

Marian MŁYNARSKI

**New Notes on the Amphibian and Reptilian Fauna of the Polish Pliocene and Pleistocene**

[Pp. 13—36, pl. IV—VI; 2 text-figures]

**Nowe uwagi o pliocenijskiej i plejstocenijskiej faunie płazów i gadów Polski \***

**Abstract.** This paper is a recapitulation of studies of amphibian and reptilian bone remains from the Pliocene and Pleistocene of Poland, collected in 1962—1974. Data concerning the localities under study — Rębielice Królewskie I and II, Zalesiaki A and B, Kozi Grzbiet and Kielniki — are given in the Introduction. Tabulated lists of the amphibian and reptilian species which occurred in these localities are presented. The Systematic Part contains a survey of all forms found so far, special emphasis being laid on the Palaeobatrachidae, Discoglossidae and Viperidae. Much attention is given to the taxonomic importance of teeth in the Palaeobatrachidae and the pathology and irregularities of the structure of the caudal vertebrae in the Colubridae. In the final part the ecological and faunistic characteristics of the new localities are briefly discussed on the basis of an analysis of the amphibians and reptiles found in them. The study reverts to a previous paper of the same author from 1962 (Acta Zool. Cracov. Vol. 7, No. 11).

**INTRODUCTION**

Since the publication of the first paper (MŁYNARSKI, 1962) on an analogous subject, a few new karst localities referred to the border period between the Pliocene and Pleistocene and to the Pleistocene have been found, excavated and investigated. At Rębielice Królewskie I, described earlier (MŁYNARSKI, 1960, 1962), much larger numbers of new amphibian and reptilian remains have been collected, which permits a better and more detailed characterization

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

of the herpetofauna of this classical locality. The reptiles have already been characterized in detail in another paper (MŁYNARSKI, 1964).

Most of the localities, both the new ones and those discussed in the paper of 1962, are situated in the Kraków—Wieluń Jurassic Mountains. One of them, on the so-called Kozi Grzbiet, lies in the Świętokrzyskie Mts.

Abundant bone materials were collected in the course of an investigation carried out for many years according to a fixed plan by the Vertebrate Laboratory, Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow. On this basis it was possible to determine and describe a number of forms very closely, among them some new ones to the Polish herpetofauna. The list of the fossil amphibians and reptiles of Poland has been extended and has undergone some changes resulting from the revision of the systematic position of certain forms (MŁYNARSKI, 1962, p. 182 and 1964, p. 343). This was possible owing to, among other things, a find of rather numerous, distinctly pathological bones and the possibility of comparison of our materials with the abundant palaeoherpetological materials from other European countries.

Analysis of the forms or genera and the numbers of their members added to the knowledge of the presumable ecological nature of the localities under study and the nature of the whole „preglacial” and Pleistocene herpetofauna of Poland.

In 1962—1975 our materials were utilized by several outstanding foreign scientists, whose studies permitted a more accurate and critical determination of quite a few forms. I should like to express my heartfelt thanks to Dr. Colette VERGNAUD-GRAZZINI (Paris) for her help in the identification of the bony remains of amphibians, notably the Palaeobatrachidae. I am very much indebted to Prof. Zdeněk ŠPINAR (Prague) and Mr Antoni ŻYLKA for their help in the determination of the Pelobatidae and Mr Gottfried BÖHME (Berlin — G. D. R.) for acquainting me with his new taxonomic methods, which allowed a more accurate determination of the Anura. Last not least, I thank all my Polish and foreign colleagues, with whom I discussed a number of interesting problems concerning the geological age, ecological nature and presumable climate of the localities in question and to Mr. Krzysztof MALCZEWSKI for making the illustrations.

#### LOCALITIES

All the new localities described in this paper are typical karst crevices, often remnants of old caves. The localities in the rocks of the Kraków—Wieluń Jurassic Mts. are specially characteristic and numerous. In all of them bone remains were mixed with weathering clay which filled the karst crevices. In the case of localities referred to older geological periods the clay is typically dark-red or brick-red. The vertebrate bones are detached and usually preserved only in fragments. This is why their identification is often hard and, in some



cases, inaccurate in spite of improved taxonomic methods (e.g. vertebrae of snakes or fragmentary jaws of lizards).

The discussions of particular localities are provided with tabular lists of the forms (species, genera) occurring in them. As in the previous papers, the following scale of abundance is applied here: the designation „very common” indicates that the remains of a given animal were extremely numerous not only in the whole series or layer, but also in each of the samples of material under study. The designation „fairly common” informs that the bones of this amphibian or reptile were encountered in each or nearly each sample examined. The term „common” is used for animals whose remains were found in most of the samples examined and „rare” for those whose bones were present in several cases, whereas the designation „very rare” refers to the forms for which a bone or bones of only one specimen were met with only in a single isolated case. Symbols representing the faunistic and ecological nature of a form are placed in front of its systematic name (cf. MLYNARSKI, 1964).

All the herpetological materials used in this study are in the possession of the Herpetological Division of the Vertebrate Laboratory, Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Cracow.

### Rębielice Królewskie I

This locality, discovered and described by MOSSOCZY (1959) lies near Kłobuck, N.W. of Częstochowa, in the Kraków—Wieluń Jurassic Mts. In connection with the discovery of a new locality on the same hill in 1964, the two sites have been differentiated as Rębielice Królewskie I and II. The age of Rębielice Królewskie I is supposed, after KOWALSKI (1960), to be the late period of the younger Pliocene (cf. also KOWALSKI in MOSSOCZY, 1959; MLYNARSKI, 1964, p. 326). It may thus be assumed that we are concerned here with the fauna of the very boundary between the Pliocene and the Pleistocene, and then that of a Villafranchian nature. Recently, however, remains of a very small number of mammals from considerably younger, Cromerian layers have been found at this locality (KOWALSKI, personal communication). Since the appearance of the first paper (MLYNARSKI, 1962), new materials of very abundant amphibian and reptilian remains have been collected. Part of this material has already been published (MLYNARSKI, 1964), but the new remains of amphibians have never been worked out before.

The bones of *Pelobates* cf. *fuscus* (LAURENTI), *Pelobates* cf. *syriacus balcanicus* KARAMAN and the small brown frog *Rana* cf. *latastei* BOULENGER prevail among the amphibian remains of this locality. There is no certainty as to the occurrence of discoglossids and consequently they are not included in the list. The Salamandridae of the genus *Triturus*, probably closely related to modern *Triturus* cf. *cristatus* (LAURENTI), were not numerous. *Pliobatrachus langhae* FEJÉRVÁRY also occurred rarely and in small numbers.

Out of the reptiles, special attention should be given to numerous snakes

of the family Colubridae, including the „Rębielice endemite”, *Coluber robertmartensi* MLYNARSKI (MLYNARSKI, 1964). *Ophisaurus pannonicus* KORMOS is here fairly common, although not so frequent as it is at Weże I. The lizards of the genus *Lacerta* are numerous and common, but, apart from the Anguidae, there are no members of other groups, e.g. those of the Agamidae, characteristic of Ivanovce in Slovakia. Tortoises are represented by two species only; one of them is a small characteristic form, *Geoemyda mossoczyi* (MLYNARSKI, 1964), which has already been recorded from several other localities, e.g. Malușteni in Rumania, Kamenskoye in the Ukraine (U. S. S. R.) and recently Zalesiaki in Poland (TARASHCHUK, 1969; MLYNARSKI, 1969). The other tortoise, *Emys* cf. *orbicularis* (LINNAEUS), somewhat more numerous here, was a very common form throughout the European „preglacial” and also in the interglacial periods of the Pleistocene.

A close analysis of our material does not confirm the supposition about the occurrence of members of the genus *Eryx* (Boidae) at this locality (MLYNARSKI, 1964).

### Amphibians and Reptiles of Rębielice Królewskie I

EU	CE	<i>Triturus</i> sp.	**	AMTJ
EN	FOSS	<i>Pliobatrachus langhae</i>	**	AMTF?
EU	CE	<i>Pelobates</i> cf. <i>fuscus</i>	*****	IT
EN	TM	<i>Pelobates</i> cf. <i>syriacus balcanicus</i>	*****	IT
EU	CE	<i>Bufo</i> cf. <i>bufo</i>	***	FS
EN	CE	<i>Bufo</i> cf. <i>viridis</i>	**	FS
EN	M	<i>Rana</i> cf. <i>latestei</i>	*****	FS
EN	FOSS	<i>Geoemyda mossoczyi</i>	***	?
EU	CE	<i>Emys</i> cf. <i>orbicularis</i>	*****	AMTJ
EN	TM	<i>Ophisaurus pannonicus</i>	*****	IT
EU	CE	<i>Anguis</i> cf. <i>fragilis</i>	***	FS
EN	M	<i>Lacerta</i> cf. <i>sicula</i>	***	IT
EN	M	<i>Lacerta</i> cf. <i>viridis</i>	*****	FS
EN	M	<i>Lacerta</i> sp. (cf. <i>muralis</i> )	*****	IT
EN	FOSS	<i>Coluber robertmartensi</i>	***	IT
EN	M	<i>Coluber</i> cf. <i>viridiflavus</i>	*****	IT
EN	TM	<i>Elaphe</i> cf. <i>situla</i>	***	IT
EU	CE	<i>Natricinae</i> indet.	**	FS
EU	CE	<i>Viperidae</i> indet.	**	FS

Explanation of symbols: \*\*\*\*\* — very common, \*\*\*\* — fairly common, \*\*\* — common, \*\* — rare, \* — very rare, M — Mediterranean, — TM Pontomediterranean, CE — Central European, FOSS — fossil form, T — thermophilous, EU — eurothermic, IT — xerotherm form, FS — forest and scrub forms, AQ — aquatic, — AMTJ — amphibious. Analogous symbols are used in further parts of this paper.

The herpetofauna of Rębielice Królewskie I, despite its great similarities to other European faunas of more or less the same age, differs essentially from

them. This is undoubtedly connected with some specific ecological environment prevailing here at the time of formation of the bone breccia. In this case tortoises of the *Geoemyda-Emys* complex, characteristic of the boundary between the Pliocene and Pleistocene may be of stratigraphic importance (MŁYNARSKI, 1968).

