosity.

Condylura izabellae n. sp.

Derivatio nominis: I dedicate this form to my wife Izabella.

Diagnosis. As regards its morphological characters this species is identical with *Condylura kowalskii* n. sp., from which it differs only in size (Pl. III, Figs. 3 and 4).

Holotype: Rębielice Królewskie I, left humerus, MF/1007/1, with its both proximal and distal parts damaged.

Material. Four damaged radii, MF/1007/2—5, and one femur, MF/1007/6 from Rębielice Królewskie I. These specimens are stored in the collection of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow.

Description and measurements. The proximal width of the humerus is considerably smaller than that in *Condylura kowalskii* n. sp. (Table III). The other measurements differ essentially from the measurements of the previous form. The length of this small humerus forms about 70% of the length of the humerus of *Condylura kowalskii* n. sp. The same percentage relation characterizes the width of the shaft. The pectoral crest is shaped like that in *Condylura kowalskii* n. sp. and its summit occurs half-way along the shaft. The greater tuberosity is also similar and so is the oval shape of the clavicular articular surface, separated

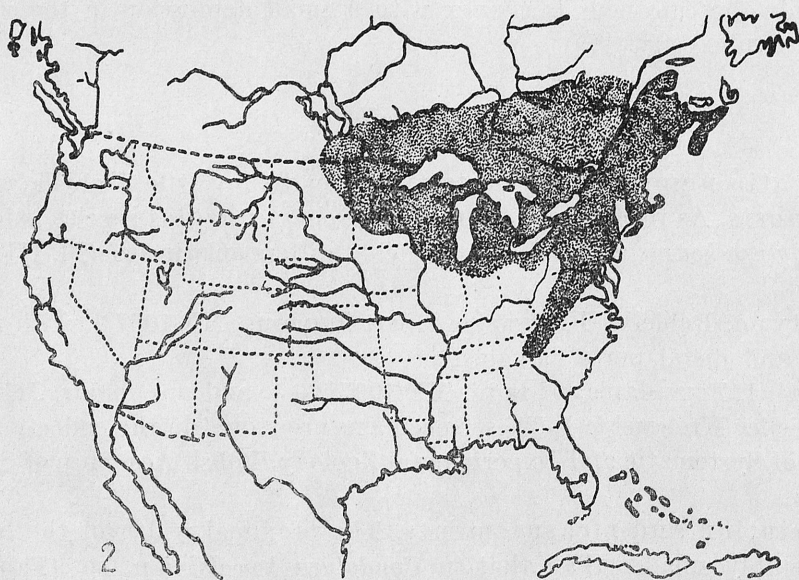
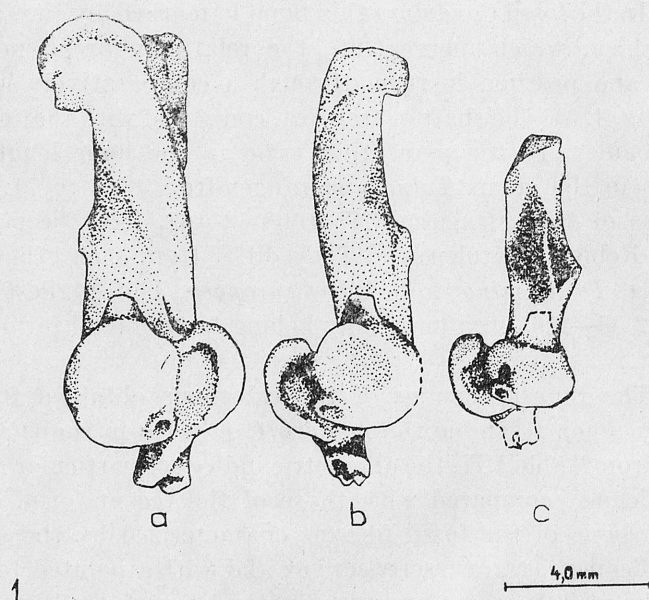


Fig. 5. 1 — lateral views of the clavicular region of the humeri; a — *Condylura cristata* (rec.), b — *Condylura kowalskii* n. sp., c — *Condylura izabellae* n. sp., 2 — Geographical distribution of *Condylura cristata* in North America (from TRUE 1897)

from the head by a well-developed groove (Fig. 5. lc.; Pl. XVI, Figs. 3 and 4). The terete tubercle is distinct.

