POLSKA AKADEMIA NAUK
ZAKŁAD ZOOLOGII SYSTEMATYCZNEJ I DOŚWIADCZALNEJ

ACTA ZOOLOGICA CRACOVIENSIA

Tom XXIII Kraków, 28. II. 1979 Nr 9

Kazimierz KOWALSKI

Fossil *Zapodidae (Rodentia, Mammalia)* from the Pliocene and Quaternary of Poland

(Pp. 199—212, pls XXIII—XXIV, 1 text-fig.)

Kopalne *Zapodidae (Rodentia, Mammalia)* z pliocenu i czwartorzędu Polski*

Abstract. Remains of *Protozapus intermedius* BACHMAYER et WILSON 1970 occur at Podlesice (Lower Pliocene) and those of *Sminthozapus janossyi* SULIMSKI 1962 at Węże 1 and Rębielice Królewskie 1 (Astian and Lower Villafranchian). Some nondescript remains of *Zapodinae* have been found in Zamkowa Dolna Cave (Middle Villafranchian). The genus *Sicista* GRAY 1827 is present starting from the Villafranchian and next in the localities of the Early and Late Pleistocene. The complicated structure of the molars likens the fossil remains of *Sicista* from the localities in Poland to the modern species *Sicista betulina* (PALLAS 1778).

INTRODUCTION

Remains of the *Zapodidae* occur in very small numbers in the fossil faunae of the Tertiary and Quaternary of Europe. This is due partly to the very small size of the teeth of these rodents. No doubt, however, they never became greatly differentiated and did not play a major ecological role.

In Poland a member of the subfamily *Zapodinae*, *Sminthozapus janossyi* SULIMSKI 1962 has been described from the Pliocene locality Węże I (SULIMSKI 1962, 1964). KOWALSKI (1960) has described a single tooth of *Sicista* cf. *praeloriger* KORMOS 1930 from the somewhat younger fauna of Rębielice Królewskie I. Remains described as *Sicista betulina* (PALLAS 1778) were besides mentioned from the layers of the youngest Pleistocene or Early Holocene in the cave in Żytnia Skała (KOWALSKI et al. 1967) and in Mamutowa and Ciemna Caves (BOCHEŃSKI et al. 1968; NADACHOWSKI, 1976).

*Praca wykonana w ramach problemu MR. II. 3.

In the latest years some remains belonging to the *Zapodidae* have been found at the Polish localities of fossil faunae referred to the period ranging from the Early Pliocene to the Early Pleistocene (Podlesice, Węże I, Rębielice Królewskie I, Zamkowa Dolna Cave, layer C, Kamyk, Zalesiaki, Kozi Grzbiet). The present paper gives a description of these remains and also of specimens, so far not described, from the Late Pleistocene and Holocene layers of the caves: in Żytnia Skała, Mamutowa, Ciemna, Sąspowska and Zamkowa Dolna.

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

SYSTEMATIC PART

Family *Zapodidae* COUES 1875
Subfamily *Zapodinae* TROUESSART 1880
Genus *Protozapus* BACHMAYER et WILSON 1970
Protozapus intermedius BACHMAYER et WILSON 1970
(pl. XXIII: 1—3)

Material. Podlesice, Early Pliocene: left m_1 (MF/1612/1), left m_2 (MF/1612/2), right m_2 (MF/1612/3).

Description. M_1 heavily worn. Anteroconid well developed, situated medially. Protoconid and metaconid joined posteriorly, their anterior tops being isolated so that they all together form a horseshoe. Ectolophid running from postero-external edge of protoconid to anterointernal edge of hypoconid. Mesolophid well developed. Postero-entoconid valley open.

M_2 (No. MF/1612/2) heavily worn, perhaps belonging to the same individual as does m_1, whereas right m_2 (No. MF/1612/3) is lightly worn. The conspicuous anteroconid passes lingually into the anterior cingulum and posteriorly joins the metaconid. There is no protostylid spur. The mesolophid reaches the tooth edge. Behind it the internal edge of the tooth shows a distinct incision.

Dimensions given in Table I.

Discussion. The teeth described above show no morphological differences in relation to the specimens of *Protozapus intermedius* from the Turolian of Kohfidisch in Austria (BACHMAYER and WILSON 1970), their dimensions are also similar. This species has hitherto been found only at Kohfidisch.

