ACTA ZOOL. CRACOV. | 27 | 8 | 127—148 | KRAKÓW, 31. I. 1984

Marian MŁYNARSKI

Notes on the amphibian and reptilian fauna of the Polish Miocene

[With 2 text-figs.]

Uwagi o faunie płazów i gadów z miocenu Polski*

Abstract. This paper is a recapitulation of the studies carried out so far on the Polish Miocene herpetofauna from the localities at Pińczów, Opole and Przeworno (Fig. 1). The characteristics of the localities, including stratigraphical and palaeoecological data, are given in the introductory part. Palaeoecological and zoogeographic notes are presented also in the last part. The systematic part provides brief discussions of all the forms found in the Miocene of Poland up to now. Noteworthy is the description of the first Polish find of fossil remains of a crocodile (? *Tomistoma* sp.) from marine deposits at Pińczów and the considerations on the occurrence of similar forms in the European Tertiary (by T. M. ANTUNES; see Fig. 2). All the forms — genera and species — so far reported are tabulated on p. 140.

This paper links up with the author's previous publications devoted to the survey of younger — Pliocene and Pleistocene — amphibians and reptiles of Poland (MŁYNARSKI, 1962, 1977).

I. INTRODUCTION

In contradistiction to the Pliocene and Pleistocene karst localities which are extremely numerous, only two Miocene land localities are known: Opole, in older literature referred to as Nowa Wieś Królewska near Opole (WEGNER, 1913: Königliches Neusdorf bei Oppeln) and Przeworno. They are both situated in Silesia and so we expect to find some other localities of Miocene vertebrates in this region, lying roughly between Opole, Wrocław and Strzelin (cf. the map in Fig. 1).

The locality at Opole was discovered first. Its classic fauna of the Middle-Miocene vertebrates is known chiefly from WEGNER's (1913) monograph. The material collected by that author was unfortunately lost during World War II. In 1955—1960 workers of the Institute of Palae-

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

ontology, Wrocław University, under the direction of Prof. Z. RYZIEWICZ excavated a new locality of the same age, situated in the proximity of WEGNER's localities and with a similar fauna. Unluckily, neither does this locality exist any longer; the material derived from it is stored in the above-mentioned Institute (abbr.: ZPWR).

The search carried out for years at the locality of Przeworno (Przeworno II) by palaeontologists from Warsaw, Wrocław and Kraków and now continued chiefly by workers of the Laboratory of Vertebrates, Institute of Systematic and Experimental Zoology, Polish Academy of Sciences in Kraków, is also being brought to a close. It is in this Institute that most of the remains of vertebrates, including all amphibians and reptiles, from this locality are kept (abbr.: ZZSiD).

So far we have only the first signal of the occurrence of reptiles in the marine Miocene of this country: it is a single tooth of a big crocodile described for the first time in this paper from quarry No 2 on the periphery of the town of Pińczów on Nida. This locality, or rather localities in several quarries are known for their rich fauna of fish, especially sharks, and also of cetaceans and invertebrates.

Now we have at our disposal relatively rich palaeoherpetological literature devoted to the Miocene fauna of Poland. Most of the publications were prepared jointly by foreign and Polish authors under the scheme of the collaboration of long standing subsidized by the Polish Academy of Sciences and Consejo Superior de Investigaciones Cientificas (Spain). The present notes, like my previous similar publications (MŁYNARSKI, 1962, 1977) given to younger herpetological faunas, is to provide synthetic data concerning the amphibians and reptiles of the Polish Neogene as well as the present state of studies on them.

A c k n o w l e d g m e n t s: I wish to extend my heartfelt thanks to Prof. MIGUEL TELES ANTUNES of Universidade Nova in Lisbon for his studing the remains of a crocodile from Pińczów and discussing the Tertiary remains of crocodiles in Europe at length (see Fig. 2). He has thus become a co-author of the present paper.

I owe my deepest thanks to Prof. Andrzej RADWAŃSKI of Warsaw University for the loan of the crocodile remain as well as for his valuable remarks concerning Pińczów and the other localities here discussed. I am also greatly indebted to Dr Jerzy GŁAZEK of Warsaw University for similar remarks.

My special thanks go to Prof. Richard ESTES of San Diego State Univeristy (California) and Dr Borja SANCHÍZ of the National Museum of Natural Sciences in Madrid for their collaboration in the study of the Polish Miocene herpetofauna. Finally, I am very grateful to Dr Zbigniew SZYNDLAR of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, in Kraków for his long cooperation and valuable remarks.

II. LOCALITIES

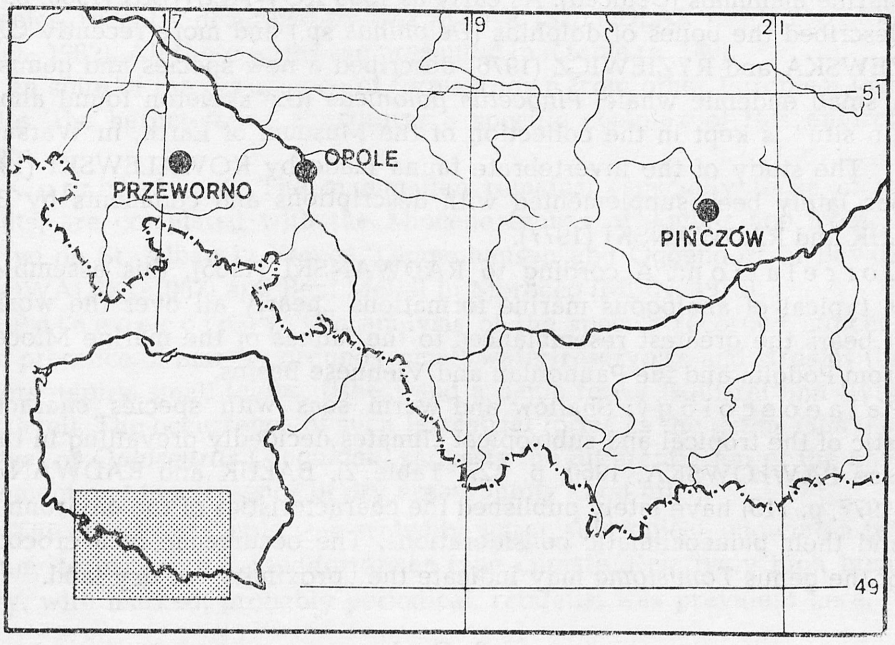

Fig. 1. Miocene localities of vertebrate faunas in Poland

1. Pińczów

This locality is plotted on the map in Figure 1. It is situated in Quarry No 2 at Nowa Wieś, a suburb of the town of Pińczów on the River Nida.

All the materials of vertebrates come from the so-called „Pińczów marbles". The remains (a tooth) of a crocodile and the below mentioned accompanying fauna have been derived from the lower part of the profile of the quarry. They are mostly strongly fossilized fish remains, easy to extract by mechanical methods from the soft Lower Tortonian marine limestones.