Radius. The four small radii, MF/1007/2—5, derived from the same locality, belong most probably to this form. Their measurements are given in Table V. As regards size, they differ from the analogous bones of *Condylura kowalskii* n. sp. to the same degree as does the humerus. For instance, the percentage relation of the width of the radius shaft in the small form forms 77.3% of this width in the large form.

Femur. The preserved proximal part of the left femur, MF/1007/6, belongs presumably to this form. In shape it quite resembles this bone in *Condylura kowalskii* n. sp., which is true of its trochanters and head. It also lacks the intertrochanteric crest. The measurements of this bone are as follows: proximal width — 2.37 mm, head diameter — 1.12 mm, shaft width and thickness — 0.85×0.85 mm. The proximal width forms 81.7% of the width of the large form, which would also refer this bone to *Condylura izabellae* n. sp.

DISCUSSION

Both the fossil forms described in this paper are referred to the family *Talpidae*, above all, by their typical talpoid humerus, indicating the moderately underground ways of life. Out of the characters that indicate the membership of these forms in the subfamily *Talpinae*, we must mention, in addition to the humerus, above all, the typical talpoid, laterally flattened mandible, which is narrowed towards the front and slightly bent to the outside. The clavicles are relatively stout, suggesting the fossorial function of the limbs.

Condylura kowalskii. n. sp. differs from the *Scaptonychini* in the lack of the cingulum on the upper and lower molars and, in addition, in the characteristics and distribution of the premolars, i.e. two-rooted ones with a characteristic conic shape and loose distribution.

The clavicles of *Scaptonyx*, *Urotrichus*, *Neurotrichus* and *Condylura* are very similar and, acc. to CAMPBELL (1939), in all the three forms their length is half the length of the humerus. This is also true of *Condylura kowalskii* n. sp. The clavicles described in this paper differ from those of *Scaptonyx* chiefly in size and, besides, in the position of the ventral process, which is situated more proximally in *Scaptonyx* (vide CAMPBELL, 1939). Moreover, the distal articular surface of *Scaptonyx* is round and devoid of the process which in *Condylura* gives the attachment for the cleidodeltoid muscle.

The humeri of *Scaptonyx* and *Condylura* are similar in shape and differ only in details. The humerus of *Condylura* is, in the first place, characterized by its greater specialization for underground ways of life. The places of attachment of pectoral muscles are divided into two definite areas, the pectoral crest and pectoral ridge which are at a right angle to each other. In addition, the olecranon

fossa is much larger than it is in *Scaptonyx* and the proximal part of the humerus much wider.

Compared with the *Talpini*, *Condylura kowalskii* n. sp. shows differences chiefly in dentition. In M_1 the para- and metaconules are distinct and the para- and metacones are equal in height. The anterior accessory cuspid is exceptionally well developed and bent downwards. The para- and metafossa are deep and pocket-like. The essential differences occur in the mandible and lower teeth. The mandible has a more delicate shape and is more pointed at the end than that in the *Talpini*. It has a characteristic sulciform depression on the internal side, at the P_1 — P_4 height and above the mandibular commissure. The mandibular process is strongly laterally flattened, with the articular trochlea raised up. The mandibular fossa is shallow and extensive, without sharp edges. On the internal side this part of the mandible is convex.