The only differences between *Protozapus intermedius* and *Sminthozapus janossyi* in the structure of lower teeth are the lack of the protostylid spur and the presence of a distinct incision in the labial edge behind the mesolophid in m_2 of the former. Both these characters are also present in the specimens from Podlesice, which makes them different from *Sminthozapus janossyi* from Węże. No doubt these two forms are closely related to each other and the rightness of the separation of the older form into a distinct genus remains an open matter. The absence of the *Zapodidae* from the Miocene of Europe indicates that *Proto-*

Table I

Dimensions of teeth in *Zapodinae*

		Protozapus intermedius				Węże (MF/1613)		Węże Sulimski 1964	*Sminthozapus janossyi*					cf. *Sminthozapus* sp. Zamkowa Dolna Cave, layer C (MF/1615)	
		Podlesice (MF/1612)			Kohfidisch (Bachmayer and Wilson 1960)				Rębielice Królewskie (MF/1614)						
		1	2	3		1	2		1	2	3	5	5	1	2
M_1	L	1·16	—	—	1·0—1·1	1·29	—	1·0—1·3	1·09	1·14	—	—	—	—	—
	W	0·86	—	—	0·8—0·9	0·97	—	0·7—1·0	0·79	0·84	—	—	—	—	—
M_2	L	—	1·28	1·28	1·2	1·32	—	1·0—1·4	—	—	1·17	—	—	1·24	1·24
	W	—	0·85	0·92	0·9	1·00	—	0·7—1·0	—	—	0·85	—	—	0·71	0·75
P^4	L	—	—	—	0·5	—	0·51	0·7 (alv.)	—	—	—	—	—	—	—
	W	—	—	—	0·5	—	0·53	0·7 (alv.)	—	—	—	—	—	—	—
M^1	L	—	—	—	1·2	—	1·16	1·0—1·3	—	—	—	1·16	—	—	—
	W	—	—	—	1·0	—	0·88	0·8—1·0	—	—	—	1·12	—	—	—
M^2	L	—	—	—	1·0	—	—	0·9—1·3	—	—	—	—	1·10	—	—
		—	—	—	0·9	—	—	0·7—0·9	—	—	—	—	0·94	—	—

zapus appeared as an immigrant from Asia together with other species characteristic of the continental climate. In contradistinction to what is observed in Europe, in Asia the evolution of this group proceeded uninterruptedly in the Tertiary (SHEVYREVA 1970).

Genus *Sminthozapus* SULIMSKI 1962
Sminthozapus janossyi SULIMSKI 1962
(pl. XXIII: 4—8)

Material. Węże I, Astian: fragmentary right mandible with m_1—m_2 (MF/1613/1), fragmentary right mandible with alveoli of m_1—m_3 and incisor (MF/1613/2), fragmentary left maxilla with p^4—m^1 (MF/1613/3).
Rębielice Królewskie I, Lower Villafranchian: right m_1 (MF/1614/1), left m_1 (MF/1614/2), right m_2 (MF/1614/3), 2 left m^1 (MF/1614/1—2).

Description. Węże: Anteroconid on m_1 very small, hardly perceptible as a widening of the anterior cingulum. The protoconid and metaconid form a nearly symmetrical crescent, separated from the remaining elements of the crown and with its horns pointing to the front. The mesoconid is well developed, but much lower than the protoconid, and the valley behind the entoconid is open.

M_2 has 2 roots strongly flattened anteroposteriorly. The well-developed anteroconid is united with the meta- and protoconid. The protostylid spur is present but it does not reach the tooth edge. Towards the end it joins the mesostylid and a closed fosette is formed between them. The mesostylid extends to the tooth edge, there being no distinct incision in the internal tooth edge. The crown of p^4 is round in outline, with a cusp situated anteromedially and a distinct cingulum on the lingual and the buccal side.

M^1 is slightly worn and its structure is more clearly visible than in the specimens illustrated by SULIMSKI (1962, Pl. II, 2). The paracone and metacone are higher than the other cusps. The anterior cingulum is well developed, the anterocone present though low, and the paracone and protocone are united directly by means of the protoloph. The mesoloph extends to the buccal tooth edge and is connected with the paracone by a low lateral ridge, but has no connection with the metacone, which is quite isolated. The hypocone is not distinguishable as a separate cusp and the posterior cingulum is high and well developed.

Rębielice Królewskie I. The specimens of m_1 do not differ from this tooth from Węże only that they entirely lack the anteroconid. M_2 is more heavily worn than is the corresponding specimen from Węże. The anterior cingulum is well, especially anterolabially, developed. The protostylid spur is united with the metaconid. The labial valley is somewhat deeper than in the Węże specimen and the ectolophid is arranged more obliquely.

Dimensions: see Table I.

Discussion. The material described from Węże belongs beyond doubt to *Sminthozapus janossyi*. On account of extant p^4 it adds to our knowledge of

this species. The development of the protostylid spur makes the teeth of *Sminthozapus janossyi* somewhat more complicated than are those of *Protozapus intermedius*. Out of the known forms of the *Zapodidae*, it most resembles, as SULIMSKI has already stated (1964), *Eozapus setschuanus* (POUSARGUES 1896), which however has no protostylid spur and cannot be regarded as a descendant of the Pliocene form from Europe. Except for the lack of the anteroconid on m_1, the material from Rębielice Królewskie little differs from the specimens from Węże I and probably belongs to the same species.