Geological age: middle portion of the Upper Miocene — „Lower Tortonian Leitha-limestone" (RADWAŃSKI, 1965, p. 267).

Accompanying fauna: The vertebrates are represented by a fish fauna rich in forms, including numerous members of the *Elasmobranchii* (KOWALEWSKI, 1930; JERZMAŃSKA, 1958; PAWŁOWSKA, 1960). Of the bony fish (*Teleostomi*) *Scorpaena ensiger* JORDAN et GILBERT described from this locality by JERZMAŃSKA (1958) and the forms of the genera *Chrysophrys* and *Sphaerodus* are noteworthy.

The sharks (*Elasmobranchii*) are represented by relatively more forms and are besides more numerous. They have been described by PAWŁOWSKA (1960), who also gives a list of all the species known so far. RADWAŃSKI (1965) described the caudal fin-rays of skates (*Raiidae*).

The Pińczów Miocene locality has also provided some remains of marine mammals (*Cetacea*). As early as 1930 KOWALEWSKI (1930, p. 55) described the bones of dolphins (*Delphinus* sp.) and more recently CZYŻEWSKA and RYZIEWICZ (1976) described a new species and genus of a small endemic whale, *Pinocetus polonicus* (the skeleton found almost „in situ" is kept in the collection of the Museum of Earth, in Warsaw).

The study of the invertebrate fauna made by KOWALEWSKI (1930) has lately been supplemented with descriptions and comments by BAŁUK and RADWAŃSKI (1977).

Correlation: According to RADWAŃSKI (1965), this assemblage is typical of analogous marine formations „nearly all over the world". It bears the greatest resemblances to the faunas of the marine Miocene from Podolia and the Pannonian and Viennese Basins.

Palaeoecology: Shallow and warm seas with species characteristic of the tropical and subtropical climates decidedly prevailing in them (see PAWŁOWSKA, 1960, p. 427, Table 2). BAŁUK and RADWAŃSKI (1977, p. 115) have lately published the characteristics of the environment and their palaeoclimatic considerations. The occurrence of a crocodile of the genus *Tomistoma* may indicate the „proximity" of dry land.

2. Opole

The locality, plotted on the map in Figure 2, was situated in a suburb of the town of Opole, in its district called Nowa Wieś Królewska. Nearly all the vertebrate remains were found on the premises of the now inactive cement plant „Bolko". The state of their preservation, especially of bones found in 1955—1960, made it in many cases impossible to extract them whole. Soft and waterlogged fragments crumbled despite careful handling. This is especially true of small mammalian forms as well as amphibians and reptiles.

Geological age: Upper Middle Miocene — Sarmatian (RYZIEWICZ, 1957; KOWALSKI, 1967).

Accompanying fauna: The vertebrate fauna of Opole is characterized by a great variety of forms and the presence of both large and small species, including rodents important for stratigraphic determinations. And so it contains elephant-like animals (mastodons), rhinoceroses, members of the large *Suidae* and deer (RYZIEWICZ, 1959). The presence of tapirs also deserves to be noted (RYZIEWICZ, 1961).

The rodential fauna has been studied by KOWALSKI (1967). The occurrence of fossil beavers of the genus *Steneofiber* (op. cit., p. 2) as well as fossil squirrels *(Sciurus)* and flying squirrels *(Sciuropterus)* is in this case worth noticing.

Herpetofauna: However scanty and unique the material is, it is characterized by a great variety of forms. There is only one turtle spe-

cies in it, this being so far regarded as an „endemic form" *(Geoemyda eureia)*. The fauna of amphibians and snakes is rich and includes new species, recently described by SZYNDLAR (SZYNDLAR in MŁYNARSKI et al., 1982). All these forms are presented in a table (p. 140).

In spite of the occurrence of forms known from other European localities, the herpetofauna constitutes a specific complex of this environment.

Correlation: The mammalian remains, especially those of rodents, are correlated with the Miocene faunas of similar age from La Grive de St. Alban in France, Giggenhausen and Oggendorf in Bavaria (KOWALSKI, 1967) and Beni Mellal in Morocco (MEIN, 1975).

Palaeoecology: An analysis of the species recorded indicates the presence of marshy grounds, small water reservoirs and streams (beavers, tapirs, small teleost fishes) and a damp forest (squirrel and flying squirrel). The occurrence of such terrestrial forms as the genus *Glis (Gliridae)* or *Ophisaurus (Anguidae)* suggests the differentiation of the environment and the presence of dry areas, sunny karst hills).

The climate of Opole was probably warm, subtropical, showing a tendency to pass into a Mediterranean-type climate. Relatively high humidity, with marked, probably periodical, rainfalls, was prevalent here.

3. Przeworno

This locality (see Fig. 1) or rather localities, designated Przeworno I, II and III, are situated in a small quarry in a place of that name. All of them, at least Przeworno I and II from III, differ in geological age and faunal composition. This also points to an ecological differentiation. The bony remains of land vertebrates are relatively few in number; however, they are often found „in situ" or scattered near each other (e.g. remains of frogs or turtles). The state of their preservation and the degree of fossilization are somewhat better than in the case of the material from Opole, but they are also flimsy, soft after exposure, and as a result hard to extract (GŁAZEK et al., 1971).

Geological age: Przeworno I, commonly called „lower", lies in the bottom portion of the northern wall of the quarry and now is completely covered with water. According to GŁAZEK et al. (1977, Table 1), it is the youngest of these localities and they date it to the period between the Burdigalian and the Aquitanian.

Przeworno II, called „upper", from which most of the bony remains so far collected have been derived, according to the authors quoted above, covers the period between the Upper Vindobonian and the Younger Badenian. KOWALSKI and ZAPFE (1974) mention the Vindobonian without any closer determinations.

KUBIAK (1981 a and b) claims that these two localities are nearly the

same age, the different ecological environments being rather responsible for the difference in the faunal composition.

On the other hand, Przeworno III is clearly younger. It lies in the western part of the quarry. Only remains of water beetles of the family *Dytiscidae* are known from it (GALEWSKI and GŁAZEK, 1973, 1978).

Accompanying fauna: The mammalian fauna of Przeworno consists exclusively of members of relatively large forms. For instance, no remains of insectivores or rodents, met with at Opole, have, as yet, been found here. This is probably connected with the conditions of fossilization. The first list of the fauna was given by SULIMSKI (in GŁAZEK et al., 1971). Since then studies have been conducted on the remains of a monkey *Pliopithecus* (KOWALSKI and ZAPFE, 1974), mastodon *Gomphotherium angustidens* (CUVIER) (KUBIAK, 1975) and members of the families *Equidae, Rhinocerotidae, Suidae* and *Tayassuidae* (KUBIAK, 1981a and b). Publications on the *Carnivora* (HEIZMANN and KUBIAK) and *Cervidae* (CZYŻEWSKA) are in preparation.