Compared with the dentition of *Talpa*, the lower teeth are brachyodont. The premolars are two-rooted, set slantingly to the front, and with their height slightly increasing from the front towards the back. In M_1 and M_2 the main difference lies in the better development of the metaconid, metastylid and entocristid and hence the prefossid and postfossid are closed and delimited lingually. The oblique crest is not joined with the posterior wall of the trigonid but runs as far as the metastylid. The anterior root is round in section, the posterior one flattened longitudinally, and both of them are directed obliquely to the back. The humerus of *Condylura kowalskii* n. sp. is more elongated than this bone in the genus *Talpa*. The percentage relation of the proximal width to the length in the fossil *Condylura* is 63%, whereas it ranges between 71.42 and 74.67% in the genus *Talpa*. The relation of the distal width to the length is 50.3% in the fossil form and 57.6—60.0% in the genus *Talpa*. The clavicular articular surface of both fossil forms is oval, separated from the head by a narrowing and parallel to the long axis of the humerus.

The membership of both these fossil forms in the *Condylurini* is suggested by the following main characters:

- 1) P_1 and P_2 , spaced wide and with a morphology characteristic of *Condylura*.
- 2) The mandible, moulded lightly, narrowing to the front more than it is in the genus *Talpa*, with a fossiform depression on the internal side and the mandibular and angular processes characteristic of *Condylura* as regards shape.
- 3) The clavicle, flattened characteristically antero-posteriorly, with unparallel articular surfaces, elliptic humeral articular facet and a protuberance, typical of *Condylura*, for the attachment of the cleidodeltoid muscle.
- 4) The humerus of *Condylura kowalskii* n. sp. is similar to that in the recent species of this genus in the following characters: a) the percentage relation of the proximal and distal widths to the bone length is, respectively, 63.0 and 50.3% in the fossil form and 63.93 and 52.0% in the recent species; b) the clavicular articular facet of both the fossil and recent forms is oval, parallel to the long axis of the humerus and separated from the head by a well-developed furrow; c) the greater tuberosity is analogous in shape to and the brachial fossa as shallow

as the corresponding details in the modern form, and the deltoid process is situated in the same place and has a similar shape; d) the terete tubercle of the fossil form differs neither in proportions nor in shape from this tubercle in the modern form. Moreover, the olecranon crest of the former is situated in the same place as it is in the latter.

5) As in recent *Condylura*, the ulna has a delicate sinusoid shape. The semilunar fossa is shallow and relatively poorly developed. The styloid process is analogous in shape to that in the modern form.

6) The characteristic feature of the radius in *Condylura* is its slender shape and the length of the shaft, in which it resembles this bone in *Urotrichus*, *Neurotrichus* and shrews. The surface of the shaft and the distal portion is smooth with no such diversified sculpture as that in the genus *Talpa*. The lower margin of the distal portion of the bone is slightly arcuately convex in *Condylura*, whereas, as emphasized by HUTCHINSON (1968), it is serrated in the genera *Parascalops* and *Talpa*.

Condylura kowalskii n. sp. differs from the only recent species of this genus, *Condylura cristata* ILLIGER, 1811 in the following characters: 1) M_1 and M_2 of the fossil form are shorter and distinctly broader than the specimens of these teeth in *Condylura cristata* that we had at our disposal. 2) M_1 and M_2 are equal in size to the corresponding teeth of the modern form but M_2 has a short cingulum (ant. accessory cuspid) on the anterior wall. 3) As can be seen from Table II, the fossil clavicles are considerably smaller than the clavicles of *Condylura cristata*; according to HUTCHINSON (1968), the percentage relation of the length of the ventral process to the maximum length of the bone is 52% in *C. cristata*, whereas in the fossil form from Rebielice Królewskie this relation is 82.1% and thus it differs markedly from the value obtained for the modern species. 4) As regards humeri, the only difference is that in size. The fossil specimen is smaller and of subtler build than the humeri of the modern species used for comparison, which would indicate the more moderate underground ways of life.