### Rębielice Królewskie II

This locality was discovered in 1967. It was situated on the same Jurassic hill, about 800 m NW of the previous locality, in the village of Rębielice Królewskie. It was only a small pocket filled with dark-red weathering clay, at that time scarcely a remainder of a larger karst crevice destroyed by work in the quarry. The clay contained very numerous and well-preserved bones of vertebrates. Unfortunately, apart from very scanty material no other remains were found and now the excavation must be regarded as completed. Nevertheless, even in this scanty material, approaching 10 kg in weight, relatively many forms of vertebrates have successfully been identified. This material has not, as yet, been worked out.

The geological age of Rębielice Królewskie II is probably the same as or very close to that of Rębielice Królewskie I. There are however very great differences in the quantitative composition of herpetofauna, even though the same forms occur in both these localities. In this connection I think that we are here concerned with two different environments.

In the material under discussion special attention should be given to the remains of big Palaeobatrachidae (*Pliobatrachus*). The fragmentary jaws of these amphibians, larger and robuster than the analogous bone fragments of *Pliobatrachus langhae* FEJÉRVÁRY from other localities, are particularly characteristic and easy to distinguish. As in Rębielice Królewskie I, a small brown frog, provisionally designated *Rana* cf. *latastei* BOULENGER, occurs at this locality. The very small number of *Pelobates*, dominant at the previous locality, also suggests a different biotope. Toads (*Bufo*) are not numerous here, either,

### Amphibians and Reptiles of Rębielice Królewskie II

ЄЄ	ЄЄ	<i>Triturus</i> sp. (cf. <i>vulgaris</i> )	*	АМТЖ
ЇЖ	ЇОSS	<i>Pliobatrachus</i> aff. <i>langhae</i>	****	АМТЖ?
ЄУЇ	ЄЄ?	<i>Pelobates</i> sp.	*	ЇЇ
ЄУЇ	ЄЄ	<i>Bufo</i> cf. <i>bufo</i>	***	ЇS
ЇЖ	М	<i>Rana</i> cf. <i>latastei</i>	****	ЇS
ЄУЇ	ЄЄ	<i>Emys</i> cf. <i>orbicularis</i>	***	АМТЖ
ЇЖ	М	<i>Lacerta</i> cf. <i>viridis</i>	***	ЇЇ
ЇЖ	М	<i>Lacerta</i> sp. (cf. <i>muralis</i> )	***	ЇЇ
ЇЖ	М	<i>Coluber</i> sp.	****	ЇЇ
ЄУЇ	ЄЄ	<i>Natrix</i> cf. <i>natrix</i>	***	ЇS, АМТЖ



and no Discoglossidae have been found at all. As regards turtles, *Emys* cf. *orbicularis* (LINNAEUS) was relatively common, if we take into account the small amount of the material found, whereas *Geoemyda*, characteristic of Rębielice Królewskie I, has not been met with, nor are there any specimens of *Ophisaurus pannonicus* KORMOS. The fauna of other lizards and snakes was similar to that of the previous locality.

### Zalesiaki

This locality lies on the River Warta near Działoszyn in the northern part of the Kraków—Wieluń Jurassic Mts. It is situated near the classical locality at Weże (cf. MŁYNARSKI, 1962) and has been discovered by Dr. WIĘCKOWSKI, who in 1970 collected its bone material and delivered it to us. Although this geologist distinguished a number of samples, no exact layers have been determined at this locality. Unluckily, excavation has already been finished and there is no hope of obtaining any more material.

The analysis of the fauna of small mammals made by Prof. K. KOWALSKI permits the supposition that we are concerned with two geological periods. Thus, samples 1, 2, 5, 7, 8, 9 and 10, referred further to as Zalesiaki A, contain exclusively younger Cromerian elements and samples 3, 6, 11, 12, 14 and 15, in addition to the forms characteristic of the Cromerian, have older elements, probably dating from the Upper Pliocene. According to Prof. KOWALSKI, these last samples agree in age with Weże I, but their herpetofauna resembles rather that of Rębielice Królewskie I. The origin of sample 13 is quite obscure, it may be referred to the Cromerian as well as the „preglacial” period, and therefore cannot be included either in Zalesiaki B or in Zalesiaki A.

#### 1. Zalesiaki B

In the herpetofauna of this hypothetical layer the presence of *Geoemyda mossoczyi* MŁYNARSKI, whose remains were found in samples 11 and 12, is particularly striking. This is thus the second, after Rębielice Królewskie I, locality with remains of this tortoise in Poland. Although there are only several detached shell plates in this material, but in this case these very plates are of particular taxonomic importance (pygale and metaneurale). The remains of snakes of the family Colubridae are relatively numerous in this locality. The palatine bone of a small specimen, preserved in sample No. 6, in shape resembles the corresponding bone of the contemporary species *Elaphe quatuorlineata* (LACÉPÈDE) (SZUNYOGHY, 1932, p. 32, Fig. 65). Beside the vertebrate of large snakes of the Coluber-Elaphe type the samples contain vertebrae characteristic of the *Natrix natrix* (LINNAEUS) type, which may be a Cromerian element here.

In comparison with reptiles the remains of amphibians are not numerous, which would point to the more terrestrial, xerothermic nature of environment. The vertebrae of Salamandridae are similar to the vertebrae of the modern species *Triturus cristatus* (LAURENTI). Remains of a small brown frog, characte-

ristic of our „preglacial”, termed *Rana* cf. *latastei* BOULENGER occur in samples Nos. 12 and 14. There are also remains of a toad, very similar to the corresponding fragments of bones of *Bufo bufo* (LINNAEUS).

#### Amphibians and Reptiles of Zalesiaki B (older)

89	C8	<i>Triturus</i> cf. <i>cristatus</i>	**	AMJC
90	C8	<i>Bufo</i> cf. <i>bufo</i>	***	FS
91	M	<i>Rana</i> cf. <i>latastei</i>	****	FS
92	FOSS	<i>Geoemyda</i> <i>mossoczyi</i>	**	?
93	M	<i>Lacerta</i> cf. <i>viridis</i>	***	
94	FOSS	<i>Coluber</i> sp. (cf. <i>robertmertensi</i> )	****	
95	FM	<i>Elpaha</i> cf. <i>quatuorlineata</i> (?)	*	
96	C8	<i>Natrix</i> cf. <i>natrix</i>	***	

#### 2. Zalesiaki A

Generally speaking, the Cromerian-type fauna which has been found here resembles the amphibian and reptilian fauna of Kozi Grzbiet in Świętokrzyskie Mts. In consequence, it is quite similar to the contemporary herpetofauna of Poland. The presence of *Pliobatrachus langhae* FEJÉRVÁRY, a typical palaeobatrachide, is a kind of sensation. This species has been described by FEJÉRVÁRY (1917), as in our case, from Middle Pleistocene (pre-Mindel, cf. VERGNAUD-GRAZZINI and HOFFSTETTER, 1972, p. 172) and so Cromerian strata.

#### Amphibians and Reptiles of Zalesiaki A (younger)

97	C8	<i>Triturus</i> cf. <i>cristatus</i>	**	AMJC
98	FOSS	<i>Pliobatrachus</i> <i>langhae</i>	**	AMJC?
99	C8	<i>Bufo</i> cf. <i>bufo</i>	***	
100	C8	<i>Pelobates</i> cf. <i>fuscus</i>	**	IT
101	C8	<i>Rana</i> sp. (big form, cf. <i>temporaria</i> )	***	FS
102	C8	<i>Anguis</i> cf. <i>fragilis</i>	**	FS
103	C8	<i>Lacerta</i> sp. (cf. <i>agilis</i> )	***	IT
104	M	<i>Coluber</i> or <i>Elaphe</i> sp.	***	IT
105	C8	<i>Natrix</i> cf. <i>natrix</i>	****	FS, AMJC

#### Kielniki

This locality is situated near Kłobuck, NE of Częstochowa, in the Kraków—Wieluń Jurassic Mountains, and then a relatively short way from the localities at Rebielice Królewskie and Kamyk. Regarded by STWORZEWICZ (1975) as an Early Pleistocene locality, probably it may be more precisely referred to the Günz glaciation. This is suggested by its mammalian fauna and the snails of the family Zonitidae. The herpetofauna of Kielniki is very poor and corresponds closely to the contemporary herpetofauna of Poland. It contributes

nothing to the exact knowledge of the stratigraphy of this locality. If we take into account the phylogenetic longevity of the morphologic forms corresponding to the modern amphibians and reptiles, the composition of this herpetofauna, as presented below, does not permit us to refer this material to younger periods. No special layers have been distinguished at Kielniki and as regards amphibians and reptiles, the scanty material of this locality has already been exploited completely.

### Amphibians and Reptiles of Kielniki

ЄУЄ	ЄЄ	<i>Triturus</i> cf. <i>vulgaris</i>	*	FS AQ
ЄУЄ	ЄЄ	<i>Bufo</i> cf. <i>bufo</i>	**	FS
ЄУЄ	ЄЄ	<i>Hyla</i> cf. <i>arborea</i> (?)	*	FS
?	?	<i>Rana</i> sp. (small form)	***	?
ЄУЄ	ЄЄ	<i>Lacerta</i> cf. <i>agilis</i> (?)	**	IT
ЄУЄ	ЄЄ	<i>Natrix</i> cf. <i>natrix</i>	**	FS AMFF

### Kozi Grzbiet

Kozi Grzbiet lies near Miedzianka, NE of Kielce, in the Świętokrzyskie Mts. (Chęciny Range). This locality was excavated and entirely exhausted in 1971—1974. Several layers differing in faunal composition were distinguished during excavation. These layers differ from each other also in their herpetofauna, above all, in numbers of particular forms.

The herpetological bone material obtained from this locality is so rich that only the collections from Weże I and Rębielice Królewskie I may be compared with it in this respect. The amphibian and reptilian bony remains collected at Kozi Grzbiet outnumber all the materials from the remaining Polish localities. They are characterized by a great diversity of forms and possibility to make up long series of bones of taxonomic importance, e.g. the parasphenoid bone of Salamandridae or the ilium of Anura. Special attention should also be given to bones with pathological or teratological qualities in this material.

An analysis of the fauna of small mammals indicates the existence of several types of environments, which probably differed in age. However, an analysis of the herpetofauna does not confirm these findings unequivocally. Supposedly we are concerned here, as in the case of Zalesiaki A, with a Middle-Pleistocene fauna of the Günz-Mindel interglacial (Cromerian).