Herpetofauna: It is characterized by the occurrence of turtles, which abound in both specimens and species. The members of the genus *Ptychogaster* from locality II come in first in respect of numerousness. The remains of small tortoises *(Testudo)* are derived from locality I, whereas the occurrence of *Geoemyda* is very doubtful (MŁYNARSKI, 1978). The presence of a big specimen of *Chelydropsis (Chelydridae, Chelydropsinae),* hitherto unknown from Poland, was found at Przeworno II (MŁYNARSKI, 1981 a and b).

The remains of lizards, few in number, come from locality I („lower") and belong to the genus *Ophisaurus (Anguidae)* (BACHMAYER and MŁYNARSKI, 1977). Only one vertebra of a snake, identified by SZYNDLAR (in prep.) as *Colubridae* indet. („upper" Przeworno), has been found here so far.

The amphibians, also occurring at locality II, are represented by *Latonia seyfriedi* (H. v. MEYER) of large size (MŁYNARSKI, 1976; SANCHIZ and MŁYNARSKI, 1979). This animal was here relatively numerous and common and it may even be regarded as predominant in the whole vertebrate fauna of Przeworno.

Correlation: Localities Przeworno I and II are correlated in respect of age and the composition of the vertebrate fauna with the classic localities at Steinheim in Württemberg. On the other hand, its similarity to Opole is smaller than it seemed to be. The herpetofauna of Przeworno forms an assemblage typical of this locality and comprising elements very characteristic of the European Miocene.

Palaeoecology: The environment is like that at Opole, with a distinct differentiation of damp, wooded (Przeworno II) and dry (Przeworno I) areas. For a more detailed characterization see p. 131.

III. SYSTEMATIC PART

Amphibians

Order: *Caudata* OPPEL, 1811
Family: *Salamandridae* GRAY, 1825
Genus: *Chelotriton* POMEL, 1853
1. *Chelotriton paradoxus* POMEL, 1853

ESTES (MŁYNARSKI et al., 1982) showed the presence of this species in the material from Opole. In this so scanty material there was one dorsal vertebra of an adult specimen, its build being very characteristic of the species named. Morphologically it resembles the recent Asiatic tritons *Tylototriton verrucosus* ANDERSON, 1871 from southern China and *T. andersoni* BOULENGER, 1892 from Japan, whose distribution is clearly refugial in character (see FRAYTAG in „Grzimeks Tierleben", 1970, map on p. 28). They are, as yet, the only remains of a fossil salamandrid from the Polish Miocene (ZPWR).

Order: *Anura* GIBEL, 1847
Family: *Palaeobatrachidae* COPE, 1865
2. *Palaeobatrachidae* indet.

B. SANCHÍZ (MŁYNARSKI et al., 1982) recorded a member of this group, which could not be determined more closely, from the material from Opole (ZPWR), whereas it is not represented at all at Przeworno, which has already provided very rich material of Miocene anurans. These are characteristic of much younger karst localities in this country (MŁYNARSKI, 1977).

Family: *Discoglossidae* GÜNTHER, 1858
3. *Latonia seyfriedi* MEYER, 1843

As has already been mentioned, this amphibian was one of the dominants both at Przeworno and at Opole. Some remains of this animal were presented for the first time in figures by WEGNER (1913), who assigned them to the family *Siluridae*.

The bones of *Latonia* are particularly numerous in the material from Przeworno (MŁYNARSKI, 1977; SANCHÍZ and MŁYNARSKI, 1979). They come from locality Przeworno II. The rich material of excavations carried out for many years is stored in Kraków (ZZSD). This, probably the most numerous member of the whole vertebrate fauna, has hitherto been the only amphibian from this locality.

Genus: *Bombina* OKEN, 1816

4. *Bombina* sp.

The occurrence of members of this recent genus has been reported on the basis of a well-preserved fragmentary ilium from Opole by SANCHÍZ (MŁYNARSKI et al., 1982). The oldest remains of *Bombina* known hitherto were also derived from Poland, from the Upper Pliocene of Rębielice Królewskie (SANCHÍZ and MŁYNARSKI, 1979, HODROVÁ, 1981).

The finding of *Bombina* remains in the Miocene indicates that we are concerned with a phylogenetically considerably older form than it has been expected so far. For it was thought for a long time that the origin of the tribe of recent *Bombina* dated back at the most to the Lower or Middle Pleistocene. The origin of the recent European species was usually referred to the Pleistocene; now we must approach these suppositions with great reservation.

Reptiles

Order: *Crocodylia* GMELIN in LINNAEUS, 1788

Family: *Crocodylidae* CUVIER, 1807

Genus: *Tomistoma* S. MÜLLER, 1846

(Diagnosis: WERMUTH, 1953, p. 501)

5. ? *Tomistoma* sp.

(by Teles Miguel ANTUNES)*

No doubt, the tooth found by Prof. RADWAŃSKI at Pińczów belonged to a crocodile. It is preserved in the collection of the Institute of Geology, Warsaw University. We are concerned with a very big specimen but not yet a gigantic one. In its dimensions it conforms exactly to the numerous teeth I examined from the Upper and Middle Miocene (in this last case from the Middle Tortonian) of Portugal, Spain and western France, from which it besides does not differ in anything. And so we deal here with a crocodile related to *Tomistoma egganbugense* (TOULA et KAIL, 1885) and *Tomistoma lusitanica* (VIANNA et MORAES, 1942), and therefore to the species characterized by their build typical of the genus under discussion. On the other hand, I do not think it expedient to introduce the genus *Gavialosuchus* into these considerations, because its type-species *G. americanus* (SELLARDS, 1915) differs much more in morphology from the generotype of *Tomistoma* — *T. schlegeli* (S. MÜLLER, 1838). This opinion has not been accepted by all other palaeontologists.

---

* Prof. T. M. ANTUNES, Universidade Nova de Lisboa, Facultade de Ciencias e Tecnologia, Quinta do Cabeço-Olivais, P-1899. Lisboa, Portugal.