?Sminthozapus sp.
(pl. XXIV: 1)

Material. Zamkowa Dolna Cave, Layer C, Middle Villafranchian: right m_2 (MF/1615/1) and left m_2 (MF/1615/2).

Description. M_2 is narrower and more elongated than in *Sminthozapus janossyi*. There is no direct union of the anteroconid and protoconid. The mesolophid ends in the clearly separated mesoconid, which in MF/1615/2 forms an almost completely isolated cusp. The protostylid spur is present. The valley behind the entoconid shows a distinct tendency to become closed. The tooth has two roots slightly flattened anteroposteriorly.

Dimensions: see Table I.

Discussion. The material described is to scanty to allow its determination to specific level. It seems, however, that the differences seen in both preserved m_2 compared with the specimens of *Sminthozapus janossyi* are too great for these teeth to be included in the same species.

Subfamily *Sicistinae* ALLEN 1901
Genus *Sicista* GRAY 1827
Sicista praeloriger KORMOS 1930
(pl. XXIV: 2—8)

Material. Rębielice Królewskie I, Lower Villafranchian (?): right m_1 (MF/77).
Zamkowa Dolna Cave, layer C, Middle Villafranchian: right m^1 (MF 1616).
Kamyk, Günz: left m_1, right m_1, left m^1, 2 right m^1 (MF/1617).
Kozi Grzbiet, Mindel I/Mindel II, layer 2a+b+c: fragmentary right mandible with m_1—m_2; layer 2b: right m^2 (MF/1618).
Zalesiaki, Cromerian (?): fragmentary right mandible with incisor and m_1—m_2, 2 left m^1 (MF/1619).

Description. The molar teeth do not differ in structure from those of the modern species *Sicista betulina*. In one specimen of m_1 from Kozi Grzbiet (MF/1618/1) there is an additional cusp between the metaconid and the anteroconid. The structure of these teeth is complicated by the presence of numerous spurs. In m_1 the ridge that connects the entoconid and hypoconid may branch, forming

a fosette between the two branches. One or two spurs extend from the entoconid towards the posterolophid and sometimes there are other spurs of the entoconid directed anteriorly. In m_2 of the specimen from Zalesiaki (MF/1619/1) a distinct additional spur goes off from the ridge connecting the metaconid with the protoconid to the rear. In the specimen of m_2 from Kozi Wierch (MF/1618/1) in addition to this last spur, a spur which limits the fosette between the hypoconid and ectolophid goes off to the front. All the specimens of upper teeth have very well developed spurs going off from the cusps and ridges connecting them, and complicating the tooth structure.

Dimensions are given in Table II.

Table II

Dimensions of teeth in *Sicista praeloriger*

		Rębielice Królewskie (MF/77)	Zamkowa Dolna Cave layer C (MF/1616)	Kamyk (MF/1617)					Kozi Grzbiet (MF/1618)		Zalesiaki (MF/819)		
				1	2	3	4	5	1	2	1	2	3
M_1	L	1·17	—	1·18	1·15	—	—	—	1·14	—	1·09	—	—
	W	0·90	—	0·89	0·86	—	—	—	0·81	—	0·82	—	—
M_2	L	—	—	—	—	—	—	—	1·09	—	1·09	—	—
	W	—	—	—	—	—	—	—	±0·88	—	0·80	—	—
M^1	L	—	1·03	—	—	1·05	1·07	1·05	—	—	—	1·00	0·98
	W	—	0·97	—	—	1·00	1·10	1·03	—	—	—	0·95	0·90
M^2	L	—	—	—	—	—	—	—	—	1·03	—	—	—
	W	—	—	—	—	—	—	—	—	0·92	—	—	—

Discussion. Four fossil species of the genus *Sicista* are known. The geologically oldest of them is *Sicista bagajevi* Savinov 1970 from Gusinyi Perelet, a Pliocene locality in Kazakhstan (Savinov 1970). It shows a very high degree of complication of the pattern in molars. The dimensions of teeth are somewhat smaller than those in the above-described specimens from Poland and, besides, the upper molars are distinctly more elongate.

Kormos (1930) described a new species, *Sicista praeloriger*, from the „Biharian" fauna of Betfia (Püspökfürdö) in Roumania. Schaub (1930) described the material from Betfia once again and gave a drawing of the holotype (Schaub 1930, Fig. 16). He also found a specimen of *Sicista praeloriger* in the material of similar geological age from Nagyharsany in Hungary. The description of *Sicista praeloriger* given by Schaub (1930) concerns the whole of abundant material from Betfia and the specimen from Nagyharsany. The author points out the presence of slight differences in the structure of mandible between *S. praeloriger* and the modern specimens of *Sicista* from Hungary that he had at his disposal. He also states that the degree of development of ancillary elements of the crown

pattern in molars is very various in particular specimens of *S. praeloriger*. In some of them (including the holotype) this development is considerable, whereas in other specimens from Betfia and in the specimen from Nagyharsany the structure of molars is simple, resembling that in *S. subtilis*. From this fact SCHAUB (1930) infers that *S. praeloriger* was a "comprehensive type" from which next the two species of today have developed.