The distinctly dominant forms are newts *Triturus* cf. *cristatus* (LAURENTI) and grass snakes *Natrix* cf. *natrix* (LINNAEUS), found in such large numbers for the first time. Both these species abound in all layers. The presence of *Pliobatrachus langhae* FEJÉRVÁRY in layers 2 B+C and C is particularly noteworthy. Snake remains are also numerous in this fauna. It is the first time



that we came upon four forms corresponding to the snakes living in Poland at the present time. The occurrence of the bellied toad (*Bombina* cf. *bombina* /LINNAEUS/) and adder (*Vipera* cf. *berus* /LINNAEUS/) is also interesting. Both these forms did not appear in fairly large numbers before the Upper Pleistocene, and all their earlier finds were based either on very scanty material, not very valuable taxonomically, or simply on unreliable data.

Amphibians and Reptiles of Kozi Grzbiet

Layers				2A	2B	B+C	C	A+B+C
896	C8	<i>Triturus</i> cf. <i>cristatus</i>	FS AMJK	*****	*****	***	*****	*****
736	F0SS	<i>Pliobatrachus</i> <i>langhae</i>	AMJK?	**	***	*	*	
896	C8	<i>Bombina</i> cf. <i>bombina</i>	AQ	**	***	**	***	***
896	C8	<i>Pelobates</i> cf. <i>fuscus</i>	IT	**				
896	C8	<i>Bufo</i> cf. <i>bufo</i>	FS	***	***	**	***	***
896	C8	<i>Bufo</i> cf. <i>viridis</i>	FS IT	**	*			**
896	C8	<i>Hyla</i> cf. <i>arborea</i> (?)	FS	*				
896	C8	<i>Rana</i> cf. <i>temporaria</i>	FS		**		***	***
896	C8	<i>Rana</i> cf. <i>arvalis</i>	FS	***	*	**		
896	C8	<i>Anguis</i> cf. <i>fragilis</i>	FS	*				
896	C8	<i>Lacerta</i> sp. (cf. ? <i>agilis</i> )	IT	**	**	*	**	**
896	C8	<i>Natrix</i> cf. <i>natrix</i>	FS AMJK	*****	*****	***	*****	*****
896	C8	<i>Coronella</i> cf. <i>austriaca</i>	IT	***	**	*?	**	**
736	M	<i>Elaphe</i> cf. <i>longissima</i>	FS	***	**	**	***	***
896	C8	<i>Vipera</i> cf. <i>berus</i>	FS	***	**	*?	**	**

The layers A+B+C contain, in addition, a fairly rich material from the heap formed during excavation.

As can be seen from the Table, *Pelobates* cf. *fuscus* occurs only in the richest layer A. The presence of *Hyla arborea* is uncertain, because it is based on only one ilium. The remains of *Anguis* are also very rare and few and those of lizards of the genus *Lacerta*, a form which probably stands close to modern *L. agilis* (LINNAEUS), make only a small proportion of the bony material under study. The green toad (*Bufo viridis* LAURENTI) also occurs rarely and in small numbers. Out of the snakes, the adder and *Coronella* occur more or less uniformly, not unlike the Aesculapian snake (*Elaphe longissima* /LAURENTI/), which outnumbers them evidently.

SYSTEMATIC PART

Amphibians

Salamandridae

Bone remains of members of this family, mainly vertebrae of small specimens, occurred in very small numbers in our fossil materials. It was only in the material

from Kozi Grzbiet that really numerous and various bone fragments, e.g. fragments of the shoulder girdle, bones of the limbs and particularly valuable cranial bones, were found. In determining specimens, it was therefore possible to base oneself in this case not only on the morphology of vertebrae, which, regardless of the taxonomic methods worked out repeatedly (e.g. TEEGE, 1957), may be deceptive. The morphology of the parasphenoid is of particularly great taxonomic importance, which has also been emphasized by BRUNNER (1957). This flat bone subsisted in a good state of preservation in similar materials of detached bones. Its shape is very characteristic of the contemporary species (GAŁUSZKA, MS) of the genera *Triturus* and *Salamandra*. Even a rather unexperienced worker can determine these species fairly accurately on the basis of this bone. Since in the case of Kozi Grzbiet there were whole series of this bone and many other bone remains in each layer, the determination of the systematic position of the form (*Triturus* cf. *cristatus*) occurring in it may be regarded as reliable. No other Salamandridae, even those of the genus *Triturus vulgaris* (LINNAEUS) at Rebielice Królewskie and Kielniki has been established only on the basis of vertebrae and thus it is not quite certain. Such vertebrae were identified by me in the past as remains of Salamandridae indet. The occurrence of the fossil salamander or another form closely related to it has not, as yet, been found in Poland, either.

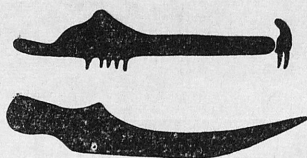


Fig. 1. Schematic reconstruction of maxillare, intermaxillare and mandible of *Pliobatrachus* FEJÉRVÁRY. Del. B. MALCZEWSKA

### Palaeobatrachidae

The species *Pliobatrachus langhae* FEJÉRVÁRY has been included in this completely extinct and archaic group (VERGNAUD-GRAZZINI and MLYNARSKI, 1970; VERGNAUD-GRAZZINI and HOFFSTETTER, 1972). Both these papers contain a comprehensive discussion of the systematic position of this species, which was problematic until recently. In Poland it was reported from Weże I and Rebielice Królewskie I (MLYNARSKI, 1960, 1961, 1962) and now its remains have been found on Kozi Grzbiet, at Rebielice Królewskie II and at Zalesiaki A (younger). In all these three localities the presence of the Palaeobatrachidae was recorded, above all, on the basis of fragmentary maxillae and intermaxillae, the morphology of which is very characteristic of the group under study. They are completely different from the corresponding bones in other anurans. At first sight they resemble the maxillae of small fishes, they are very robust and marked by an, as it were, primitive sculpture. Both the intermaxillae and the

anterior parts of the maxillae are toothed, the teeth being conical, sharp, strong and elongated in these forms. No doubt they were functional teeth. The wide alveolar surface of the maxilla is also noteworthy. The teeth are accreted with the external margin of the two bones discussed. Their number ranges from 1 to 8 in *Pliobatrachus langhae* from Rebiełice Królewskie II and from 15 to 18 in *Palaeobatrachus* (VERGNAUD-GRAZZINI and HOFFSTETTER, 1972, p. 162). The mandible of the Palaeobatrachidae is also characteristic because of the presence of the well-developed protruding coronoid process on the angular. In view of the taxonomic significance of the teeth under discussion they are presented in the plates. A similar type of the jaw structure is typical of all Palaeobatrachidae. In the extremely rich Tertiary materials from Czechoslovakia (ŠPINAR, 1972) these characters are not well seen owing to a strong compression of specimens, but their outlines agree with the outlines of our specimens.

*Pliobatrachus langhae* was described by FEJÉRVÁRY (1917) from the sacrum and urostyle only. Now we know much more about the morphology of the skeleton of this amphibian, but still we cannot make a reconstruction of the whole skeleton, as it was possible in the case of the Czechoslovakian members of the genus *Palaeobatrachus*. For instance, we do not know for certain how the parasphenoid was built; in all the other Palaeobatrachidae it has no lateral processes and is lanceolate in shape. So far, no such parasphenoids have been found in our material. There are also some differences in morphology between the ilium of the old Eocene and Oligocene palaeobatrachides and that of *Pliobatrachus* from Rebiełice Królewskie II. For the present, these scanty remarks indicate the expediency of the retention of the separate genus *Pliobatrachus* for the geologically young forms encountered in the period from the boundary between the Pliocene and Pleistocene up to Günz-Mindel interglacial.

Some slight morphological differences can be detected between the remains from Rebiełice Królewskie II and those from Kozi Grzbiet and Zalesiaki. The specimens from Rebiełice were, above all, considerably bigger and more strongly built than the specimens from the latter localities and also than FEJÉRVÁRY'S (1917) holotype. In the morphology of the bone surface of the jaws of our specimens one can see some differences in sculpture. In this connection it may well be that at Rebiełice Królewskie II we are concerned with another form, perhaps a separate species of the genus *Pliobatrachus*, but although the material is relatively abundant, the lack of other bones of essential importance and of comparative materials does not permit the description of this form. Finally, these may be population differences; none the less, it is worth while to examine closely all the remains of this form, found so far in its localities in Rumania, Hungary and Germany (e.g. Voigtstedt; THENIUS, 1965).

The Palaeobatrachidae are a typical European group, so far unknown from the other continents. Although they have been compared to members of the contemporary Pipidae, they certainly stand far from these last forms both in respect of morphology (and so do our materials) and from the viewpoint of zoogeography (ŠPINAR, 1972; VERGNAUD-GRAZZINI and HOFFSTETTER, 1972).



## Discoglossidae

The absence of members of the genus *Discoglossus* from our Pliocene and Pleistocene localities seems rather strange. Up to the present, only at Weże I have I found and even there only a small number of remains which may have belonged to members of this genus. Because of the large size of these bones (ilium) it may be supposed that they belonged to specimens of the species *Discoglossus giganteus* WETTSTEIN-WESTERHEIMB. This is a phylogenetically longeval species occurring in many localities of Europe from the Miocene to the Early Pleistocene. Recently, extremely numerous remains of this big animal have been found in the material from Ivanovce in Slovakia. Bones of the same form are also known from Arondelli in Italy (Villafranchian; VERGNAUD-GRAZZINI, 1970). In Poland I have described some very well preserved remains of *Discoglossus giganteus* from the Upper Miocene of Przeworno in Silesia (MLYNARSKI, 1976). No remains of either this form or any smaller forms corresponding to the modern species of the genus *Discoglossus* and *Alytes* have been collected from the localities discussed in the present paper.

The occurrence of *Bombina* cf. *bombina* (LINNAEUS) on Kozi Grzbiet is interesting and important to the knowledge of the genesis of the modern forms. In this case the bone material is fairly abundant; it contains whole series of bones of great taxonomic significance (ilium and sacrum). In addition, there are some well-preserved urostyles with lateral processes typical of discoglossides and many characteristic opisthocelous vertebrae. All these parts of skeleton agree in morphology and size with the corresponding bones of the species living in Poland now (*Bombina bombina* [LINNAEUS] and *B. variegata* [LINNAEUS]). I regard the distinction of these two species from each other exclusively on the basis of their skeletons as impossible or highly unreliable, especially in connection with their extreme variation and tendency towards all sorts of irregularities (MADEJ, 1965). Since the fauna from Kozi Grzbiet lacked "mountainous" elements, I refer the remains of *Bombina* to the lowland species (*Bombina* cf. *bombina*).