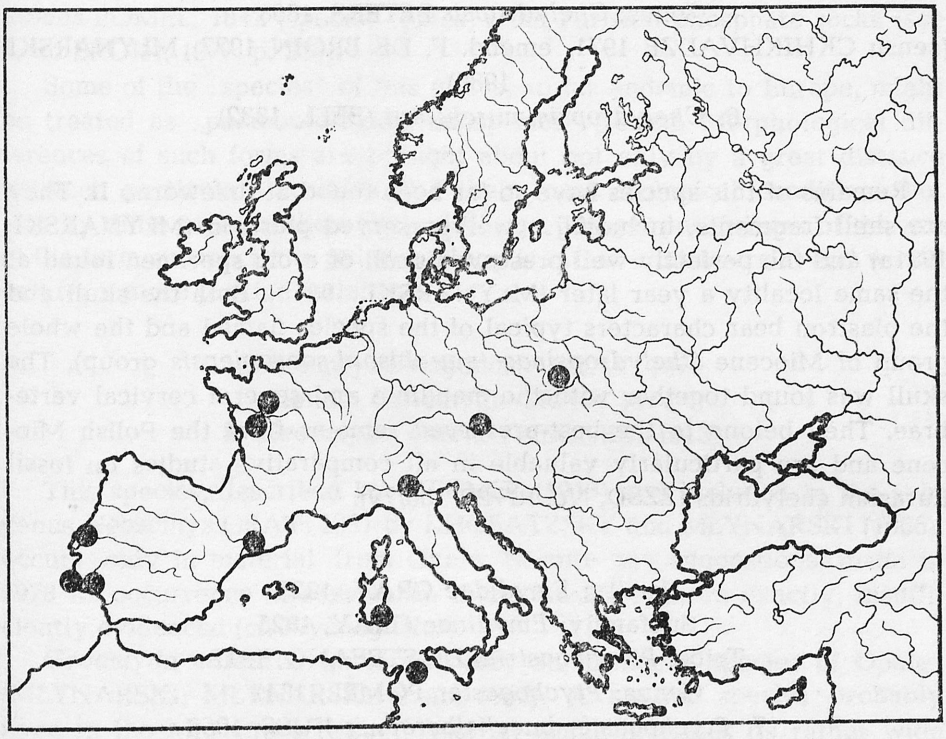

Fig. 2. Approximate distribution of robust-toothed *Tomistomatinae* in Europe (by M. T. ANTUNES)

The wide geographic distribution of this reptile (ANTUNES, 1961, Fig. 13), now still more expanded (Fig. 2), and the fact that it often occurred in the marine environment draw attention to the considerable distance between the localities of *T. eggenburgense* and *T. lusitanica*. After all, they may actually be distinct species or only local modifications of populations (geographical races?).

I should like to explain the foregoing problems as well as some other ones connected with them in more detail some time, but at present it is naturally impossible for the poverty of material.

To sum up, we can only state that at Pińczów we are concerned with a crocodile with apparently more delicate teeth than those found so far among other fossil remains of this group of reptiles. The supposition may therefore be put forward and even be regarded as well-grounded that it is still another form, distinct from *Tomistoma* and *Gavialis*.

Order: *Testudines* BATSCH, 1788
Suborder: *Cryptodirida* COPE, 1870
Family: *Chelydridae* AGASSIZ, 1857
Subfamily: *Chelydropsinae* MŁYNARSKI, 1980

Genus: *Chelydropsis* PETERS, 1868
(sensu CKHIKHVADZE 1971; emend. F. DE BROIN 1977; MŁYNARSKI 1980)
6. *Chelydropsis murchisoni* (BELL, 1832)

Remains of this species have so far been found at Przeworno II. They are shell fragments, including a well-preserved plastron (MŁYNARSKI, 1981a) and the perfectly well preserved skull of a big specimen found at the same locality a year later (MŁYNARSKI, 1981b). Both the skull and the plastron bear characters typical of the species named and the whole group of Miocene *Chelydropsinae* (*murchisoni-sansaniensis* group). The skull was found together with the mandible and several cervical vertebrae. They belong to the best-preserved remains from the Polish Miocene and are particularly valuable in all comparative studies on fossil Eurasian chelydrids (ZZSD, No. RF/PR 180/79).

Family: *Emydidae* GRAY, 1825
Subfamily: *Emydinae* GRAY, 1825
Tribe: *Ptychogastrini* DE STEFANO, 1917
Genus: *Ptychogaster* POMEL, 1842
7. *Ptychogaster buechelbergense* KUSS, 1958

Members of the genus *Ptychogaster* are undeniable dominants among the turtles in the fauna of Przeworno II. They were all small specimens, whose shell did not exceed 20 cm in length. All the remains described from the same locality as *Geoemyda* aff. *eureia* probably belong to the same form (cf. the diagrammatic drawing of a fragment of the plastron; MŁYNARSKI, 1978, p. 85, Fig. 3). The shell, with the posterior lobe of the plastron missing, is in the excellent state of preservation (ZZSD, No. FR.178/76) and constitutes, beside the above-mentioned skull of *Chelydropsis*, the best-preserved turtle remains from the Polish Miocene (MŁYNARSKI, 1978, Pls. 16—20).

Members of the genus *Ptychogaster* should be numbered in the subfamily *Emydinae*. This is suggested by both the structure of the pygal region of the carapace and the lack of the batagural process of the skull, which unfortunately in our case has not, as yet, been found (see MŁYNARSKI, op.cit. pp. 89—90).

We consider the species determinations, both in our case and in many other cases, to be, in a sense, tentative, for more than 20 „species" of the genus *Ptychogaster* have already been described from Europe, but in fact they differ slightly from each other. The characters of these „species" might be regarded as characters of particular populations. In this connection most of them are probably synonyms of *Ptychogaster emy-*

doides POMEL, 1842 (species typica) from Parisian phosphate rocks (see F. de BROIN, 1977, p. 238).

Some of the „species" of this genus, so far endemic to Europe, might be treated as „palaeontological subspecies" (races). Morphological differences of such forms are brought about not only by a great distance between particular localities and their local ecological conditions but also by differences in their geological age. The purposefulness of the use of the term subspecies in palaeontology is rather controversial and would call for a more precise definition.

Subfamily: *Batagurinae* GRAY, 1870
Genus: *Geoemyda* GRAY, 1834
8. *Geoemyda eureia* (WEGNER, 1913)

This species, described by WEGNER (1913) and included in the subgenus *Heosemys* GRAY, 1831 by KHOSATZSKY and MŁYNARSKI (1966), occurs only in material from Opole. Despite my suggestions made in 1978 its occurrence at Przeworno is uncertain or, more exactly, insufficiently evidenced (cf. *Ptychogaster*).

Geoemyda eureia is no longer only an „endemic species of Opole" (MŁYNARSKI; MŁYNARSKI et al., 1982). A similar species probably lived in the Miocene of Upper Austria, which indicates its rather wide distribution.

Geoemyda eureia is the oldest of small turtles of this genus, characteristic of the Younger Neogene of Europe. It shows a great similarity to recent species from south-eastern Asia.

Family: *Testudinidae* GRAY, 1822
Genus: *Testudo* LINNAEUS, 1785
9. *Testudo* sp.