Later, *Sicista praeloriger* has been found in further European fossil localities of the „Biharian" period (i. e. in the faunas containing *Allophaiomys* or *Microtus* and *Pitymys*) at Czortków in the Ukraine (TOPACHEVSKI 1965), Koneprusy in Czechoslovakia (FEJFAR 1959), Sackdillinger Höhle in German Federal Republic (HELLER, 1933) and Les Valerots in France (CHALINE, 1972). As regards the specimens from Sackdilling and Les Valerots, we have at our disposal detailed drawings, which permit the statement that the structure of molars shows a high degree of complication.

As can be seen, therefore, both the holotype of *S. praeloriger* from Betfia and the material from Central and Western Europe (Poland, German Federal Republic, France) have a complicated structure of molars, corresponding to the structure of these teeth in *S. betulina* or even exceeding it in this respect. This suggests that the material described by SCHAUB (1930) was not homogeneous and contained two species, *S. praeloriger* as well as another form resembling *S. subtilis* (PALLAS 1773). On account of the small precision of excavatory investigation in the past it is hard to decide whether all the materials described by this author were the same age.

TOPACHEVSKI (1965) described a new species, *Sicista vinogradovi* TOPACHEVSKI 1965, from the fauna of Nogaysk in the Ukraine (containing, among other genera, *Allophaiomys*). The scanty material shows a marked complication of molars. Their dimensions exceed somewhat those in *S. praeloriger*, but the poverty of materials of both these species makes it difficult to find if these differences are significant. In TOPACHEVSKI'S (1965) opinion, the proportions of the mandible of his species are also different from those in *S. praeloriger*, which would, however, call for confirmation on the basis of richer material.

Lastly, ERBAEVA (1976) described the species *Sicista pliocaenica* ERBAEVA 1976 from the Pliocene locality at Beregoveya in the Buryat A.S.S.R. The structure of teeth of this form is simple, resembling that of *S. subtilis*.

In the light of these data it seems that two evolutionary lines of *Sicista*, one with teeth with additional complications, represented by the modern forest species *S. betulina*, and the other with simple teeth, represented by the modern steppe species *S. subtilis*, have existed since as early as the Pliocene. The first of them includes *S. bagajevi* from the Pliocene of Kazakhstan, *S. praeloriger* and, perhaps conspecific with it, *S. vinogradovi*. This line appeared in Europe towards the end of the Pliocene (Lower or Middle Villafranchian) and was the only one occurring in Central and Western Europe. It underwent slight morphological changes in the Pleistocene and gave origin to the modern species *Sicista betulina*.

The other evolutionary line existed in Asia also as early as the Pliocene and

was represented by *Sicista pliocaenica*. In the Middle Pleistocene it was continued by *S. subtilis* on Chios Island (STORCH 1975) and is also known from the Younger Pleistocene of south-eastern Europe. It remains to elucidate whether or not some of the specimens from Hungary and Roumania included by SCHAUB (1930) in *Sicista praeloriger* belong to this group and what their geological age is.

Sicista betulina (PALLAS 1778)

Material. The whole of material described here comes from the caves situated in the area of the Jurassic ridge extending between Cracow and Częstochowa in Poland.

Dimensions of teeth in

		Sicista praeloriger Poland				*Sicista praeloriger* HELLER 1933	*Sicista vinogradovi* TOPACHEVSKI 1965	*Sicista bagajevi* SAVINOV 1970			
		n	min	m	max			n	min	m	max
M_1	L	5	1·09	1·15	1·18	1·1	1·2	35	0·8	0·86	0·9
	W	5	0·81	0·86	0·90	0·8	0·8	—	—	—	—
M_2	L	2	1·09	1·09	1·09	1·1	—	21	0·85	0·91	1·0
	W	2	0·80	0·84	0·88	0·8	—	—	—	—	—
M_3	L	—	—	—	—	0·8	—	16	0·7	0·76	0·8
	W	—	—	—	—	0·7	—	—	—	—	—
P^4	L	—	—	—	—	0·5	—	25	0·45	0·49	0·55
M^1	L	6	0·98	1·03	1·07	1·0	1·1	31	1·0	1·05	1·15
	W	6	0·90	0·99	1·10	1·0	1·1	31	0·9	1·06	1·2
M^2	L	1	—	1·03	—	1·1	1·05	21	1·0	1·1	1·15
	W	1	—	0·92	—	0·9	1·0	21	0·95	1·01	1·1
M^3	L	—	—	—	—	0·6	—	8	0·6	0·7	0·8
	W	—	—	—	—	0·7	—	8	0·75	0·77	0·85