Fossil remains of *Bombina* have hitherto been known only from Csarnota in Hungary (BOLKAY 1913/1915) and Arondelli in Italy (VERGNAUD-GRAZZINI, 1970). In both cases the authors based themselves on very scanty material. BOLKAY, for instance, had at his disposal one pterygoid and two atlases and then his diagnosis is not certain, as MERTENS (1928) has already emphasized. As regards the material from Arondelli, the author based herself on one ilium. Although this bone is of established great taxonomic significance, the possibility of mistake cannot be excluded in this case, either. Both these localities are considerably older than ours on Kozi Grzbiet.

*Bombina* is a phylogenetically young form. According to MERTENS (1928), the "Ice Age" or more exactly its younger period, exerted a decisive influence on the origin of its modern species. In this connection, I think that the form

from Kozi Grzbiet is not one of the modern forms, but perhaps ancestral to them. Its great similarity to both modern species does not exclude this fact.

### Pelobatidae

Out of the materials discussed here, only those from Rębielice Królewskie I contained very numerous remains of the genus *Pelobates*, which have been differentiated into two distinct forms. In ŻYLKA'S (MS) opinion, these remains resemble the corresponding skeletal fragments of modern *Pelobates fuscus* (LAURENTI) and *P. syriacus balcanicus* KARAMAN. Undescribed hitherto, this material was examined by Prof. ŠPINAR, who corroborated ŻYLKA'S opinion. According to him, the morphology of the internal surface of the frontoparietal, bearing impressions of the upper part of the brain, is a very important taxonomic character. In the case of the two species mentioned above these characters are clear and easy to distinguish. Our material has been sent to Prague, where it will be utilized in preparing a separate publication on the fossil Pelobatidae of Europe. It is a noteworthy fact in this case that, if the modern specimens of *P. syriacus balcanicus* outsize those of *P. fuscus*, the forms from Rębielice Królewskie I were nearly the same size. This was therefore either a dwarfed population of the first species or another fossil form, perhaps ancestral to the modern Balcan spadefoot toad.

Members of the genus *Pelobates* are widely spread and numerous in the Pliocene and Pleistocene of Europe. In our materials they are rather numerous at Weże I, but very rare in younger localities, i.e. Zalesiaki and Kozi Grzbiet. Members of the genus *Eopelobates* have not been found anywhere but at Weże I (MŁYNARSKI, 1961a, 1962).

### Bufonidae

Remains of toads occur in a fairly large number in all our localities, but nowhere are these animals distinct dominants. Their specific membership can be fairly exactly determined on the basis of the morphology of their bones, especially that of the ilium. As early as the Upper Pliocene (Weże I and Rębielice Królewskie I?) the remains resembling modern *Bufo bufo* (LINNAEUS) occurred in the largest numbers. The forms related to *Bufo viridis* LAURENTI were considerably less common, whereas the bones similar to those of modern *Bufo calamita* LAURENTI were the rarest, their identification being not quite reliable and thus needing checking. All the three forms are known from a number of Pliocene and Pleistocene localities of Europe and virtually they have not changed morphologically till the present time. NEMEC (1972) described remains of these three modern forms found in an excellent state of preservation at, e.g. Stránská Skála I near Brno in Czechoslovakia (this is a locality of the Günz-Mindel period).

It should be remembered that the species *Bufo tarloi* MŁYNARSKI, described

from Weże I (MLYNARSKI, 1961a) has been synonymized with *Pliobatrachus langhae* FEJÉRVÁRY (VERGNAUD-GRAZZINI and MLYNARSKI, 1970).

## Hylidae

However common, the remains of tree frogs are not numerous in the fossil materials of Europe. In the materials from the Polish localities they are extremely rare. The presence of a form related to modern *Hyla arborea* (LINNAEUS) was established on the basis of the morphology of the ilium, whose ala is characteristically oval in section.

## Ranidae

The remains of frogs are common and numerous in all fossil localities in Poland. A distinct differentiation of forms is also visible here (cf. MLYNARSKI, 1962, p. 183). Only small forms occur in materials from older localities, such as Rebielice Królewskie I, Weże I and now also Rebielice Królewskie II and Zalesiaki B. These forms are comparable with the small modern frogs from southern Europe — *Rana latastei* BOULENGER and *R. graeca* BOULENGER. The first of them was also found at Arondelli (VERGNAUD-GRAZZINI, 1970). Although I regard the identification of frogs carried out so far on our material as preliminary, the very fact of occurrence of only small forms of brown frogs in old localities in a sense characterizes the whole of their herpetofauna.

In younger localities, e.g. those dating from the Günz-Mindel (Cromerian), there occur large frogs, equal in size to the frogs living in Poland now. They, too, are brown frogs, mostly relative to an morphologically identical with modern *Rana temporaria* LINNAEUS, more rarely *R. arvalis* NILSEN. The presence of the so-called green frogs of the *Rana esculenta*-complex (BERGER, 1975) in our materials is very uncertain. This may possibly be associated with the lack of a suitable environment.

In fragmentary materials frog remains are extremely similar to each other. The taxonomic criteria of such authors as SCHAEFFER (1932) or MÄRZ (1969) often fail. For this reason many authors prefer to identify these forms only down to the genus (*Rana* sp.).

## Reptiles

### Testudines

Remains of tortoises occur only in three of the Polish localities mentioned in this paper. They belonged to members of two species which differed considerably both in morphology and in origin as well as in position in the up-to-date systematics.

*Geoemyda mossoczyi* MLYNARSKI has been described from Rebielice Królewskie I (MLYNARSKI, 1964). This form is related to Miocene *G. eureia* (WEGNER) from the Upper Miocene of Opole (WEGNER, 1913) and at the same time it



stands close to the modern south-east Asiatic species of the subgenus *Heosemys* (sensu KHOSATZKY & MŁYNARSKI, 1966). This small tortoise with a strongly toothed margin of the convex carapace is already known from several Pliocene and Early Pleistocene localities of Europe (Rumania, Ukraine and Poland). It has a characteristic sculpture of the shell plates and a fairly distinct medial keel of the carapace, as if broken off at the metaneural (cf. MŁYNARSKI, 1964, Fig. 43, p. 431). Luckily, the pygal and metaneural plates with a characteristic tuberos process are preserved in the quantitatively poor material from Zalesiaki B. On the basis of these plates it was possible to determine the systematic position of this tortoise.

*Emys* cf. *orbicularis* (LINNAEUS) is one of the commonest Pliocene and Pleistocene tortoises of Europe. Recently a small number of characteristic shell fragments of this form have been found in the material from Rebielice Królewskie II. In Poland the European pond tortoise is also known from Rebielice Królewskie I and may have occurred at Weże I, together with *Emys wermuthi* MŁYNARSKI, and Weże II (material in the possession of Dr. SULIMSKI of the Institute of Palaeozoology in Warsaw). This modern species, or to be more circumspect, a morphological form very closely related to it, is already known from many European localities. Their list has been presented in another publication (ULLRICH and MŁYNARSKI, in press). *Emys orbicularis* is a modern species in Poland; its remains have been found also at the Holocene archaeological localities of the Neolithic (MŁYNARSKI, 1971).

## Sauria

The Anguidae are represented in our fossil herpetofauna by members of the genera *Ophisaurus* and *Anguis*.

In Poland *Ophisaurus pannonicus* KORMOS has been reported from Weże I and II, Rebielice Królewskie I, Podlesice, Kamyk and Kadzielnia (MŁYNARSKI, 1962, p. 182). New, well-preserved remains of this limbless lizard have lately been found only at Rebielice Królewskie I. The most characteristic cranial fragments have been reproduced and described (MŁYNARSKI, 1964, pp. 327, 328, Figs. 1—2). As has already been mentioned, this form has not been recorded at any of the new localities discussed in this paper.

*Anguis* cf. *fragilis* LINNAEUS is a phylogenetically old species. In our materials it is rather rare and relatively unfrequent. In addition to the localities mentioned in 1962, i.e. Weże I, Podlesice and Kadzielnia, it occurs also at Rebielice Królewskie I (MŁYNARSKI, 1964) and now I have found its presence in the materials from Kozi Grzbiet and Zalesiaki A. Fragmentary jaws of slow worms with typical sharp teeth, curved backwards, have been preserved in all these localities. At Rebielice Królewskie I there were, in addition, characteristic osteoderms. All the bones found so far agree in size with the contemporary bones of *Anguis fragilis*. It is known from numerous Pliocene and Pleistocene localities of Europe (MŁYNARSKI, 1962, p. 186).

Remains of the lizards of the genus *Lacerta* occur in all our localities. As far as the materials under discussion are concerned, they are only fragmentary mandibles and maxillae of a limited taxonomic value. On the basis of these remains it is, naturally, difficult to determine the species even approximately. It was possible to determine the systematic position more exactly only for the specimens from Rebielice Królewskie I, thanks to the intermaxilla and other parts of the skull had been found there (MLYNARSKI, 1964, p. 328). Forms related to modern *Lacerta viridis* (LAURENTI) and *Lacerta sicula* RAFINESQUE occur in this locality. Other forms are *Lacerta* sp., related to *L. agilis* LINNAEUS, and *L. muralis* LAURENTI. Similar forms, „large” of the *L. viridis* group and „small” of the *L. muralis* group occur at Rebielice Królewskie II. Forms resembling *L. agilis* are encountered in the materials from a younger period. In all cases I based myself on the proportions of and similarity to the modern bones used in comparisons. These determinations, as has already been stated repeatedly, are naturally neither reliable nor definitive. For a general analysis of the herpetofauna it is however important to find whether it contains the „small” or the „large” forms of the genus discussed.

### Serpentes

Snake remains, especially their numerous vertebrae, were present in all the localities under study. Particularly numerous were the remains of members of the family Colubridae, which occurred, above all, at Rebielice Królewskie I and II and on Kozi Grzbiet.