Some remains of a small tortoise have so far occurred exclusively in material from Przeworno I („lower"). They are only shell fragments which do not permit the determination of their specific membership, especially as we are concerned with so controversial forms as European fossil testudinis. It may have been a form related to *Testudo steinheimensis* STAESCHE, 1933 from Steinheim in Württemberg. However, the systematic position of over 200 (sic!) fossil „species" of this genus awaits a thorough, complex and, as far as possible, collectively prepared revision. In spite of their apparent similarities to the recent species of the so-called Greek turtles, most of the Tertiary forms belong to some lateral and independent evolutionary lines. Preliminarily they can be arranged in several distinct groups (F. de BROIN, 1977), whose descendant, possibly the only one, is *Testudo marginata* SCHOEPFF, 1782, now ousted to its Balkan refuges (see MŁYNARSKI, 1980b, pp. 39—40).

Order: *Sauria* McCARTNEY, 1802
Suborder: *Lacertilia* OWEN, 1842
Infraorder: *Anguimorpha* FURBRINGER, 1900
Family: *Anguidae* GRAY, 1825
Subfamily: *Anguinae* GRAY, 1825
Genus: *Ophisaurus* DAUDIN, 1803
Ophisaurus moguntinus BOETTGER, 1874

Remains of this lizard, common in the European Miocene, occur in relatively large numbers both at Opole (ZPWR) and at Przeworno I („lower"). ESTES (MŁYNARSKI et al., 1982) has pointed out that *Ophisaurus fraasi* (HILGENDORF, 1883), quoted by BACHMAYER and MŁYNARSKI (1977), is synonymous with this species.

If the determination of the remains from Opole by ESTES (op. cit.) does not arouse any reservations, the material from Przeworno (ZZSD No. RF. PR-4) needs re-examining. It may well be that beside the species under discussion there was another lizard there. It is worth noticing that there are no osteoderms at all, which are co characteristic and, as a rule, survive perfectly well in fossil material.

Ophisaurus moguntinus is a form morphologically resembling recent *O. apodus* (PALLAS, 1775). It may therefore be considered, as I have already suggested, to be an ancestor in the phylogeny of the recent species (MŁYNARSKI, 1962, p. 186; ESTES in MŁYNARSKI et al., 1982).

Ophisaurus moguntinus is already known from many Miocene localities of Europe. It has been described from the classical Steinheim locality, so frequently referred to in this paper and rather similar to Przeworno in respect of its fauna. However, the material from Steinheim contains also remains of another lizard of the group *Anguidae*. And so a revision of these lizards would by all means be valuable in studies on fossil anguids of Europe.

Suborder: *Serpentes* LINNAEUS, 1758
Infraorder: *Alethinophidia* HOFFSTETTER, 1955
Superfamily: *Booidea* GRAY, 1825
Family: *Boidae* GRAY, 1825
Subfamily: *Erycinae* BONAPARTE, 1831
Genus: *Ogmophis* COPE, 1884
11. *Ogmophis europaeus* SZYNDLAR, 1982

Both this species and all the forms that can be fairly precisely identified come from Opole (ZPWR). According to SZYNDLAR (in MŁYNARSKI et al., 1982), it is the first case of occurrence of this American genus in Europe. Morphological differences, notably the large size of the snake from Opole, provided that author with the basis for its description as a new species.

Ogmophis europaeus is one of the small boids characteristic of the Tertiary of Europe (see HOFFSTETTER and RAGE, 1972). The recent members of this subfamily, as a rule, lead a fossorial life.

Superfamily: *Colubroidea* OPPEL, 1811
Family: *Colubridae* OPPEL, 1811
Subfamily: *Natricinae* BONAPARTE, 1838
Genus: *Palaeonatrix* SZYNDLAR, 1982
12. *Palaeonatrix silesiaca* SZYNDLAR, 1982

This is another fossil member of the *Natricinae*, described from Opole (ZPWR), new to the European ophifauna (SZYNDLAR in ESTES et al., 1982). Members of the group *Natricinae* were common in the Plio- and Pleistocene of Poland (MŁYNARSKI, 1962, 1977). All these snakes, dealt with in a monograph by SZYNDLAR (dissertatio, in lit.), belonged already to the recent genus *Natrix*.

13. *Colubridae* indet.

This is how SZYNDLAR (dissertatio, in lit.) defined the only incomplete vertebra of a small snake found so far in the material of Przeworno II. It is an interesting fact that no other remains of snakes have been found at this locality for many years, which indicates that they were quite rare in this environment (ZZSiD).

Family: *Viperidae* LAURENTI, 1768
14. *Viperidae* subfam. gen. sp. indet.

Two vertebrae of vipers, which escape determination to specific level, subsist in the material from Opole (ZPWR). According to SZYNDLAR (MŁYNARSKI et al., 1982), we are even unable to settle whether they represent a true-viper or a pit-viper (*Crotalinae*), now occurring in Asia and also recorded from the European Tertiary (SZYNDLAR, op. cit.).

In younger materials from the Plio- and Pleistocene of Poland (MŁYNARSKI, 1962) only members of the *Viperinae* occur for certain (SZYNDLAR, in lit.).

The presence of poisonous snakes of the group *Solenoglypha* in the Polish Miocene indicates a wealth of the ophifauna from Opole.

Remark: WEGNER's (1913, p. 212) monograph mentions a snake under the name of *Tamnophis* sp. WEGNER (op. cit.) compares these remains to *T. pouchetti* DE ROCHEBRUNE from the Miocene of France. As his material does not exist any longer and the description does not permit us to determine the identity of the form in question (neither is a figure if this find given), these remains belonged probably to one of

the three forms described lately by SZYNDLAR (MŁYNARSKI et al., 1982; in lit.).

Table I

Amphibians and Reptiles of the Polish Miocene

Forms	Opole	Przeworno	Pińczów
1. *Chelotriton paradoxus*	x		
2. *Palaeobatrachidae* indet.	x		
3. *Bombina* sp.	x		
4. *Latonia sayfriedi*	xxx	xxxx	
5. *Tomistoma* sp.			x
6. *Chelydropsis murchisoni*		xx	
7. *Ptychogaster buechelbergensis*		xxxx	
8. *Geoemyda eureia*	xxx	?	
9. *Testudo* sp.		xx	
10. *Ophisaurus moguntinus*	xxx	xx	
11. *Ogmophis europaeus*	xx		
12. *Palaeonatrix silesiaca*	x		
13. *Viperidae* indet.	x		
14. *Colubridae* indet.		x	
15. *Reptilia* inc. sed.	x		

x — very rare, xx — rare, xxx — common, xxxx — very common.

15. *Reptilia* incertae sedis

As far as the material from Opole (ZPWR) is concerned, special attention should be given to a fragment, probably of the roofing bones of a skull, covered with characteristic osteoderms, which resemble scales of some *Scincomorpha*. Having carried out a close analysis, ESTES (MŁYNARSKI et al., 1982) arrives at the conclusion that we are not in a position to determine — even in approximation — what reptile is represented by these remains. His considerations and accurate drawings made by SZYNDLAR for the publication quoted will perhaps permit other investigators to identify this strange fragment in the future. Unfortunately, as emphasized at the outset, here we are concerned with material, which is already unique, from the Opole locality that has not existed for many years.