Mamutowa Cave, trench I, layer 2 and trenches II—IV, layer 9, Upper Pleniglacial: right m_1, right m_2, left maxilla with p^4—m^3, right maxilla with p^4—m^2; material without accurate stratigraphic position, Late Würm: left mandible with m_1, right toothless mandible, right m_1, fragmentary left maxilla with p^4—m^1, fragmentary right maxilla with p^4—m^1 (MF/1126).
Sąspowska Zachodnia Cave, Late Glacial or Holocene: left mandible with m_1, left m_3, 2 left maxillae with p^4—m^1 (MF/1293).
Rock-shelter in Żytnia Skała, layers from the Late Würm or Earliest Holocene: 3 left mandibles with m_1—m_2, right toothless mandible, fragmentary left maxilla with m^1, fragmentary left maxilla with p^4—m^2, left

m^1, fragmentary right maxilla with m^2; Holocene: 2 left toothless mandibles, left m_1, left m_2, right mandible with m_1—m_3, right mandible with m_2, 2 right toothless mandibles, 3 right m_1, fragmentary left maxilla with m^2, fragmentary toothless left maxilla, left m^1, fragmentary right maxilla with p^4—m^1 (MF/913).

Ciemna Cave — Southern Tunnel, Holocene: left m_1, right m_2, fragmentary left maxilla with m^2, right m^2 (MF/1627).

Zamkowa Dolna Cave, layer b, Late Würm: fragmentary left maxilla with m^1 (MF/1149).

Description. The structure of molars is similar to that in *Sicista betulina*, with numerous additional spurs complicating the pattern of the crown surface. M_1 has always a spur going off from the entoconid towards the posteroloph.

Table III

different species of *Sicista*

Sicista betulina Late Quaternary, Poland				*Sicista betulina* Recent, Poland				*Sicista subtilis* Late Pleistocene Bacho, Kiro, Bulgaria				*Sicista subtilis* Recent n = 1
n	min	m	max	n	min	m	max	n	min	m	max	
15	0·98	1·11	1·18	20	0·98	1·04	1·11	7	1·18	1·23	1·30	1·13
15	0·71	0·80	0·90	20	0·76	0·85	0·86	7	0·88	0·93	0·97	0·86
6	1·05	1·11	1·18	20	0·92	1·02	1·10	2	1·16	1·17	1·19	1·15
6	0·80	0·84	0·92	20	0·78	0·81	0·85	2	0·95	0·95	0·95	0·87
2	0·83	0·83	0·83	20	0·66	0·78	0·85	—	—	—	—	0·78
2	0·63	0·66	0·69	20	0·58	0·64	0·70	—	—	—	—	0·70
7	0·45	0·51	0·58	20	0·41	0·47	0·54	1	—	0·61	—	0·48
12	0·89	1·02	1·06	20	0·88	0·94	1·00	2	1·17	1·17	1·17	1·05
12	0·92	1·00	1·08	20	0·85	0·94	1·00	2	1·12	1·15	1·17	1·12
8	0·96	1·04	1·12	20	0·89	0·96	1·05	2	1·13	1·14	1·15	1·04
8	0·92	0·97	1·04	20	0·82	0·89	0·95	2	1·03	1·08	1·12	1·06
3	0·60	0·64	0·68	20	0·52	0·60	0·67	—	—	—	—	0·67
3	0·74	0·76	0·79	20	0·59	0·66	0·73	—	—	—	—	0·69

The mesostylid is well-developed. In m_2 there is also a spur going off backwards from the entoconid and in m_3 a distinct spur directed to the back starts from the protoconid.

Dimensions are given in Table III.

Discussion. The presence of additional spurs unambiguously indicates the membership of this material in *S. betulina*. In *S. subtilis* there are no additional spurs, the tooth crowns are higher, the main cusps are better developed and the mesostylid is less conspicuous. The dimensions of the material from the Late Pleistocene of Poland on the average somewhat exceed the dimensions of the modern population of *S. betulina* from northern Poland (Białowieża), but are

smaller than those in *Sicista subtilis* from the late Pleistocene of Bulgaria (Text-fig. 1).

In Poland *Sicista subtilis* occurs in the layers referred to the youngest period of the Last Glaciation and the Early Holocene, where it is relatively numerous. In the Late Pleistocene its range covers a marked part of Europe (German Federal Republic, northern Italy, Switzerland, Austria and France). At the same time *S. subtilis* occurs in south-eastern Europe (Bulgaria, Roumania and Ukraine) (KOWALSKI and NADACHOWSKI, in press).