*Coluber robertmertensi* MLYNARSKI. This big and sturdy snake has been described from the cranial fragments found in the new materials from Rebielice Królewskie I (MLYNARSKI, 1964, pp. 331—332, Figs. 9—18). Some vertebrae of a large colubride, probably belonging to the same species, were present in the material from Rebielice Królewskie II. *Coluber robertmertensi* differed from the modern European colubrides in its more solid structure and in musculature of the jaws. Rebielice Królewskie I provided also a form similar to modern *Coluber viridiflavus* LACÉPÈDE, described besides from Węże I (MLYNARSKI, 1961b). In all these cases I used skull bones of distinct taxonomic significance (SZUNYOGHY, 1932) as the basis and compared them with modern osteological materials. I have attached less importance to the structure of vertebrae so far (methods described by AUFFENBERG, 1963, and MARKERT, 1975).

*Coluber* sp. — this is how I have referred to the remains, mostly vertebrae, of a large snake of the subfamily Colubrinae (sensu HOFFSTETTER, 1939). Such forms were found in many localities, among others, at Rebielice Królewskie I. At Zalesiaki B this may as well be a form of the genus *Elaphe*. In such cases we are simply concerned with a big indeterminate colubrine.

*Elaphe* cf. *situla* (LINNAEUS) has been reported from the new materials from Rebielice Królewskie I (MLYNARSKI, 1964, p. 334, Figs. 17—18). In this case I based myself on the bones of essential taxonomic significance, i.e. the transverse, basisphenoid and quadrate (SZUNYOGHY, 1932).

*Elaphe* cf. *quatuorlineata* (LACÉPÈDE) has recently been identified on the basis of the palatine from Zalesiaki B. It is a south-east European species (MERTENS and WERMUTH, 1960). Even if we assumed that this determination is unreliable, we are certainly concerned here with a snake that has no corresponding form in the modern herpetofauna of Poland.

*Elaphe* cf. *longissima* (LAURENTI). The Aesculapian snake has been identified in the material from Kozi Grzbiet and it probably occurred at Zalesiaki A. This snake was common in the Pleistocene and Early Holocene of Poland (Józefów near Bilgoraj and Giebułtów near Cracow; KOWALSKI et al., 1963; MŁYNARSKI, 1961c). Recently, numerous Late Pleistocene remains of this snake have been found in the material from the caves in the Saspowska Valley in the Ojeów National Park. This unquestionably thermophilous form belongs to rather members of Polish herpetofauna of the present day.

*Coronella* cf. *austriaca* (LAURENTI) in a fossil state has been found for the first time in Poland in the material from Kozi Grzbiet (skull bones and numerous characteristic vertebrae). This thermophilous snake belongs to the modern herpetofauna of this country and is widely distributed in Europe. Its fossil remains are already known from many European localities (cf. SZUNYOGHY, 1932; MŁYNARSKI, 1961b). Among other workers, BOLKAY (1913) mentioned it from Brasso in Transylvania (Rumania) and BRUNNER (1957) from Breitenberghöhle in southern Germany (Mindel-Riss).

*Natrix* cf. *natrix* (LINNAEUS). Fossil remains of the grass snake are known from most of our localities. It occurred in particularly large numbers on Kozi Grzbiet. It is easy to identify this form on the basis of the skeleton, no matter which we have at our disposal the skulli (SZUNYOGHY, 1932) or the vertebrae (HOFFSTETTER as early as 1939 and, recently, MARKERT, 1975). It is characteristic that the bone remains of grass snakes are not very numerous in the materials from younger localities of the Pliocene and its boundary with the Pleistocene. For instance, at Weże I there were only some small forms having *Natrix*-characters (sensu HOFFSTETTER, 1939). The species under discussion is the commonest snake of the contemporary Polish herpetofauna. Its remains are also known from the Holocene (Giebułtów and Józefów).

Fossil members of the family Viperidae have not hitherto been known for a certainty from the territory of Poland. Occasionally I have met with vertebrae of vipers in different materials, especially among bone remains from Kamyk (Günz-Mindel, probably Cromerian II; cf. MŁYNARSKI, 1962; p. 181). Now, not only vertebrae and taxonomically important cranial fragments, but also a maxilla in an excellent state of preservation and with an undamaged fang has been discovered in the materials from Kozi Grzbiet (layer 2 A). In this case the bony venom-apparatus is taxonomically important. In our specimen it is built identically with these apparatuses in modern adders living in Poland. This is therefore a reliable find, so far one of the oldest in Europe.

Vipers, evolutionarily young forms, are not known from the periods preceding the Pleistocene in Europe. BOLKAY (1913) mentioned them from the Pleistocene



of Brasso (Bresov in Transylvania, Rumania). At the same time from the same layer he (BOLKAY, 1913) described a new species *Vipera gadulyi* BOLKAY, whose systematic position has been confirmed by SZUNYOGHY (1932). I had an opportunity to determine an extremely well preserved specimen of the adder from travertines of Ganovce near Poprad in Czechoslovakia.

### Pathologic Vertebrae of Snakes

Snake vertebrae with visible pathologic characters form a slight though appreciable proportion of the materials from Kozi Grzbiet. They are whole sets of vertebrae of different sections of the spinal column, which have undergone a close fusion. They often look as if they have been thrust into each other by force and in consequence the structure arising is similar to a pine-cone. In

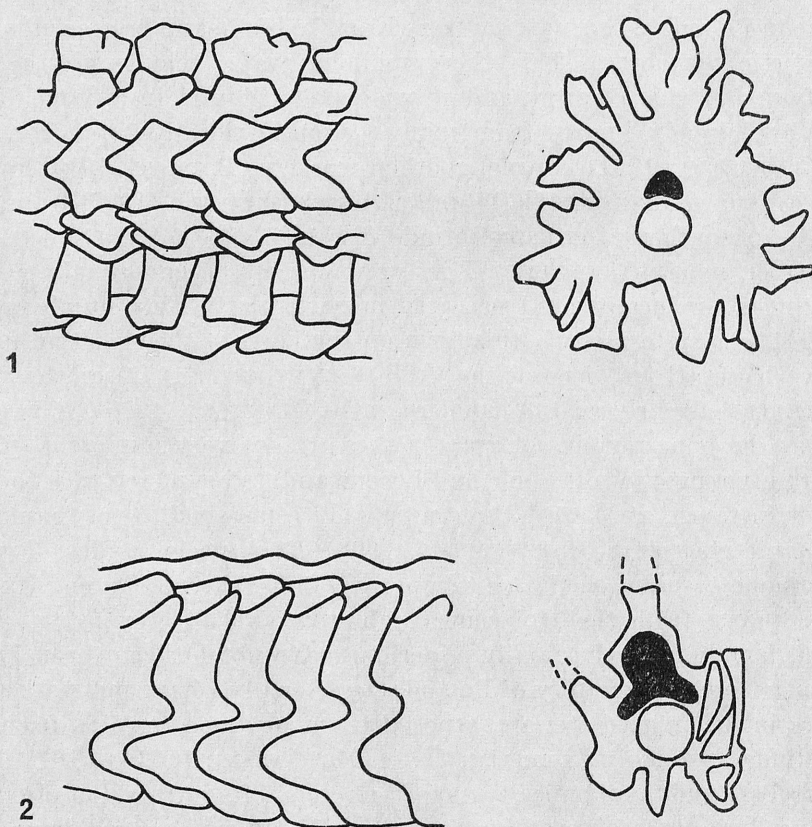


Fig. 2. Caudal vertebra of *Eryx* sp. from Iraq, a recent form. (1), caudal vertebra of Colubrid snake from Rebielice Królewskie I ("*Eryx*"). (2) Schematic del. B. MALCZEWSKA

several cases the vertebrae fused were the terminal caudal ones and externally they resembled the ending of the tail of erycines (Boidae). In my paper of 1694 in the list of reptiles from Rebielice Królewskie I I mentioned forms included

in the genus *Eryx* just on the basis of their terminal caudal vertebrae. Having recompared this of their terminal caudal vertebrae. Having recompared this material with the material from Kozi Grzbiet and with the caudal vertebrae of the modern Erycinae, I must admit my mistake. Although externally, when seen from the side, the vertebrae in question and the caudal vertebrae of the genus *Eryx* are as like as two peas, yet in section, seen from the cranial side, they have the structure of typical caudal vertebrae of the Colubridae (cf. MLYNARSKI, 1964, p. 337, Figs. 19—21). As regards the true Erycinae, their vertebrae bear numerous and very characteristic pleurapophyses, which give them the appearance of snow-flakes (cf. HOFFSTETTER and RAGE, 1972). The „pathologic” caudal vertebrae described by BRUNNER (1957, p. 372, Fig. 17/3) are probably analogous to ours.

It is difficult to say whether such cone-shaped sets of terminal caudal vertebrae are really pathologic structures. They have a very symmetrical and regular appearance and, what follows, do not resemble bony structures brought about by diseases or even by posttraumatic coalescence, as in the case of the vertebrae of other sections of the spinal column. In the members of the genus *Eryx* the ending of the tail is of functional significance, because they are forms adapted to burrowing in the soil. This specialization has not been observed in the Colubridae known from Europe. On the other hand, practically all snakes bury themselves in the ground or use the tail as an auxiliary organ. In connection with the execution of such a task it may have come to the fusion of the vertebrae and formation of the bony structures similar to those in the Erycinae.

I have had no chance hitherto to see similar „pathologic” caudal vertebrae in modern snakes. In this connection the supposition may be put forward bashfully that some unidentified forms of colubrides resembling the Erycinae in their ways of living lived in the Pliocene and Middle Pleistocene.

#### FAUNISTIC AND ECOLOGICAL CHARACTERISTICS

The amphibian and reptilian fauna of the younger localities described here, as I have repeatedly emphasized, resembles the modern fauna of the Balkan Peninsula. The new finds at Rebielice Królewskie I and II and Zalesiaki make it possible to characterize this herpetofauna more closely.