IV. ZOOGEOGRAPHICAL AND ECOLOGICAL NOTES

All the amphibian and reptilian species represented in the Polish Miocene, except perhaps *Bombina* (*Bombina* sp. from Opole), belong to forms which are already extinct in the Polish territory. This is a fauna on the one hand, typical of the Miocene and, on the other hand, specific of each of the localities. Besides, the amphibians and reptiles discussed

in this paper, like the whole Miocene herpetofauna of Europe, show distinct affinity (morphological similarities) to recent species from various, often very remote, zoogeographical regions and provinces. In this connection our forms might be recognized as various zoogeographical elements, arranged in the following groups:

1. Eurasian elements

In this group, which includes several of our forms, two subgroups can be distinguished:

a. Oriental elements, comprising *Geoemyda* and *Tomistoma* and

b. Palaearctic elements, with *Bombina,* which has a very distinct discontinuous distribution. According to STUGREN (1980, p. 113: „The Northern Caucasus and the Southern Ural areas are regarded as the geographical centre of the origin of *B. bombina*"), the genus *Bombina* is of Asiatic origin and its centre of origin would lie in the Far East. These forms have hitherto been assumed to be phylogenetically very young. Their presence as early as the Miocene, shown by SANCHÍZ (MŁYNARSKI et al., 1982), makes us consider whether their centre of origin was really in the above-mentioned area. Both *Bombina* and a number of other forms may be regarded as Eurasian elements, without their centres of origin being specified for the time being.

Chelotriton, related to the recent species of *Tylototriton* pushed off to their Asiatic refuges, is also a Palaearctic element. Discontinuity in the distribution of the Tertiary European and recent Asiatic forms is in the case of the *Caudata* fairly significant. Giant salamanders of so well-known a genus as *Andrias* is should be mentioned here. However, are we not concerned in these cases with migrations in the opposite direction? It may also be assumed that in the Tertiary similar forms inhabited vast areas of the Palaearctic and that their withdrawal to refugal areas and the discontinuity of distribution were connected with climatic changes, i.e. the Pleistocene glaciations.

2. Nearctic elements

The presence of „American" forms in the European Miocene has been recorded many a time. In our material the snake of the genus *Ogmophis,* probably fairly widely ranging in Europe in the Miocene, is an unquestionable American element.

The members of the genus *Chelydropsis* bear distinct morphological similarities to the recent, typically American, chelydrids, whose present centre of origin lies approximately in the southeastern part of the Nearctic. Because of the great similarity in shell structure they were even included in the American genus *Chelydra* (MŁYNARSKI, 1980, 1981b) for many years. Despite their affinities these turtles constitute a separate Eurasian evolutionary line.

On the other hand, the species regarded as Eurasian or European but having characters of the subfamily *Emydinae*, which embraces chiefly fresh-water turtle species of the New World, might be numbered in the group of „American" elements (McDOWELL, 1964).

3. European „endemic forms"

In this group we should, above all, include the turtles of the genus *Ptychogaster* (F. De BROIN, 1977, p. 238). In spite of their apparent similarities to the American species of the genus *Terrapene* and, on the other hand, to oriental Asiatic members of *Cuora*, the ptychogastrids constitute a completely different morphological type and have not, as yet, been found anywhere out of Europe. And so, in this sense, they are certainly „endemic". However, as we have managed to point out (MŁYNARSKI, 1978), they should be placed in the „American" and not „Eurasian" group of turtles. Here we should put the question once again whether McDOWELL's (1964) criteria can be applied for fossil forms. This seems to concern the forms from the Neogene, which are already very similar to the recent species.

As regards older, e.g. Miocene turtles from Geiseltal, these criteria fail or even misinform and lead to overhasty conclusions (MŁYNARSKI, 1977b). Summing up, it may therefore be stated that the ptychogastrids are actually „endemic" in our Continent and that their centre of origin was here but, on the other hand, they exhibit distinct affinities with the group of American species.

Latonia seyfriedi, one of the biggest discoglossids known so far, is also in a sense „endemic". The remains of this big amphibian have been known from many European Miocene localities for more than 100 years. This form shows a huge similarity to recent members of the genus. *Discoglossus*, characteristic of the Mediterranean countries, including the Magreb countries in North Africa. This was the reason why the remains of *Latonia* were assigned to a recent genus (*Discoglossus giganteus* WETTSTEIN-WESTERHEIMB, 1955; MŁYNARSKI, 1977; SANCHÍZ and MŁYNARSKI, 1979). In spite of morphological similarities of these two amphibians it would not be risky to put forward the supposition that we are concerned here with a fossil Miocene ancestor of the recent dwarfish species.

Palaeonatrix silesiaca, one of the oldest members of the *Natricinae*, is also a European element or „endemic" species. However, it is not an ancestor to the recent European grass-snakes (*Natrix natrix, Natrix tessellata*), but forms an extinct side branch.

4. Forms of wide distribution

This designation may be used, e.g. for the members of the genus *Testudo*, vipers (*Viperidae* indet.) and snakes (*Colubridae*). On the basis

of the very fragmentary material of no major taxonomic importance it is virtually hard to compare these forms with recent species.

The members of the genus *Ophisaurus* are characterized by their fairly wide distribution. In our case *O. moguntinus* is however, as mentioned above, an ancestor or at least near kin of recent *O. apodus*, typical member of the present-day Balkan fauna, inhabiting also large areas of the Asiatic continent and Asia Minor. And so it is an Asiatic rather than European lizard, widely ranging in the Tertiary.

5. Environment

A huge majority of the amphibians and reptiles from the Polish Miocene belonged to the fauna of moist environments, woods and thickets abounding in water. This supposition is supported by studies on other groups of vertebrates. Mammals, too, represent the same type of the wood fauna of warm subtropical forests (see the description of the localities). The remains of small fish, which are not numerous either at Przeworno or at Opole, give evidence of the presence of not very large water reservoirs, while gravel and pebbles indicate the occurrence of rivers or streams.

All the amphibians mentioned here, *Tomistoma* and the Eurasian chelydrid (*Chelydropsis*) may be reckoned among aquatic forms, i.e. the forms more or less closely associated with water environment. All of them however represent a different type of adaptation, the differentiation of ecological niches. And to the *Discoglossidae*, among them above all the genus *Bombina* and probably *Latonia*, which resembles recent *Discoglossus*, are rather strongly connected with water all the year round. The older *Palaeobatrachidae* were also typical water animals (ŠPINAR, 1972). On the other hand, *Chelotriton* was somewhat less closely associated with water environment, which would be indicated by its morphological similarity to the members of the recent genus *Tylototriton*. In the present case comparisons of these forms are somewhat risky.

Chelydropsis was associated with water environment, mainly with rather large reservoirs at that, but it, too, like e.g. *Chelydra*, often went away from the water and even hunted on land (MŁYNARSKI, 1980).