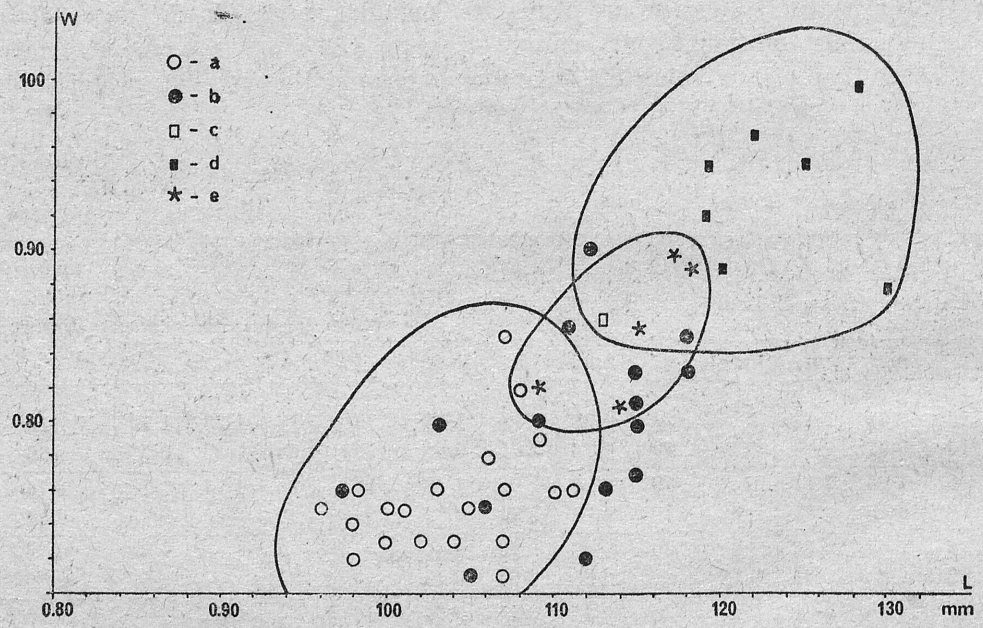


Fig. 1. Scatter-diagram showing the length (l) and width (w) of different *Sicista*-populations. a — *S. betulina*, Recent, Białowieża, Poland, b — *S. betulina*, Late Pleistocene and Holocene, Poland; c — *S. montana*, Recent, U.S.S.R.; d — *S. montana*, Bacho-Kiro Cave, Bulgaria, Late Pleistocene; e — *S. praeloriger*, Poland

While describing the material of *Sicista* from the Late Pleistocene of Hungary, JANOSSY (1953) arrived at the conclusion that the specimens of this period cannot be determined to specific level and that their characters are intermediate between *S. subtilis* and *S. betulina*. FEJFAR (1959) shares this view. Since these authors examined material from the border-land between the steppe and the forest zone of Europe, they may have dealt with specimens of both species. In comparing materials from the Late Pleistocene of Poland and Bulgaria, the author of the present paper observed distinct characters that differentiated these species. Since the two evolutionary lines of *Sicista*, represented respectively by *S. subtilis* and *S. betulina*, seem to have been isolated for a long time, it is hardly

probable that in so late a period there exist intermediate forms between them. The characters of dentition which distinguish *S. subtilis* and *S. betulina* from each other are given by TOPACHEVSKI (1965).

Institute of Systematic and Experimental Zoology
Polish Academy of Sciences
31-016 Kraków, Sławkowska 17, Poland

REFERENCES

BACHMAYER F. and WILSON R. W. 1970. Small mammals (*Insectivora, Chiroptera, Lagomorpha, Rodentia*) from the Kohfidisch fissures of Burgenland, Austria. Ann. Naturhistor. Mus. Wien, **74**: 533—587.

BOCHEŃSKI Z., KOWALSKI K., MŁYNARSKI M., SZYMCZAKOWSKI W. 1968. Przemiany fauny w holocenie Polski. Folia quatern., Kraków, **29**: 59—70.

CHALINE J. 1972. Les rongeurs du pléistocène moyen et supérieur de France, Cahiers de paléont., Paris, 410 pp.

ERBAEVA M. A. 1976. Ербаева М. А. 1976. Древние бугорчатозубые грызуны Забайкалья. Геол. и Геофиз., Новосибирск, 1976 (2):144—149.

FEJFAR O. 1959. Fosilní zástupci rodu *Sicista* GRAY, 1827 na území ČSR. Čas. pro miner. a geol., Praha, 4/1/:25—35.

HELLER F. 1933. Fossile Sicistareste aus dem Fränkischen Jura. Palaeont. Ztschr., **15** (1): 63—72.

JÁNOSSY D. 1953. Neueres Vorkommen seltener Säugetiere (*Sicista, Apodemus, Asinus*) aus dem ungärlandischen Spätpleistozän. Földt. Közl., Budapest., **83** (10—12): 419—436.

KORMOS T. 1930. Diagnosen neuer Säugetiere aus der oberpliozänen Fauna des Somlyoberges bei Püspökfürdö. Annales Mus. Nat. Hung., Budapest, **27**: 237—246.