Rebielice Królewskie I is characterized by the occurrence of numerous and common forms associated with xerothermic biotope. These are, above all, numerous snakes and lizards, many of which, e.g. *Ophisaurus pannonicus*, *Coluber* cf. *viridiflavus*, *Elaphe* cf. *situla* or *Lacerta* cf. *sicula*, were Mediterranean or Ponto-Mediterranean forms. Most of the reptiles included in the list (p. 16) are animals inhabiting the rocky slopes of karst hills. The Pelobatidae, which are of steppe origin and associated with areas of loose and soft soil, predominate among the amphibians of this locality. They are, therefore, inhabitants of a different ecological niche, probably steppes stretched at the foot of jurassic hills. *Pelobates* cf. *syriacus balcanicus*, driven southwards in the Pleistocene,

lives in south-eastern Europe now (GILSEN, 1936; ESTES, 1970). It is related to modern *Pelobates fuscus*. According to ESTES (1970, p. 335), this last species, „derived probably from northern populations of *P. syriacus*, remained in Europe wherever the advancing ice sheets permitted, and as GILSEN (1936) has already noted, again spread widely over northern Europe during the thermal maximum”. The finding of both these species together in the „preglacial” of Poland seems to deny this supposition. These species probably arose earlier, but only one of them returned to the territory of Central and Northern Europe after the Pleistocene.

The forms associated with scrubs, like *Bufo* cf. *bufo*, *Anguis* and *Triturus*, or water, e.g. *Pliobatrachus* or *Emys*, are relatively few at Rębielice Królewskie I.

*Geoemyda mossoczyi* is probably less closely associated with water environment than *Emys*. Being similar to the modern tortoises of the subgenus (genus sensu McDOWELL, 1964) *Heosemys* from south-eastern Asia, it must have been a form well adapted to life on the land. The aquatic forms or, to be more circumspect, forms associated more closely with water may have come here from some not very remote areas, e.g. from the area represented by Rębielice Królewskie II.

Rębielice Królewskie II is marked by the presence of forms associated with water environment (*Emys* cf. *orbicularis*, amphibians). Lack of remains of fishes and other vertebrates associated with water indicates that these were small water reservoirs, perhaps drying up periodically, formed in karst hollows in the ground. They were then mating grounds for all the amphibians of the region. The relatively numerous remains of the Palaeobatrachidae (*Pliobatrachus*) suggest the existence of a water environment. According to ŠPINAR (1972) and also to VERGNAUD-GRAZZINI and HOFFSTETTER (1972), the members of this family are associated with water environment even after the mating season. In this respect they therefore resemble the Discoglossidae. A similar supposition is naturally justified in the case of the members of the genus *Palaeobatrachus*. Was, however, *Pliobatrachus* also so closely associated with water environment? Its remains have hitherto been found together with remains of terrestrial animals and never accompanied, e.g. by a large number of discoglossides. Thus, we may suppose that it was already a form less closely connected with water environment or less demanding than older palaeobatrachides and living in a somewhat different ecological niche.

Zalesiaki B, probably corresponding in age with Rębielice Królewskie, differs from it in the composition of its fauna. In this respect it resembles Rębielice Królewskie I rather than II. It is therefore a thermophilous fauna but associated more closely with scrubs or forests. Special attention should be given to the occurrence of *Geoemyda mossoczyi* in it. A closer characterization of the environment is not feasible. It may well be that there are considerably younger elements here, derived from Zalesiaki A.

Kielniki (STWORZEWICZ, 1975), the oldest Pleistocene locality mentioned in the present paper, is characterized by an amphibian and reptilian fauna



typical of deciduous forests and scrublands. Although there are also some thermophilous elements (*Lacerta*) in it, all these animals are eurythermic. In this case brown frogs (*Rana* sp.) of small size are dominant. The relatively poor bone material of amphibians and reptiles does not permit any very nice conclusions.

Kozi Grzbiet can be characterized fairly accurately thanks to the very rich material of amphibian and reptilian bone remains obtained from this locality. Generally speaking, we are concerned here with a forest or scrub herpetofauna similar to the modern fauna, with a certain proportion of thermophilous forms. The same species occur in nearly all layers, their composition being slightly different quantitatively.

Newts (*Triturus* cf. *cristatus*) and grass snakes (*Natrix* cf. *natrix*) are the dominants of the herpetofauna of this locality. These two forms may be inhabitants of both forests and deciduous scrubs. A similar habitat is also typical of brown frogs and toads. The presence of rather numerous though not very frequent specimens of *Bombina* and *Pliobatrachus langhae*, which are associated with water environment throughout their active life, indicates the existence of probably small and shallow water reservoirs. Most of the forms occurring here are typical eurythermic species, in the case of brown frogs and *Vipera* cf. *berus*, boreal ones. The thermophilous forms are here represented by *Pliobatrachus*, *Elaphe* cf. *longissima*, *Lacerta* sp. and *Coronella* cf. *austriaca*, although now these last two species reach far to the north in Europe. The abundant snake fauna suggests a differentiated environment. No doubt at Kozi Grzbiet there must have been some overgrown and wooded areas and also open places, exposed to the sun's rays and even perhaps with xerothermic vegetation. This locality however nearly completely lacks forms associated with open steppe areas, which are so abundantly represented by spade-foot toads (*Pelobates*) at Rebielice Królewskie I. The only remains of a related form, *Pelobates fuscus*, which have been found in the material discussed may have derived from distant regions and been brought to Kozi Grzbiet in owls' pellets.

In contradistinction to the paper of 1962, in the present publication I do not compare the herpetofauna of our new localities with the faunae of localities similar in age in other European countries. Despite evident similarities, each of these faunae shows distinct differences not only in specific composition but also in the abundance of particular species. Thus, e.g. the apparently closely related faunae of Rebielice Królewskie I and II and Ivanovce in Slovakia differ very distinctly from each other. The same is also true of the faunae of Hájnačka, Betfia, Arondelli and also the younger Pleistocene localities. Big differences in composition between these faunae are connected with their different ecologic habitats rather than geologic age.

## REFERENCES

- AUFFENBERG W. 1963. The fossil snakes of Florida. *Tulane Stud. Zoology*, **10** (3): 131—216, 51 figs.
- BERGER L. 1975. Płazy i gady. Fauna słodkowodna Polski (4). Warszawa—Poznań. 110 p., 46 figs.
- BOLKAY J. 1913/1915. Additions to the fossil herpetology of Hungary from the Pannonian and Praeglacial Period. *Mitt. Jahrb. kgl. ung. Reichsanstalt*, Budapest, **21** (7): 217—230, pls 11—12, 5 figs.
- BRUNNER G. 1957. Die Breitenberghöhle bei Gössweinstein/Ofr. *N. Jahrb. Geol. Pal. (Abh.)*, Stuttgart, **104** (11): 500—517.
- ESTES R. 1970. New fossil pelobatid frogs and a review of the genus *Eopelobates*. *Bull. Mus. Comp. Zool., Cambridge Mass.*, **139** (6): 293—339, 31 figs.
- FEJÉRVÁRY G. J. 1917. Anoures fossiles de couches preglaciaires de Püspökföld en Hongrie. *Földt. közl.*, Budapest, **47**: 141—172, 2 pls.
- GALUSZKA E. (MS). Osteologia czaszek czterech gatunków traszek występujących w Polsce. 28 p., 15 pls. (praca magisterska UJ).
- HOFFSTETTER R. 1939. Contribution à l'étude de Elapidae actuels et fossiles et de l'ostéologie des Ophidiens. *Arch. Mus. Hist. Nat., Lyon*, **15** (3): 78 p., 2 pls, 13 figs.
- HOFFSTETTER R. & RAGE J.-C. 1972. Les Erycinae fossiles de France (Serpentes, Boidae). *Comprehension et histoire de la sous-famille. Ann. Pal. (Vertebres)*, Paris, **58** (1): 123 p., 2 pls., 11 figs.
- GILSÉN T. 1936. On the history of evolution and distribution of the European pelobatids. *Zoogeographica*, **3**: 119—131.
- KHOSATZKY L. I. & MŁYNARSKI M. 1966. Fossil tortoises of the genus *Geoemyda* GRAY, 1834 (s. lat.) of Europe. *Acta zool. cracov.*, Kraków, **11** (13): 397—420, pls. 29—33, 7 figs.
- KOWALSKI K. 1960. Pliocene Insectivores and Rodents from Rębielice Królewskie (Poland). *Acta zool. cracov.*, Kraków, **5** (5): 154—194, pls. 19—21.
- KOWALSKI K. in MOSSOCZY Z. 1959. Odkrycie miejsc występowania kości kregowców kopalnych w okolicach Kłobucka. *Przegląd Geol.*, Warszawa, **7** (3): 132—134.
- MADEJ Z. 1965. Variations in the sacral region of the spine in *Bombina bombina* (LINNAEUS, 1761) and *Bombina variegata* (LINNAEUS, 1758) (Salientia, Discoglossidae). *Acta biol. cracov.*, Kraków, **8**: 185—197, 25 figs.
- MARKERT D. 1975. Schlüssel zur Bestimmung der Wirbel süddeutscher Ophidier und dessen Anwendung auf Pleistozän/Holozän Reptilienmaterial aus dem Euerwanger Bühl (Franken). *N. Jb. Geol. Paläont. Abh.*, Stuttgart, **149** (2): 211—226, 6 figs.
- MÄRZ R. 1969. *Gewöll- und Ruppenskunde*. Berlin, 287 p., 307 figs. Amphibia: 81—87, figs 119—132.
- MERTENS R. 1928. Zur Naturgeschichte der europäischen Umken (*Bombina*). *Zt. Morphol. ökol. Tiere*, Berlin, **11**: 613—623.
- MERTENS R. & WERMUTH H. 1960. Die Amphibien und Reptilien Europas. (Dritte Liste nach dem Stand vom 1 Januar 1960), Frankfurt am Main, 264 p., 44 figs.
- MCDOWELL S. 1964. Partition of the genus *Clemmys* and related problems in the taxonomy of the aquatic Testudinidae. *Proc. Zool. Soc. London*. **143** (2): 239—279, 11 figs.
- MŁYNARSKI M. 1960. Pliocene Amphibians and Reptiles from Rębielice Królewskie (Poland). *Acta zool. cracov.*, Kraków, **5** (4): 131—150, pls. 17—18.
- MŁYNARSKI M. 1961a. Serpents pliocènes et pléistocènes de la Pologne avec la revue critique de Colubridés fossiles. *Folia Quatern.*, Kraków, (4): 45, 6 pls.
- MŁYNARSKI M. 1961b. Czwartorzędowa fauna węży (Colubridae) z Giebułtowa koło Krakowa. (résumé). *Folia Quatern.*, Kraków, (6): 9, 3 pls.