Condylura kowalskii n. sp. has also some characters in common with the *Scalopini*, especially with the genus *Scapanulus*, whose humerus resembles that of *Condylura* in most proportions. Nevertheless the differences between these two forms occur in 1) the position of the head of the humerus, which is deflected from the long axis of the bone at an angle of about 30° in *Condylura*, whereas in *Scapanulus* and all the *Scalopini* the axis of the head is subparallel to the long axis of the shaft; 2) on account of the widening of the trochlea, the depression between it and the fossa lig. M. flexor digit. prof. disappears in the *Scalopini*, but is present in *Condylura*; 3) in *Condylura* the terete tubercle is more distinct and shorter than it is in *Scapanulus*; 4) in the humerus of *Condylura* the articular surface for the clavicle is subcircular in shape and parallel to the long axis of the bone, whereas in *Scapanulus* it is of the typical talpoid shape and inclined at a definite angle.

The membership of *Condylura izabellae* n. sp. in the *Condylurini* is indicated

by the following characters: 1) the shape and proportions of the humerus much resemble those of the humerus of *Condylura kowalskii* n. sp. and *Condylura cristata*; 2) the axis of the head forms the same angle with the long axis of the humerus; 3) the articular facet for the clavicle is also subcircular and almost parallel to the long axis of the humerus; moreover, this facet is separated from the head by a well-developed furrow; 4) the terete tubercle is as long and distinct as that in *Condylura kowalskii* n. sp. and *Condylura cristata*; 5) the summit of the pectoral crest occurs half-way along the shaft of the humerus just as in the two previous species.

The form under description has some characters in common with *Scalopoides isodens* HUTCHISON (1968). In this respect special attention should be given to 1) the similar shape of the articular facet for the clavicle, 2) the same orientation of the head towards the long axis of the humerus, and 3) the similar shape of the greater tuberosity and brachial fossa. On the other hand, these two forms differ in the following characters: 1) in *Scalopoides* the clavicular articular facet is not parallel to the long axis of the humerus and not separated from the head by a furrow; 2) there occurs a „scalopinae ridge” (CAMPBELL, 1939), characteristic of the humerus of *Scalopoides* and all the *Scalopinae*; 3) in *Scalopoides* the edge of the terete tubercle merges into the edge of the lesser tuberosity.

Condylura izabellae n. sp. differs clearly from *C. kowalskii* n. sp. in its smaller size.

The presence of remains of *Condylura* ILLIGER, 1811 in the Pliocene of Poland fills the gap in the enigmatic past of this only member of the *Condylurini* of the New World. Its fossil remains are known from the Pleistocene of North America (HUTCHISON, 1968). No remains of this interesting mole have hitherto been found in the Pleistocene materials from Poland and Europe. Further studies will probably provide more detailed information about the time of its extinction in the Old World. So far this genus has commonly been considered to be endemic in the New World. On the other hand, in TRUE'S (1897) opinion, all the American moles are immigrants from the Old World.

The contemporary distribution of *Condylura cristata* in the New World includes, above all, the surroundings of the Great Lakes and, according to TRUE (1897) and WALKER (1965), it occurs from the Province of Manitoba to Labrador in Canada and in the south in the States of Minnesota, Wisconsin, Indiana, Ohio, North Carolina and Georgia. As can be seen from the map presented (Fig. 5. 2) its distribution is closely associated with definite ecological conditions. It likes marshy and wet regions. This genus probably lived in similar condition at Weże I and, in particular, at Rebielice Królewskie I and II, the fauna of which contained many forms connected with water environment (amphibians, water turtles and, out of mammals, *Desmana* — KOWALSKI, 1960b, 1962, 1964; RZEBIK-KOWALSKA, 1971; SULIMSKI, 1959, 1962).

The causes of the extinction of *Condylura* in the Old World, fairly rapid, it seems, are interesting against the background of the biology of its modern species. In this case climatic conditions and competition may have been the

only decisive factors. As regards the former, it is well known that the modern *Condylura* tolerates winter conditions, feeds under ice and penetrates under snow (MERRIAM, 1884, after REED, 1951). If we were concerned with a rapid drying of the terrain and the disappearance of water reservoirs, the *Desmaninae*, so numerous at that time, would certainly have become extinct as well.