KOWALSKI K. 1960. Pliocene Insectivores and Rodents from Rębielice Królewskie (Poland). Acta zool. cracov., Kraków, **5** (5): 155—201.

KOWALSKI K., KOZŁOWSKI J. K., KRYSOWSKA-IWASZKIEWICZ M., PAWLIKOWA B., WIKTOR A. 1967. Badania osadów schronisk podskalnych w Żytniej Skale (Bębło, pow. Kraków). Folia quatern., Kraków, **25**: 1—48.

KOWALSKI K., NADACHOWSKI A. 1978. *Redentia*. In: Bacho-Kiro Cave (in press).

NADACHOWSKI A. 1976. Fauna kopalna w osadach Jaskini Mamutowej w Wierzchowiu koło Krakowa. Folia quatern., Kraków, **48**: 17—36.

SAVINOV P. F. 1970. Савинов П. Ф. 1970. Тушканчиковые (*Dipodidae, Rodentia*) неогена Казахстана. In: Материалы по эволюции наземных позвоночных, Москва, 91—134.

SCHAUB S. 1930. Fossile *Sicistinae*. Eclogae geol. Helv., Basel, **23** (2): 616—637.

SHEVYREVA N. S. 1970. Шевырева Н. С. 1970. К вопросу о эволюции семейства *Zapodidae* (*Dipodoidea, Rodentia, Mammalia*). In:Материалы по еволюции наземных позвоночных, Москва, 85—90.

STORCH G. 1975. Eine mittelpleistozäne Nager-Fauna von der Insel Chios, Ägäis. Senckenbergiana biol., Frankfurt a. M., **56** (4—6): 165—189.

SULIMSKI A. 1962. Two new rodents from Węże 1 (Poland). Acta palaeont. pol., Warszawa, **7** (3—4): 503—512.

Sulimski A. 1964. Pliocene *Lagomorpha* and *Rodentia* from Węże 1 (Poland). Acta palaeont. pol., Warszawa, 9 (2): 149—261.

Togachevskij V. A. 1965. Топачевский В. А. 1965. Насекомоядные и грызуны Ногайской позднеплиоценовой фауны. Киев, Наукова Думка, 163 pp.

STRESZCZENIE

Autor opisuje szczątki kopalne gryzoni z rodziny *Zapodidae* z pliocenu i czwartorzędu Polski i omawia ich stanowisko systematyczne. Podrodzina *Zapodinae* reprezentowana jest od dolnego pliocenu do środkowego wilafranszu. W dolnym pliocenie Podlesic wykazano obecność *Protozapus intermedius* Bachmayer et Wilson 1970. W środkowym i górnym pliocenie Węży 1 i Rębielic Królewskich 1 występuje zbliżony do niego gatunek *Sminthozapus janossyi* Sulimski 1962. W środkowym wilafranszu Jaskini Zamkowej Dolnej (warstwa C) stwierdzono nie dające się bliżej oznaczyć szczątki *Zapodinae*.

Rodzaj *Sicista* Gray 1827 pojawia się prawdopodobnie w dolnym wilafranszu Rębielic Królewskich 1, a następnie obecny jest w stanowisku środkowego wilafranszu Jaskini Zamkowej Dolnej (warstwa C), jak również w dolnym i środkowym plejstocenie (Kamyk, Kozi Grzbiet, Zalesiaki). Jest on tu reprezentowany przez gatunek *S. praeloriger* Kormos 1930, który poprzez obecność dodatkowych komplikacji szkliwa na zębach trzonowych zbliża się do współczesnego, leśnego gatunku *S. betulina* (Pallas 1778) i jest zapewne jego przodkiem. Ten ostatni obecny jest też w stanie kopalnym w Polsce w faunach z okresu ostatniego zlodowacenia i holocenu.

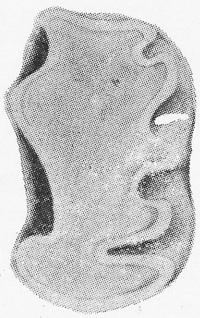
Dotychczasowe materiały wskazują, że linie rozwojowe wiodące do dwu współczesnych europejskich gatunków rodzaju *Sicista*: stepowego *S. subtilis* (Pallas 1773) i leśnego *S. betulina*, wyodrębniły się w odpowiednich środowiskach w Azji już w pliocenie.