- MLYNARSKI M. 1961c. Płazy z pliocenu Polski (Summary). Acta pal. polon., Warszawa, **6** (3): 261—282, 6 pls.
- MLYNARSKI M. 1962. Notes on the Amphibian and Reptilian Fauna of the Polish Pliocene and Early Pleistocene. Acta zool. cracov., Kraków, **7** (11): 176—194, pl. 14.
- MLYNARSKI M. 1963. Die plio-pleistozänen Wirbeltierfaunen von Hajnáčka und Ivanovce (Slovakie), ČSSR. IV. Schildkröten-Testudines. N. Jb. Geol. Paläont. Abh., Stuttgart, **118** (3): 231—244, pls. 23—26.
- MLYNARSKI M. 1964. Die jungpliocäne Reptilienfauna von Rębielice Królewskie, Polen. Senckenberg. biol., Frankfurt a. M., **45** (3/5): 325—347, 43 figs.
- MLYNARSKI M. 1969. Remarks on the fossil chelonians from Malușeni in Southern Moldavia, Rumania. Acta zool. cracov., Kraków, **14** (7): 151—162, 3 figs.
- MLYNARSKI M. 1968. Die plio-pleistozänen Schildkröten Mitteleuropas. Ber. deutsch. Ges. geol. Wiss. A., Berlin, **13** (3): 351—356, 2 figs.
- MLYNARSKI M. 1971. Żółw błotny (*Emys orbicularis* LINNAEUS) z cmentarza kultury pucharów lejkowatych na stanowisku 1 w Sarnowie... (Summary). Prace Muz. Archeol. Etnograf. Łódź, ser. archeol., (18): 125—129, 1 fig.
- MLYNARSKI M. 1976. *Discoglossus giganteus* WETTSTEIN-WESTERHEIM, 1955 (Discoglossidae, Anura) from the Miocene of Przeworno in Silesia (Poland). Acta zool. cracov., Kraków, **21** (1): 1—12, pls. 1, 2 figs.
- NEMEC J. 1972. Osteology of isolated anuran bones from Stránská Skála near Brno (Lower Quaternary). Studia Mus. Moraviae, Brno, **20** (n. s. 12): 21—33, 6 pls., 4 figs.
- SCHAEFER H. 1932. Die Artbestimmung der deutschen Anuren nach dem Skelett. Zeit. Anatom. Entwicklges., Berlin, **97** (6): 768—776, 19 figs.
- ŠPINAR Z. 1972. Tertiary frogs from Central Europe. Praha. 286 p., 184 pls., 95 figs.
- SZUNYOGHY J. 1932. Beiträge zur vergleichenden Formenlehre des Colubridenschädels, nebst einer kranilogischen Synopsis der fossilen Schlangern Ungarns. Acta zool., Stockholm, **13**, 56 pls., 116 figs.
- STWORZEWICZ E. 1975. *Aegopinella lozeki* n. sp. and *Aegopinella ressmanni* (WEST.) (Gastropoda, Zonitidae) from the Early Pleistocene of Poland. Acta zool. cracov., Kraków, **20** (12): 481—488, pls. 39—41, 2 figs.
- TARAŠČUK V. I. 1971. (Fossil turtles of the genus *Geoemyda* from the Neogen Deposits in the Ukraine-Summary). Sbor. prac. zool. Muz. Kiev, (34): 100—112, 2 figs.
- TEEGE M.-J. 1957. Studien zur Entwicklung und Gestalt der Urodelenwirbel. Ztschr. wiss. Zoolog., Leipzig, **160** (1/2): 95—162, 29 figs.
- THENIUS E. 1965. Ein Primaten-Rest aus dem Altpleistozän von Voigtstedt in Thüringen. Paläontol. Abh., **2** (2/3): 685—689.
- ULLRICH H. & MLYNARSKI M. (in lit.). Reptilienreste aus dem jungpleistozänen Travertins von Burgtonna. Quartärpal., Weimar.
- VERGNAUD-GRAZZINI C. 1970. Les amphibiens fossiles du gisement d'Aronelli. Palaeontograph. Italica, Pisa, **66**: 47—65, 2 pls., 4 figs.
- VERGNAUD-GRAZZINI C. & HOFFSTETTER R. 1972. Présence de Palaeobatrachidae (Anura) dans des gisements tertiaires français. Caractérisation, distribution et affinités de la famille. Palaeovertebrata, Montpellier, **5** (4): 157—177, 2 pls., 2 figs.
- VERGNAUD-GRAZZINI C. & MLYNARSKI M. 1969. Position systematique du genre *Pliobatrachus* FEJÉRVÁRY, 1917. C. R. Acad. Sc. Paris, sér. D.: 2399—2402, 1 pl.
- ŻYLKA A. [MS.]. Osteologia grzebiuszki ziemnej *Pelobates fuscus* (LAURENTI, 1768) z uwzględnieniem cech taksonomicznych szkieletu (praca magisterska, UJ).



## STRESZCZENIE

Praca niniejsza nawiązuje do podobnej publikacji autora z roku 1962. Zawiera ona wyniki długoletnich studiów nad szczątkami płazów i gadów z kilku nowych stanowisk na terenie Polski. Wiek ich obejmuje okres od górnego pliocenu i jego granicy z plejstocenem po środkowy plejstocen.

W części ogólnej podano charakterystykę stanowisk, z których uzyskano materiał. Są to: Rębielice Królewskie I (pliocen górny lub dolny vilfrancz, stanowisko wymienione już w 1962 roku), Rębielice Królewskie II (prawdopodobnie tego samego wieku), Zalesiaki B (prawdopodobnie vilfrancz) i Zalesiaki A (cromerian), Kielniki (Günz) i Kozi Grzbiet (cromerian, Günz-Mindel) w Górach Świętokrzyskich. Wszystkie poprzednie stanowiska leżą na terenie Wyżyny Krakowsko-Wieluńskiej (Jura).

W części systematycznej omówiono szerzej gatunki płazów i gadów stwierdzonych w wymienionych powyżej stanowiskach. Dużo uwagi poświęcono też znaczeniu taksonomicznemu niektórych izolowanych kości, szczególnie kości szczęk u *Palaeobatrachidae*. Osobny rozdział poświęcono też zmianom patologicznym i nieprawidłowościom w budowie kręgów węży.

W części końcowej podano krótką charakterystykę faunistyczną i ekologiczną omawianych stanowisk na podstawie ich herpetofauny.

## PLATE IV

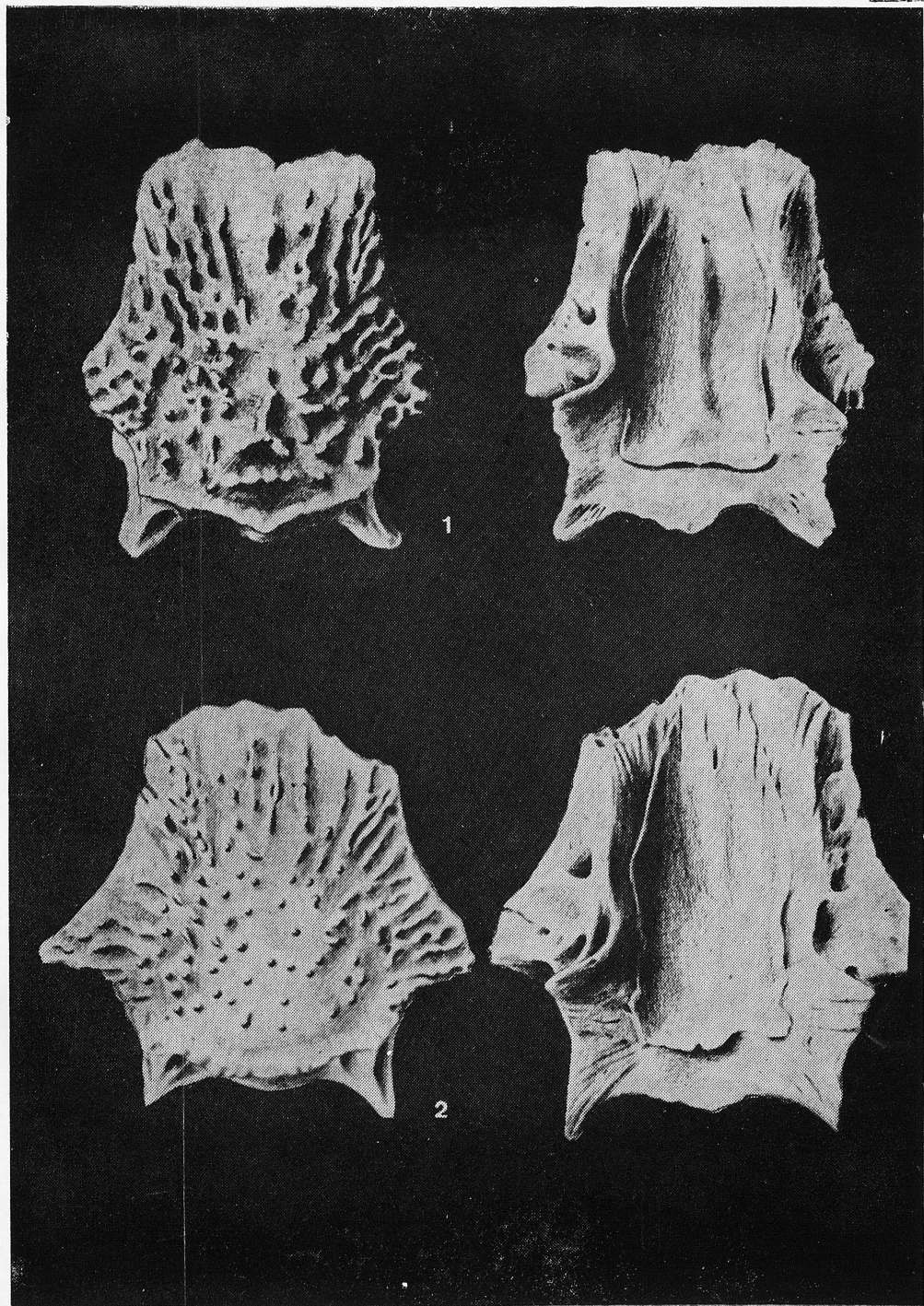
1. *Pelobates* cf. *fuscus* (LAURENTI) (size about 12 mm) from Rębielice Królewskie I
2. *Pelobates* cf. *syriacus balcanicus* KARAMAN (size about 15 mm) from Rębielice Królewskie I