The Pliocene and Pleistocene *Talpidae* of Poland, worked out in the present study, suggest that competition was the decisive factor that brought about the extinction of *Condylura* in the Old World. The abundance of forms in this family, especially those having amphibious ways of living like *Condylura* (e.g. *Desmaninae*), was much greater at that time than it is today. The exclusively terrestrial forms were also considerably more numerous at that time, especially those of the genus *Talpa*. No doubt, there was heavy competition for food both on land and in water. *Condylura*, with its relatively delicate dentition and snout and comparatively long tail (75—81% of body length — TRUE, 1897), must have proved inferior at that competition. This would be supported by some analogies in the modern fauna, e.g. an increase in the size of a population of musk-rats (*Ondatra zibethicus* L.) inducing a dramatic fall and sometimes even the disappearance of the desman population (*Desmana moschata* PALL. — BABUSHKIN, 1974).

It remains to consider the problem of convergence. In THENIUS'S (1972) opinion, its possibility cannot be excluded. In the case of the relatively complete and well documented material under discussion the convergence seems to be out of question. In addition, it is hard to suppose that it might refer even to such details, characteristic of the genus *Condylura*, as the sulciform depression on the internal side of the mandible or the characteristic shape of the calcaneus.

The presence of another form of the genus *Condylura*, conspicuously smaller than *Condylura kowalskii* n. sp. is an interesting fact, which resembles analogous situations among both the fossil and the modern forms of the genus *Talpa*, e.g. in the Caucasus a small form, *T. minima* DEP. (acc. to RABEDER, 1972, *Talpa minor* FREUD.), lives beside *T. europaea caucasica* SAT., sometimes even in neighbouring galleries, and similarly in the Pleistocene of Austria *T. minor* FREUD. commonly occurred beside *T. europaea* L. (RABEDER, 1972).

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STRESZCZENIE

W bogatych materiałach kopalnych *Insectivora* z pliocenu Polski napotkano liczne szczątki, zwłaszcza postkranialne, należące do rodzaju *Condylura* ILLIGER, 1811. Badania wykazały prawie całkowitą identyczność formy kopalnej z jedynym współczesnym gatunkiem tego rodzaju, *Condylura cristata*, żyjącym obecnie w Ameryce Północnej. Różnice ograniczały się jedynie do mniejszych wymiarów elementów kostnych, subtelniejszej ich budowy, obecności szczątkowego cingulum na przedniej ścianie M_2 i nieco bardziej proksymalnie przesuniętego wyrostka wentralnego (processus ventralis) obojczyka u form kopalnych.

Opisano dwa gatunki kopalne *Condylura*: *C. kowalskii* n. sp. i *C. izabellae* n. sp.

Tryb życia formy kopalnej wydaje się być podobny do trybu życia formy współczesnej.

РЕЗЮМЕ

В плиоценовых отложениях Польши найден богатый ископаемый материал по насекомоядным. Особенно обильны остатки посткраниального скелета представителей рода *Condylura* ILLIGER, 1811. Исследованиями доказана почти полная идентичность ископаемой формы с единственным современным видом этого рода — *Condylura cristata*, обитающим в настоящее время в Северной Америке. Ископаемая форма, однако, отличается от современной более мелкими размерами, присутствием рудиментарного cingulum в передней части M_2 и несколько проксимально передвинутым вентральным отростком (processus ventralis) ключицы.

В статье приводится описание двух новых видов: *Condylura kowalskii* n. sp. и *Condylura izabellae* n. sp.

Образ жизни ископаемых форм по всей вероятности был похож на образ жизни современного вида.