At present the turtles of the genus *Geoemyda* are animals that more often occur on land than in water. At the same time, they do not avoid this environment but even forage in it. In our case they occurred in thickets and in areas adjacent to water reservoirs (KHOSATZKY and MŁYNARSKI, 1966).

Finally, the snake *Palaeonatrix* may have lived near water environment, but its presence, similarly to the presence of the recent grass-snake (*Natrix natrix*), need not evidence this very environment.

Dry and more open areas are represented by tortoises (*Testudo*), *Ophisaurus* and snakes. In this last case we should be very circumspect,

for the genus *Ogmophis* is, according to RAGE (1977), related to the recent species of the genus *Charina*, which inhabit the wooded mountainous areas of the western part of the United States. These snakes live in damp environments, e.g. moist forest bottoms or moist riverside sands (WRIGHT and WRIGHT, 1957). And so our *Ogmophis* was a member of rather a forest or thicket fauna than that of dry and open areas typical of the recent European members of the genus *Eryx*.

It is also difficult to determine the type of habitats of the colubrids from Przeworno or viperids from Opole. Members of these groups may have inhabited both moist and dry thicket areas, perhaps the border--zones of forests and open areas.

6. Climate

The reptiles are evident thermophilous animals. Their abundance and diversity, sure enough, indicate a mild climate but it is only the crocodile, whose secondary marine environment is here of no interest to us (see p. 135), that is a true tropical form. To be sure, turtles of the genus *Geoemyda* occur in the tropical zone nowadays, but frequently just in the mountains and so in a considerably cooler climate, marked by great fluctuations in temperature (KHOSATZKY and MŁYNARSKI, 1966, p. 414). *Chelydropsis* also belongs to a group of turtles which are characterized by an exceptional capability to adapt themselves to various climatic conditions and great differences in temperature (e.g. *Chelydra* in the Nearctic). The same besides is true of the tortoises (*Testudo*, a small form), *Ophisaurus* and most of the snakes.

Except for *Latonia* all the amphibians, owing to their association with water environment, are animals resistant to changes in temperature. And so whole communities of these animals, inhabiting the given environment, and not single detached forms, can throw light on the climate itself and notably on temperatures. The numbers of particular forms are also important in this respect. The characterization of the environments of the Polish Miocene will be the more accurate the more forms, including mammals, we shall be able to identify in it. Bioecological conclusions made on the basis of the herpetofauna constitute an essential contribution to the general faunistic analysis.

Translated into English
by Jerzy ZAWADZKI

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

REFERENCES

ANTUNES, M. T., 1961. *Tomistoma lusitanica* crocodilien du Miocène de Portugal. Rev. Facult. Ciênc., Lisboa, **2**, sér. c-9 (1): 588.

BACHMAYER, F. & MŁYNARSKI, M., 1977. Bemerkungen über die fossilen *Ophisaurus* Reste (*Reptilia, Anguidae*) von Österreich und Polen. SBer. österr. Akad. Wiss., Math.-naturw. Kl., Abt. I., Wien, **186** (6/8): 285—289.

BAŁUK, W. & RADWAŃSKI, A., 1977. Organic communites and facies development of the Korytnica bassin (Middle Miocene; Holy Cross Mountains, Central Poland). Acta geol. polon., Warszawa, **27** (2): 85—123.

BROIN DE, F., 1977. Contribution à l'étude des Chéloniens continnteaux du crétacé et du tertiaire de France. Mém. Mus. Nat. Hist. Natur. (n.s.) C, Paris, **38**: 38—366.

CKHIKHVADZE, V. M., 1973. Tretičnoe čerepachi Zajsanskoj kotloviny. Tbilisi.

CZYŻEWSKA, T. & RYZIEWICZ, Z., 1976. *Pinocetus polonicus* gen. n., sp. n. (*Cetacea*) from the Miocene Limestones of Pińczów, Poland. Acta pal. polon., Warszawa, **21** (3): 259—291.

FREYTAG, G. E., 1970. Schwanzlurche und Blindwühle in: „Grzimeks Tierleben", Zürich—München, **5**: 313—358.

GALEWSKI, K. & GŁAZEK, J., 1978. Upper Miocene *Dytiscidae* (*Coleoptera*) from Przeworno (Lower Silesia) and the problem of *Dytiscidae* evolution. Bull. Acad. Pol. Sci., sér. sc. biol., Cl. II. Warszawa, **25** (12): 781—789.

GŁAZEK, J., OBERC, J., SULIMSKI, A., 1971. Miocene vertebrate faunas from Przeworno (Lower Silesia) and their geological setting. Acta geol. polon., Warszawa, **21** (3): 473—516.

GŁAZEK, J., GALEWSKI, K., WYSOCZAŃSKI-MINKIEWICZ, T., 1977. Nowe dane o krasie kopalnym w Przewornie. Kras i speleolog., Katowice, **10** (1): 81—88.

HODROVÁ, M., 1981. Plio-Pleistocene frog fauna from Hajnáčka and Ivanovce, Czechoslovakia. Věstnik Ústř. úst. geolog., Praha, **56** (4): 215—224.

HOFFSTETTER, R. & RAGE, J.-C., 1972. Les *Erycinae* fossiles de France (*Serpentes, Boidae*). Compréhension et histoire de la sou-famille. Ann. Paléont. (Vertébrés), Paris, **58** (1): 1—46.

JERZMAŃSKA, A., 1958. *Scorpaena ensignes* (JORDAN et GILBERT) z miocenu Pińczowa (summary). Acta pal. polon., Warszawa, **3** (2): 151—159.

KHOSATZKY, L. I. & MŁYNARSKI, M., 1966. Fossil tortoises of the genus *Geoemyda* GRAY, 1834 (s. lat.) of Europe. Acta zool. cracov., Kraków, **11** (13): 294—321.

KOWALEWSKI, K., 1930. Stratygrafia miocenu okolic Korytnicy w porównaniu z trzeciorzędem pozostałych obszarów Gór Świętokrzyskich. Spraw. Państw. Inst. Geolog., Warszawa, **6** (1): 52—55.

KOWALSKI, K., 1967. Rodents from the Miocene of Opole. Acta zool. cracov., Kraków, **12** (1): 1—18.

KOWALSKI, K. & ZAPFE, H., 1974. *Pliopithecus antiquus* (BLAINVILLE, 1839) (*Primates, Mammalia*) from the Miocene of Przeworno in Silesia (Poland). Acta zool. cracov., Kraków, **19** (2): 19—32.

KUBIAK, H., 1975. *Gomphotherium angustidens* (CUVIER, 1806) (*Proboscidae, Mammalia*) from the Miocene of Przeworno (Silesia, Poland). Acta zool. cracov., Kraków, **20** (11): 469—480.

KUBIAK, H., 1981a. *Suidae* and *Tayassuidae* (*Artiodactyla, Mammalia*) from the Miocene of Przeworno in Lower Silesia. Acta geol. polon., Warszawa, **31** (1—2): 59—70.