# ERRATA

Page	Line	Instead of	Should be
19	9	***	*** $\mathcal{IC}$
19	10	****	**** $\mathcal{IC}$
19	11	*	* $\mathcal{IC}$
19	12	***	*** $\mathcal{FS}, AM\mathcal{IC}$
33	41	y	by
Plate VI		Fig. 4	Fig. 5
Plate VI		Fig. 5	Fig. 4

*Acta Zoologica Cracoviensia XXII/2*

*M. Mlynarski*

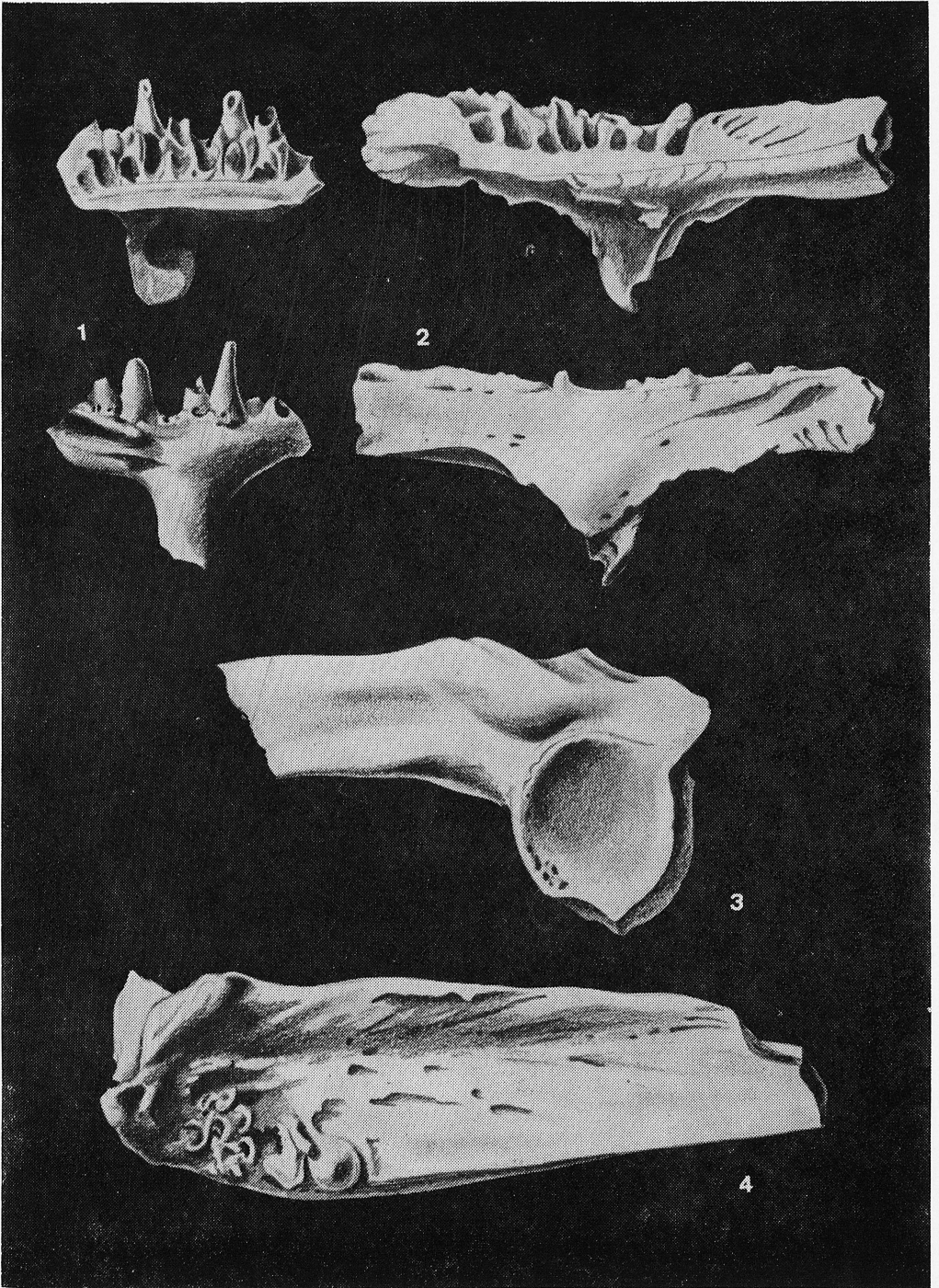


*M. Mlynarski*  
*del. J. Kalibaba*



## PLATE V

1. *Palaeobatrachus* sp. from Boutersem (Hoogbutsel, Belgium), Tongrien (Eocene). Maxillare (size about 5 mm)
2. *Pliobatrachus* cf. *langhae* FEJÉRVÁRY from Rębielice Królewskie II. Maxillare (size about 14 mm)
3. *Pliobatrachus* cf. *langhae* FEJÉRVÁRY from Rębielice Królewskie II. Ilium (size about 13 mm)
4. *Pliobatrachus langhae* FEJÉRVÁRY from Kozi Grzbiet. Alveolar surface of maxillare (size about 18 mm)

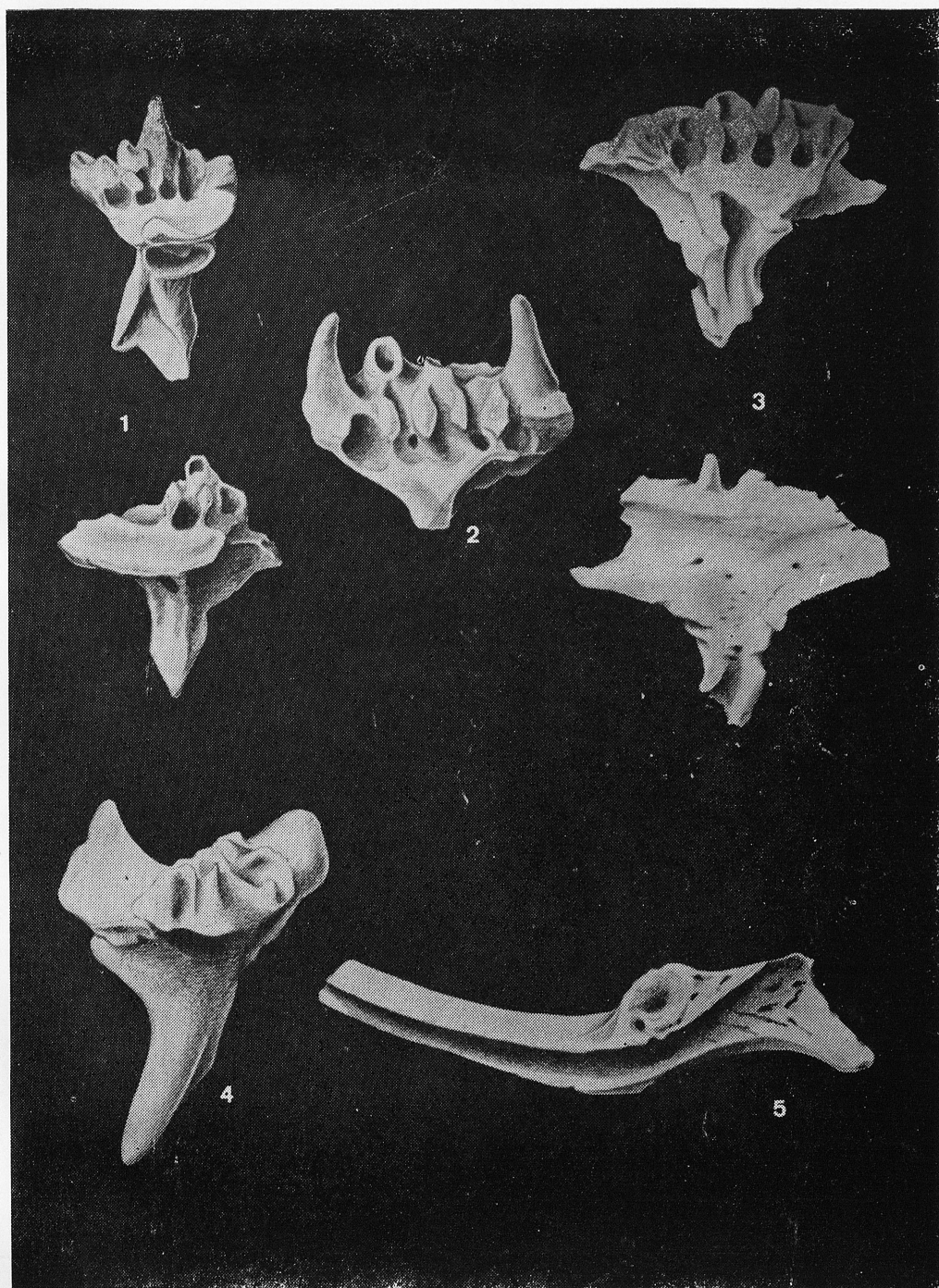


*M. Mlynarski*  
*del. K. Malczewski*

PLATE VI

1. *Pliobatrachus* cf. *langhae* FEJÉRVÁRY from Rębielice Królewskie II. Intermaxillare (size about 8 mm)
2. *Pliobatrachus langhae* FEJÉRVÁRY from Kozi Grzbiet. Maxillare? (size about 4 mm)
3. *Pliobatrachus* cf. *langhae* FEJÉRVÁRY from Rębielice Królewskie II. Maxillare (size about 9 mm)
4. *Pliobatrachus* cf. *langhae* FEJÉRVÁRY from Rębielice Królewskie II. Angulare (size about 15 mm)
5. *Pliobatrachus langhae* FEJÉRVÁRY from Zalesiaki A. Intermaxillare (size about 6 mm)





Redaktor zeszytu: doc. habil. dr Z. Bocheński

PAŃSTWOWE WYDAWNICTWO NAUKOWE — ODDZIAŁ W KRAKOWIE — 1977

Nakład 810+80 egz. Ark. wyd. 2,25. Ark. druk.  $1\frac{8}{10}$ +3 wkładki. Papier ilustr. kl. III 70×100 80 g  
Zam. 165/77 Cena zł 15. —

DRUKARNIA UNIWERSYTETU JAGIELLOŃSKIEGO W KRAKOWIE