Plate XIV

Fig. 1 — Right mandible of *Condylura cristata*: labial and lingual views. Fig. 2 — *Condylura kowalskii* nov. sp. from Rębielice Królewskie I, MF/1006/4, fragment of right mandible with P_1 and P_2 ; labial and lingual views. Fig. 3 — *Condylura kowalskii* n. sp. from Weże I (MZ/VIII/Vm 301/8), left mandible with alveoli of M_1 — M_3 ; lingual and labial views. Fig. 4 — right mandible from Weże I (MF/1005/33), with M_2 ; labial and lingual views. Fig. 5 — clavicle of *Condylura kowalskii* n. sp. from Rębielice Królewskie I (MF/1006/14); anterior and posterior views.

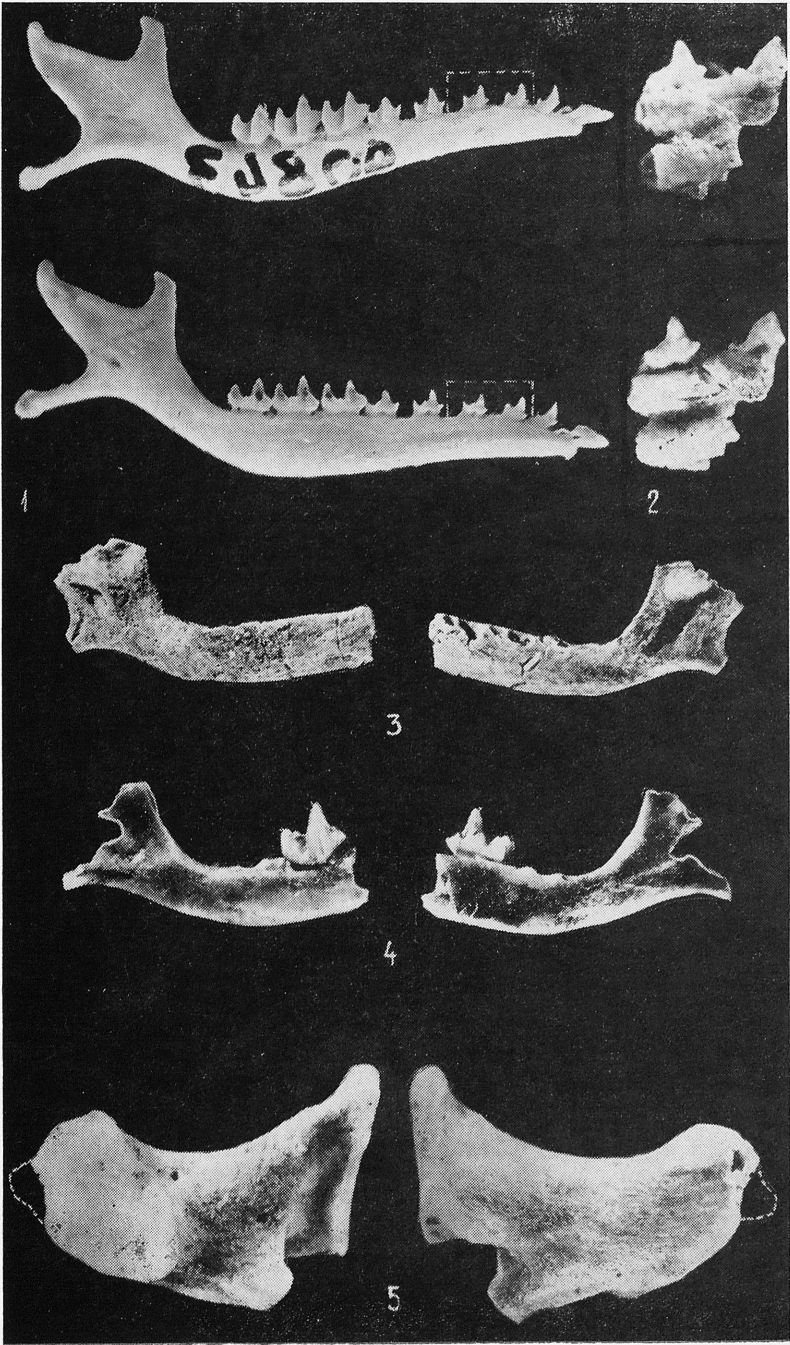
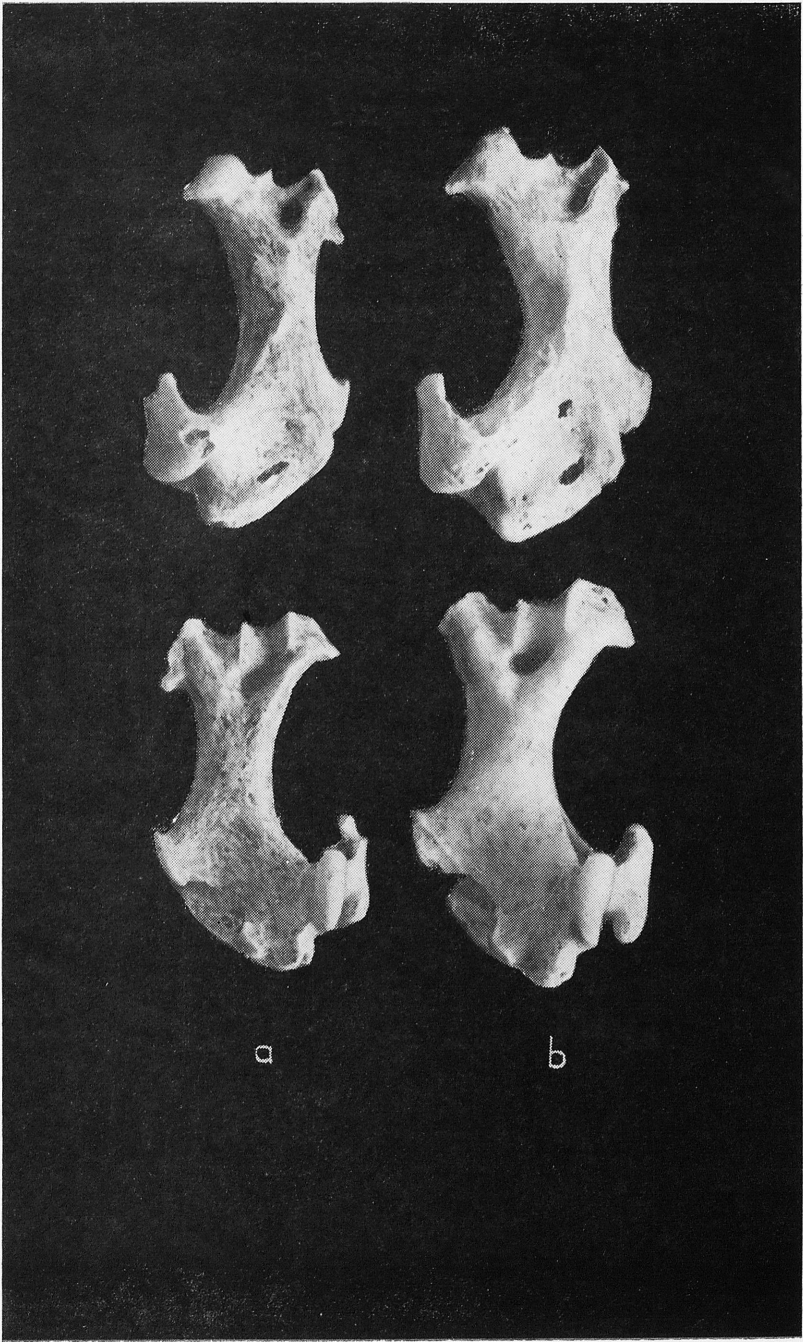