PLATES

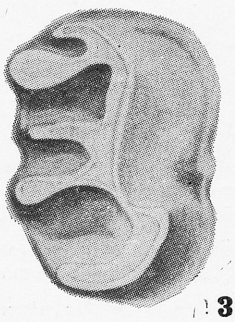
Plate XXIII

1—3 — *Protozapus intermedius*, Podlesice. 1 — m_1, MF/1612/1, L = 1·16 mm; 2 — m_2, MF/1612/2, L = 1·28 mm; 3 — m_2, MF/1612/3, L = 1·28 mm, 4—5 — *Sminthozapus janossy*, Węże 1. 4 — m_1—m_2, MF/1613/1, Lm_1 = 1·29 mm, Lm_2 = 1·32 mm; 5 — p^4—m^1, MF/1613/3, Lp^4 = 0·51 mm, Lm^1 = 1·16 mm. 6—8 — *Sminthozapus janossyi*, Rębielice Królewskie 1, 6 — m_1, MF/1614/1, L = 1·09 mm; 7 — m_2, MF/1614/3, L = 1·17 mm; 8 — m^1, MF/1614/4, L = 1·16 mm

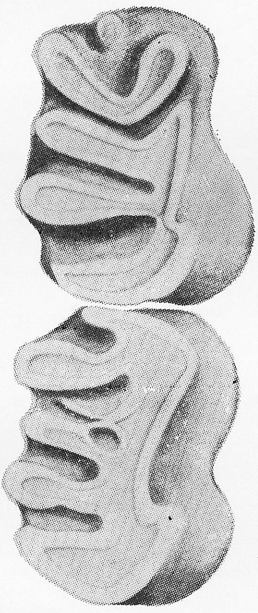
1



2

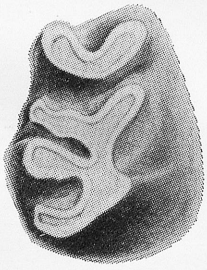


3

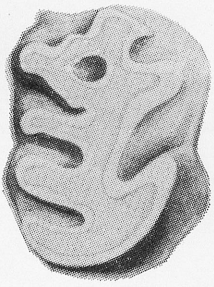


4

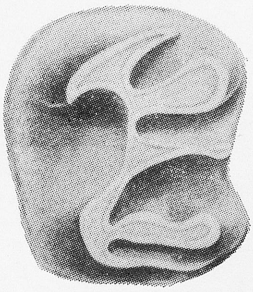
5



6



7



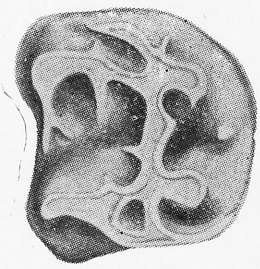
8

K. Kowalski

Plate XXIV

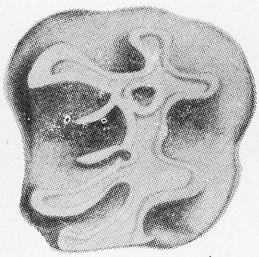
1 — ? *Sminthozapus* sp., Zamkowa Dolna Cave, layer C, MF/1615/2, L = 1·24 mm; 2—8 — *Sicista praeloriger*. 2 — Zamkowa Dolna Cave, layer C, m^1, MF/1616, L = 1·03 mm; 3—5 — Kamyk. 3 — m_1, MF/1617/1, L = 1·18 mm; 4 — m^1, MF/1617/4, L = 1·07 mm; 5 — m^1, MF/1617/5, L = 1·05 mm; 6—7 — Kozi Grzbiet. 6 — m_1, MF/1618/1, L = 1·14 mm; 7 — m^2, MF/1618/2, L = 1·03 mm; 8 — Zalesiaki, m_1—m_2, MF/1919/1, Lm_1 = 1·09 mm, Lm_2 = 1·09 mm

1

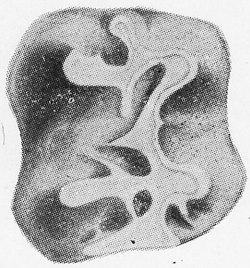


2

3

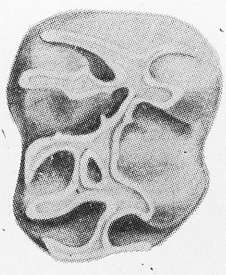


4

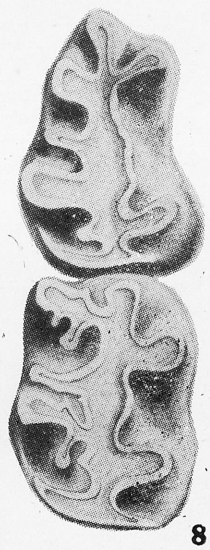


5

6



7



8

K. Kowalski

ISBN 83-01-00314-6
ISSN 0065-1710

Redaktor zeszytu: prof. dr M. Młynarski

PAŃSTWOWE WYDAWNICTWO NAUKOWE—ODDZIAŁ W KRAKOWIE—1978

Nakład 810+90. Ark. wyd. 1,25. Ark. druk. $^{14}/_{16}$+2 wkładki. Papier druk. mat. kl. III 70×100, 58 g.
Zam. 611/78 Cena zł 10,—

DRUKARNIA UNIWERSYTETU JAGIELLOŃSKIEGO W KRAKOWIE