KUBIAK, H., 1981b. *Equidae* and *Rhinocerotidae* (*Perissodactyla, Mammalia*) from the Miocene of Przeworno in Lower Silesia. Acta geol. polon., Warszawa, **31** (1—2): 71—79.

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.

MEIN, P., 1975. Biozonation de Neogéne Mediterraneen à partir des Mammifers. Proc. VIth INQUA Congress Bratislava, Reg. Comm. Med. Neogene Strat., p. 18.

MŁYNARSKI, M., 1962. Notes on the amphibian and reptilian fauna of the Polish Pliocene and Early Pleistocene. Acta zool. cracov., Kraków, **7** (11): 177—198.

MŁYNARSKI, M., 1976. *Discoglossus giganteus* WETTSTEIN-WESTERHEIMB, 1955 (*Discoglossidae, Anura*) from the Miocene of Przeworno in Silesia (Poland). Acta zool. cracov., Kraków, **21** (1): 1—12.

MŁYNARSKI, M., 1977a. New notes on the amphibian and reptilian fauna of the Polish Pliocene and Pleistocene. Acta zool. cracov., Kraków, **22** (2): 13—36.

MŁYNARSKI, M., 1977b. Bemerkungen über die Schildkröten (*Testudinoidea*) des Geiseltales. „Eozäne Wurbeltiere des Geiseltales". Wiss. Beitr., Halle (Saale), **1977** (2) (P5): 99—105.

MŁYNARSKI, M., 1978. Tortoises (*Emydidae* and *Testidinidae*) from the Miocene of Przeworno in Silesia (Poland). Acta zool. cracov., Kraków, **23** (6): 79—92.

MŁYNARSKI, M., 1980a. Die Schildkröten des Steinheimer Beckens. B. *Chelydridae* mit einem Nachtrag zu den *Testudinoidea*. In: Die tertiären Wirbeltiere des Steinheimer Beckens. Teil 2. Palaeontograph. Suppl., Stuttgart, **8**, 2, B (35).

MŁYNARSKI, M., 1980b. Die pleistozänen Schildkröten Mittel- und Osteuropas (Bestimmungsschlüssel). Folia Qutern., Kraków, (52): 44.

MŁYNARSKI, M., 1981a. *Chelydropsis murchisoni* (BELL, 1832) (*Testudines, Chelydridae*) from the Miocene of Przeworno in Silesia (Poland). Acta zool. cracov., Kraków, **25** (7): 219—226.

MŁYNARSKI, M., 1981b. *Chelydropsinae*, the Eurasiatic fossil snapping turtles (*Chelydridae*). Chelonologica, **2** (2). 67—63.

MŁYNARSKI, M., SZYNDLAR, Z., ESTES, R., SANCHÍZ, B., 1982. Lower vertebrate fauna from the Miocene of Opole (Poland). Estud. geol., Madrid, **39** (1—2): 103—119.

PAWŁOWSKA, K., 1960. Szczątki ryb z wapieni mioceńskich Pińczowa. Acta pal. pol., Warszawa, **5** (4): 421—434.

RADWAŃSKI, A., 1965. A contribution of the knowledge of Miocene *Elasmobranchii* from Pińczów (Poland). Acta pal. pol., Warszawa, **3** (2): 151—159.

RAGE, J. C., 1977. An erycinae snake (*Boidae*) of the genus *Calamagras* from the French Lower Eocene, with comments on the phylogeny of the *Erycinae*. Herpetologica, Lawrence, **33** (4): 459—463.

RYZIEWICZ, Z., 1957. O ssakach mioceńskich znalezionych w okolicach Opola. Spraw. Wroc. Tow. Nauk., Wrocław, **9**: 105.

RYZIEWICZ, Z., 1959. Uzupełniające badania ssaków z Nowej Wsi Królewskiej koło Opola. Zjazd Anat. Zool. Pol., Kraków, ?: 477—478.

RYZIEWICZ, Z., 1961. A tapir tooth from Nowa Wieś Królewska near Opole. Acta pal. pol., Warszawa, **6**: 331—338.

RYZIEWICZ, Z., 1969. Szczątki waleni mioceńskich z Pińczowa. Przegląd Zool., Wrocław, **13** (2): 224—225.

SANCHÍZ, F. B. & MŁYNARSKI, M., 1979. Remarks on the fossil Anurans from the Polish Neogene. Acta zool. cracov., Kraków, **24** (3): 175—188.

ŠPINAR, Z., 1972. Teriary frogs from Central Europe, Praha.

STUGREN, B., 1980. Geographical variations of the Fire Bellied Toad (*Bombina bombina* [L.]) in the USSR (*Amphibia, Anura, Discoglossidae*). Zool. Abh. Staatl. Mus Dresden, **36** (5): 101—115.

WEGNER, R. N., 1913. Tertiär und umgelagerte Kreide bei Oppeln (Oberschlesien). Palaeontograph., Stuttgart, **60**: 175—274.

WERMUTH, H., 1953. Systematik der rezenten Krokodile. Mitt. Zool. Mus. Berlin, **29** (2): 375—514.

WRIGHT, A. H. & WRIGHT, A. A., 1957. Handbook of Snakes of the United States and Canada. New York, **1**.

STRESZCZENIE

Praca niniejsza nawiązuje do podobnych publikacji autora z lat 1962 i 1977 poświęconych młodszym, plio- i plejstoceńskim herpetofaunom Polski. Zawiera ona wyniki długoletnich studiów nad szczątkami płazów i gadów trzech mioceńskich stanowisk na terenie Polski, z których stanowisko w Pińczowie (miocen morski) wymieniono jedynie ze względu na pojedyncze i, jak dotychczas, unikalne znalezisko. Wiek ich obejmuje okres od miocenu środkowego po wyraźnie górny (Vindobon).

W części wstępnej podano charakterystykę stanowisk. Są to Pińczów, Opole oraz Przeworno I i II. Dwa ostatnie, z których opisano bogatą faunę lądową, leżą na Śląsku i należą już dziś do klasycznych mioceńskich stanowisk europejskich.

W części systematycznej omówiono krótko wszystkie rodzaje i gatunki płazów i gadów ze stanowisk lądowych oraz załączono dokładny opis i dyskusję po'więconą zębowi krokodyla z rodzaju *Tomistoma* (?) z Pińczowa. Jej autorem jest prof. dr. M. T. ANTUNES z Lizbony.

W części końcowej podano krótkie rozważania zoogeograficzne i paleozoogeograficzne oraz uwagi odnośnie do środowiska omawianych stanowisk.

Celem niniejszej notatki, tak jak i poprzednich jest zorientowanie specjalistów w aktualnym stanie badań nad kopalną herpetofauną Polski.

Redaktor pracy: dr Z. Szyndlar