Plate XV

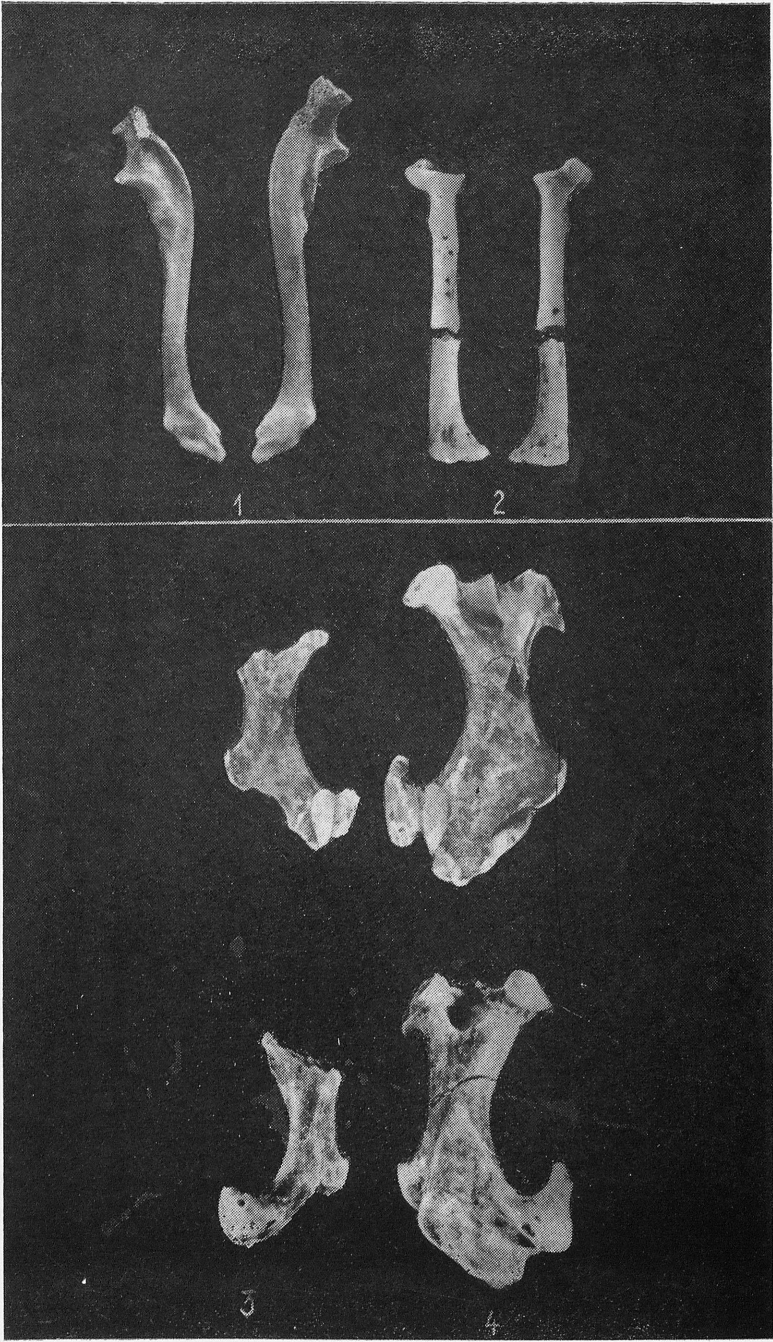
Left humerus of *Condylura kowalskii* n. sp. from Rębielice Królewskie I (MF/1006/16) — (a), in comparison with left humerus of *Condylura cristata* (b); anterior and posterior views



S. Skoczeń

Plate XVI

Fig. 1 — left ulna of *Condylura kowalskii* n. sp. from Rębielice Królewskie I (MF/1006/35). lateral view. Fig. 2 — left radius from Rębielice Królewskie I (MF/1006/46, 47); lateral view. Figs. 3, 4, — left humerus of *Condylura izabellae* n. sp. from Rębielice Królewskie I (MF/1007/1), (3) in comparison with right humerus of *Condylura kowalskii* n. sp. from Rębielice Królewskie I (MF/1006/18), (4): posterior and anterior views



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